Planning Commission Meeting Agenda
Tuesday, October 20, 2026, 7:00 PM
Council Chambers, 616 NE 4th AVE

NOTE: The City welcomes public meeting citizen participation. TTY Relay Service: 711. In compliance with the ADA, if you need special assistance to participate in a meeting, contact the City Clerk's office at (360) 834-6864, 72 hours prior to the meeting so reasonable accommodations can be made (28 CFR 35.102-35.104 ADA Title 1)

To Participate Remotely:

OPTION 1 -

1. Go to www.zoom.us and download the app or click "Join A Meeting" and use Meeting ID – 875 1192 7860
2. Or, from any device click https://us06web.zoom.us/j/87511927860

OPTION 2 - Join by phone (audio only):
Dial 877-853-5257 and enter meeting ID# 875 1192 7860

For Public Comment:
Click the raise hand icon in the app or by phone, hit *9 to "raise your hand", or email to communitydevelopment@cityofcamas.us

These will be entered into the meeting record. Emails received up until one hour before the start of the meeting will be emailed to the Meeting Body prior to the meeting start time.

CALL TO ORDER

ROLL CALL

PUBLIC COMMENT

This is the public's opportunity to comment about any item on the agenda, including items up for final action.

MINUTES

1. September 29, 2026 Planning Commission Special Meeting Minutes

MEETING ITEMS

2. Updates to Washougal & Evergreen School District Capital Facility Plans, General Sewer Plan, Water System Plan, and Transportation System Plan
   Presenter: Alan Peters, Community Development Director; Rob Charles, Utilities Manager; and James Carothers, Engineering Manager
   Time Estimate: 60 minutes

MISCELLANEOUS UPDATES

NEXT MEETING DATE

CLOSE OF MEETING

Planning Commission Special Meeting Minutes
Tuesday, September 29, 2026, 7:00 PM
Council Chambers, 616 NE 4th AVE

CALL TO ORDER

Commissioner Hull called the meeting to order at 7:00 p.m.

ROLL CALL

Present: Troy Hull, Shawn High, Hannah Burak, Joe Keller, Paul Anderson and Joe Walsh
Remote: Geoerl Niles

Staff Present: Alan Peters, Robert Maul, Shawn MacPherson, Sophie Webster and Carey Certo

Council Members Remote: Jennifer Senescu

PUBLIC COMMENT

Tyler Sanders, Glen DeWillie and Randal Friedman offered public testimony.

MINUTES

1. September 15, 2026 Planning Commission Meeting Minutes

   It was moved by Commissioner Burak and seconded by Commissioner High, to approve the minutes of the September 15, 2026, Planning Commission Meeting. The motion passed unanimously.

MEETING ITEMS

2. Our Camas 2045 Comprehensive Plan Periodic Update, Our Downtown Camas 2045 Subarea Plan, Downtown Design Manual, and associated amendments to Titles 17 and 18 of the Camas Municipal Code
   Presenter: Alan Peters, Community Development Director

   It was moved by Commissioner Burak and seconded by Commissioner Keller to forward a recommendation to City Council to approve, the Our Camas 2045 Comprehensive Plan Periodic Update, Our Downtown Camas 2045 Subarea Plan, Downtown Design Manual, and associated amendments to Titles 17 and 18 of the Camas Municipal Code as submitted with the following additional recommendations:

1. **For the Downtown Plan, the City should consider additional details and plans for the following historic areas, the historic [city] steps, the Mill Ditch Green Space Connector, and the Cedar Street right-of-way.**

2. **We recommend adjusting the border of the new multi-family zone east of Elm Street to retain the existing zoning.**

3. **And third, we recommend the City Council look closely at the infrastructure needed to support demand for water under the new plan, and recommend a demand analysis, transport study to understand the extent and movement of the [PFAS] contamination considering mandatory conservation measures.**

The motion passed unanimously.

MISCELLANEOUS UPDATES

There were no miscellaneous updates.

NEXT MEETING DATE

The next meeting is scheduled for October 20, 2026.

CLOSE OF MEETING

The meeting closed at 8:54 p.m.

Staff Report

October 20, 2026 Planning Commission Meeting

Updates to Washougal & Evergreen School District Capital Facility Plans, General Sewer Plan, Water System Plan, and Transportation System Plan
Presenter: Alan Peters, Community Development Director; Rob Charles, Utilities Manager; and James Carothers, Engineering Manager
Time Estimate: 60 minutes

Phone	Email
360.817.7254	apeters@cityofcamas.us

BACKGROUND: The City of Camas is in the final stages of adopting the *Our Camas 2045* Comprehensive Plan. The Planning Commission forwarded a recommendation to City Council to approve the periodic update to the plan on September 29, 2026. The City's utility system plans, transportation plans, and school district capital facilities plans are also being updated to ensure consistency with *Our Camas 2045* and the City's 20-year growth projections. This workshop provides an opportunity for the Planning Commission to review the plans and provide feedback prior to their consideration for adoption at a public hearing on November 17, 2026.

SUMMARY: Capital facilities planning is an essential component of the Washington State Growth Management Act (GMA), ensuring that public infrastructure and services are planned and provided in coordination with anticipated population and employment growth. Under RCW 36.70A.070, comprehensive plans must include a capital facilities element that inventories existing facilities, forecasts future needs, and identifies proposed improvements. The GMA also requires a transportation element that addresses future transportation needs, establishes performance standards, and identifies transportation improvements and funding strategies.

Capital facilities plans (CFPs) help ensure that adequate public services are available to support planned development while maintaining adopted levels of service. As part of the *Our Camas 2045* update, the City has updated its General Sewer Plan, Water System Plan, and Transportation System Plan to reflect the land use assumptions and needs associated with anticipated growth through 2045. The Washougal and Evergreen School Districts have also updated their capital facilities plans, which the City adopts by reference pursuant to WAC 365-196-415.

<u>Evergreen School District Capital Facilities Plan</u>
The Evergreen School District (ESD) captures a portion of the northwest area of Camas, including ongoing residential development in Camas Meadows and Green Mountain. ESD's CFP was adopted June 10, 2025, and covers the 2026-2032 horizon. The plan identifies existing school capacities, projected student enrollment, anticipated facility needs, and funding strategies to accommodate future growth. Notably, the plan projects declining student enrollment through

2032 and focuses on maintaining or replacing existing facilities rather than expansion of new schools. As a result, ESD will not be collecting any school impact fees.

Washougal School District Capital Facilities Plan

The Washougal School District (WSD) captures a small area of Camas along SE 3rd Ave with no anticipated residential growth. The WSD CFP was adopted June 10, 2025, and covers the 2022-2027 horizon. Like ESD, the plan projects declining student enrollment and no need for collection of school impact fees.

General Sewer Plan

The purpose of the City's General Sewer Plan (GSP) is to provide a roadmap for managing the wastewater collection system over the next 20 years, accommodating growth, and maintaining a high level of service for existing customers. The Plan addresses key issues such as the replacement of older, deteriorating sanitary sewer facilities, evaluation of collection and treatment capacity for existing deficiencies and future development, assessment of sanitary sewer lift stations and force mains, and the City's infiltration and inflow (I/I) reduction program. The GSP and its recommendations were prepared in accordance with Washington Administrative Code (WAC) 173-240-050 and meet the requirements of the Washington Growth Management Act (GMA). The City owns and operates most of its sewer collection system, which includes gravity sewers, pump stations, force mains, and Septic Tank Effluent Pump (STEP) systems, and treats wastewater at the Camas Wastewater Treatment Plant (WWTF) before discharge to the Columbia River.

Water System Plan

The Water System Plan (WSP) documents changes to the City's water system, identify required system improvements, and appropriately outline capital improvement projects to meet future water demands. Maintaining a current WSP is required to meet the regulations of the Washington State Department of Health (DOH) and the requirements of the Washington State Growth Management Act. The WSPU complies with the requirements of DOH as set forth in the Washington Administrative Code (WAC) 246-290-100. The plan is intended to guide improvements over the next 10 years while providing a framework for the 20-year planning horizon through 2046.

The Capital Improvement Plan includes investments in new and expanded wells, reservoirs, pump stations, transmission pipelines, and distribution system improvements. Major near-term projects include expansion of Wells 8, 11, and 12, storage improvements in the 343 and 542 pressure zones, pumping improvements, and the North Shore transmission pipeline.

The plan identifies PFAS as a significant concern requiring additional investment and planning. The plan recommends an adaptive approach to PFAS mitigation, including continued monitoring, evaluation of treatment alternatives, and development of treatment facilities to achieve regulatory compliance. The City has initiated treatment improvements at Well 13, and the plan anticipates additional treatment may be necessary at other wellfields. PFAS mitigation and related source development projects are incorporated into the Capital Improvement Plan to guide future funding and implementation decisions.

Transportation System Plan

The Camas TSP is a long-range plan to guide transportation investments within the City's planning area through the future horizon year of 2045. As the transportation element of the City's Comprehensive Plan, these transportation system improvements address current deficiencies and serve future local and regional needs, and align with the community's goals, objectives, and vision for the future. This TSP was developed through community and stakeholder input and is based on the City's transportation system needs, opportunities, and anticipated available funding. The State of Washington Growth Management Act (GMA) in RCW 36.70A.070 (6) requires the TSP to include:

- An inventory of transportation facilities and services.
- Adoption of multimodal levels of service standards for all locally owned arterials and active transportation facilities.
- A forecast of multimodal transportation for a minimum of 10 years including land use assumptions used in estimating travel (in this case, 25 years based on the adopted regional land-use plan).
- Identification of specific actions to bring transportation facilities and services to established multimodal levels of service.
- A list of transportation system needs to meet current and forecasted demand and implement the multimodal network.
- A finance plan that serves as the basis for the six-year transportation improvement program.

Evergreen Public Schools

EVERGREEN PUBLIC SCHOOLS
CAPITAL FACILITIES PLAN

2026-2032

BOARD OF DIRECTORS

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Dr. Christine Moloney

SENIOR DIRECTOR OF CAPITAL FACILITIES

Nicole Daltoso

Adopted by the Evergreen School District Board of Directors
June 10, 2025

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Appendix A – Capital Facilities Inventory

Appendix B – Population and Enrollment Data

I. EXECUTIVE SUMMARY

The Evergreen Public Schools Capital Facilities Plan (CFP) is a six-year plan prepared by district staff as the organization's capital facility planning document, in part, to support the use of school impact fees as provided for under the Washington State Growth Management Act (the "GMA"). School districts adopt capital facilities plans to satisfy the requirements of the GMA and to provide Clark County (the "County), the City of Vancouver, and the City of Camas (the "Cities") with a schedule and financing program for the district's capital improvement needs over the next six years (2026-2032) to ensure that adequate school facilities are available to serve new growth and development.

In accordance with the Growth Management Act and the County and City Impact Fee Ordinances, this CFP contains the following required elements:

- A description of space requirements for educational programs (Section II)
- An inventory of existing capital facilities owned by the District (Section III)
- Future enrollment projections for each grade span (Section IV)
- A forecast of proposed capacities of expanded or new capital facilities over the next six years based on the inventory of existing facilities and the standard of service (Section V)
- A six-year plan for financing capital facilities within projected funding capacities, which identifies sources of public funds for such purposes. The financing plan separates projects and portions of projects which add capacity from those which do not, since the latter are generally not appropriate for impact fee funding (Section VI)
- A calculation of impact fees based on the formula in the County and City impact fee ordinances and supporting data substantiating such fees (Section VII)

In developing this CFP, the District used the following guidelines:

- The District will use information from recognized sources, such as professional demographers and planners, county and city adopted land use plans and county GIS data.
- The District will use data it generates from reasonable methodologies.
- The CFP and methodology to calculate the impact fees will comply with the GMA and county and city codes.
- The six-year facility needs are based on an enrollment forecast that takes local development trends into account.
- The District has future plans to replace permanent/bricks and mortar facilities for its students and will develop a CFP to accomplish that objective. While the District does not anticipate a further need for additional students to be housed in portables, the District will do so as necessary. Housing students in portables, temporarily, is necessary to qualify for state funds that are needed to build new schools.

The Evergreen School District is comprised of 54 square miles. It serves a significant portion of the Vancouver Urban Growth Area and smaller areas in the Camas Urban Growth Area and rural Clark County.

The District serves residents from the cities of Vancouver and Camas and from unincorporated Clark County. The District is bordered by Vancouver School District to the west, Camas School District to the east and Battle Ground and Hockinson School Districts to the north. The Columbia River and state line border the District to the south.

The District serves a population of 23,366 students (October 2024 enrollment). For purposes of facility planning, the CFP considers grades K-5 as an elementary school, grades 6-8 as a middle school, and grades 9-12 as a high school.

In addition, Cascadia Technical Academy (formerly known as the Clark County Skills Center) is located in and operated by Evergreen Public Schools serving students half days from all Clark County school districts. The District serves home schooled students in grades K-8 through a supplemental program operated by Home Choice Academy and pre-school special needs students at four elementary schools. The District runs Transition to Kindergarten programs at seven locations with an enrollment of 110 students.

In February 2018, voters approved a bond measure which funded the projects noted below. The bond program is scheduled to close out the 2025-2026 school year.

- Replacement of five elementary schools (Burton, Ellsworth, Marrion, Image, and Sifton)
- Construction of one new elementary school with capacity for 550 students (Mill Plain)
- Replacement of Wy'east Middle School
- Replacement of Mountain View High School
- A permanent addition to Heritage High School
- A new District Office
- Replacement of alternative schools, including Legacy High School, Archway Academy (formerly known as 49th Street Academy), and Hollingsworth Academy (formerly known as the Transitions program).

Due to savings across all bond projects, the District was also able to replace Mill Plain Elementary, the Transportation facility, and add music room additions at Evergreen High School and Union High School. These projects concluded in 2025.

II. DISTRICT EDUCATIONAL PROGRAMS AND STANDARDS OF SERVICE

The District's standard of service is based on program year, class size by grade span, number of classrooms, types of facilities, and the District's adopted educational program. Quality education plays a vital role in growing a strong local economy. To provide quality education, the District must have quality facilities to serve as the supporting space for developing the whole child within a community to prepare them for a competitive world. The educational program standards, which typically drive facility space needs include grade configuration, optimum facility size, class size, educational program offerings, classroom utilization and scheduling requirements.

In addition to student population, other factors such as collective bargaining agreements, government mandates, state and federal funding requirements and community expectations affect classroom space requirements. Programs, such as special education, bilingual education, preschool and daycare programs, and other specialized programs, often supplement traditional educational programs. These programs can have a significant impact on the available student capacity of school facilities.

The District's current program and educational standards are summarized below. The program and educational standards may vary during the six-year CFP planning horizon. Absent significant changes in factors that are beyond the District's control, the District will provide the following programs and standards of service in 2026 through 2032. If significant changes occur that require new facilities or improvements, beyond what is identified in this CFP, the District will prepare and submit an updated CFP.

A. Elementary Educational Standards

Elementary schools provide education in all core subject areas including reading, writing, math, social studies and science. All students receive instruction in P.E., music, art and have access to media programs. Full day kindergarten is provided at each elementary school. Transition to kindergarten is provided at Crestline, Endeavour, Harmony, Image, Mill Plain, Sifton, and Sunset. The District's educational standards of service, which directly affect elementary school capacity, include:

- Class sizes for grades K-3 are targeted at 23 students per class.
- Class sizes for grades 4-5 are targeted at 25 students per class.
- Music instruction and physical education are provided in separate (pull-out) classrooms.
- All elementary schools have a library media resource center which includes additional space for a technology lab.
- Special education services are provided for some students in learning spaces that are separate from the general education classroom. Special education learning spaces can serve 1 to 15 students at any one time.

B. Middle and High School Program Standards

Middle schools provide instruction in the core disciplines of English, math, social studies, science, physical education, music and art. Students have elective offerings available including music, art, technology, and vocational technical courses.

High schools provide course work including English, history, science, math, physical education, music and art. Additionally, elective offerings include vocational technical programs.

The District educational standards of service, which directly affect middle school and high school capacity include:

- Class sizes for grades 6-8 are targeted at 27.33 students per class.
- Class sizes for grades 9-12 are targeted at 30 students per class.
- Special programs, such as music, art, physical education, drama, home and family education learning assistance, are provided in separate instructional space. The class size ranges from 20 to 70 students.
- The District provides science classroom space that supports advanced coursework at the secondary level that require water, sinks, gas, hoods, safety equipment, etc.
- It is not possible to achieve 100% utilization of all regular teaching stations throughout the day due to schedule conflicts, the need for specialized rooms for certain programs and the need for teachers to have work space during their planning period.

C. District-wide Educational Programs

In addition to elementary, middle, and high school program standards, the Evergreen School District's core services and program offerings include the following:

- Physical education space is provided to meet strengthened health standards. This can include covered play areas, field space, gyms and other multi-use spaces.
- Technology access is necessary and expectations are increasing. Technology (either within the classroom or in dedicated labs) takes extra space that is not calculated in current state square footage allowances, but is necessary for student learning. Technology support and infrastructure needs are also increasing, which further erodes the state square footage allowances.
- Art and music spaces are critical to the District's educational programs. As student population grows, additional support space for these essential programs is required.
- In an information driven environment, access to knowledge through appropriately sized library/media spaces is essential.
- Extra-curricular activities need space in order to be supported properly with growing student populations.

D. District-wide Support and Special Services

In addition to the above core educational programs, the following support services are essential to the District's educational program:

- Food service preparation, delivery and use space. Cafeteria, food preparation and delivery space must be maintained. Miscalculating the need for this core service can have significant impacts on the overall learning environment for students.

- Other support centers, including transportation, maintenance, warehouse and print shop facilities are critical to support the educational program and the business operation.

The following special services are also necessary to meet the needs of special populations:

- Special Education services are provided at all schools within the District. Currently, most students receive special education services at their neighborhood schools. Special needs program standards change year to year as a result of various external or internal changes. External changes may include mandates or needs for special services, or use of technology. Internal changes may include modifications to the program year, class sizes, and grade span configurations. Changes in physical aspects of the school facilities also affect special educational service standards.
- Special populations require specific support, which often necessitates dedicated spaces. Federal and state programs, including Title 1 reading and math, highly capable, and bilingual are necessary, but come with limited funding that does not cover the cost of adding facilities to support the programs.
- Early Childhood programs, such as new or expanded preschool programs are a vital service and an essential educational component. They place additional demands on facilities.
- Supplementary services in core academic areas and multiple pathways that prepare students for a broader range of post-secondary learning opportunities require additional space.

III. CAPITAL FACILITIES INVENTORY

The facilities inventory serves to establish a baseline for determining the facilities needed to accommodate future demand at acceptable levels of service. This section provides an inventory of capital facilities owned and operated by the District including schools, portables, undeveloped land and support facilities. Portable classrooms are used on an interim basis to house students until funding can be secured to construct permanent classrooms.

A complete listing of District facilities can be found in Appendix A.

A. School Sites

Facility Type	No. of Schools	No. of Classrooms		Capacity	
		Permanent	Temporary	Permanent	Temporary
Elementary Schools	22	589	109	13,942	2,580
Middle Schools	6	218	102	5,958	2,788
High Schools	6	350	20	10,500	600

(1) Capacity is based on the space requirements for the District's educational programs as outlined in Section II. Portable classrooms are excluded from capacity calculation but shown above for reference.

(2) High schools include four comprehensive high schools and two alternative high schools. Other special programs that provide district wide support are included in Section B Services below.

B. Services

In addition to schools, the District owns and operates additional facilities which provide special programs and operational support functions to the schools.

SUPPORT FACILITIES	LOCATION	DESCRIPTION
Administrative Service Center	13413 NE LeRoy Haagen Memorial Drive Vancouver, WA 98682	Supports all facilities
Maintenance Facility	3004 NE 124th Avenue Vancouver, WA 98682	Supports all facilities
McKenzie Stadium	2205 NE 139th Avenue Vancouver, WA 98682	Supports extracurricular
Transportation	14015 NE 28th Street Vancouver, WA 98682	Supports student transportation
Warehouse – Central Receiving & Distribution	2205 NE 138th Avenue Vancouver, WA 98684	Supports all facilities
49th Street Academy	14619-B 49th Street Vancouver, WA 98682	Leased for early childhood education
Old Legacy	2219 NE 128th Avenue Vancouver, WA 98684	Leased for early childhood education
Cascadia Technical Academy	12200 NE 28th Street Vancouver, WA 98682	Consortium program with pull-out enrollment

C. Land Inventory

The District owns undeveloped sites in addition to the sites with built facilities.

The undeveloped sites listed below are for future growth, including:

- 6.05 acres south of NE 9th Street and east of NE 136th Avenue, Vancouver WA 98682 for a future school or support service.
- 1.54 acres located at the NE corner of Marrion Elementary School
- 3.27 acres located at the NE corner of Mountain View High School
- 20 acres located at SE 29th Street and SE 176th Avenue, known as the Vancouver Innovation Center for a future middle school.

IV. STUDENT ENROLLMENT PROJECTIONS

A. Projected Student Enrollment 2024-2030 (Headcount)

The District's six-year enrollment projection is based on a forecast prepared by Flo Analytics, which considers enrollment projection models to estimate future enrollment, including cohort survival, grade progression, and population ratio. Local population, and housing and development trends are also considered.

Due to compounding factors, K-12 enrollment has decreased. One factor hindering enrollment growth has been the slow growth in the child population within Evergreen School District boundaries. After averaging, 1,835 births each year from 2011-12 to 2015-16, birth totals fell to 1,626 in 2021-22 and rebounded to 1,756 in 2022-23. The annual K-to-birth ratio is a key metric representing a combination of net migration between birth and age five and the share of five-year-old residents enrolled in District K classes, often referred to as a "capture rate." Ratios for Evergreen School District have fluctuated, recovering from the 2020-21 low of 0.75, but have not returned to pre-pandemic levels. The middle scenario assumes that K-to-birth ratios will increase slightly in the next years before stabilizing at 0.89 from 2028 through 2032.The District added more than 40,000 residents since 2000, including growth of over 18,000 between the 2010 and 2020 census. The school-age population, ages five to 17, decreased by 518 between 2010-2020, and annual average growth rate of -0.2 percent. The population under age five decreased by about 900 during the same period, resulting in an annual average growth rate of -0.9 percent.

K-12 enrollment decreased by 843 students between 2017-18 and 2019-20, then decreased by 1,311 students in 2020-21 during the COVID-19 pandemic. Enrollment continued to decline in each subsequent year, losing 739, 207, 414 students in 2021-22, 2022-23, and 2023-24, respectively, resulting in a six-year K-12 decline of 3,514 students (13.5 percent) between 2017-18 and 2023-24. The largest numeric and percentage enrollment loss between 2017-18 and 2023-24 among grade groups K-5, 6-8, 9-12 occurred in the K-5 grade group, in which enrollment fell by 2,151 students (19.1 percent). Grades 6-8 also had enrollment losses over the 2017-18 to 2023-24 period amounting to 855 students (14.6 percent). Enrollment in grades 9-12 decreased by 508 students (5.7 percent) between 2017-18 and 2023-24.

In the middle growth scenario projected by Flo Analytics, K-12 enrollment is expected to decrease from 22,499 in 2023-24 to 20,740 in 2033-34, representing a loss of about 1,800 students in the ten-year period. K-5 enrollment is expected to increase by 457 students (5.0 percent), from 9,123 in 2023-24 to 9,580 in 2033-34, 6-8 enrollment is expected to decrease by 534 students (10.6 percent), from 5,021 to 4,487, and 9-12 enrollment is expected to decrease by 1,682 students (20.1 percent), from 8,355 to 6,673.

As a result of projected future housing development, there is a potential to see growth in the following attendance areas: Fisher's Landing Elementary, Harmony Elementary, Columbia Valley Elementary, Shahala Middle, Pacific Middle, Frontier Middle, Mountain View High, and Union High.

Grade	Fall 2024	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31
Total K-5	9,046	8,883	8,795	8,813	8,871	9,056	9,205
Total 6-8	4,844	4,751	4,684	4,686	4,624	4,491	4,381
Total 9-12	8,240	7,783	7,554	7,308	7,161	7,024	6,982
TOTAL	***22,130***	***21,417***	***21,033***	***20,807***	***20,656***	***20,571***	***20,568***

V. CAPITAL FACILITIES NEEDS

A. Forecast Facility Needs

Facility needs for purposes of the Growth Management Act and impact fees are based on existing capacity and forecast enrollment. The 2025 Facility needs are shown in the table below and the amount of the facility need that is attributed to forecast growth is described under the table.

Facility	2024 Capacity	2032 Projected Enrollment	2032 Facility Need
Elementary Schools	13,942	9,369	-4573
Middle Schools	5,958	4,309	-1649
High Schools	10,500	6,938	-3562
TOTAL	***30,400***	***20,616***	***-9784***

- Elementary Schools: The baseline enrollment forecast shows a decrease of students.
- Middle Schools: The baseline enrollment forecast for grades 6 through 8 shows a strong decline as grades matriculate through 2032. It should be noted that the replacement of Wy'east Middle during the 2018 bond was not treated as a growth-related facility need.
- High Schools: The baseline enrollment forecast shows a decrease of students as grades matriculate through 2032.

B. Land Acquisition

Acquisition of new school sites in advance of enrollment needs is critical to prepare to meet the challenge of potentially increasing enrollment and addressing existing needs. However, the District has experienced a decline in enrollment so it does not anticipate the need to acquire land in the near future. The District currently owns one potential middle school site and one small site to accommodate the expansion of support services. As growth occurs and enrollment follows suit, and both development regulations and educational programming are modified over time, these sites may not be suitable for development at the time when construction is needed.

The District does have school replacement and capital renewal needs. A future bond would not add capacity as it is not projected for the District to see growth, but rather level out enrollment.

VI. CAPITAL FACILITIES FINANCE PLAN

A. Six Year Financing Plan

Anticipated property acquisition and new construction is based on the enrollment forecast, capacity, the District's educational standards and the community's support of finance tools to fund the improvements. At the time of this plan's adoption, there is no present need for new capital facilities.

In the event that current facilities do not fully address space needs for student growth and a reduction in interim student housing (portables), the Board could consider various courses of action, including, but not limited to:

- Update this capital facilities plan;
- Increase class sizes;
- House students in additional portables;
- Alternative scheduling options;
- Change the instructional model, or
- Modify the school calendar

VII. SCHOOL IMPACT FEES

The GMA authorizes jurisdictions to collect impact fees to supplement funding of additional public facilities needed to accommodate new development. Impact fees cannot be used for the operation, maintenance, repair, alteration, or replacement of existing capital facilities used to meet existing service demands.

A. School Impact Fees

The county's and cities' impact fee programs require school districts to prepare and adopt CFPs meeting the specifications of the GMA and the county and city ordinances. Impact fees are calculated in accordance with the local jurisdiction's formula, which is based on projected school facility costs necessitated by new growth contained in the District's CFP. The formula allocates a portion of the cost for new facilities to the single family and multi-family house that create the demand (or need) based on a student factor, or the average number of students that live in new single family and multi-family homes. The formula also provides a credit for state match and Bond Proceeds (or property taxes).

B. Methodology and Variables Used to Calculate School Impact Fees

When assessed the District's impact fees are calculated utilizing the formula in the Clark County and Vancouver impact fee ordinances.

C. Proposed Impact Fee Schedule

Based on the fact that adequate capacity exists at each grade level in existing facilities, and that enrollment is expected to decline, the District is not entitled to seek impact fees upon adoption of this plan. State law allows collected impact fees to be encumbered or spent within 10 years of when paid. RCW 82.02.080.

EVERGREEN PUBLIC SCHOOLS
APPENDIX A
CAPITAL FACILITIES INVENTORY

ELEMENTARY SCHOOLS	SITE (ACRES)	ADDRESS	OCCUPANCY	Building SF per WAC	Attached Covered Play SF	Detached Covered Play SF	Portable SF	Modular SF	Other	*Total SF*
Burnt Bridge Creek	10.41	14619-A NE 49th Street Vancouver, WA 98682	1988	49,414	4,230	0	9,408	0	500	***63,552***
Burton	17.4	13501 NE 28th Street Vancouver, WA 98684	2022	61,425	0	3,200	0	0	0	***64,625***
Columbia Valley	11.58	17500 SE Sequoia Circle Vancouver, WA 98683	2004	60,556	2,200	3,200	0	0	0	***65,956***
Crestline	10.77	13003 SE 7th Street Vancouver, WA 98683	2014	60,143	3,761	3,634	0	0	0	***67,538***
Ellsworth	10.14	512 SE Ellsworth Road Vancouver, WA 98664	2021	61,425	0	3,200	0	0	0	***64,625***
Emerald	9.43	4000 NE 164th Avenue Vancouver, WA 98682	2020	61,425	0	3,200	0	0	0	***64,625***
Endeavour	8.86	2701 NE Four Seasons Lane Vancouver, WA 98684	2008	60,556	2,200	3,200	6,272	0	0	***72,228***
ESD 112 PreK (former 49th St Academy)	2.71	14619-B 49th Street Vancouver, WA 98682	1988	10,799	0	0	1,568	0	0	***12,367***
Home Choice Academy	w/BUR	13419 NE 28th Street Vancouver, WA 98684	2003	0	0	0	0	13,295	0	***13,295***
Fircrest	11.16	12001 NE 9th Street Vancouver, WA 98684	1976	54,400	4,500	0	1,568	0	500	***60,968***
Fisher's Landing	11.69	3800 SE Hiddenbrook Drive Vancouver, WA 98683	1996	49,972	4,010	0	9,408	0	500	***63,890***
Harmony	13.7	17404-A NE 18th Street Vancouver, WA 98684	1991	49,519	4,020	0	12,544	0	500	***66,583***
Hearthwood	10.97	801 NE Hearthwood Boulevard Vancouver, WA 98684	1981	49,100	4,500	0	1,568	4,608	500	***60,276***
Illahee	34.2	19401 SE 1st Street Camas, WA 98607	2001	55,699	4,016	0	4,704	0	500	***64,919***
Image	20.94	5201 NE 131st Avenue Vancouver, WA 98682	2020	61,425	0	3,200	0	0	0	***64,625***
Marrion	16.02	10119 NE 14th Street Vancouver, WA 98664	2021	61,425	0	3,200	0	0	0	***64,625***
Mill Plain	8.64	16200 SE 6th St Vancouver, WA 98684	2023	61,425	0	3,200	0	0	0	***64,625***
Orchards	11.81	11405 NE 69th Street Vancouver, WA 98662	2004	60,556	2,200	3200	3,136	5,040	0	***74,132***
Pioneer	47.24	7212 NE 166th Avenue Vancouver, WA 98682	1993	49,519	4,020	0	9,408	0	0	***62,947***
Riverview	10.76	12601 SE Riveridge Drive Vancouver, WA 98683	1976	54,400	4,500	0	1,568	0	500	***60,968***
Sifton	10.64	7301 NE 137th Avenue Vancouver, WA 98682	2020	61,425	0	3,200	0	0	0	***64,625***
Silver Star	11.92	10500 NE 86th Street Vancouver, WA 98662	1973	41,463	1,728	3,634	11,508	0	0	***58,333***
Sunset	10.11	9001 NE 95th Street Vancouver, WA 98662	1976	54,400	4,500	0	4,704	0	500	***64,104***
York	11	9301 NE 152nd Avenue Vancouver, WA 98682	2003	56,108	2,200	3,200	0	0	0	***61,508***
TOTAL ELEMENTARY	**322.1**			**1,246,579**	**52,585**	**42,468**	**77,364**	**22,943**	**4,000**	**1,445,939**

EVERGREEN PUBLIC SCHOOLS
APPENDIX A
CAPITAL FACILITIES INVENTORY

MIDDLE SCHOOLS	SITE (ACRES)	ADDRESS	OCCUPANCY	Building SF per WAC	Attached Covered Play SF	Detached Covered Play SF	Portable SF	Modular SF	Other	*Total SF*
Cascade	16.4	13900 NE 18th Street Vancouver, WA 98684	2004	110,315	0	6,570	3,136	8,064	1,000	***129,085***
Covington	21.45	11200 NE Rosewood Avenue Vancouver, WA 98662	2006	112,361	0	3,200	7,840	8,064	1,000	***132,465***
Frontier	w/PIO	7600 NE 166th Avenue Vancouver, WA 98682	1995	101,046	0	3,600	17,248	0	2,000	***123,894***
Pacific	17.18	2017 NE 172nd Avenue Vancouver, WA 98684	1983	106,581	0	2,946	29,792	0	500	***139,819***
Shahala	w/ILL	601 SE 192nd Avenue Vancouver, WA 98683	2001	104,298	0	3,224	18,816	0	720	***127,058***
Wy'east	25	1112 SE 136th Avenue Vancouver, WA 98683	2022	134,860	3,637	0	0	0	500	***138,997***
TOTAL MIDDLE SCHOOLS	**80.03**			**669,461**	**3,637**	**19,540**	**76,832**	**16,128**	**5,720**	**791,318**

HIGH SCHOOLS	SITE (ACRES)	ADDRESS	OCCUPANCY	Building SF per WAC	Attached Covered Play SF	Detached Covered Play SF	Portable SF	Modular SF	Other	*Total SF*
Legacy	6.6	13300 NE 9th St, Vancouver WA 98684	2021	27,700	0	1,440	0	0	0	***29,140***
Hollingsworth Academy	w/LHS	13400 NE 9th St, Vancouver WA 98684	2021	28,710	0	0	0	0	0	***28,710***
Archway Academy (fka Transitions)	w/LHS	13500 NE 9th St, Vancouver WA 98684	2021	8,460	0	0	0	0	0	***8,460***
Evergreen (includes Sports Annex in bldg sf only - see below for parcel/acres)	27.77	14300 NE 18th Street Vancouver, WA 98684	1969/2007	264,354	0	0	13,748	0	1,619	***279,721***
HeLa	2.89	9105 NE 9th Street Vancouver, WA 98664	2013	69,008	0	3,600	0	0	0	***72,608***
Heritage	45.44	7825 NE 130th Avenue Vancouver, WA 98682	1999/2022	253,601	0	0	0	0	1,700	***255,301***
Old Legacy - LHX (Leasing to EOCF)	6.81	2219 NE 138th Ave, Vancouver, WA 98684	1987	11,554	0	0	3,136	5,180	M	***19,870***
Mountain View	38.23	1500 SE Blairmont Drive Vancouver, WA 98683	2022	279,411	0	0	0	0	3,250	***282,661***
Union	45.75	6201 NW Friberg/Strunk Street Camas, WA 98607	2007	234,900	0	0	0	11,648	0	***246,548***
TOTAL HIGH SCHOOLS	**173.49**			**1,177,698**	**0**	**5,040**	**16,884**	**16,828**	**6,569**	**1,223,019**
Cascadia Technical Academy	11.91	12200 NE 28th Street Vancouver, WA 98682	1983 to 2014	100,704	0	0	0	0	0	***100,704***
TOTAL CCVSC	**11.91**			**100,704**	**0**	**0**	**0**	**0**	**0**	**100,704**

SUPPORT FACILITIES	SITE (ACRES)	ADDRESS	OCCUPANCY	SF			Portable SF	Modular SF	Other	Total SF
Administrative Services Center	5.97	13413 NE LeRoy Haagen Memorial Dr. Vancouver, WA 98684	2021	71,940	0	0	0	0	0	***71,940***
Evergreen HS Sports Annex	18.03	14405 NE 28th St., Vancouver WA 98684	2022	see Evergreen High School						
Maintenance	2.57	3004 NE 124th Avenue Vancouver, WA 98682	1981	7,000	0	0	0	0	0	***7,000***
McKenzie Stadium	5.75	2211 NE 138th Ave, Vancouver WA 98684	1984	4,916	0	0	0	0	0	***4,916***
Transportation	22.66	14015 NE 28th St., Vancouver WA 98682	2024	26,000	0	0	950	0	0	***26,950***
Warehouse (Central Receiving)	5.71	2205 NE 138th Avenue Vancouver, WA 98684	1976	25,000	0	0	0	0	0	***25,000***
TOTAL SUPPORT FACILITIES	**60.69**			**134,856**	**0**	**0**	**950**	**0**	**0**	**135,806**

VACANT LAND	SITE (ACRES)	ADDRESS								Total SF
Future School Site (across from Winco)	6.05	NE 9th St / NE 136nd Avenue Vancouver, WA 98682	N/A	0	0	0	0	0	0	**0**
NE Corner of Marrion ES	1.54	No situs address	N/A	0	0	0	0	0	0	**0**
NE Corner of MTV (soccer field)	0.95	No situs address	N/A	0	0	0	0	0	0	**0**
NE Corner of MTV	2.32	No situs address	N/A	0	0	0	0	0	0	**0**
Vancouver Innovation Center	20	No situs address (SE 29th St & SE 176th Ave)	N/A	0	0	0	0	0	0	**0**
TOTAL VACANT LAND	**30.86**			**0**	**0**	**0**	**0**	**0**	**0**	**0**

EVERGREEN PUBLIC SCHOOLS
APPENDIX B
POPULATION/ENROLLMENT PROJECTIONS

Enrollment Forecasts by Individual Grade – Middle Scenario

Grade	2023–24	2024–25	2025–26	2026–27	2027–28	2028–29	2029–30	2030–31	2031–32	2032–33	2033–34
K	1,354	1,400	1,394	1,398	1,528	1,521	1,534	1,543	1,551	1,560	1,568
1	1,495	1,385	1,432	1,425	1,430	1,562	1,555	1,569	1,578	1,586	1,595
2	1,552	1,507	1,396	1,444	1,437	1,442	1,575	1,568	1,582	1,591	1,599
3	1,549	1,574	1,528	1,416	1,464	1,457	1,462	1,597	1,590	1,604	1,613
4	1,589	1,547	1,572	1,526	1,414	1,462	1,455	1,460	1,595	1,588	1,602
5	1,584	1,604	1,561	1,586	1,540	1,427	1,475	1,468	1,473	1,610	1,603
6	1,601	1,557	1,576	1,534	1,559	1,514	1,402	1,450	1,443	1,448	1,582
7	1,681	1,606	1,562	1,581	1,539	1,564	1,518	1,406	1,454	1,447	1,452
8	1,739	1,688	1,613	1,569	1,588	1,546	1,571	1,525	1,412	1,460	1,453
9	1,846	1,766	1,714	1,638	1,593	1,612	1,570	1,595	1,548	1,434	1,482
10	1,881	1,853	1,774	1,722	1,646	1,601	1,620	1,577	1,603	1,555	1,441
11	2,346	2,199	2,173	2,097	2,047	1,975	1,932	1,950	1,909	1,934	1,888
12	2,282	2,216	2,122	2,097	2,022	1,973	1,902	1,860	1,878	1,837	1,862
K–5	9,123	9,017	8,883	8,795	8,813	8,871	9,056	9,205	9,369	9,539	9,580
6–8	5,021	4,851	4,751	4,684	4,686	4,624	4,491	4,381	4,309	4,355	4,487
9–12	8,355	8,034	7,783	7,554	7,308	7,161	7,024	6,982	6,938	6,760	6,673
Total	22,499	21,902	21,417	21,033	20,807	20,656	20,571	20,568	20,616	20,654	20,740

Enrollment Forecasts by Individual Grade – High Scenario

Grade	2023–24	2024–25	2025–26	2026–27	2027–28	2028–29	2029–30	2030–31	2031–32	2032–33	2033–34
K	1,354	1,434	1,427	1,447	1,580	1,574	1,589	1,598	1,608	1,617	1,627
1	1,495	1,412	1,484	1,481	1,501	1,639	1,633	1,649	1,658	1,668	1,678
2	1,552	1,530	1,434	1,511	1,508	1,528	1,669	1,663	1,679	1,688	1,698
3	1,549	1,597	1,563	1,469	1,547	1,544	1,565	1,709	1,703	1,719	1,729
4	1,589	1,571	1,607	1,577	1,482	1,561	1,558	1,579	1,724	1,718	1,734
5	1,584	1,619	1,589	1,630	1,599	1,503	1,583	1,580	1,601	1,748	1,742
6	1,601	1,596	1,619	1,593	1,635	1,603	1,507	1,587	1,584	1,605	1,753
7	1,681	1,630	1,613	1,640	1,614	1,656	1,624	1,527	1,608	1,605	1,626
8	1,739	1,714	1,649	1,636	1,664	1,637	1,680	1,647	1,549	1,631	1,628
9	1,846	1,792	1,753	1,691	1,677	1,706	1,678	1,723	1,689	1,588	1,672
10	1,881	1,867	1,800	1,765	1,703	1,689	1,718	1,690	1,735	1,701	1,599
11	2,346	2,271	2,244	2,183	2,149	2,088	2,085	2,113	2,085	2,129	2,096
12	2,282	2,259	2,197	2,175	2,115	2,081	2,025	2,012	2,040	2,012	2,056
K–5	9,123	9,163	9,104	9,115	9,217	9,349	9,597	9,778	9,973	10,158	10,208
6–8	5,021	4,940	4,881	4,869	4,913	4,896	4,811	4,761	4,741	4,841	5,007
9–12	8,355	8,189	7,994	7,814	7,644	7,564	7,506	7,538	7,549	7,430	7,423
Total	22,499	22,292	21,979	21,798	21,774	21,809	21,914	22,077	22,263	22,429	22,638

Data reported as of June 2024

WASHOUGAL SCHOOL DISTRICT

4855 EVERGREEN WAY WASHOUGAL, WA 98671 PH: 360.954.3000 FAX: 360.954.3099

WASHOUGAL SCHOOL DISTRICT

CAPITAL FACILITIES PLAN

2022 - 2027

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Adopted by the Washougal School District Board of Directors

June 10, 2025

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I. INTRODUCTION

A. Purpose of the Capital Facilities Plan

The Washington State Growth Management Act (the "GMA") includes public school facilities and services that must be provided as cities and counties plan for growth. School districts have adopted capital facilities plans to satisfy the requirements of the GMA and to identify additional school facilities necessary to meet the educational needs of the growing student populations anticipated in their districts.

The Washougal School District (the 'District") has prepared this Capital Facilities Plan (the "CFP") to provide Clark County (the "County") and the cities of Washougal and Camas (the "Cities") with the District's anticipated capital facility needs and the District's schedule and financing plan for those improvements over the next six years (2022 - 2027).

In accordance with the Growth Management Act and the County and City Impact Fee Ordinances, this CFP contains the following required elements:

- The District's standard of service, which is based on program year, class size by grade span, number of classrooms, types of facilities, and other factors identified by the District, including teacher contracts and funding requirements,
- An inventory of existing capital facilities owned by the District, showing the locations and capacities of the facilities, based on the District's standard of service.
- Future enrollment forecasts for each grade span (elementary, middle, and high schools).
- A forecast of the future needs for capital facilities and school sites based on the District's enrollment projections.
- The proposed capacities of expanded or new capital facilities over the next six years based on the inventory of existing facilities and the standard of service.
- A six-year plan for financing capital facilities within projected funding capacities, which clearly identifies sources of public money for such purposes. The financing plan separates projects and portions of projects that respond to growth from those that do not, since the latter are generally not appropriate for impact fee funding.

B. Overview of the Washougal School District

District Overview and Strategic Facility Planning

The Washougal School District is located in southwest Washington and serves residents of

Washougal, Camas, and unincorporated Clark County, as well as the Columbia River Gorge communities in the Cape Horn area of Skamania County. The District spans a long, narrow band of land stretching from the Columbia River on the south to the White Pass School District boundary in Lewis County. This unique geographic configuration includes parts of both Clark and Skamania Counties and borders two additional counties—Cowlitz and Lewis—to the north and west. The District is bordered by seven school districts to the west—Camas, Hockinson, Battle Ground, Woodland, Kalama, Kelso, and Toutle Lake—and by the Skamania School District to the east. The northern section of the District encompasses uninhabited wilderness around Mt. St. Helens in the Gifford Pinchot National Forest. Jemtegaard Middle School is located within the boundaries of the Columbia River Gorge National Scenic Area.

As of May 2025, Washougal School District serves approximately 2,558 full-time equivalent (FTE) students. Of these, 1,170 attend four elementary schools (PreK–5), 572 attend two middle schools (6–8), and 776 attend one high school and one K–8 virtual alternative school with 40 students attending. For facility planning purposes, this Capital Facilities Plan defines grade bands as PreK–5 for elementary, 6–8 for middle, and 9–12 for high school.

In February 2025, the District re-evaluated enrollment forecasts and student generation rates using information provided by OSPI and other recognized methodologies. These included analysis of land development trends, housing starts, and local residential construction. The resulting projections, combined with demographic data and development activity, inform both short- and long-term planning reflected in this updated Capital Facilities Plan.

According to the City of Washougal's Comprehensive Plan, the city's population is expected to grow by approximately 6,700 residents over the next 20 years, reaching nearly 25,000 by 2045. This growth includes the development of more than 3,700 new housing units, many of which are expected to house families with school-age children. Major residential and mixed-use developments such as the Pendleton District and Hyas Point are anticipated to bring hundreds of new homes to the area. These factors point to a likely increase in student enrollment over time.

In response, the District must proactively plan to meet both current and future educational facility needs. In the near term, the most pressing challenge is to update and modernize existing infrastructure to ensure that facilities remain safe, functional, and supportive of student learning. Over the next six years, the District will focus on renovating aging facilities, expanding capacity for program growth, and improving outdoor and shared spaces that benefit both students and the broader community.

At the same time, strategic long-term planning is essential. With limited land availability and increasing development pressure, it is critical for the District to explore property acquisition options now to secure viable sites for future schools. Delaying this action could result in higher

costs and fewer location choices, making it more difficult to accommodate projected enrollment increases.

Ultimately, preparing for enrollment growth and maintaining high quality facilities are essential to the District's mission. Our schools must provide environments that not only support foundational learning but also equip students with the skills and traits—such as critical thinking, collaboration, innovation, and adaptability—needed to thrive in a global economy. By aligning facility planning with instructional vision and community growth, Washougal School District reaffirms its commitment to helping all students reach their full potential.

Accordingly, the District's facility planning is focused on three critical areas:

1. **Land Acquisition for Future School Sites**
   With increasing development and limited available land, the District is actively studying the purchase of additional property for future schools. Acquiring land now will ensure the ability to respond to future enrollment needs and protect against cost increases and land scarcity.

2. **Infrastructure Modernization**
   Many District facilities are aging and require updates to remain safe, functional, and aligned with modern learning needs. This includes increasing space for program growth, addressing mechanical and structural improvements, and expanding the District's maintenance and warehouse storage capacity to better manage equipment, supplies, and seasonal needs.

3. **Enhanced Safety and Outdoor Learning Environments**
   To reduce theft and better protect District assets, planned upgrades to security systems include improved access controls and surveillance technology. Simultaneously, outdoor spaces—playgrounds, athletic fields, and green spaces—must remain welcoming, safe, and reflective of the pride our community holds in its schools. These areas serve not only students but the broader community as hubs of recreation, connection, and shared experience.

Washougal School District is proud of the strong support it receives from the community and is committed to maintaining modern, functional facilities that reflect community values and serve all residents. Quality school facilities attract families, contribute to property values, and support a thriving local economy. As the city grows and evolves, the District remains focused on long-range educational, financial, and operational planning that ensures we continue to meet the needs of current students while preparing for those yet to come.

Investing in our schools—through property acquisition, modernization, and outdoor facility

upgrades—is not just about keeping up with growth. It is about creating the conditions where students can thrive, where the community can gather, and where Washougal fulfills its vision of being known for educational excellence, innovation, and a strong, connected community.

II. DISTRICT EDUCATIONAL PROGRAMS AND STANDARDS OF SERVICE

To provide quality education, the District must have quality facilities. Facilities provide the physical structure necessary for achieving educational goals established by the Board of Directors. School facility needs are dictated not only by student enrollment, but also by the space required to accommodate the District's adopted educational program. Beyond regular education, the District also provides specialized programs with unique facility needs such as special education, dual language programs, technology education, transitional kindergarten, early learning programs and after school programs.

The District's program and educational standards for 2025 are summarized below. The program and educational standards may vary during the six-year CFP window. Absent significant changes in factors that are beyond the District's control, the District will provide the following programs and standards of service. If significant changes occur that require new facilities or improvements, beyond what is identified in this CFP, the District will prepare and submit an updated CFP to the County and Cities.

A. District-wide Educational Programs

The District's core services and program offerings include the following:

- Elementary schools provide education in all core subject areas including reading, writing, math, social studies and science. In addition, students participate in P.E., music, art and library programs weekly.
- Middle schools provide instruction in the core disciplines of English, mathematics, social studies, science, P.E., music, art and CTE. Students have elective offerings available including robotics, music and art. An extracurricular sports program is offered after school to students in 7th and 8th grades. 6th graders are able to participate in cross country and wrestling.
- High schools provide course work including English, history, science, mathematics, P.E., music, art and CTE. Additional offerings include career and technical education programs, career counseling, access to Running Start at Clark College, and Advanced Placement courses. An extracurricular program includes clubs, athletics, arts, etc.
- The District provides science classroom space supporting advanced coursework at the secondary level that require water, sinks, gas, hoods, safety equipment, etc. Schools are

working to meet expanded science standards and this will require spaces that cannot typically be met by adding portables.

- The District will need to upgrade elementary, middle school, and high school spaces supporting health, fitness, fine arts and extracurricular activities. This includes replacing the turf and gym floor at the high school.
- Technology access is necessary and expectations are increasing. Technology (either within the classroom or in dedicated labs) takes extra space that is not calculated in current state square footage allowances but is necessary for student learning. Technology support and infrastructure needs are also increasing, including the installation of fiber optic cable to Jemtegaard and Canyon Creek Middle School as well as Cape Horn Elementary.
- Beginning in the fall of 2022, the District added Transition to Kindergarten. For the 2024-25 school year the District has one Transition to Kindergarten in each elementary school.
- Library/Media demands are crucial. In an information driven environment, access to knowledge through appropriately sized library/media spaces is essential.
- Extra-curricular activities need space in order to be supported properly.
- Supplementary services in core academic areas and multiple pathways that prepare students for a broader range of post-secondary learning opportunities require additional space and spaces that are modernized to reflect industry standards to replicate the real-life working environments for our students to gain quality learning experiences in these post-secondary fields.

In addition to the above core educational programs, the following support services are essential to the District's educational program:

- Given current enrollment, the core facilities are sufficient.
- Maintenance and warehouse support facilities are a necessary component in the District operations and may, in the future, need to be expanded in response to growth.

The following special services are also required to meet the needs of special populations:

- Special Education programs are provided at all schools within the District. Special needs program standards change year to year as a result of various state and Federal regulation adjustments. Changes may also be prompted by research-based modifications to programs, class sizes, and the changes in the population of students eligible for services. Modifications in school facilities are sometimes needed to meet the unique needs of individual students or cluster small groups of students with similar needs.
- Federal and state programs, including Title 1 Reading and Math, Highly Capable, and Bilingual are required programs with limited funds that do not cover the expense of adding facilities as needed to support the programs.

- The District's early learning program is housed in six classrooms across the District, one or two classrooms at each elementary school.

B. Elementary Educational Standards

The following District educational standards of service affect elementary school capacity:

- Class sizes for grades K-1 are targeted not to exceed 23 students per class.
- Class sizes for grades 2-3 are targeted not to exceed 24 students per class.
- Class sizes for grades 4 and 5 are targeted not to exceed 26 students per class.
- Music instruction will be provided but in separate classrooms.
- Physical education is provided in a separate area.
- All elementary schools have a library/media resource center.
- A standard for technology has been developed for elementary classrooms.
- Special education, Title I and LAP (Learning Assistance Program) instruction is provided for some students in classrooms that are separate from regular teaching stations. Class sizes in these programs tend to be small, usually not more than 15 students.

C. Middle and High School Program Standards

The following District educational standards of service affect middle and high school capacity:

- Class sizes for grades 6-8 are targeted not to exceed 28 students per class.
- Class sizes for grades 9-12 are targeted not to exceed 29 students per class.
- Music, art, PE, drama, and career and technical education classes are provided in separate instructional space.
- Counseling and career center programs are provided in separate spaces.
- A standard for technology has been developed for secondary classrooms. Technology labs are provided in separate spaces.
- Each middle and high school has a separate library/media resource center.

III. CAPITAL FACILITIES INVENTORY

The facilities inventory serves to establish a baseline for determining the capital improvements necessary to accommodate future student enrollment at acceptable levels of service. This section provides an inventory of capital facilities owned and operated by the District, including schools, portables, support facilities, and outdoor spaces. In addition to assessing overall capacity, the inventory also reflects the importance of maintaining modern structures and ensuring outdoor areas are safe, functional, and usable for both educational and community purposes. This comprehensive view helps the District plan strategically for updates, replacements, and future expansion to support student learning and community use.

In the Washougal School District, teaching stations are defined as dedicated instructional spaces that meet essential criteria for delivering core academic instruction. These spaces

include necessary components such as appropriate student desks or work surfaces, instructional presentation equipment (e.g., whiteboards, display technology), and teacher workspace. Teaching stations are counted based on the District's grade-level class size caps and reflect spaces used for direct instruction. Gymnasiums, libraries, large group assembly spaces, and other non-classroom areas are not included in our teaching station count.

To guide planning and space adequacy, we reference the **Washington State School Construction Assistance Program (SCAP)** square footage standards, which recommend:

- **90 square feet per student** for Grades K–6
- **117 square feet per student** for Grades 7–8
- **130 square feet per student** for Grades 9–12

These ranges inform long-term planning efforts, helping ensure instructional spaces are appropriately sized and equipped to meet student needs. All spaces classified as **Direct Instructional Space**—including general education classrooms, science and computer labs, and other learning environments that require specialized student engagement—are included in this analysis. Non-assignable spaces such as hallways, restrooms, mechanical rooms, and circulation areas are excluded from teaching station calculations.

A. Schools

The District maintains four elementary schools, two middle schools, one high school, and one alternative school. The elementary schools serve grades TK-5, middle schools serve grades 6-8, and the high school serves grades 9-12. Presently the alternative school serves grades K-8 virtually. The District is planning to offer an alternative 9 – 12 program starting in the 2025-26 school year.

Table 1 shows the name, number of teaching stations and student capacity for the elementary schools based on the District's standard of service described above.

Table 1: Elementary School Inventory 2024-25

Elementary Schools	Building Opened	Total Building Sq. Ft.	Teaching Stations	Student Capacity	2024-25 Enrollment	Utilization Rate
Gause 1100 34th Street, Washougal, WA 98671	1953	56,196	24	600	236	39%
Hathaway 630 24th Street, Washougal, WA 98671	1934	48,901	21	525	294	56%

Cape-Horn Skye 9731 Washougal River Road, Washougal, WA 98671	1958	43,838	18	450	282	63%
Columbia River Gorge 35300 SE Evergreen Hwy, Washougal, WA 98671	2017	63,883	25	625	351	56%
Total		212,818	88	2,200	1,163	52%

Table 2 shows the name, number of teaching stations and student capacity of the two middle schools based on the District standard of service described above.

Table 2: Middle School Inventory 2024-25

Middle Schools	**Building Opened**	**Total Bldg. Sq. Ft.**	**Teaching Stations**	**Student Capacity**	**2024-25 Enrollment**	**Utilization Rate**
Canyon Creek MS 9731 Washougal River Road, Washougal, WA 98671	2001	46,609	15	420	168	40%
Jemtegaard MS 35300 SE Evergreen Hwy, Washougal, WA 98671	2017	58,483	21	588	415	71%
Total		105,092	36	1,008	583	58%

Table 3 shows the name and number of teaching stations and student capacity of each high school based on the District standard of service described above.

Table 3: High School Inventory 2024-25

High School	Building Opened	Total Bldg. Sq. Ft.	Teaching Stations	Student Capacity	2024-25 Enrollment	Utilization Rate
Washougal HS 1201 39th Street Washougal, WA 98671	1956	150,471	42	1,218	875	72%
Excelsior 1201 39th Street Washougal, WA 98671	2017	8,996	4	116	0	N/A
Total		159,467	46	1,334	875	

Student capacity was determined based on the number of teaching stations within each building and the space requirements of the District's current educational programs and standards of service. Student capacity as noted in Tables 1, 2, and 3 does not include capacity that is currently provided in portables at each school.

B. Portables

Portable classrooms are used on an interim basis to house students until funding can be secured to construct permanent classrooms. To accommodate future growth on a short term and immediate basis, the Washougal School District may purchase and utilize portable classrooms.

The District currently has a total of seven dual-classroom portables, totaling 14 classroom spaces. None of these spaces are used for basic education classrooms. Instead, the portables are used to support other programs, including non-Washougal School District operated early learning programs and specialized services. Table 4 identifies the number of portables located at each elementary school site and distinguishes between those used for interim capacity (as

teaching stations) and those used for special programs or other educational purposes.

Table 4: Portables Inventory

Facility Type	Number of Portables Number of Classrooms	Number of Classrooms Used as Teaching Stations	Number of Students Housed in Portable Classrooms
Elementary Schools	7 Portables 14 Classrooms	12 teaching stations	0
TOTAL	7/14	12	0

C. Support Facilities

In addition to schools, the District owns and operates additional facilities that provide special programs and operational support functions to the schools. An inventory of these facilities is provided in Table 5.

Table 5: Support Facility Inventory

Facility	Location
Administrative Service Center	4855 Evergreen Way, Washougal, WA 98671
Maintenance Facility/ Warehouse	4855 Evergreen Way, Washougal, WA 98671
Transportation Facility	4855 Evergreen Way, Washougal, WA 98671
Fishback Stadium	1201 39th Street, Washougal, WA 98671
Warehouse Facility	995 E Street, Washougal, WA 98671

IV. STUDENT ENROLLMENT PROJECTIONS

A. Existing Enrollment

The District's enrollment by grade level in March 2025 was 2,558 full-time equivalent (FTE) students. Of these, 1,170 students attend four elementary schools (PreK–5), 572 students attend two middle schools (6–8), 776 students attend one high school and 40 students attend the K–8 virtual alternative school.

B. Projected Student Enrollment

The District's six-year enrollment projections are based on a report from OSPI Report 1049. The District's projected enrollment data is informed by the Information and Condition of Schools (ICOS) system—a statewide, web-based inventory and facilities tracking tool. ICOS provides

school districts with data on building conditions and supports planning through accurate facility information, condition ratings, and comparative analysis. This system is used by the state to guide programs such as the School Construction Assistance Program and the Asset Preservation Program, and helps districts identify future capital needs.

The following table shows existing enrollment and the District's six-year enrollment forecast by grade level bands. As reflected in Table 6a, the District is forecasting a decrease of 11 elementary students, 156 middle school students and 172 high school students.

The District's six-year enrollment projections are also based on a report from Johnson Economics Demographer Report as a baseline. The following table shows existing enrollment and the District's six-year enrollment forecast by grade level bands. As reflected in Table 6b, the District is forecasting as a baseline an increase of 151 elementary students, a decrease of 77 middle school students and a decrease of 139 high school students.

Table 6a: WSD Enrollment Forecast

Grade	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**
Total TK-5	1107	1092	1051	1037	1018	999
Total 6-8	560	563	566	546	526	507
Total 9-12	752	733	725	738	750	756
Totals	**2419**	**2388**	**2342**	**2321**	**2294**	**2262**

Table 6b: Projected Enrollment (OSPI Cohort Survival) 2026 – 2030

Grade	**2026**	**2027**	**2028**	**2029**	**2030**
Total K-5	1017	965	948	920	894
Total 6-8	560	556	532	513	473
Total 9-12	808	764	725	701	700
Totals	**2385**	**2285**	**2205**	**2134**	**2067**

V. CAPITAL FACILITIES NEEDS

Table 7: Capital Facilities Needs

Project Description	**Cost Estimate**	**Added Capacity**	**Cost for Added Capacity**
Portables	$1,200,000	312 [2]	$1,200,000
Future School Site	$2,000,000	TBD [1]	$2,000,000

Maintenance Facility/Warehouse	$1,400,000	In response to growth	$1,400,000
Technology Infrastructure	$1,000,000	In response to growth	$1,000,000
Total	**$5,600,000**		**$5,600,000**

1. Cost for the future school site represents a portion of the total cost of the project and would include State SCAP and local dollars within the financing package. The District does not own and has not yet selected the future school site.
2. To accommodate short-term and immediate enrollment growth, the District may purchase and utilize portable classrooms. This plan incorporates those facilities—along with the necessary equipment and furniture—into the District's project list. In addition to serving as interim classroom space, the District is also focused on modernizing and increasing the efficiency of its aging portable inventory to ensure they provide safe, functional, and supportive learning environments. When growth-related, impact fee revenue may be used to fund the acquisition or improvement of portable facilities.

VI. CAPITAL FACILITIES FINANCE PLAN

A. Six-Year Finance Plan for Planned Facility Improvements

The total cost for the above planned and needed improvements is $5,600,000. Funds for the improvements are identified in Table 8A and 8B below.

Table 8A: Secured Finance Plan - Based on March 2025

Type	Amount
Impact Fees (as of 3/25)*	$3,349,795.83
Unreserved Capital Projects Funds	$1,880,463.13
Reserved (Levy Proceeds/Other)	$1,067,220.64

*To be spent on facilities listed in a capital facilities plan adopted by the District.

Table 8B: Unsecured Finance Plan

Type	Amount
Impact Fees (1)	$2,000,000
Capital Projects Funds (bonds and state match)	$500,000
Total Unsecured	$2,500,000

(1) From projects in the pipeline.

B. Financing Sources

The cost for all the planned improvements will be paid for with school impact fees that have been collected for these facilities contained in the District's prior CFP, or current or future CFPs if such plans identify facilities needed to serve growth, and other available public funds.

The Growth Management Act authorizes local jurisdictions to collect impact fees to supplement funding of additional public facilities needed to accommodate new development. Local jurisdictions in Clark County have adopted impact fee programs that require school districts to prepare and adopt a Capital Facilities Plan. Impact fees reflected within this Capital Facilities Plan do not include expenditures on new permanent facilities needed for growth except for the land purchase and other facilities needed for growth from the prior plan, which are carried forward. Under RCW 82.02.070(3)(b), impact fees may be expended or encumbered for a permissible use within ten years of receipt. Therefore, the District will not be collecting additional impact fees once this plan is adopted until the plan is updated and additional facilities are identified to serve growth.

VII. 20-YEAR OUTLOOK

The City of Washougal is planning for significant growth through the year 2045. According to the City's "Onward: Comprehensive Plan Update," Washougal's population is projected to increase by approximately 6,724 residents, growing from about 18,150 today to roughly 24,874 residents by 2045. To accommodate this population growth, the City has outlined a strategy that prioritizes development within current city boundaries, emphasizing higher-density residential and mixed-use development in key areas such as the Town Center and the waterfront. This approach supports smart growth while preserving the city's natural character and small-town feel.

To meet the housing needs of this growing population, the City anticipates the construction of 3,735 new housing units over the next two decades. Of these, nearly 2,000 are planned to be affordable to households earning below 80% of the area median income. This mix of market-rate and affordable housing is designed to ensure that Washougal remains accessible to a wide range of residents, including families, seniors, and workers employed locally and throughout the region.

Employment growth is expected to accompany this residential development. Projections show an increase of 2,961 jobs by 2045, driven by growth in manufacturing, retail, and professional services. Developments such as the Hyas Point mixed-use project and the revitalization of the Pendleton District are expected to significantly contribute to this economic expansion by attracting businesses, creating new commercial space, and enhancing public amenities.

For the Washougal School District, this projected growth carries important implications. Over the next five years, the District expects continued enrollment decline due to an aging population and the delayed build-out of major housing developments. However, between 2028 and 2030, student enrollment is projected to stabilize and then gradually increase as new families move into completed residential areas. By 2045, enrollment is expected to surpass current levels, reaching an estimated 3,250 students. This trend underscores the importance of maintaining flexibility in school facility planning—balancing short-term enrollment shifts with long-term capacity needs.

In response to projected long-term enrollment growth, the Washougal School District is committed to proactively updating facilities and increasing capacity where needed. While current enrollment trends show a temporary decline, the District is planning with a long-term lens to ensure facilities are prepared to support a growing student population. This includes evaluating existing building capacity, modernizing aging infrastructure, and identifying opportunities for targeted expansion at key school sites. The District will continue to monitor housing development timelines and population shifts to inform future capital projects. Through responsible planning and strategic investment, Washougal School District aims to ensure that every student has access to safe, functional, and future-ready learning environments as the community grows.



General Sewer Plan

October 2026 / DRAFT

General Sewer Plan

October 2026 / DRAFT

This document is released for the purpose of information exchange review and planning only under the authority of Matthew Huang, October 2026, State of Washington PE No. 54002

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Abbreviations

°F	degrees Fahrenheit
2010 GSP	2010 General Sewer/Wastewater Facility Plan
AACE	American Associate of Cost Estimators
AAF	average annual flow
AAL	average annual load
AB	aeration basin
AD	Anaerobic Digesters
ADF	average day flow
ADWF	average dry weather flow
AKART	all known, available and reasonable methods of prevention, control and treatment
aSRT	Aerobic solids retention times
ATS	automatic transfer switch
BNR	biological nutrient removal
BOD	biochemical oxygen demand
BOD_5	5-day biochemical oxygen demand
CARA	critical aquifer recharge areas
$cBOD_5$	5-day carbonaceous biological oxygen demand
CCTV	closed-circuit television
cf/hr	cubic feet per hour
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIP	Capital Improvement Program
City	City of Camas
CMC	City municipal code
CMMS	Computerized Maintenance Management System
CMP	corrugated metal pipe
CWA	Clean Water Alliance
d/D	depth versus diameter
DNS	determination of non-significance
DSHT	Digested Sludge Holding Tank
DWF	dry weather flow
Ecology	Washington State Department of Ecology
EI&C	Electrical, instrumentation, and control
ELA	engineering, legal, and administration
ENR	Engineering News Report
FOG	fats, oil, and grease
FONSI	finding of no significant impact
fps	feet per second

ft^3	cubic feet
GIS	geographic information system
GMA	Growth Management Act
gpad	gallons per acre per day
gpcd	gallons per capita day
gpd	gallons per day
gpm	gallons per minute
GSP	General Sewer Plan
GWI	groundwater infiltration
H_2S	hydrogen sulfide
HARL	Hills at Round Lake
HGL	hydraulic grade line
HP	horsepower
HST	high speed turbo
I/I	infiltration and inflow
IDWF	influent dry weather flow
kcal/day	kilocalories per day
kVA	kilovolt-amperes
kW	killowatts
LS	lift station
M	million
MCC	motor control center
MDDF	maximum daily design flow
MDDL	maximum daily design load
MDF	minimum daily flow
MDS-EB	main distribution switchboard - elevator board
MG	million gallons
$Mg(OH)_2$	Magnesium hydroxide
mg/L	milligrams per liter
mgd	million gallons per day
MH	manhole
mL	milliliter
mL/g	milliliters per gram
MLSS	mixed liquor suspended solids
mm	millimeter
MMF	maximum monthly flow
MML	maximum month load
MS4	Municipal Separate Storm Sewer System
MWD	maximum week design load
MWDF	maximum week design flow

N/A	not applicable
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NH_3	ammonia
NH_3-N	ammonia-nitrogen
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
PARIS	Permitting and Reporting Information System
PC	primary clarifier
PCB	polychlorinated biphenyls
PDF	peak day flow
PDL	peak day load
PFAS	per- and polyfluoroalkyl substances
PHDF	peak hour demand flow
PHDL	peak hour design load
PHF	peak hour flow
PIDF	peak instantaneous design flow
PLC	programmable logic controller
ppd	pounds per day
ppd/sf	pounds per day per square foot
ppm	parts per million
psig	pounds per square inch gauge
PVC	polyvinyl chloride
PWWF	peak wet weather flow
QA/QC	quality assurance and quality control
R&R	repair and replacement
RAS	return activated sludge
RCW	Revised Code of Washington
RDII	rainfall dependent infiltration and inflow
RDT	rotary drum thickener
RPA	Reasonable Potential Analysis
SC	secondary clarifier
SCADA	supervisory control and data acquisition
scfm	standard cubic feet per minute
SEPA	State Environmental Policy Act
SOR	surface overflow rate
SR	State Route
SRT	solids retention time
SS	stainless steel

SSF	slow sand filtration treatment plant
STE	septic tank effluent
STEF	septic tank effluent filter
STEG	septic tank effluent gravity
STEP	septic tank effluent pump
SU	standard units
SVI	sludge volume index
SWBD	switch board
SWCAA	Southwest Clean Air Agency
SWD	side water depth
SWPP	stormwater pollution prevention plan
TCLP	toxic characteristic leachate procedure
TDH	total dynamic head
TKN	total Kjeldahl nitrogen
TPS	thickened primary sludge
TSMC	Taiwan Semiconductor Manufacturing Co.
TSS	total suspended solids
UGA	urban growth area
UGB	urban growth boundary
USEPA	United States Environmental Protection Agency
UT1	Utility Transformer No. 1
UT2	Utility Transformer No. 2
UV	ultraviolet
UVT	ultraviolet transmittance
VCP	vitrified clay pipe
VFD	variable frequency drive
WAC	Washington Administrative Code
WAS	waste activated sludge
WRF	water reclamation facility
WSE	water surface elevation
WWF	wet weather flow
WWTF	wastewater treatment facility
WWTFO	Washington Wastewater Treatment Facility Operator

EXECUTIVE SUMMARY

ES.1 Introduction

The City of Camas (City) is located in Clark County, Washington, near the border of Washington and Oregon, along the Columbia River near Vancouver, Washington. The City owns and operates most of the sewer collection system within the City limits and its urban growth area (UGA). The collection system is a combination of gravity sewers, lift stations (LS), force mains (FM), and septic tank effluent pump (STEP) systems. Wastewater is collected and treated by the City at the Camas Wastewater Treatment Facility (WWTF) and then discharged to the Columbia River.

The purpose of the City's General Sewer Plan (GSP) is to provide a roadmap for managing the wastewater collection system over the next 20 years, accommodating growth, and maintaining a high level of service for existing customers. The Plan addresses key issues such as the replacement of older, deteriorating sanitary sewer facilities, evaluation of collection and treatment capacity for existing deficiencies and future development, assessment of sanitary sewer lift stations and force mains, and the City's infiltration and inflow (I/I) reduction program. The GSP and its recommendations were prepared in accordance with Washington Administrative Code (WAC) 173-240-050 and meet the requirements of the Washington Growth Management Act (GMA). The City owns and operates most of its sewer collection system, which includes gravity sewers, pump stations, force mains, and Septic Tank Effluent Pump (STEP) systems, and treats wastewater at the Camas Wastewater Treatment Plant (WWTF) before discharge to the Columbia River. Key elements addressed in the GSP include:

- The need and timing of the replacement of older, deteriorating sanitary sewer facilities within large, neighborhood-size areas within the City.
- The evaluation of the City's collection system and treatment capacity to address both existing system deficiencies and future development, as well as plan for future potential development-driven deficiencies.
- The evaluation of sanitary sewer LS and FM for removal, rehabilitation and replacement.
- The City's infiltration and inflow (I/I) program to evaluate options and needs for I/I reduction.
- Implementation of recommended improvements by priority which maintains affordable rates for the system users.

ES.1.1 Sewer Service Area

The current sewer service area covers approximately 7,600 acres, including properties within the City limits, and the future service area extends to the UGA, totaling 8,900 acres. A map of the sewer service area is presented in Figure ES.1.

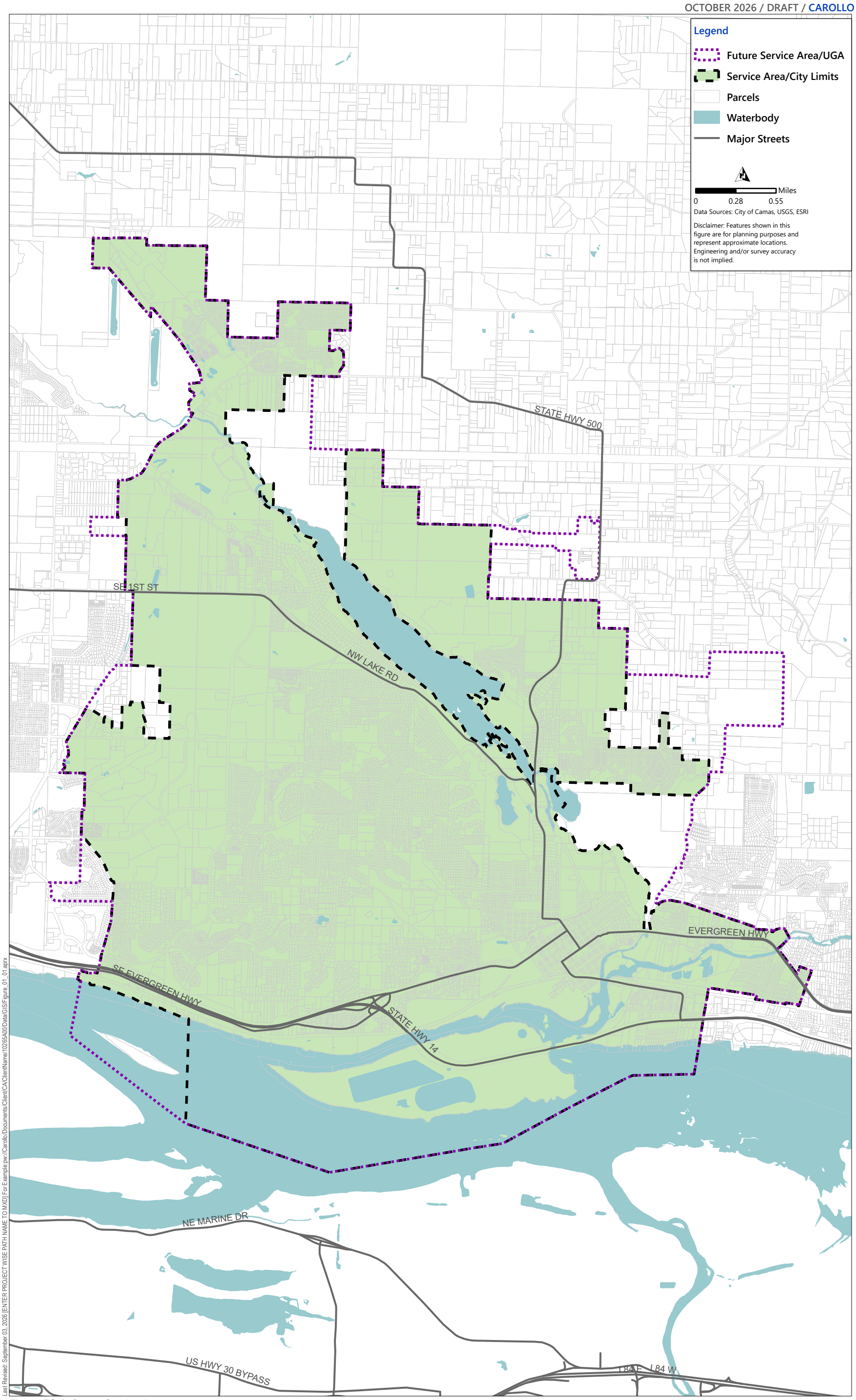


Figure ES.1 Sewer Service Area

ES.2 Policies

The City is responsible for managing and operating its wastewater system in accordance with all local, state, and federal regulations. To best manage the wastewater system and comply with regulations, the City has adopted wastewater system policies and criteria. These policies guide the development and financing of the infrastructure required to provide wastewater service and document the City's commitments to current wastewater system customers as well as those considering service from the City. The policies and criteria are organized into the following categories:

- Sewer Service.
- Environmental Stewardship.
- Design Criteria and Standards.
- Financial Policies.
- Regulatory Requirements.

ES.3 Basis of Planning

Chapter 3 of the GSP presents flow and load projections for the collection system and WWTF based on planned development and future population growth through 2045. Slightly different methodologies were used to project wastewater flows for the collection system and the WWTF due to the specific requirements of each analysis and the availability of data. For example, collection system flow monitoring data was collected from January 15, 2025, to April 29, 2025, while WWTF flow and load projections are based on an evaluation of historical plant data. The collection system was projected for both 2045 and buildout conditions, while the WWTF analysis was projected through 2045.

ES.3.1 Collection System Flow Projections

The collection system flow projections were developed for use in the City's calibrated hydraulic model of the sewer system. The modeled system primarily includes gravity sewers that are 8-inch or larger and the trunk of the STEP system. The data collected during the flow monitoring program, along with population growth projections, land use development projections, and wastewater flow factors, were used to develop the flow projections. The updated hydraulic model flow projections summary is presented below, reflecting 2025, 2045, and buildout planning horizons:

Table ES.1 Hydraulic Model Flow Projections Summary

Planning Horizon	ADWF (mgd)	PWWF (mgd)	Peaking Factor (PWWF:ADWF)
2025	2.85	22.9	8.04
2045	5.32	26.8	5.04
Buildout	7.55	35.2	4.67

Notes:
ADWF - average dry weather flow; mgd - million gallons per day; PWWF - peak wet weather flow.

ES.3.2 WWTF Flow and Load Projections

The City's WWTF receives flows from the gravity collection system, septic tank effluent from the City's STEP system, and the septage receiving station. Load and flow projections were developed independently for the WWTF based on historical influent flow and raw wastewater pollutant concentrations, typical septage and STEP system characteristics and population growth projections, and industrial flow contributions. The influent flow projections developed for the WWTF for 2025 and 2045 are summarized in Table ES.2:

Table ES.2 Current and Projected WWTF Flows

Flow Parameter	2025 Flow (mgd)	2045 Flow (mgd)
Average Annual Flow (AAF)	2.9	5.4
Maximum Monthly Flow (MMF)	4.0	7.5
Minimum Daily Flow (MDF)	5.7	10.7
Peak Hourly Flow (PHF)	10.8	20.4
Peak Instantaneous Design Flow (PIDF)	11.8	22.2

Wastewater loading data, related to effluent limitations contained in the City's WWTF National Pollution Discharge Elimination System (NPDES) permit, were also projected to evaluate treatment capacity for future conditions. Historical values for 5-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), and Total Kjeldahl Nitrogen (TKN) and projections to 2045 are detailed and summarized in Table ES.3:

Table ES.3 Current and Projected WWTF Loads

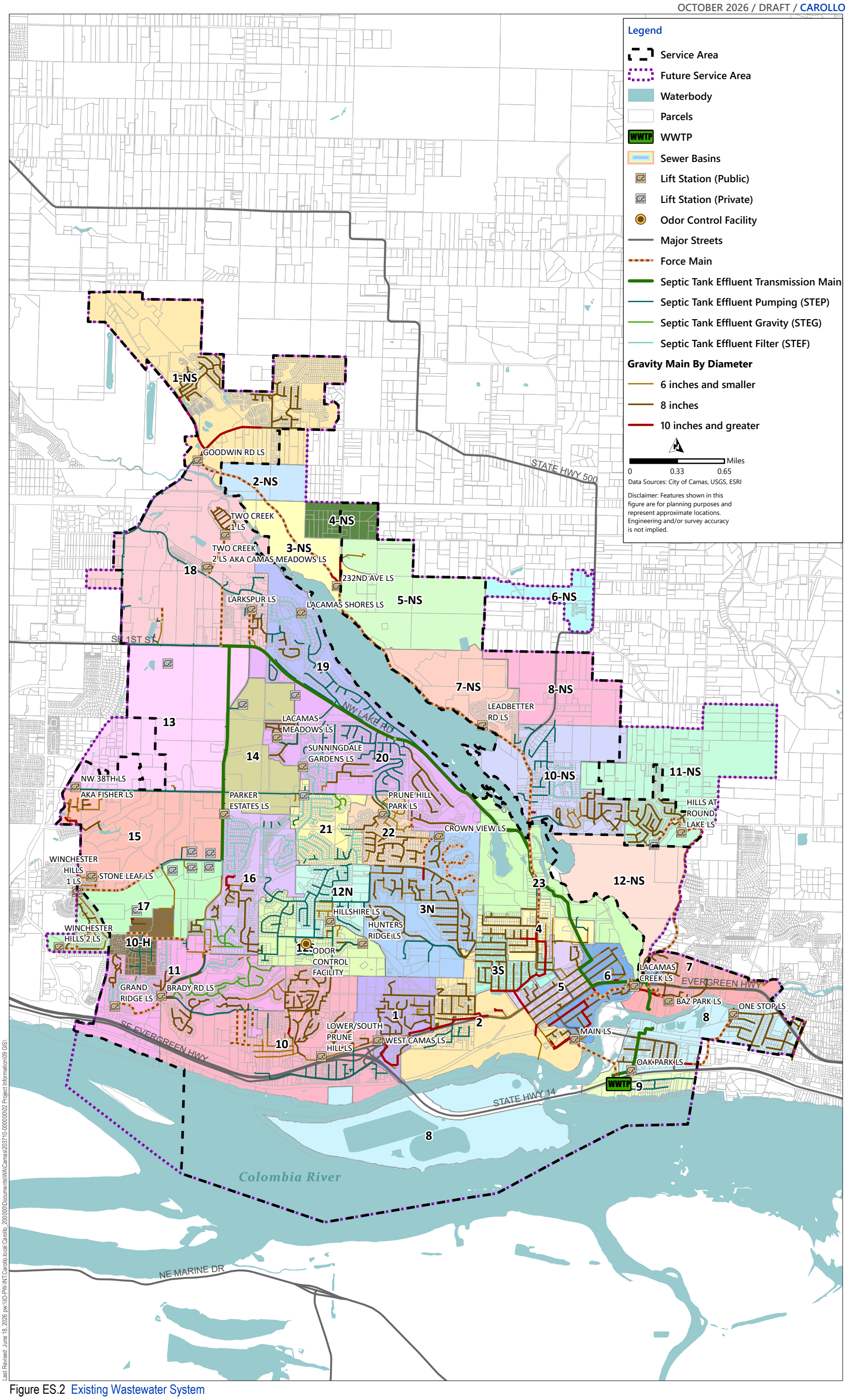
Load Parameter	2025 Influent Load (ppd)	2045 Influent Load (ppd)
Sewered Population	30,056	37,080
BOD_5 (ppd)		
Average Annual	3,200	6,000
Maximum Month	4,000	7,500
Maximum Week	4,500	8,500
TSS (ppd)		
Average Annual	3,100	5,800
Maximum Month	3,900	7,300
Maximum Week	4,300	8,100
TKN (ppd)		
Average Annual	1,300	2,500
Maximum Month	1,500	2,800
Maximum Week	1,600	3,000

Notes:
ppd - pounds per day.

ES.4 Existing System

Chapter 4 describes the sewer system within the City's service area, which is owned, maintained, and operated by the City. A map of the existing system is shown in Figure ES.2. The City's conventional gravity sewer system includes 405,499 (76.8 miles) linear feet of gravity mains, while STEP systems account for 290,019 linear feet (54.9 miles). The earliest portions of the gravity system date back to the 1920s. There are 28 lift stations operated within the service area and approximately 65,218 linear feet (12.4 miles) of force main. These systems convey wastewater to the City's WWTF. The septic tanks provide preliminary wastewater treatment, solids settling, and some digestion such that the effluent is not as strong as raw sewage collected in the conventional system. The City pumps out the septage from the STEP systems on a 5 to 7-year cycle.

The City's WWTF is located along the Columbia River in the southeastern portion of its sewer service area. The WWTF was originally constructed in 1972 and has had several modifications since that time to increase capacity and improve treatment capabilities to continue to meet all effluent permit requirements. The City's NPDES effluent discharge limitations, prohibitions, and requirements are similar to other municipal facilities, with standard 30/30 monthly TSS and BOD concentration limits and a mandatory 85 percent reduction in each. Additionally, the WWTF has ammonia limits of 20 milligrams per liter (mg/L) (NH_3 as N) in the summer and 7 mg/L (NH_3 as N) in the winter. An aerial view of the WWTF with each unit process and building identified is shown in Figure ES.3.



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Figure ES.2 Existing Wastewater System



Figure ES.3 WWTF Aerial Image with Site Plan

ES.5 Infiltration and Inflow Program

Chapter 5 of this GSP summarizes the City's efforts to reduce I/I from 2016 through 2024 and the quantifiable, positive improvement that has been accomplished. I/I consist of two components which may combine or act independently to increase flow volume and peak flows in the sewer system. If too much I/I enters the sewer system such that it operates at or above capacity, sanitary sewer overflows (SSO) could occur. More dilute wastewater can also be more difficult to treat under percent removal NPDES permits, such as those held by the City. The City has a long history of I/I studies and control efforts, investing over $4.55 million (M) in collection system I/I work and $750,000 in WWTF improvements to address I/I flows. I/I, comprising infiltration (groundwater entering through defects) and inflow (stormwater entering directly), can lead to surcharging, sewage backups, hydraulic overloading, and reduced treatment efficiency.

Though the City has reduced I/I on a gpcd basis and the 2025 NPDES permit no longer requires annual I/I reporting, the City is continuing to invest in the collection system to further reduce I/I through its ongoing repair and replacement program. Specifically, it is recommended to investigate I/I sources in flow meter basins with high I/I based on the recent flow monitoring completed in 2025 as part of this planning effort, including 5-1-2 (upstream of Crown View LS and South Prune Hill LS) and 4-1-3 (downtown).

ES.6 System Analysis

Chapter 6 describes the hydraulic modeling analysis conducted for gravity pipes, STEP main, force main, and LS in the modeled portion of the City's collection system. The modeled collection system includes primarily gravity sewers 8-inch or larger, force mains, lift stations, and the trunk of the STEP system. The analysis identified capacity deficiencies associated with current and projected future use and recommends improvements to alleviate any identified concerns. The collection system was evaluated by applying three planning scenarios:

- **Existing:** Matching existing (2026) calibrated conditions.
- **20-Year:** Incorporating growth through 2045 as identified in the 2045 Comprehensive Plan.
- **Build-Out:** Development of the full-service area including UGA.

Performance and design criteria for the conveyance system are outlined below:

- **Performance Criteria:**
  - Sewer pipes can be surcharged. If surcharging is within 3-feet from manhole (MH) rim, then the sewer was deemed deficient.
  - No surcharging (d/D>1) is allowed at shallow MHs which is defined as MHs where the distance between crown of pipe and MH rim is less than 3-feet.
- **Design Criteria:**
  - The City defines the acceptable d/D value of 0.92 for design of new sewers under design storm conditions and build out scenario.
  - The City's lift station should have sufficient firm capacity to pump the PWWF during the design storm with the largest pump out of service.
  - The City's force main and STEP should not exceed a maximum pipe velocity of 8 feet per second (fps) during the design storm.

ES.6.1 Gravity Collection System Evaluation

For each planning scenario, the associated PWWF was routed through the hydraulic model. The peak hydraulic grade line in manholes and gravity pipelines was compared to the established performance criteria. Under existing conditions, ten potential problem areas were identified where capacity is deficient to convey the PWWF. Three additional deficiency problem areas occur under 20-year (2045) conditions due to additional projected flows. Table ES.5 shows a summary of the pipe capacity improvements.

ES.6.2 STEP and Force Main System Evaluation

The evaluation of the City's wastewater collection system extended beyond gravity pipes to include the STEP system and force mains, with the force mains associated with lift stations incorporated into the hydraulic model. A primary performance criterion for both existing force mains and STEP mains was that their maximum pipe velocity should not exceed 8 fps during the design storm. Additionally, lift stations were assessed to ensure sufficient firm capacity to handle the PWWF from their tributary areas, meaning they could operate with the largest pump out of service. The hydraulic analysis revealed that the STEP system transmission main exceeds this velocity criterion under both existing and projected 2045 PWWF conditions, particularly in areas with steep downhill slopes like NW Parker Street and NW Lake Road. However, no practical improvement project was identified to address these high velocities because the STEP system operates under low pressure, and the steep downhill segments function hydraulically more like gravity mains than pressurized force main. As a result, improvements typically used to address high velocities in pressurized systems would not be practical in these locations. Table ES.5 shows a summary of the pipe capacity improvements.

ES.6.3 Lift Station Evaluation

The City's hydraulic model includes twelve of the City's 28 lift stations. The estimated current and future PWWFs were compared to the firm capacities of these modeled lift stations. Six of the modeled lift stations are considered deficient in the existing system scenario, and an additional three lift stations are identified as deficient under the 20-year conditions. Table ES.6 shows a summary of the lift stations' capacity improvements.

ES.6.4 General System Evaluation

The evaluation of the collection system also identified a need for general improvements to enhance overall system management, safety, and future planning capabilities. These general improvement projects are crucial for supporting current operations, improving accuracy in future evaluations, and informing subsequent capital improvement planning efforts. informing subsequent capital improvement planning efforts. Table ES.7 summarizes the recommended general improvements.

ES.6.5 Annual Repair and Replacement Evaluation

The City has established an Annual Repair and Replacement Program as a vital component of its CIP, dedicating $67.9 M over the 19-year planning horizon (2027 to 2045) with an average annual cost of approximately $3.6 M. These annual projects are critical for maintaining existing infrastructure, ensuring reliable service, and proactively addressing wear and tear across the entire wastewater collection and treatment system. These programs are essential for continuous system functionality, prolonging asset life,

and supporting the long-term goals of the General Sewer Plan. Table ES.8 shows a summary of the City's annual programs.

ES.6.6 Recommended Improvements

The collection system evaluation identified improvements needed to address existing deficiencies, accommodate projected 20-year demands, and support reliable system operation. The recommended improvements generally fall into the following categories:

- **Pipe Capacity Improvements:** Improvements to gravity sewers, force mains, and STEP transmission main where additional capacity is needed. Table ES.4 summarizes these pipe capacity improvements.
- **Lift Station Improvements:** Upgrades to pump capacity and redundancy at lift stations that do not meet existing or projected 20-year firm capacity requirements. Table ES.5 summarizes the recommended improvements for the lift stations identified as deficient.
- **General Improvements:** Improvements to support system monitoring, data collection, asset management, and ongoing system planning. Table ES.6 summarizes these recommended general improvements.

The recommended improvements include both short-term and long-term projects. Short-term improvements are generally intended to address existing system deficiencies or operational needs identified under current conditions and are recommended for implementation between 2027-2035. Long-term improvements are primarily associated with projected growth and are intended to accommodate increased demands through the 20-year planning horizon, with implementation recommended between 2036 and 2045. The timing of individual projects should be coordinated with system needs, development, and available funding and may be adjusted as conditions change. The recommended improvements are incorporated into the Capital Improvement Plan presented in Chapter 9.

Table ES.4 Recommended Pipe Capacity Improvement Projects

Project ID	Improvement Type	Location	Existing Size (inches)	Proposed Size (inches)	Length (feet)	Phase
P-01	Gravity	NW 6th Place West Upsize Improvements	8 8 8 12	12 15 18 18	814 179 386 86	Short-term
P-02	Gravity	NW 6th Place East Upsize Improvements	8 12	18 18	577 105	Short-term
P-03	Gravity	NW 6th Place Avenue West Upsize Improvements	12 12	18 21	333 2,302	Short-term
P-04	Gravity	NW 6th Place Avenue East Upsize Improvements	12 18 21 21 24 21	24 27 27 30 36 36	402 446 532 519 1,009 909	Long-term
P-05	Gravity	NW Fargo Street, NW 18th Loop, and NW 18th Avenue Upsize	8 8	12 15	1,736 1,008	Short-term

Project ID	Improvement Type	Location	Existing Size (inches)	Proposed Size (inches)	Length (feet)	Phase
P-06	Gravity	NE Garfield Street to NE 15th Avenue to NE Franklin Street to along the Creek Improvements	8 15 21 15	15 18 30 30	1,222 256 254 1,217	Long-term
P-07	Force Main	South Prune Hill Force Main Improvements	10	18	925	Short-term
P-08	Force Main	West Camas Lift Station Force Main Improvements	6	15	574	Short-term
P-09	Force Main	Main Lift Station Force Main Improvements	18	24	2,348	Long-term
P-10	Force Main	Leadbetter Road Lift Station Dual Force Main Improvements	-	10	6,500	Long-term
P-11	Gravity	Division Street Upsize	8 8 8	12 15 18	247 580 2,032	Short-term
P-12	Gravity	SE Everett Road to Leadbetter Rd Extension	-	8 12 18	2,031 692 6,036	Long-term
P-13	Gravity	SE 283rd Avenue to NE Woodburn Drive Extension	-	12	6,782	Long-term
S-01	STEP	NW Parker Street to NW Lake Road STEP Main Improvements	-	30	14,032	Long-term

Table ES.5 Recommended Lift Station Improvement Projects

Project ID	Location	Description	Phase
LS-01	Lower/South Prune Hill	Construct a new Lower/South Prune Hill LS with a pump capable of pumping 3.0 mgd of firm capacity to provide additional capacity and support future system needs. The station's firm capacity needs to convey more than double its current firm capacity from 0.86 mgd. Extensive upgrades to the station are recommended in the short term. An additional planning-level allowance of $150,000 was included for odor control improvements. The estimated cost is $5,381,000 and is planned for 2033.	Short-term
LS-02	West Camas	Construct a new West Camas LS with a pump capable of pumping 3.3 mgd of firm capacity to provide additional capacity and support future system needs. The LS is downstream of Lower/South Prune Hill LS, so this project should be implemented after the Lower/South Prune Hill LS Improvements (LS-01). An additional allowance of $100 per linear foot was included for asbestos cement pipe removal. The estimated cost is $5,204,000 and is planned for 2031.	Short-term
LS-03	Crown View	Construct a new Crown View LS with a pump capable of pumping 1.0 mgd of firm capacity to provide additional capacity and support future system needs. The LS is not able to serve existing system PWWF, nor 20-year and buildout PWWF. The station's firm capacity needs to convey more than triple its current firm capacity from 0.32 mgd. Extensive upgrades are recommended in the short-term. The estimated cost is $4,290,000 and is planned for 2034.	Short-term

Project ID	Location	Description	Phase
LS-04	Lacamas Creek	Replace the two existing pumps capable of pumping 2.13 mgd each to meet the required firm capacity. The LS receives more PWWF than its firm capacity during 20-year conditions (2.13 mgd vs 1.37 mgd firm capacity). Replacing the pumps in this station is recommended in the long-term. The estimated cost is $1,245,000 and is planned for 2045.	Long-term
LS-05	Main LS	Construct a new Main LS with pumps capable of pumping 21.0 MGD of firm capacity to provide additional capacity and support future system needs. An additional planning-level allowance of $150,000 was included for odor control improvements. The estimated cost is $10,640,000 and is planned for 2029.	Long-term
LS-06	Goodwin Road	Add a pump capable of pumping 0.49 mgd. The LS receives more PWWF than its firm capacity during the 20-year conditions (0.71 mgd vs 0.49 mgd firm capacity). Adding an additional third pump to the station is recommended in the long-term. The estimated cost is $502,000 and is planned for 2043.	Long-term
LS-07	232nd Avenue	Add a pump capable of pumping 0.53 mgd. The LS receives more PWWF than its firm capacity during existing and 20-year conditions (2.60 mgd vs 0.53 mgd firm capacity). Adding an additional third pump to the station is recommended in the long-term. The estimated cost is $502,000 and is planned for 2042.	Long-term
LS-08	Leadbetter Road	Add a pump capable of pumping 0.87 mgd. The LS receives more PWWF than its firm capacity during existing and 20-year conditions (3.63 mgd vs 0.87 mgd firm capacity). Activating the station's 8-inch dual force main and adding an additional third pump to the station is recommended in the long-term. The estimated cost is $2,379,000 and is planned for 2041.	Long-term
LS-09	Hills at Round Lake	Replace the two existing pumps with three new pumps, each capable of pumping 0.65 mgd to meet the required firm capacity. The LS receives more PWWF than its firm capacity during 20-year conditions (1.21 mgd vs 0.96 mgd firm capacity). Replacing the pumps in this station is recommended in the long-term. The estimated cost is $1,504,000 and is planned for 2044.	Long-term

Table ES.6 Recommended General Improvement Projects

Project ID	Project Name	Description	Phase
G-01	Basin 4-1-3 Pilot I/I Study	This program will investigate the source and magnitude of I/I of storm and groundwater into the wastewater system at locations where suspected high I/I is currently or is forecast to exceed conveyance and/or Lift Station capacity. Identifying and removing non-sewage flow where that would reduce surcharging such that costly capacity improvements might be avoided. The estimated cost is $200,00 and is planned for 2027.	Short-Term

Project ID	Project Name	Description	Phase
G-02	Basin 5-1-2 Flow Monitoring	This project is to install temporary flow meters in Basin 5-1-2 to capture flows from the Camas LS and Upper Prune Hill contributing areas separately. Both areas have pipe and LS capacity deficiencies and additional flow monitoring within this basin would help to understand if part of the basin is contributing a greater portion of I/I. This study should evaluate if projects within the basin have the potential to reduce I/I such that projects to increase hydraulic capacity within the system can be avoided. Reducing I/I has downstream benefits at the treatment plant as well. The estimated cost is $300,00 and is planned for 2027.	Short-Term
G-03	Geographic Information System (GIS)	This program will implement ongoing enhancements to the GIS, including asset mapping, data collection, database maintenance, and integration with utility management systems. Maintaining accurate and up-to-date spatial information will improve infrastructure planning, field operations, emergency response, and asset management while supporting informed decision-making and efficient delivery of utility services. The estimated cost is $250,00 and is planned for 2027.	Short-Term
G-04	Hydraulic Modeling	The City's collection system model is heavily skeletonized, only 28 percent of the City's collection system pipes are included. A full pipe or less skeletonized model is needed for a more robust evaluation of the system. In order to expand the model, accurate and updated GIS for the collection system should be developed. The estimated cost is $200,00 and is planned for 2029.	Short-Term
G-05	Electrical System Arc Flash Study	No arc flash labels were found on the plant's distribution equipment, and the owner confirmed that an Electrical System Study is not maintained. Carollo recommends completing this study as soon as possible and applying arc flash labels in accordance with Occupational Safety and Health Administration requirements to ensure worker safety. The estimated cost is $75,00 and is planned for 2027.	Short-Term
G-06	Hazardous Area Classification Study	To ensure regulatory compliance, and safety, Carollo recommends conducting a hazardous area classification study per NFPA 820 and upgrading any areas that do not meet code. The estimated cost is $50,00 and is planned for 2027.	Short-Term
G-07	Flood Risk Assessment	This project is a comprehensive flood risk analysis for all major electrical and control systems to assess vulnerabilities and strengthen flood resilience at the WWTF. The estimated cost is $100,00 and is planned for 2027.	
G-07	General Sewer Plan	2035 General Sewer Plan Update. The estimated cost is $700,00 and is planned for 2035.	Short-Term
		2045 General Sewer Plan Update. The estimated cost is $700,00 and is planned for 2045.	Long-Term

Table ES.7 Recommended Annual Maintenance Improvement Projects for Collection System

Project ID	Project Name	Description	Phase
R-01	Sewer Main R&R Program	This project includes miscellaneous improvements at the existing WWTF to address operational, maintenance, and reliability needs, with an estimated total cost of $20.4 M over the 19-year planning horizon	Annual
R-02	Miscellaneous Lift Station Projects	This program focuses on miscellaneous improvements at existing LSs, including pump and piping replacement, electrical upgrades, and wet well improvements, with an estimated total cost of $38,000,000 over the 19-year planning horizon	Annual

ES.7 Wastewater Treatment Facility

Chapter 7 summarizes efforts to identify shortfalls in WWTF capacity that will prevent the City from reliably treating and disposing of projected flow and loads in compliance with their NPDES permit at the end of the planning period (i.e., year 2045). To address the identified deficiencies, an alternatives analysis of the most viable improvement options was conducted, which resulted in the development of 25 projects to be incorporated into the GSP's capital improvement program (CIP).

The recommended WWTF improvement projects were prioritized based on the anticipated timing of the need for each improvement and categorized as short-term and long-term projects similar to the collection system projects. Because many of the recommended improvements are relatively smaller scale projects, their implementation timing is primarily based on when the improvement is needed to address existing operational or capacity needs, maintain reliable treatment, or accommodate projected increases in flow and loads. The 25 recommended WWTF projects with their respective priorities are summarized in Table ES.8. The annual WWTF miscellaneous projects are summarized in Table ES.9.

Table ES.8 Recommended WWTF Improvement Projects

Project ID	Description	Project Priority
TP-01	Replace existing Parshall Flume with a new, higher-capacity one to accommodate peak flow conditions and prevent influent wastewater spraying, including structural modifications.	Short-Term
TP-02	Construct a bypass around Primary Clarifiers No. 1 and 2 to route flows greater than the maximum day flow around the primary treatment process, including installation of a new 30-inch bypass pipeline.	Short-Term
TP-03	Construct a new Aeration Basin Influent Flow Splitter Box to improve flow distribution to the aeration basins, including new slide gates and piping.	Short-Term
TP-04	Replace existing screens and slide gates at the Plant Headworks to improve reliability and operation of the screening process.	Short-Term
TP-05	Relocate the internal recycle (IR) piping at the three existing aeration basins to the beginning of the Anoxic Selector to improve the treatment process and flow distribution.	Short-Term
TP-06	Modify baffle walls separating the anaerobic selectors within the existing aeration basins to improve flow distribution and maintain proper separation, including replacing plywood baffles with stainless steel.	Short-Term
TP-07	Demolish existing Secondary Clarifier No. 1 and construct a new one to match the size, slope, and criteria of Secondary Clarifier No. 3, improving reliability and performance.	Short-Term
TP-08	Replace the Return Activated Sludge (RAS) pumps for Secondary Clarifier No. 2 to match the size (1,400 gpm) of those serving Secondary Clarifier No. 3, improving pumping capacity.	Short-Term
TP-08	Replace the RAS pumps for Secondary Clarifier No. 2 to match the size (1,400 gpm) of those serving Secondary Clarifier No. 3, improving pumping capacity.	Short-Term
TP-09	Replace existing Plant Drain Lift Station No. 1 pumps and rehabilitate the wet well, addressing concrete corrosion and end-of-life equipment.	Short-Term
TP-10	Replace existing Plant Drain Lift Station No. 2 pumps and rehabilitate the wet well, addressing concrete corrosion and end-of-life equipment.	Short-Term
TP-11	Plantwide replacement of existing electrical conduit and support stands to improve the reliability and condition of the plant electrical infrastructure.	Short-Term

Project ID	Description	Project Priority
TP-12	Plantwide improvements to equipment enclosures and cable protection to enhance the reliability and security of the instrumentation and control system.	Short-Term
TP-13	Replace MCC-A and relocate associated electrical equipment to improve reliability and maintainability of the plant electrical system, allowing the Old Controls Building to be repurposed.	Short-Term
TP-14	Replace existing diffusers in the three aeration basins and add diffusers to one of the anoxic zones within each basin to function as swing zones, providing greater operational flexibility.	Short-Term
TP-15	Replace the two existing Disk Filtration Units with new units (6.0 mgd capacity) to improve filtration performance and operational reliability.	Short-Term
TP-16	Construct a new second UV disinfection channel outside the existing building to provide sufficient disinfection capacity for the entire plant effluent at peak hour flow (22.2 mgd).	Short-Term
TP-17	Replace the existing effluent transfer pumps with larger impellers, motors, and associated VFDs to provide sufficient capacity to pump the entire plant effluent flow (22.2 mgd) during high river conditions.	Short-Term
TP-18	Construct a second new plant outfall to the Columbia River to provide additional discharge capacity and improve reliability and flexibility.	Short-Term
TP-19	Construct a new electrical building west of the Digester complex to house electrical equipment serving the digester facilities, meeting hazardous area classification requirements.	Short-Term
TP-20	Construct a second Rotary Drum Thickener (RDT) for Waste Activated Sludge (WAS) thickening to provide redundancy and improve reliability.	Short-Term
TP-21	Construct a new Primary Clarifier No. 3 to improve primary treatment performance and provide additional process capacity.	Long-Term
TP-22	Construct a new Secondary Clarifier No. 4 to provide additional secondary treatment capacity and accommodate future growth.	Long-Term
TP-23	Replace the two existing 150-hp multistage centrifugal blowers with two new 150-hp high-speed turbo (HST) blowers to provide sufficient aeration capacity for future peak oxygen demands.	Short-Term
TP-24	Replace the existing sludge dryer with new sludge drying equipment to maintain reliable biosolids processing as the existing equipment approaches the end of its useful life.	Long-Term
TP-25	Replace the existing biofilters with new biofilters (biotrickling filters) to maintain reliable odor control as existing equipment approaches the end of useful life.	Long-Term

Table ES.9 Recommended Annual Maintenance Improvement Projects for WWTF

Project ID	Project Name	Description	Phase
R-03	Miscellaneous WWTF Projects	This program is dedicated to the replacement of wastewater pipelines constructed prior to the 1940s, with an estimated total cost of approximately $9.5 M over the 19-year planning horizon.	Annual

ES.8 Operations and Maintenance

Chapter 8 provides an overview of the City's wastewater utility organization, staffing, and operations and maintenance (O&M) program. The City has recently separated the water and sewer groups into two divisions. Staff work to provide effective and efficient service for utility rate payers through regular O&M activities on these systems.

ES.9 Capital Improvement Plan

The CIP presented in Chapter 9 includes projects needed to accommodate growth, repair and replace aged infrastructure, and attain level of service goals. As shown on Table ES.10, the CIP is organized and prioritized in two separate project categories: short-term (2027-2036) and long-term (2037-2045) periods. Projects are grouped into pipelines, LSs, STEP mains, annual rehabilitation and repair, treatment plant, and general types of infrastructure work. The total recommended CIP is estimated at $270.3 M. The CIP recommends budgeting $132.4 M in the short-term. The average annual short-term cost for all recommended projects is approximately $14.8 M per year from 2027 through 2035. The CIP recommends $137.8 M in the long-term with an average annual long-term cost of approximately $13.8 M per year from 2036 through 2045. The average annual cost over the 19-year planning horizon from 2027 through 2045 is $14.2 M. Table ES.11 presents the costs by project category and planning period.

Table ES.10 Capital Improvement Plan Summary(1)

Planning Period	Total Cost (M$)	Annual Cost (M$)
Short-term (2027 to 2036)	$132.4	$14.8
Long-term (2037 to 2045)	$137.8	$13.8
Total	**$270.3**	**$14.2**

Notes:
(1) Totals may not sum due to rounding.

Table ES.11 CIP Summary by Project Type(1)

Project Category	Total Capital Cost	Short-term (2027-2036)	Long-term (2037-2045)
Treatment Plant	$95,830,000	$51,280,000	$44,550,000
Gravity and Force Main	$39,570,000	$21,585,000	$17,980,000
STEP Main	$32,760,000	$0	$32,760,000
Lift Station	$31,310,000	$25,201,000	$6,109,000
General	$2,575,000	$1,875,000	$700,000
Annual Programs	$67,880,000	$32,154,000	$35,730,000

Notes:
(1) Totals may not sum due to rounding.

ES.10 Financial Analysis

[To be completed and included in next draft GSP.]

CHAPTER 1 INTRODUCTION

1.1 Introduction

The purpose of the City of Camas' (City) General Sewer Plan (GSP) is to present policies and an assessment of the system to recommend facility improvements. The GSP is intended to provide a road map for accommodating growth and maintaining a high level of service for existing customers. The existing system is aging and will continue to require investment to maintain a high level of service.

The GSP presents findings from evaluations of the existing sanitary sewer system which provides the groundwork for recommendations to resolve existing deficiencies and concerns, as well as accommodating growth. This chapter presents the objectives of this GSP, and a brief overview of the City's wastewater collection system. A list of abbreviations is provided in the Table of Contents to assist the reader in understanding the information presented in this GSP.

This GSP and recommended improvements were prepared in accordance with requirements of Washington Administrative Code (WAC) 173-240-050, which is administered by the Washington State Department of Ecology (Ecology) and meets the requirements of the Washington Growth Management Act (GMA).

This GSP addresses the following key issues:

- The need and timing of the replacement of older, deteriorating sanitary sewer facilities within large, neighborhood-size areas within the City.
- The evaluation of the City's collection system and treatment capacity to address both existing system deficiencies and future development, as well as plan for future potential development-driven deficiencies.
- The evaluation of sanitary sewer lift stations and force mains for removal, rehabilitation, and replacement.
- The City's infiltration and inflow (I/I) program to evaluate options and needs for I/I reduction.
- Implementation of recommended improvements by priority which maintains affordable rates for the system users.

1.2 Background and Goals

The City is located in Clark County, Washington near the border of Washington and Oregon. It is between the cities of Vancouver and Washougal along the Columbia River as shown in Figure 1.1. The City owns and operates most of the sewer collection system within the City limits and the Urban Growth Boundary (UGB). The collection system is a combination of gravity sewers, lift station, force mains, and septic tank effluent pump (STEP) systems. Wastewater is collected and treated by the City at the Camas Wastewater Treatment Facility (WWTF) and then discharged to the Columbia River.

The City completed its last General Sewer Plan in 2024. The GSP provides a recognized framework for making decisions about Camas's sanitary sewer service area which includes properties both inside the City and UGB limits. It is intended to aid decision-makers as well as users, including Public Works staff, City Council members, the Mayor, City staff, builders, developers, community groups, and other government agencies.

1.3 Referenced Documents

The following documents were referenced in the preparation of this GSP:

- City of Camas 2024 General Sewer Plan.
- Camas 2035 Comprehensive Plan and draft 2045 Comprehensive Plan
- Camas Code of Ordinances.
- Washington Administrative Code, Title 173. Defines the structure of general sewer plans.
- Criteria for Sewage Works Design (Ecology, 2008). Provides guidance for the design of municipal sewer systems and establishes minimum requirements in the State of Washington.
- Camas 2016 Water System Plan and draft 2026 Water System Plan (concurrent).

1.4 Washington State Requirements

The goals of this GSP include:

- Prepare the GSP in compliance with WAC Chapter 173-240-050.
- Meet the requirements of the Washington State Criteria for Sewage Works Design.

Each WAC requirement is detailed in Table 1.1 as well as in the specified location within the GSP.

Table 1.1 WAC GSP Requirements

Requirement	Location in GSP	Reference
Purpose and need for the proposed GSP	Chapter 1	WAC 173-240-050(3)(a)
Discussion of who will own, operate, and maintain the system	Chapter 2	WAC 173-240-050(3)(b)
Existing and proposed service boundaries	Chapter 4	WAC 173-240-050(3)(c)
Layout map including: ▪ Boundary lines of municipality or district and vicinity. ▪ Existing sewers and areas served by each. ▪ Proposed sewers and areas served by each. ▪ Existing and proposed pump stations and force mains. ▪ Topography and elevations of existing and proposed ground. ▪ Information on streams, lakes, other bodies of water, and discharges. ▪ Information on water systems.	 Figure 1.1 Figures 4.1 and 4.2 Figure 4.1 Figure 4.1 Figure 4.5 Figure 4.7 and 4.9 Figure 4.10	WAC 173-240-050(3)(d)(i) through WAC 173-240-050(3)(d)(vii)
Population trends and methods used to determine those trends	Chapter 3	WAC 173-240-050(3)(e)
Information on existing wastewater facilities in the area	Chapter 4, Chapter 7	WAC 173-240-050(3)(d)(vii)
Discussion of infiltration and inflow problems	Chapter 5	WAC 173-240-050(3)(g)
Discussion of the provisions for treatment and adequacy of treatment	Chapter 6, Chapter 7	WAC 173-240-050(3)(h)
Information on facilities producing industrial wastewater	Chapter 4	WAC 173-240-050(3)(i)

Requirement	Location in GSP	Reference
Information on existing wells or other water supply sources	Chapter 4	WAC 173-240-050(3)(j)
Discussion of alternatives evaluated, and alternatives chosen	Chapter 6, Chapter 7	WAC 173-240-050(3)(k)
Information on existing and proposed cost per service	Chapter 10	WAC 173-240-050(3)(l)
Statement regarding compliance with any adopted water quality management plan under the Federal Water Pollution Control Act	Appendix A	WAC 173-240-050(3)(m)
Statements regarding compliance with SEPA and, if applicable, NEPA	Appendix A	WAC 173-240-050(3)(n)

Notes:
NEPA - National Environmental Policy Act; SEPA - State Environmental Policy Act.

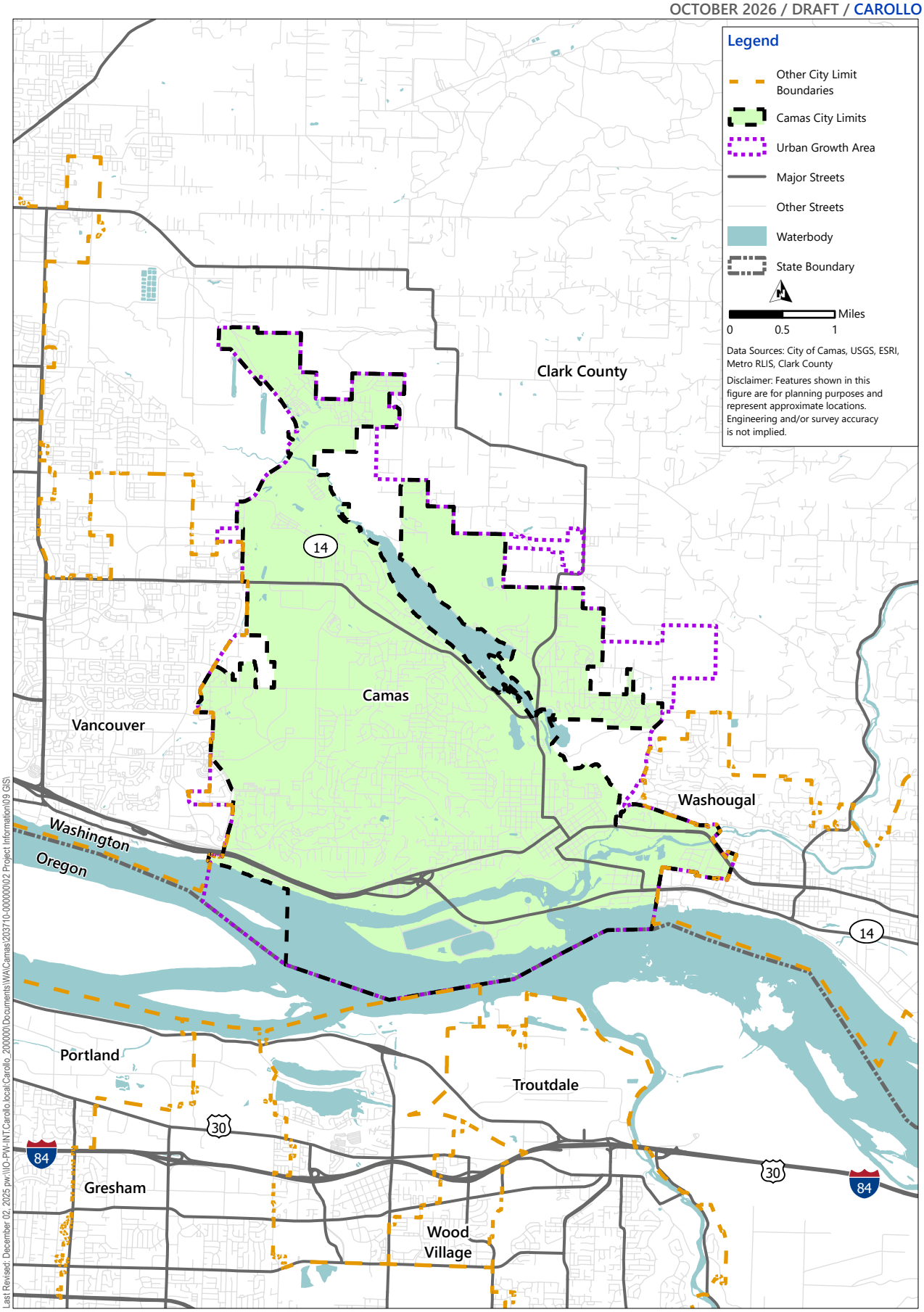


Figure 1.1 Vicinity Map
CITY OF CAMAS
GENERAL SEWER PLAN

1.5 Report Organization

This GSP contains 10 chapters, followed by appendices that provide supporting documentation for the information presented in the report. The chapters are briefly described below:

- **Chapter 1 - Introduction:** This chapter presents the need for this GSP and the objectives of the study. Lists of abbreviations and reference materials are also provided to assist the reader in understanding the information presented.
- **Chapter 2 - Policies and Criteria:** This chapter documents applicable regulations, summarizes City policies impacting long-term sewer system planning, and presents the City's design criteria which are relevant to sewer system evaluation and planning.
- **Chapter 3 - Basis of Planning:** This chapter presents an evaluation of historical wastewater flows and loads through the City's collection system and entering the WWTF. This chapter also establishes the WWTF's flow and load projections based upon future population growth for 2045 and build out.
- **Chapter 4 - Existing System:** This chapter describes the City's existing sewer collection system, adjacent sewer service areas, and WWTF.
- **Chapter 5 - Infiltration and Inflow Program:** This Chapter focuses on summarizing the City's efforts on I/I reduction from 2016 through 2024. It summarizes the amount of I/I for these years and specific projects completed to address I/I.
- **Chapter 6 - Collection System:** This chapter presents an evaluation of the available capacity of the existing system to convey current and future sewer flows. Recommendations are provided for improvement projects to address capacity deficiencies and level of service goals.
- **Chapter 7 - Wastewater Treatment Facility:** This chapter summarizes the WWTF Engineering report including condition of existing processes, capacity of existing processes and recommendations that will allow the City to reliably and cost-effectively serve their customers now and into the future.
- **Chapter 8 - Operations and Maintenance:** This chapter provides an overview of the City's Public Works organization, staffing, and operation and maintenance (O&M) program. This chapter documents existing practices and identifies changes that may improve system operation and maintenance.
- **Chapter 9 - Capital Improvement Plan:** This chapter describes the improvements necessary to resolve existing and future deficiencies and accommodate growth. The proposed improvements are also listed by priority and project type.
- **Chapter 10 - Financial Analysis:** This chapter evaluates the financial status of the City's wastewater utility and the ability to finance Capital Improvement Program (CIP) projects.

Appendices are included as follows:

- Appendix A - SEPA Checklist/Approvals.
- Appendix B - References.
- Appendix C - Demographic Projections.
- Appendix D - Camas Flow Monitoring Report 2025.
- Appendix E - Hydraulic Model Update Technical Memorandum.
- Appendix F - I/I Program Reports.

- Appendix G - Local Limits Program Reports.
- Appendix H - Wastewater Treatment Plant Permits.
- Appendix I - Evaluation of the Wastewater Treatment Facility Report.
- Appendix J - Reasonable Potential Analysis Project Memorandum.
- Appendix K - Condition Assessment of Camas Wastewater Treatment Facility Project Memorandum
- Appendix L - CIP Project Sheet.
- Appendix M - Financial Backup.

1.6 SEPA and Approval Process

A SEPA Checklist has been prepared for this GSP and is presented in Appendix A. It is anticipated that this proposed GSP will not have a probable significant adverse impact on the environment and that an environmental impact statement will not be required. However, many of the projects proposed herein will require SEPA checklists and an engineering determination will be made with each individual project.

1.7 Acknowledgements

Carollo Engineers and their team members would like to acknowledge and thank the following individuals for their efforts and assistance in completing this GSP. Their cooperation and courtesy in obtaining a variety of necessary information were valuable components in completing and producing this report:

- Scott Collins, Public Works Director.
- Rob Charles, City of Camas, Utilities Manager.
- Kyle Stephens, WWTP Manager.
- Jacob Taylor, Lead WWTP Operator.
- Angelica Vazquez, Lab Analyst WWTP.
- Jay Martell, Sewer Maintenance Lead.
- Alan Peters, Community Development Director.
- Debra Brooks, Financial Analyst.
- Matthew Thorup, Assistance Finance Director.

CHAPTER 2 POLICIES AND CRITERIA

2.1 Introduction

The City is responsible for managing and operating its wastewater system in accordance with all local, state, and federal regulations. To best manage the wastewater system and comply with regulations, the City has adopted wastewater system policies and criteria. These policies guide the development and financing of the infrastructure required to provide wastewater service and document the City's commitments to current wastewater system customers as well as those considering service from the City. The following sections outline the City's policies and design criteria that are relevant to sewer system planning. Existing policies are listed in Table 2.2 through Table 2.5. Proposed new policies are also listed in each table. These policies and criteria will guide the planning process throughout this GSP. Once adopted by the City, they are implemented through updates to municipal code provisions, engineering standards, and utility review processes.

The policies and criteria are organized into the following categories:

- Table 2.1 - Service Policies and Extensions.
- Table 2.2 - Environmental Stewardship.
- Table 2.3 - Design Policies and Criteria.
- Table 2.4 - Wastewater Treatment Plant Redundancy and Reliability Requirements.
- Table 2.5 - Financial Policies.
- Table 2.6 - Regulatory Requirements.
- Table 2.7 - National Pollutant Discharge Elimination System (NPDES) Influent Design Criteria and Effluent Limits.

2.2 Sewer Service

Table 2.1 summarizes the existing policies regarding the wastewater service area and extension of sewer service to new customers. The City is committed to serving customers in its sewer service area in accordance with established policies. The current sewer service area includes approximately 7,600 acres within its corporate boundaries. The future service area has been defined as the City's Urban Growth Area (UGA) and is shown in Figure 2.1.

Table 2.1 Service Policies and Extensions

Subject	Policy	Source
Service Area	Where service is available, require connection to public water for domestic and irrigation needs and connection to sewer systems. Promote connection to sewer and water before system failure of private well or septic.	Camas 2045 Comprehensive Plan Policy PFS-4.2 (Appendix C)
Service Area	The City should be the sole provider of urban services, including water and sewer, within the UGA for sewer services and the Water Service Area for water. Require all new construction to connect to City systems.	Camas 2045 Comprehensive Plan Policy PFS-4.3 (Appendix C)
Service Area	Coordinate plans for providing public utility services in UGAs and rural areas with plans for transitioning undeveloped land to urban uses.	Camas 2045 Comprehensive Plan Policy PFS-4.5 (Appendix C)
Utility Extension	Do not extend utilities without annexation or commitments for annexation. Exceptions may be made in cases where human health is threatened. In areas where utilities presently extend beyond City limits, but are within UGAs, plan development jointly with the County. A joint development must be consistent with City standards.	Camas 2045 Comprehensive Plan Policy PFS-4.5 (Appendix C)
Utility Extension	Extend public sanitary sewer service, as required, throughout urban areas. Service may be provided outside urban areas to serve areas where imminent health hazards exist.	Camas 2045 Comprehensive Plan Policy PFS-4.14 (Appendix C)
Coordination with Other Agencies	Plan public utility services so that service provision maximizes efficiency and cost effectiveness and ensures concurrency. Coordinate with other entities to provide services within the urban area.	Camas 2045 Comprehensive Plan Policy PFS-4.6 (Appendix C)
System Policies	Maintain and improve City utility systems through preventative maintenance and regular assessments and improvements to meet regulatory standards.	Camas 2045 Comprehensive Plan Policy PFS-4.1 (Appendix C)
System Ownership	The sanitary sewage disposal system of the City, including the treatment plant and all other parts of such system and all additions and improvements thereto and extensions thereof, which may be made hereafter, shall be considered as a part of and belonging to the water works utility of the City. The cost of the construction and installation of the hereinafter provided additions, improvements and extensions and the cost of maintenance and operation of such system as improved shall be charged to the water works utility of the City, and any rates and charges which may be collected hereafter for sewage disposal service shall be paid into the "water and sewer revenue fund" of the City, to be hereafter created.	CMC 13.60.010
Ownership of System - Commercial and Industrial	All STEP systems serving commercial, industrial, and other nonresidential properties shall be owned by the owner of the subject property, except for the service box at the point where the STEP system connects to the City sanitary sewer system, which shall be owned by the City. The owner shall be responsible for maintaining all components of the STEP system and its ownership and shall be responsible for pumping the STEP tank as needed and for disposing of the waste in an approved manner. The owner shall further be responsible for paying all electrical costs associated with the operation of the STEP system.	CMC 13.62.060(B)
Ownership of System - Residential	After inspection and acceptance of an installed STEP system on residential property, the City shall be the owner of all components of the STEP system with the exception of the sewer line from the structure to the tank, which shall be owned by the property owner. The City will be responsible for maintaining the components of the STEP system owned by the City, and in addition will be responsible for pumping the STEP tank and disposing of waste material when required. The owner will be responsible for maintaining the sewer line connecting the tank to the structure on the subject property. The owner will further be responsible for paying for all electrical costs associated with the operation of the STEP system.	CMC 13.62.060(A)
Construction	On and after May 1, 1949, it shall be unlawful to construct any means of sewerage or excreta disposal such as septic tanks without having first obtained a permit from the City health officer or his authorized representative.	CMC 13.60.040
Sewer Lien and Ownership	The City shall have a lien against premises to which sewer service is available for delinquent and unpaid charges for sewer services, for penalties levied pursuant to Section 13.60.050(B), for unpaid connection charges, and for unpaid sewer system development charges. All such delinquent charges shall bear interest at the rate of eight percent per annum. Such lien shall be superior to all other liens and encumbrances except general taxes and local and special assessments.	CMC 13.60.055(A)
Connections	All property owners whose property abuts a street or alley in which there is a public sanitary sewer or which is within one hundred fifty feet of a public sanitary sewer may be required to connect their ~~private drains and~~ sewers to the City sanitary sewer system at the direction of the City Engineer. Those properties which abut a street or alley in which there is a public sanitary sewer or which are located within one hundred fifty feet of a public sanitary sewer, and which are located within a designated health hazard area or which pose a threat to the general health, shall be connected to the sanitary sewer. Such connection shall be in the most direct manner possible and with a separate connection for each residence or structure.	CMC 13.60.050(A) - suggest deleting stricken text
Connections	Use traditional gravity sewer systems (in lieu of STEP systems) to serve future customers and reduce maintenance and power costs.	Camas 2045 Comprehensive Plan Policy PFS-4.15 (Appendix C)
Prohibited Connection	Prohibit construction of new private wells and subsurface sewage disposal systems in new developments.	Camas 2045 Comprehensive Plan Policy PFS-4.3 (Appendix C)

Subject	Policy	Source
Application to Connect a STEP System	Any property owner seeking to connect their property to the sanitary sewer system of the City by means of a STEP system shall file an application with the public works department on a form provided by the City. The application shall contain the name and address of the owner, the location of the property to be connected to the sanitary sewer system, the nature of the structure to be constructed on the subject property, the proposed use of the subject property, the proposed location of the STEP system, the design of the STEP system, and such other information as the public works department may require. Upon receipt of any such application, the public works director, or their authorized designee, shall review the application and grant the same if he determines that the subject property is suitable for use of a STEP sanitary sewer system, and if the design, location and other information set forth in the application comply with the standards and specifications adopted by the City for STEP systems and the criteria set forth in this chapter.	CMC 13.62.030
Installation Responsibility of a STEP system	The individual owner shall be responsible for and shall pay for the installation of the STEP/ STE system, including but not limited to, service connection per CMC 13.64.050 if required, the tank, pump apparatus, control box, electrical wiring, conduit, plumbing from the structure to the tank, plumbing from the tank to the service box, excavation and backfill material. The City shall, prior to installation, determine the appropriate size tank.	CMC 13.62.040(A)
Sewer Responsibility	Sanitary sewers shall be provided to each lot at no cost to the City and designed in accordance with City standards: ▪ Detached units shall have their own sewer service and STEP or STEF or conventional gravity system as required. ▪ Duplex units may have up to two sewer services at the discretion of the engineering and public works departments. ▪ Multifamily units shall have one sewer lateral per building. ▪ Commercial or industrial units shall have privately owned and maintained sewer systems acceptable to the City.	CMC 17.19.040(C)
Right-of-Entry Agreement	Any owner seeking to connect their property to the sanitary sewer system of the City by means of a STEP system shall be required to execute a right-of-entry agreement authorizing the City and its employees to have access to the owner's property for the purpose of maintaining and inspecting the STEP system and appurtenances thereto. Such right-of-entry agreement shall be executed upon approval of an application for a STEP system.	CMC 13.62.050
Inspection	The superintendent and other duly authorized employees of the City bearing proper credentials and identification shall be permitted to enter upon all properties for the purpose of inspecting, observing, measuring, sampling, and testing sewer connections, operations, and facilities in accordance and to ensure compliance with the provisions of this chapter. No such entry or inspection shall be made without the consent of the owner or occupant of such building or premises unless the City employee shall have obtained a search warrant, or unless exigent circumstances exist that would justify an inspection and entry without obtaining a warrant.	CMC 13.68.030
Enforcement	It shall be the duty of the City health officer or their authorized agent to enforce the provisions of Sections 13.60.020 through 13.60.110 and in the performance of this duty the health officer or his duly authorized agent is authorized to enter at any reasonable hour any premises as may be necessary in the enforcement of Sections 13.60.020 through 13.60.110.	CMC 13.60.080
FOG and Capacity	Grease, oil and sand interceptors shall be provided, when in the opinion of the superintendent, they are necessary for the proper handling of liquid wastes containing grease in excessive amounts, or any flammable wastes, sand, and other harmful ingredients, except that such interceptors shall not be required for private living quarters. All interceptors shall be of a type and capacity approved by the superintendent and shall be located as to be readily and easily accessible for cleaning and inspection.	CMC 13.68.020(H)
Private System - Flush toilet	Every residence, place of business or other building or place where persons congregate, reside or are employed and which does not abut a street or alley in which there is a public sanitary sewer shall be provided with a private water-flush toilet by the owner or agent of the premises; said water-flush toilet system to be built or rebuilt, constructed and maintained in such a manner as to meet the requirements of construction and maintenance hereinafter described.	CMC 13.60.060

Notes:
CMC - Camas Code of Ordinances; FOG - fats, oil, and grease; STE - septic tank effluent; STEF - septic tank effluent filter.

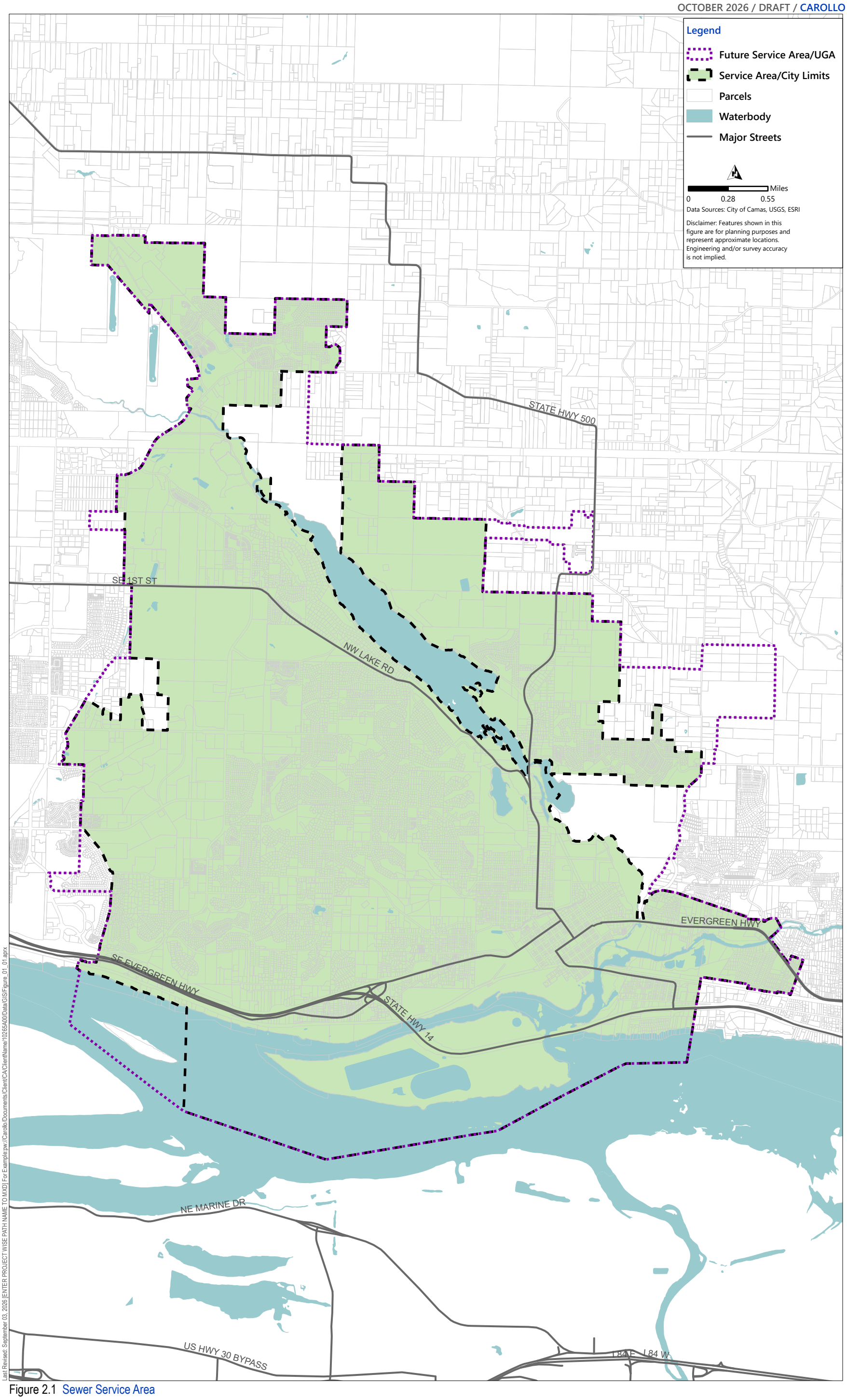


Figure 2.1 Sewer Service Area

2.2.1 Environmental Stewardship

The following section summarizes existing policies regarding environmental stewardship. Stormwater is included in the environmental stewardship because while the GSP focuses on the sanitary sewer, stormwater has a direct impact on sewer capacity, treatment efficiency, and environmental protection. Inflow and infiltration (I/I) or direct stormwater connections to the sanitary system increase flow that do not belong in the sewer, leading to capacity limitations and/or potential overflows. The inclusion of stormwater in this GSP emphasized that these flows should be managed through the stormwater system rather than the sanitary sewer, consistent with the regulatory requirements and best practices, unless otherwise stated.

Table 2.2 Environmental Stewardship Policies

Subject	Policy	Source
Minimizing Impacts of Utility Facility Siting and Operations	Minimize the effects on adjacent properties, the environment, and the visual quality of the community of siting, developing, operating, and maintaining facilities.	Camas 2045 Comprehensive Plan Policy PFS-4.29 (Appendix C)
Allowable Discharges (Stormwater)	Examples of allowable discharges include the following: ▪ Broken water mains. ▪ Diverted stream flows. ▪ Rising ground waters. ▪ Uncontaminated ground water infiltration, as defined in 40 CFR 35.2005(20). ▪ Uncontaminated pumped ground water. ▪ Foundation drains. ▪ Air conditioning condensation. ▪ Irrigation water from agricultural sources that is commingled with urban stormwater. ▪ Springs. ▪ Water from crawl space pumps. ▪ Footing drains. ▪ Flows from riparian habitats and wetlands. ▪ Discharges from emergency firefighting activities.	CMC 14.04.070
Conditional Discharges (Stormwater)	The following types of discharges shall not be considered illegal discharges for the purposes of this chapter if they meet the stated conditions, or unless the Director determines that the type of discharge, whether singly or in combination with others, is causing or is likely to cause pollution of surface water or groundwater: ▪ Potable water, including water from water line flushing, hyperchlorinated water line flushing, fire hydrant system flushing, and pipeline hydrostatic test water. Planned discharges shall be de-chlorinated to a concentration of 0.1 ppm or less, pH-adjusted, if necessary and in volumes and velocities controlled to prevent re-suspension of sediments in the stormwater system. ▪ Lawn watering and other irrigation runoff are permitted but shall be minimized. ▪ De-chlorinated swimming pool discharges. These discharges shall be de-chlorinated to a concentration of 0.1 ppm or less, pH-adjusted, if necessary and in volumes and velocities controlled to prevent re-suspension of sediments in the stormwater system. ▪ Street and sidewalk wash water, water used to control dust, and routine external building wash down that does not use detergents are permitted if the amount of street wash and dust control water used in minimized. At active construction sites street sweeping must be performed prior to washing the street. ▪ Non-stormwater discharges covered by another NPDES permit, provided, that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations; and provided, that written approval has been granted for any discharge to the storm drain system. ▪ Other non-stormwater discharges. The discharges shall be in compliance with the requirements of a SWPPP, reviewed and approved by the City, which addresses control of such discharges by applying AKART to prevent contaminants from entering surface or ground water.	CMC 14.04.080
Septic System Elimination (Sanitary Sewer)	Coordinate with Clark County to eliminate septic systems.	Camas 2045 Comprehensive Plan Policy PFS-4-16 (Appendix C)
Illicit Connections (Stormwater)	The following connections, both past, current, and future, to the stormwater system are expressly prohibited: ▪ The construction, use, maintenance, or continued existence of illicit connections to the storm drain system is prohibited. ▪ This prohibition expressly includes, without limitation, illicit connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection. ▪ A person is considered to be in violation of this chapter if the person connects a line conveying sewage to the MS4 or allows such a connection to continue.	CMC 14.04.090
Wastewater Discharges (Sanitary Sewer)	Except as hereinafter provided, no person shall discharge or cause to be discharged any of the following described water or wastes to any public sewer: ▪ Any liquid or vapor having a temperature higher than 150 °F. ▪ Any water or waste which may contain more than 100 ppm by weight, of FOG. ▪ Any gasoline, benzene, naphtha, fuel oil, motor oil, lubricants or other flammable or explosive liquid, solid or gas. ▪ Any garbage that has not been properly shredded. ▪ Any ashes, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar, plastics, wood, paunch manure, or any other solid or viscous substance capable of causing obstruction to the flow in sewers or other interference with the proper operation of the sewage works. ▪ Any waters or wastes having a pH lower than 5.5 or higher than 9.0 or having any other corrosive property capable of causing damage or hazard to structures, equipment, and personnel of the sewage works. ▪ Any waters or wastes containing a toxic or poisonous substance in sufficient quantity to injure or interfere with any sewage treatment process, constitute a hazard to humans or animals, or create any hazard in the receiving waters of the sewage treatment plant. ▪ Any waters or wastes containing suspended solids of such character and quantity that unusual attention or expense is required to handle such materials at the sewage treatment plant. ▪ Any noxious or malodorous gas or substance capable of creating a public nuisance.	CMC 13.68.020(C)

Notes:
°F - degrees Fahrenheit; AKART - all known, available and reasonable methods of prevention, control and treatment; CFR - Code of Federal Regulations; MS4 - Municipal Separate Storm Sewer System; ppm - parts per million; SWPP - stormwater pollution prevention plan.

2.2.2 Design Criteria and Standards

The City's wastewater system design standards, design details, specifications, and construction standards are documented in the Camas Design Standards Manual (2019) available from this City's Public Works department website. Additional design requirements and recommendations applicable to the City's sewer system are found in the Ecology *Criteria for Sewage Works Design* book, also known as the Orange Book. Current design criteria policies are outlined in Table 2.3.

The following section summarizes the existing and proposed policies regarding system design. It is recommended that the proposed new policies listed below be adopted by the City. Within this GSP, the capacity limitations of the collection system are evaluated against the proposed new design criteria policies.

Table 2.3 Design Criteria Policies

Subject	Policy	Source
Design	▪ Sewer systems shall be designed and constructed to achieve total containment of sanitary wastes and maximum exclusion of I/I. No new combined sewers will be approved.	Orange Book Section C1-1.3
Sewer location	▪ Siting of public sanitary sewer mains and MHs shall be restricted to the public right-of-way and/or easement dedicated for this utility.	Orange Book SectionC1-1.5
Design Period	▪ Service laterals shall be designed for the ultimate development of the parcel being served. ▪ Collection sewers (that is, laterals and submains) shall be designed for the ultimate development of the tributary area. ▪ Selection of the design period for trunk and interceptor sewers shall be based on an evaluation of economic, functional, and other considerations.	Orange Book Section C1-3.2
Design Flows	▪ Sewer systems shall be designed on the basis of per capita flows for the design period in conjunction with a peaking factor or approved alternative methods. ▪ Generally, the sewers shall be designed to carry at least the peak hourly flow when operating at capacity. Peak hourly flow should be the design average daily flow in conjunction with a peaking factor.	Orange Book Section C1-3.3
Lift Station Design Criteria	▪ The firm capacity of a pumping station shall be equal to or greater than the peak hourly design flow. Because mechanical and electrical equipment is typically designed for a 20-year life, it is recommended that the peak design flow be based on a 20-year forecast or greater. ▪ The number of pumps selected shall allow the station to provide the peak design flow with the largest pump out of order. ▪ The station shall be designed to remain fully operational during the 100- year flood/wave event.	Orange Book Sections C2-1.2.1 C2-1.2.3 C2-1.1
Lift Station Pump	▪ Pumps should be designed for pumping sewage and capable of passing solids at least three inches in diameter. Pump suction and discharge should be four inches or greater.	Orange Book Section C2-1.2.4
Design Storm	▪ In accordance with all applicable federal, state, and local regulations, the City should design its wastewater system facilities to adequately and reliably convey peak hour flows associated with a Design Storm event without overflowing or discharging to any water bodies. The Design Storm is defined as a 20-year interval, 24-hour storm recorded at Portland International Airport rain gauge.	2024 General Sewer Plan

Subject	Policy	Source
Emergency Back-up Power	▪ All sewage pump stations should be designed with capability for emergency power in case the primary electrical feed is out of service. A portable engine generator unit that is plugged into a pigtail at the pump station commonly provides emergency power for small pump stations. Larger pump stations should have permanent engine generator units with automatic transfer switches to transfer the electrical feed from the primary to the standby unit when a power failure is detected by the instrumentation and control system.	Orange Book Section C2-1.8.3
Surcharging	▪ The City's design criteria require the depth of flow versus the diameter of the pipe (d/D) ratio to be equal to or less than 1 during the design storm (no surcharging).	2024 General Sewer Plan
Inflow/Infiltration	▪ Future development shall be designed for a peak inflow and infiltration rate of 1,000 gpad.	Proposed New Policy

Notes:
d/D - depth versus diameter; gpad - gallons per acre per day; MH - manhole.

2.2.2.1 Wastewater Treatment Plant Design Criteria

Ecology maintains requirements for hydraulic and loading capacities as well as the redundancy of treatment processes and equipment. These requirements are presented in the Orange Book, Ecology's guidelines for WWTF design (2008) and are derived from the Federal standards developed by the United States Environmental Protection Agency (USEPA).

Ecology's criteria for designation of WWTFs are divided into three reliability classes based on the nature of their receiving water. Corresponding redundancy and reliability requirements are presented in Table 2.4 based on Ecology's guidelines and Federal standards. These requirements are the basis of the capacity analysis.

Table 2.4 Wastewater Treatment Plant Redundancy and Reliability Requirements From Washington Criteria for Sewage Works Design (Ecology, 2008)

WWTF Component	Flow Criteria	Load Requirement	Class 1 Reliability Criteria
Plant Headworks Mechanical Screens Manual Bar Rack	Pass all flows	-	A backup screen designed for mechanical or manual screening must be provided
Primary Clarifiers	PHF + Recirculation	PHDL(1)	50% of flow with largest unit out of service
Aeration Basins	MWDF	MWDL	At-least two equal volume basins shall be provided
Aeration Systems (Blowers)	-	PHDL(2)	Enable design oxygen transfer to be maintained with the largest capacity unit out of service
Aeration Systems (Diffusers)	-	PHDL(2)	Air diffuser system for each aeration basin shall be able to provide the design oxygen transfer of the system with the largest section of diffusers taken out o
Secondary Clarifiers	PHF + Recirculation	PHDL(1)	75% of flow with largest unit out of service

WWTF Component	Flow Criteria	Load Requirement	Class 1 Reliability Criteria
Effluent Filters	Pass all flows	-	-
UV Channel	PHF (Hydraulic Considerations), MDDF (For Disinfection Requirements)	-	-
Effluent Pump Station	PIDF	-	Have capacity to handle peak flow with largest capacity pump out of service
Pumps (Internal Recycle, RAS, WAS, Thickened Sludge, Digester Heat Recirculation, Centrifuge Feed, Scum, in-plant lift stations, Septage etc.)	Peak flow as for appropriate process	-	A backup pump shall be provided for each set of pumps performing the same function
Sludge Digestion and Dewatering Equipment	-	MDDL(2)	-
Major yard piping	PIDF	-	Sized for peak flows and to allow bypassing of each unit process
Power source	-	-	Sufficient to operate all vital components during peak flow conditions, together with critical lighting and ventilation
Emergency power generator	-	-	Sufficient to operate all vital components during peak flow conditions, together with critical lighting and ventilation

Notes;
(1) TSS loading only.
(2) BOD_5 loading only.
MDDF - maximum daily design flow, MDDL - maximum daily design load; MMF - maximum monthly flow; MWD - maximum week design load; MWDF - maximum week design flow; PHDF - peak hour design flow. PHDL - peak hour design load; PHF - peak hour flow; PIDF - peak instantaneous design flow; RAS - return activated sludge; UV - ultraviolet; WAS - waste activated sludge.

2.2.3 Financial Policies

The City's financial policies support the operation of the wastewater utility. A summary of financial policies applicable to the GSP are outlined in Table 2.5.

2.2.4 Regulatory Requirements

The City's criteria is developed based on federal and state statues, regulations, and permits. These laws help to determine the design criteria for the City's collection, treatment, and disposal facilities. These regulatory requirements are outlined in Table 2.6.

Table 2.5 Financial Policies

Subject	Policy	Source
Connection – Required when	▪ There is imposed upon those property owners who are within the area served by the sanitary system and who refuse to connect to such sanitary sewer system a penalty in an amount equal to the charge that would have been made for sewer service if such property had been connected to the sanitary sewer system. Such penalties as provided herein shall accrue monthly until such property is connected to the sanitary sewer system. All penalties collected pursuant to this provision shall be considered revenue of the sanitary sewer system.	CMC 13.60.050(B)
Credits	▪ Those properties that have been disconnected from the City sewer system since January 1, 1972, shall receive a credit for the prior connection. The credit for the prior connection shall be in an amount equal to the sewer system development charge for the use classification of the prior connection. The sewer system development charge imposed under this chapter shall be the difference between the amount due under the present use classification less the amount that would have been assessed under the use classification for the prior connection, provided however, that the City shall not be required to reimburse the property owner in the event the credit exceeds the sewer system development charge for the new connection.	CMC 13.72.040(A)
Credits	▪ Those properties that are not presently connected to the City's sewer system but which have been assessed and paid a monthly penalty pursuant to Section 13.60.050(B) shall receive a credit against the sewer system development charge in an amount equal to the total monthly penalties paid prior to connection, provided however, that the City shall not be required to reimburse the property owner in the event the credit exceeds the sewer system development charge for the new connection.	CMC 13.72.040(B)
Lien	▪ The city shall have a lien against premises to which sewer service is available for delinquent and unpaid charges for sewer services, for penalties levied pursuant to Section 13.60.050(B), for unpaid connection charges, and for unpaid sewer system development charges. All such delinquent charges shall bear interest at the rate of eight percent per annum. Such lien shall be superior to all other liens and encumbrances except general taxes and local and special assessments. ▪ Notice of such sewage lien shall be provided in accordance with RCW 35.67.210, and such sewage lien may be foreclosed as provided by RCW 35.67.220 through 35.67.250.	CMC 13.60.055
Violation – Penalty	▪ Any person, firm or corporation who violates or refuses or fails to comply with any of the provisions of Sections 13.60.020 through 13.60.110 shall be guilty of a misdemeanor and shall be punished by a fine of not less than 25 dollars nor more than one hundred dollars or imprisoned in the City jail for a period of thirty days or by both such fine and prison term.	CMC 13.60.090
Violation – Each day a separate offense	▪ Every person, firm or corporation shall be deemed guilty of a separate offense for each and every day during any portion of which any violation of any provisions of Sections 13.60.020 through 13.60.110 is committed, continued, or permitted by such person, firm or corporation and shall be punishable therefore as provided by Sections 13.60.020 through 13.60.110.	CMC 13.60.100
Inflow Connection	▪ There is imposed upon those property owners who are within the area served by the sanitary system and who refuse to connect to such sanitary sewer system a penalty in an amount equal to the charge that would have been made for sewer service if such property had been connected to the sanitary sewer system. Such penalties as provided herein shall accrue monthly until such property is connected to the sanitary sewer system. All penalties collected pursuant to this provision shall be considered revenue of the sanitary sewer system.	CMC 13.60.050(B)
Installation Responsibility – Inspection fee	▪ The individual owner shall be responsible for and shall pay for the installation of the STEP/STE system, including but not limited to, service connection per CMC 13.64.050 if required, the tank, pump apparatus, control box, electrical wiring, conduit, plumbing from the structure to the tank, plumbing from the tank to the service box, excavation and backfill material. The city shall, prior to installation, determine the appropriate size tank. ▪ During and at the completion of installation, the STEP/STE system shall be inspected by the city to ensure that it has been properly installed. There shall be a fee as per the fee schedule established by the city council per resolution for inspection of the STEP system, which fee shall be collected by the building department at the time the permit for connection to the municipal sewer system is issued.	CMC 13.62.040
Ownership of system	▪ Residential. After inspection and acceptance of an installed STEP system on residential property, the city shall be the owner of all components of the STEP system with the exception of the sewer line from the structure to the tank, which shall be owned by the property owner. The city will be responsible for maintaining the components of the STEP system owned by the city, and in addition will be responsible for pumping the STEP tank and disposing of waste material when required. The owner will be responsible for maintaining the sewer line connecting the tank to the structure on the subject property. The owner will further be responsible for paying for all electrical costs associated with the operation of the STEP system. ▪ Commercial and Industrial. All STEP systems serving commercial, industrial, and other nonresidential properties shall be owned by the owner of the subject property, except for the service box at the point where the STEP system connects to the city sanitary sewer system, which shall be owned by the city. The owner shall be responsible for maintaining all components of the STEP system and its ownership, and shall be responsible for pumping the STEP tank as needed and for disposing of the waste in an approved manner. The owner shall further be responsible for paying all electrical costs associated with the operation of the STEP system.	CMC 13.62.060
Sewer Service Development	▪ Pursuant to the authority conferred upon cities and towns by RCW 35.92.020 and 35.92.025, the City Council of the City finds that property owners who seek to connect property to the sewer system of the City should be assessed a charge in order that such property shall bear its equitable share of the cost of the sewer system. The council further finds that the charge should be based upon the property owner's anticipated use of the sewer system as related to the historical cost of the sewer system and the projected cost of additions to the sewer system to meet new demand. That portion of the charge based upon the historical costs of the sewer system shall be measured by the undepreciated value of the sewer system and plant in service at the time the charge is imposed. That portion of the charge based upon the projected cost of future improvements shall be based upon appropriate studies by engineers and/or financial consultants. The charge imposed by this chapter shall be denominated as a "sewer system development charge" and shall be in addition to any sewer connection or permit fees imposed by other ordinances of the City.	CMC 13.72.010
Damage to STEP	▪ The cost of repairing any damage to a STEP system which has resulted from the negligence, gross negligence, or intentional acts of the owner shall be the responsibility of the owner. This responsibility includes any clogging which may result due to improper use of the STEP system by the owner.	CMC 13.62.070
Septage users	▪ There is imposed upon customers of the city of Camas water and sewer utility who have septic tanks or chemical toilets and reside within the city limits a service charge as per the fee schedule established by the city council per resolution when waste from the septic tank or chemical toilet is dumped into the city sanitary sewer system. ▪ Septic tank waste or chemical toilet waste generated outside of the city limits of Camas may not be dumped into the city sanitary sewer system.	CMC 13.64.040
Connection Charges for STEP	▪ Except as hereinafter provided, the connection charge for connecting a STEP/STE sewer system to the Camas municipal sewer system shall be the cost of materials, the costs of labor for City personnel at then prevailing rate for such personnel, and the amount of any fees or charges required to be paid to any third parties in order to make such connection. ▪ The connection charge for connecting a STEP/STE sewer system to the Camas municipal sanitary sewer system with a one-inch service line or less shall be as per the fee schedule established by the City Council per resolution, or the actual cost to the City calculated in accordance with subsection A of this section, whichever is greater. ▪ No connection charge will be assessed if a service line has already been installed connecting the subject property to the City sanitary sewer system.	CMC 13.64.050

Subject	Policy	Source
Sewer Volume Charges	The sewer volume charges for each residential customer from November 1 through February 28 shall be based upon that customer's actual water consumption during that period. The four billing cycles between November I through February 28 shall be the customer's "four billing cycle water consumption history." The sewer volume charges for each residential unit for the remainder of the year shall be based on the average water consumption in the previous "four billing cycle water consumption history." Zero water consumption in any of the four water consumption history billing periods shall not constitute a "complete four billing cycle water consumption history." ▪ Residential customers that have a "complete four billing cycle water consumption history" as specified above shall be charged the applicable inside city or outside city monthly sewer charge and volume charge as set forth in the chart in Section 13.64.010 above. ▪ Residential customers that do not have a "complete four billing cycle water consumption history" as specified above, shall be charged the applicable inside city or outside city monthly service charge set forth in Section 13.64.010 and a volume charge equivalent to seven hundred cubic feet of water usage as the monthly sewer billing rate. ▪ Residential customers may apply for a reduction in sewer rates when, due to a qualifying leak as defined in Section 13.44.030, the sewer charge is substantially increased. The amount of the reduction shall be calculated in the same manner as a water leak credit as set forth in Section 13.44.030.	CMC 13.64.060
Sewer Service Development Charge - Credits	▪ Development Credit: » A developer (as defined in CMC 3.88.030.K) shall be entitled to a credit against the applicable system development charge for the dedication of land or for the design or engineering or construction of an "eligible improvement". For purposes of this section, an eligible improvement shall mean an improvement or real property that is: required as a condition of development approval; identified in the general sewer plan or capital improvement plan; and included in the current system development charge calculation as being funded by system development charges. » The amount of the credit shall be the dollar amount assigned to the improvement or to the land in the system development charge calculation. Where only a portion of the improvement is constructed, or a portion of the land is dedicated, the amount of the credit shall be pro-rated. » Credits earned for one category of system development charge, e.g. water, may not be applied against a different system development charge, e.g. sewer. » Approval from the city council shall be required prior to the start of construction or dedication of any eligible improvement. "Approval" in the context of this subsection (4) shall be satisfied if the city requires the construction or dedication of the eligible improvement as a condition of approval for a land use application. If a developer wishes to construct an eligible improvement that is not otherwise a condition to an approved land use application, prior approval must be obtained from the city council. » No system development charge credit shall be granted until either the eligible improvements have been designed, engineered, or constructed by the developer, and such work has been accepted by the city; or until the land has been dedicated by the developer and such dedication has been accepted by the city. » If system development charges become due and payable prior to the developer becoming eligible for the issuance of credits as provided in section (5), the developer may apply to the public works director to defer collection of the charges until construction or dedication is completed. The public works director may condition deferral upon: • The developer posting a bond or other financial security satisfactory to the city in an amount equal to one hundred twenty-five percent (125%) of the deferred system development charges, which bond or other financial security shall be conditioned upon the developer either paying the deferred system development charges or completing construction or dedication within a specified time, • The withholding of an occupancy permit, or • Such other conditions acceptable to the city. » If the developer is dissatisfied with the decision of the community development director, the developer may seek to have that decision reviewed by the city council. » Upon acceptance of the eligible improvement, the developer may submit an application for the system development charge credit to the finance department on a form to be created by the finance department. After submission of the application and verification of entitlement thereto, the finance department shall issue a credit voucher to the developer specifying the amount of the system development charge credit and the type of credit. » The credit may, at the option of the developer, be applied all or in part to the system development charges owing for the developer's project. » To the extent the credit exceeds the amount of the system development charges owed by the developer, or the developer chooses not to apply the credit to the developer's project, the unused credit may be applied to a different project of the developer or to the project of a different developer. » Before the system development charge can be transferred to a different project or a different developer, the holder of the system development charge credit shall file with the finance department an application to transfer the credit on a form to be created by the finance department. The application shall identify the transferee, and the amount of the system development charge credit being transferred. The transfer application shall be accompanied by an administrative fee in an amount as may be set by resolution of the city council. » When credits are to be redeemed, the holder of the system development charge credit shall file an application for redemption on a form to be created by the finance department. Redemption shall be permitted only in increments equal to whole system development charge, or when redemption will exhaust the entire system development charge credit. The application for redemption shall be accompanied by an administrative fee in such amount as may be set by resolution of the city council. When system development charge credits are being redeemed, such redemption shall not allow for system development charge credits to be pro-rated among more than one residential lot in amounts that are less than the existing system development charge per lot. For example, where system development charges are five thousand dollars per residential lot and a developer wishes to redeem eleven thousand dollars worth of credits, the developer shall not be allowed to apply one thousand dollars per residential lot over eleven lots. The developer may apply five thousand dollars to two residential lots and the remaining one thousand dollars to one residential lot. » The finance department shall be responsible for maintaining appropriate records documenting the issuance, transfer, and redemption of system development charge credits. » Expiration of Credits. Any credits issued after the effective date of this ordinance shall expire and become null and void ten years from the date of approval of the original credit by the city council. Transfer of credits or partial use of credits shall in no event extend the expiration date of those credits.	CMC 13.72.040
Sewer Service Development Charge – Payment of Sewer System Development Charge	▪ The sewer system development charge owing under the provisions of this chapter shall be paid by the applicant at the time of issuance of the plumbing permit or building permit, whichever shall first occur, or as scheduled by a separate agreement with the city. ▪ No sewer service shall be furnished to the property of any person seeking to connect to the sewer system of the city until the sewer system development charge imposed by this chapter has been paid to the city treasurer or until such time as the city and the applicant have entered into a separate agreement providing for the payment of such sewer system development charge.	CMC 13.72.070
Sewer Service Development Charge – Revenue Disposition	▪ All revenues collected pursuant to this chapter shall be paid into the water and sewer capital reserve fund, and shall be used for the purpose of financing system improvements. Such revenues shall not be used to offset current operation or maintenance costs.	CMC 13.72.080

Subject	Policy	Source
Sewer Service Development Charge – Appeal	▪ Any applicant aggrieved by the amount of the sewer system development charge found by the engineer to be required under the provisions of this chapter, may appeal to the board of adjustment from such finding by filing a written notice of appeal with the city clerk within twenty days from the time such property owner is given notice of such amount. The chairman of the board of adjustment shall cause a notice of the time and place of hearing to be mailed to the applicant. At such hearing, the applicant shall be entitled to be heard and to introduce evidence on his own behalf. The board of adjustment shall thereupon ascertain the correct amount of the sewer system development charge, and the city clerk shall immediately notify the appellant thereof, by mail, which amount, together with the costs of appeal, if appellant is unsuccessful therein, must be paid within ten days after such notice is given. ▪ The chairman of the board of adjustment may, by subpoena, require the attendance at any appeal of any person, and may also require him to produce any pertinent books and records. Any person served with such subpoena shall appear at the time and place therein stated, and shall produce the books and records required, if any, and shall testify truthfully under oath administered by the chairman in charge of the hearing on appeal, as to any matter required of him pertinent to the appeal, and it is unlawful for him to fail or refuse to do so.	CMC 13.72.090

Notes:
(1) Some provisions of the Camas Municipal Code are not shown in this table because they are regulatory in nature (e.g., permit requirements, violation enforcement) rather than financial policy measures. For complete information, the Camas Municipal Code is available on the City's website.

Table 2.6 Regulatory Requirements

Subject	Policy
Federal Clean Water Act Condition S1	Condition S.1 of the City's permit requires the treatment plant effluent to meet limits for BOD_5, TSS, fecal coliform bacteria, pH, and total ammonia.
Federal Clean Water Act Condition S2	Condition S.2.lists monitoring requirements including influent and effluent flow, BOD_5, TSS, pH, temperature, total ammonia, fecal coliform, priority pollutant metals, oil and grease and cyanide. A program to address oil and grease is also required. The City must monitor twice per 5 years for effluent whole effluent toxicity and conduct quarterly and yearly priority pollutant monitoring of its influent and effluent in support of its industrial pretreatment program. Additionally, per the terms of the City's coverage under the Statewide Biosolids permit, the City must annually test its biosolids for pollutants and compliance with pathogen reduction and vector attraction reduction criteria.
Federal Clean Water Act Condition S4	Condition S.4.A specifies the WWTF design capacity for maximum month BOD_5 loading is 5,616 ppd and 6,405 ppd for TSS. The peak hour flow, dry weather monthly average, and maximum month average flow capacities for the WWTF are 11.09, 2.86 and 6.10 mgd, respectively. Condition S.4.B requires the City to prepare a plan to maintain adequate capacity when flows and loadings to the WWTF exceed 85% of design capacity for 3-consecutive months.
NEPA	The NEPA was established in 1969 and requires federal agencies to determine environmental impacts on all projects requiring federal permits or funding. Federally delegated activities such as NPDES permits or Section 401 Certification are considered state actions and do not require NEPA compliance. If a project involves federal action (through, for example, an Army Corps of Engineers Section 404 permit), and is determined to be environmentally insignificant, a FONSI is issued, otherwise an Environmental Assessment or EIS would be required. NEPA is not applicable to projects that do not include a federal component.
Federal Clean Air Act	The Federal Clean Air Act requires all wastewater facilities to plan to meet the air quality limitations of the region. The City falls in the jurisdiction of the SWCAA. The SWCAA is responsible for enforcing federal, state and local outdoor air quality standards and regulations in Clark, Cowlitz, Lewis, Skamania and Wahkiakum counties of southwest Washington state. The Camas generator is permitted by SWCAA.
State Water Pollution Control Act	The intent of the state Water Pollution Control Act is to "maintain the highest possible control standards to ensure the purity of all waters of the state consistent with public health and the enjoyment…the propagation and protection of wildlife, birds, game, fish and other aquatic life, and the industrial development of the state." Under the RCW 90.48 and the WAC 173-220, Ecology issues permits for wastewater treatment facilities and land application of wastewater under WAC 173-216.
Criteria for Sewage Works Design, Ecology	Ecology has published design criteria for collection systems and wastewater treatment plants. While these criteria are not legally binding, their use is strongly encouraged by Ecology since the criteria are used by the agency to review engineering reports for upgrading wastewater treatment systems. Commonly referred to as the "Orange Book," these design criteria primarily emphasize unit processes through secondary treatment, and also includes criteria for planning and design of wastewater collection systems. Any expansion or modification of the City collection system and/or WWTF plant will require continued conformance with Ecology criteria.
Certification of Operators of Wastewater Treatment Plants, WAC 173-230	Wastewater treatment plant operators are certified by the state Water and Wastewater Operators Certification Board. The operator assigned overall responsibility for operation of a wastewater treatment plant is defined by WAC 173-230 as the "operator in responsible charge." This individual must have state certification at or above the classification rating of the plant. The City WWTF is currently assigned a Class 4 rating and the operating staff assigned to the plant have the required certification. (One of the operators has a Class 4 certification; two have Class 3 certification, and one has Class 2 certification).
Surface-Water Quality Standards (WAC 173-201A)	In the State of Washington, WAC 173-201A establishes water quality standards for surface waters based on maintaining public health, recreational use and protection of fish, shellfish, and wildlife. Table 2.4 includes surface water criteria for many toxic substances, including ammonia, residual chlorine, several heavy metals, PCBs, and pesticides.
State Environmental Policy Act	WAC 173-220 requires a statement in all wastewater comprehensive plans regarding proposed projects in compliance with the SEPA, if applicable. The capital improvements proposed in this plan will fall under SEPA regulations. A SEPA checklist is included in Appendix A of this report for use in the environmental review for the project. In most cases a DNS is issued; however, if a project will have a probable significant adverse environmental impact an EIS will be required.
Accreditation of Environmental Laboratories (WAC 173-050)	The State of Washington established a requirement that all laboratories reporting data to comply with NPDES permits must be generated by an accredited laboratory. This accreditation program establishes specific tasks for QA/QC that are intended to ensure the integrity of laboratory procedures. Accreditation requirements must be met for any on-site laboratory or outside laboratory used to analyze samples. Only accredited laboratories may be used for analyses reported for compliance with NPDES permits. In planning for an on-site laboratory, staffing must be sufficient to allow for QA/QC procedures to be performed. The Camas WWTF lab is currently accredited for determination of the following parameters TSS, BOD_5, ammonia, dissolved oxygen, pH and fecal coliform.
Minimal Standards for Solid Waste Handling (WAC 173-304)	Grit and screenings are subject to the minimal standards for solids waste handling under WAC 173-308, and their disposal is regulated under the state solid waste regulations, WAC 173-304. Waste placed in a municipal solid waste landfill must not contain free liquids, nor exhibit any of the criteria of a hazardous waste as defined by WAC 173-303. To be placed in a municipal solid waste landfill, grit, screenings, and incinerator ash must pass the paint filter test. This test determines the amount of free liquids associated within the solids, and includes the TCLP test, which determines if the waste has hazardous characteristics.
Shoreline Management Act	The Shoreline Management Act of 1971 (RCW 90.58) establishes a broad policy giving preference to shoreline uses that protect water quality and the natural environment, depend on proximity to the water, and preserve or enhance public access to the water. The Shoreline Management Act jurisdiction extends to lakes or reservoirs of 20 acres or greater, streams with a mean annual flow of 20 cfs or greater, marine waters, and an area inland 200 feet from the ordinary high-water mark. Projects are reviewed by local governments according to state guidelines and a local Shoreline Master Program. The Camas wastewater treatment plant and portions of the collection system are located within shoreline areas.

Notes:
BOD_5 - 5-day biochemical oxygen demand; cfs - cubic feet per second; DNS - determination of non-significance; FONSI - finding of no significant impact; mgd - million gallons per day; PCB - polychlorinated biphenyls; ppd - pounds per day; QA/QC - quality assurance and quality control; RCW - Revised Code of Washington; SWCAA - Southwest Clean Air Agency; TCLP - toxic characteristic leachate procedure; TSS - total suspended solids.

2.2.4.1 NPDES Permit

Table 2.7 presents a brief overview of relevant design criteria and effluent limitations contained in the City's WWTF NPDES Permit No. WA0020249. The City's current permit was issued July 1, 2025 and was effective as of August 1, 2025. This NPDES permit places limits on various water quality parameters, flow rates, and waste loading pertaining to the discharge of treated effluent from the WWTF.

Table 2.7 NPDES Influent Design Criteria and Effluent Limits

NPDES Influent Design Criteria and Effluent Limits		
NPDES Influent Design Criteria		
Parameter		**Value**
MMF		6.1 mgd
Monthly Average Dry Weather Flow		2.86 mgd
BOD_5 Max Month Loading		5,616 ppd
TSS Max Month Loading		8,011 ppd
NPDES Effluent Limits		
Parameter	**Average Monthly Limit**	**Average Weekly Limit**
BOD_5	▪ 20 mg/L ▪ 842 ppd ▪ 85% removal of influent	▪ 30 mg/L ▪ 1,264 ppd
TSS	▪ 20 mg/L ▪ 1,017 ppd ▪ 85% removal of influent	▪ 30 mg/L ▪ 1,525 ppd
Heat Load(1)	▪ 5.87 x 10^8 kcal/day	▪ N/A
Fecal Coliform Bacteria(2)	▪ 200 organisms/100 mL	▪ 400 organisms/100 mL
NH_3-N Summer(3)	▪ 20 mg/L	▪ 30 mg/L
NH_3-N Winter	▪ 7 mg/L	▪ 11 mg/L

Notes:
(1) Applicable only from June 1 – September 30.
(2) Geometric mean.
(3) Summer ammonia limits apply to the months of June through September.
kcal/day - kilocalories per day; mg/L - milligrams per liter; mL - milliliter; N/A - not applicable; NH_3-N - ammonia.

CHAPTER 3 BASIS OF PLANNING

3.1 Introduction

This chapter presents an evaluation of historical wastewater flows and loads through the City's collection system and entering the WWTF. This chapter establishes the WWTF's flow and load projections based upon planned development and future population growth through 2045.

The remainder of this Chapter is divided into four sections:

- Section 3.2 provides definitions for the wastewater flow terminology used in this chapter, as many of the terms are not commonly used outside of planning and design evaluations.
- Section 3.3 presents the collection system flow monitoring results, which are used to set a baseline for flow projections and development of the hydraulic model.
- Section 3.4 presents projected flows for the City's collection system, which are used in hydraulic modelling evaluations.
- Section 3.5 presents projected flows and loads for the WWTF, which are based on an evaluation of historical plant data. They are used in unit process capacity evaluations.

The collection system and WWTF projections were developed in conjunction with the City's *Draft 2045 Comprehensive Plan* updated and reflect the latest available land use and demographic information. While both analyses are based on the same overall growth projections, different methodologies and available data were used to develop the collection system and WWTF flow projections. The collection system was projected for both 2045 and buildout conditions, while the WWTF analysis was projected through 2045. The specific methodologies and data used to develop each projection are described in the applicable sections of this chapter.

3.2 Definitions

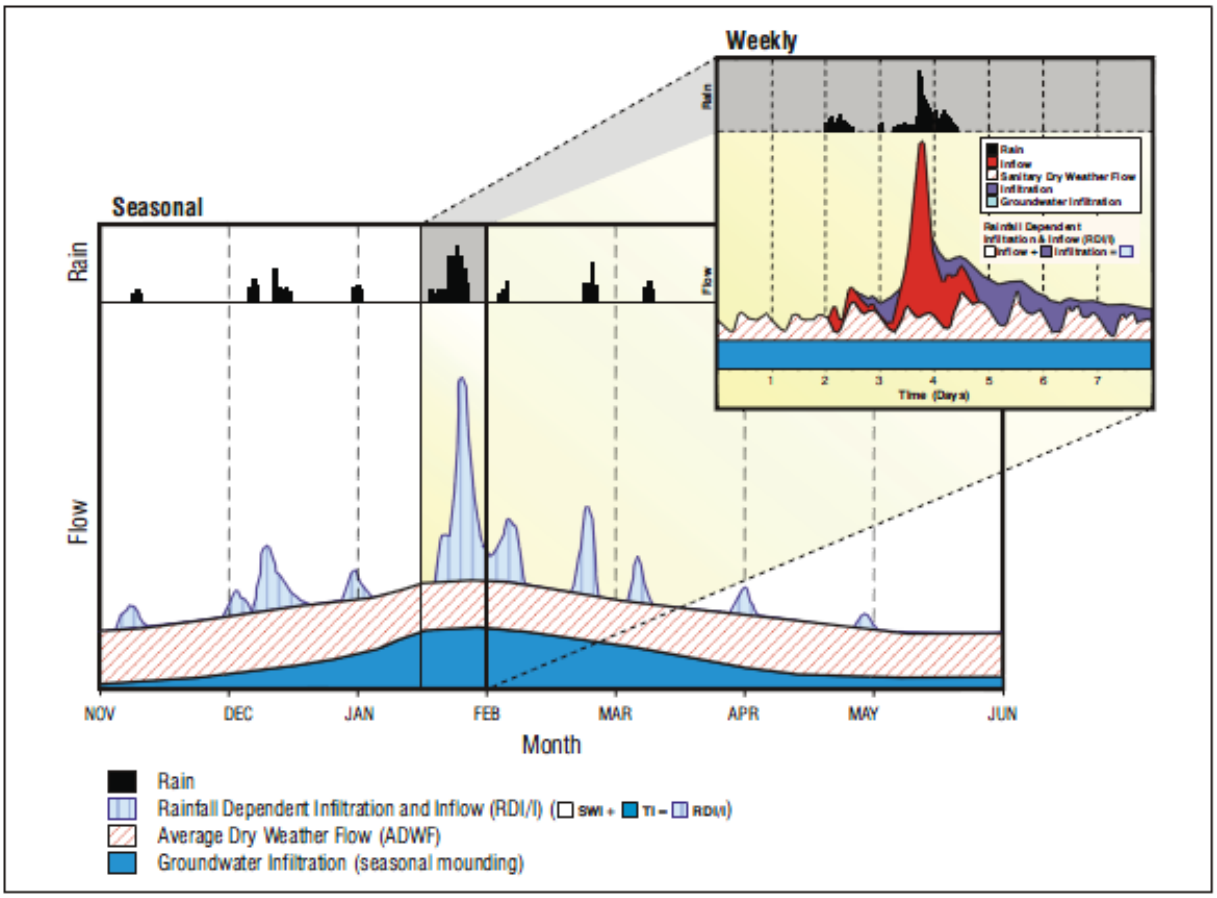
Wastewater flows are analyzed by separating dry weather flow (DWF) from wet weather flow (WWF) to establish base flows. These base flows identified during dry weather are then used as the basis to project both wet and dry weather flows. The different flow components for the sewer collection system are illustrated in Figure 3.1.

Due to the separate collection system and WWTF projections established, the following terminology was used to differentiate the various flow parameters:

- **Average Dry Weather Flow (ADWF)** establishes a similar flow parameter as influent dry weather flow (IDWF); ADWF was differentiated as it was based on a period of record for the collection system flows that differs from the IDWF.
- **Average Annual Flow/Load (AAF/AAL)** is the average flow or load that occurs over a calendar year. AAF and AAL were estimated based on the historical influent flow and concentration data from the City's WWTF.
- **Groundwater Infiltration (GWI)** in a sewer is the process where surrounding groundwater inadvertently enters into the sanitary sewer system through sewer pipes and manholes through

defects like cracks, porous joints, root intrusion, and structural failure. The ADWF used in this analysis includes both wastewater (WW) and GWI. Including the GWI component results in a higher flow basis for the projections and provides a conservative estimate of future wastewater flows.

- **Influent Dry Weather Flow (IDWF)** is the average daily flow during the two driest months of the year (July and August). The IDWF includes the base flow generated by the City's connections plus the dry weather GWI component. For the City, the IDWF was estimated throughout the service area based on the historical influent flow data from the WWTF.
- **Maximum Month Flow/Load (MMF/MML)** is the maximum 30-day running average influent flow observed at the WWTF during a calendar year. MMF and MML were estimated based on the historical influent flow and load data from the City's WWTF.
- **Peak Day Flow/Load (PDF/PDL)** is the maximum 24-hour average flow and load observed at the WWTF during a calendar year. PDF and PDL were estimated based on the historical influent flow and concentration data from the City's WWTF.
- **Peak Hour Flow (PHF)** is the highest hourly flow predicted to occur during the design storm. Rainfall derived inflow and infiltration (RDII) causes flows in the collection system to increase during wet-weather conditions. PHF is typically used for designing sewers and lift stations. Therefore, the PHF and the collection system "Design Flow" are synonymous and will be used interchangeably throughout this GSP.
- **Peak Wet Weather Flow (PWWF)** is the maximum one-minute flow rate predicted in the collection system during a wet weather event, resulting from the combination of DWF and RDII. The collection system model is simulated at one minute time steps, and PWWF represents the maximum modeled flow within one minute interval. PWWF represents the design condition used to evaluate the capacity of collection system facilities under wet weather conditions and is presented for existing and future planning scenarios. PWWF differs from PHF, which represents the highest hourly flow during the design storm.
- **Rainfall Dependent Infiltration and Inflow (RDII)** is the additional flow entering the sanitary sewer collection system as a direct result of rainfall events. RDII includes inflow, which enters the collection system quickly through direct connections such as roof drains, catch basins, and cross-connections with stormwater facilities, and infiltration, which enters more gradually through defects such as cracked pipes, faulty joints, and deteriorated manholes. RDII is added to the DWF to determine the total WWF used for capacity evaluations of collection system facilities.



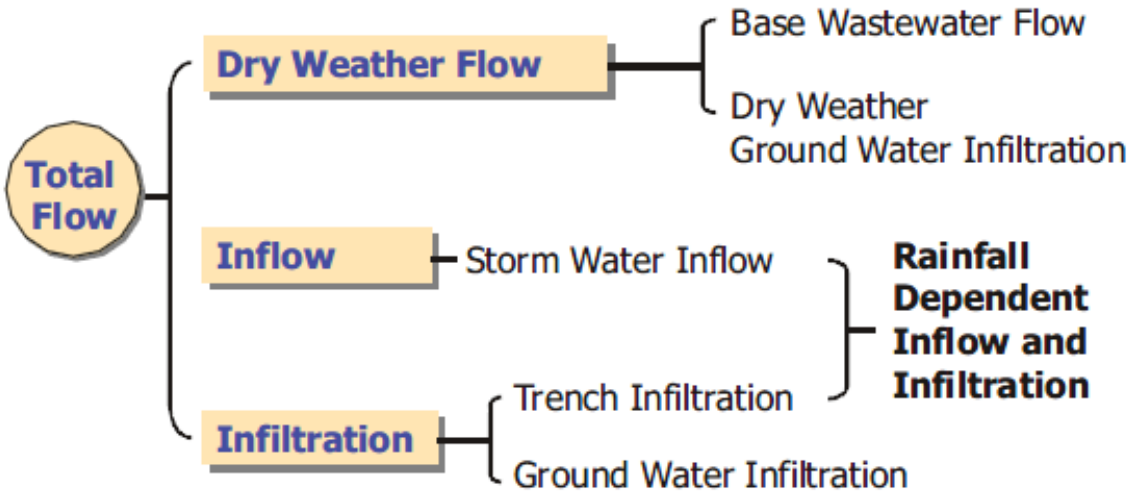


Figure 3.1 Typical Wastewater Flow Components

Note: This figure is not based on flow data specific to the City.

3.3 Collection System Flow Monitoring Results

As part of the project, ADS conducted a temporary flow monitoring program within the City's sanitary sewer collection system. The purposes of the Flow Monitoring Program were to collect data for correlating real collection system flows with the hydraulic model's predicted flows, evaluate the system's capacity, and estimate basin I/I. The temporary flow monitoring data was collected from January 15, 2025, to April 29, 2025. The "Camas Flow Monitoring Report 2025" prepared by ADS summarizes the flow monitoring program and was submitted to the City as a stand-alone report. The report is included as Appendix D.

3.3.1 Flow Monitoring Sites

Four sewer basins were monitored by ADS during the flow monitoring period, and three additional areas were evaluated using City supervisory control and data acquisition (SCADA) data. The additional areas included the STEP system, for which flows were estimated using WWTF influent data, and two North Shore areas upstream of Basin 4-1-3. Figure 3.2 provides a flow monitoring schematic showing the monitoring locations and connections between the monitored basins within the collection system. Figure 3.3 shows the flow monitoring basins. For additional information on the flow monitoring program and data analysis, see Appendix E - *Hydraulic Model Update* (Carollo, 2026).

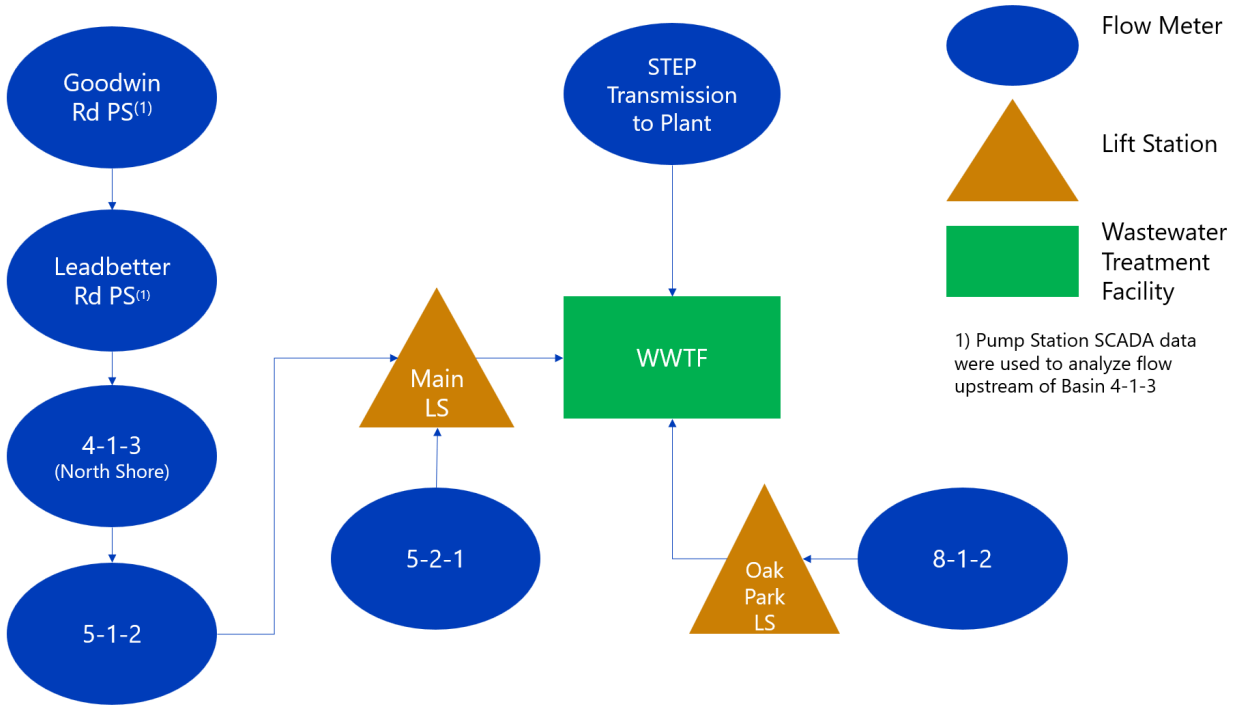


Figure 3.2 Flow Monitoring Schematic

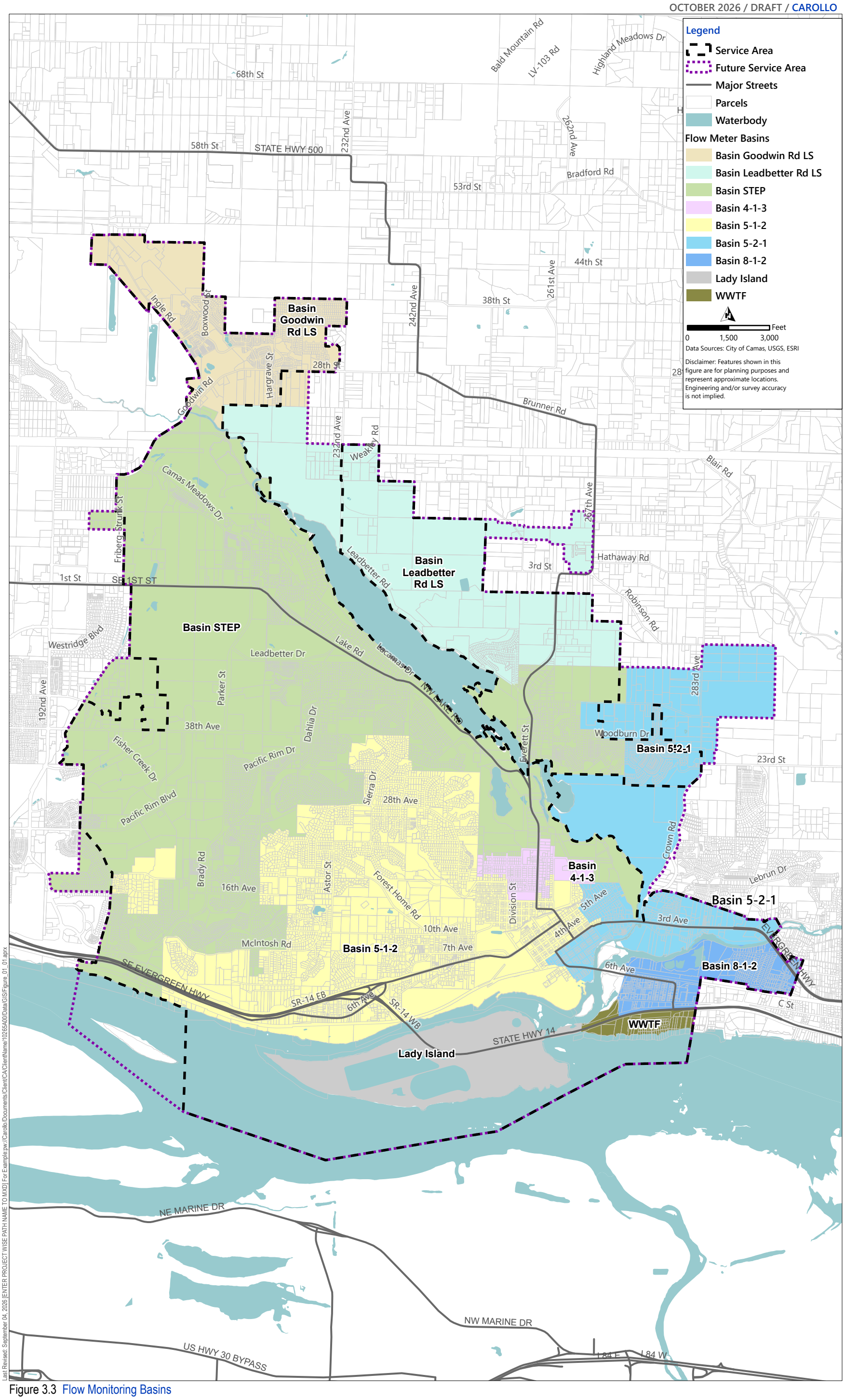


Figure 3.3 Flow Monitoring Basins

3.3.2 Average Dry Weather Flow Data

The ADWF projections are derived from land use category data and corresponding wastewater flow factors. This method assumes that areas with similar land uses, such as low-density residential parcels, produce equivalent quantities of wastewater flow on a per area basis. In this GSP, the resulting ADWF represents the base wastewater flow generated by the population and land uses within the service area. GWI is estimated separately and added to the wastewater flow for collection system modeling. System-wide flow projections can be compared with recorded flows from temporary collection system flow monitors, and WWTF influent data to evaluate reasonableness of the projections. This method of estimating base flows is consistent with the previous GSP.

3.3.2.1 ADWF Development

Existing ADWFs for each basin were estimated using data from the Camas flow monitoring report for each of the flow monitoring basins. ADWF was then developed using the dry days from the flow monitoring period based on the following set of minimum criteria, where all of the following criteria must be met:

- Less than 0.1 inch of rain in the previous day.
- Less than 0.4 inches of rain in the previous three days.
- Less than 1.0 inch of rain in the previous five days.
- In addition, those dry days that exhibited unusual flow patterns were not used to generate ADWF values for a basin.

Characteristic dry weather 24-hour diurnal flow patterns were developed for each basin from hourly data. The patterns represent the observed dry weather flow response for each basin and therefore include the combined effects of wastewater flow and GWI. GWI was considered separately during the flow estimation and modeling process; however, it was not removed from the monitored flow data prior to developing the diurnal patterns. The hourly flow data were also used to calibrate the hydraulic model to the observed DWFs during the flow monitoring period. Weekday and weekend flow patterns were developed separately to account for differences in daily flow characteristics. An example of the DWF diurnal patterns from one of the City's flow meters, Flow Meter 5-1-2 is shown in Figure 3.4. For more information regarding all of the City's flow meters, see Chapter 4 - Existing System.

Carollo calculated representative average weekday and weekend DWF levels and velocities at each monitoring site using the flow monitoring data provided by ADS. The meter data were aggregated from 15-minute to hourly intervals and used to develop representative weekday and weekend DWF patterns for model calibration. Further details on DWF development and mode calibration are provided in Appendix E - *Hydraulic Model Update* (Carollo, 2026).

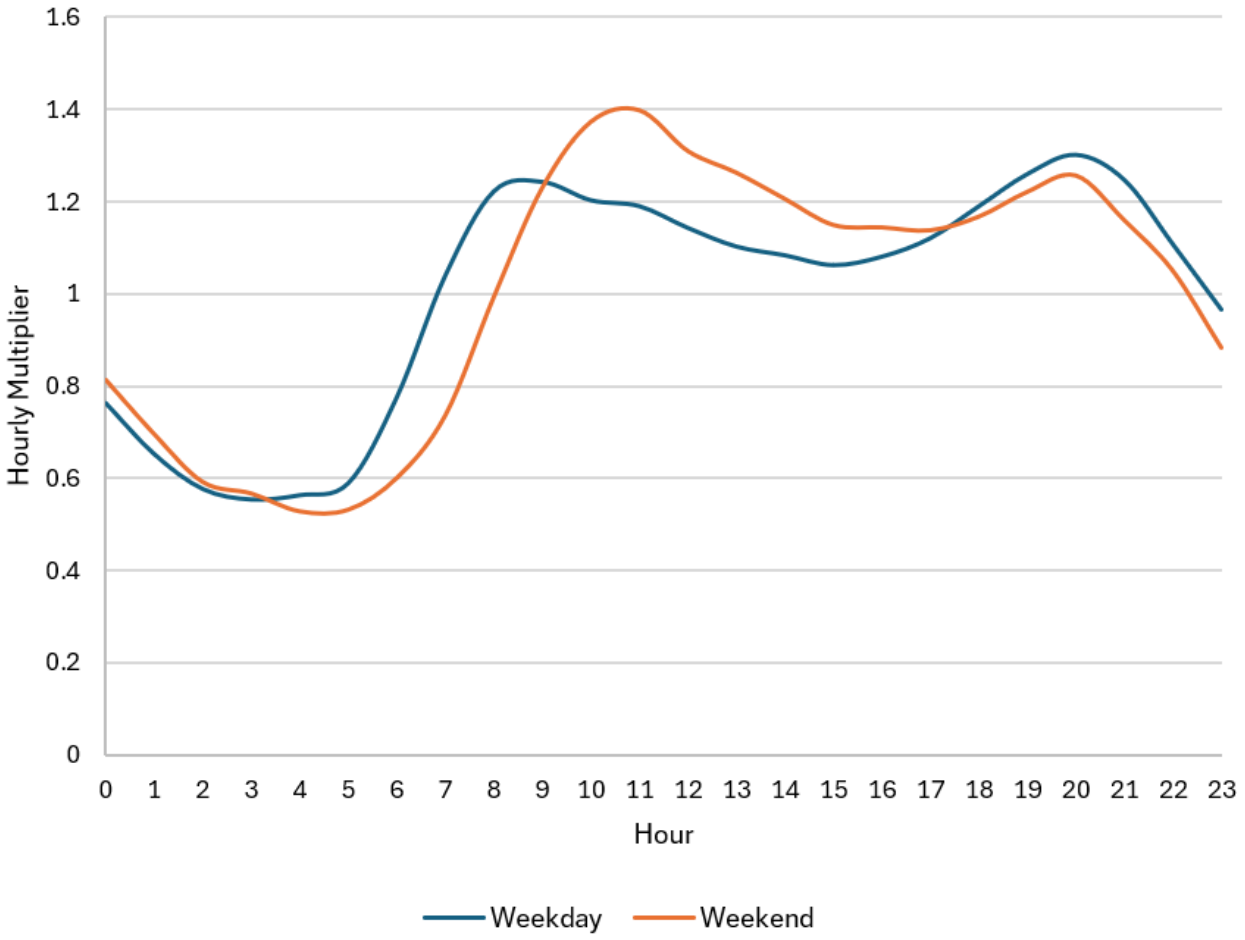


Figure 3.4 Typical Weekday vs Weekend Dry Weather Flow Variation (Meter 5-1-2)

3.3.3 Rainfall Data

An important part of the flow monitoring program was the collection and analysis of rainfall data. Rainfall events were screened based on a minimum rainfall intensity of 0.1 inches per hour within a 48-hour period. Back-to-back rainfall events were also considered to evaluated the cumulative rainfall depth and resulting I/I response in the collection system. Based on this screening, three significant rainfall events were selected for I/I analysis and hydraulic model calibration. Table 3.1 summarizes a range of events that occurred during the course of the flow monitoring period available and recorded at the ADS rain gauge for calibration. Further detail on the rainfall data and three storms used to calibrate the model can be found in Appendix E - *Hydraulic Model Update* (Carollo, 2026).

Table 3.1 Identified Storm Events

Storm Event	Start Date	End Date	Total Event Rainfall (inch)	Total 24-hour Volume (inch)	Maximum Peak Intensity (inch/hour)
1	1/31/2025	2/5/2025	0.82	0.63	0.11
2	2/14/2025	2/19/2025	1.34	1.04	0.16
3	2/21/2025	2/25/2025	2.82	1.82	0.23
4	3/2/2025	3/5/2025	0.24	0.13	0.04
5	3/12/2025	3/19/2025	2.45	1.18	0.14
6	3/20/2025	4/1/2025	2.74	1.12	0.18
7	4/5/2025	4/9/2025	1.15	0.94	0.23

3.3.4 Wet Weather Flow Data

The flow monitoring data was also evaluated to determine how the collection system responds to wet weather events. As mentioned in Section 3.3.2, the flow monitoring program captured three main rainfall events. The rainfall event that occurred on February 23, 2025, was associated with the largest RDII response during the flow monitoring period and is the most appropriate to be used for RDII analysis.

Figure 3.5 shows an example of the wet weather response at Meter 5-1-2 during the February 23, 2025, rainfall event. This figure also illustrates the volume of RDII that entered the system from the collection system upstream of Meter 5-1-2. The grey line represents the ADWF, while the green line represents the measured flow during the storm event. As can be seen in the figure, the flow increased by 5 to 10 times ADWF due to RDII entering the system during the wet weather events.

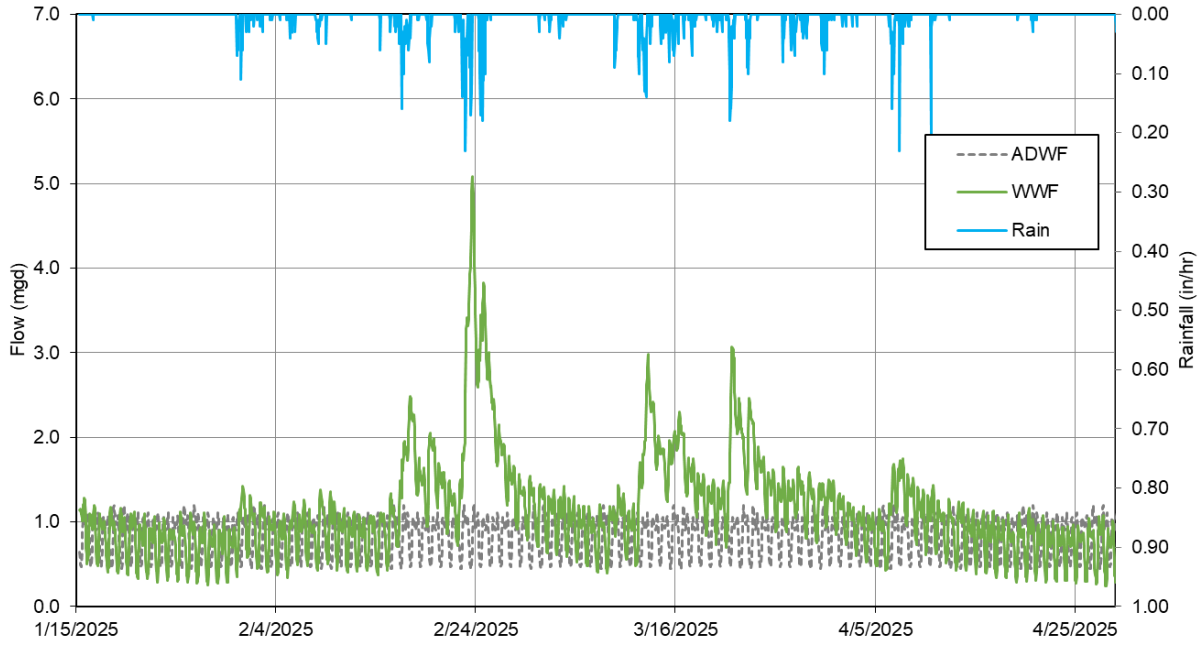


Figure 3.5 Example Wet Weather Response (Meter 5-1-2)

3.4 Collection System Flow Projections

Wastewater collection systems have several distinct flow sources based on the contributors in the service area:

1. Residential flow.
2. GWI.
3. Commercial and industrial flow.
4. RDII.

The flow from these sources have been grouped into these categories based on typical analytical procedures and the availability of information for each source. Residential flows include contributions from single family homes and multifamily units. Ecology issues discharge permits for the City's large industrial customers since the City does not have a pretreatment program in place. RDII is caused by rainfall events and includes contributions from connected impervious areas such as roof drains and catch basins (inflow), and groundwater (infiltration) leaking into the collection system. The sum of these components is the total flow through the collection system into the WWTF.

The flows throughout the collection system were estimated using the calibrated hydraulic model to predict dry and wet weather flows, as presented in Appendix E - *Hydraulic Model Update* (Carollo, 2026).

3.4.1 Sewered Population

Population projections are determined from the *Draft Comprehensive Plan 2045* which are summarized by year in Table 3.2. The *Draft Comprehensive Plan 2045* is included in Appendix C - Demographic Projections.

Table 3.2 Population Summary

Year	Population Projections	Source
2023	29,352	(1)
2026	30,421	(2)
2045	37,080	(1)

Notes:
(1) City *Draft Comprehensive Plan 2045*.
(2) Assumes a growth rate of 1.2 percent per year based on the City *Draft Comprehensive Plan 2045*.

3.4.2 Land Use

Land use designations and regulations provide important information for evaluating sewer system capacity. Existing and future land use information is an integral component in projecting wastewater generation within the service area. The type of land use in an area will affect the volume and strength of the wastewater generated. Adequately estimating the generation of wastewater from various land use types is important in sizing collection system facilities.

The City has nine land use designations for parcels within the UGA in the *Draft 2045 Comprehensive Plan*, as shown in Figure 3.6 excluding water, which are categorized into the nine GSP designations. The land use designations used in this GSP align with those in the 2024 GSP which can be related back to the Comprehensive Plan designations. Area totals for each land use category are summarized by acreage in Table 3.3.

Table 3.3 Comprehensive Plan Land Use Summary

Comprehensive Plan Designation	General Sewer Plan Designation	Total Area (acres)(1)(3)
Residential Low	Single Family High	355
	Single Family Medium	2,398
	Single Family Low	972
Residential Medium	Multi Family Low	136
Residential High	Multi Family High	403
Mixed Use/Commercial	Commercial	1,251
Mixed Employment/Industrial	Industrial	2,048
Public Facility(2)	City	34
Parks and Open Space	Park/Open Space	1,687
	Total	**9,286**

Notes:
(1) Total area within each comprehensive plan designation within the urban growth boundary.
(2) The acreage for Public Facility is based on the City's GIS data because the Comprehensive Plan does not provide acreage or land use information for this designation.
(3) Totals may not match due to rounding.
GIS - geographic information system.

Maps of the City's existing and future land use within the future service area were developed with data provided by the City's Planning Department. Existing development information was taken from zoning data, and future land use is the preferred land use from the *Draft 2045 Comprehensive Plan*. Additional details on developing flows by land use type can be found in Appendix E - *Hydraulic Model Update* (Carollo, 2026).

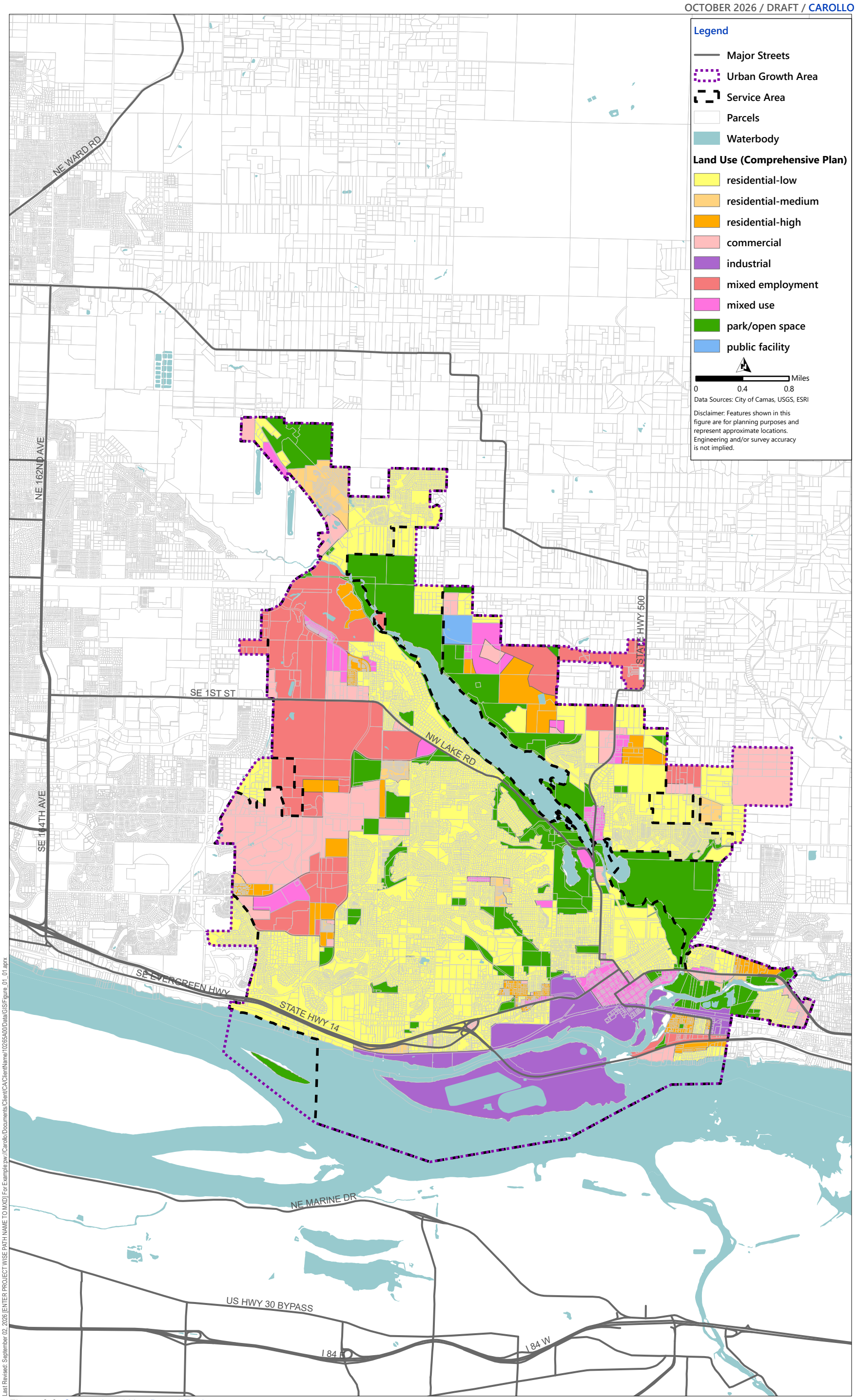


Figure 3.6 Current Land Use Based Zoning

3.4.3 Wastewater Flow Factors

In order to develop wastewater flow projections and allocate future flows to the collection system, relationships between land use and wastewater generation were developed. These relationships, called wastewater flow factors, are established based on the average wastewater flow generated for each existing land use type. The land use flow factors were established to project the estimated ADWF through future development of the City's wastewater collection system and project future flows within the Study Area boundary.

Average wastewater flow coefficients are volume rates, usually expressed in gpad, applied to either gross or net acres to calculate average day flow generated from a particular land use. A flow coefficient was developed for each of the land use classifications that were discussed previously. The flow coefficient provides a means to transform a land use category from acreage into wastewater flow. The resulting flow is then input into the appropriate sewer area in the sewer system model. Municipalities in the Pacific Northwest area, wastewater flow coefficients for residential areas typically range between 500 to 3,000 gpad, and commercial and industrial areas might range from 1,000 to 4,000 gpad, with typical values averaging approximately 1,500 gpad. Land uses designated as open space and parks are assumed to generate negligible amounts of sewage flow, and as a result have a flow coefficient of zero.

The wastewater flow coefficient developed for the City's STEP basin is lower than the typical residential flow coefficients discussed above. The STEP basin contains the majority of the City's population; however, wastewater flows from the basin are collected through a septic tank effluent pumping system rather than a conventional gravity collection system. Because there was no direct flow monitoring of the STEP basin, the basin wastewater flow was estimated by subtracting the flows measured in the other monitored basins from the total WWTF influent flow. The resulting STEP basin flow was then used to develop the basin-specific wastewater flow coefficient.

The lower coefficient is likely related to the operating characteristics of the STEP system. STEP tanks discharge wastewater through individual pumps that operate between defined pump-on and off levels. As a result, wastewater is discharged intermittently rather than a continuously, and the timing and volume of discharges are influenced by tank storage and pump cycling. The selected coefficient reflects the average wastewater flow estimated for the STEP basin and the observed operating characteristics of the STEP collection system.

3.4.3.1 Vacant Parcels

It is assumed that vacant parcels do not generate wastewater flows, therefore, are excluded from the development of wastewater flow factors. Large amounts of parcel area are only partially developed. Allowing a flow factor to represent the entire area of a parcel when the parcel is not fully developed would misrepresent flows and deflate the flow factors. For this reason, partially vacant parcels were determined through the maximum lot size for each zoning category, defined in the CMC 18.09.040. If a parcel exceeded that maximum area lot size, the area used for flow factor development was the maximum lot size of that zoning category. This assumption was performed for single family land use types and allowed for more realistic flow factors to be used.

3.4.3.2 Flow Factor Development

The coefficients are developed using the following procedure:

- Average flows for each flow metering tributary area were derived from the flow-monitoring data (see Section 4).
- The acres for each land use type contained in each flow-monitoring tributary area were calculated using GIS data.
- Preliminary coefficients for each land use type were assumed based on typical values, which can be estimated from the approximate number of dwelling units per acre, an assumed per capita wastewater generation rates, and/or the typical number of people per dwelling unit for each land use type.
- The flow factors for each meter basin were adjusted up or down (balanced) within a reasonable range (based on engineering judgment) until the calculated average flows from each basin matched what was measured during the flow monitoring period. Flow factors are developed using the field estimated ADWF excluding parks, open space, water, vacant, and the Top 2 large industrial users: Taiwan Semiconductor Manufacturing Co., also known as "TSMC" (formerly, WaferTech) and Analog Devices, Inc. (formerly known as Linear Technology, Inc.). If the flow coefficients produced average flows that were significantly different from the field measured flows, further investigation was conducted to verify that the tributary basins were delineated correctly and if the collection system configuration was correct.
- Once the flow factors for each of the five meters basins were balanced, a weighted average of the flow factors for each land use type was calculated based on the acreage contribution from each basin. The weighted average flow factors for each land use type represent wastewater generation by land use for the City as a whole and are used to project future wastewater flows.
- If the projected flow factor for an area is lower than its existing flow factor, the existing flow factor will be used to maintain a conservative estimate.

For example, flow meter 8-1-2 ADWF during the flow-monitoring period was approximately 0.12 mgd. The tributary service area upstream of this flow meter is developed with buildings falling into a variety of zoning categories, including commercial, industrial, multi-family high, and single-family medium. The preliminary flow factors were multiplied by the acreages for each land use designation and adjusted until the flows equaled 0.12 mgd. This process was repeated for each flow meter basin, and weighted flow factors were calculated for each land use category. The resulting basin-specific flow factors and system-wide weighted average flow factors are presented in Section 3.4.3.3.

3.4.3.3 Existing and Future Flow Factors

The existing wastewater flow factors developed for each flow monitoring basin are presented and each land use type is presented in Table 3.4. Column 2 of Table 3.4 presents the system-wide weighted average flow factors. For more information regarding the City's flow monitoring program, see Appendix E - *Hydraulic Model Update* (Carollo 2026).

Table 3.4 Basin-Specific Flow Factors by Land Use Classification Summary (in gpad)

Land Use Type(1)	Average(2)	Basin 5-2-1	Basin 8-1-2	Basin 5-1-2	Basin 4-1-3(3)	Basin STEP
Single Family Low	270	530	N/A	220	520	175
Single Family Medium	380	600	510	320	610	180
Single Family High	620	720	N/A	400	700	190
Multi-Family Low	730	770	N/A	610	800	220
Multi-Family High	750	800	800	700	800	250
Commercial	780	900	790	700	800	250
Industrial	800	950	800	800	800	150
City	700	N/A	N/A	N/A	700	N/A

Notes:
(1) Land use types such as open space, water, parks, and vacant lots are not included in this table as they are assumed to contribute zero flows.
(2) Weighted average flow factors exclude the STEP/WWTF, since this basin operates differently from the rest of the system and represents a septic tank effluent pumping basin rather than a gravity basin. This weighted average flow factors were used to project future flows.
(3) The Goodwin Road LS and Leadbetter Road LS basins were originally included within Basin 4-1-3 during development of the DWF calibration flow factors. As a result, separate DWF flow factors were not developed for these upstream basins after the original Basin 4-1-3 area was subdivided. Instead, the calibrated Basin 4-1-3 flow factors were applied to both the Leadbetter Road LS and Goodwin Road LS basins. The original Basin 4-1-3 area was later divided into three separate basins to better represent the significant upstream inflows identified in the ADS flow monitoring data, and SCADA data from the Leadbetter Road LS and Goodwin Road LS was used to redistribute flows during the wet weather event calibration.
(4) Land Use types shown as zero indicate that those land use categories were not present within the basin.
LS - lift station.

Land uses designated as open space and parks are not shown in Table 3.3 because they are assumed to generate negligible wastewater flow and therefore have a flow factor of zero. Table 3.3 summarizes the wastewater flow factors used to project dry weather flow. The weighted average flow factors shown in the table exclude the Basin STEP because it operates differently from the City's gravity collection system. The exclusion is due to the Basin STEP operating differently since solids are stored on-site and only the liquid effluent is pumped into the City's sewer system.

Basin-specific wastewater flow factors were applied to existing developed land use areas to estimate existing ADWF. For future conditions, the system-wide weighted average flow factors were applied to projected future land use areas to estimate future ADWF. Using the weighted average factors for future projections reflect wastewater generation patterns across the City as a whole, while the basin-specific factors better represent existing conditions within each monitored basin.

3.4.4 Industrial Customer Flows

The City currently has two major industrial customers which must submit industrial discharge monitoring reports to Ecology for various flows, constituents, and characteristics as a condition of their discharge permits. The collective AAF from these contributors is 0.97 mgd with a PDF of 1.1 mgd as shown in Table 3.5. These flows can represent a large portion of influent flows for the WWTF. Flow data was taken from Ecology's Permitting and Reporting Information System (PARIS) data from 2022 to 2025, as reported to and recorded on Ecology's Water Quality Permitting and Reporting Information System.

Table 3.5 Industrial Customer Flows

Industry	MDF (gpd)	PDF (gpd)	AAF (gpd)
TSMC Washington (formerly known Wafertech Industries)(1)	669,774	756,000	688,249
Analog Devices(2)	229,296	368,452	278,222
All Flows	**889,070**	**1,124,452**	**966,471**

Notes:
(1) Flows shown are data from 2025.
(2) Flows shown are data from 2024.
gpd - gallons per day; MDF - minimum daily flow.

Table 3.6 presents the projected flows for the existing, 2045, and buildout conditions. Flows for the two largest water users were estimated using their historical water consumption data and the medium growth projections. The projected water use was multiplied by 95 percent to account for the assumed water-to-sewer return ratio.

Table 3.6 Industrial Customer Projected Flows

Industry	Existing (mgd)	2045 (mgd)	Buildout (mgd)
TSMC Washington (formerly known Wafertech Industries)	0.739	0.884	1.058
Analog Devices	0.249	0.293	0.317
All Flows			

Notes:
(1) Projected sewer flows for the two largest users were developed using historical water consumption data and the medium projected growth scenario, which represents the average of the low and high projected growth scenarios.

3.4.5 Hydraulic Model Dry Weather Flow Projections

Developing an accurate estimate of the future quantity of wastewater generated at buildout of the collection system is an important step in sizing sewer system facilities for future scenarios. Wastewater flow factors, described in Section 3.4.3, and projected developed acreage for each planning period were used to develop wastewater flow projections based on future land use. The projected developed acreage was determined using the City's GIS development map to identify parcels that are currently under development, planned for development, or identified for future development. Parcels identified for development within the City limits were assumed to be developed by 2045 and were included in the corresponding planning period acreage. For buildout conditions beyond 2045, all parcels within the UGA were assumed to be developed and connected to the sewer system. Table 3.7 outlines the projected ADWFs for each flow monitoring basin for current, 2045, and buildout conditions. Figure 3.7 shows parcels and its projected planning growth between existing, 2045, and buildout conditions.

Table 3.7 ADWF for Hydraulic Modelling

Flow Meter Basin	Existing ADWF (mgd)	Projected 2045 ADWF (mgd)	Projected Buildout ADWF (mgd)
5-1-2	0.62	0.86	1.06
5-2-1	0.20	0.44	0.53
4-1-3	0.07	0.07	0.07
8-1-2	0.11	0.11	0.15
WWTF/STEP	1.70	3.00	4.39
Leadbetter Road LS	0.04	0.68	1.02
Goodwin Road LS	0.10	0.17	0.33
Total(1)	**2.85**	**5.32**	**7.55**

Notes:
(1) Totals may not sum due to rounding.

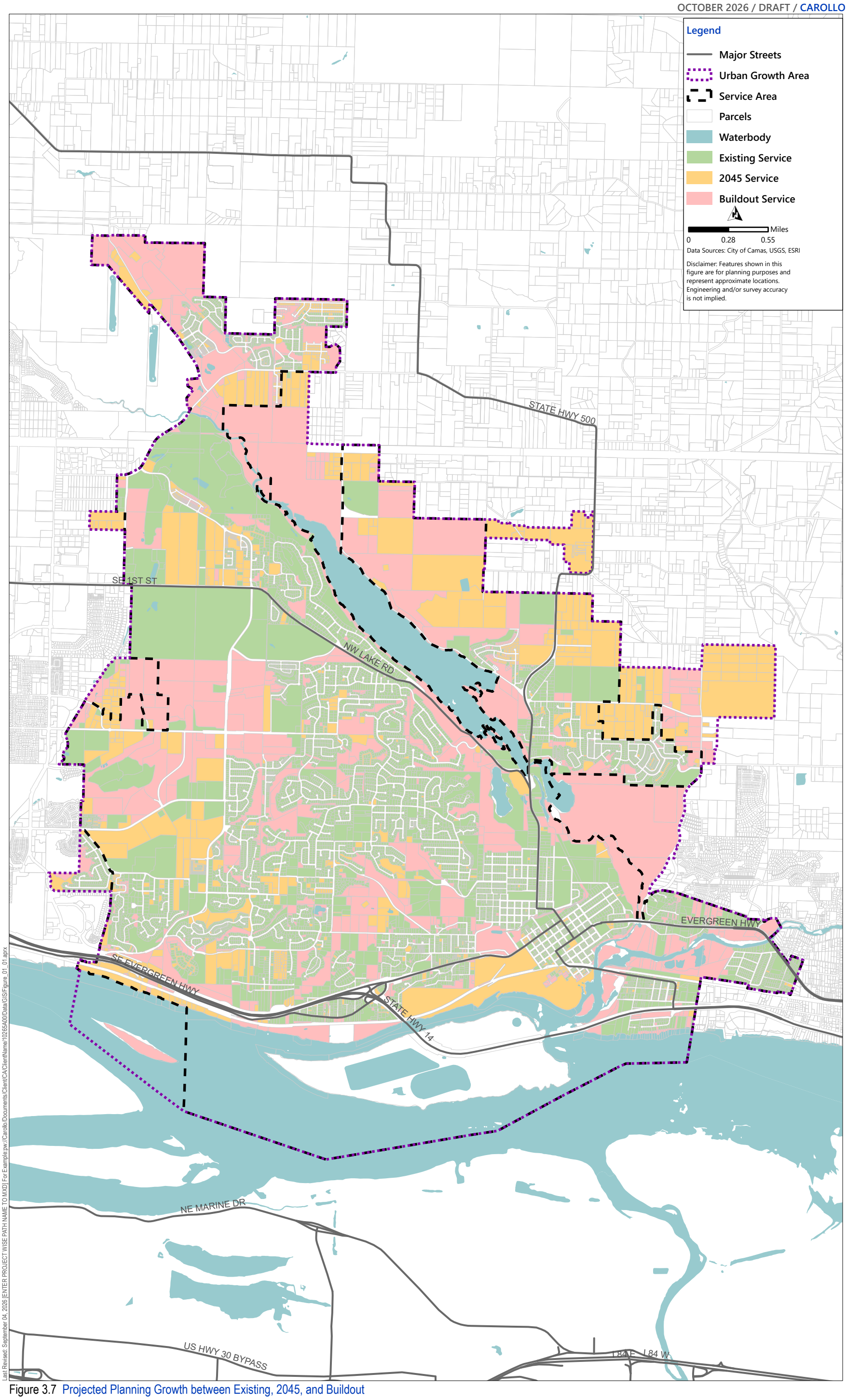


Figure 3.7 Projected Planning Growth between Existing, 2045, and Buildout

3.4.6 Design Storm

Design storms are rainfall events used to analyze the performance of a collection system during peak flows and volumes and have a specific recurrence interval and rainfall duration. The design storm is used for sizing projects. The National Oceanic and Atmospheric Administration (NOAA) publishes isopluvial (rainfall contour) maps[1] that approximate the total rainfall depth for a range of storm size recurrence intervals for standardized storm durations.

The first step in the development or selection of the design storm is to define its recurrence interval and rainfall duration. The recurrence interval is based on the probability that a given rainfall event will occur or be exceeded in any given year. For example, a "100-year storm" means there is a 1 in 100 chance that a storm as large as, or larger, than this event will occur at a specific location in any year. Duration is the length of time in which rainfall occurs.

Discrete storm events are defined as rainfall events separated by a minimum of 48 hours with no precipitation. A 20-year recurrence interval is recommended to match the pump station life cycle sizing in Ecology's Criteria for Sewage Works Design book (Orange Book); therefore, the collection system must also be able to convey a 20-year storm.

The NOAA information is based on older rainfall data and does not provide a hydrograph corresponding to the accumulated rainfall. To identify a suitable storm hydrograph, a statistical analysis of historical rainfall recorded by the City and nearby gauges were conducted. Approximately 20 years of rainfall records from the City's HYDRA Rainfall Network and 60 years of records from Portland International Airport were reviewed to identify a representative historical storm. The December 7, 2015, storm was selected because its rainfall pattern and 24-hour rainfall depth of 3.37 inches provided a reasonable match to the 10-year design rainfall identified by NOAA and was consistent with rainfall records from other regional gauges. Therefore, the December 7, 2015, rainfall pattern was used to develop the 10-year design storm hydrograph shown in Figure 3.8.

[1] Miller, J., R. Frederick, and R, Tracey. Precipitation-Frequency Atlas of the Western United States, Volume IX-Washington. Washington DC, NOAA 1973.

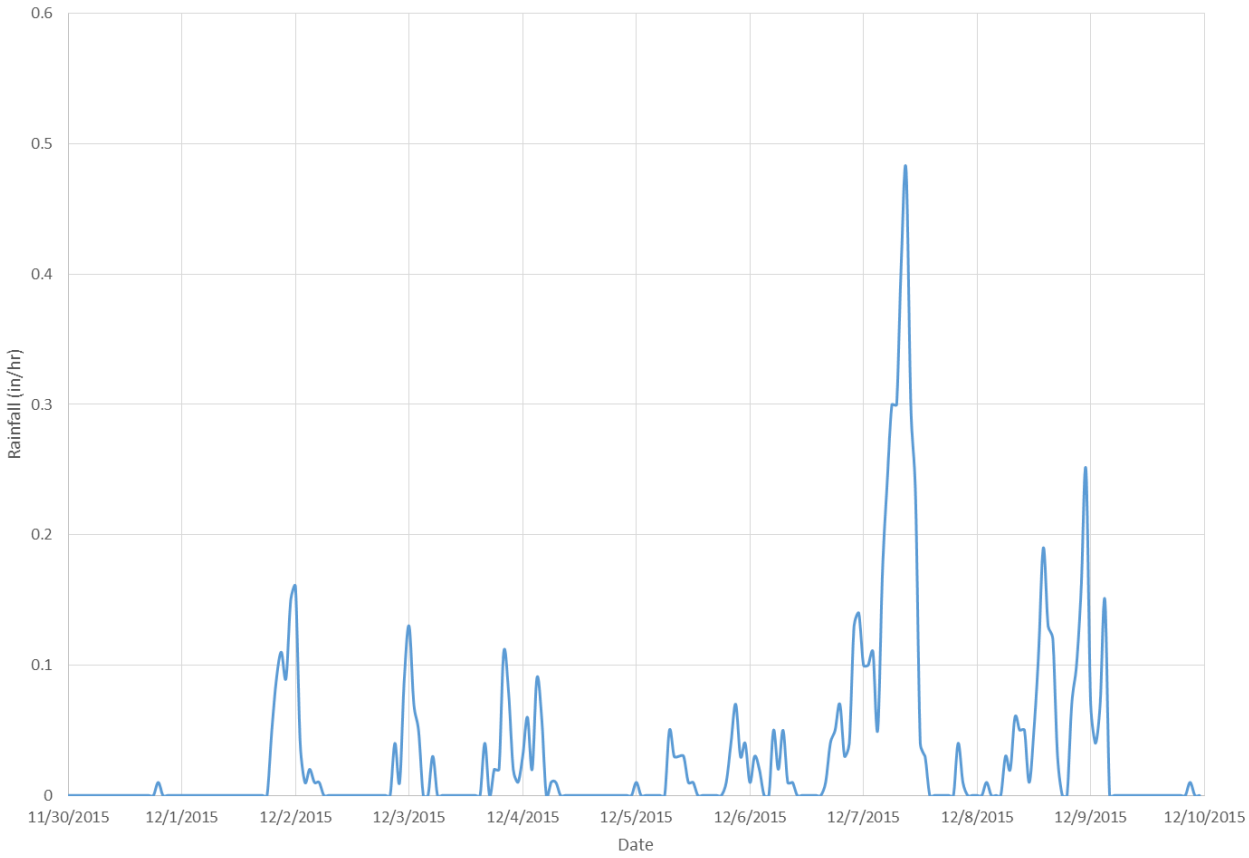


Figure 3.8 Design Storm Hyetograph

3.4.7 Hydraulic Model Wet Weather Flow Projections

The existing STEP Basin flow was estimated using WWTF influent flow data because the basin was not directly monitored. The estimated STEP Basin flow was calculated by subtracting the combined flow measured at the gravity flow monitoring meters from the total flow measured at the WWTF. This estimated flow was used to represent the STEP Basin contribution in the model.

To project future PWWF, I/I within the future service area was defined. No increase in I/I was assumed within the existing service area that are currently sewered parcels, based on the assumption that ongoing maintenance will offset system degradation over time. For future system conditions, additional undeveloped areas within the Urban Growth Boundary, including the Basin WWTF/STEP area and North Shore area were added to the model and assumed to contribute additional I/I to the system. These growth areas were assigned the calibrated I/I parameters from Basin 8-1-2, because Basin 8-1-2 exhibits a relatively low I/I response characteristic of newer infrastructure. This corresponded to an I/I flow rate of approximately 2,000 gpad.

Table 3.8 summarizes the projected PWWF's for each flow monitoring basin under existing, 2045, and buildout conditions. To evaluate the system's unconstrained peak flows, upstream pipes and pump stations were significantly upsized in the model to eliminate hydraulic restrictions; therefore, this is not equal to the actual peak influent flows to the WWTF.

Table 3.8 PWWF Flow Projections for Hydraulic Modelling

Flow Meter Basin	Existing PWWF (mgd)	2045 PWWF (mgd)	Buildout PWWF (mgd)
5-1-2	15.9	17.9	19.4
5-2-1	0.6	1.5	1.7
4-1-3	5.5	7.3	8.3
8-1-2	0.3	0.3	0.4
WWTF(2)	22.9	26.8	35.2
STEP(2)	6.1	7.1	13.7
Leadbetter Road LS	1.1	3.1	4.1
Goodwin Road LS	0.4	0.7	1.3

Notes:
(1) Flows shown are gross peak wet weather flow.
(2) WWTF flows represent measured influent flow at the wastewater treatment facility. STEP Basin flows were estimated by subtracting the combined flows measured at the gravity flow monitoring meters from the total WWTF influent flow.

3.4.8 Hydraulic Model Flow Projections Summary

Table 3.9 presents the total projected ADWF and PWWF for the three planning periods for the modeled portion of the system (gravity and STEP areas upstream of the gravity system). The table also includes the ratio of PWWF to ADWF, referred to as the peaking factor. The peaking factor decreases from 8.04 under existing conditions to 5.04 in 2045 and 4.67 at buildout. This decrease is primarily a result of wastewater flows increasing with projected growth while existing system I/I was held constant. No increase in I/I was assumed for the existing sewered area, based on the assumption that the City's ongoing annual maintenance program will help offset system degradation over time. Note that the flows presented in Table 3.9 are unconstrained flow which represent the maximum flow to the WWTF if all capacity deficiencies are addressed and bottlenecks are removed.

Table 3.9 Flow Projections Summary

Planning Horizon	ADWF (mgd)	PWWF (mgd)	Peaking Factor (PWWF:ADWF)
2025	2.85(1)	22.9	8.04
2045	5.32	26.8	5.04
Buildout	7.55	35.2	4.67

Notes:
(1) The ADWF value shown for 2025 represents ADWF during the flow monitoring period used for the hydraulic model calibration, not the historical dry weather influent flow to the treatment plant of 2.5 mgd.

3.5 Wastewater Treatment Facility Flow and Load Projections

The City's WWTF receives flows from the gravity collection system, septic tank effluent from the City's STEP system, and the septage receiving station.

The WWTF uses different flow parameters for designing and evaluating wastewater process capacity. The influent flow projections developed for the WWTF are consistent with the collection system flow projections and are summarized in Table 3.10. The 2045 PHF projection was developed by multiplying the

projected PDF of 19.3 mgd by a diurnal peaking factor of 3.6 recorded during a peak flow event in January 2024. This peaking factor is based on historical influent flow data and differs from the one presented in Table 3.9 which is a theoretical unconstrained flow.

Table 3.10 WWTF Influent Flow Projection

Flow Parameter	2025 Flow (mgd)	2045 Flow (mgd)
AAF	2.9	5.4
MMF	4.0	7.5
MDF	5.7	10.7
PHF	10.8	20.4
PIDF	11.8	22.2

Wastewater loading data is important for sizing several critical treatment processes. The wastewater loading components of principal interest are the BOD_5, the TSS, and total Kjeldahl nitrogen (TKN). Influent loading projections were developed based on historical influent flows and raw wastewater pollutant concentrations, typical septage and STEP system characteristics, population growth projections and industrial flow contributions. Historical values for BOD_5, TSS, and ammonia (NH_3) and projections to 2045 are detailed in Table 3.11 and Figure 3.9.

Table 3.11 Current and Projected WWTF Loads

Load Parameter	2025 Influent Load (ppd)	2045 Influent Load (ppd)
Sewered Population	30,056(1)	37,080(2)
BOD_5 (ppd)		
Average Annual	3,200	6,000
Maximum Month	4,000	7,500
Maximum Week	4,500	8,500
TSS (ppd)		
Average Annual	3,100	5,800
Maximum Month	3,900	7,300
Maximum Week	4,300	8,100
TKN (ppd) (3)		
Average Annual	1,300	2,500
Maximum Month	1,500	2,800
Maximum Week	1,600	3,000

Notes:
(1) Assuming a growth rate of 1.2 percent per year based on the Camas 2045 Comprehensive Plan.
(2) Sewered population is based on the Camas 2045 Comprehensive Plan.
(3) Influent TKN concentrations are not monitored by the WWTF. Influent TKN values were estimated, assuming an average ratio of NH_3:TKN of 0.7.

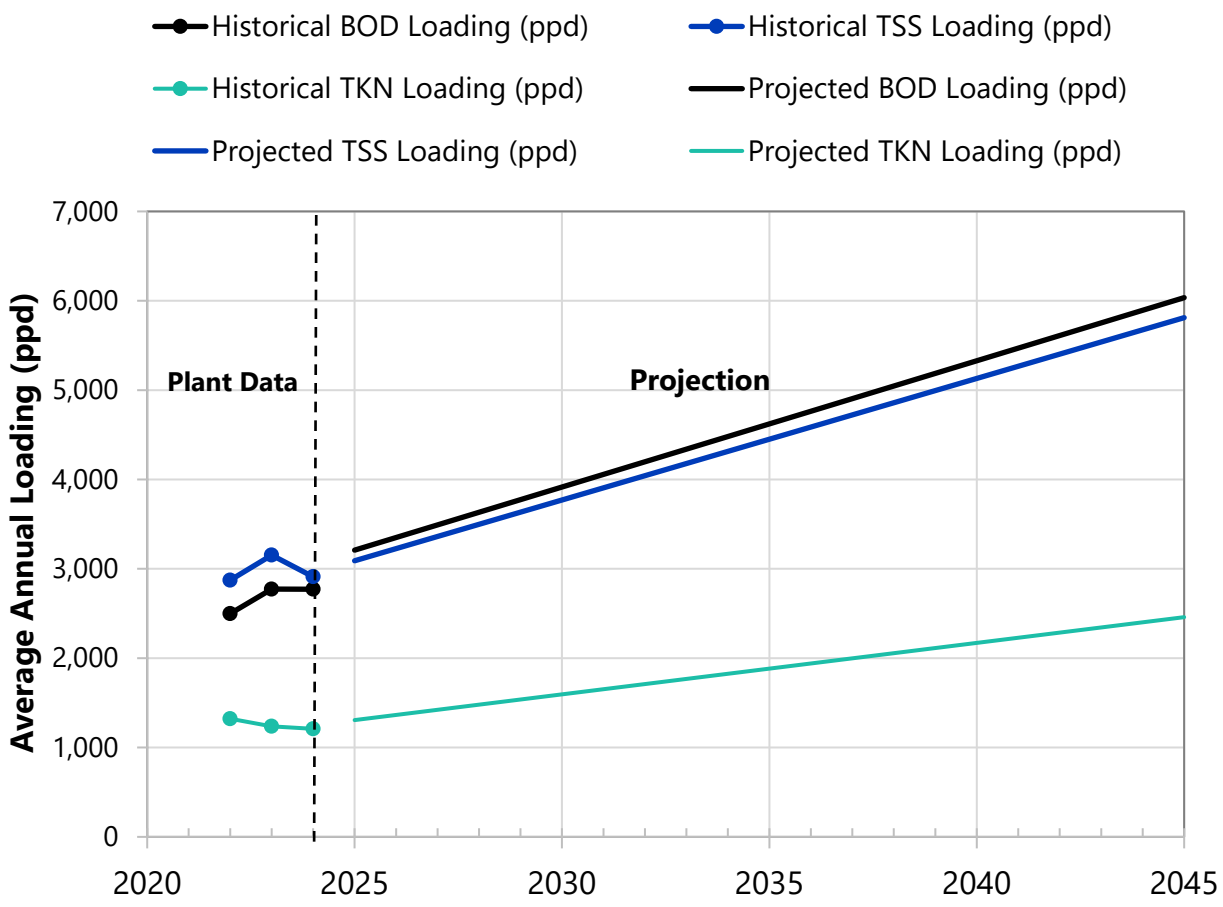


Figure 3.9 Current and Projected WWTF Average Annual Pollutant Loading

CHAPTER 4 EXISTING SYSTEM

4.1 Introduction

The purpose of a sewage collection system is to adequately convey sewage to locations where it can be treated and safely discharged. This chapter describes the City's existing sewer collection system, adjacent sewer service areas, and WWTF. The City's collection system utilizes both conventional gravity sewer with lift stations as well as STEP pumping stations, STEF, and septic tank effluent gravity systems (STEG) to convey wastewater to the WWTF. These systems are influenced by the natural environment, critical areas, and the service area which are summarized in this Chapter.

This chapter will serve as the framework on which to base the GSP, which was last updated in 2024. These considerations establish the basis of planning for the demographic and system analysis which will be the framework for identifying potential for development within the established service area. Consideration for the adequacy of the system to serve the anticipated development within the service area study boundaries is also reliant upon existing system characteristics.

4.2 Sewer Service Area

The City's service area is shown in Chapter 2 - Existing System in Figure 2.1. The service area contains approximately 7,600 acres. The current service area includes the City limits, and the future service area extends to the UGA which totals 9,300 acres. Adjacent sewer systems include City of Vancouver, the Discovery Clean Water Alliance (CWA), and City of Washougal. These systems are described in greater detail in Section 4.5.

4.3 Collection System

The City's sewer system is comprised of four major facility types:

1. Conventional Gravity Sewer.
2. STE Systems - Includes STEP mains less than 21-inches in diameter, STEF, and STEG.
3. STEP Transmission Mains - Includes STEP mains 21-inches in diameter and above.
4. LSs with Force Mains.

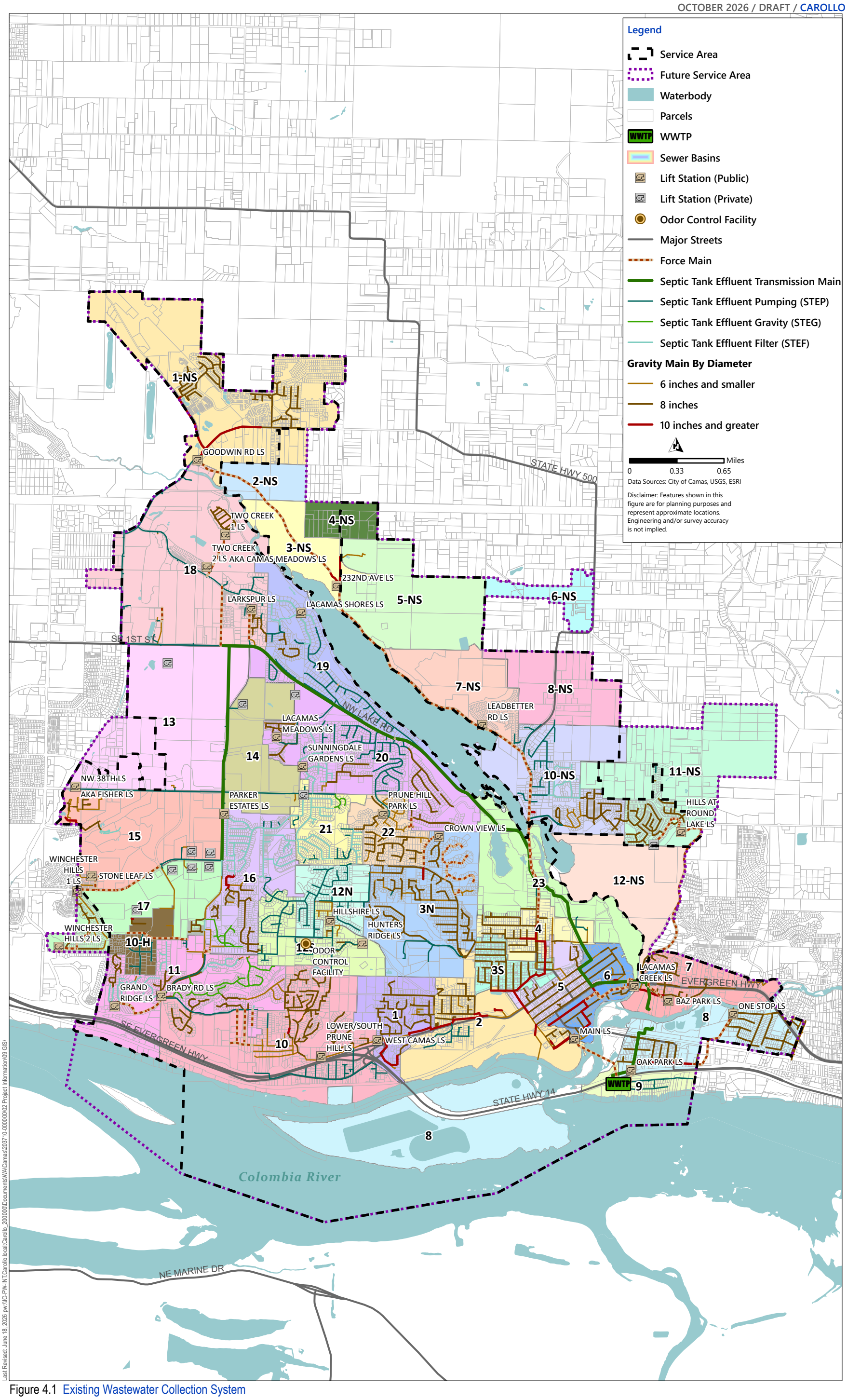
The conventional gravity sewer system is the most common sewer conveyance method in the region and relies on a downward slope throughout the profile to convey flow to a WWTF or intermediate lift station. In addition to the conventional gravity sewer system and lift station, three STE systems are utilized in the City's collection system: STEF, STEG, and STEP, which are explained in further detail in Section 4.3.2. There are 28 lift stations that are located within the service area which convey sewage and STE for treatment where gravity sewers are not effective, as well as one separate remote odor control station. Properties within the sewer service area outside of the gravity sewer portion of the City's collection system use on-site septic tank systems which provide some wastewater treatment, solids settling, and digestion. Similar to lift stations, STEP systems allow service where gravity systems may not be effective, or which were originally located outside the boundaries of a public sewer system service area.

Figure 4.1 and Table 4.1 summarize the City's pipe infrastructure by sewer type, based on data from the City's GIS database. Some pipe segments appear disconnected in Figure 4.1 due to gaps or missing information in the GIS records. As previously noted, the infrastructure is predominantly gravity sewer (405,500 feet) while the STE systems account for 290,019 feet. Figure 4.2 shows the direction of flow through the collection system.

Table 4.1 Summary of Pipe Infrastructure by Type

Sewer Type	Pipe Length (feet)	Pipe Length (miles)
Gravity Main	405,499	76.8
Force Main(1)	65,218	12.4
STEP Transmission Main	20,449	3.9
STEP Main	191,742	36.3
STEF Main	63,524	12.0
STEG Main	14,304	2.7
Total	**760,736**	**144.1**

Notes:
(1) Force main pipe length was determined by incorporating both existing GIS data and newly drawn force main segments identified in the North Shore area.



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Figure 4.1 Existing Wastewater Collection System
CITY OF CAMAS
GENERAL SEWER PLAN

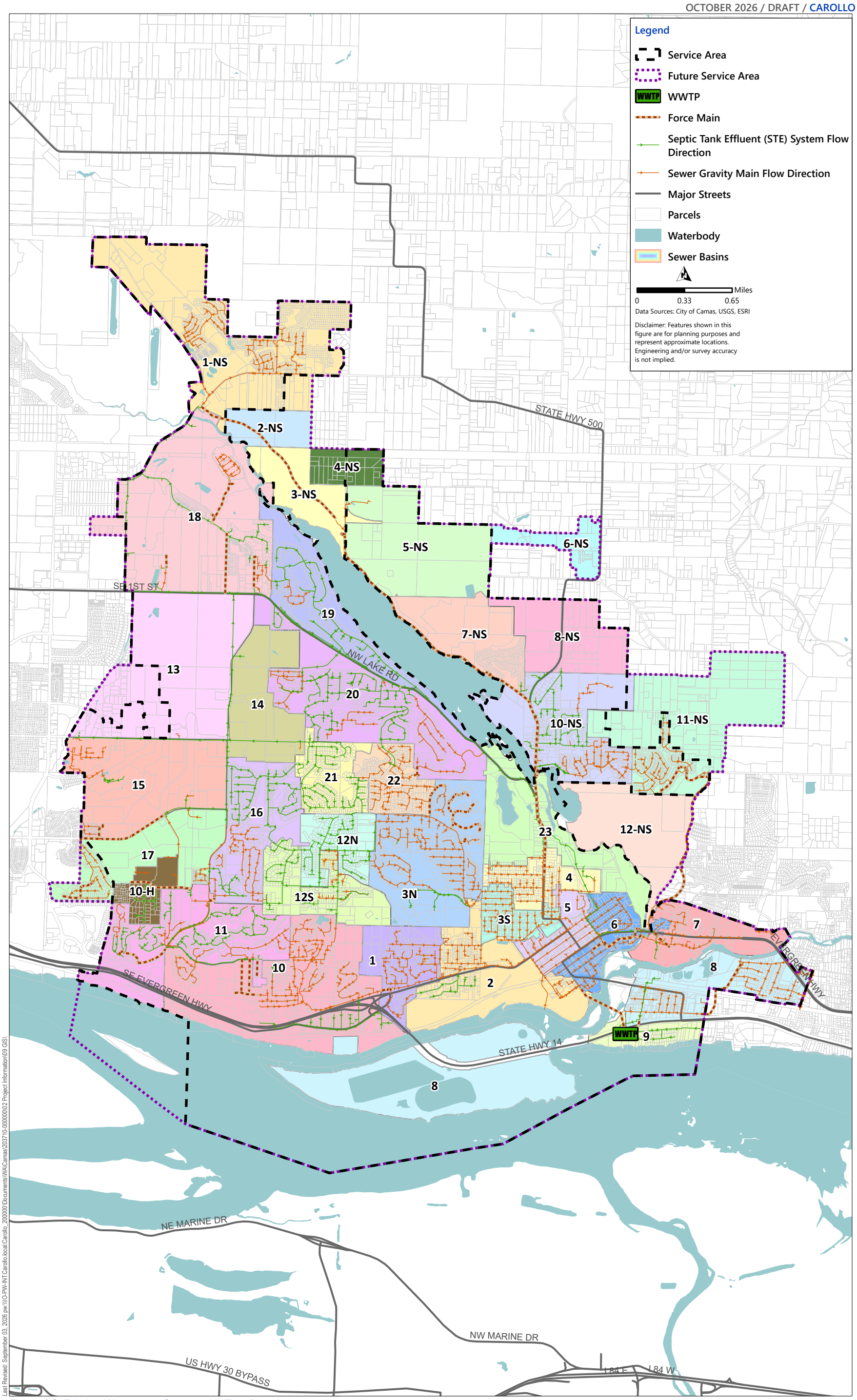


Figure 4.2 Existing Wastewater System with Flow Direction

4.3.1 Gravity System

Portions of the system served by conventional gravity sewers date from its beginning in the 1920's and includes the following basins identified in Figure 4.1: Downtown, Oak Park, Parkers Landing, basins along the Columbia River and State Route (SR) 14, and portions of Prune Hill (Basin 2, 3S, 4, 5, 6, 8, 10, and 11). The North Shore area is and will continue to be served by conventional gravity sewers. A new transmission main for the North Shore was constructed in December 2018.

The earliest portions of the gravity sewer system were constructed with vitrified clay pipe (VCP). Much of this VCP was later replaced with cast iron, concrete, and eventually polyvinyl chloride (PVC). Therefore, the relative age of sanitary sewer can be identified by the material type. The system utilizes a pipe diameter ranging from 4 inch to 24-inch segments where the majority of the system is 8 inches or less in diameter. A summary of pipe infrastructure by diameter is shown in Table 4.2.

Table 4.2 Summary of Gravity Sewer Infrastructure by Size

Pipe Diameter (inches)	Pipe Length (feet)	Pipe Length (miles)
8 inches and below	295,393	55.9
10	9,809	1.9
12	13,769	2.6
15	2,365	0.4
18	2,772	0.5
20	259.1	0.0
21	2,345	0.4
24	370.9	0.1
Other	976	0.2
Unknown(1)	77,441	14.7
Total(2)	**405,500**	**76.8**

Notes:
(1) Pipes with unknown diameter also include segments where the diameter field is null.
(2) Totals may not exactly match due to rounding.

4.3.2 STE Systems

Starting in 1985, the City required new customers in the western portion of the service area to be served using the STE system. Due to the City's topography and shallow bedrock, the STE systems allowed the City to serve areas without the costly installation of gravity sewers. The three STE systems address site specific challenges within the City's collection system. STEP systems consist of a septic tank equipped with a pump at the outlet to convey effluent flows to the STEP transmission main, rather than an on-site drain field. STEG systems consist of a septic tank with an outlet that conveys effluent flows by gravity to the STE transmission main. STEF systems utilize a siphon to convey effluent flows to the STE transmission main. Figure 4.1 shows the STEF, STEG, and STEP systems and STE transmission mains within the City's conventional gravity collection system.

The City owns and maintains the residential STE systems described above. The City pumps out the septage from the STE systems on a 5 to 7-year cycle. Commercial and Industrial systems are owned and maintained by the property owner. The City receives and treats septage from all systems at the WWTF. STE system pipes are shown on Figure 4.1 designated as STEP, STEF or STEG.

Table 4.3 Summary of STE Infrastructure by Size

Pipe Diameter (inches)	Pipe Length (feet)	Pipe Length (miles)
8 inches and below	215,383	40.8
10	23,111	4.4
12	4,586	0.9
18	2,535	0.5
20	2,932	0.6
24	3,338	0.6
Unknown(1)	17,111	3.2
Total(2)	**21,024**	**4.0**

Notes:
(1) Pipes with unknown diameter also include segments where the diameter field is null.
(2) Totals may not exactly match due to rounding.

4.3.3 STEP Transmission Main

The STEP transmission main is a transmission main that conveys STE system flows and major industrial dischargers to the WWTF. The pressurized transmission main is shown in Figure 4.1; the STEP transmission main is approximately 34,402 linear feet in length and is 21-inches to 24-inches in diameter. The transmission main conveys flow directly to the WWTF and does not receive flows from other sewer systems.

4.3.4 Lift Stations

The City currently operates 28 LS whose characteristics are summarized in Table 4.4. Of these 28 lift stations, 13 serve the gravity system and 15 serve the STE systems. Lift stations are identified in Figure 4.1. There are approximately 65,218 feet, or 12.4 miles, of force main associated with the lift station ranging from 4-inches to 18-inches in diameter. The majority of lift stations serve relatively small service areas and have capacities of less than 500 gallons per minute (gpm). The North Shore is served by three lift stations: Goodwin LS, 232nd Avenue LS, and Leadbetter LS which were installed in December 2018. The Main LS, with a capacity of 7,700 gpm, conveys the majority of the gravity system to the WWTF through an 18-inch diameter force main under Lacamas Creek.

4.3.5 Odor Control Station

The City operates two odor control stations located at 325 NE 23rd Avenue in Basin 23 and 2806 NW 18th Avenue in Basin 12. The stations' purpose within the collection system is to mitigate nuisance odors associated with the collection system. These facilities help improve air quality near sewer facilities and reduce potential impacts on nearby residents and businesses. The stations are not designed to provide flow conveyance or pumping capacity.

Table 4.4 Summary of Lift Stations

Lift Station		Location	Basin Number	STE or RAW	Number of Pumps	Pump Motor Size (HP)	Pump Capacity (gpm, each)	Total Station Capacity (gpm, 1 standby)	TDH (feet)
1	232nd Avenue	Near 618 NE 232nd Avenue	3-NS	RAW	2(1)	15.2	365	365	87
2	Baz Park	1906 NE 3rd Loop	7	RAW	2	7.5	488	488	38
3	Brady Road	919 NW Brady Road	11	STE	2	35	511	511	60
4	Camas Meadows	6902 NW Morgan Way	20	STE	2	35	221	221	222
5	Crown View	3222 NW Ivy Lane	3N	RAW	2	20	222	222	124
6	Fisher (NW 38th Ave)	5870 NW 38th Avenue	13	STE	2	23	126	126	206
7	Goodwin Rd	2305 NE Goodwin Road	1-NS	RAW	2(1)	15.2	300	300	94
8	Grand Ridge	843 NW Grande Ridge Road	11	STE	2	11	133	133	160
9	Hills at Round Lake	1960 NE Tanoak Drive	11-NS	STE	2	11	256.9	256.9	93.2
10	Hillshire	2303 NW Artz Court	12S	RAW	2	10	175	175	70.1
11	Hunters Ridge	2021 NW 17th Avenue	12S	RAW	2	23	152	152	174
12	Lacamas Creek	1641 NE 3rd Avenue	6	RAW	2(1)	25	950	950	67
13	Lacamas Meadows	3263 NE 45th Avenue	20	STE	2	23	173	173	203
14	Lacamas Shores	6230 NW El Rey Drive	19	STE	2	23	195	195	168
15	Larkspur	6162 NW Larkspur Street	18	STE	2	23	264	264	154
16	Leadbetter Rd	1050 SE Leadbetter Road	7-NS	RAW	2(1)	26.6	605	605	111
17	Lower (aka South) Prune Hill	2381 NW 6th Place	10	RAW	2	10	600	600	39
18	Main Station	480 SE 3rd Avenue	6	RAW	3	125	3850	7700	85
19	Oak Park	907 SE Polk Street	8	RAW	2	10	350	350	57
20	One Stop	200 SE Yale Street	8	RAW	2	5	231	231	36.2
21	Parker Estates	3436 NW Parker Street	16	STE	2	20	339	339	103
22	Prune Hill Park	3403 NW Sierra Drive	22	STE	2	7.5	350	350	53
23	Stone Leaf	5713 NW 26th Avenue	15	STE	2	23	423	423	81.2
24	Sunningdale Gardens	4043 NW Dahlia Loop	20	STE	2	10	260	260	63
25	Two Creeks	7402 NW Morgan Way	18	STE	2	10	166	166	70.7
26	West Camas	1625 NW 6th Place	1	RAW	2	30	1000	1000	74
27	Winchester Hills 1	19617 SE 34th Street	17	STE	2	6.5	97.9	97.9	66.7
28	Winchester Hills 2	19320 SE 42nd Circle	17	STE	2	5	125	125	65

Notes:
(1) Two pumps installed; space for a third pump.
HARL - Hills at Round Lake; HP - horsepower.

4.4 Drainage Basins

This section summarizes the previously discussed system elements in the context of the drainage basins in the City's sewer service area. The attributes of the 23 flow basins are summarized in Table 4.5.

Table 4.5 Drainage Basin Attributes

Drainage Basin No.	Flow Meter Basin	Area (acres)	Connected Acreage	No. of LS	Miles of Sewer			
					Total STE	Gravity	Force Main	Total[1]
1	5-1-2	169	80.3	1	-	3.8	0.09	3.9
2	5-1-2	341	65.2	0	0.95	3.8	-	4.7
3N	5-1-2	398	231.5	1	1.00	6.4	0.94	8.3
3S	5-1-2	91	57.1	0	-	3.2	-	3.2
4	4-1-3	117	82.4	0	0.94	3.2	0.11	3.4
5	5-1-2	99	56.0	0	0.04	3.4	-	3.5
6	5-2-1	128	68.1	2	0.49	3.8	0.73	5.5
7	5-2-1	174	66.5	1	0.23	2.2	0.15	2.8
8	8-1-2	477	120.7	2	0.53	5.0	0.37	6.4
9	8-1-2	87	30.3	0	0.83	0.1	0.50	1.5
10	5-1-2	622	241.2	1	2.27	7.0	0.63	9.8
10-H	5-1-2	78	60.7	0	0.72	0.2	0.43	1.4
11	5-2-1	394	182.1	2	5.23	3.6	0.65	9.6
12N	WWTF/STEP	134	92.6	0	3.52	0.0	-	3.2
12S	5-1-2	192	96.8	2	2.44	1.3	-	4.1
13	WWTF/STEP	557	285.2	1	1.45	0.0	0.00	2.0
14	WWTF/STEP	235	92.2	0	1.04	0.1	-	1.5
15	WWTF/STEP	383	126.3	1	1.92	1.7	0.39	4.0
16	WWTF/STEP	274	129.5	1	4.68	2.5	0.00	7.5
17	WWTF/STEP	254	84.5	2	0.20	2.9	0.66	3.7
18	WWTF/STEP	671	345.8	3	3.88	1.9	1.21	7.0
19	WWTF/STEP	267	181.4	1	5.60	0.5	0.00	5.1
20	WWTF/STEP	461	213.7	2	7.21	4.2	0.02	14.6
21	WWTF/STEP	139	86.1	0	3.74	-	-	3.7
22	WWTF/STEP	128	86.0	1	0.27	3.4	0.26	3.9
23	WWTF/STEP	295	60.9	1	1.18	0.7	0.02	4.5
1-NS	Goodwin Road	615	89.3	1	0.03	5.8	-	5.9
2-NS	Leadbetter Road	90	0.0	0	-	-	-	-
3-NS	Leadbetter Road	157	0.0	1	-	2.9	0.46	3.3
4-NS	Leadbetter Road	79	0.0	0	-	-	-	-
5-NS	Leadbetter Road	364	34.0	0	-	1.6	-	1.6

Drainage Basin No.	Flow Meter Basin	Area (acres)	Connected Acreage	No. of LS	Miles of Sewer			
					Total STE	Gravity	Force Main	Total(1)
6-NS	Leadbetter Road	83	0.0	0	0.00	-	-	-
7-NS	Leadbetter Road	215	14.2	1	0.09	2.1	0.57	2.8
8-NS	Leadbetter Road	93	36.7	0	-	-	-	-
9-NS	Leadbetter Road	119	0.0	0	-	-	-	-
10-NS	WWTF/STEP	345	193.4	0	4.38	3.4	1.33	9.3
11-NS	5-2-1	500	65.1	1	0.05	3.0	0.52	3.6
12-NS	5-2-1	270	0.0	0	-	0.2	3.75	4.0
				Total(1)	**54.9**	**76.8**	**12.4**	**144.1**

Notes:
(1) Totals may not match exactly due to rounding.

4.5 Wastewater Treatment Facility

The City's WWTF is located along the Columbia River in the southeastern portion of its sewer service area. The WWTF was originally constructed in 1972 and has had several modifications since that time. The first major upgrade and expansion of liquid stream processes was completed in February of 2000. A subsequent Phase 2A upgrade, primarily addressing solids treatment, including anaerobic digesters and sludge drying facilities, was completed in 2012. Phase 2B, completed in 2014, improved blower controls, added a third secondary clarifier, new effluent filters, and digester gas treatment facilities. The WWTF will soon undergo a significant upgrade project to replace the internal mechanism of the two primary clarifiers, new sludge degritting system, install second dewatering centrifuge, new septage receiving and screening equipment, replacement of two of the multi-stage centrifugal blowers with high-speed turbo blowers and associated controls modification, new emergency generator, and new UV disinfection system to increase the efficiency of plant equipment.

The facility process flow diagram is shown in Figure 4.2. An aerial view of the WWTF with each unit process and building identified is shown in Figure 4.3. The liquid stream treatment begins with climbing bar screens at the plant headworks to remove larger material which is washed, compacted, and disposed of at a landfill. Primary solids-liquid separation occurs in two circular primary clarifiers with the primary effluent discharging to a splitter box where it is combined with RAS from the secondary clarifiers (SC) and split between three aeration basins (AB), where biomass is aerated to promote biological oxidation and improve water quality. Secondary treatment in the ABs consists of influent channel selector zones followed by two anoxic and three aerobic zones to remove carbonaceous material and reduce ammonia concentrations. Magnesium hydroxide ($Mg(OH)_2$) is added at the SC splitter box to provide supplemental alkalinity.

Mixed liquor from the three ABs is combined and split between three secondary clarifiers. The three clarifiers provide separation of the biomass from the secondary treatment processes (termed activated sludge) and discharge of liquid effluent to two mechanical disc filters. UV disinfection is provided in an open channel system with four banks of UV lamps prior to discharge to the outfall in the Columbia River. One of the SCs is not used due to its flat bottom.

The effluent either flows by gravity or is pumped to the outfall via the three effluent pumps, which are operated in a two duty and one standby configuration. Transitions between gravity and pumped effluent

flow are performed automatically when the pumps are placed in "auto" mode. When the Columbia River level rises, gravity effluent discharge is stopped by closing the flap gate in the effluent manhole. The existing outfall is a 36-inch corrugated metal pipe (CMP) and extends approximately 850 feet south into the Columbia River channel. The diffuser portion of the outfall is located along the outer 150 feet of the pipe and is equipped with 16 vertical risers, each oriented vertically with rubber Tideflex check valve-type nozzles. The vertical risers discharge effluent perpendicular to the flow of the Columbia River.

Solids from the primary clarifiers are first conveyed to two hydro-cyclones and a classifier for degritting then thickened in the gravity thickener. Thickened primary sludge (TPS) is then pumped to anaerobic digesters. Solids from the secondary clarifiers are moved by a sludge-scraper mechanism to a wet well and then withdrawn by pumps. The settled solids (RAS) are pumped back to the aeration basin splitter box. Excess activated sludge wasted (WAS) from all three secondary clarifiers is sent to a storage tank and thickened in a rotary drum thickener. Thickened primary and secondary solids are then combined in anaerobic digesters for stabilization, reduction of volatile solids, and production of biogas. Dewatering of the digested sludge is accomplished through a centrifuge and then conveyed to a belt dryer, which evaporates most of the remaining water content in the biosolids. The dewatered and dried biosolids are dried to achieve Class A and are hauled off-site for land application.

Odors are controlled at the plant through unit-specific odor control ductwork. Air from the digesters and sludge holding tank is filtered through a hydrogen sulfide (H_2S) scrubber with a bark media bed. Other orders from the process (centrifuge room, grit room, influent channel, etc.) are blown through a biofilter bed located to the west of the dryer building.

The unit capacity for each major component at the WWTF is summarized in Table 4.6.

Table 4.6 Unit Process Capacity

Unit	Number of Units	Design Criteria(1)
Bar Screens		
Climbing Bar Screens	2	▪ Perforation Size: 1/4 inches (6 mm)
Manual Coarse Bar Screen (Bypass)	1	▪ Bar Spacing: 3/4 inches (19 mm)
Primary Clarifiers	2	▪ Diameter: 60 feet (each) ▪ Depth: 10 feet ▪ Volume: 211,500 gallons (each)
Aeration Basins	3	▪ Volume: 100,800 ft^3 (each)
Aerobic	3	▪ Total Volume: 176,400 ft^3
Anoxic	2	▪ Total Volume: 108,360 ft^3
Selector (SAx)	3	▪ SAx-1 Volume: 2,700 ft^3 ▪ SAx-2 Volume: 1,600 ft^3 ▪ SAx-3 Volume: 4,500 ft^3 ▪ SAx-4 Volume: 9,000 ft^3

Unit	Number of Units	Design Criteria[1]
Secondary Clarifiers		
SC No. 1	1	▪ Diameter: 75 feet ▪ Depth: 13 feet ▪ Volume: 424,000 gallons
SC No.2	1	▪ Diameter: 75 feet ▪ Depth: 17 feet ▪ Volume: 461,800 gallons
SC No.3	1	▪ Diameter: 75 feet ▪ Depth: 14 feet ▪ Volume: 462,700 gallons
Effluent Disc Filters	2	▪ Capacity: 3.0 mgd (each)
UV Disinfection[1]	4	▪ Peak Day Process Flow: 10.04 mgd
Hydrocyclones	2	▪ Capacity: 220 gpm
Gravity Thickener	1	▪ Diameter: 30 feet ▪ Depth: 10 feet
Anaerobic Digesters	2	▪ Volume: 24,500 ft^3 (each)
Centrifuge	1	▪ Capacity: 130 gpm
Rotary Screen Thickener	1	▪ Capacity: 100-300 gpm

Notes:
ft^3 - cubic feet; mm - millimeter.

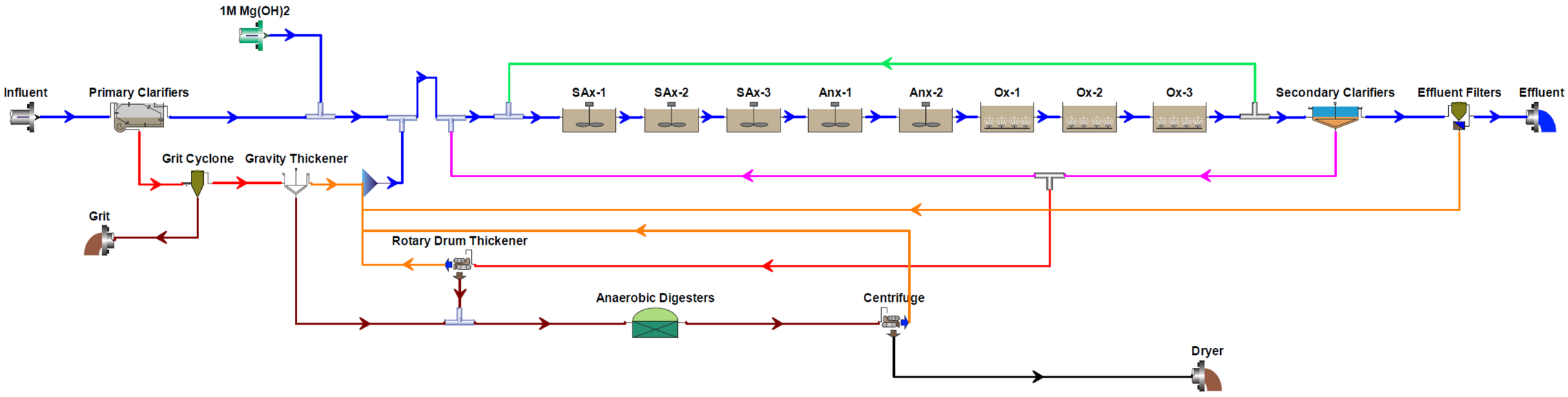


Figure 4.3 BioWin Process Flow Diagram



Figure 4.4 WWTF Aerial Image with Site Plan

4.5.1 Recent Plant Upgrades

Several upgrades have taken place at the WWTF since the previous GSP (Carollo, 2024), which have improved the plant's efficiency and reliability:

- WWTP UV Disinfection Improvements (HDR TO4):
  - Replacement of the primary sludge grit classifiers.
  - Install a second dewatering centrifuge.
  - Increase in the septage receiving capacity with new screen.
  - Replacement of two of the multi-stage centrifugal blowers with high-speed turbo blowers and associated controls modification to have two turbo blowers operate in tandem with two centrifugal blowers.
  - Replacement of the internal mechanisms in the primary clarifiers with all 316 stainless steel (SS).
  - Replacing the UV disinfection system with new UV equipment and controls.
  - Moving the electrical generator out of the Equipment Building.

Additionally, the plant recently had the channels in the headworks structure rehabilitated (recoated) due to extensive damage to the concrete from H_2S.

4.5.2 Plant Flows

The WWTF receives influent flows from the Main and Oak Park pump stations and a septage truck unloading station. STEP flows in the collection system are conveyed to the plant and intersect the Main line just before the influent structure. The combined flow from the STEP system, the pump stations, and septage truck unloading station are measured by a Parshall flume. The combined flow measured by the Parshall flume is recorded as the WWTF influent flow.

The WWTF has a three-year AAF of 2.73 mgd from the collection system with approximately 33 percent of the AAF from industrial users. This relatively high percentage of industrial users increases the influent ammonia concentrations but decreases the TSS and biochemical oxygen demand (BOD) concentrations resulting in a high nitrogen and low carbon influent compared to a typical municipal facility. The previously described STEP and STEF system contributes nearly 60 percent of the average day dry weather influent flows (which includes the 33 percent of flow from industrial users) also contributes to unique influent characteristics when brought into the facility due to an estimated 35 percent reduction of BOD in the 5-day test (BOD_5) and a 60 percent reduction of TSS in the septic tank.

Although septic tank solids are also returned to the facility through septic delivery, these solids also have reduced BOD_5 and TSS loadings due to the nearly five-year detention time. NPDES effluent discharge limitations, prohibitions, and requirements are similar to other municipal facilities with standard 30/30 monthly TSS and BOD concentration limits with a mandatory 85 percent reduction in each. However, the WWTF has ammonia limits of 20 mg/L (NH_3 as N) in the summer and 7 mg/L (NH_3 as N) in the winter.

4.5.3 NPDES Violations

The current NPDES permit became effective on August 1, 2025, and will expire on July 31, 2030. From 2019 to 2024 the plant had eight permit violations all involving reported low effluent pH values which were caused by default readings during the cleaning and calibration of the effluent pH probe. The WWTF has a minimum effluent pH requirement of 6.0; however, the probe defaults to a value of 3.0 when being cleaned. As the low readings were caused by instrumentation error and not actual effluent violations, there was no enforcement action necessary.

4.6 Adjacent Sewer Service Areas

Four sewer service areas with their own WWTFs are within a 20-mile radius of the Camas WWTF. All of the facilities listed in Table 4.7 have Columbia River outfalls. Distances vary from the closest, Washougal WWTF, approximately 3.5 miles away, to the farthest, Salmon Creek WWTF, approximately 20 miles away.

Table 4.7 Adjacent Service Areas WWTFs

Facility/Service Area	MMF (mgd)	Biological Treatment Process	Disinfection	Biosolids
Salmon Creek (Clark County)	10.3	Aeration Basins	UV	Land Applied
Marine Park (Vancouver)	16.1	Aeration Basins	UV	Incinerated
Westside (Vancouver)	28.3	Aeration Basins	UV	Incinerated
Washougal	2.2	Oxidation Ditch	UV	Lagoon

All of these nearby treatment facilities utilize activated sludge treatment processes and UV disinfection; however, the greatest variation in treatment can be seen in the processing of biosolids. Salmon Creek WWTF operates similarly to Camas through the land application of biosolids. Marine Park and Westside incinerate solids produced at those City of Vancouver facilities.

4.6.1 City of Vancouver

The City of Vancouver currently uses 716 miles of sanitary sewer and forty-one pump stations to convey sewage to Vancouver's Marine Park and Westside WWTFs. Vancouver's collection system is divided into three basins currently: the Westside Basin, Eastside Basin, and Diversion Basin. Wastewater generated in the Eastside Basin is conveyed to and treated exclusively at the Marine Park facility. Diversion Basin wastewater is conveyed to and treated at either the Marine Park or Westside WWTF. Westside Basin sewage is conveyed to and treated exclusively at the Westside Treatment Facility.

The largest nearby treatment facility is Westside in Vancouver at 28.3 mgd average annual flow. Altogether, Marine Park and Westside WWTFs serve 200,000 residents per 2025 census data. Currently, Marine Park does not treat its solids on-site and instead conveys them to Westside through a force main and gravity sewer. Once at Westside, a fluidized bed furnace incinerates scum and solids from the primary and secondary clarifiers at both plants.

4.6.2 City of Washougal

The City of Washougal currently operates fourteen LS throughout the City and conveys sewage through more than 1.5 miles of force mains to the Washougal Treatment Plant. The treatment plant consists of an oxidation ditch followed by a secondary clarifier and UV disinfection. Similar to other plants in the region, effluent is discharged to the Columbia River.

4.6.3 Clark County

Clark County formed the Discovery CWA in January 2013 to provide framework for regional wastewater collection. The CWA serves unincorporated Clark County, the City of Battle Ground, the City of Ridgefield, and Clark Regional Wastewater District.

Nearby Salmon Creek WWTF is part of the CWA and serves approximately 100,000 residents. Although the average annual flow is typically between 8-10 mgd, the plant has the capacity to treat up to 15 mgd. Future expansion is underway to improve the Columbia River outfall as well as increase capacity to 17.5 mgd. Odor control will be built as well due to odorous air present particularly during the summer and early fall.

4.7 Natural Environment and Critical Areas

Topics considered to describe the existing system's natural environment include topography, soils and geology, and climate including rainfall. Critical areas within the natural environment highlight the connection between the sewer system and these characteristics. Critical areas include wetlands, critical aquifer recharge areas (CARA), geologically hazardous areas, frequently flooded areas, and fish and wildlife habitat conservation areas.

4.7.1 Natural Environment

Relatively steep topography with slow to moderate infiltration rates comprise a majority of the City's geography. The City enjoys moderate temperatures between the average high of 62°F and average low of 37°F. Heavy rainfall, characteristic of the Pacific Northwest region, provides an average annual precipitation of 50 inches while snowfall is not typically heavy, annually averaging 9 inches.

4.7.1.1 Topographical Characteristics

As shown in Figure 4.4, elevation ranges from slightly above sea level (20 feet) to greater than 750 feet in the City. Steep slopes comprise a large portion of the landscape which range from 5 to 15 percent. A relatively flat plateau is present at the most central portion of the City near Prune Hill while the older, denser zones lie along the Columbia River. Similarly, the UGA was developed on a steep slope with a plateau at 470 feet elevation residing just outside of the City Limits.

4.7.1.2 Soils and Geology

According to the National Resources Conservation Service, Clark County is approximately 5 percent cinebar stony silt loam with 30 to 70 percent slopes. However, the City has a much higher percentage of Lauren gravelly loam from 0 to 8 percent slopes and Hesson Clay loam from 0 to 8 percent slopes. These soil types are categorized as hydrological soil groups B and C, respectively, which indicate slow to moderate infiltration rates when wet with a slow to moderate rate of water transmission. This indicates moderate runoff coefficients for the region. Additional details on the soil groups are available in Figure 4.6.

4.7.1.3 Climate

The City's climate is characterized by a combination of rainfall, wind, and temperature patterns for the nearby region. The average high temperature is 62°F and the average low is 37°F. The temperature is known to vary from 36°F to 84°F throughout the year with a warm season from June to September. Altogether, summers last approximately three months with warm weather and winters are cold with the heaviest rainfall occurring in late November or early December.

Historical precipitation data was gathered from Airport Way No.2 Rain Gage (Station 111) of the City of Portland HYDRA Rainfall Network and a rain gauge installed by ADS. The average three and a half-year rainfall patterns indicate the November through February period average 5 inches per month or more with a peak in January at approximately 10.1 inches. The maximum annual rainfall occurred in 2022 at 54.61 inches total which is 12.3 percent greater than the 2022-2025 average. The driest month of the year is typically July with less than one inch of rainfall recorded between 2022 and 2024. The average annual rainfall patterns are detailed in Table 4.8. Average annual snowfall is 9 inches, and average annual precipitation is approximately 50 inches.

Table 4.8 City of Portland Airport Way 2 Pump Station (Hydra 111) Precipitation 2022-2025

Year	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	**Annual**
2022	7.25	3.28	5.69	7.1	5.77	4.47	0.3	0	0.28	4.27	7.16	9.04	**54.61**
2023	3.84	2.64	5.84	6.54	0.96	1.3	0.04	0.57	1.97	2.81	6.95	9.33	**42.79**
2024	10.1	5.25	4.08	2.38	3.61	1.5	0.11	0.76	1.77	3.71	8.51	7.55	**49.33**
2025(1)	3.48	5.91	5.95	1.85	-	-	-	-	-	-	-	-	**17.19**
Average	**6.17**	**4.27**	**5.39**	**4.47**	**3.45**	**2.42**	**0.15**	**0.44**	**1.34**	**3.60**	**7.54**	**8.64**	**47.87**
Minimum	**3.48**	**2.64**	**4.08**	**1.85**	**0.96**	**1.3**	**0.04**	**0**	**0.28**	**2.81**	**6.95**	**7.55**	**31.94**
Maximum	**10.1**	**5.91**	**5.95**	**7.1**	**5.77**	**4.47**	**0.3**	**0.76**	**1.97**	**4.27**	**8.51**	**9.33**	**64.44**

Notes:
(1) Rain Gauge data obtained from Camas Flow Monitoring 2025 by ADS dated May 28, 2025.

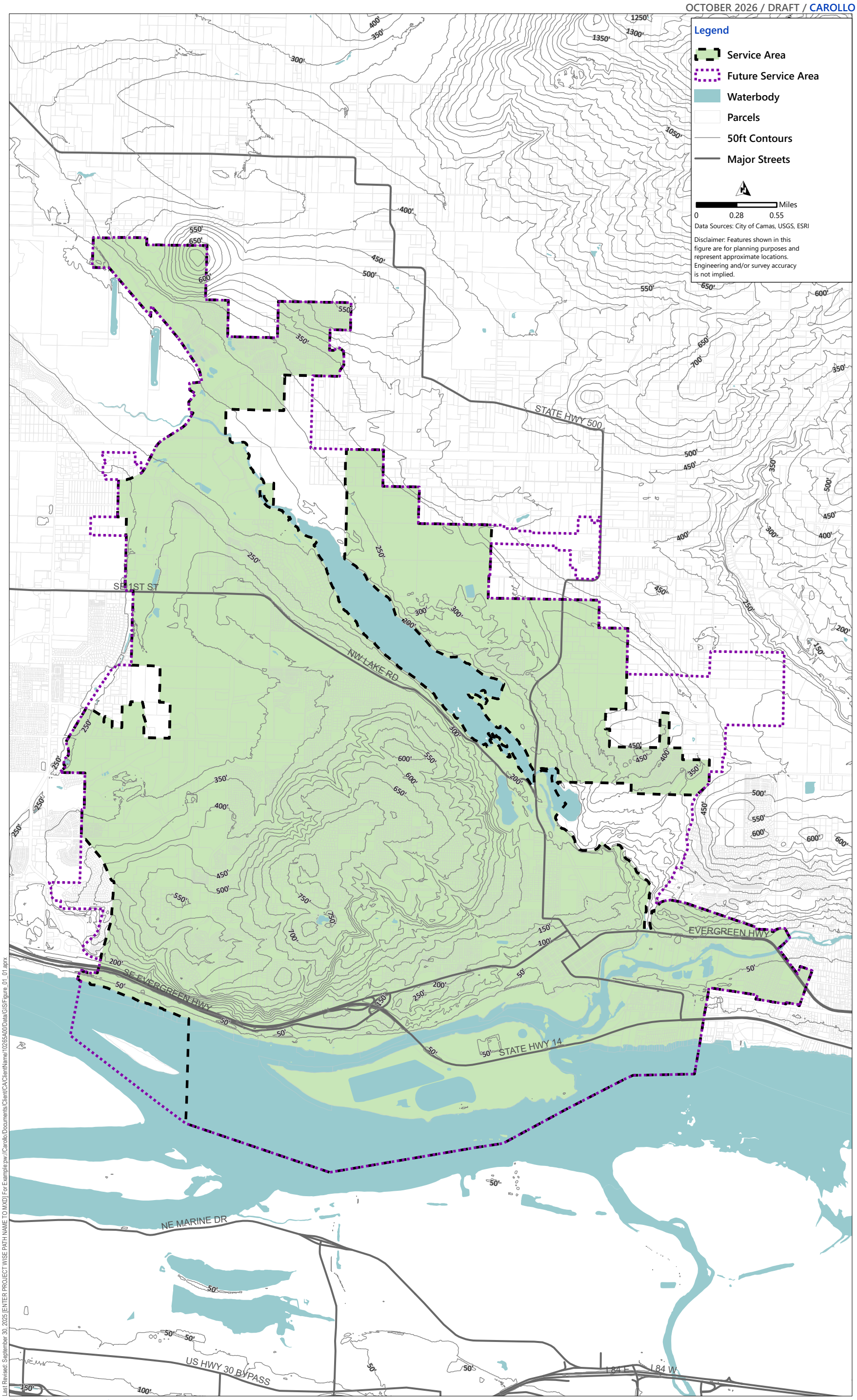


Figure 4.5 Topography

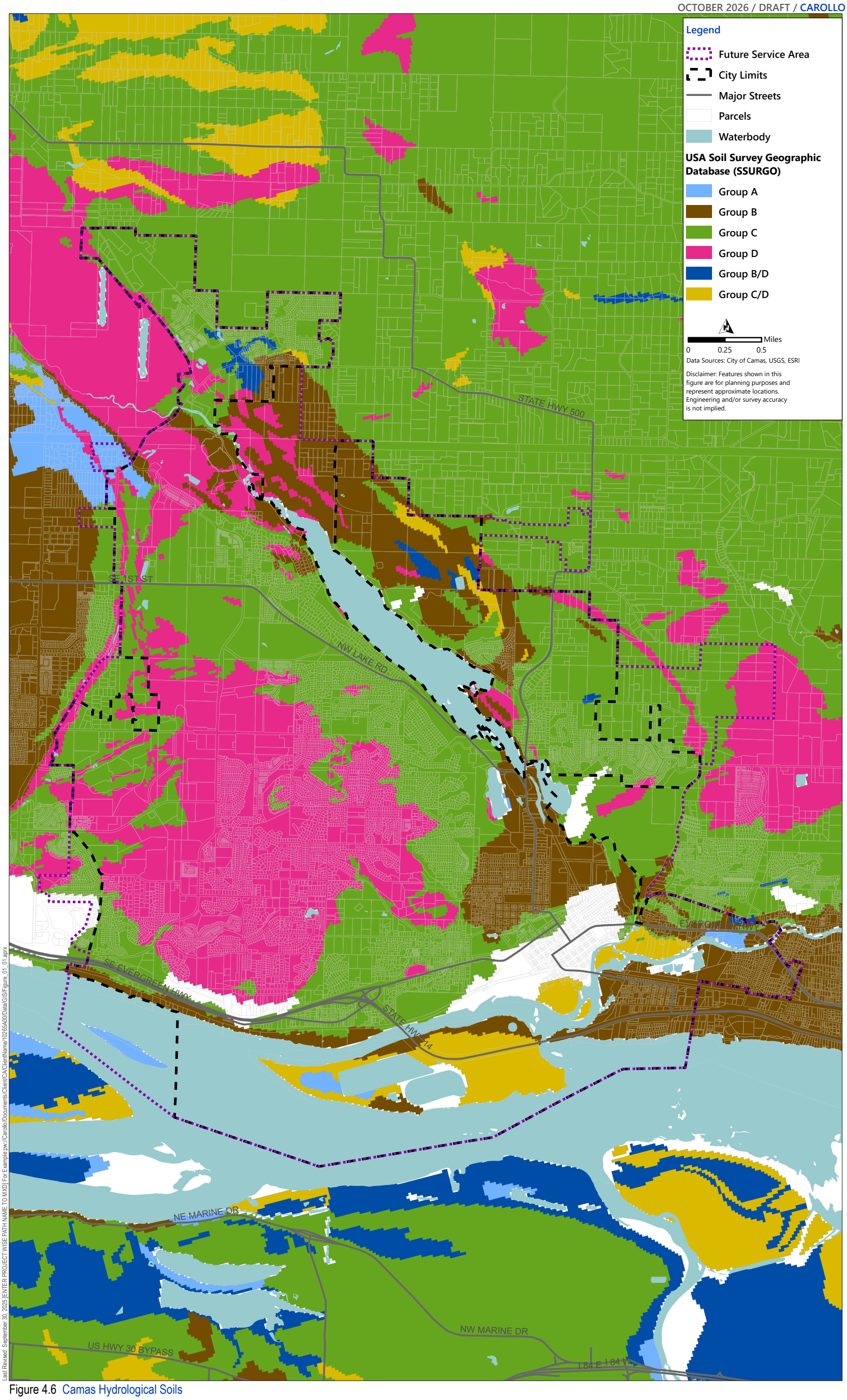


Figure 4.6 Camas Hydrological Soils

4.7.2 Critical Areas

Critical areas define crucial components for planning in an area including protected lands, e.g., wetlands, CARAs, and conservation areas, as well as areas with greater risk to its inhabitants, e.g., frequently flooded areas and geologically hazardous areas. Identifying these areas allows for the mitigation of unnecessary risk or harm to protected lands; additionally, policies in the City's *Draft 2045 Comprehensive Plan* (Camas, 2025) outline goals to protect and restore these sites.

4.7.2.1 Wetlands

Ecology currently rates wetlands based upon several key factors including their 'ability to be replaced, sensitivity to disturbances, rarity, functional performance, and importance in biodiversity' (Ecology, 2006). These levels include categories I-IV with a Category I wetland requiring the greatest protection. As defined by the wetland rating system, Category I wetlands have valuable biodiversity and hydrogeomorphic functionality in pollutant removal, stormwater storage, and even buffering natural disasters.

Within the City, there are >1,200 acres of recognized wetland which are protected by several local, state, and federal ordinances and laws including the Growth Management Act, Critical Areas Ordinance, CWAs, and CMC 16.53.050. These regulations entail the study of a wetland's functionality and that adverse impacts be avoided or reduced. Figure 4.7 illustrates the City's wetlands delineated using reports filed with the city and published data.

4.7.2.2 Critical Aquifer Recharge Areas

The majority of raw water supply for the City is provided by groundwater resources. This critical resource is protected by the CARA ordinance and the CMC. CMC 16.55.070 focuses on Aquifer Recharge Areas and required reports for proposed activities.

CARAs are located in multiple regions of the City and surrounding areas. Currently, two wellhead-protected areas are within the City limits with the southernmost protected area extending beyond the UGA. Figure 4.8 shows these regions in relation to wells which serve more than 20 people.

4.7.2.3 Frequently Flooded Areas

Frequently flooded areas are defined as regions with >1 percent chance of flooding per year. These regions are near surface water bodies which include Lacamas Lake, Columbia River, Washougal River, Jones Creek, Boulder Creek, Round Leaf Lake, and Fallen Leaf Lake, as shown in Figure 4.8. Due to low elevations, portions of the southeastern region of the City are located within the 100-and 500-year Federal Emergency Management Agency floodplain. Construction regulations focus on decreasing flood hazards of the structure which are detailed in a critical area report.

4.7.2.4 Geologically Hazardous Areas

Geologically hazardous areas are typically defined by the possibility of natural disasters including earthquakes and volcanic activity. These hazard potentials are then increased by the presence of steep slopes prone to landslide, particular soil groups prone to liquefaction, and other circumstances which have the potential to compound emergency scenarios. The United State currently operates on a Category 1-4 system to determine building code stringency as it pertains to natural disasters where Category 4 is the most stringent. The City is rated as a Category 4, which indicates a high potential for landslides and other events.

In the Clark County Code Chapter 40.430, Clark County defines three types of geologic hazard areas which include seismic, landslide, and steep slope. The county's Geologic Hazard regulation requires developers to have a Geologic Hazard Area Study completed on any property which is identified in a hazard area.

4.7.2.5 Fish and Wildlife Habitat Conservation Areas

As defined in the City's *Draft 2045 Comprehensive Plan*, one of the primary plans for the City is to protect "Key aquatic habitats in Camas include the Columbia and Washougal Rivers, Lacamas Creek, Camas Slough, Lacamas Lake, and various streams, ponds, and wetlands, all often bordered by riparian zones" (Camas, 2025). Multiple threatened species have been found to inhabit or pass through the region, and regulations are currently in place to prevent harm to any habitat including WAC 365-190-130. These regions are defined as Fish and Wildlife Habitat Conservation Areas which are protected.

Regulations include completing a habitat assessment before construction. These regulations impact any proposed sanitary sewer pipelines or lift stations in order to protect the fish and wildlife habitat.

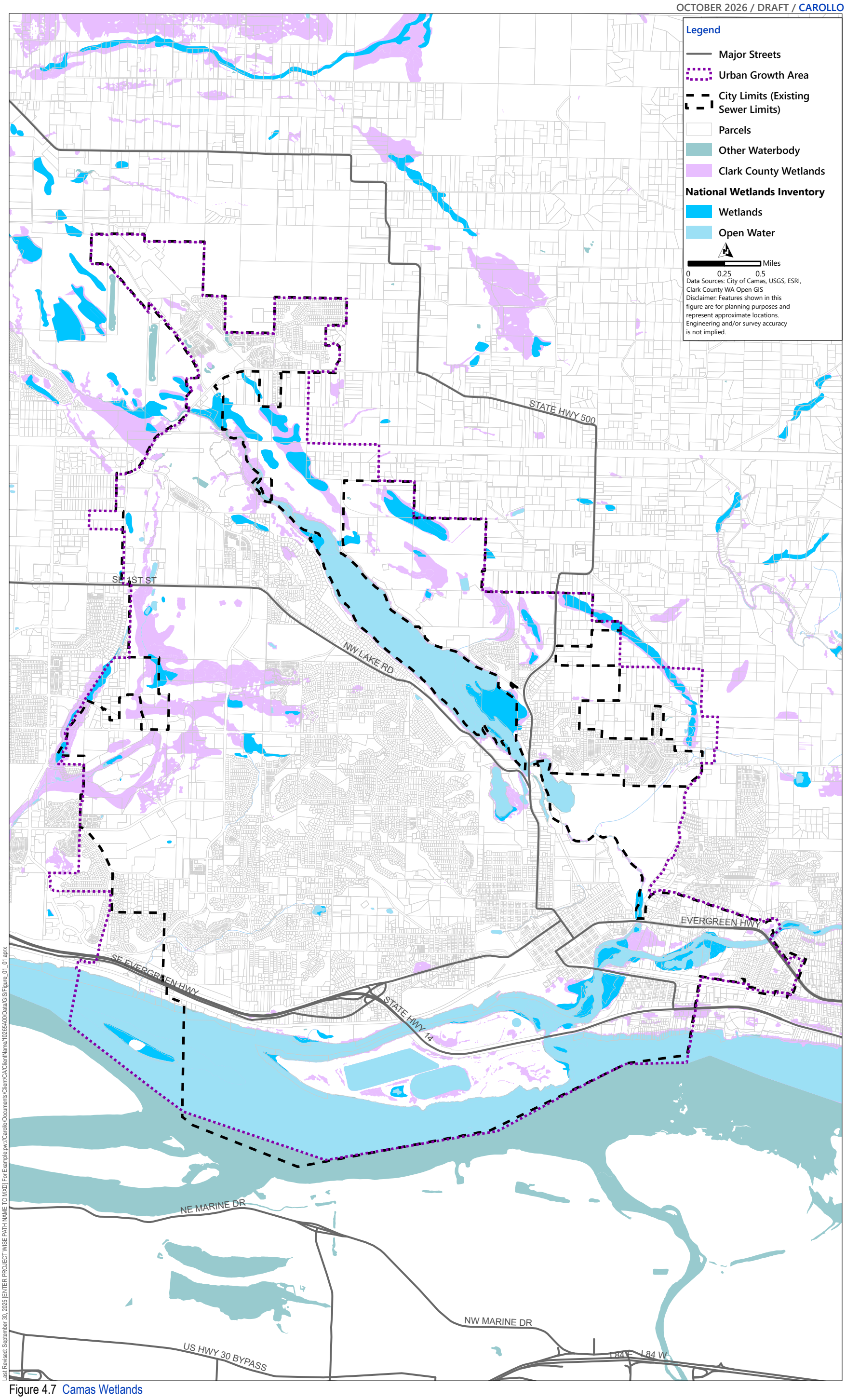


Figure 4.7 Camas Wetlands

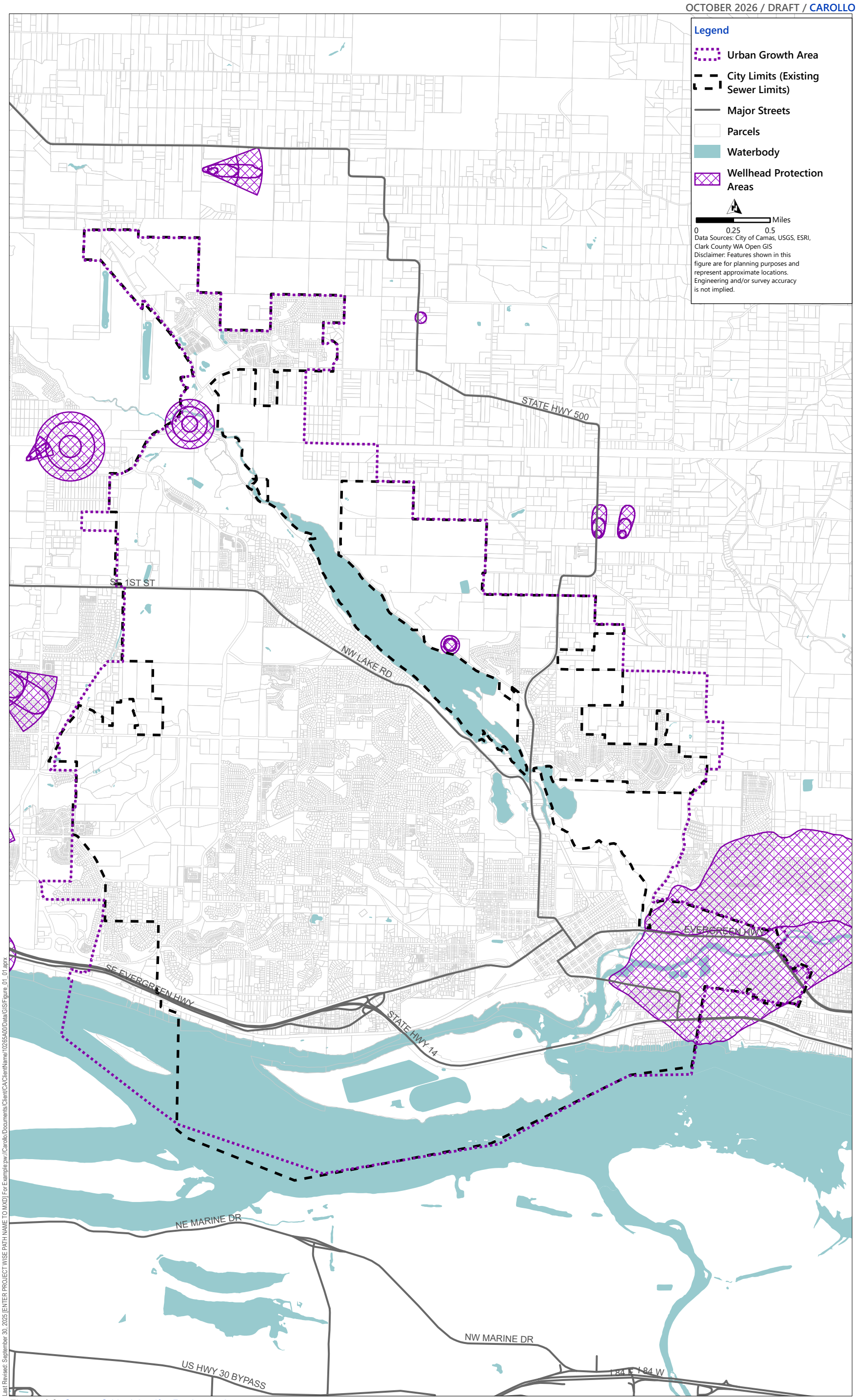


Figure 4.8 Camas Critical Aquifer Recharge Areas

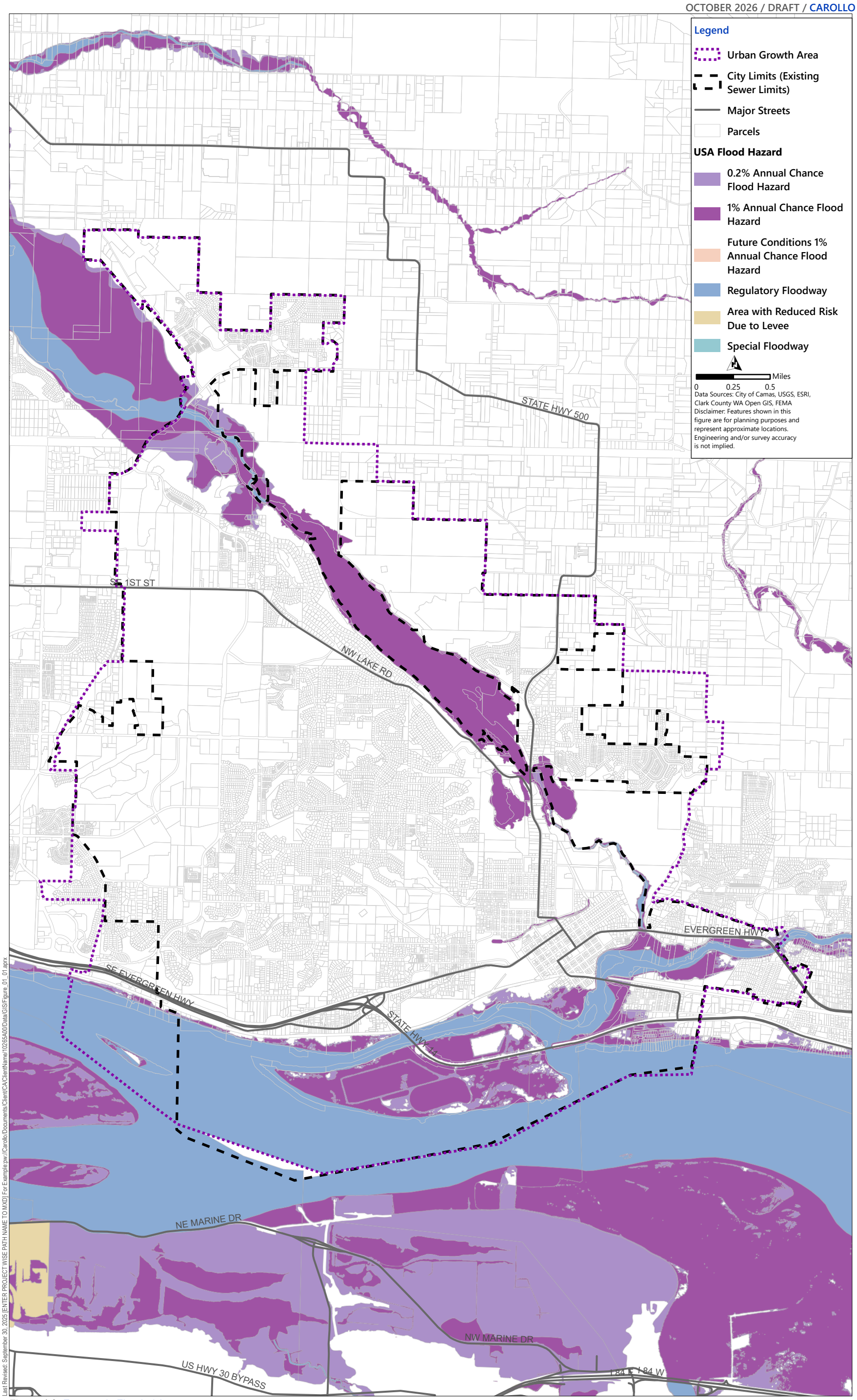


Figure 4.9 Frequently Flooded Areas

4.8 Water System

The City owns and operates a multi-source municipal water system, shown in Figure 4.10, which uses ground water and surface water to supply, treat, store, and distribute potable water to residential and commercial customers. The City currently obtains its water from 10 groundwater wells and two surface water resources. The wellhead protection areas are regulated to prevent leakage from the sanitary sewer system from infiltrating a well; these areas are shown in Figure 4.11.

The surface water resources include the Jones Creek Intake constructed in 1913 and the Boulder Creek Intake constructed in 1931. Surface water sources may be operated between November 1st and May 15th. Seasonal raw water from the Boulder and Jones Creek intakes is conveyed to the recently constructed slow sand filtration treatment plant (SSF Plant) where the water is filtered prior to chemical treatment and discharge to the distribution system. The SSF Plant has the capacity to treat the entire permitted flow of 1,570 gpm from the City's surface water sources. The surface water sources have lower operating expenses than groundwater sources. The ten groundwater wells are located in the 343 Zone excluding Well 9 which is located in the 544 Zone.

The City currently maintains and operates seven storage facilities with a combined total capacity of 9.95 million gallons (MG) including Butler Reservoir (1.2 MG), Gregg Reservoir (0.1 MG), Lacamas Reservoir (2.0 MG), 18th Avenue Reservoir (2.0 MG), Lower Prune Hill Reservoir No. 2 (1.5 MG), and the Upper Prune Hill Reservoirs (3.15 MG). This capacity is available for normal and emergency conditions, such as fire suppression. Ten booster pump stations are used to move water between pressure zones. Table 4.9 lists the booster pump stations and their capacities.

Table 4.9 Booster Pump Stations

Booster Pump Station	Capacity (gpm)
Butler	1,400
New Gregg	3,500
Forest Home	1,000
Lower Prune Hill	2,750
Lacamas	2,500
Angelo	4,000
Upper Prune Hill	4,300
Crown Road	2,400
Francis Road	80
Green Mountain Estate	1,840

The City owns over 159 miles of pipelines in its water transmission and distribution system compared to only 87.5 miles of collection system. Approximately 43 percent of the pipeline is Ductile Iron followed by Cast Iron at 14 percent. Additionally, the distribution system includes numerous meters, isolation valves, and hydrants. Two emergency interties are available with the City of Washougal. These interties provide water from the City to the City of Washougal under low pressure conditions. The City's intertie with Vancouver is located at the intersection of SE Columbia Palisades Drive and SE Brady Road. Additionally, the City has an agreement for emergency use of two fire hydrants located at SE 1st and Friberg for firefighting purposes.

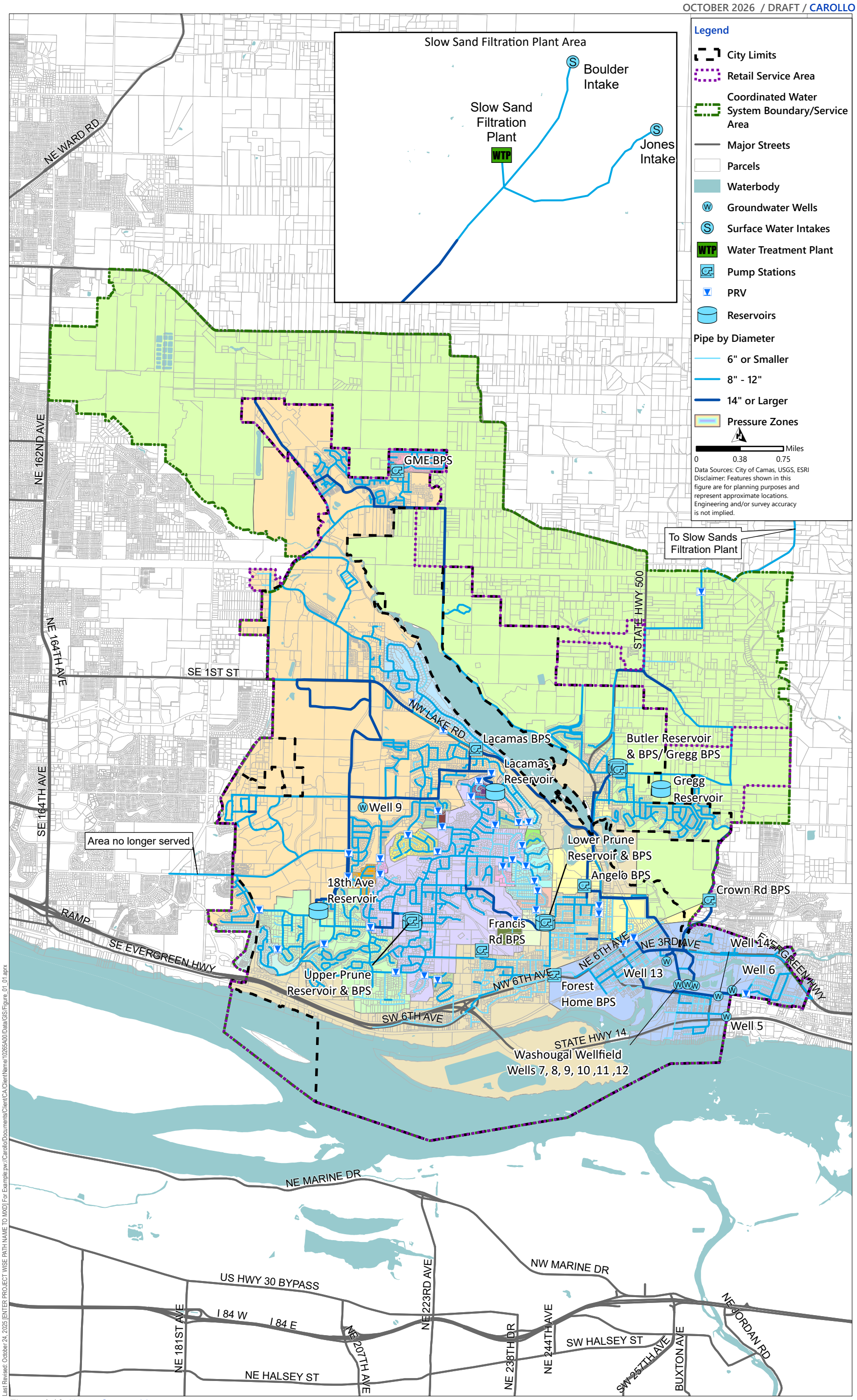
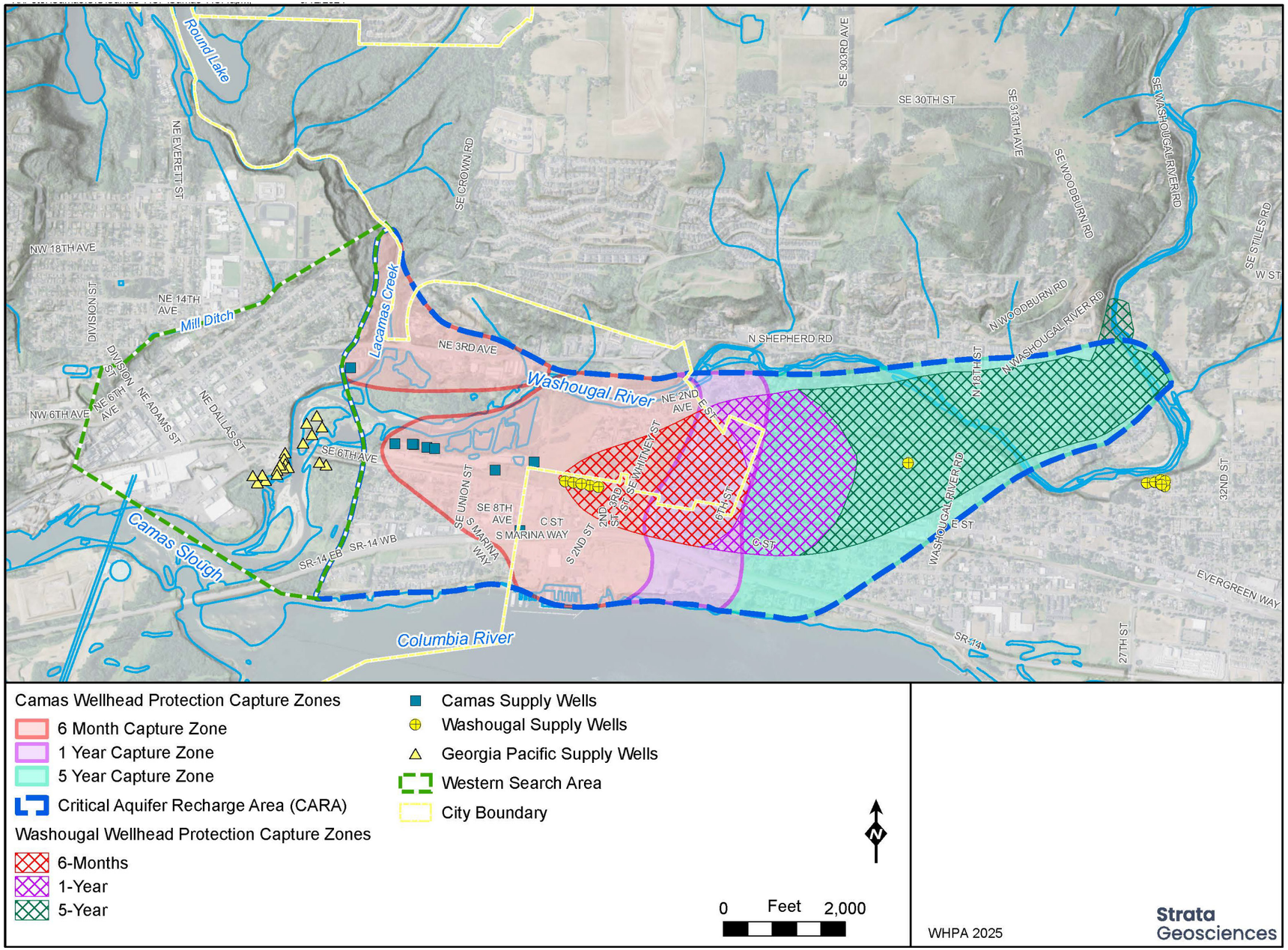


Figure 4.10 Water System Map



Source: City Of Camas Wellhead Protection Plan Update, Strata Geosciences, LLC, July 2026

Figure 4.11 Wellhead Protection Capture Zones

CHAPTER 5 INFLOW/INFILTRATION PROGRAM

5.1 Introduction

Infiltration and inflow (I/I) consist of two components which may combine or act independently to increase flow volume and peak flows in the sewer system. If too much I/I enters the sewer system such that the sewer system is operating at or above its capacity, sanitary sewer overflows could occur. More diluted waste can also be difficult to treat if using percent removal criteria as the basis. Proper attention to the lower than typical biological solids loading under these conditions is warranted in the design and operation of the WWTF. The definitions of infiltration and inflow are described below:

- **Infiltration:** Infiltration is defined as stormwater or groundwater flows that enter the sewer system by percolating through the soil and then through defects in pipelines, MHs, and joints. Examples of infiltration entry points are cracks in pipelines, misaligned joints, and root penetration. Due to this process, infiltration may be seen hours after a storm has occurred.
- **Inflow:** Inflow may be seen immediately after or during the storm. Inflow occurs when stormwater enters the sewer system via storm drain cross connections, leaky MH covers, or cleanouts. Examples of inflow entry points are roof drains and downspout connections, leaky MH covers, and illegal storm drain connections. Gross pipeline or system structural defects can be severe enough to allow storm or groundwater to enter the system rapidly and exhibit response time characteristics that could be categorized as inflow.

Key adverse effects of I/I on wastewater collection and treatment facilities include:

- Surcharging of sewer MHs.
- Sewage backups in facilities.
- Hydraulic overloading of unit processes at the WWTF.
- Reduced treatment efficiency at the WWTF due to dilute concentrations.
- Prematurely reaching capacity for collection systems and/or WWTF components.

This Chapter focuses on summarizing the City's efforts on I/I reduction from 2016 through 2024 and the quantifiable, positive improvement that has been accomplished in reducing I/I. It summarizes the amount of I/I for these years and specific projects completed to address I/I. This chapter also discusses recommendations for future I/I activities.

5.2 Historical I/I Control Efforts

The City has conducted I/I studies since 1977. The City has spent more than $4.55 million (M) in collection system I/I work and $750,000 on wastewater treatment facility improvements to address I/I flows.

The 1977 I/I Report attributed approximately 2.6 mgd to infiltration and 2.1 mgd to inflow. Major infiltration sources identified included roof and foundation drains, catch basins and multi-hole MH covers. By 1987, a sealing project was underway for individual sewer services.

In 1994, a consultant wrote a memorandum stating that estimated I/I entering the system was 3.54 mgd and the major source was likely faulty service connections. It was concluded that a more cost-effective alternative to reducing I/I would be to increase treatment capacity.

In 1997, a Facility Plan determined the City had excessive I/I based on USEPA criteria, and an 8-year sewer system rehabilitation program began based on monitored basins with the highest risk of I/I. During this study, a peak I/I flow of 3.4 mgd was determined.

In 2007, excessive inflow was determined at 62 gallons per capita day (gpcd) for infiltration and 383 gpcd for inflow. This is based on the USEPA criteria for excessive I/I to be 120 gpcd for infiltration and 275 gpcd for inflow. A total of 26 collection system projects were identified to address capacity and condition issues, 18 of which would reduce I/I.

In 2016, the City commissioned an evaluation of the collection system to document existing infiltration and inflow as a condition of their new stormwater permit. This evaluation utilized pump station run time, WWTF flow, and precipitation records to identify basins that were yielding high I/I values. This provided data to confirm the basins with high I/I, which were 3S, 3N, 4, and 10 (shown in Figure 4.1). Then smoke testing, manhole inspection, and closed-circuit television (CCTV) inspection were used to identify specific locations within these basins to determine source of I/I. The results of the 2016 I/I Study were used to plan and prioritize projects in order to reduce I/I.

In 2020, the City commissioned a follow-up study to document the reduction in I/I achieved by implementing the recommendations of the 2016 evaluation. The specific objectives of the 2020 study included:

1. Comparing the I/I with that measured in previous flow monitoring efforts completed for the 2016 I/I Study to assess the efficacy of rehabilitation efforts.
2. Identifying areas of the City where the I/I related peaking factor exceeds 3.4:1.
3. Identifying additional areas of high I/I in order to identify new areas for rehabilitation.

The 2020 Study demonstrated that since 2016, the City has observed a reduction in peak WWTF flows and high flow events, even though the population of the City and the extent of the sewer system have both increased over this time. Additionally, the City's WWTF no longer experiences excessive infiltration or inflow as defined by the USEPA, which is examined below in Section 5.7.3.

5.3 Required I/I Reporting

Special condition S.4.E of the 2015 Camas WWTF NPDES permit required the City to conduct a study of inflow sources and annual analysis of I/I using the Ecology Information Manual for Treatment Plant Operators. Special Condition S.4.E has been removed in the 2025 Camas WWTF NPDES permit and the City is no longer required to conduct annual I/I reporting. However, for completeness, this section summarizes the I/I Reporting completed through 2024 under the previous permit. Special condition S.4.E indicates the Annual I/I Report included:

1. Average monthly flow and total precipitation for each month for the past year.
2. Maximum monthly and peak hourly hydraulic design capacity for the plant.
3. Design population equivalent for the treatment plant and population served by the facility for the past year.

4. The amount of I/I for each year since the base year and the percentage of maximum monthly design capacity each year's I/I represents.
5. Percent increase or reduction in I/I for each year after the base year I/I.
6. Additional lengths of sewer lines added to the collection system for the past year.

The Annual I/I reports for 2021 through 2025 and the City's I/I Program are provided in Appendix F and summarized throughout this chapter. Values in this Chapter are based on numbers that were reported in the Annual Reports. It is recommended that the City continue to calculate and monitor these I/I values although it is not required in the NPDES permit. Please note that the City is updating their treatment plant capacity and values may change after completion.

5.4 Calculated I/I at the WWTF

Special condition S4.E.3 of the 2015 NPDES permit states that the annual period for the required I/I reporting is May 1st through April 30th. WWTF flow records are utilized to characterize I/I in the collection system. Table 5.1 shows the calculated I/I at the WWTF based on the annual I/I reports. The 2016 Annual Report selected May 2011-April 2012 to be the base year to compare future I/I against. This base year was selected because it represents the 20-year median rainfall. The average 12-month rainfall in Camas from the 20-year period of 1997 to 2017 was approximately 46.4 inches, and from May 2011 to April 2012 the rainfall was approximately 47.6 inches, which was the 50th percentile of all 20, 12-month totals and only 1.2 inches more than the 20-year average. Additionally, using 2011 to 2012 as the selected base year incorporates the City's recent growth. Per permit requirements, the I/I was compared with maximum monthly hydraulic design capacity for the Camas Wastewater Treatment Facility. Additionally, I/I was compared with the previous year. The fluctuations seen in I/I in Table 5.1 are largely due to variations in rainfall. Reductions in I/I from specific projects are presented in further sections.

Table 5.1 Annual Report Calculated I/I at the WWTF(1)

Year	Calculated I/I (mgd)	I/I as Percent of Design Capacity	I/I Percent Increase/Decrease
2011	1.511	25%	N/A
2012	2.340	38%	+55%
2013	0.591	10%	-75%
2014	0.985	16%	+67%
2015	2.277	37%	+131%
2016	1.920	31%	-16%
2017	1.021	17%	-47%
2018	1.052	17%	+3%
2019	1.541	25%	+47%
2020	1.334	22%	-13%
2021	1.400	23%	+5%
2022	1.264	21%	-16%
2023	2.266	37%	+79%
2024	1.734	28%	-23%

Notes:
(1) Values presented in this table are obtained from annual I/I reports.

5.5 Field Investigation

Several evaluations were conducted to determine areas of excessive I/I. Field investigation methods include flow monitoring and analysis, smoke testing, MH inspection, and video inspection.

5.5.1 Flow Monitoring and Analysis

Under the City's 2015 NPDES permit, the City was required to:

- Quantify the level of inflow from each collection system basin or sub-basin in order to identify areas exceeding a peak day to monthly average peaking factor of 3.4:1 during the design rainfall event.
- Prioritize the list of projects to most cost-effectively reduce the level of inflow to a peaking factor of 3.4:1 or less.

While the current permit does not include these requirements, this section summarizes the analyses carried out to date. The analysis for flow monitoring includes evaluation of WWTF flow data, pump station run-time data, and collection system flow monitoring data. As part of this GSP, ADS conducted a wet-weather analysis to assess RDII attributed to each of the 4 monitored tributary areas. During the flow monitoring period there were 5 storm events captured. A storm is defined as a rain event with at least 0.8 inch of rain with no rain interruption of more than 12 hours. Captured storm volumes ranged from 1.15 inches (April 6, 2025) to 2.84 inches (February 21, 2025). The storm event on February 21, 2025 has roughly a 2-year, 24-hour return frequency. Gross I/I is calculated for each storm and each flow meter tributary area as the difference between the actual recorded flow minus the ADF weekend and weekday pattern. Wet weather responses are normalized according to basin size in order to properly characterize relative I/I performance among the basins evaluated. As a general rule, basins may be considered to yield excessive RDII if such normalized values are much greater than 5. Two of the 4 metered basins evaluated, Basin 4-1-3 and Basin 5-1-2 (shown in Figure 3.3), slightly exceeded this value with 6.0 percent and 7.1 percent rainfall ingress, respectively. The highest RDII is attributed to Basin 5-1-2 that encompasses Basin 3N, 3S, and 10 consistent with previous studies.

The highest-ranking storm event identified occurred on February 21, 2025 with 2.84 inches rainfall and 6.664 mgd total WWTF influent flow on February 23, 2025, followed by March 11, 2025 at 2.47 inches rainfall and 4.820 mgd total WWTF influent flow of March 13, 2025. Crown View, South Prune Hill, Hillshire and Baz Park lift stations were identified to exceed the peaking factor criterion of 3.4:1.

Based on the ADS flow monitoring and pump station I/I evaluation, Basins 10, 12S, 22, and 4 which are tributary to these lift stations are recommended for further flow assessment. Basins are shown in Figure 4.2 in Chapter 4.

5.5.2 Video Inspection

Until 2023, the City contracted with specialist firms to perform regular CCTV inspections of its gravity sewer system. In 2024, the City purchased a CCTV van to perform inspections in-house. The inspections identify structural and operational defects, such as broken pipes, cracks, grease, roots, sag, separated and offset joints, and other problems. Several structural defects identified in CCTV inspections were repaired when identified. Other defects may be addressed through increased preventative maintenance, repair, or monitoring. The results are being used to develop a list of projects which the City incorporated into their ongoing repair and replacement program.

5.6 Completed I/I Projects

Completed I/I projects are shown in Table 5.2. These projects have cost the City in excess of $6.5M over the past decade.

Table 5.2 Completed I/I Projects

Year	Basin	Project Title	Description	Project Cost(1)
2026	1,10	6th Pl Emergency	Replaced collapsed pipe on 6th Pl east of NW Sierra St to West Camas PS wet well. Two contracts (emergency) and full replacement of approx. 200 LF gravity pipe.	$100,431 $125,348
2026	1,10	Design-South Prune Hill trunkline replacement	Design and construct replacement of South trunk line from West Camas PS along 6th P to NW 2nd (cross country) then to NW View Ridge vicinity.	RR funds future
2025	14	Prune Hill Park PS	Rehab wet well, valve vault, electrical, etc.	$876,393
2023	14	Lacamas Shores PS	Rehab pump station controls and electrical system.	$120,000
2023	13	Sunningdale Garden PS	Rehab wet well, valve vault, piping, and electrical system.	$415,286
2022	3S	NW 14th Street Improvements	Replaced 22 LF gravity pipe at intersection of NW 14th and NW Benton and repaired manhole.	$10,000
2021	6,7	Lacamas Creek PS Improvements	Demolished existing Lacamas Creek PS and constructed two new satellite stations Lacamas Creek and Baz Park. Replaced existing force main and gravity main and lined existing manholes.	$3,217,664
2019	10	View Ridge Court Sewer Replacement	Replacement of sewers.	$370,000(3)
2018	3S	Mill Ditch Repair	Replaced section of sewer line between Dallas Street and Birch Street.	$417,105(2)
2018	3S	Mill Ditch Repair	Rehabilitate or replace 15-inch CONC from MH 3-2-6 to 3-1-1 (1,370 feet).	
2017	4	NE Dallas Street Sewer Replacements	Replacement of several sewer pipes.	$129,000(3)
2017	4	NE Adams Street Sewer Replacements	Replacement of several sewer pipes.	$100,000(3)
2017	4	Everett and Franklin Sewer Replacement	Replacement of sewer line from 19th and Franklin to Everett and Everett to 21st.	$352,000(3)
2016	4	Franklin Street Sewer Improvement	Replaced sewer line between MH 4-1-1 and MH 4-1-4.	$952,883(2)

Notes:
(1) Cost values reflect actual construction costs at the time of completion.
(2) Value from the 2017 Annual Report.
(3) Value from the I/I Follow-Up Study.

5.7 Planned I/I Projects

The City will continue to address I/I throughout the collection system through their ongoing repair and replacement program. Based on replacing all gravity and STEP mains installed prior to 1940 by the end of the planning horizon (2045), the City's annual pipeline repair and replacement program is $1,100,000 annually.

It is also recommended the City investigate sources of I/I in flow meter basins 5-1-2 (specifically upstream of Crown View LS and South Prune Hill LS) and 4-1-3 (downtown), as these basins exhibit high I/I and have potential to reduce or eliminate downstream capacity projects (discussed in Chapter 6 and Chapter 9). Priority basins were historically 3N, 3S, and 4. Based on the 2025 flow monitoring and potential for I/I reduction to reduce or eliminate capacity-related improvement projects identified in this GSP, current priority basins are 22, 10, 12S, and 4.

Flow monitoring basin 5-1-2 contains two sewer pathways. To the north, sewer basins 12N and 22 flow through 3N which in turn flows through 3S. To the south, sewer basin 12S flows south to basin 10 and then east through basin 1 and then 2. It is recommended that the City conduct flow monitoring within Basin 5-1-2 to assess where in the basin the I/I is generated, what the sources of I/I are, and if projects to reduce I/I can be cost effective alternatives to capacity projects in these areas (discussed in Chapter 6 and Chapter 9) and in the downstream system. A combination of night-time reconnaissance, flow monitoring, and CCTV inspection is recommended.

Basin 4-1-3 is a smaller basin which overlaps with sewer basin 4. In this area, it is recommended that the City identify sources of I/I in the basin, implement I/I reduction projects, and perform post-construction flow monitoring to quantify the impact of the projects in I/I. Results from the I/I pilot study can be used to estimate potential I/I reduction from similar projects in other areas, for example Basin 5-1-2.

It is recommended that both the Basin 5-1-2 Flow Monitoring and the Basin 4-1-3 Pilot I/I Study be completed in 2027 prior to design and construction of the capacity projects in these basins and downstream of these basins in order to evaluate if I/I projects are cost-effective and can eliminate or reduce the need for the capacity projects.

Table 5.3 presents the planning projects and project costs. These projects are included in the annual program and general projects of the Capital Improvement Plan presented in Chapter 9. Capital improvements from these studies would be paid for from ongoing rehabilitation and replacement budgets.

Table 5.3 Planned I/I Projects

Year	Basin	Project Title	Description	Project Cost
Ongoing	N/A	Gravity and STEP Main Repair and Replacement	Ongoing repair and replacement of gravity mains at end of useful life	$1,100,000/year
2027	10,1,2,12N, 12S,22,3N, 3S	Basin 5-1-2 Flow Monitoring	Install temporary flow meters in Basin 5-1-2 to separately monitor flows from the area along 6th Avenue and the area of Upper Prune Hill to identify areas contributing high I/I.	$300,000
2027	4	Basin 4-1-3 Pilot I/I Study	Investigate the source and magnitude of I/I. Identify opportunities to reduce non-sewage flow and measure the impact of I/I reduction projects in the area. Information from the pilot study should be used to assess cost of I/I reduction vs capacity improvements.	$200,000

CHAPTER 6 COLLECTION SYSTEM

6.1 Introduction

The City's customer base continues to increase through system expansion. With this growth, some of the City's sewer infrastructure may reach conveyance capacity. This chapter presents an evaluation of the available capacity of the existing system to convey current and future sewer flows. The City's collection system is broken up between gravity mains and STEP systems that flow to the treatment plant separately.

Using the City's updated sewer model, major pipes and lift stations in the modeled collection system were evaluated for meeting established capacity criteria. The modeled collection system is primarily gravity sewers that are 8-inch or larger where data is available and the trunk of the STEP system. The model represent a skeletonized version of the system. An overview of the modeled collection system is shown in Figure 6.1. The system was calibrated with seven flow basins of which four are flow meters installed by ADS during the 2025 flow monitoring study, two are lift station SCADA data, and one is the wastewater treatment facility SCADA data which helped calibrate the STEP basin system by subtracting the gravity collection system to isolate the STEP basin system. The model was delineated into seven flow monitoring basins with similar diurnal patterns and wet weather flow parameters, also shown in Figure 6.1. Additional details on the model used to evaluate the collection system can be found in Appendix E - Hydraulic Model Development. This chapter identifies recommended projects to address capacity deficiencies and to serve future users.

6.2 Evaluation Criteria

Defining performance criteria is a critical step in the master planning process because it sets metrics by which the collection system infrastructure will be evaluated to meet service goals set by the City. Sewer pipe capacities are dependent on many factors, including roughness of the pipe, the maximum allowable depth of flow, and slope of pipe. The City's applications of these factors and established requirements are discussed in Sections 6.2.1 and 6.2.2.

It is important to differentiate performance and design criteria when judging the performance of collection system infrastructure. Design criteria establish the standards for designing and constructing new sewers. Performance criteria establish the standards that are used to analyze adequacy of existing facilities and to trigger future infrastructure needs. Performance criteria are commonly less stringent than design criteria because existing sewer systems typically have aged significantly and would require extensive reconstruction to meet standards for new design. It is generally inappropriate to use standard design criteria as performance criteria, especially when significant wet weather flows impact an existing collection system (as is the case with an aged sewer system). For instance, new sewers are designed to convey flow under non-surcharged conditions (assuming limited I/I), while surcharging may be permissible during the analysis of existing sewers, especially during PWWFs. The following sections describe the City's established design criteria and performance criteria used herein.

6.2.1 Design Criteria

The design criteria are used to size new infrastructure recommended to alleviate system deficiencies.

6.2.1.1 Conveyance System

It is common practice to use diameter-based flow depth criteria for pipes when designing new gravity sewers. The d/D ratio is defined as the depth of flow in a pipe during peak flow conditions divided by the pipe's diameter. The City defines the acceptable d/D value of 0.92 for design of new sewers under design storm conditions and build out scenario. The City's Sewer Standards also define the minimum pipe diameter, which is 8-inch.

6.2.1.2 Lift Stations and Force Mains

Any new lift stations recommended will need to follow the City's Sewer Standards for lift stations and force main construction to meet Ecology requirements. These are detailed in Section 2.2.2 of Chapter 2 - Policies and Criteria.

6.2.2 Performance Criteria

6.2.2.1 Design Storm

The sewer system hydraulic capacity analysis was performed using a historical 10-year, 24-hour rainfall event (Station Portland Airport, HYDRA Rain Gauge Network) on December 6, 2015. This design storm is discussed in Section 3.4.6 of Chapter 3 - Basis of Planning.

For this GSP, the HYDRA historical event referenced above was selected as the design storm for modeling system response and system performance evaluation to realistically represent peak wet weather conditions. The historical HYDRA event was chosen for three reasons:

- NOAA Precipitation Atlas isopluvial mapping indicates that a 10-year, 24-hour storm at Camas produces approximately 3.5 inches of rainfall.
- The selected historical storm produced 3.37 inches of rainfall in 24 hours and provides a measured storm hydrograph for modeling.

6.2.2.2 Conveyance System

When evaluating existing sewers, using a conservative d/D ratio may lead to unnecessary replacement of existing pipelines. Therefore, the following performance criteria for the conveyance system was developed and used to evaluate the system under design storm PWWF conditions. The PWWF was defined using the standards summarized in Section 6.2.1.1.

- Sewer pipes can be surcharged. If surcharging is within 3-feet from manhole rim, then the sewer was deemed deficient.
- No surcharging (d/D>1) is allowed at shallow manholes. Shallow manholes are defined as MHs where the distance between crown of pipe and manhole rim is less than 3 feet. Shallow manhole locations are shown on Figure 6.1.

6.2.2.3 Lift Stations and Force Mains/Pressurized Mains

The City's performance criteria for existing lift stations include firm capacity, which is capacity with the largest pump out of service and force main and STEP main velocities. According to City Sewer Standards:

- Firm pump capacity shall be provided to handle the PWWF from the lift station's tributary area.
- Existing force mains shall not exceed a maximum pipe velocity of 8 feet per second (fps) for the design storm.
- The existing STEP mains and force mains shall not exceed a maximum velocity of 8 fps.

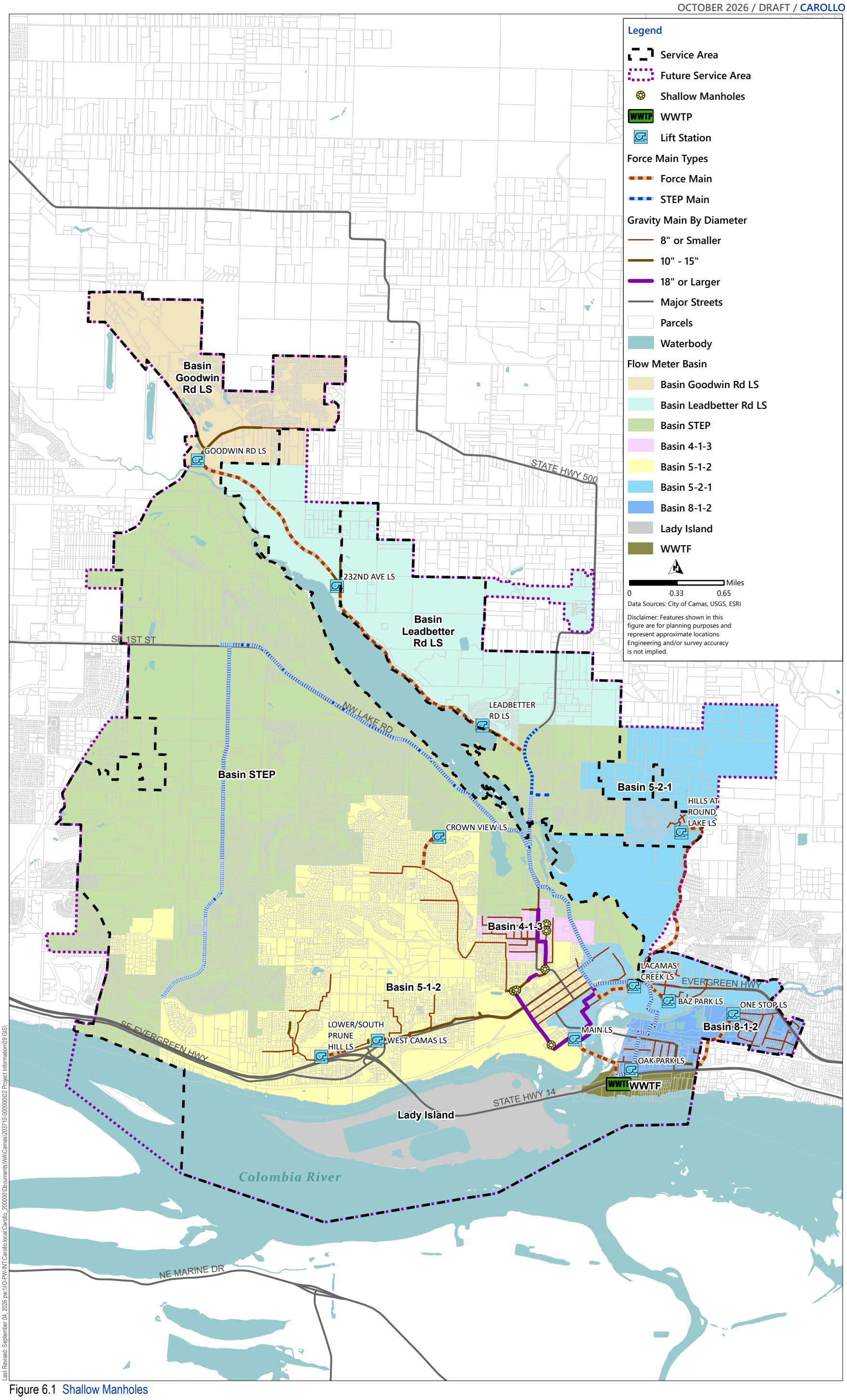


Figure 6.1 Shallow Manholes

6.3 Gravity Collection System Evaluation

A capacity analysis of the modeled collection system was performed using the City's calibrated hydraulic model and using the evaluation criteria identified above in Section 6.2. The capacity analysis identified areas in the sewer system where the performance criteria for surcharging were exceeded, or where the capacity of lift stations were exceeded. The collection system was evaluated for three development scenarios:

- Existing: Matching existing conditions.
- 20-Year: Incorporating growth through 2045 as identified in the 2045 Comprehensive Plan.
- Buildout: Development of the full-service area including UGA.

For the remainder of the chapter, the system evaluation focuses on existing and 20-year system conditions to identify capacity deficiencies and improvement projects for the 20-year planning horizon. The buildout scenario was used to size projects needed in the 20-year planning horizon to accommodate buildout conditions.

6.3.1 Key Causes of Deficiencies

The calibrated hydraulic model was exercised under design storm conditions, and the predicted results were analyzed using the performance criteria to identify segments of the system not meeting those criteria. The key causes triggering deficiencies in the City's collection system include:

- Adverse slopes and misaligned inverts.
- Shallow MHs.
- Pipe restrictions caused by a single, or a few, smaller diameter pipes between larger diameter pipes.
- Pipe diameter not sufficient to convey the PWWF.
- Lift station firm capacity not sufficient to pump the PWWF.
- Backwater condition.

6.3.2 Existing System Problem Areas

For the existing sewer collection system, the PWWF was routed through the hydraulic model to assess performance. In accordance with the established criteria for existing sewers, where the model predicted potential deficiencies, these were identified. Existing deficiencies are primarily located in Flow Monitoring Basin 5-1-2, with primary capacity issues in the downstream larger trunk lines receiving flow from smaller tributary areas and delivering sewage to NE Adams to SE 3rd Avenue Basin 5-1-2 experiences elevated I/I that contributes to the observed deficiencies along 6th Avenue, Division Street, and NW Fargo Street. Basin 4-1-3 is a smaller basin that also shows elevated I/I which causes observed deficiencies along NE Franklin Street and along the Mill Ditch. The locations of these predicted deficiencies under existing PWWF conditions are shown in Figure 6.2.

6.3.3 20-Year System Problem Areas

The 20-year (2045) system analysis was performed in a similar manner to the existing system analysis. The 20-year condition evaluated whether or not the sewers would be adequately sized to convey the future PWWFs, including projected growth in the North Shore area. This analysis incorporates the preliminary assumptions made for how and where to connect the growth areas to the existing system. The City's preference is for new development to connect to the gravity system and not the STEP system, where practical.

Three additional deficiency problem areas occur during 20-year PWWF conditions. The additional projected flows from the North Shore area add significant amounts of flow and are predicted to exceed the evaluation criteria and cause additional surcharging in the system. Additional growth upstream of 6th Avenue NW causes existing deficiencies to worsen under 20-year. The 20-year deficiency problem areas are shown in Figure 6.3.

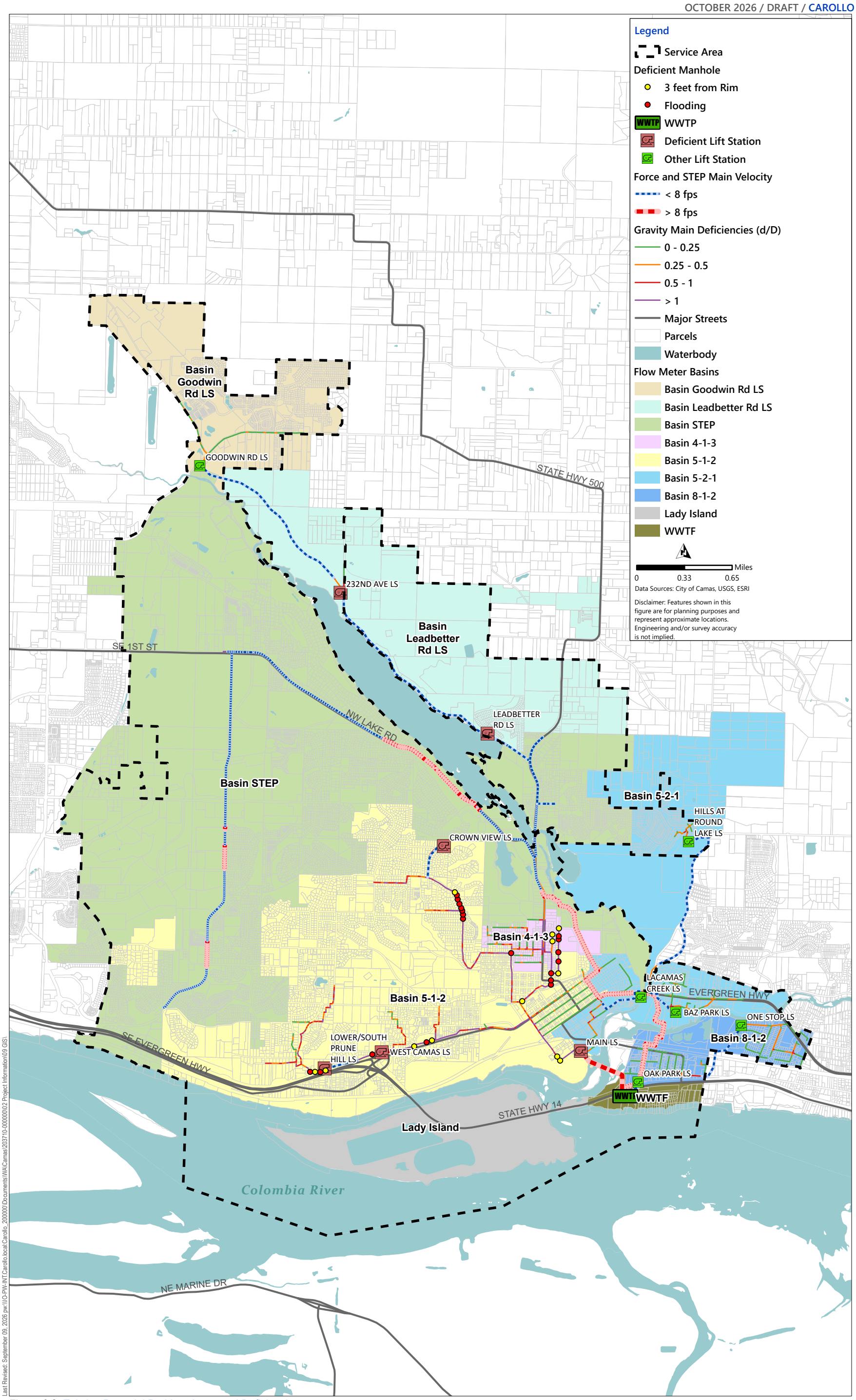


Figure 6.2 Existing Potential Problem Areas and Deficiencies

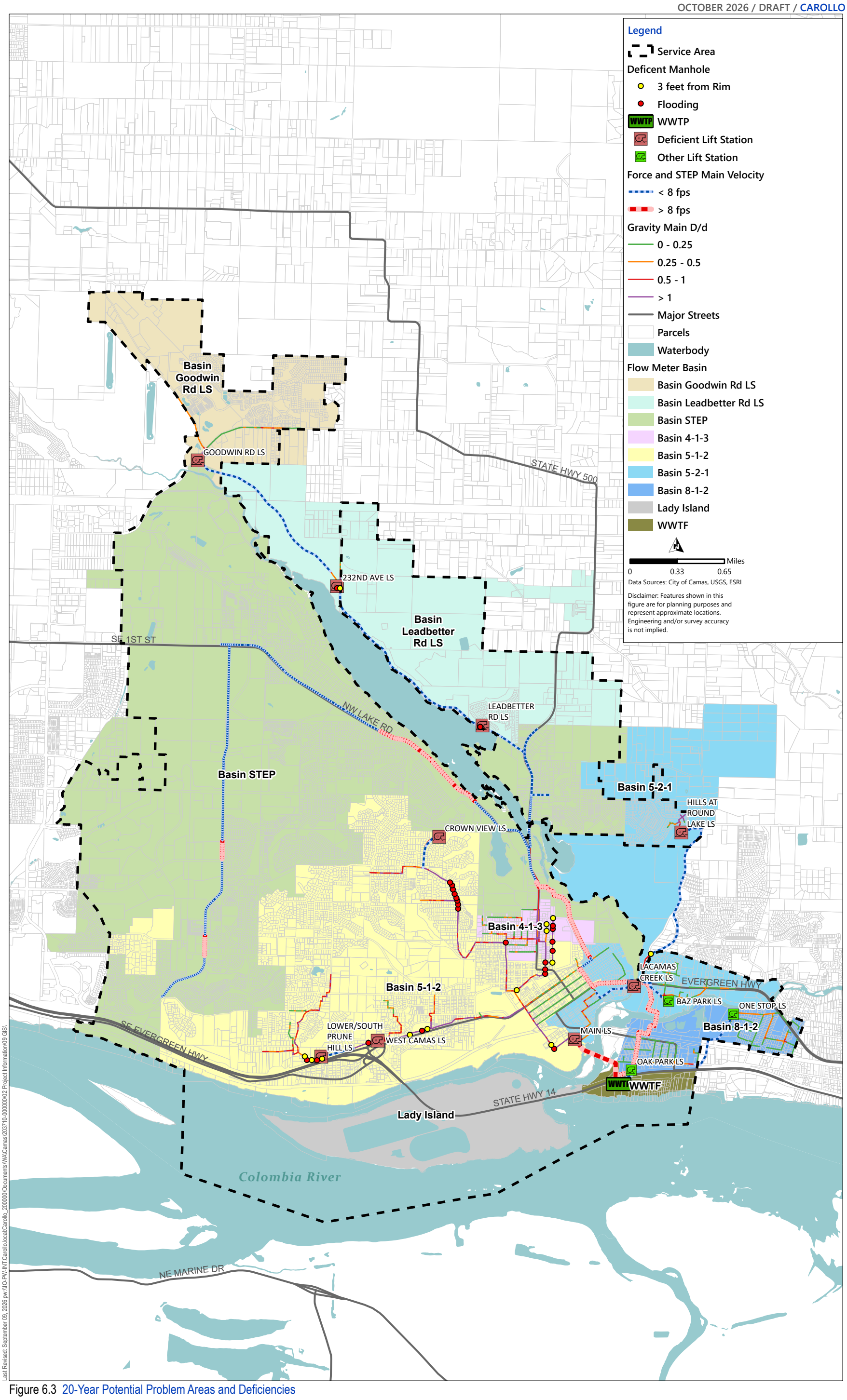


Figure 6.3 20-Year Potential Problem Areas and Deficiencies

6.4 STEP System Evaluation

The STEP system area was incorporated into the model with the main pipeline modeled as seen in Figure 6.3. The hydraulic analysis results show that the STEP system transmission main exceeds the performance criteria velocity of 8 fps under the existing PWWF and projected 2045 PWWF flows. These exceedances are located mainly where there are steep downhill slopes. Because the velocity is exceeded due to steep slopes under low pressure, there is no practical improvement project to address the high velocity. These velocity exceedance areas are mainly located along NW Parker Street from NW PacificRimBoulevard to NW 38th Avenue and along NW Lake Road from NW Leadbetter Drive to NW Lacamas Lane.

6.5 Lift Station Evaluation

Ensuring that lift stations have adequate capacity to convey peak flows is important to prevent sewage overflows at or near lift stations. In accordance with the established performance criteria, the City's existing lift stations were evaluated using results from the calibrated hydraulic model to determine if the lift stations have available capacity to convey existing and future PWWFs. If a lift station has inadequate capacity to pump the PWWFs, the water level in the wet well may rise to the overflow point, spilling sewage. Lift stations predicted to experience an influent PWWF greater than the existing firm capacity of the station were flagged as deficient.

The City's hydraulic model includes 12 of the City's 28 lift stations. The modeled lift stations are located in the City's gravity collection system. All flow from the gravity collection system goes through Main LS except for a small portion of gravity flow that enters the WWTP via One Stop LS and Oak Park LS. All 12 modeled stations are shown in Figure 6.1 in light blue. The estimated current and future peak flows were compared to the lift station firm capacities. The firm capacity of a lift station is defined as the capacity with the largest pump out of service. Table 6.1 summarizes the results of the lift station evaluation. Table 6.1 includes the total capacity at each station, as an additional point of reference for the modeled PWWF's. Firm and total capacities were provided by the City through as-built drawings and spreadsheet. Figures 6.2 and 6.3 show deficient lift stations in red and lift stations meeting the firm capacity in green.

Table 6.1 Lift Station Evaluation

Lift Station Name	No. of Pumps	Total Capacity (mgd)	Firm Capacity (mgd)	Existing Modeled PWWF (mgd)(4)	20-Year Modeled PWWF (mgd)(4)	Firm Excess Deficiency	20-Year Excess Deficiency
232nd Ave(1)(3)	2	1.05	0.53	0.70	1.42	Yes	Yes
Baz Park(1)	2	1.29	0.65	0.19	0.19	No	No
Crown View	2	0.64	0.32	0.85	0.85	Yes	Yes
Goodwin Rd(1)(3)	2	0.98	0.49	0.37	0.71	No	Yes
Hills at Round Lake(2)	2	0.74	0.37	0.20	0.96	No	Yes
Lacamas Creek(1)	2	2.74	1.37	0.96	1.54	No	Yes
Leadbetter Rd(1)(3)	2	1.74	0.87	0.88	2.6	Yes	Yes
Main(2)	3	16.6	11.1	15.9	18.5	Yes	Yes
Oak Park(2)	2	1.0	0.5	0.32	0.32	No	No
One Stop(2)	2	0.66	0.33	0.17	0.17	No	No
South Prune Hill(2)	2	1.73	0.86	2.40	2.60	Yes	Yes
West Camas(2)	2	2.88	1.44	3.10	3.13	Yes	Yes

Notes:
(1) Total and firm capacity from as-built drawings.
(2) Total and firm capacity provided by the City "Lift Station info List (updated 11-2-21).xlsx" spreadsheet.
(3) Has space for a third pump.
(4) PWWF Results shown are without any constrictions.

Based on the analysis and the results presented in Table 6.1, six of the modeled lift stations are considered deficient in the existing system scenario per the City's firm capacity performance criteria. These deficiencies are exacerbated and an additional three lift stations are identified as deficient under the 20-year conditions.

6.6 Recommended Collection System Improvements

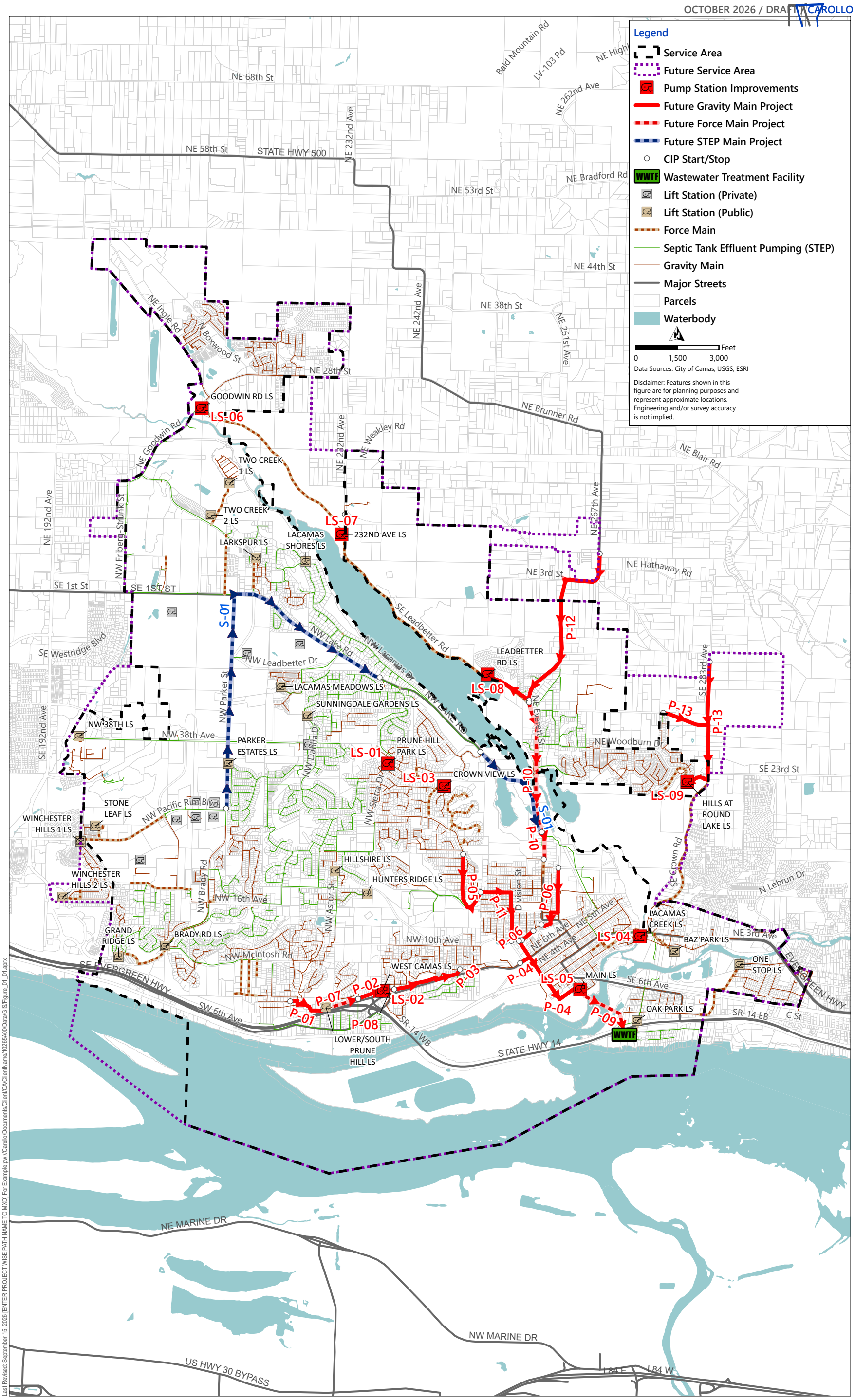
Following completion of the existing and 20-year system analyses, improvement projects and alternatives were developed to address the identified capacity deficiencies. These improvements are sized to meet buildout PWWF. The analysis identified 10 localized areas with pipeline capacity deficiencies and nine lift stations requiring upgrades to meet the established firm capacity criteria. In addition to these deficiency-driven projects, three system expansion improvements were developed to provide new conveyance capacity for planned future growth in the North Shore area and to connect future development to the existing sewer system.

The proposed improvements were not necessarily extended to achieve a d/D ratio of 0.92 or less in every pipe segment. Instead, the improvement extents were established to address identified capacity deficiencies while allowing some surcharging of the system. In locations where localized d/D ratios remain above 0.92, the hydraulic grade line (HGL) was evaluated to confirm that it remains at least 3 feet below the MH rim during PWWF. This approach provides a practical and cost-effective balance between improving system performance and limiting the extent of improvements while avoiding conditions that could result in manhole flooding. Localized d/D ratios greater than 0.92 may occur due to the existing

pipe geometry and hydraulic profile and do not necessarily indicate an unresolved capacity deficiency when the HGL remains at least 3 feet below the MH rim.

Figures 6.4, Table 6.2, and Table 6.3 identify the location and extents of the recommended system improvement projects. Tables 6.2 and 6.3 provide details of the recommended improvement (length, diameter, street location, etc.). The improvements summarized in Tables 6.2 and 6.3 utilize a numbering system cross-referenced with Figure 6.4. The deficiencies addressed by each project are explained in Section 6.5. Individual project summaries with additional project details are included in Appendix L - CIP Project Sheets. The columns used in Tables 6.2 and 6.3 refer to the following:

- Project ID: Assigned unique identifier associated with each improvement project. This is an alphanumeric number that starts with one or two letters indicating the type of improvement and continues with a number and a letter:
  - P= Pipe,
  - S= STEP,
  - LS = Lift Station.
- Improvement Type: Gravity pipelines, STEP pipes, or lift stations.
- Location: Street in which the improvement is proposed.
- Existing Size: This represents the diameter of the existing pipelines (inches), or the total capacity of existing lift stations (mgd).
- Proposed Size: This represents the diameter of the proposed pipelines, or the total capacity of lift stations after proposed improvement, or upon construction if a new facility to serve future growth.
- Length: Estimated length of the proposed improvement in feet. It should be noted that the length estimates do not account for re-routing the alignment to avoid unknown conditions, if more detailed planning and design identifies such constraints.



Last Revised: September 15, 2026 [ENTER PROJECT WISE PATH NAME TO MXD] For Example:pw://Carollo/Documents/Client/CA/ClientName/10265A00/Data/GIS/Figure_01_01.aprx

Figure 6.4 Proposed Pipeline and Lift Station Improvements

6.6.1 Recommended Pipeline Improvements

These are the recommended collection system improvements projects:

P-01: NW 6th Place West Improvements

P-01 experiences surcharging upstream of the South Prune Hill LS under existing conditions, as illustrated in Figure 6.4. The model also identified potential manhole flooding during the design storm at modeled MHs 10-1-8, 10-1-7, and 10-1-6. These deficiencies are caused by capacity limitations associated with the existing pipe diameters and slope constraints within the reach.

The proposed NW 6th Place West Upsize Improvements consist of upsizing approximately:

- 422 LF of pipe between MHs 10-6-1 and 10-1-11 should be upsized from 8- to 12-inch;
- 809 LF of pipe between MHs 10-1-11 to 10-1-7 from 8-inch to 15-inch, and;
- 472 LF of pipes between MH 10-1-7 and the South Prune Hills LS wet well from 8- to 18-inch.

The proposed improvements provide additional gravity conveyance capacity, alleviate the modeled surcharging and potential manhole flooding, and allow the system to meet the City's design criteria.

P-02: NW 6th Place East Improvements

P-02 experiences surcharging along NW 6th Place under existing conditions. The model also identified potential manhole flooding during the design storm at modeled MHs 10-1-3 and 10-1-1. This deficiency is caused by capacity limitations within the flatter gravity sewer pipelines in the reach.

The proposed NW 6th Place East Improvements consist of upsizing approximately:

- 682 LF of pipe between MH 10-1-3 to West Camas LS wet well from 8- to 21-inch.

The proposed gravity sewer improvements are located along NW 6th Place between South Prune Hill LS and West Camas LS, at an approximate depth of 5 to 10 feet. These improvements provide additional conveyance capacity, alleviate the modeled surcharging and potential manhole flooding, and allow the system to meet the City's design criteria.

P-03: NW 6th Place Avenue West Improvements

A capacity deficiency exists immediately downstream of the West Camas LS along NW 6th Avenue. The model identified surcharging and potential MH flooding at MHs 1-1-10, 1-1-6, and 1-1-4 under existing conditions. This deficiency is caused by capacity limitations in the existing gravity sewer and backwater conditions from downstream deficiencies.

The proposed NW 6th Avenue West Improvements consist of upsizing approximately:

- 1,943 LF of pipe between MHs 1-1-10 and 2-1-11 from 12- to 24-inch, and;
- 592 LF of pipe between MHs 2-1-11 and 2-1-9 from 12- to 21-inch.

The proposed gravity sewer improvements are located along NW 6th Avenue, immediately downstream of the West Camas LS and extending through Forest Home Park, at an approximate depth of 5 feet. These improvements will provide additional conveyance capacity to alleviate the modeled surcharging and potential manhole flooding and accommodate projected future growth.

Under the buildout scenario, additional segments were identified that exceed the City's design criterion of d/D less than 0.92. To meet the d/D criterion under buildout conditions:

- 446 LF of pipe between MHs 3-1-1 and 5-8-1 should be upsized from 18- to 27-inch;
- 260 LF of pipe between MHs 5-8-1 and 5-1-12 should be upsized from 21- to 30-inch,
- 402 LF of pipe between MHs 2-1-1 and 5-1-12 should be upsized from 12- to 30-inch;
- 545 LF of pipe between MHs 5-1-12 and 5-1-11 should be upsized from 21- to 36-inch;
- 947 LF of pipe between MHs 5-1-10 and 5-1-7 should be upsized from 24- to 36-inch;
- 1,126 LF of pipe between MHs 5-1-7 and 5-1-2 should be upsized from 21- to 36-inch, and;
- 34 LF of pipe between MHs 5-1-2 and 5-1-1 should be upsized from 24- to 36-inch.

These additional improvements are not needed under the 20-year scenario because the modeled surcharging remains more than 3 feet below the MH rim, but are recommended to meet the City's d/D criterion under full buildout conditions.

P-04: NW 6th Place Avenue East Improvements

Following implementation of the upstream P-03 (NW 6th Place Avenue West Improvements), the model identified surcharging along NW 6th Avenue between MHs 2-1-2B and 2-1-2. The additional upstream conveyance capacity results in increased downstream flows and reveals a capacity deficiency within the gravity sewer extending toward Main LS.

The proposed NW 6th Avenue East Improvements consist of upsizing gravity along NW 6th Avenue and SE 3rd Avenue to the Main LS. To alleviate surcharging, the proposed pipeline profile between MHs 5-1-5 and 5-1-1 was modified to provide a steeper downward slope through the relatively flat portion of the alignment, improving hydraulic conveyance through this segment. The shallow MH at 5-1-6 should also be evaluated during future project planning and design to determine whether an adjustment to the pipeline profile or MH invert could provide additional hydraulic benefit while maintaining adequate cover.

The proposed improvements consist of upsizing approximately:

- 446 LF of pipe between MHs 3-1-1 and 5-8-1 from 18- to 27-inch;
- 260 LF of pipe between MHs 5-8-1 and 5-1-12 from 21- to 30-inch;
- 402 LF of pipe between MHs 2-1-1 and 5-1-12 from 12- to 30-inch;
- 545 LF between MHs 5-1-12 and MHs 5-1-11 from 21- to 36-inch;
- 947 LF between MHs 5-1-10 and 5-1-7 from 24- to 36-inch;
- 1,126 LF of pipe between MHs 5-1-7 and 5-1-2 from 24- to 36-inch, and;
- 34 LF between MHs 5-1-2 and 5-1-1 from 21- to 36-inch.

The proposed improvements consist of gravity sewer pipelines generally located at an approximate depth of 5 feet.

Portions of the proposed improvements are located beneath an existing building, and a portion of the proposed alignment crosses an existing railroad. The proposed improvements may also be affected by an existing bridge along the alignment. An alternative alignment analysis was not performed as part of this GSP because future redevelopment and land use changes may affect the continued presence of the existing building and the feasibility of potential alternative alignments. Alternative alignments should be

evaluated during future project planning and design, when additional information regarding redevelopment and future land use is available. Depending on the condition and structural constraints of the existing bridge, replacement or modification of the bridge may be required to accommodate the proposed improvements.

P-05: NW Fargo, NW 18th Loop, NW 18th Avenue Improvements

The model identified surcharging and potential manhole flooding downstream of Crown View LS area along NW Fargo Street, NW 18th Loop, and NW 18th Avenue, indicating the need for additional gravity sewer capacity. Model surcharging and manhole flooding were identified between MHs 3-1-33 to 3-1-25. The deficiency is caused by a combination of pipe capacity limitations and changes in pipe slope. While portions of the upstream system have relatively steep slopes, several downstream pipe segments flatten, reducing hydraulic capacity and causing the HGL to increase.

The proposed NW Fargo Street, NW 18th Loop, and NW 18th Avenue Improvements consist of upsizing approximately:

- 2,744 LF of pipe between MHs 3-1-26 to 3-1-14 should be upsized from 8- to 15-inch.

The proposed gravity sewer improvements are located at an approximate depth of 10 feet. These improvements will provide additional conveyance capacity and alleviate the modeled surcharging and manhole flooding.

Under the buildout scenario, additional segments were identified that exceed the City's design criterion of d/D less than 0.92. To meet the d/D criterion under buildout conditions:

- 763 LF of pipe between MHs 3-1-36 and 3-1-33 should be upsized from 8- to 12-inch, and;
- 1,218 LF of pipe between MHs 3-1-33 and 3-1-26 should be upsized from 8- to 15-inch.

These additional improvements are not required under the 20-year scenario because the modeled surcharging remains more than 3 feet below MH rim but are recommended to accommodate full buildout conditions.

P-06: NE Garfield Street to NE 15th Avenue to NE Franklin Street along the Mill Ditch Improvements

P-06 experiences surcharging and potential manhole flooding along Division Street between NE Garfield Street and NE 15th Avenue, continuing toward NE Franklin Street and along the Creek Improvements area during the design storm. The model identified deficiencies at MHs 4-2A-1, 4-2-1, 4-1-2, 4-1-1, and 3-2-2 due to insufficient capacity in the existing gravity mains.

The proposed improvements include upsizing:

- 282 LF of pipe between MHs 4-2A-2 to 4-2A-Q should be upsized from 8- to 12-inch;
- 115 LF of pipe between MHs 4-2A-Q and 4-2A-1 from 8- to 15-inch;
- 795 LF of pipe between MHs 4-2A-1 and 4-2-2 from 8- to 18-inch;
- 427 LF of pipe between MHs 4-2-2 and 4-2-1 from 8- to 24-inch;
- 256 LF of pipe between MHs 4-2-1 and 4-1-2 from 8- to 27-inch;
- 254 LF of pipe between MHs 4-1-2 and 4-1-1 from 21- to 30-inch;
- 158 LF of pipe between MHs 4-1-1 and 3-2-6 from 21- to 30-inch, and;
- 347 LF of pipe between MHs 4-1-1 and 3-2-4 from 15- to 36-inch.

The portion of pipe between MHs 3-2-4 and 3-2-2 along the Mill Ditch is excluded from the project because these pipes were recently upsized, are in good condition, and meet performance criteria (i.e., they do not surcharge within 3 feet from MH rim). The proposed gravity sewer improvements would be constructed at an approximate depth of 10 feet and provide additional conveyance capacity to address the modeled surcharging and potential manhole flooding under the existing and 20-year conditions.

Under the buildout scenario, additional segments were identified that would exceed the City's design criterion of d/D less than 0.92. To meet the d/D criterion under buildout conditions, approximately:

- 290 LF of pipe between MHs 4-1-6 and 4-1-4 should be upsized from 18- to 24-inch;
- 269 LF of pipe between MHs 4-1-4 and 4-1-3 should be upsized from 21- to 24-inch;
- 422 LF of pipe between MHs 4-1-3 and 4-1-2 should be upsized from 18- to 30-inch, and;
- 376 LF of pipe between MHs 3-2-4 and 3-2-2 should be upsized from 21- to 30-inch.

These additional improvements are not required under the 20-year scenario because the modeled surcharging remains more than 3 feet below MH rim but are recommended to accommodate full buildout conditions.

P-07: South Prune Hill LS Force Main Improvements

P-07 experiences velocities above the City's maximum design criterion in the existing 10-inch force main serving the South Prune Hill LS. The South Prune Hill LS captures flows from the eastern portion of the City's gravity collection system. Based on the modeled flows and hydraulic conditions, the existing force main has the potential to exceed the City's maximum design criterion of 8 fps under existing and 20-year conditions.

The proposed improvement consists of upsizing approximately:

- 925 LF of force main between the South Prune Hill LS wet well and MH 10-1-3 from 10- to 18-inch.

The proposed improvement provides additional conveyance capacity and reduces force main velocities to improve system performance under future conditions.

It should be noted that the existing-condition velocity may appear to be below the City's 8 fps criterion because upstream hydraulic restriction limit the flow entering the force main. When P-01 improvements are implemented, the increased conveyance capacity upstream allows additional flow to reach the South Prune Hill LS, resulting in increased force main velocities and periods of unstable hydraulic performance. The proposed P-07 improvement addresses the interaction between the upstream gravity system and the force main provides more stable performance as additional system capacity is made available.

P-08: West Camas LS Force Main Improvements

The West Camas force main, located downstream of the P-01 and P-07 improvements along NW 6th Place, experiences a capacity deficiency under existing conditions. Implementation of the upstream improvements will increase conveyance capacity and allow additional flows to reach the West Camas LS, reaching in increased flows within the existing force main between the West Camas wet well and MH 1-1-10. The existing 6-inch force main does not have sufficient capacity to convey these increased flows.

The proposed improvement consists of upsizing approximately:

- 574 LF of force main between the West Camas wet well and MH 1-1-10 from 6- to 15-inch.

This improvement provides the additional conveyance capacity needed to accommodate the increased flow resulting from the upstream improvements.

P-09: Main LS Dual Force Main Improvements

P-09 includes the Main LS force main, which conveys flows from the majority of the City's sewer collection system, excluding the STEP Basin and Flow Meter 8-1-2, to the WWTF. As the downstream force main for the preceding system improvements, the Main LS force main conveys the increased flows resulting from the proposed upstream improvements. Under both existing and 20-year conditions, the modeled PWWF velocity in the existing 18-inch force main is approximately 14 fps, exceeding the City's design criteria of greater than 8 fps.

The proposed improvement consists of installing approximately:

- 2,347 LF of 21-inch force main from the Main LS wet well to the WWTF, creating a dual force main system.

The additional force main provides increased conveyance capacity for existing and future flows and reduces the hydraulic loading on the existing 18-inch force main. The existing force main would remain in service as part of the dual force main system.

The proposed dual 18-inch and 21-inch force main configuration should be evaluated as part of the system modeling to confirm PWWF velocities, available conveyance capacity, and operating conditions under 20-year and buildout conditions. Although the 20-year PWWF velocity remains slightly above the City's 8 fps criterion, further upsizing would reduce velocities during lower-flow conditions below the minimum velocity required to flush pipes (2.5 fps). Therefore, the proposed 24-inch force main provides a balance between reducing PWWF velocities and maintaining adequate velocities during lower-flow conditions.

P-10: Leadbetter Road Dual Force Main Improvements

The Leadbetter Road LS captures all flows from the North Shore area. Based on the modeled flows to the LS wet well, the existing single 8-inch force main does not have sufficient capacity to convey projected flows under 20-year system conditions, resulting in velocities that exceed the City's 8 fps design criterion and potential manhole flooding upstream of the Leadbetter Rd LS.

The proposed improvement consists of activating the existing parallel 8-inch force main and installing approximately:

- 6,500 LF of parallel 10-inch force main from Node_161, near the intersection of SE Leadbetter Road and NE Everett Street, to Node_27, near the intersection of NE 23rd Avenue and NE Everett Street.

These improvements increase force main capacity and alleviate the potential for upstream MH flooding under 20-year conditions. While the modeled PWWF velocity slightly exceeds the City's maximum design criterion of 8 fps, further upsizing would reduce velocities during lower-flow conditions below the minimum velocity required to flush pipes (2.5 fps). Therefore, the proposed 10-inch force main provides a balance between reducing PWWF velocities and maintaining adequate velocities during lower-flow conditions.

P-11: Division Street Improvements

Along Division Street, downstream of P-05, the model identified surcharging and manhole flooding between MHs 3-1-11 to 3-1-10, and 3-1-6 under the existing system, indicating the need for additional pipe capacity. To alleviate surcharging:

- 827 LF of pipe between MHs 3-1-14 and 3-1-11 from 8- to 15-inch;
- 505 LF of pipe between MHs 3-1-11 and 3-1-9 from 8- to 21-inch, and;
- 1,526 LF of pipe between MHs 3-1-9 and 3-1-2 from 8- to 18-inch.

These improvements provide additional conveyance capacity, alleviate the modeled surcharging and potential manhole flooding, and allow the system to meet the City's design criteria.

Under the buildout scenario, the gravity sewer segment between MHs 3-1-2 and 3-1-1 was identified as exceeding the City's design criterion of d/D less than 0.92. To meet the d/D criterion under buildout conditions:

- 276 LF of pipe between MHs 3-1-2 and 3-1-1 should be upsized from 15- to 18-inch.

This improvement is not required under the 20-year scenario because the surcharging is not within 3 feet from MH rim but are recommended to accommodate full buildout conditions. This project is at a depth of approximately 10 feet.

P-12: SE Everett Road to Leadbetter Road Extension

The proposed project will extend the existing sanitary sewer system to serve planned development. The improvements consist of installing approximately:

- 2,031 LF of 8-inch,
- 692 LF of 12-inch, and;
- 6,036 LF of 18-inch gravity sewer along the proposed alignment from NE Everett Road to NE Leadbetter Road.

New sewer infrastructure will provide the capacity necessary to accommodate projected development and connect the new development to the existing public sewer system. Project timing and implementation will be driven by development needs and coordinated with the developer. For more information, see Chapter 9 - Capital Improvement Plan.

P-13: SE 238rd Avenue to NE Woodburn Drive Extension

The proposed project will extend the existing sanitary sewer system to serve planned development. The improvements consist of installing approximately:

- 6,782 LF of 12-inch, 692 LF of 12-inch gravity sewer along the proposed alignment from SE 283rd Avenue to NE Woodburn Drive.

New sewer infrastructure will provide the capacity necessary to accommodate projected development and connect the new development to the existing public sewer system. Project timing and implementation will be driven by development needs and coordinated with the developer. For more information, see Chapter 9 - Capital Improvement Plan.

S-01: NW Parker Street to NW Lake Road STEP Main

The NW Parker Street to NW Lake Road STEP Main conveys flows from the STEP Basin areas associated with NW Parker Street and NW Lake Road. Based on the modeled flows and velocity results, the existing 21- and 24-inch STEP mains do not have sufficient capacity to convey projected flows under 20-year system conditions, resulting in elevated hydraulic grade lines. To address this deficiency and provide additional capacity for future conditions, a parallel STEP main is proposed. The existing STEP main will remain in place for emergency bypass.

The proposed improvement consists of approximately:

- 14,032 LF of 30-inch STEP main.

Following construction, the existing STEP main in this area will be taken out of active service and retained for emergency bypass conditions or use during PWWF events. The proposed 30-inch STEP main will provide the primary conveyance capacity for flows from the STEP Basin and accommodate projected future flows. For more information, see Chapter 9 - Capital Improvement Plan.

There are 11 projects recommended to address existing system deficiencies and three projects recommended to address future growth-driven deficiencies. Some projects address deficiencies that are existing and are exacerbated by future growth.

Table 6.5 shows a summary of the City's recommended pipe capacity improvements and expansion.

Table 6.2 Recommended Pipe Capacity Projects

Project ID	Improvement Type	Location	Existing Size (inch)	Proposed Size (inch)	Length (feet)
P-01	Gravity	NW 6th Place West Upsize Improvements	8 8 8	12 15 18	422 809 472
P-02	Gravity	NW 6th Place East Upsize Improvements	8	21	682
P-03	Gravity	NW 6th Place Avenue West Upsize Improvements	12 12	24 21	1,943 592
P-04	Gravity	NW 6th Place Avenue East Upsize Improvements	18 21 12 21 24 21 21	27 30 30 36 36 36 36	446 260 402 545 947 1,126 34
P-05	Gravity	NW Fargo Street, NW 18th Loop, and NW 18th Avenue Upsize	8	15	2,744
P-06	Gravity	NE Garfield Street to NE 15th Avenue to NE Franklin Street to along the Creek Improvements	8 8 8 8 8 21 21 15	12 15 18 24 27 30 36 36	282 115 795 427 256 254 158 347

Project ID	Improvement Type	Location	Existing Size (inch)	Proposed Size (inch)	Length (feet)
P-07	Force Main	South Prune Hill Force Main Improvements	10	18	925
P-08	Force Main	West Camas LS Force Main Improvements	6	15	574
P-09	Force Main	Main LS Dual Force Main Improvements	-	21	2,348
P-10	Force Main	Leadbetter Road LS Dual Force Main Improvements	-	10	6,500
P-11	Gravity	Division Street Upsize	8 8 8	15 21 18	827 505 1,526
P-12	Gravity	SE Everett Road to Leadbetter Road Extension	- - -	8 12 18	2,031 692 6,036
P-13	Gravity	SE 283rd Avenue to NE Woodburn Drive Extension	-	12	6,782
S-01	STEP	NW Parker Street to NW Lake Road STEP Main Improvements	-	30	18,063

6.6.2 Recommended Lift Station Improvements

It is recommended that nine lift stations all be upgraded to improve pump capacity and redundancy and to accommodate existing and 20-year system demands. South Prune Hill, West Camas, Crown View, and Main LSs do not currently meet the City's required firm capacity under existing conditions. Improvements at these stations consist of adding redundant pumping capacity to allow the stations to maintain service during a pump outage or maintenance event. Table 6.2 shows the recommended lift station improvements.

Table 6.3 Recommended Lift Station Improvement Projects

Project ID	Improvement Type	Location	Description
LS-01	Lift Station	Lower/South Prune Hill	Construct a new Lower/South Prune Hill LS with a pump capable of pumping 3.0 mgd of firm capacity to provide additional capacity and support future system needs.
LS-02	Lift Station	West Camas	Construct a new West Camas LS with a pump capable of pumping 3.3 mgd of firm capacity to provide additional capacity and support future system needs. This LS is downstream of Lower/South Prune Hill LS, so this project should be implemented after the Lower/South Prune Hill LS improvements.
LS-03	Lift Station	Crown View	Construct a new Crown View LS with a pump capable of pumping 1.0 mgd of firm capacity to provide additional capacity and support future system needs.
LS-04	Lift Station	Lacamas Creek	Replace the two existing pumps capable of pumping 2.13 mgd each to meet the required firm capacity.
LS-05	Lift Station	Main LS	Construct a new Main LS with pumps capable of pumping 21.0 mgd of firm capacity to provide additional capacity and support future system needs.
LS-06	Lift Station	Goodwin Road	Add a pump capable of pumping 0.49 mgd.
LS-07	Lift Station	232nd Avenue	Add a pump capable of pumping 0.53 mgd

Project ID	Improvement Type	Location	Description
LS-08	Lift Station	Leadbetter Road	Add a pump capable of pumping 0.87 mgd
			Replace the three existing pumps with pumps capable of pumping 1.82 mgd each.
LS-09	Lift Station	Hills at Round Lake	Replace the two existing pumps with three new pumps, each capable of pumping 0.65 mgd to meet the required firm capacity.

6.6.3 Recommended General Projects

The recommended sewer improvements identified in this GSP are critical to maintaining reliable and adequate wastewater collection and conveyance as the City continues to grow. The improvements address existing capacity deficiencies, accommodate projected future flows, and provide additional capacity to support planned development and 20-year conditions. Improvements include gravity sewer upsizing, force main, and STEP main improvements, lift station upgrades, and extensions of the existing sewer collection system to serve future growth areas. In addition to these capital improvements, several general system improvements are recommended to support ongoing sewer system management, improve understanding of system conditions, and inform future capital improvement planning. Table 6.3 shows a summary of the recommended general improvement projects.

Table 6.4 Recommended General Projects

Project ID	Improvement Type	Project Name	Description
G-01	Study	Basin 4-1-3 Pilot I/I Study	This program will investigate the source and magnitude of I/I of storm and groundwater into the wastewater system at locations where suspected high I&I is currently or is forecast to exceed conveyance and/or lift station capacity. Identifying and removing non-sewage flow where that would reduce surcharging such that costly capacity improvements might be avoided.
G-02	Study	Basin 5-1-2 Flow Monitoring	This project is to install temporary flow meters in Basin 5-1-2 to capture flows from the Camas LS and Upper Prune Hill contributing areas separately. Both areas have pipe and LS capacity deficiencies and additional flow monitoring within this basin would help to understand if part of the basin is contributing a greater portion of I/I. This study should evaluate if projects within the basin have the potential to reduce I/I such that projects to increase hydraulic capacity within the system can be avoided. Reducing I/I has downstream benefits at the treatment plant as well.
G-03	General	Basin 5-1-2 Flow Monitoring	This project includes general GIS improvements to maintain and update wastewater asset information, improve data accuracy, and support ongoing system planning and management.
G-04	Study	Systemwide	Update and expand the City's hydraulic model to include additional collection system pipes and provide a more complete evaluation of system capacity and deficiencies.
G-08	General	Systemwide	2035 General Sewer Plan Update
	General	Systemwide	2045 General Sewer Plan Update

6.6.4 Recommended Annual Repair and Replacement Program

The City has established an annual maintenance program as part of its CIP to maintain and improve the existing wastewater system. These improvements will help the City address aging infrastructure, maintain reliable operation of the collection system, and extend the useful life of existing assets. Continued investment in these projects will also help the City address maintenance needs as they arise and support the long-term goals of the GSP. Table 6.4 shows a summary of the City's annual repair and replacement program.

Table 6.5 Recommended Annual Repair and Replace Program Projects

Project ID	Improvement Type	Project Name	Description
R-01	R&R	Sewer Main R&R Program	This program will investigate the condition of wastewater collection system pipelines identified as having been installed prior to 1940s. The program will evaluate the condition and performance of these older pipelines to identify potential structural, operational, or capacity concerns and determine whether rehabilitation or replacement is needed.
R-02	R&R	Miscellaneous LS Projects	This project includes miscellaneous improvements at existing lift stations to address operational and maintenance needs. Improvements may include pump and piping replacement, electrical and controls upgrades, instrumentation, wet well improvements, odor control, and other equipment or site improvements as needed. These improvements will help maintain reliable operation and address deficiencies that may be identified through regular operation and maintenance of the lift stations.

6.7 Additional Recommendations

Our collection system evaluation was limited to the collection system that was modeled. The collection system includes gravity and STEP elements, but only portions of the gravity system and the STEP transmission main are set up for capacity evaluation with the hydraulic model. Other factors such as lack of extensive city-wide GIS limited the scope of the collection system evaluation. The following bullet points explain future projects the City should undergo to allow more effective evaluation of the gravity and STEP system, respectively:

- **Gravity Collection System Model:** The gravity collection system model is skeletonized, with only 28 percent of the gravity system pipes, STEP trunk mains, force mains are connected to the 12 modeled lift stations. While most of the critical trunks are included, a full pipe or less skeletonized model is needed for a more robust evaluation of the system. To expand the model, accurate and updated GIS for the collection system should be developed.
- **STEP Main Model Calibration:** The STEP system model should be further calibrated to verify and refine the modeled results. Additional metering at lift stations farther upstream would provide data necessary to properly calibrate the STEP portion of the model. While these individual lift stations do not necessarily need to be explicitly represented in the hydraulic model, accurate data on their flows and contributions to the STEP system should be collected and incorporated into the model. The current STEP system model primarily includes the major trunk lines; therefore, incorporating additional STEP mains and piping would provide a more detailed representation of the system and improve the accuracy of future hydraulic evaluations and model refinement. The addition of a manhole with a flow meter near the intersection of NW Lake Road and NW Lacamas Drive or near NW

Parker Street and NW Knapp Lane should also be considered to provide additional flow data and aid in model calibration.

- **STEP Main Condition Assessment:** The addition of manholes to the STEP system would help facilitate investigation of the STEP mains condition and allow any partially obstructed portion of the STEP Main to be identified. A future investigation of debris, solids, and other obstruction is recommended in the sags in the system.
- **STEP System Lift Stations:** The STEP system lift stations could not be fully evaluated under PWWF conditions using the system model due to limited operational data. Implementing SCADA systems with historian capabilities would allow the City to monitor and record pump operation, flow conditions, and pump run times, providing the data necessary to evaluate lift station performance and improve future system modeling. SCADA implementation should be prioritized at lift stations where the City anticipates receiving the highest flows, as well as at all future City-owned lift stations as they are expanded or constructed.

CHAPTER 7 WASTEWATER TREATMENT FACILITY

7.1 Introduction

The City serves the water quality needs of approximately 8,500 residential, industrial, and commercial accounts by maintaining and operating their WWTF which has a maximum month design flow of 6.1 mgd.

To support development of the City's GSP, a unit process analysis was completed to identify shortfalls in plant capacity that will prevent the City from reliably treating and disposing of projected flow and loads at the end of the planning period (i.e., year 2045). To address the identified deficiencies, an alternatives analysis of the most viable improvement options was conducted, which resulted in the development of 25 projects to be incorporated into the GSP's CIP.

This chapter summarizes the methods and results of these tasks, thus defining the condition and capacities of the WWTF's unit processes and presenting sequenced recommendations that will allow the City to reliably and cost-effectively serve their customers now and into the future.

7.1.1 Current National Pollution Discharge Elimination System Permit

The City's WWTF effluent must comply with limits on BOD_5, TSS, ammonia, pH, summer heat load, and fecal coliform bacteria as conditions of their NPDES permit. The current permit, Permit No. WA0020249, is effective as of August 1, 2025. The current discharge limits are summarized in Table 7.1. See Appendix H for the City's Permit.

A Reasonable Potential Analysis (RPA) was prepared to identify any new reasonable potential for the projected 2035 discharges to cause or contribute to any excursions above state water quality standards with the current design effluent water quality. The *Reasonable Potential Analysis Project Memorandum*, included in Appendix J, did not identify any new reasonable potentials.

Table 7.1 NPDES Permit Effluent Limits for Permit No. WA0020249

NPDES Permit Effluent Limits		
Parameter	**Average Monthly**	**Average Weekly**
BOD_5	▪ 20 mg/L ▪ 842 ppd ▪ 85% removal	▪ 30 mg/L ▪ 1,264 ppd
TSS	▪ 20 mg/L ▪ 1,017 ppd ▪ 85% removal	▪ 30 mg/L ▪ 1,525 ppd
Ammonia (NH_3 as N) during summer (1)	▪ 20 mg/L	▪ 30 mg/L
Ammonia (NH_3 as N) during winter (2)	▪ 7 mg/L	▪ 11 mg/L
Parameter	**Minimum**	**Maximum**
pH	▪ 6 SU	▪ 9 SU

NPDES Permit Effluent Limits		
Parameter	**Monthly Geometric Mean**	**7-day Geometric Mean**
Heat Load during summer (1)	▪ 5.87 x 10^8 kcal/day	▪ N/A
Fecal Coliform Bacteria	▪ 200 organisms/100 mL	• 400 organisms/100 mL

Notes:
(1) Applicable only from June 1 to September 30.
(2) Applicable only from October 1 to May 31.
SU - standard units.

7.1.2 Past Evaluation of Reuse

In the *2010 General Sewer/Wastewater Facility Plan* (Gray & Osbourne, Inc. 2010) (2010 GSP), the City explored their potential to practice wastewater reclamation, or the production and beneficial use of reclaimed water. As such, an evaluation was completed to understand the feasibility of reusing effluent from the WWTF or constructing a new water reclamation facility (WRF) to treat wastewater for reuse.

The evaluation determined that, though environmental and social benefits are difficult to quantify and assess, the City and their surrounding communities can benefit indirectly from the use of reclaimed water in the following ways:

- Development of additional outdoor recreational sites for the community.
- Irrigation of parks and playfields, which can potentially increase property values.
- Conservation of the quality and quantity of the City's water resources.
- A flexible and reliable alternative water source for industrial water customers.

However, the evaluation also confirmed that the production of reclaimed water is only economically feasible if the cost of producing reclaimed water is less than or equal to the cost of purchasing water or developing additional water rights.

Capital, operation, and maintenance costs for the two alternatives were taken from the 2010 general sewer plan and converted from 2006 dollars to 2025 dollars. A new 20-year present worth analysis was conducted with the updated values. Both the 2010 GSP and the current 20-year present worth analysis found that neither the costs to modify the existing WWTF nor construct a satellite WRF were less than or equal to the cost of developing additional water rights, which are available at notably lower costs. The cost to develop and acquire additional water rights was expected to not exceed $5 million in 2006, which would be $15 million in 2025.

Comparisons of the two alternatives are shown in Table 7.2. Alternative 1 has a 20-year present worth of $30.5 million and alternative 2 has a 20-year present worth $81.6 million. Both alternatives are considerably larger than the 15 million dollars to develop and acquire additional water rights. Therefore, water reclamation and reuse were determined to be economically infeasible and not pursued at the City's WWTF. As the potential for reclaimed water demands have not significantly changed since 2010, the previous analysis remains applicable to current conditions.

Chapter 10 of the 2010 GSP documents the feasibility evaluation of reuse in further detail.

Table 7.2 Reuse Alternative Cost Comparison

	Alternative 1 Modify Existing WWTF	Alternative 2 Construct Satellite WRF
Capital Cost(1)	$24,414,000	$68,235,000
Annual O&M Cost(2)	$317,000	$705,000
20-year Present Worth(3)	$30,457,000	$81,662,000

Notes:
(1) 2010 GSP used 2006 costs. The Handy-Whitman Index for the Pacific Region in July 2006 and July 2025 were used.
(2) 2010 GSP reported 2004 costs. Costs were updated using the Handy-Whitman Index for the Pacific Region in January 2004.
(3) Discount rate assumed 5% bond repayment rate and 4% inflation for a total rate of 1%.

7.2 Unit Process Analysis

A unit process analysis comparing the design or rated capacity of each WWTF unit process against its requisite treatment demands under current and projected flows and loads. This is detailed in Appendix I - *Evaluation of the Wastewater Treatment Facility Report*. This comparison identified deficiencies or limitations in the plant's current installed capacity to meet its various regulatory and operational requirements by 2045.

To this end, the unit process analysis was completed in the following six sequential tasks:

- Compile and analyze three years (January 2022 to December 2024) of WWTF data.
- Develop a hydraulic model of the collection system (collection system model) to estimate future average day flow (ADF), MMF, MDF, and peak hour flow (PHF) at the WWTF under the design storm.
- Estimate future flows and mass loadings through the planning year 2045.
- Prepare spreadsheet-based capacity estimates of existing liquid and solids processes to meet anticipated permit conditions under current and future influent characteristics.
- Update and recalibrate hydraulic and BioWin models with recent plant data (May to June 2025) to assess future flows and loadings impacts on existing plant facility performance. Both models were originally developed for the previous GSP (2024).
- Conduct plant tours in June 2025 to review and update prior condition assessments completed as part of the 2024 GSP and identify any limitations.
- Using both the spreadsheet-based capacity assessment and the results of the calibrated hydraulic and BioWin modes, determine future treatment capacities required for each unit processes and estimate the ideal timing of future plant improvements.

The following sections highlight key points and findings from the above tasks.

7.2.1 Flows and Loads

Flows and loads and presented are in Chapter 3 - Basis of Planning. Tables 3.10 and 3.11 present the current and projected flows and loads, which must be treated and discharged to the Columbia River. These projections were developed according to historical influent flows and raw wastewater pollutant concentrations, typical septage and STEP system characteristics, population growth projections, and industrial flow contributions. Projected future flows are based on Comprehensive Plan 2045 land uses and

wastewater flow factors developed for the various land uses. Chapter 3 Basis of Planning details the method by which these flows and loads were analyzed.

7.2.2 Hydraulic Modeling

Carollo Engineers' Hydraulix® modeling software was used to establish the hydraulic capacities of individual unit processes and water surface elevations (WSE) under 2045 peak flows. More specifically, this software modeled the flow through the WWTF by calculating both energy grade lines and hydraulic grade lines according to head loss and velocity at each hydraulic element under various influent flow conditions identified in Table 7.3.

Each individual unit process was considered "at risk" when the model indicated less than 18 inches of freeboard in a structure or less than six inches of fall from flow over a weir to the downstream water surface. A unit process was considered "overloaded," or as having a true hydraulic limitation, when the model indicated less than 12 inches of freeboard or a weir was submerged. Less than 12 inches of freeboard in an open channel puts the WWTF at risk of flow overtopping a structure and must be avoided at all costs. Additional details about the hydraulic model assumptions and results can be found in Section 5.5 of the Evaluation of the Wastewater Treatment Facility Report in Appendix I.

7.2.3 State Point Analysis

The relationship between mixed liquor suspended solids (MLSS) concentrations, plant flows, and clarifier capacity can also be illustrated by another graphical method commonly called state point analysis as described below.

A clarifier state point analysis determines the effect of operating conditions on secondary clarifier capacity by comparing the actual solids loading to the theoretical maximum solids loading rate in pounds per day per square foot (ppd/sf) of the clarifier surface area as a function of the MLSS concentration. Key factors in a state point analysis are the MLSS concentration, the flow fed to the clarifiers, and the settling velocity of the MLSS as predicted by the selected correlation between SVI and settling velocity. State point analyses are very useful for predicting the ability of secondary clarifiers to operate successfully under peak flow conditions. Additional information on the state point analysis is provided in the Evaluation of the Wastewater Treatment Facility Report in Appendix I.

The desktop analysis indicates that the City should reconstruct Secondary Clarifier No. 1 with a new sloped bottom and spiral scraper mechanism identical to the existing Secondary Clarifier No. 3, as well as constructing a fourth Secondary Clarifier (No. 4) in the future (by 2040) to provide adequate capacity to treat flows and loads through 2045 and beyond.

The statistical evaluation of historical plant data revealed periodic occurrences of sludge bulking in the biological nutrient removal (BNR) process. For the three years of data examined there were three periods where the sludge volume index (SVI) exceeded the proposed design SVI of 160. Although these periods present less than 10 percent of the days in that two-year period, they are a concern as they indicate that the current method of bulking control (chlorination) takes weeks to be effective. All three episodes occurred in winter or early spring when peak wet weather flows typically occur. The secondary clarifiers could fail in the future (when both plant flow and peak flows are projected to be higher than existing flows) if the peak flows occur during a bulking episode.

There have been significant advances in the last decade in the use of selectors and other methods of obtaining a densified activated sludge that provides lower and more stable operating SVIs. It is recommended that the WWTF evaluate the causes of the bulking including identification of the causative organisms and evaluate the feasibility of implementing at least one of the methods before or during the next design and construction project at the WWTF.

7.2.4 BioWin Modeling

BioWin version 6.3 was used to simulate the real-world physical, chemical, and biological treatment processes of the WWTF. This model was updated and recalibrated using existing treatment facility operational data from January 2022 through December 2024 supplemented by data obtained from the special sampling events, and by running a dynamic simulation using the daily plant influent and effluent values (BOD_5, TSS, ammonia) and MLSS concentrations from May 2025.

Once the calibration effort was deemed acceptable, parameters were established for future conditions under which the WWTF must operate. Specifically, this effort adopted the flows and load projections presented in Tables 7.3 and 7.4 while assuming that effluent limits on ammonia would be as low as 7 mg/L for all scenarios.

Finally, the BioWin model was used to model performance of the entire WWTF under the following anticipated future conditions:

- TSS removal rates of 54, 47, 44 and 34 percent were assumed for the primary clarifiers under 2045 average annual, maximum monthly, maximum week, and maximum day conditions (Table 7.4)
- A minimum aerobic solids retention times (aSRT) of 8.0 days under maximum month conditions and 6.05 days under maximum week conditions. These aSRTs result in nitrification safety factors of 2.9 and 2.2 under maximum month and maximum week flow conditions, respectively.
- An SVI, which is a quantification of MLSS settling velocity, of 160 milliliters per gram (mL/g).

Additional details about the process simulation (BioWin modeling) including the model configuration and results can be found in Section 5.4 of the Evaluation of the Wastewater Treatment Facility Report in Appendix I.

7.2.5 Condition Assessment

A condition assessment was conducted as part of the 2024 GSP to identify major facility deficiencies and provide a general priority rating for mechanical equipment, treatment units, structures, and electrical, instrumentation, and control (E&IC) systems. The compiled information was updated during the plant tours conducted in June 2025 as part of this GSP Update to determine which portions of the facility can be retained, which require major upgrades, and which should be abandoned or replaced.

To begin, the assessment team reviewed drawings and design criteria for each unit process, including the recommended WWTF redundancy criteria for flows and loads as published in the *Criteria for Sewage Works Design* (August 2008, Department of Ecology) and summarized in Table 2.4 of Chapter 2.

Next, the team discussed maintenance history, plant shortcomings, and general operational issues with City staff, who also accompanied the team on walk-through inspections of the WWTF following the general occurrence of the processes and associated major equipment in the direction of flow.

Table 7.5 summarizes each key WWTF component's condition and rated capacity. For more information, see Appendix K, *Condition Assessment of Camas Wastewater Treatment Facility Project Memorandum*.

Table 7.3 2025 Condition Assessment Summary

WWTF Component	Rated Capacity	2019 Condition Assessment Associated with 2024 GSP(1)	2025 Condition Assessment
Plant Headworks			
Influent Pipe	▪ N/A	▪ Headworks influent pipe configuration occasionally causes upstream overflow at the Parshall Flume during high flows.	▪ Same observation as in 2019 Condition Assessment. Influent piping should be modified by installing a rigid plate or concrete cover.
Influent Screens and associated washer/compactors	▪ Two mechanical screens. 7 mgd per screen, total 14 mgd. ▪ Washer/compactors are rated for 10 cf/hr.	▪ No significant condition issues identified.	▪ One of the influent screens needs a bearing replacement, and the plant is planning to perform this repair in-house.
Manual Bar Rack	▪ One manual bar rack.	▪ No significant condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Slide Gates	▪ Seven slide gates.	▪ No significant condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Primary Clarifiers (PC)	▪ 60-foot diameter, 10-foot SWD. ▪ SOR - 3,608 gpd/sf at PHF with both units operational.	▪ No significant condition issues identified.	▪ Severe corrosion of clarifier mechanisms; city replacing internals of both clarifiers as part of ongoing project.
Aeration Basin Influent flow splitter box	▪ N/A.	▪ N/A	▪ One shaft mixer was non-operational; staff noted the structure's freeboard is limited during high-flow events.
Aeration Basins (AB)	▪ Three ABs - 120 feet long, 40 feet wide and 21 feet SWD. ▪ ~3.9 to 5.7 mgd on max. week loading (3 AB, 3 SC at SVI of 90 - 160 mL/g).	▪ Flow split between the 3 basins is uneven. ▪ Weir walls between the zones are uneven. Wooden walls in anaerobic zones.	▪ Same observation as in 2019 Condition Assessment. Also, the internal recycle from the end of the aerobic zone is sent to the end of the anaerobic zone.
Secondary Clarifiers (SC)	▪ Three 75-foot diameter SC, 15 feet SWD.	▪ SC. No. 1 is non-operational due to its flat bottom	▪ Same observation as in 2019 Condition Assessment.
Aeration System	▪ Four 150 hp centrifugal blowers. ▪ Firm capacity of 4,890 scfm at 10 psig.	▪ Unable to control blowers when operating multiple in parallel	▪ Same observation as in 2019 Condition Assessment. City is replacing two 150 hp blowers with 100 hp high speed turbos; however, the new and old blowers will not be able to operate together.
Effluent Filters	▪ Two Cloth disk filters (10 micron). 3 mgd per filter, total 6 mgd.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment. Plant staff indicated the filters are backwashing 30% of the time, which is higher than the anticipated 20% or less.
UV Channel	▪ Four UV banks. ▪ 13.7 mgd at 65% UVT.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment. City is replacing the existing UV system with new UV system as part of an ongoing project.
Effluent Transfer Pumps	▪ Three 4,550 gpm at 16-feet TDH, 30 hp pumps. Firm Capacity is 13.09 mgd.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Non-potable Water Transfer Pumps	▪ Three 200 gpm at 185-feet TDH, 15 hp pumps.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment. City is replacing the motors for these pumps with new motors and variable frequency drives as part of an ongoing project.
RAS Pumps	▪ Each SC has two RAS pumps. ▪ SC No. 1 has two pumps 1,000 gpm each. ▪ SC No. 2 has two pumps 1,050 gpm each. ▪ SC No. 3 has two pumps 1,400 gpm each	▪ No condition issues identified. SC No. 1 is not operation.	▪ Same observation as in 2019 Condition Assessment. ▪ City is replacing the VFD for a couple of RAS pumps as part of an ongoing project.
WAS Pumps	▪ Each SC has one WAS pump. ▪ SC No. 1 has one pump 85 gpm. ▪ SC No. 2 has one pump 85 gpm. ▪ SC No. 3 has one pump 240 gpm.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Primary Sludge Pumps	▪ Two pumps. Each 220 gpm.	▪ No condition issues identified.	▪ One of the primary sludge pumps was making a very loud noise.
Internal Recycle Pumps	▪ Each AB has one submersible pump. 3,125 gpm.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Degritting Cyclone ang grit classifier	▪ Two units. Each 220 gpm.	▪ End of useful life.	▪ Same observation as in 2019 Condition Assessment. City is replacing both units with new as part of an ongoing project.
Gravity Thickener	▪ One unit. 30-foot diameter, 10-foot SWD.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment. ▪
Thickened Primary Sludge Pumps	▪ Two units. Progressive Cavity pumps, 130 gpm each.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Rotary Drum Thickener	▪ One unit. 100-300 gpm.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Thickened WAS Pumps	▪ Two units. Progressive Cavity pumps, 50 gpm each .	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Anaerobic Digesters (AD) and Digested Sludge Holding Tank (DSHT)	▪ Two AD tanks. 32-foot diameter, 29-feet SWD. ▪ One DSHT tank. 32-foot diameter, 29-feet SWD.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
AD mixing and heating equipment	▪ Each digester has one draft tuber mixer and spiral heat exchanger. ▪ One hot water boiler with hot water pumps.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.

WWTF Component	Rated Capacity	2019 Condition Assessment Associated with 2024 GSP(1)	2025 Condition Assessment
Digested Sludge Pumps	▪ Two units. Progressive Cavity pumps, 130 gpm each	▪ N/A	▪ N/A
Dewatering Centrifuge	▪ One unit. 130 gpm at 2-2.5% solids	▪ Near end of useful life.	▪ No issues observed with the existing unit. ▪ City is adding one new centrifuge (unit) as part of an ongoing project.
Sludge Thermal Dryer	▪ One complete belt-drying system.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Plant Drain Pump Station No. 1	▪ Two submersible pumps. 250 gpm each.	▪ Shows signs of concrete corrosion and pumps at the end of useful life.	▪ Same observation as in 2019 Condition Assessment.
Plant Drain Pump Station No. 2	▪ Two submersible pumps. 450 gpm each	▪ Shows signs of concrete corrosion and pumps at the end of useful life.	▪ Same observation as in 2019 Condition Assessment.
Electrical Components			
Utility Transformer No. 1 (UT1)	▪ 500 kVA	▪ N/A	▪ Owned and maintained by power utility. ▪ UT1 shows some signs of rusting but no major concerns.
▪ UV Electrical Room ▪ MDS-UV ▪ MCC-D1 ▪ MCC-D2 ▪ MCC-D3	▪ N/A	▪ N/A	▪ No major issues observed. ▪ City is replacing the UV system and associated power distribution panels and a new ATS.
▪ Old Controls Building ▪ MCC-A ▪ PLC-A ▪ Network Rack ▪ Transformer TL and Panel L	▪ N/A	▪ N/A	▪ The main concern in this building is the working clearance around electrical equipment seems low, increasing likelihood of tripping hazard.
Utility Transformer No. 2 (UT2)	▪ 1000 kVA	▪ N/A	▪ Owned and maintained by power utility. ▪ UT2 shows some signs of rusting but no major concerns.
▪ Equipment Blower Building ▪ MDS-EB ▪ MCC-C1/C1A ▪ MCC-C2/C2A ▪ Blower VFDs	▪ N/A	▪ N/A	▪ No major issues observed. ▪ City is replacing as part of an ongoing project the following: ▪ Two blowers and associated VFDs. ▪ New centrifuge control panels and VFDs
Emergency Generator	▪ 250 kW	▪ N/A	▪ City is replacing with new 450 kW generator as part of an ongoing project.
▪ Digester Electrical Building ▪ SWBD-F ▪ MCC-F	▪ N/A	▪ N/A	▪ Main concern in this room is that it seems to be sharing walls with process areas. As such, it is very important to understand hazardous area classification of the area per NFPA 820. ▪ City is adding a new MCC-F as part of the ongoing project.
▪ Biosolids Electrical Building ▪ SWBD-F ▪ MCC-F	▪ N/A	▪ N/A	▪ Main concern in this room is that it seems to be sharing walls with process areas. As such, it is very important to understand hazardous area classification of the area per NFPA 820.
Instrumentation and Controls			
SCADA system	▪ N/A	▪ N/A	▪ The current control system operates on standalone desktop PCs. When the remote display interface is engaged, control functionality on the primary desktop becomes inaccessible. This configuration presents a single point of failure and limits operational flexibility. To address this, a transition to multi-user control architecture is recommended. Additionally, the system must support routine Windows updates without requiring downtime of the primary control workstation, which currently manages all plant operations.
PLC Infrastructure and Upgrade Status	▪ N/A	▪ N/A	▪ Progress on PLC upgrades have progressed. Several PLC components in use have reached end-of-life status, posing reliability and supportability risks. It is strongly advised to prioritize the replacement of these legacy PLCs to ensure continued system integrity and maintainability.

Notes:
(1) Condition Assessment performed as part of the 2024 GSP.
ATS - automatic transfer switch; cf/hr - cubic feet per hour; hp - horsepower; kVA - kilovolt-amperes; kW - kilowatts; MCC - motor control center; MDS-EB - main distribution switchboard - elevator board; N/A - not applicable; NFPA - National Fire Protection Association; PLC - programmable logic controller; psig - pounds per square inch gauge; scfm - standard cubic feet per minute; SOR - surface overflow rate; SWBD - switch board; SWD - side water depth; TDH - total dynamic head; UVT - ultraviolet transmittance; VFD - variable frequency drive.

7.3 Summary of Key Improvements and Preferred Alternatives

Comprehensive analysis of the WWTF's unit processes identified several current and anticipated condition or capacity issues in WWTF's hydraulic, liquid treatment, solids treatment, and plant support systems. The following sections highlight key issues with unit processes at the WWTF and also recommend improvements to mitigate them.

Each unit process's complete description; condition findings, hydraulic capacity, and process capacity analyses; 2045 design criteria, and recommendations for improvements and alternatives are available in Appendix I - Evaluation of Wastewater Treatment Facility Report.

7.3.1 Preliminary Treatment

1. To prevent spraying of the influent wastewater during peak flow events, add a concrete cap over the portion of the channel where the influent pipe enters vertically into the structure upstream of the Parshall Flume.
2. Conduct a structural investigation, perform required structural repairs, add appropriate coatings to the channels.
3. Remove Influent Channel and Parshall Flume and replace with next larger size.
4. Replace the two screens and associated washer/compactors by 2030. The existing screens size have sufficient capacity to handle the 2045 PIDF of 22.2 mgd with both mechanical screens operating (11.1 mgd per screen) at the design blinding of 30 percent.
5. Replace all seven slide gates at the same time as replacing the influent screens.
6. Collect appropriate samples to measure incoming TKN and NH_3 as well as influent alkalinity daily.

7.3.2 Septage Receiving Station

The City is replacing the septage screening equipment as part of an ongoing project. Therefore, no recommendations for further improvements are made at this time.

7.3.3 Primary Treatment

1. Add a weir, dropbox, and piping as needed to construct a bypass around the primary clarifiers. This bypass will direct all flows greater than the MDFs around the primary clarifiers.
2. Add a third clarifier to:
    a. Maintain high removals of BOD_5 and TSS during normal flow.
    b. Operate the aeration tanks at lower MLSS concentrations during maximum month organic loadings.
    c. Reduce oxygen demands in the BNR process and increase gas production in the digesters.

7.3.4 Secondary Treatment

1. Relocate the internal recycle piping such that the recycle is introduced just upstream of the first of the two anoxic zones and not in the last anerobic zone for the three existing aeration basins.
2. The baffle walls that divide the zones within the existing aeration basins should be repoured to a smooth level. Plywood baffle walls in the anaerobic selector zone should be removed and replaced with 316 stainless steel baffle plates for rigidity.
3. Evaluate (and implement modifications if advantageous) the ability of reconfiguring the selector zones to improve the settling characteristics of the mixed liquor.
4. Demolish and rebuild Secondary Clarifier No. 1 to match the size, slope, and other criteria of Secondary Clarifier No. 3. Install new RAS, WAS, and scum pumps matching the size of those serving Secondary Clarifier No. 3.
5. Replace the RAS pumps for Secondary Clarifier No. 2 to match the size as that of Secondary Clarifier No. 3.
6. Implement hydraulic solids retention time (SRT) control by programming a hydraulic SRT control system in the plant PLC.
7. Replace the diffusers in the existing three aeration basins. Add diffusers to the second of the two anoxic zones in each aeration basin to convert it to a swing zone. Supports for diffusers in the swing zone should be adequately designed to withstand the forces exerted by the existing submersible mixers.
8. Construct a new Secondary Clarifier No. 4 with new RAS, WAS and scum pumps matching the size of that of Secondary Clarifier No. 3.
9. Construct a new Aeration Basin No. 4 with fine bubble diffusers and aeration piping and internal recirculation pump matching the size of the existing aeration basin. With four aeration basins, the plant can take one of the aeration basins out of service for cleaning and preventative maintenance and still maintain an eight-day SRT necessary for stable complete nitrification using three aeration basins by adding air to the swing zone and operating all four secondary clarifiers.

7.3.5 Aeration Blowers

Remove and replace the two existing 150 hp multistage centrifugal blowers with two 150 hp high-speed turbo (HST) blowers. It is assumed that all four blowers will need to be on-line to satisfy the 2045 peak oxygen demand.

7.3.6 Tertiary Filtration

As the existing tertiary filters approach the end of their useful life, they should be replaced with similar units.

7.3.7 UV Disinfection

The City is planning to build a new UV Channel replace the existing UV Trojan 3000+ system with a new Trojan 3000+ system as part of an ongoing project.

1. Rehabilitate the old UV Construct a new second UV channel outside the existing building on the west to allow disinfection of the entire plant effluent at PHF (22.2 mgd).

7.3.8 Effluent Pump Station and Pumps

Under high river water level conditions, when the headloss is too great for gravity flow to the Columbia River, the effluent is pumped using three vertical propeller effluent pumps, located in the second compartment of the effluent wet well. Each pump has a capacity of 4,550 gpm (6.54 mgd). The total capacity of the effluent transfer pump station is 19.6 mgd with a firm capacity of 13.09 mgd.

1. The process implications of exceeding the effluent pumps' capacity are catastrophic, under the high river level conditions. Such conditions could quickly submerge upstream plant processes. Therefore, it is recommended to replace the existing pumps with larger impellers, motor, and associated VFDs to allow pumping of the entire plant effluent (PIDF of 22.2 mgd).

7.3.9 Primary Sludge Pumping, Degritting and Thickening

The City is already planning to replace the two primary sludge degritting equipment (hydrocyclones and classifiers). Sludge pumping equipment should last for 10 to 15 years depending on the amount of grit and wear and tear they experience, so they should be replaced and repaired as needed. No additional recommendations are made for the primary sludge and degritting equipment at this time.

1. The thickened primary sludge pumps are too large for the system. For this reason, the existing units are recommended for replacement with new, appropriately sized, 70 gpm progressive cavity pumps.

7.3.10 WAS Pumping and Thickening System

No recommendations are made for the WAS pumping equipment at this time:

1. There is only one rotary drum thickener (RDT) for WAS thickening, which has been in service for more than 10 years so a second RDT is recommended for redundancy.
2. To meet hazardous area classification per NFPA 820, a new electrical building constructed to the west of the Digester complex serving all the digester equipment is purposed.

7.3.11 Anaerobic Digestion and Waste Gas Flare

The digester equipment should last for 20 to 25 years depending on the amount of grit and wear and tear they experience. Pumps should be repaired and replaced as needed. No recommendations for the Anaerobic Digestion system are made currently.

7.3.12 Dewatering Centrifuge

The City is already planning to add a second dewatering centrifuge as part of an ongoing project. With two dewatering centrifuges, the plant should be able to process the anaerobically digested sludge for the foreseeable future and therefore no recommendations are made at this time.

7.3.13 Biosolids Belt Dryer

The sludge dryer will need to be operated 7 days a week, 24 hours a day to process the maximum day sludge produced. Alternatively, if the capacity of the dryer is exceeded, the cake can be diverted for off-site disposal. The sludge dryer was installed in 2014 and is about 10+ years old. Typical sludge drying equipment will need major overhaul in the next 10 years (20-year life). City should plan to replace the

dryer in the next 10 to 15 years. However, for the 2025 GSP, a firm recommendation is not made as some of the regulations, in particular with respect to per- and polyfluoroalkyl substances (PFAS) in biosolids are still evolving.

7.3.14 Plant Drain Pump Stations

The condition assessment noted signs of concrete corrosion, and its pumps are nearing the end of useful life. As such, it is recommended that Pump Station No. 1 and 2 be rehabilitated by:

- Replacing the pumps (500 gpm each).
- Installing a liner in the wet well to extend the line of the existing structure.
- Replacing control panel, pump guide rails, and discharge piping within the wet well.
- Adding a totalizing flow meter and composite sampler.

7.3.15 Non-Potable Water Pumps

The City is planning to install new VFDs for each of the three non-potable water pumps and a new motorized strainer as part of an ongoing project. No recommendations are made at this time.

7.3.16 WWTF Electrical Upgrades

Reference section 7.9.8 of the WWTF Evaluation Report in Appendix I for more information on the current electrical system and background on previous upgrades.

1. MCC-A currently serves two WAS pumps, one general-purpose sludge pump, a compressor, two heaters, and a hoist. Carollo recommends removing MCC-A from the plant's distribution system and refeeding its remaining loads from nearby sources.
2. Carollo recommends removing PLC-A from the Old Controls Building, and controlling the current PLC-A loads from another nearby PLC. This would allow the Old Controls Building to be fully repurposed as a maintenance and workshop area, which reflects its current use.
3. The electrical equipment installed in 2002 remains in generally good condition and does not require immediate replacement; upgrades should instead coincide with future plant process improvement projects to minimize repeated modifications. However, when replacing gear in the UV or Equipment Building electrical rooms, updated layouts will likely be required to meet current National Electrical Code working clearance standards.
4. Electrical gear from 2012 remains in excellent condition and does not need replacement in the near term.
5. During the site visit, it was also noted that the water utility has no in-house electrician or instrumentation technician and no on-call agreements with outside specialists. Carollo recommends establishing either internal staffing or on-call contracts with qualified electricians and system integrators to ensure prompt response to electrical and controls issues.
6. No arc flash labels were found on the plant's distribution equipment, and the owner confirmed that an Electrical System Study is not maintained. Carollo recommends completing this study as soon as possible and applying arc flash labels in accordance with Occupational Safety and Health Administration requirements to ensure worker safety.

7. The owner also reported that the last major flood affecting the plant occurred in 1997. Carollo recommends a comprehensive flood risk analysis for all major electrical and control systems to assess vulnerabilities and strengthen flood resilience.
8. Electrical rooms from the 2002 upgrade were found to be dusty, poorly ventilated, and not fully sealed from adjacent areas. These conditions can accelerate equipment degradation and lead to premature failures of PLCs, VFDs, and network components. Carollo recommends installing dedicated ventilation systems, sealing the rooms from process and generator areas, and performing heating, ventilation, and air conditioning load calculations to determine whether air-handling units or cooling systems are needed to manage internal temperatures.
9. Throughout the plant, exposed network hardware, wiring, and cables were also observed, leaving them at risk of accidental damage. Carollo recommends installing dedicated, wall-mounted network enclosures and routing all cables through conduits for better protection and organization.
10. To ensure regulatory compliance, and safety, Carollo recommends conducting a hazardous area classification study per NFPA 820 and upgrading any areas that do not meet code.
11. Extensive corrosion was noted on outdoor conduits and equipment enclosures at several locations, including the influent/screens structure and biological basins. Carollo recommends replacing these components with PVC-coated or corrosion-resistant materials to enhance reliability and reduce any potential disruptions to plant operations due to power or control failures.

7.3.17 Facility Control Systems, Including the PLC and Central SCADA

Multiple network switches are currently installed in operational areas where they are exposed to environmental conditions. To mitigate risks associated with dust, moisture, and physical damage, the following recommendations are made:

1. Relocate switches into protective enclosures, consistent with best practices already implemented elsewhere on site.
2. As a short-term fix to minimize the risks to the network switches, place dust filter foam over vents on the switches to reduce the intrusion of dust. Additionally, place tape over unused network ports on the face of the switch until an enclosure is provided for the switches.

It was observed that the centrifuge cannot initiate operations when the system is in Automatic mode. Manual intervention is required to start the centrifuge, after which the system can be returned to Automatic. This behavior indicated a controls problem and should be investigated and resolved.

Magnesium Oxide tank level sensors are ultrasonic instruments, which are highly susceptible to condensate in the tank and will provide false readings. This sensor should be replaced with a Guided Wave Radar level instrument to eliminate the noise caused by condensate.

7.4 Recommendations

This section summarizes recommendations for WWTF improvement projects. Cost estimates and timing of projects are included in the CIP presented in Chapter 9. Each project is assigned a unique identifier which is an alphanumeric number that starts with one or two letters indicating the type of improvements and is consistent with the collection system identifiers. “TP” stands for Treatment Plant, “R” stands for Renewal and “G” stands for General. Individual project sheets are included in Appendix L - CIP Summary Sheets.

7.4.1 Recommended WWTF Improvement Projects

The improvements recommended to address WWTF capacity limitations over the next 20 years and address current condition issues that prohibit reliability or performance are summarized in this section. The recommended alternatives presented in Section 7.3 were re-organized and, in some cases, grouped together to suggest construction sequencing and project timing the city should consider when implementing these improvements. The following 25 distinct projects were developed for incorporation into the City's general sewer system plan CIP. The cost estimates of these projects can be found in Chapter 9 - Capital Improvement Plan.

- **TP-01: Parshall Flume Replacement**

  This project includes replacement of the existing Parshall Flume with a new higher-capacity Parshall Flume to accommodate peak flow conditions and structural modifications to prevent influent wastewater from spraying during peak flow events. The improvements include demolition of the existing top slab, walls, foundation slab, and guardrails; extension of the influent channel wall footing; construction of new influent channel walls and foundation slab; excavation and backfill; installation of new guardrails; construction of shoring and an elevated slab to support the new Parshall Flume; and associated electrical, instrumentation, and controls improvements. This project addresses existing and future growth-driven capacity issues.

- **TP-02: Primary Clarifier Bypass**

  This project includes construction of a bypass around Primary Clarifiers No. 1 and 2 to route flows greater than the maximum day flow around the primary treatment process. The improvements include installation of a new 30-inch bypass pipeline, structural modifications at the Plant Headworks Effluent, and installation of weir gates to control and direct flow through the bypass. Additional site work will also be required to support construction of the bypass improvements. This project is driven by growth, predominantly development in the North Shore area. This project addresses existing capacity issues and process upgrades.

- **TP-03: Aeration Basin Influent Flow Splitter Box**

  This project includes construction of a new aeration basin influent flow splitter box to improve mixing and flow distribution to the aeration basins. The splitter box should also be designed to address the issue of very little head available between the primary clarifier and aeration basins. The improvements include an 18-inch foundation slab, 12-inch-thick walls, new guardrails and aluminum grating, and associated excavation and backfill. New 60-inch by 30-inch and 24-inch by 24-inch stainless steel slide gates will be provided to control flows through the splitter box. The project also includes demolition of the existing Aeration Basin Flow Splitter Box, temporary pumping and piping during construction, installation of piping to and from the new splitter box, and additional site work as needed to complete the improvements. This project addresses existing capacity issues and process upgrades.

- **TP-04: Plant Headworks**

  This project includes replacement of the existing screens and slide gates at the WWTF Headworks to improve the reliability and operation of the screening process. The improvements include replacement of the existing screens/washer compactors with new units and installation of new 66-inch by 48-inch, 66-inch by 36-inch, and 72-inch by 36-inch stainless steel slide gates. The project also includes associated installation, electrical, instrumentation, and controls improvements, as well as

additional site work required to complete the improvements. This project addresses growth-driven capacity issues.

- **TP-05: Anoxic Selector IR Re-Piping**

  This project includes relocation of the internal recycle piping at the three existing aeration basins to improve the treatment process. The IR piping will be relocated to introduce recycled flow at the beginning of the Anoxic Selector, just upstream of the first of the two anoxic zones, rather than discharging into the last anaerobic zone. The project also includes associated electrical, instrumentation, and controls improvements, as well as additional site work required to complete the improvements. The City currently has two options for where recycled flow is discharged to: one from the splitter box (currently used) and the other at the end of the selector zone. It is recommended that the City use switch to discharge at the end of the selector zone and to monitor and test before and after the switch to assess improvement in treatment performance from this change to see if it is sufficient. TP-05 could potentially be completed in-house. This project addresses existing capacity issues and process upgrades.

- **TP-06: Anaerobic Selectors Baffle Wall**

  This project includes modifications to the baffle walls separating the anaerobic selectors within the existing aeration basins to improve flow distribution and maintain proper separation between treatment zones. The existing baffle walls between the anoxic and anaerobic zones will be repoured to provide a smooth and level surface. Gradient should be evaluated for improved settleability. Existing plywood baffle walls within the anaerobic selector zones will be removed and replaced with 316 stainless steel baffle plates to provide increased rigidity and durability. The project also includes associated electrical, instrumentation, and controls improvements. This project addresses existing capacity issues and process upgrades.

- **TP-07: Replace Secondary Clarifier No. 1**

  This project includes demolition and replacement of Secondary Clarifier No. 1 to improve the reliability and performance of the secondary treatment process. The new clarifier will be constructed as a 75-foot-diameter clarifier with a 15-foot SWD, matching the size, slope, and other design criteria of Secondary Clarifier No. 3. The improvements include a new concrete foundation slab and walls, sludge collection box, launder and effluent structures, aluminum grating, stairs, platforms, and railings, as well as new internal clarifier mechanisms. New RAS and WAS pumps will also be installed to match the size of those serving Secondary Clarifier No. 3. The project also includes associated demolition, installation, electrical, instrumentation, and controls improvements, and additional site work required to complete the improvements. The City is currently evaluating this project. This project addresses existing capacity issues and process upgrades.

- **TP-08: SC No. 2 RAS Pump Replacement**

  This project includes replacement of the RAS pumps serving Secondary Clarifier No. 2 to improve pumping capacity and maintain consistency with the existing Secondary Clarifier No. 3 facilities. Two new non-clog submersible RAS pumps, each rated at 1,400 gpm, will be installed to match the pump capacity serving Secondary Clarifier No. 3. The project also includes associated installation, electrical, instrumentation, and controls improvements. This project addresses existing capacity issues, age-related issues, and process upgrades. This project is driven by growth, predominantly development in the North Shore area.

- **TP-09: Replace Plant Drain Pump Station 1**

  This project includes rehabilitation of Plant Drain Pump Station No. 1 to address concrete corrosion identified during the condition assessment and replace pumps that are nearing the end of their useful life. The improvements include replacement of the existing pumps with new pumps rated at 500 gpm each, installation of a liner in the wet well to extend the service life of the existing structure, and replacement of the control panel, pump guide rails, and discharge piping within the wet well. A totalizing flow meter and composite sampler will also be installed to improve flow monitoring and sampling capabilities. The project includes associated demolition and temporary piping, electrical, instrumentation, and controls improvements, installation, and additional site work required to complete the rehabilitation. The City may consider constructing a single Plant Drain Pump Station to replace No. 1 and 2. This project addresses existing capacity issues, age-related issues, and process upgrades.

- **TP-10: Replace Plant Drain Pump Station 2**

  This project includes rehabilitation of Plant Drain Pump Station No. 2 to address concrete corrosion identified during the condition assessment and replace pumps that are nearing the end of their useful life. The improvements include replacement of the existing pumps with new pumps rated at 500 gpm each, installation of a liner in the wet well to extend the service life of the existing structure, and replacement of the control panel, pump guide rails, and discharge piping within the wet well. A totalizing flow meter and composite sampler will also be installed to improve flow monitoring and sampling capabilities. The project includes associated demolition and temporary piping, electrical, instrumentation, and controls improvements, installation, and additional site work required to complete the rehabilitation. The City may consider constructing a single Plant Drain Pump Station to replace nos. 1 and 2. This project addresses existing capacity issues, age-related issues, and process upgrades.

- **TP-11: PLANTWIDE: Electrical Conduit and Stand Replacement**

  The project includes plantwide replacement of existing electrical conduit and support stands to improve the reliability and condition of the plant electrical infrastructure. Existing conduit and support stands will be demolished, with existing conductors protected for reuse where feasible. New electrical conduit and support stands will be installed throughout the plant as needed. This project addresses existing age-related issues.

- **TP-12: NETWORK: Equipment Enclosure and Cable Protection Upgrade**

  This project includes plantwide improvements to equipment enclosures and cable protection to improve the reliability and protection of the instrumentation and control system. Improvements include installation of new instrumentation and control cabinets, de-termination and re-termination of existing conductors, and installation of conduit to provide additional protection for cables and conductors. This project addresses existing age-related issues.

- **TP-13: MCC-A Replace and Electric Equip Relocation**

  This project includes replacement of MCC-A and relocation of associated electrical equipment to improve the reliability and maintainability of the plant electrical system. MCC-A currently serves two WAS pumps, one general-purpose sludge pump, a compressor, two heaters, and a hoist. MCC-A will be removed from the plant distribution system, and its remaining loads will be re-fed from nearby electrical sources. PLC-A will also be removed from the Old Controls Building, with its current loads

transferred to another nearby PLC. This will allow the Old Controls Building to be fully utilized as a maintenance and workshop area, consistent with its current use. The project includes replacement of MCC-A and relocation of electrical equipment from the Old Controls Building, along with associated electrical, instrumentation, and controls work. The City is currently evaluating this project. This project addresses existing age-related issues.

- **TP-14: Replace Aeration Basin Diffusers**

  This project includes replacement of the existing diffusers in the three aeration basins and installation of additional diffusers in the second of the two anoxic zones within each basin. The additional diffusers will allow the anoxic zones to function as swing zones, providing greater operational flexibility and treatment capacity. New diffuser supports within the swing zones will be designed to withstand the forces exerted by the existing submersible mixers. This project addresses existing age-related issues.

- **TP-15: Disk Filtration Replacement**

  This project includes replacement of the two existing disk filtration units with new units to improve filtration performance and operational reliability. The new disk filtration units will be sized for a capacity of 6.0 mgd. Plant staff indicated that the existing filters are currently backwashing approximately 30 percent of the time, which is higher than the anticipated 20 percent or less. The project includes removal of the existing disk filtration units, installation of the new units, and associated electrical, instrumentation, and controls improvements. The City will assess the need for the disk filters, which are currently not run all the time, prior to completing this project. This project addresses existing age-related issues.

- **TP-16: Second UV Channel**

  This City recently constructed a second UV disinfection channel which will be used going forward while the existing channel will serve as bypass. This project is to rehabilitate the existing channel and put back into service for UV disinfection to provide sufficient disinfection capacity for the entire plant effluent at peak hour flow conditions of 22.2 mgd. The project includes installation of the new UV equipment and associated electrical, instrumentation, and controls improvements will also be included. This project addresses growth-driven capacity and process constraints, primarily from development in the North Shore Area.

- **TP-17: Effluent Transfer Pump Replacement**

  This project includes replacement of the existing effluent transfer pumps with larger impellers, motors, and associated VFDs to provide sufficient capacity to pump the entire plant effluent flow of 22.2 mgd. Under high river water level conditions, when gravity flow to the Columbia River is not sufficient due to increased headloss, the effluent transfer pumps are required to convey plant effluent. The existing station consists of three vertical propeller pumps, each rated at 4,550 gpm (6.54 mgd), with a total station capacity of 19.6 mgd and a firm capacity of 13.09 mgd. The existing capacity is insufficient to convey the full peak flow, and failure to provide adequate pumping capacity during high river conditions could result in elevated water levels and potential impacts to upstream plant processes. The replacement pumps will be rated at approximately 4,700 gpm and will include associated structural and mechanical modifications, installation, and electrical, instrumentation, and controls improvements. This project addresses existing age-related issues.

- **TP-18: Outfall**

  This project includes construction of a second plant outfall to the Columbia River to provide additional discharge capacity and improve the reliability and flexibility of the plant effluent discharge system. The new outfall will consist of approximately 36-inch corrugated metal pipe with a 16-port, 160-foot diffuser. The project includes mobilization, cleanup, and demobilization; erosion control; additional pipe fittings; trench safety; excavation and backfill; and installation of the new outfall. Associated electrical, instrumentation, and controls improvements will also be included. This project addresses growth-driven capacity and process constraints, primarily from development in the North Shore Area.

- **TP-19: Digester Electrical Building**

  This project includes construction of a new electrical building west of the Digester complex to house electrical equipment serving the digester facilities. The new CMU block electrical building will be designed to meet the hazardous area classification requirements of NFPA 820 and provide a suitable location for electrical equipment serving the digester process. The project includes construction of the new building, electrical equipment and installation, and associated electrical, instrumentation, and controls improvements. This project addresses code compliance issues.

- **TP-20: New Rotary Drum Thickener**

  This project includes construction of a second RDT for WAS thickening to provide redundancy and improve the reliability of the thickening process. The existing RDT has been in service for more than 10 years, and a second unit is recommended to provide additional operational flexibility and backup capacity. The project includes a new RDT, associated polymer blending unit, thickened sludge pump, access platform, stairs, and supporting structures. The project also includes installation, additional site work, and associated electrical, instrumentation, and controls improvements. This project provides reliability and redundancy for the thickening process.

- **TP-21: Primary Clarifier No. 3**

  This project includes construction of a new Primary Clarifier No. 3 to improve primary treatment performance and provide additional process capacity. The additional clarifier will help maintain high BOD_5 and TSS removals during normal flow conditions, allow the aeration basins to operate at lower MLSS concentrations during maximum month organic loadings, and reduce oxygen demands in the BNR process while increasing gas production in the digesters. The new clarifier will be approximately 60 feet in diameter with a 10-foot SWD and will include new internal mechanisms, sludge collection box, concrete foundation and walls, launder structure, aluminum stairs, catwalk framing, grating, and railing. The project also includes new LS pumps, excavation and backfill, installation, additional site work, and associated electrical, instrumentation, and controls improvements. This project addresses growth-driven capacity and process constraints, primarily from development in the North Shore Area.

- **TP-22: Secondary Clarifier No. 4**

  This project includes construction of a new Secondary Clarifier No. 4 to provide additional secondary treatment capacity and accommodate future growth. The new clarifier will be approximately 75 feet in diameter with a 15-foot SWD and will include new internal mechanisms, sludge collection box, effluent box, launder structure, concrete foundation and walls, aluminum grating, stairs, platforms, and railings. The project also includes new RAS and WAS pumps and approximately 36-inch piping to connect the new clarifier to the existing system. Associated excavation and backfill, installation,

additional site work, and electrical, instrumentation, and controls improvements will also be included. This project addresses growth-driven capacity and process constraints, primarily from development in the North Shore Area.

- **TP-23: Centrifugal Blower Replacement**

  This project includes replacement of the two existing 150 hp multistage centrifugal blowers with two new 150 hp HST blowers to provide sufficient aeration capacity for future peak oxygen demands. The existing centrifugal blowers will be removed and replaced with two HST blowers (Model HST 10-3600-1-U150-48). It is assumed that all four blowers will need to operate simultaneously to meet the projected 2045 peak oxygen demand. The project also includes associated installation and electrical, instrumentation, and controls improvements. The City is currently working on a project to increase capacity of blowers 3 and 4. This project addresses existing capacity issues and process upgrades.

- **TP-24: Biosolids Dryer Replacement**

  This project includes replacement of the existing sludge dryer with new sludge drying equipment to maintain reliable biosolids processing as the existing equipment approaches the end of its useful life. The existing sludge dryer was installed in 2014 and is more than 10 years old. Typical sludge drying equipment may require a major overhaul within approximately 10 years, and the City should plan for potential replacement within the next 10 to 15 years. However, a firm recommendation for replacement is not made as part of this 2025 GSP, because regulations related to biosolids, particularly per- and polyfluoroalkyl substances (PFAS), continue to evolve and may affect future biosolids management requirements. The project includes new sludge belt drying equipment (BDS-10) and associated components, partial demolition and expansion of the existing building, additional site work, installation, and associated electrical, instrumentation, and controls improvements. The City has contracted for an evaluation of the dryer and alternatives for solids handling. This project addresses growth-driven capacity and process constraints, primarily from development in the North Shore Area.

- **TP-25: Biofilter Replacement**

  This project includes replacement of the existing biofilters with new biofilters to maintain reliable odor control as the existing tertiary filters approach the end of their useful life. The new biofilter odor control system will be designed for approximately 10,000 cubic feet per minute and will include associated ductwork, sump pumps, water panels, and other necessary components. The project also includes construction of a structural pad, installation, and associated electrical, instrumentation, and controls improvements. Prior to completion of this project, the City may consider replacing the biofilters with trickling filters which have a smaller footprint. This project addresses growth-driven capacity and process constraints, primarily from development in the North Shore Area.

7.4.2 Recommended Annual WWTF Repair and Replacement Program

The City has established an annual maintenance program as part of its CIP to maintain and improve the WWTF. These improvements will help the City address aging infrastructure, maintain reliable operation of the WWTF, and extend the useful life of existing assets. Continued investment in these projects will also help the City address maintenance needs as they arise and support the long-term goals of the GSP. Table 7.4 shows a summary of the City's annual repair and replacement program for the WWTF.

Table 7.4 Recommended Annual Repair and Replacement Program for the WWTF

Project ID	Improvement Type	Project Name	Description
R-03	R&R	Miscellaneous WWTF Projects	This project includes miscellaneous improvements at the existing WWTF to address operational, maintenance, and reliability needs. Improvements may include replacement or rehabilitation of process equipment, electrical and controls upgrades, instrumentation, piping, structural improvements, and other equipment or site improvements as needed. These improvements will help maintain reliable plant operation and address deficiencies that may be identified through regular operation, maintenance, and future condition assessments.

7.4.3 Recommended General WWTF Projects

General project recommendations for the WWTF include the following studies and assessments:

- **G-05: Electrical System Arc Flash Study**

  No arc flash labels were found on the plant's distribution equipment, and the owner confirmed that an Electrical System Study is not maintained. Carollo recommends completing this study as soon as possible and applying arc flash labels in accordance with Occupational Safety and Health Administration requirements to ensure worker safety. This project should be completed in the near term to address the identified safety concern.

- **G-06: Hazardous Area Classification Study**

  For regulatory compliance, and safety, Carollo recommends conducting a hazardous area classification study per NFPA 820 and upgrading any areas that do not meet code. This project should be completed in the near term to address the identified safety concern.

- **G-07: Flood Risk Assessment**

  Carollo recommends a comprehensive flood risk analysis for all major electrical and control systems to assess vulnerabilities and strengthen flood resilience.

7.4.4 Additional Recommendations

The following sections present additional recommendations, some of which can be performed by City staff, such as sampling, and therefore are not included in the CIP.

7.4.4.1 Additional Monitoring of Plant Influent

Carollo recommends that the City expand monitoring of the plant influent wastewater to include TKN, NH4 and alkalinity.

7.4.4.2 Mixed Liquor Settling Characteristics

Historical SVI data (Appendix I - *Evaluation of the Wastewater Treatment Facility Report*) shows that poor settling of the mixed liquor occurs during the late winter and spring each year. During these bulking episodes, the SVI can increase to values between 250 and 350. These episodes of poor settling present a significant risk of operational upset since peak wet weather flows often occur during this same period.

Carollo recommends that the microorganisms and probable causes for the bulking episodes be found, and methods evaluated for reducing or stopping the bulking.

7.4.4.3 Supplemental Alkalinity

The treatment plant currently uses magnesium hydroxide to supplement the natural wastewater alkalinity so that sufficient alkalinity is present to allow nitrification in the activated sludge process. Essentially complete nitrification is needed to meet the plant's NPDES permit. While magnesium hydroxide is often a desirable chemical for adding alkalinity, it does contribute to the formation of struvite scale in sludge processes, piping, and appurtenances. Struvite is a sparingly soluble mineral that is composed of ammonium, magnesium, and phosphate (NH4MgPO4·6H2O). Often magnesium is the element that limits the formation of struvite.

The alkalinity (and oxygen) consumed by the nitrification process can be partially recovered by denitrification. Denitrification (aka nitrogen removal) converts the nitrate formed by the nitrification process into nitrogen gas which then escapes from the water. Although denitrification is not required by the City's NPDES permit and is not likely to be required in the future, it can be used to reduce the need for supplemental alkalinity. There are several factors to be considered, but the City may be able to enhance denitrification through operational controls of the treatment process.

Carollo recommends that the City investigate switching to an alternative chemical to provide the needed alkalinity for the nitrification process to reduce the formation of struvite scaling. In addition, the City should evaluate alternative strategies for enhancing denitrification with the dual goals of reducing the need for supplemental alkalinity and reducing oxygen demands.

7.4.4.4 Potentially Toxic Compounds

During calibration of the BioWin model matching predicted effluent 5-day carbonaceous biological oxygen demand ($cBOD_5$) and NH_4 concentrations with measured values required reducing kinetic coefficients for both types of reactions. This suggests the presence in the municipal wastewater of one or more compounds that are toxic to both ordinary heterotrophic organisms and nitrifying bacteria. Semiconductor manufacturing is known to use compounds that are toxic to the bacteria in activated processes, so it is possible that the biological process at the treatment plant experiences inhibition. The intermittent recycling of ammonia with the dewatering centrate is responsible for intermittently high effluent ammonia concentrations but it does not appear to be entirely responsible for the elevated effluent ammonia concentrations.

Carollo recommends both evaluation of the biological reaction rates and discussions with the industrial customers are called for to proactively identify these toxins and develop methods or procedures for minimizing their presence in the raw wastewater.

7.4.4.5 Selector Design and Densified Activated Sludge

Over the course of the last few decades the design of biological selectors and various methods of achieving densified activated sludge has advanced considerably. A densified activated sludge has been operationally defined as one with larger, denser floc particles that settle faster. Mixed liquor settling can be improved through the use of improved selector design, operational controls, the use of cyclones, and mobile-biofilm carriers.

In conjunction with an evaluation of bulking at the plant, Carollo recommends that the City also investigate the potential for implementing one or a combination of the methods for achieving a densified activated sludge. Ideally this should be completed before the next design and construction project at the wastewater treatment facility.

CHAPTER 8 OPERATION AND MAINTENANCE

8.1 Introduction

This chapter provides an overview of the City Wastewater Utility organization, staffing, and O&M program. This chapter documents existing practices and identifies changes that may improve system O&M.

8.2 Organization Structure

The City Public Works Department is organized as shown in Figure 8.1 and is managed by Scott Collins. The Utility group is managed by Rob Charles. There are various groups relevant to this Plan including the WWTF, and a combined group with responsibilities pertaining to sewer and water disciplines. The WWTF is supervised by Kyle Stephens.

Note, Stormwater and Sewer/Water groups assist each other during abnormal conditions, such as cleanup after a major storm or repairs requiring specialized staff and equipment.

The Capital Engineering group, managed by James Carothers, leads major wastewater capital projects, such as new lift stations. The Utility group leads lift station retrofits, repair and replacement projects, and operations and maintenance projects.

8.3 Staffing

8.3.1 Maintenance and Operations Staff

The City has recently separated the water and sewer groups into two divisions. Staff under the sewer division work on sewer mains including the STE systems. They are also in charge of making sewer system repairs. Operational staff work full shifts on weekdays and there is always at least one person on duty during the day on weekends. There is always at least one person on call in the evenings to address emergencies.

No additional positions are sought although as of October 2025, there is one vacant water/sewer staff position the City is seeking to fill. There is also a vacant water/sewer supervisor position in the budget that has remained unfilled for several years.

8.3.2 Wastewater Utility Engineering Staff

WWTF staff work primarily on the treatment plant and are also in charge of the sewer lift stations in the conveyance system. The City's WWTF NPDES permit requires a Washington Wastewater Treatment Facility Operator (WWTFO) Class IV certified operator to be responsible for the plant at all times. Table 8.1 lists WWTF staff certifications. The City has two Class IV operators in the event that one is unavailable. The NPDES permit does not require anyone other than the responsible operator(s) to hold a certification, but the City requires all operators to have a Class I certification or have the ability to acquire one within six months of employment.

Table 8.1 Wastewater Utility Operator Certifications

Name	Position	Certification
Kyle Stephens	WWTF Manager	WWTFO Class IV
Jacob Taylor	WWTF Operator Lead	WWTFO Class IV
Ken Murray	WWTF Operator	WWTFO Class I
Steve Carroll	WWTF Operator	WWTFO Class II
Joe Calderone	WWTF Operator	WWTFO Class I
Matt Golphenee	WWTF Operator	WWTFO Class II
Casey Chase	WWTF Operator	WWTFO Class I
Aaron Eyler	WWTF Operator	WWTFO Class I
Angelica Vazquez	WWTF Laboratory Analyst	WWTFO Class I

8.4 Records

For O&M record keeping, the WWTF uses a Computerized Maintenance Management System (CMMS) called Fiix, which is a Rockwell software, data-tracking Excel spreadsheets, handwritten logbooks, and an electronic repository of equipment documentation. The WWTF staff have a "WWTF" shared drive at the plant, which is a reference library of construction documents, O&M documentation for individual equipment, training materials, etc.

The STEP systems tanks are set using iAUDIT on an iPad. Once the tank set is complete and the City accepts the system, the data is entered into Tyler to track the asset and its 8-year preventative maintenance schedule. An as-built drawing is also created and saved to the shared drive for future reference. The City currently uses iAUDIT to document work and plans to move to the same software as the WWTF in the future to better track current activities. The implementation plan is to add new activities to the software as it comes up.

City staff and third-party customer service representatives receive utility-related calls made by system users, and information is dispatched to the appropriate utility staff.

8.5 Current Operation and Maintenance Program

8.5.1 Maintenance

8.5.1.1 Lift Station Inspection and Maintenance

Lift station inspection and maintenance is completed by City WWTF Operators listed in Table 8.1.

For all lift stations, pump run hours are closely tracked to identify potential issues. Additionally, periodic maintenance is completed. Table 8.2 presents each activity and frequency staff completes for the sewer lift stations.

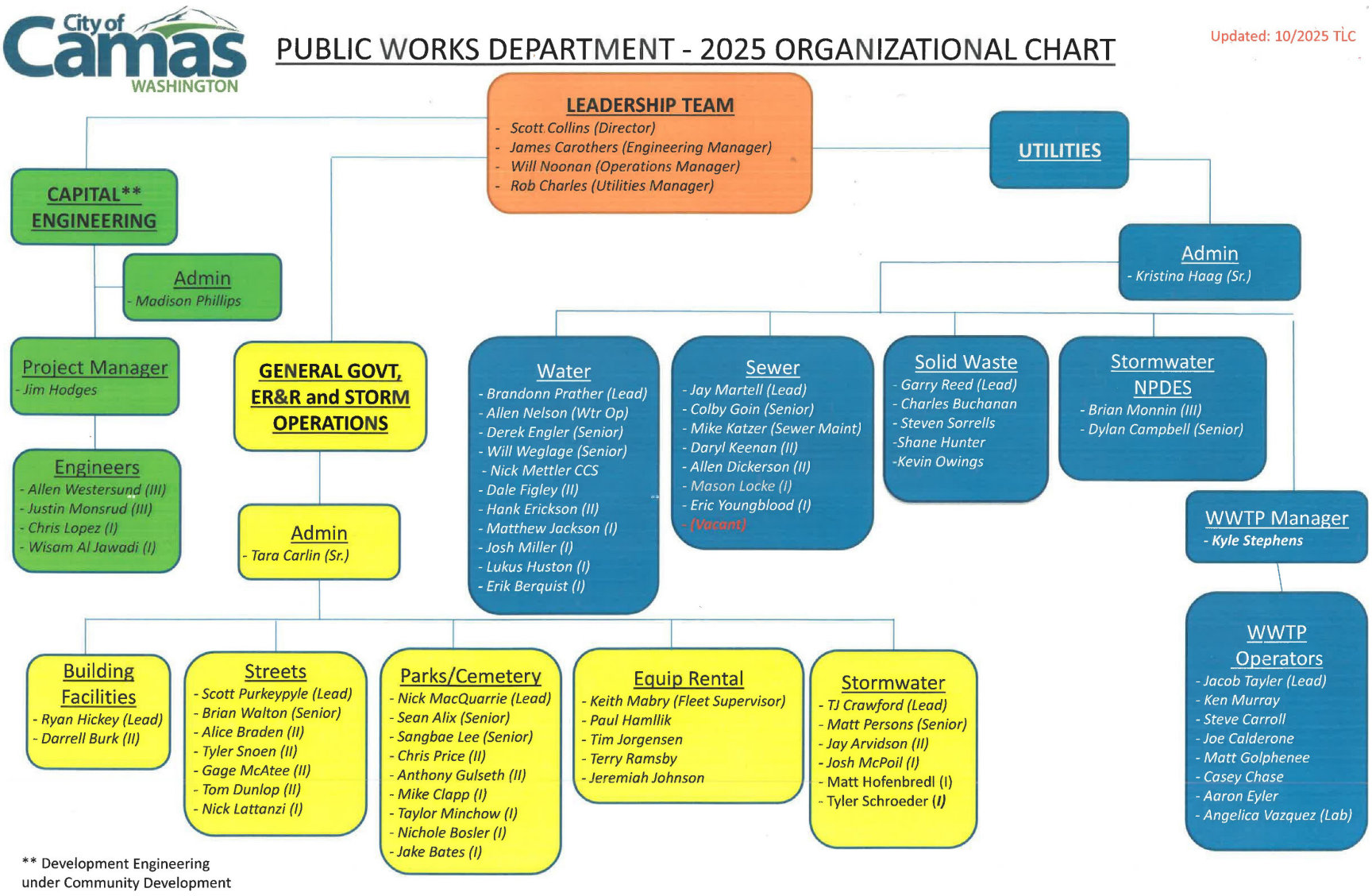


Figure 8 1 Organization Structure Chart

Table 8.2 Summary of WWTF and Sewer Lift Station Maintenance

Frequency	Component	Activity
Daily	SCADA	Review lift station alarm history. Check pump/level/pressure/flow trend charts.
	Record Keeping	Update pump runtime tracking spreadsheets. Review updated sheets for anomalies. Submit requests for any necessary maintenance via CMMS.
Weekly	Controller	Check for active alarms. Verify pumps, level indicator, and other controller-monitored equipment is operating normally in "AUTO". Document pump run hours. Verify no tripped breakers.
	Pumps	Run pumps in hand to verify proper operation. Inspect for unusual sounds, vibration, or leaks.
	Generator Set	Check ATS status and verify there are no faults and system is ready for emergency operation. Check generator fuel. Check generator for leaks or signs of mechanical failure. Check generator control paned for faults. Generator auto-exercises on Thursdays.
	Dry Well	Verify dry well is dry. Verify sump pump or floor drain is functioning properly. When running pumps, verify check valves open/close. Verify force main pressure (static and pumping). Check for piping leaks.
	Wet Well	Inspect influent flow, verifying it is not abnormally high or low, color, odor, etc. Inspect for excess debris or grease accumulation. If able, break up FOG and pump out. Verify level sensors are free of debris or obstructions, clean, as necessary.
	Odor Control System	Verify proper operation and odor level. Inspect for unusual sounds, vibration, odor, and leaks.
	Surge Tank	Verify proper operation, checking controller for any faults.
	Grounds	Monitor physical appearance of station. Remove any accumulated trash or debris. Monitor and control vegetation. Monitor for odors emanating from station.
Quarterly	Pumps	Perform drawdown testing for each pump.
	Record Keeping	Update pump tracking spreadsheet with draw down test results.
	Odor Control System	Change out carbon media at Lacamas Meadows Lift Station. In depth check of biofilter systems.
Bi-Annually	Gas Sensors	Calibrate lower explosive limit meters.
	Grounds	Herbicide application, where necessary.
	Odor Control System	Change out odor control media on carbon absorber units.
	Isolation Valves	Exercise isolation valves at all lift stations to maintain operability.
Annually	Generator	Third-party preventative maintenance.
	Pumps	Pull pumps for visual inspection.
	Main Pump Station Pumps	Third-party preventative maintenance.
	Piping	Winterize any water piping.
	Odor Control System	Winterize biofilters prior to freezing weather. Turn off odor control units that are not operated during winter months. Turn on odor control units that are operated during summer months.
	Wet Well	Cleaning of any wet wells that have accumulated excessive FOG/floatables/debris.
Every 3 Years	Pumps	Third-party pump inspections and testing.

8.5.1.2 Pipeline Video Inspection

A CCTV inspection of the gravity main by push camera was completed in 2013. For future pipe and manhole inspections, the City purchased a CCTV van in 2024 and is currently televising gravity mains in the system. The City uses Granite data management software along with GIS to manage the CCTV data. The City's goal is to CCTV all 45 miles of gravity pipe over the next two years. Once the baseline data is collected and hot spots are identified a maintenance schedule can be developed. Inspections will be performed in accordance with all industry standards and best practices.

8.5.1.3 Manhole Inspection and Maintenance

The City inspects manholes on an as-needed basis. The City may choose to implement their own standards for manhole inspections, rather than rely on the National Association of Sewer Service Companies standards.

8.5.1.4 Root Cutting

Root maintenance is completed as needed. It is anticipated that additional root cutting tasks may be identified through contracted video inspection on an as needed basis.

8.5.1.5 Grease Removal

The City educates customers on FOG as part of their general education program. The City is also using the FOG Best Management Practices platform to administer and oversee ongoing FOG management and handling practices. Through video inspection, the City has identified pipes with heavy FOG. These hot spots are shown in Figure 8.2.

8.5.1.6 Hydraulic Line Cleaning

Flushing is done every month for flat areas in the system. Where normal flushing is insufficient to address known problem areas, pipe jetting is completed either as preventative maintenance or on an as needed basis.

8.5.1.7 Repair Sewers

Point repairs are conducted to address pipe deficiencies identified through CCTV inspection and are undertaken as required and as resources allow. Work may be completed by City staff or through a small works type contract.

8.5.1.8 STEP Maintenance

The City owns and maintains the STEP system. Currently, the City conducts solids pumping from about 5,000 STEP tanks annually through city staff and contractors. Additionally, it maintains the STEP tanks, pumps, and telemetry concurrently. The City has an active STEP tank education program with customers. It is recommended to conduct a STEP tank condition assessment to identify repair and replacement needs including inspection of the STEP tank and connections to the STEP tank as well as an inspection of the proper function of the STEP tank. From this condition assessment, a STEP repair and replacement program should be developed and included in the City's CIP. Current STEP tank replacement costs are about $11,000 per STEP tank to be installed by a contractor.

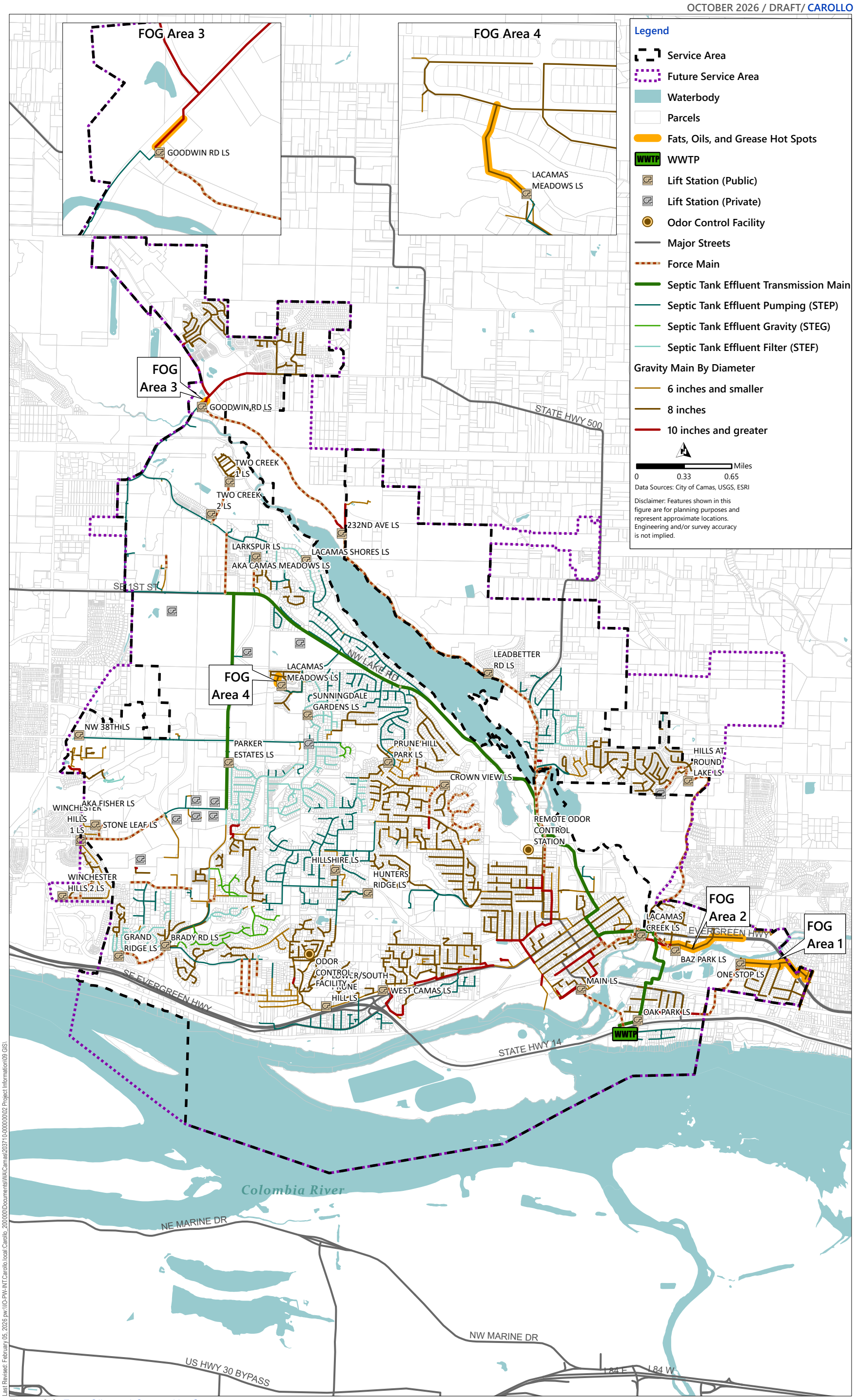


Figure 8.2 Fats, Oils, and Grease Hot Spots

8.5.2 Operations

The City operations group are generally divided into treatment, pump stations, and pipes. The City operators at the WWTF conduct various activities, including monitoring and adjusting treatment parameters, conducting water quality measurements and other related lab tests, and managing the City's Class A, Exceptional Quality Biosolids program. The WWTFOs are also responsible for monitoring the pump stations throughout the collection system. The treatment facility operators monitor the sanitary pump stations while the water/sewer staff monitor the septic tank effluent systems throughout the City. Water/sewer staff are responsible for pipe activities associated with operating the collection system, including repairing pipelines. City staff also lead operations during emergencies or natural disasters. Emergency operations include preparing and planning for emergencies and conducting drills.

Individual staff duties and operations include administration tasks, training, and tool maintenance. Staff have their own administrative duties to complete weekly as well as meetings to attend in addition to their normal operator duties. They are also in charge of maintaining and cleaning their tools and equipment. The City values the importance of training staff; thus, staff will also allocate time annually to training and conferences as a means to further develop their skills.

8.6 Future Operation and Maintenance Needs

The WWTF plans to expand their internal maintenance capabilities while reducing dependency on third-party maintenance contracting. The WWTF is working to develop deeper pump, clarifier and instrumentation inspection and maintenance skills. The WWTF plans to constantly expand and improve their usage of the CMMS and its work ordering and tracking capabilities. Furthermore, the WWTF has an ongoing effort to develop an extensive set of Standard Operating Procedures for common operations, maintenance, safety, and administrative tasks.

As stated above, the City purchased a CCTV van to complete video inspection of the collection system and is developing a hydraulic line cleaning program while completing the video inspection. The hydraulic line cleaning program can be completed by the City or third-party contractors. With this inspection and cleaning program, it is expected that other repair needs will be identified for roots, FOG, and point repairs.

Currently the City's staffing focus is to fill the current vacant water/sewer staff position. In the future, to aid in the development of non-capital utility projects, the City would like to add a staff civil engineer and an electrician to the utility team.

CHAPTER 9 CAPITAL IMPROVEMENT PLAN

9.1 Introduction

This chapter summarizes the Capital Improvement Plan (CIP). The CIP includes projects needed to accommodate growth, repair and replace aged infrastructure, and attain level of service goals. The CIP is arranged in terms of short-term (2027 to 2036) and long-term (2037 to 2045) periods. Projects are grouped into pipelines, lift stations, STEP mains, Rehabilitation and Replacement (R&R), treatment plant, and general types of infrastructure work. The CIP consists of the cost estimates and schedules for the recommended improvements.

The following sections present cost estimating assumptions, recommended projects, estimated costs for each project, and a summary of the CIP.

9.2 Cost Estimating Assumptions

Cost estimates were developed for each of the recommended projects in the CIP for budgeting purposes. The CIP costs are planning level estimates only and should be refined during pre-design of the projects as final costs of a project with depend on actual labor and materials costs, competitive market conditions, final project scope, implementation schedule, and other variable factors. The CIP cost estimates presented in this GSP do not include future inflation and should be reevaluated and updated as part of future CIP updates to account for changes in construction costs and inflation.

All costs are given in 2025 dollars. The Handy-Whitman Index for Water Utility Construction in the Pacific Region for January 2025 is 1,401. The CIP cost estimates in this chapter are Class 5 (budget-level estimates and has an expected accuracy range of -50 percent to +100 percent.

9.2.1 Conveyance Cost Assumption

This section provides the CIP for pipelines, lift stations, and STEP system. Cost estimates for conveyance infrastructure represent total project cost including materials, construction, engineering, legal, and administrative costs. Costs were represented as unit costs, as described in subsequent sections. Costs are based on costs provided by the City or similar projects completed by Carollo. The following are the total mark-ups to direct costs: 30 percent for construction contingency, 25 percent for general conditions and overhead, 20 percent for engineering, legal, and design costs (ELA), 5 percent for City administration, and 8.8 percent (applied to 65 percent of the construction cost) to account for Camas' sales tax.

9.2.1.1 Total Conveyance Project Capital Improvement Cost

The costs presented in this Plan are high-level planning costs to help the City in making financial decisions.

As shown in the following sample calculation of the conveyance projects capital improvement cost, the total cost of all project contingencies (construction and planning) and allied costs (engineering services, construction management, project administration and sales tax) is 106 percent of the baseline project cost.

Example:

Baseline Project Cost	**$1,000,000**
Construction Management Contingency (30%)	$300,000
Construction Cost	**$1,300,000**
General Conditions and Overhead (25%)	$325,000
Engineering, Legal, Design (20%)	$260,000
Administration (5%)	$65,000
Sales Tax (8.8%)	$114,400
Total Capital Improvement Cost	**$2,064,400**

9.2.1.2 Gravity Pipeline Unit Costs

For gravity pipes, baseline project costs are calculated by multiplying the estimated new pipe length by a proposed unit cost. All of the known pipelines involved in this CIP are between 8-inch and 36-inch. Pipeline unit costs are available in Table 9.1, broken down by pipeline diameter. These unit costs were used to estimate the baseline construction costs. The unit costs assume open-trench construction in improved areas. Costs include pavement cutting, excavation, hauling, shoring, pipe materials and installation, backfill material and installation, and pavement replacement.

Table 9.1 Pipeline Unit Costs

Pipe Size (inches)	Pipe Unit Cost(1) ($/linear foot)
8	$236
10	$268
12	$300
15	$378
16	$404
18	$443
20	$481
21	$505
24	$575
27	$736
30	$897
36	$1,203

Notes:
(1) Unit costs represent baseline construction costs and do not include additional cost factors for contingency, general conditions and overhead, engineering/planning, and City admin.

9.2.1.3 Lift Station Unit Costs

Lift station unit costs were based on costs of similar projects Carollo has completed in the past. Lift station upgrades include repair and replacement of the station itself and force main cleaning. LS telemetry includes upgrading or updating the SCADA system at the lift stations.

9.2.1.4 Force and STEP Main Unit Costs

Unit costs for force and STEP mains were based on the gravity pipeline unit costs presented in Table 9.1. These costs were used as a basis for estimating force and STEP main improvements, as the installation costs are generally similar to those of gravity pipelines of comparable diameter. Additional costs associated with appurtenances or other project-specific requirements were considered separately, where applicable.

9.2.2 Treatment Cost Assumptions

Cost estimates for treatment projects include 30 percent for construction contingency, 25 percent for general conditions and overhead, 25 percent for ELA, 5 percent for City administration, and 8.8 percent (applied to 65 percent of the construction cost) to account for Camas' sales tax.

9.2.2.1 Total Treatment Project Capital Improvement Cost

The costs presented in this GSP are high-level planning costs to help the City in making financial decisions.

As shown in the following sample calculation of the capital improvement cost, the total cost of all project contingencies (construction and planning) and allied costs (engineering services, construction management, and project administration) is 113 percent of the baseline project cost.

Example:

Baseline Project Cost	**$1,000,000**
Overall Construction Adjustment Factor (30%)	$300,000
Construction Cost	**$1,300,000**
General Conditions and Overhead (25%)	$325,000
Engineering, Legal, Design (25%)	$325,000
City Admin (5%)	$65,000
Sales Tax (8.8%)	$114,400
Total Capital Improvement Cost	**$2,129,400**

9.3 Capital Improvement Plan

As discussed, the CIPs are prioritized based on their urgency and risk to mitigate deficient systems. The timing for implementing these improvement projects is based on the affordability and urgency of the project. It is recommended that the City monitor growth and adjust project implementation accordingly.

9.3.1 Planning Periods

The following planning periods are used to define timing and prioritization of projects:

- **Short-term (2027 to 2035).** Proposed facilities determined to be a high priority.
- **Long-term (2036 to 2045).** Proposed facilities determined to be a low priority or proposed facilities to service major growth areas to be developed in the long-term.

The proposed project timing was based on existing deficiencies, City input, future growth, and the timing of other recommended improvements. Short-term projects generally include improvements needed to address existing deficiencies, projects identified by the City as a high priority, and general improvement projects such as flow monitoring and I/I studies. Some of these studies are scheduled in the short-term because the results may be used to further evaluate the need, timing, or scope of other recommended improvements, including pipeline capacity projects.

Long-term projects generally include improvements needed to address future growth and projects that are dependent on other improvements being completed first. Some projects that show deficiencies under future conditions are scheduled for the long-term because additional development is needed before the deficiency is expected to occur or because upstream improvements should be completed first. Project timing may be adjusted as the results of monitoring and other studies become available and as development and system conditions change.

9.3.2 Project Types

Projects are categorized by type. These types include the following:

- "Growth"
- "Upgrade"
- "R&R"
- "General"

Growth projects are focused on updating infrastructure to address the needs of expanding. Upgrade projects are focused on upgrading infrastructure to address level of service concerns. R&R projects are focused on renewing or replacing infrastructure in poor condition. General projects include studies and assessments. The types aid the City in determining the appropriate funding sources.

9.3.3 Project and Program Naming

An individual Project Sheet was generated for each CIP project and includes project identifiers, description, costs, project type, and comments to aid in future implementation. Project are separated into the following categories:

- "P" = Gravity and Force Main
- "LS" = Lift Station.
- "G" = General.
- "S" = STEP.
- "TP" = Treatment Plant.

A summary of all CIP projects by facility types and project type is shown in Table 9.2. A summary of costs by project category and type is presented at the end of the chapter.

9.4 Lift Station Projects

Lift stations in the CIP are recommended to be upgraded to provide pump redundancy and address PWWF greater than firm capacity during existing and future conditions. Some lift stations also have PWWF that exceeds their total pumping capacity and will require additional capacity improvements. Additional project details can be found in Chapter 6 Collection System and in the Capital Improvement Project Sheets in Appendix L.

- **LS-01: Lower/South Prune Hill LS Improvements**
  - **Description**: Upgrade the Lower/South Prune Hill LS to increase firm capacity from 0.86 mgd to 2.93 mgd, including an allowance for odor control improvements.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $5,381,000.
  - **Year:** 2033 and 2034. The timing should follow completion of G-02 (Basin 5-1-2 flow monitoring) so that the I/I evaluation can inform the need and scope of the proposed improvements. This project is also aligned with the P-01 (NW 6th Place West Improvements) and P-07 (Lower/South Prune Hill Force Main Improvements).
- **LS-02: West Camas LS Improvements**
  - **Description**: Upgrade West Camas LS to increase firm capacity from 1.44 mgd to 3.24 mgd, including an allowance for removal of existing asbestos cement force main.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $5,204,000.
  - **Year:** 2031. The timing of this project should follow completion of LS-01 (Main LS improvements), G-02 (Basin 5-1-2 flow monitoring), P-01 (NW 6th Place West Improvements), P-02 (NW 6th Place East Improvements) and P-07 (Lower/South Prune Hill Force Main Improvements). The additional downstream capacity provided by Main LS improvements should be in place before increasing pumping capacity at West Camas LS, and the G-02 I/I evaluation may reduce the scope or timing of the proposed improvements.
- **LS-03: Crown View LS Improvements**
  - **Description**: Upgrade the Crown View LS to increase firm capacity from 0.32 mgd to 0.85 mgd.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $4,290,000.
  - **Year:** 2035. The timing of this project should follow completion of G-01 (Basin 5-1-2 flow monitoring), P-05 (NW Fargo Street, NW 18th Loop, and NW 18th Avenue Improvements), and P-11 (Division Street Improvements) so that the flow monitoring and I/I evaluation can inform the need and scope of the proposed improvements. Upstream I/I reduction may reduce the scope or timing of this project and downstream improvements, and the downstream improvements should be completed first to provide adequate capacity for increased flows from the Crown View LS.

- **LS-04: Lacamas Creek Lift Station Improvements**
  - **Description**: Replace the two existing pumps at the Lacamas Creek LS to increase firm capacity from 1.37 mgd to 2.13 mgd.
  - **Reasoning:** Growth.
  - **Estimated Cost:** $1,222,000.
  - **Year:** 2045. The timing of this project is primarily driven by future flows from the Hills at Round Lake service area and should be done following the completion of LS-09 (Hills at Round Lake LS Improvements) and P-13 (SE 283rd Avenue to NE Woodburn Drive Extension). The pump replacement should follow completion of the Hills at Round Lake LS improvements to provide adequate downstream capacity and avoid creating a downstream capacity constraint.
- **LS-05: Main Lift Station Improvements**
  - **Description**: Construct a new wet well and associated pumping facilities with a minimum firm capacity of 21 mgd. Evaluate long-term conveyance and pumping options, including the existing 18-inch force main. Include a $150,000 planning-level allowance for odor control.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $10,640,000.
  - **Year:** 2040. The timing of this project depends on implementation of the recommended improvements to upstream collection system. As upstream capacity deficiencies are addressed and additional flows are conveyed through the collection system, the resulting flows will reach Main LS and increase demands on the station. The station upgrade should be evaluated following implementation of the upstream improvements to confirm the need and timing of the proposed upgrades.
- **LS-06: Goodwin Road Lift Station Improvements**
  - **Description**: Add a third pump to the Goodwin Rd LS to increase firm capacity from 0.49 mgd to 0.71 mgd.
  - **Reasoning:** Capacity Upgrade/Growth.
  - **Estimated Cost:** $502,000.
  - **Year:** 2043. The timing of this project is primarily driven by future development in the North Shore area. An additional pump should be added to the available third pump pad as development occurs, and flows increase within the upstream service area.
- **LS-07: 232nd Avenue Lift Station Improvements**
  - **Description**: Add a third pump to 232nd Avenue LS to increase firm capacity from 0.53 mgd to 2.60 mgd.
  - **Reasoning:** Growth.
  - **Estimated Cost:** $502,000.
  - **Year:** 2042. The timing of this project is primarily driven by future development within the 232nd Avenue LS service area, additional flows from the upstream Goodwin Road LS, and projected large user flows. The additional pump should be added to the available third pump pad as development occurs and flows increase within the service area.

- **LS-08: Leadbetter Road Lift Station Improvements**
  - **Description**: Activate the existing 8-inch dual force main and add a third pump to the available third pump pad at Leadbetter Road LS in the short-term. Upgrade the three existing pumps for buildout conditions in the long-term.
  - **Reasoning:** Growth.
  - **Estimated Cost:** $2,379,000.
  - **Year:** 2041. The long-term pump upgrades are primarily driven by future development, additional flows from the upstream Goodwin Rd and 232nd Avenue LS service areas, and a future airport connection. This project should align with P-10 (Leadbetter Road LS Dual Force Main Improvements) and P-12 (SE Everett Road to Leadbetter Road Extension). The long-term improvements should be implemented as development occurs and additional flows increase demands at the Leadbetter Road LS.
- **LS-09: Hills at Round Lake Lift Station Improvements**
  - **Description**: Replace the two existing pumps at the Hills at Round Lake LS to increase firm capacity from 0.96 mgd to 1.21 mgd.
  - **Reasoning:** Growth.
  - **Estimated Cost:** $1,504,000.
  - **Year:** 2044. The timing of this project is primarily driven by future development in the Hills at Round Lake service area and should be align with P-13 (SE 283rd Avenue to NE Woodburn Drive Extension). The pump replacement should be completed as development occurs and flows increase within the service area.

9.5 STEP Projects

The hydraulic model included the STEP main trunklines due to limited information available for the remaining components of the STEP system. Based on the model results, an improvement project was developed for the STEP main trunkline where deficiencies were identified. The individual STEP system components, including STEP tanks and associated infrastructure, could not be fully evaluated due to limited information. Future CIP projects should include monitoring, modeling, and condition assessments to collect additional information and support a more comprehensive evaluation of the STEP system.

- **S-01: NW Parker Street to NW Lake Road STEP Main**
  - **Description**: Install parallel STEP mains consisting of:
    - 14,002 LF of 30-inch pipe from Node 9 to Node J176 and;
    - 4,061 LF of 30-inch pipe from Node 13 to Node 15.
  - **Reasoning:** Growth.
  - **Estimated Cost:** $32,764,000.
  - **Year:** 2038. The timing of this project is primarily driven by future flows from the STEP basin area. The project should be implemented as development occurs and flows increase within the STEP basin to provide sufficient conveyance capacity for future system conditions. The parallel configuration will also provide operational flexibility by allowing one STEP main to remain in service while the other is taken out of service for maintenance and can provide additional conveyance capacity during peak wet weather conditions.

9.6 Pipeline Projects

CIP pipeline projects were determined from the results of a skeletonized model evaluation. Most pipeline projects address level of service concerns, and some are combined with growth and level of service projects.

- **P-01: NW 6th Place West Improvements**
  - **Description**:
    - Upsize 422 LF of 8-inch pipe to 12-inch;
    - 809 LF of 8-inch pipe to 15-inch, and;
    - 472 LF of 12-inch pipe to 18-inch gravity pipe.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $1,298,000.
  - **Year:** 2034. The timing of this project should follow completion of G-02 (flow monitoring in Basin 5-1-2). The flow monitoring and I/I evaluation may reduce the scope or timing of the proposed improvements.
- **P-02: NW 6th Place East Improvements**
  - **Description**:
    - Upsize 682 LF of 8-inch pipe to 21-inch gravity pipe.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $695,000.
  - **Year:** 2032. The timing of this project should follow completion of P-01 and LS-01 improvements. The proposed improvements should be evaluated after these projects are completed to confirm the need and scope of the upsizing.
- **P-03: NW 6th Place Avenue West Improvements**
  - **Description:**
    - Upsize 1,943 LF of 12-inch pipe to 24-inch, and;
    - 592 LF of 12-inch pipe to 21-inch gravity pipe.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $2,869,000.
  - **Year:** 2031. The timing of this project should follow completion of LS-02 (West Camas LS). The proposed improvements should be evaluated after the lift station upgrade is completed to confirm the need and scope of the downstream upsizing.

- **P-04: NW 6th Place Avenue East Improvements**
  - **Description:**
    - Upsize 446 LF of pipe between MHs 3-1-1 and 5-8-1 from 18- to 27-inch;
    - 260 LF of pipe between MHs 5-8-1 and 5-1-12 from 21- to 30-inch;
    - 402 LF of pipe between MHs 2-1-1 and 5-1-12 from 12- to 30-inch;
    - 545 LF between MHs 5-1-12 and manhole 5-1-11 from 21- to 36-inch;
    - 947 LF between MHs 5-1-10 and 5-1-7 from 24- to 36-inch;
    - 1,126 LF of pipe between MHs 5-1-8 and 5-1-2 from 21- to 36-inch, and;
    - 34 LF between MHs 5-1-2 and 5-1-1 from 24- to 36-inch.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $8,329,000.
  - **Year:** 2030. The timing of this project should follow completion of the upstream lift station, force main, and gravity sewer improvements. The proposed improvements should be evaluated after the upstream projects are completed to confirm the remaining need and scope.
- **P-05: NW Fargo, NW 18th Loop, NW 18th Avenue Improvements**
  - **Description:**
    - Upsize 2,744 LF of 8-inch pipe to 15-inch.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $2,099,000.
  - **Year:** 2028. The timing of this project should follow completion of G-02 flow monitoring study in Basin 5-1-2 and LS-03 (Crown View LS) improvements. The proposed improvements should be evaluated after these projects are completed to confirm the need and scope of the upsizing.
- **P-06: NE Garfield Street to NE 15th Avenue to NE Franklin Street along the Mill Ditch Improvements**
  - **Description:**
    - Upsize 282 LF of pipe between manholes 4-2A-2 to 4-2A-Q from 8- to 12-inch;
    - 115 LF of pipe between manholes 4-2A-Q and 4-2A-1 from 8- to 15-inch;
    - 795 LF of pipe between manholes 4-2A-1 and 4-2-2 from 8- to 18-inch;
    - 427 LF of pipe between manhole 4-2-2 and 4-2-1 from 8- to 24-inch;
    - 256 LF of pipe between manholes 4-2-1 and 4-1-2 from 8- to 27-inch;
    - 254 LF of pipe between manholes 4-1-2 and 4-1-1 from 21- to 30-inch;
    - 158 LF of pipe between manholes 4-1-1 and 3-2-6 from 21- to 30-inch, and;
    - 347 LF of pipe between manholes 4-1-1 and 3-2-4 from 15- to 36-inch.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $3,543,000.
  - **Year:** 2037. The timing of this project should follow completion of G-01 in Basin 4-1-3, which includes an I/I pilot study. The I/I evaluation may reduce the scope or timing of the proposed improvements.

- **P-07: Lower/South Prune Hill Lift Station Force Main Improvements**
  - **Description:**
    - Upsize 925 LF of force main between the Lower/South Prune Hill LS wet well and MH 10-1-3 from 10- to 18-inch.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $828,000.
  - **Year:** 2033. The timing of this project should follow completion of P-01 (NW 6th Place West Improvements) and coincide with LS-01 (Lower/South Prune Hill LS Improvements).
- **P-08: West Camas Lift Station Force Main Improvements**
  - **Description:**
    - Upsize 574 LF of the existing force main from 6- to 15-inch.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $556,000.
  - **Year:** 2031. The timing of this project should follow completion of LS-01 (Lower/South Prune Hill Lift Station Improvements), P-01 (NW 6th Place West Improvements, and P-02 (NW 6th Place East Improvements). The project should coincide with LS-02 (West Camas Lift Station Improvements).
- **P-09: Main Lift Station Force Main Improvements**
  - **Description:**
    - Upsize 2,348 LF of the existing force main from 18- to 24-inch.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $2,379,000.
  - **Year:** 2030. The timing of this project should coincide with LS-04 (Main LS Phase 1 Improvements) and be completed after upstream improvements. The proposed force main improvement should be evaluated after the upstream projects are completed to confirm the need and scope of the replacement.
- **P-10: Leadbetter Road Dual Force Main Improvements**
  - **Description:**
    - Activate the existing parallel 8-inch force main.
    - Install approximately 6,500 LF of parallel 10-inch force main between Node_161 to Node_27.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $3,526,000.
  - **Year:** 2041. The timing of this project should coincide with LS-08 (Leadbetter Road Lift Station Improvements) and be completed after the upstream improvements. The proposed force main improvement should be evaluated after the upstream projects are completed to confirm the need and scope of the improvement.

- **P-11: Division Street Improvements**
  - **Description:**
    - Upsize 827 LF of pipe between MHs 3-1-14 and 3-1-11 from 8- to 15-inch;
    - 505 LF of pipe between MHs 3-1-11 and 3-1-9 from 8- to 21-inch, and;
    - 1,526 LF of pipe between MHs 3-1-9 and 3-1-2 from 8- to 18-inch.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $2,514,000.
  - **Year:** 2032. The timing of this project should follow completion of P-05 and the other upstream improvements. The proposed improvements should be evaluated after the upstream projects are completed to confirm the need and scope of the upsizing.
- **P-12: SE Everett Road to Leadbetter Road Extension**
  - **Description:**
    - Install 2,031 LF of 8-inch pipe;
    - Install 692 LF of 12-inch pipe, and;
    - Install 6,036 LF of 18-inch pipe.
  - **Reasoning:** Growth.
  - **Estimated Cost:** $6,792,000.
  - **Year:** 2045. Project timing and implementation will be driven by development needs and coordinated with the developer.
- **P-13: SE 283rd Avenue to NE Woodburn Drive Extension**
  - **Description:**
    - Install 6,782 LF of 12-inch pipe.
  - **Reasoning:** Growth.
  - **Estimated Cost:** $4,119,000.
  - **Year:** 2045. Project timing and implementation will be driven by development needs and coordinated with the developer.

9.7 Treatment Plant Projects

Treatment plant projects in the CIP occur at the WWTF. The projects aim to mitigate capacity limitations over the next 19 years and address current condition issues that prohibit reliability or performance. Projects were grouped together to consider construction sequencing and project timing.

- **TP-01: Parshall Flume Replacement**
  - **Description:** Replace the existing Parshall Flume with a higher-capacity flume and make structural modifications to prevent influent wastewater from spraying during peak flow conditions.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $277,400.
  - **Year:** 2029. This project is timed to align with TP-04 (Replace Screens and Slide Gates).

- **TP-02: Primary Clarifier Bypass**
  - **Description:** Construct a bypass around Primary Clarifiers No. 1 and 2, including a new 30-inch bypass pipeline, structural modifications at the plant headworks effluent, and weir gates to control and direct flow.
  - **Reasoning:** Capacity Upgrade and Growth.
  - **Estimated Cost:** $816,000.
  - **Year:** 2030. This project is timed to align with TP-03 (Aeration Basin Flow Splitter Box).
- **TP-03: Aeration Basin Influent Flow Splitter Box**
  - **Description:** Construct a new aeration basin influent flow splitter box to improve mixing and flow distribution to the aeration basins and address limited head between the primary clarifiers and aeration basins.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $3,507,000.
  - **Year:** 2030. This project is timed to align with TP-02 (Primary Clarifier Bypass).
- **TP-04: Plant Headworks**
  - **Description:** Replace the existing headworks screens/washer compactors and slide gates, including associated electrical, instrumentation, controls, and site work.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $2,696,000.
  - **Year:** 2029.
- **TP-05: Relocating Internal Recycle Piping**
  - **Description:** Relocate the internal recycle piping at the three existing aeration basins at the beginning of the anoxic selector, upstream of the first anoxic zone. Include associated electrical, instrumentation, and controls improvements. Work can be performed in-house.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $0
  - **Year:** 2027. The City should monitor treatment performance before and after the change to confirm the effectiveness of the modification. The project could potentially be completed in-house.
- **TP-06: Modifying Anaerobic Selectors Baffle Wall**
  - **Description:** Modify the existing baffle walls within the aeration basins, including repouring the baffle walls between the anoxic and anaerobic zones and replacing existing plywood baffle walls with 316 stainless steel baffle plates.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $70,200
  - **Year:** 2027.
- **TP-07: Replace Secondary Clarifier No. 1**
  - **Description:** Demolish and replace Secondary Clarifier No. 1 with a new 75-foot-diameter clarifier, including new clarifier internals, RAS and WAS pumps, structures, and associated electrical, instrumentation, controls, and site work.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $5,329,000
  - **Year:** 2027. The City is currently evaluating this project.

- **TP-08: Secondary Clarifier No. 2 RAS Pump Replacement**
  - **Description:** Replace the RAS pumps serving Secondary Clarifier No. 2 with two new 1,400-gpm non-clog submersible pumps, including associated electrical, instrumentation, and controls improvements.
  - **Reasoning:** Capacity Upgrade and Growth
  - **Estimated Cost:** $440,000
  - **Year:** 2030.
- **TP-09 Replace Plant Drain Lift Station No. 1**
  - **Description:** Rehabilitate Plant Drain LS No. 1, including replacement of the existing pumps, wet well liner, control panel, guide rails, and discharge piping, and installation of a totalizing flow meter and composite sampler with associated electrical, instrumentation, controls, and site work.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $965,000
  - **Year:** 2030. This project is timed to align with TP-02 (Primary Clarifier Bypass).
- **TP-10: Replace Plant Drain Lift Station No. 2**
  - **Description:** Rehabilitate Plant Drain LS No. 2, including replacement of the existing pumps, wet well liner, control panel, guide rails, and discharge piping, and installation of a totalizing flow meter and composite sampler with associated electrical, instrumentation, controls, and site work.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $965,000
  - **Year:** 2030. The City may consider constructing a single Plant Drain LS to replace No. 1 and 2. This project is timed to align with TP-02 (Primary Clarifier Bypass).
- **TP-11: PLANTWIDE: Electrical Conduit and Stand Replace**
  - **Description:** Replace existing electrical conduit and support stands throughout the plant, including demolition of existing components and reuse of existing conductors where feasible.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $328,000.
  - **Year:** 2030.
- **TP-12: NETWORK: Equipment Enclosure and Cabled Protect Upgrade**
  - **Description:** Install new instrumentation and control cabinets and de-terminate and re-terminate existing conductors as needed to improve equipment protection and system reliability.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $44,000
  - **Year:** 2030.
- **TP-13: MCC-A Replace and Electric Equip Relocate**
  - **Description:** Replace MCC-A and relocate associated electrical equipment from the Old Controls Building, including removal and re-feeding of existing loads and transfer of PLC-A loads to another nearby PLC.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $491,000
  - **Year:** 2030. The City is currently evaluating this project.

- **TP-14: Replacement of Aeration Basin Diffusers and Additional Diffusers to Anoxic Zones**
  - **Description:** Replace the existing diffusers in the three aeration basins and install additional diffusers in the second anoxic zone of each basin, including new diffuser supports.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $888,000
  - **Year:** 2032.
- **TP-15: Disk Filtration Replacement**
  - **Description:** Replace the two existing disk filtration units with new 6.0-mgd units, including associated electrical, instrumentation, and controls improvements.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $2,528,000
  - **Year:** 2032.
- **TP-16: Second UV Channel**
  - **Description:** Rehabilitate the existing UV disinfection channel and install new UV equipment, including associated electrical, instrumentation, and controls improvements, to provide sufficient disinfection capacity for peak hour flows of 22.2 mgd.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $5,040,100
  - **Year:** 2032.
- **TP-17: Effluent Transfer Pump Replacement**
  - **Description:** Replace the existing effluent transfer pump impellers, motors, and associated VFDs and complete the required structural, mechanical, electrical, instrumentation, and controls improvements to provide sufficient capacity for the full 22.2-mgd plant effluent flow.
  - **Reasoning:** Capacity Upgrade and Growth
  - **Estimated Cost:** $2,287,000
  - **Year:** 2035. This project is timed to align with TP-18 (Construct a New Plant Outfall).
- **TP-18: Construction of an Additional Outfall**
  - **Description:** Construct a second outfall to the Columbia River, including approximately 36-inch corrugated metal pipe with a 16-port, 160-foot diffuser and associated site, electrical, instrumentation, and controls improvements.
  - **Reasoning:** Capacity Upgrade and Growth
  - **Estimated Cost:** $20,387,000
  - **Year:** 2035. This project is timed to align with TP-17 (Effluent Transfer Pump Replacement).
- **TP-19: Construction of a New Digester Electrical Building**
  - **Description:** Construct a second outfall to the Columbia River, including approximately 36-inch corrugated metal pipe with a 16-port, 160-foot diffuser and associated site, electrical, instrumentation, and controls improvements.
  - **Reasoning:** Capacity Upgrade and Growth
  - **Estimated Cost:** $1,267,000
  - **Year:** 2030. This project is timed to align with TP-09 (Replace Plant Drain LS No. 1) and TP-10 (Replace Plant Drain LS No. 2).

- **TP-20: Construction of New Secondary Rotary Drum Thickener**
  - **Description:** Construct a second RDT for WAS thickening, including a polymer blending unit, thickened sludge pump, access platform, stairs, supporting structures, and associated electrical, instrumentation, and controls improvements.
  - **Reasoning:** Capacity Upgrade and Growth
  - **Estimated Cost:** $1,693,000
  - **Year:** 2030. This project is timed to align with TP-09 (Replace Plant Drain LS No. 1) and TP-10 (Replace Plant Drain LS No. 2).
- **TP-21: Construction of a New Primary Clarifier No. 3**
  - **Description:** Construct a new 60-foot-diameter Primary Clarifier No. 3 with associated sludge pumping, structures, equipment, electrical, instrumentation, controls, and site work.
  - **Reasoning:** Capacity Upgrade and Growth
  - **Estimated Cost:** $6,327,000
  - **Year:** 2039.
- **TP-22: Construction of a New Secondary Clarifier No. 4**
  - **Description:** Construct a new 75-foot-diameter Secondary Clarifier No. 4 with associated RAS and WAS pumps, 36-inch connecting piping, structures, equipment, electrical, instrumentation, controls, and site work.
  - **Reasoning:** Growth
  - **Estimated Cost:** $11,692,000
  - **Year:** 2039.
- **TP-23: Centrifugal Blower Replacement**
  - **Description:** Replace the two existing 150-hp multistage centrifugal blowers with two new 150-hp HST blowers, including associated installation, electrical, instrumentation, and controls improvements.
  - **Reasoning:** Growth
  - **Estimated Cost:** $1,261,000
  - **Year:** 2027. The City is currently working on a project to increase capacity of Blowers No. 3 and 4.
- **TP-24: Sludge Dryer Replacement**
  - **Description:** Replace the existing sludge dryer with new sludge drying equipment, including associated building modifications, site work, electrical, instrumentation, and controls improvements.
  - **Reasoning:** Growth
  - **Estimated Cost:** $22,726,000
  - **Year:** 2042. The project timing allows for the City's ongoing evaluation of the dryer and solids handling alternatives and consideration of evolving biosolids regulations.
- **TP-25: Biofilter Replacement**
  - **Description:** Replace the existing sludge dryer with new sludge drying equipment, including associated building modifications, site work, electrical, instrumentation, and controls improvements.
  - **Reasoning:** Growth
  - **Estimated Cost:** $3,802,000
  - **Year:** 2043.

9.8 Annual Projects

- **R-01: Sewer Main Repair and Replacement**
  - **Description:** Replace wastewater pipelines constructed prior to the 1940s that are approaching the end of their useful life. The identified pipelines will be prioritized over the 19-year planning horizon based on age, condition, system needs, and results of I/I studies. A summary of identified pipeline lengths and unit costs are presented in Table 9.2.
  - **Reasoning:** R&R.
  - **Estimated Cost:** Approximately 20.8 million or $1,100,000 per year over the planning horizon.
  - **Year:** 2027 through 2045. Improvements will be prioritized and implemented throughout the planning horizon based on pipeline condition, system needs, and I/I study results.

Table 9.2 Sewer Main Repair and Replacement Cost Estimate

Diameter (inches)	Length (feet)	Cost ($)
8	23,341	$11,151,000
10	1,853	$1,005,000
12	953	$580,000
15	5,376	$4,117,000
18	1,175	$1,053,000
20	113	$110,000
21	872	$891,000
24	1,265	$1,473,000
Total	34,948	**$20,380,000**

- **R-02: Miscellaneous Lift Station Repair and Replacement**
  - **Description:** Complete miscellaneous improvements at existing lift stations to address operational and maintenance needs. Improvements may include pump and piping replacement, electrical and controls upgrades, instrumentation, wet well improvements, odor control, and other equipment or site improvements as needed.
  - **Reasoning:** R&R.
  - **Estimated Cost:** Approximately 38 million or $2,000,000 per year over the planning horizon. No construction, engineering, legal, or administrative costs are applied because the annual amount is based on the City's sewer capital budget.
  - **Year:** 2027 to 2045. Ongoing improvements will be implemented throughout the planning horizon based on operational and maintenance needs.

- **R-03: Miscellaneous WWTF Repair and Replacement**
  - **Description:** Complete miscellaneous improvements at the existing WWTF to address operational, maintenance, and reliability needs. Improvements may include replacement or rehabilitation of process equipment, electrical and controls upgrades, instrumentation, piping, structural improvements, and other equipment or site improvements as needed.
  - **Reasoning:** R&R.
  - **Estimated Cost:** Approximately 9.5 million or $500,000 per year over the planning horizon. No construction, engineering, legal, or administrative costs are applied because the annual amount is based on the City's sewer capital budget.
  - **Year:** 2027 to 2045. Ongoing improvements will be implemented throughout the planning horizon based on operational and maintenance needs.

9.9 General Projects

- **G-01: Basin 4-1-3 Pilot I/I Study**
  - **Description:** Investigate the source and magnitude of inflow and infiltration (I&I) of storm and groundwater into the wastewater system at locations where suspected high I&I may exceed conveyance and/or lift station capacity. Identify opportunities to reduce non-sewage flow and potentially avoid costly capacity improvements.
  - **Reasoning:** General.
  - **Estimated Cost:** $200,000.
  - **Year:** 2027.
- **G-02: Basin 5-1-2 Flow Monitoring**
  - **Description:** Install temporary flow meters in Basin 5-1-2 to separately monitor flows from the Camas LS and Upper Prune Hill contributing areas and evaluate I/I.
  - **Reasoning:** General.
  - **Estimated Cost:** $300,000.
  - **Year:** 2027.
- **G-03: Geographic Information System (GIS)**
  - **Description:** Implement ongoing enhancements to the Geographic Information System (GIS), including asset mapping, data collection, database maintenance, and integration with utility management systems.
  - **Reasoning:** General.
  - **Estimated Cost:** $250,000.
  - **Year:** 2027.
- **G-04: Hydraulic Modeling**
  - **Description:** Expand the City's collection system hydraulic model to include additional system pipes and reduce the existing level of model skeletonization. Accurate and updated GIS information will be used to support the model expansion.
  - **Reasoning:** General.
  - **Estimated Cost:** $200,000.
  - **Year:** 2029. The timing of this project should follow completion of G-03 (Geographic Information Systems (GIS).

- **G-05: Electrical System Arc Flash Study**
  - **Description:** Complete an Electrical System Study and install arc flash labels on the plant's distribution equipment.
  - **Reasoning:** General.
  - **Estimated Cost:** $75,000.
  - **Year:** 2027.
- **G-06: Hazardous Area Classification Study**
  - **Description:** Conduct a hazardous area classification study in accordance with NFPA 820 and upgrade areas that do not meet applicable requirements.
  - **Reasoning:** General.
  - **Estimated Cost:** $50,000.
  - **Year:** 2027.
- **G-07 Flood Risk Assessment**
  - **Description:** Conduct a comprehensive flood risk analysis of major electrical and control systems at the WWTF to assess vulnerabilities and improve flood resilience.
  - **Reasoning:** General.
  - **Estimated Cost:** $100,000.
  - **Year:** 2027.
- **G-08: General Sewer Plan**
  - **Description:** Implement the General Sewer Plan twice over the 20-year planning horizon, with each occurrence approximately 10 years apart.
  - **Reasoning:** General.
  - **Estimated Cost:** $700,000 per occurrence.
  - **Year:** 2035 and 2045.

9.10 Summary of CIP

Recommended improvements include 10 LS projects, one STEP project, 13 pipeline projects, three rehabilitation and replacement programs, 25 treatment plant projects, and eight general projects. Breakdown by project category is shown in Figure 9.1. The largest portion of the CIP are allocated to treatment plant projects and the annual programs at $95.8 M and $67.9 M, respectively. Gravity and force main, STEP main, and lift station projects have a combined estimated cost of $104.0 M, while general projects have the lowest allocation at $2.6 M. The total recommended CIP is estimated $270.3 M.

The CIP recommends budgeting $132.4 M in the short-term, inclusive of annual project costs. The average annual short-term cost for all recommended projects is approximately $14.7 M per year from 2027 through 2035. The CIP recommends $137.8 M in the long-term with an average annual long-term cost of approximately $13.8 M per year from 2036 through 2045. The average annual cost over the 19-year planning horizon from 2027 through 2045 is $14.2 M. Figure 9.2 presents annual costs for the City's CIP for each year of this GSP, while Figure 9.3 illustrates annual cost breakdowns for projects funded by rates and SDCs. Annual program costs are assumed to be funded by rates.

Detailed sheets for each CIP project presented in this chapter can be found in Appendix K of the GSP. Table 9.3 summarizes the total cost and annual cost for each planning period.

Table 9.3 CIP Planning Period Summary

Planning Period	Total Cost (million $)	Annual Cost (million $)
Short-term (2027 to 2035)	$132.4	$14.7
Long-term (2036 to 2045)	$137.8	$13.8
Total	**$270.3**	**$14.2**

Notes:
(1) Totals may not sum due to rounding.

Treatment plant projects and annual programs account for 35.5 percent and 25.1 percent, respectively, followed by the gravity and force main projects at $40.0 M (14.6 percent), STEP Main projects at $32.8 M (12.1 percent), lift station projects at $31.6 M (11.7 percent), and general projects at $2.6 M (1.0 percent). Table 9.4 summarizes the total estimated capital costs by facility type. Figures 9.4 and 9.5 show the short-term and long-term projects, including the year each CIP project is scheduled for implementation.

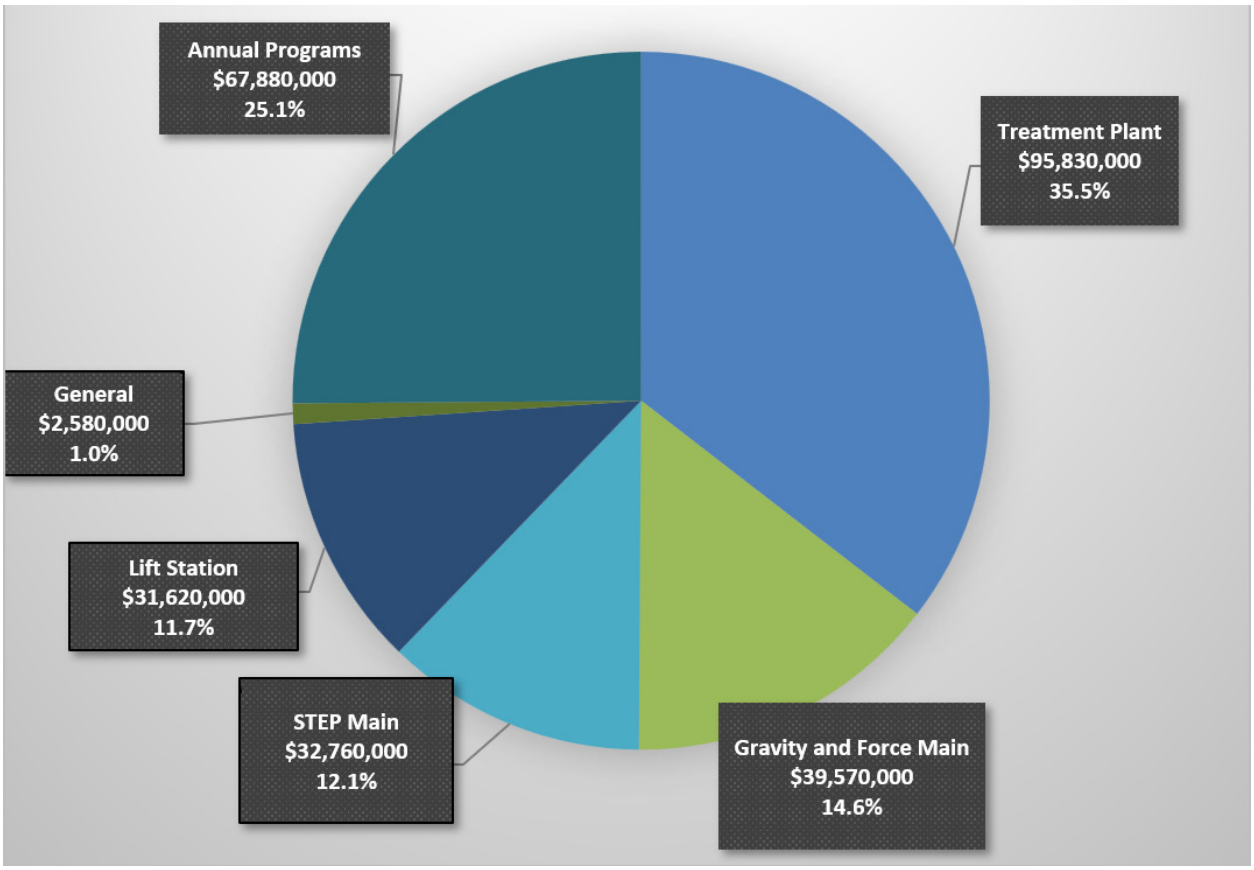


Figure 9.1 Cost by Project Category

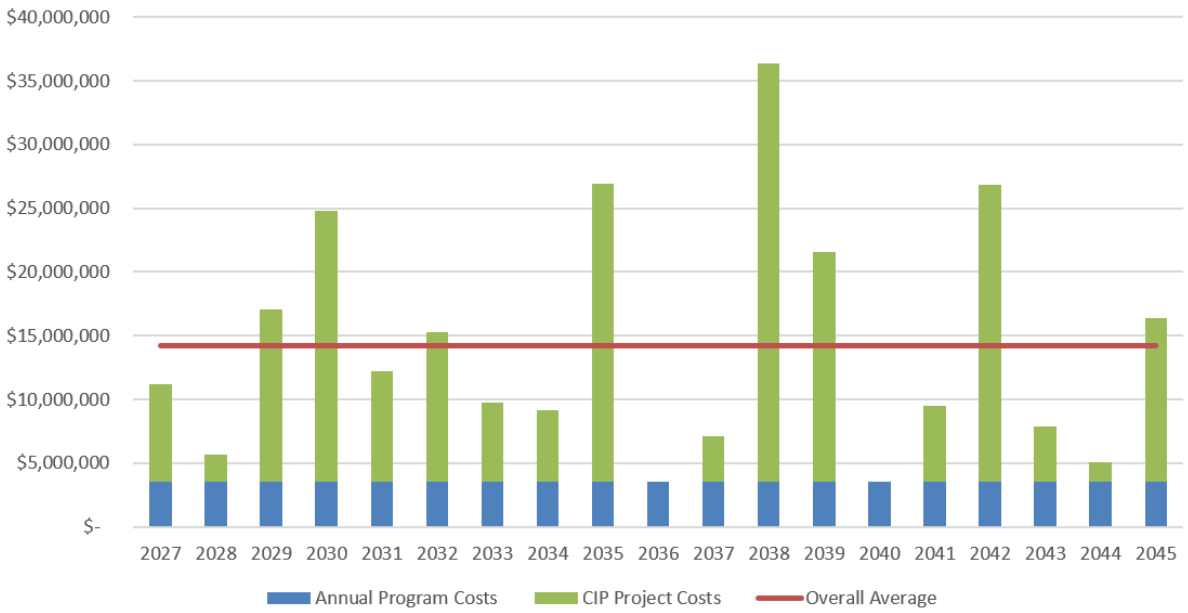


Figure 9.2 Overall CIP Annual Cost

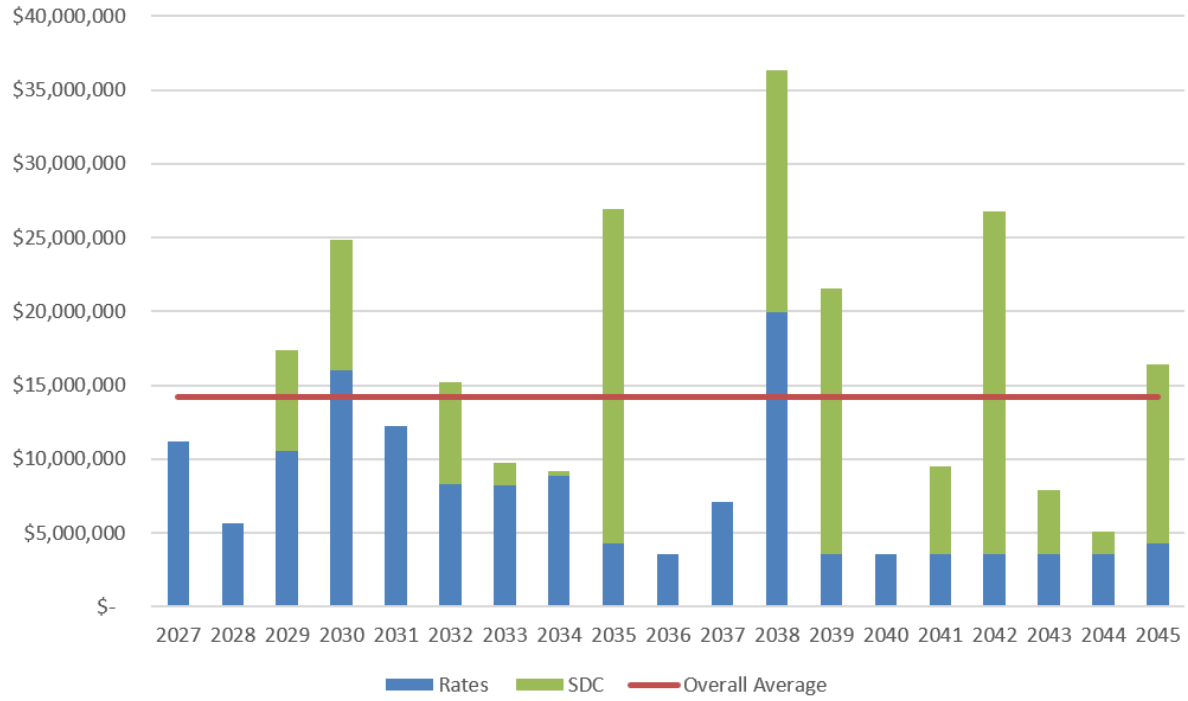


Figure 9.3 CIP Annual Cost by Project Allocation

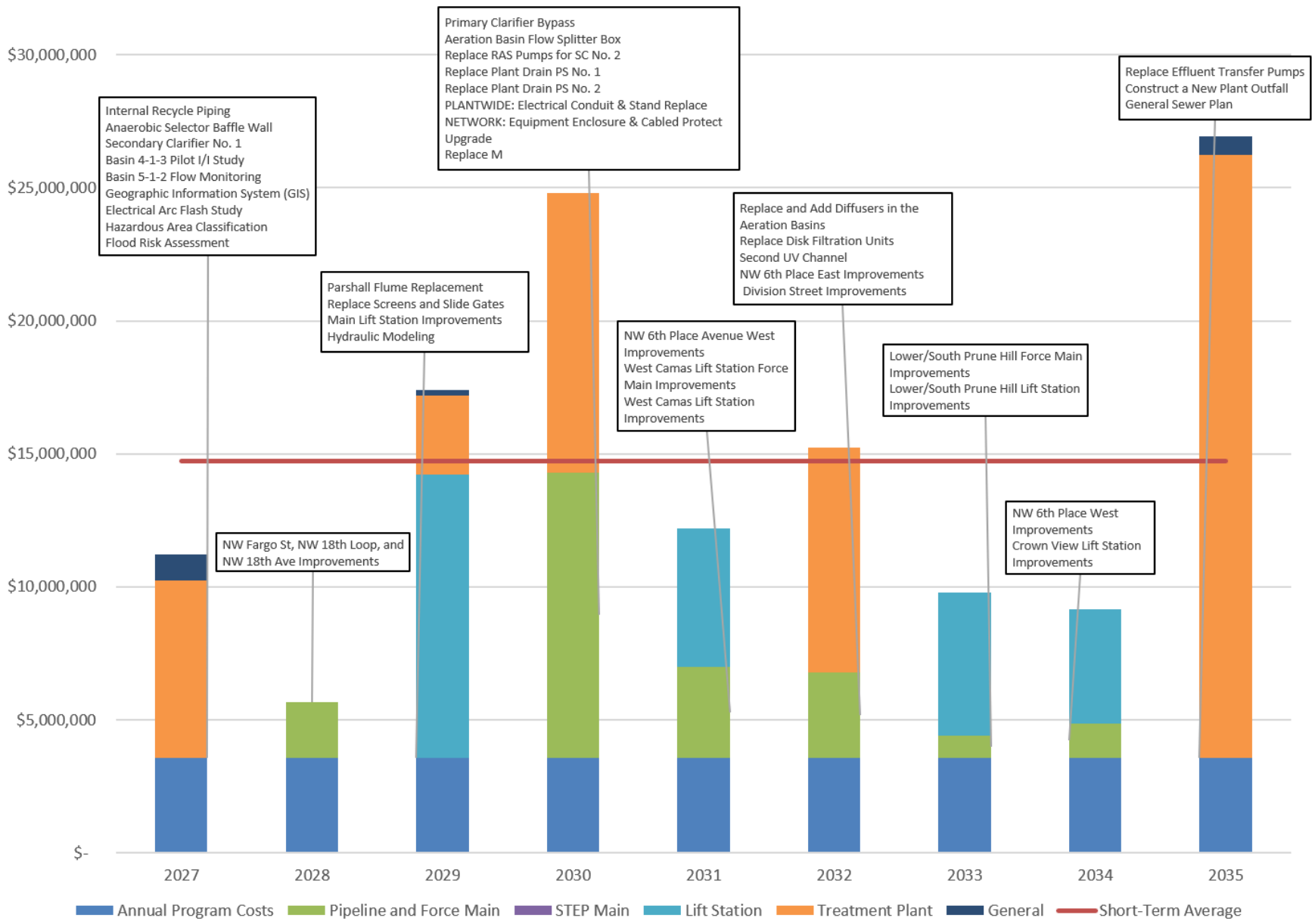


Figure 9.4 Short-term CIP Annual Cost

2030 Projects: Primary Clarifier Bypass, Aeration Basin Flow Splitter Box, Replace RAS Pumps for Secondary Clarifier No. 2, Replace Plant Drain LS No. 1, Replace Plant Drain LS No. 2, PLANTWIDE: Electrical Conduit and Stand Replace, NETWORK: Equipment Enclosure and Cabled Protect Upgrade, Replace MCC-A and Relocate Electric Equipment, Construct a New Electrical Building, Construct a Second RDT for WAS Thickening, NW 6th Place Avenue East Improvements, Main LS Dual Force Main Improvements.

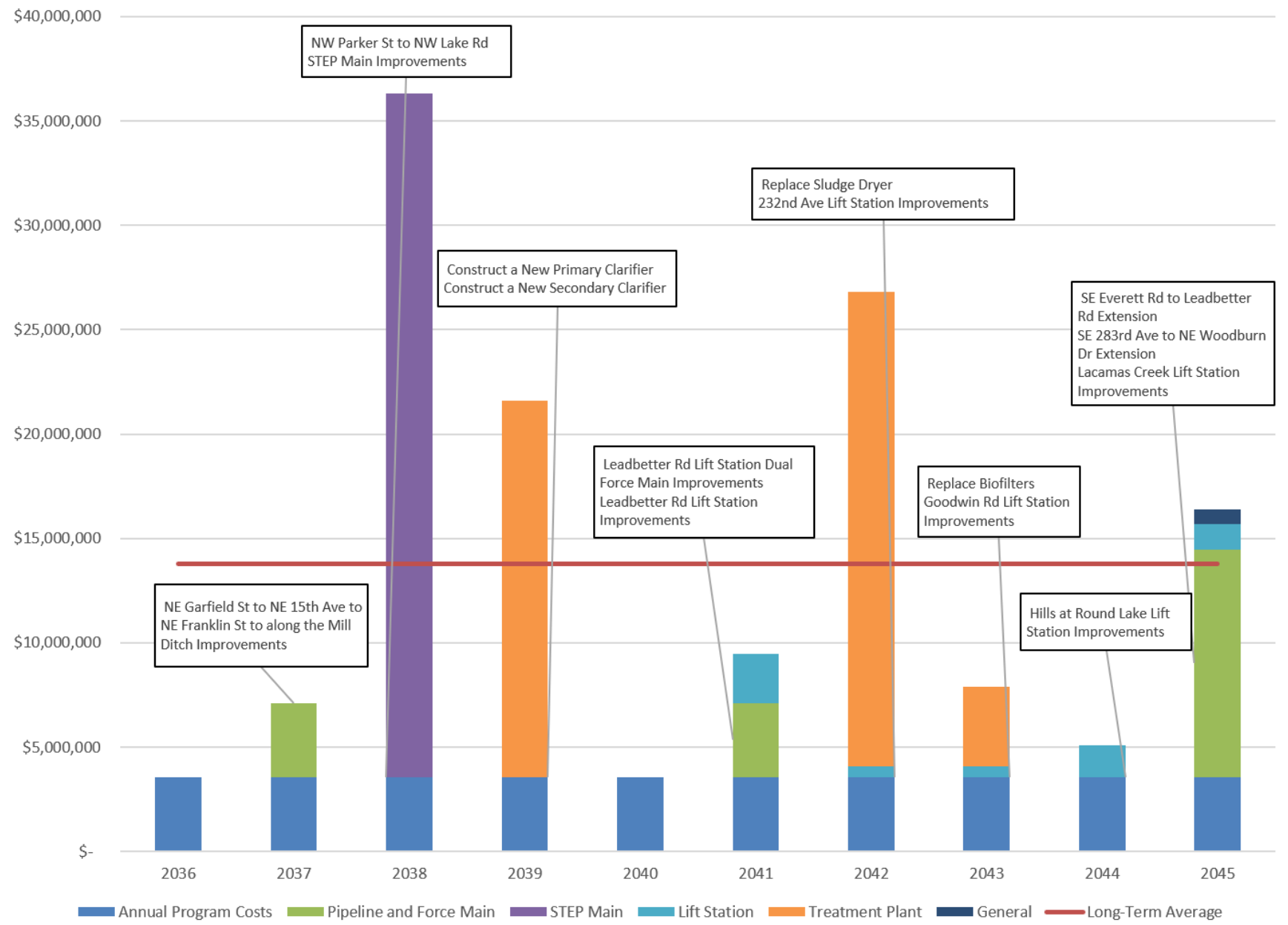


Figure 9.5 Long-term CIP Annual Cost

Table 9.4 CIP Summary by Project Type

Project ID	Title	Total Capital Cost (rounded)	Planning Period	
			Short-term (2027-2036)	Long-term (2037-2045)
Lift Station				
LS-01	Lower/South Prune Hills Lift Station Improvements	$5,400,000	X	
LS-02	West Camas Lift Station Improvements	$5,200,000	X	
LS-03	Crown View Hill Lift Station Improvements	$4,300,000	X	
LS-04	Lacamas Creek Lift Station Improvements	$1,200,000		X
LS-05	Main Lift Station Phase 2 Improvements	$10,600,000	X	
LS-06	Goodwin Road Lift Station Improvements	$500,000		X
LS-07	232nd Avenue Lift Station Improvements	$500,000		X
LS-08	Leadbetter Road Lift Station Improvements	$2,400,000		X
LS-09	Hills at Round Lake Lift Station Improvements	$1,500,000		X
STEP				
S-01	NW Parker Street to NW Lake Road STEP Main Improvements	$32,800,000		X
Pipeline				
P-01	NW 6th Place West Improvements	$1,300,000		X
P-02	NW 6th Place East Improvements	$700,000	X	
P-03	NW 6th Place Avenue West Improvements	$2,900,000	X	
P-04	NW 6th Place Avenue East Improvements	$8,300,000		X
P-05	NW Fargo Street, NW 18th Loop, NW 18th Avenue to Division Street Improvements	$2,100,000	X	
P-06	NE Garfield Street to NE 15th Avenue to NE Franklin Street to along the Creek Improvements	$3,500,000		X
P-07	Lower/South Prune Hill Force Main Improvements	$830,000	X	
P-08	West Camas Force Main Improvements	$560,000	X	
P-09	Main Lift Station Force Main Improvements	$2,400,000		X
P-10	Leadbetter Road Dual Force Main Improvements	$3,500,000		X
P-11	Division Street Improvements	$2,500,000	X	
P-12	SE Everett Road to Leadbetter Road Extension	$6,800,000		X
P-13	SE 283rd Avenue to NE Woodburn Drive Extension	$4,200,000		X
Treatment Plant				
TP-01	Parshall Flume Replacement	$280,000	X	
TP-02	Primary Clarifier Bypass	$820,000	X	
TP-03	Aeration Basin Influent Flow Splitter Box	$3,500,000	X	
TP-04	Plant Headworks	$2,700,000	X	
TP-05	Anoxic Selector Internal Recycle-Piping	$0	X	

Project ID	Title	Total Capital Cost (rounded)	Planning Period	
			Short-term (2027-2036)	Long-term (2037-2045)
TP-06	Anaerobic Selectors Baffle Wall	$70,000	X	
TP-07	Replace Secondary Clarifier No. 1	$5,300,000	X	
TP-08	Secondary Clarifier No. 2 RAS Pump Replacement	$400,000	X	
TP-09	Replace Plant Drain Lift Station No. 1	$1,000,000	X	
TP-10	Replace Plant Drain Lift Station No. 2	$1,000,000	X	
TP-11	PLANTWIDE: Electrical Conduit and Stand Replace	$330,000	X	
TP-12	NETWORK: Equip Enclosure and Cabled Protect Upgrade	$44,000	X	
TP-13	MCC-A Replace and Electric Equip Relocate	$500,000	X	
TP-14	Replace Aeration Basin Diffusers	$900,000	X	
TP-15	Disk Filtration Replacement	$2,500,000	X	
TP-16	Second UV Channel	$5,000,000	X	
TP-17	Effluent Transfer Pump Replacement	$2,300,000	X	
TP-18	Outfall	$20,400,000	X	
TP-19	Digester Electrical Building	$1,300,000	X	
TP-20	New Rotary Drum Thickener	$1,700,000	X	
TP-21	Primary Clarifier No. 3	$6,300,000		X
TP-22	Primary Clarifier No. 4	$11,700,000		X
TP-23	Centrifugal Blower Replacement	$1,300,000	X	
TP-24	Sludge Dryer Replacement	$23,000,000		X
TP-25	Biofilter Replacement	$3,800,000		X
General				
G-01	Basin 4-1-3 Pilot I/I Study	$200,000	X	
G-02	Basin 5-1-2 Flow Monitoring	$300,000	X	
G-03	Geographic Information System (GIS)	$250,000	X	
G-04	Hydraulic Modeling	$200,000	X	
G-05	Electric System Arc Flash Study	$75,000	X	
G-06	Hazardous Area Classification Study	$50,000	X	
G-07	Flood Risk Assessment	$100,000	X	
G-08	General Sewer Plan (2035 and 2045)	$1,400,000	X	X

APPENDIX A

SEPA CHECKLIST/APPROVALS

~ To be included in a future submittal. ~

APPENDIX B

REFERENCES

~ To be included in a future submittal. ~

APPENDIX C

DEMOGRAPHIC PROJECTIONS



ourCamas 2045

DRAFT - *Last Updated July 2025*

Comprehensive Plan

ourCamas 2045

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Camas City Council
John Nohr
Martin Elzingre
Leslie Lewallen
Tim Hein
Marilyn Boerke
Jennifer Senescu
John Svilarich

Camas Planning Commission
Troy Hull, Chair
Geoerl Nile, Vice Chair
Marlo Maroon
Joe Walsh
Shawn High
Mahsa Eshghi
Paul Anderson

Community Advisory Committee (CAC)
Samantha Horner
Betty Peng
Jason Irving
Kim Sogge
Carrie Schulstad
Brian K. Kuhta
Matthew Clarkson
Heidi Buhman-McNeley
Stephanie O'Dell
Alicia Brazington
Greg K Anderson
Carol Collier
Rick Melching
Colin Casad
Marlo Maroon

Climate Policy Advisory Team (CPAT)
Morgan Van Fleet
Nelson Holmberg
Cassi Marshall
Amy Hyland
Kaitlin Lee
Kimberly Lottig
Robert Carter
Paul Anderson
Dan Davis
Diana Rutherford

City Administrator
Doug Quinn

City of Camas Staff
Alan Peters, Community Development Director
Robert Maul, Planning Manager
Lauren Hollenbeck, Senior Planner
Yvette Sennewald, Senior Planner
Madeline Coulter, Planner
Carey Certo, Administrative Support Assistant
Rob Charles, Interim Public Works Director and Utilities Manager
Curleigh Carothers, Engineering Manager
Bryan Rachal, Communications Director
Ken Pearrow, GIS Coordinator

Consultant Team
WSP USA, Inc.
3J Consulting, Inc.
DKS Associates
ECOnorthwest
SERA Architects

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ourCamas 2045



Vision

01

01. Vision

Our Camas Vision Statement

This vision is written in the present tense, as if describing the city as it exists in 2045. Some aspects of the vision can be found in Camas today, while others represent aspirations. The vision provides a framework for the goals and policies of every element of Our Camas 2045.

Our Community



Camas is an inclusive community where residents experience a sense of belonging and connection. Community-wide events foster civic pride, strong bonds among neighbors and a welcoming atmosphere for new residents. Community amenities and recreation facilities throughout Camas promote active lifestyles and social interaction. Camas is recognized for excellent schools and its commitment to lifelong learning. The City promotes a strong culture of public safety, transparent communication, and good governance, allowing residents to thrive in their neighborhoods and engage in decision-making that shapes their community.

Our Environment



Camas embraces its connection to nature and enjoys a wealth of outdoor recreational opportunities. Access to forests, clean water, parks, and trails is foundational to Camas' quality of life. The community shares a deep reverence for Camas' beauty, scenery, and tranquility, and is committed to preserving and enhancing its natural resources and tree canopy. Through proactive planning, the City mitigates the effects of changing climate conditions and natural hazards, ensuring a resilient community for generations to come.

Our Neighborhoods



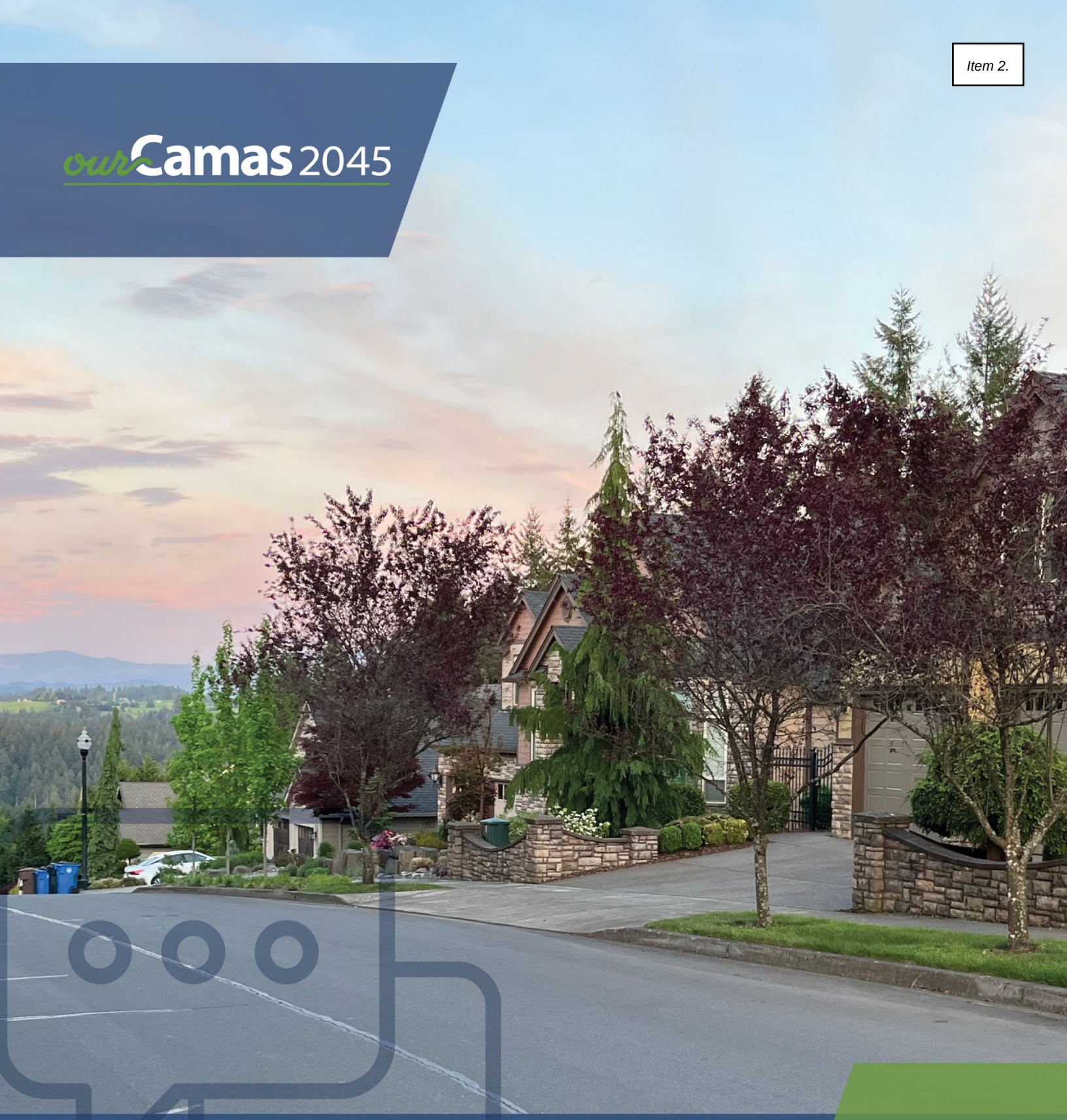
Camas embraces its small-town feel while responsibly managing growth, ensuring a prosperous and livable future for all. Camas provides a variety of housing options that meet the needs of all residents, while ensuring the town's charm and livability are sustained. Camas is home to a thriving economy and diverse businesses, affording residents ample employment opportunities and access to high wage jobs. Neighborhood commercial hubs connect residents to daily services and amenities through a network of sidewalks and bike lanes, improving access and connectivity.

Our Downtown



Charming, vibrant, and walkable, Downtown Camas is the city's living room. Downtown's history is complemented by new businesses and inclusive housing options. Expansion, resiliency and a dynamic economic landscape are critical to its success. Downtown Camas anchors the community while fostering a culture of pride, support, and connection.

ourCamas 2045



Introduction

02

02. Introduction

Our Camas 2045

Our Camas 2045 is a roadmap for the future of the city and guides land use development and public facility investment decisions between now and 2045.

Camas has a long and rich history. More than 10,000 years ago, Native Americans occupied the Columbia River Valley. The Lewis and Clark Corps of Discovery camped by the river in 1806. In the late 1800s, the La Camas Colony Company of Portland purchased 2,600 acres and began planning the construction of a paper mill to supply newsprint for The Oregonian. The construction of the mill brought the platting of the town and the City of Camas was incorporated in 1906. Today, Camas is a vibrant and diverse community that occupies approximately 16 square miles and is home to over 27,000 people.

Our Camas 2045 is an update to the prior City of Camas comprehensive plan, Camas 2035. This update incorporates new state legislation to support additional housing and climate planning and establishes a new vision for the community's future.

The history of Camas comprehensive planning dates back to 1963 when the first plan was prepared. In 1990, the state adopted the Growth Management Act (GMA) with the goal of managing the growth of cities that had previously grown in an uncoordinated fashion. GMA requires municipalities to update their comprehensive plans every 10 years to ensure future growth can be accommodated with housing and jobs, and public services and facilities are available to serve new residential, commercial, and employment areas.

The last major update to the City's comprehensive plan was in 2016. Since that time, the city has grown by over 5,000 people, added new residential areas in Grass Valley and Green Mountain, and completed the North Shore Subarea Plan, which established a new vision and zoning for the North Shore of Lacamas Lake and sets the stage for future residential, mixed use, and employment development. In conjunction with Our Camas 2045, the city prepared a downtown subarea plan. Our Downtown 2045 establishes a detailed vision and action plan to catalyze public and private investment in the historic downtown. Both plans work together to guide future development and ensure Camas' future remains as vibrant as its past.

What is a Comprehensive Plan?

Our Camas 2045 guides land use development and public facility investment decisions between now and 2045. Our Camas 2045 has eight elements that work together to achieve the community's vision and ensure long-term economic vitality:

- Community Character
- Land Use
- Housing
- Natural Environment
- Climate Change & Resiliency
- Transportation
- Public Facilities & Services
- Economic Development

Each element sets goals that will implement the vision and expresses policies that will guide land use and infrastructure decisions for the 20-year planning horizon. The elements are supported by the comprehensive plan map, which identifies land use designations throughout the City and within its urban growth area.1

Why Plan?

Planning is choosing what to do and how and when to do it. Planning is part of our everyday lives. We plan our vacations, our budgets, and even our trips to the grocery store. The detailed planning of our daily lives derives from a set of goals that we want to accomplish – in a day, in the next six months, or the next two years.

In the same way and for the same purpose, the City's plan is the basis of coordinated action – it enables public and private interests to undertake projects with a clear understanding of community goals and policies.

Our Camas 2045 helps the City identify deficiencies and take steps to remedy them. Planning can find desirable and reasonable solutions before the problem is beyond the community's economic capabilities. The plan is crucial to avoiding uncoordinated activities as the City adapts to changing conditions and experiences the population growth that is anticipated.

The plan is not intended as a rigid system of goals and development policies; rather, it is:

- Long range – looks ahead 20 years to anticipate growth and resulting community needs.
- Comprehensive – relates and integrates all types of uses and necessary public facilities.
- General – establishes general locations and areas for the elements and indicates their relationships to each other and the population they serve.
- Responsive – through regular updates, adjusts to changing conditions, unforeseen circumstances, and local and regional trends.

How is a Comprehensive Plan Related to Other Plans?

Our Camas 2045 is part of a family of state, regional, and local plans. Some, like statewide GMA and Clark County's Comprehensive Growth Management Plan, set the overall planning framework and guide the content of the Camas comprehensive plan.

Others, like plans that are specific to particular subareas, supply more detailed information about individual topics or smaller parts of the City.

Growth Management Act

The GMA establishes state goals, sets deadlines for compliance, and offers direction on how to prepare comprehensive plans and development regulations. GMA also establishes requirements for early and continuous public participation. GMA requires state and local governments to manage growth by identifying and protecting critical areas and natural resource lands, designating urban growth areas, and preparing comprehensive plans and implementing them through capital investments and development regulations.

The GMA legislation, which is Chapter 36.70A of the Revised Code of Washington (RCW), contains 15 goals.

For a community's plan to be valid, it must meet the requirements of the GMA through consistency with state statutory goals, countywide policies, and the plans of adjacent jurisdictions.

The fifteen statutory goals identified in the GMA (RCW 36.70A) are:

1. **Urban growth**. Encourage development in urban areas where adequate public facilities and services exist or can be provided in an efficient manner.
2. **Reduce sprawl.** Reduce the inappropriate conversion of undeveloped land into sprawling, low-density development.
3. **Transportation.** Encourage efficient multimodal transportation systems that will reduce greenhouse gas emissions and per capita vehicle miles traveled, and are based on regional priorities and coordinated with county and city comprehensive plans.
4. **Housing.** Plan for and accommodate housing affordable to all economic segments of the population of this state, promote a variety of residential densities and housing types, and encourage preservation of existing housing stock.
5. **Economic development.** Encourage economic development throughout the state that is consistent with adopted comprehensive plans, promote economic opportunity for all citizens of this state, especially for unemployed and for disadvantaged persons, promote the retention and expansion of existing businesses and recruitment of new businesses, recognize regional differences impacting economic development opportunities, and encourage growth in areas experiencing insufficient economic growth, all within the capacities of the state's natural resources, public services, and public facilities.
6. **Property rights.** Private property shall not be taken for public use without just compensation having been made. The property rights of landowners shall be protected from arbitrary and discriminatory actions.
7. **Permits.** Applications for both state and local government permits should be processed in a timely and fair manner to ensure predictability.

8. **Natural resource industries.** Maintain and enhance natural resource-based industries, including productive timber, agricultural, and fisheries industries. Encourage the conservation of productive forestlands and productive agricultural lands, and discourage incompatible uses.
9. **Open space and recreation.** Retain open space and green space, enhance recreational opportunities, enhance fish and wildlife habitat, increase access to natural resource lands and water, and develop parks and recreation facilities.
10. **Environment.** Protect and enhance the environment and enhance the state's high quality of life, including air and water quality, and the availability of water.
11. **Citizen participation and coordination.** Encourage the involvement of citizens in the planning process, including the participation of vulnerable populations and overburdened communities, and ensure coordination between communities and jurisdictions to reconcile conflicts.
12. **Public facilities and services.** Ensure that those public facilities and services necessary to support development shall be adequate to serve the development at the time the development is available for occupancy and use without decreasing current service levels below locally established minimum standards.
13. **Historic preservation.** Identify and encourage the preservation of lands, sites, and structures, that have historical or archaeological significance.
14. **Climate change and resiliency.** Ensure that comprehensive plans, development regulations, and regional policies, plans, and strategies under RCW 36.70A.210 and chapter 47.80 RCW adapt to and mitigate the effects of a changing climate; support reductions in greenhouse gas emissions and per capita vehicle miles traveled; prepare for climate impact scenarios; foster resiliency to climate impacts and natural hazards; protect and enhance environmental, economic, and human health and safety; and advance environmental justice.
15. **Shorelines of the state.** For shorelines of the state, the goals and policies of the shoreline management act as set forth in RCW 90.58.020 shall be considered an element of the county's or city's comprehensive plan.

Urban Growth Areas

An urban growth area is a defined area of land adjacent to city limits within which urban growth is encouraged and beyond which growth can occur only if it is not urban in nature.

Each county that adopts a comprehensive plan under the GMA must designate urban growth areas. The City of Camas has 11,848 acres of land within the urban growth areas. This land, combined with the vacant land available within the City limits, must accommodate the City's population and employment projections as established by the state's Office of Financial Management. The population and employment projections for the City for the year 2045 are 37,080 people and 11,615 jobs. The City is proposing urban growth area expansion to accommodate increased job capacity (see the Land Use Element for additional details).

County Planning Goals and Policies

The Comprehensive Growth Management Plan, adopted by Clark County and its cities and last updated in 2016, guides local jurisdictions as they work to decide questions of regional land use and services.

Clark County is in the final stages of fully updating this plan for 2025 through 2045. As County and city plans were developed, representatives of the City of Camas met on a regular basis over the span of two years with officials of the County and its cities to coordinate efforts. This level of communication helps ensure that the plans and capital projects of these jurisdictions are consistent when adopted. Our Camas 2045 is consistent with the concepts put forward in the County's Comprehensive Growth Management Plan, and the initial drafts of its pending comprehensive plan, and the countywide planning policies as required by RCW 36.70A.100 and 210, WAC 365-196-305; 400(2)(c); 510 and 520.

Local Plans

The goals and policies included in Our Camas 2045 are implemented through development regulations established in the Camas Zoning Code (Title 18 of the Camas Municipal Codes) as well as the standards set forth in existing plans and policy documents.

Our Camas 2045 has been developed to ensure consistency with all other relevant local plans as listed below:

- Strategic Plan (updated annually)
- Legacy Lands Master Plan (in development)
- Lake Management Plan (2024)
- North Shore Subarea Plan (October 2022)
- Camas Water System Plan (October 2019)
- Camas General Sewer Plan (June 2022)
- Camas General Sewer/Wastewater Facility Plan (November 2011)
- City of Camas Parks, Recreation, and Open Space Comprehensive Plan (March 2022)
- Camas Design Standards Manual–Engineering (adopted October 20, 2014, Res. 1308, updated annually)
- Camas Design Review Manual (May 2, 2016)
- Camas Shoreline Master Program (spring 2021)
- Downtown Design Manual (revision in process, to be adopted with Our Downtown Camas 2045, the Downtown Subarea Plan)
- Camas Stormwater Design Standards Manual (June 2022)
- Six-Year Street Plan (Updated annually)
- 2025–2030 Capital Facilities Plan Project List (to be updated with Our Camas 2045)
- Transportation Impact Fee Update (May 2012)

Amending a Comprehensive Plan

The City is required to review its comprehensive plan at least every ten years. However, the City's comprehensive plan and development regulations are reviewed and evaluated regularly.

Our Camas 2045 is based on the best available information. As years go by, new information or changing circumstances – for instance, a revised sewer or water plan – may prompt changes to this plan. By state law, amending a comprehensive plan can occur only once a year and must follow the procedures that are set forth in RCW 36.70A.130.

Amendments to a comprehensive plan require legislative action, which entails the adoption of a resolution or ordinance following notice and public hearing indicating, at a minimum, a finding that a review and evaluation has occurred and identifying the revisions made, or that a revision was not needed and the reasons.

The review and evaluation must include the consideration of critical area ordinances, population projections, and other plans and policies in effect.

Under certain circumstances, amendments can occur more frequently:

- The initial adoption of a subarea plan. Subareas must clarify, supplement, or implement jurisdiction-wide comprehensive plan policies, and may only be adopted if the cumulative impacts of the proposed plan are addressed by appropriate environmental review under chapter 43.21C RCW.
- The development of an initial subarea plan for economic development located outside of the 100 year floodplain in a county that has completed a state-funded pilot project that is based on watershed characterization and local habitat assessment
- The adoption or amendment of a shoreline master program under the procedures set forth in Chapter 90.58 RCW.
- The amendment of the capital facilities element of a comprehensive plan that occurs concurrently with the adoption or amendment of a county or city budget.
- The adoption of comprehensive plan amendments necessary to enact a planned action under RCW 43.21C.440, provided that amendments are considered in accordance with the public participation program established by the county or city under this subsection (2)(a) and all persons who have requested notice of a comprehensive plan update are given notice of the amendments and an opportunity to comment.

Developing Our Camas 2045

Our Camas 2045 began with a citywide outreach process to better understand the community's vision and priorities related to Camas' future. The Our Camas Visioning process reached over 1,000 community members through community conversations, community events, an online survey, online mapping tools, and the project website.

The City hosted two Community Summits. The first, held in June 2024, was an open house event where members of the public could provide feedback on the draft vision statement and goals, as well as provide ideas to achieve the vision and goals. The second Community Summit was held in October 2024 and provided a forum for community members to provide feedback on the draft land use alternatives, development scales, review development concepts for downtown, and learn about the County's climate planning efforts and greenhouse gas inventory.

There were several advisory committees that participated in the development of the plan.

- Project Advisory Committee (PAC) – technical stakeholders, agency partners, service providers
- Community Advisory Community (CAC) – broad cross-section of community interests

- Climate Policy Advisory Team (CPAT) – community members advising on climate goals and policies
- Existing advisory bodies that consulted on the vision, goals, policies, and plan:
    - Downtown Camas Association (DCA)
    - City Council
    - Planning Commission

Following preparation of the draft plan, the City hosted pop-up events throughout the summer and fall of 2025 to seek input on the preferred alternative map and draft goals and policies.

In addition to the outreach efforts described above, the City maintained a public engagement website throughout the visioning process and the development of Our Camas 2045. During spring 2024, a community survey and interactive map gathered feedback from the community on things they like about Camas, things they would change in the future, important topics to address in the plan, and areas of opportunity or concern both downtown and in the wider Camas community. A second online survey accompanied the second community summit to seek input on the draft land use alternatives and development concepts for downtown. The City prepared a Story Map in Spring 2025 to present and obtain feedback on the preferred land use alternative and proposed zoning and comprehensive plan land use designation changes.

The City of Camas values residents' opinions and is committed to being responsive. The final comprehensive plan incorporates the contributions and comments from those who participated in the project engagement. A summary of all engagement activities is included in Appendix X.

ourCamas 2045



Community Character

03

Community Character

This element integrates art, culture, growth and identity into the comprehensive plan, while ensuring community engagement is inclusive and open.

03. Community Character

Vision

In 2045, Camas is an inclusive community where residents experience a sense of belonging and connection. The city's unique identity is defined by its small-town feel and the incorporation of the natural landscape into walkable neighborhoods and high-quality development. Camas maintains its distinct sense of place through inclusive community engagement, sustainable development practices, and intentional placemaking that reinforces Camas' beauty, livability, and lasting connection to nature.

Introduction

The community character element establishes a framework for preserving and enhancing the physical, cultural, and social characteristics that make Camas feel like Camas. Community character is shaped not only by the built environment, but also by the natural landscape, cultural identity, historic context, and the ways in which people engage with their surroundings. As Camas plans for continued growth through the 2045 horizon, this element ensures that the qualities residents value—such as the City's small-town atmosphere, its connection to nature, and its strong civic identity—are maintained and reinforced through thoughtful development, design standards, public investment, and public engagement.

Camas' natural and built environment is defined by its integration of the natural features of the land with the development of housing, commercial buildings and its connecting infrastructure. In 2025, the City of Camas is home to 16 parks, 12 miles of scenic trails, and over 1,060 acres of parks and open space. From the forested paths around Lacamas Lake to the many playgrounds throughout the city, the natural beauty of Camas is a defining part of community life.

Camas' diversifying community is comprised of just over 27,000 people and expected to grow to over 37,000 by 2045. While most people who live in Camas commute to nearby cities for employment, in 2025, there are approximately 9,550 jobs within the city with the largest employment sectors being education and

healthcare, followed by professional services. The Georgia Pacific Mill remains a significant part of the city's economic history and a symbol of Camas' working roots.

The majority of housing in Camas is single family detached homes. Most residents own their home, with renters making up 20% of residents. There are approximately 10,000 housing units in Camas in 2025. By 2045, the city needs to add 4,226 new units to support the growing population. Camas also needs a greater variety of housing types at a range of price points to meet residents' diverse needs. By 2045, new multifamily and mixed-use buildings near transit, in Downtown, North Shore, and along NW Parker Street and Pacific Rim Boulevard will expand options for existing and new residents. These future developments will complement the strong sense of place already present in Camas' established neighborhoods like Prune Hill, Crown Park, and Evergreen Terrace.

Access to public art and community events is an important priority to define and enhance the identity of Camas. Beloved local traditions like Camas Days, the Camas Farmers Markets, and seasonal parades and festivals foster a deep sense of connection and pride. New development will include and support inclusive public gathering spaces to host events, ensuring that the community spirit thrives as the city grows.

Key community resources to preserve and enhance include the existing built infrastructure, high quality schools, access to living wage jobs, parks, open space and recreational amenities, and the distinctive Downtown area, where historic storefronts, local restaurants, and venues like the Liberty Theatre draw residents and visitors alike.

The community will connect with city government and processes through accessible engagement and neighborhood leadership. Ongoing collaboration will help ensure that Camas remains a place where people feel heard, welcomed, and at home.

Community Character Goals and Policies

Goal CC-1 Art, Culture, and Heritage

Camas is a city where history, art, and culture are celebrated and accessible to all. Camas events and activities will instill a sense of belonging among residents of all ages, making Camas an ideal place to live and work.

Policy CC-1.1 Encourage and promote a wide range of artistic and cultural activities by reducing barriers and increasing access to hosting and attending community events that define and enhance Camas' community identity.

Policy CC-1.2 Incentivize development sites to create spaces conducive to the provision of art and other cultural activities and amenities. Encourage murals, sculptures, interactive art installations, and

interpretive displays that celebrate the history, culture, and creativity of Camas.

Policy CC-1.3 Develop a process to memorialize historic sites and create and maintain an official inventory of Camas' historic and cultural resources.

Policy CC-1.4 Support the formation of a local arts commission that provides funding and support for local artists and artistic events in Camas.

Policy CC-1.5 Require a percentage of capital project budgets to be allocated for public art and design enhancements.

Policy CC-1.6 Prioritize naming streets, parks, and public facilities after historically significant people, events, geographic features, or native flora and fauna. Consider allowing naming rights in recognition of significant donations.

Goal CC-2 Sustainable Growth and Distinct Identity

Camas' unique identity is enhanced by high-quality urban design that respects the natural landscape, fosters a connection to nature, and integrates sustainable development.

Policy CC-2.1 Establish and enforce clear and objective design standards to ensure that new development respects and enhances Camas' architectural, historical, and natural character.

Policy CC-2.2 Regulate land use and development to protect natural topographic, geologic, vegetative, and hydrologic features, and natural contours of undeveloped properties.

Policy CC-2.3 Promote and provide educational resources for tree-lined streets, rain gardens, and preservation and use of native landscaping to reinforce Camas' connection to nature.

Policy CC-2.4 Align development regulations and design guidelines with dark sky standards to encourage the preservation of the night sky.

Policy CC-2.5 Establish distinctive gateway features at major points of entry into Camas, including attractive signage, landscaping, and public art that reflect Camas' distinct identity.

Policy CC-2.6 Ensure that street signage, lighting, landscaping, and street furniture are designed and maintained with a cohesive aesthetic that enhances community identity.

Policy CC-2.7 Revise the City's sign standards to ensure that all permanent and temporary signage is attractive and well-maintained, with clear regulations and enforcement mechanisms.

Policy CC-2.8 Provide educational and volunteer programs related to climate science, the connections between habitat conditions and native species, and effective ways to mitigate the impacts of climate change.

Goal CC-3 Community Engagement

Camas will have a strong sense of community through open communication, inclusive and meaningful outreach efforts, and enduring partnerships throughout the community.

Policy CC-3.1 Increase access to public engagement by ensuring materials and procedures are accessible for all community members, especially vulnerable groups such as low-income, Limited English Proficiency (LEP) individuals, youth, elderly, and differently abled.

Policy CC-3.2 Utilize outreach strategies such as focus groups and listening posts that accommodate the needs of everyone and account for the broad spectrum of community members.

Policy CC-3.3 Develop and implement strategies to support neighborhood leadership and associations to increase community involvement and provide opportunities to participate in the development processes.

Policy CC-3.4 Regularly inform the community of activities and events through a range of outreach methods including traditional and social media, partnerships with schools, and information at fairs and events.

Policy CC-3.5 Develop a City education program to inform the community on the inner workings of their local government, city functions, and an opportunity to engage with staff.

ourCamas 2045



Land Use

04

Land Use Element

The land use element is designed to support development that adheres to the City's vision to ensure Camas' future is as bright as its past.

04. Land Use

Vision

Camas embraces its small-town feel while responsibly managing growth, ensuring a prosperous and livable future for all. Camas provides a variety of housing options that meet the needs of all residents, while ensuring the town's charm and livability are sustained. Camas is home to a thriving economy and diverse businesses, affording residents ample employment opportunities and access to high wage jobs. Neighborhood commercial hubs connect residents to daily services and amenities through a network of sidewalks and bike lanes, improving access and connectivity.

Land Use Overview

The City of Camas is home to great schools, family-wage jobs, high quality neighborhoods, and an abundance of open space and recreational amenities. Camas has grown into a dynamic, vibrant city with diversified employment opportunities and services that cater to its residents' various needs. In 2025, Camas maintains its small town charm and character, and downtown remains the heart of the City with a mix of restaurants, shops, professional offices, and residential development. The Grass Valley area is home to several national and international technology and manufacturing firms. Newer residential development has occurred recently in the Green Mountain area, and planned transportation improvements in the North Shore area will improve connectivity and provide better transportation options throughout the City.

The land use element is designed to support development that adheres to the City's vision to ensure Camas' future is as bright as its past. The GMA identifies the land use element as the foundation of the comprehensive plan. GMA outlines the framework by which the plan will be implemented and establishes land use designations to accommodate the City's population and employment projections. The development of land in accordance with the goals and policies included in the land use element will ensure the achievement of an appropriate balance of public facilities, housing, employment, services, and recreational uses throughout the City.

Population Projections

GMA requires that each jurisdiction accommodate its share of the region's growth. The City of Camas is expected to have a population of 37,080 by 2045 (based on the County adopted growth rate of 1.2 percent per year), a 7,729-person increase from the 2023 population of 29,352. During the same period, Camas is expected to add 13,658 jobs.

Land Use Designations

In order to ensure the City's vision and land use goals are achieved, land use designations are used to assign a variety of development uses and building densities to land throughout the City. The plan identifies areas for residential, commercial, mixed use, mixed employment and industrial development. The plan also identifies areas for parks and open space to support recreation and enhance natural areas, including habitat and wildlife corridors.

Table 1 Land Use Designations

Comprehensive Plan Designation	Corresponding Zones	Total (Acres)[1]
Residential Low	Residential 15,000 (R-15)	407
	Residential 12,000 (R-12)	27
	Residential 10,000 (R-10)	280
	Residential 7,500 (R-7.5)	151
	Residential 6,000 (R-6)	19
	North Shore Lower Density (LD-NS)	145
	Downtown Residential (R-DT)	68
Residential Medium	Multi-Family 10 (MF-10)	37
Residential High	Multi-Family 18 (MF-18)	41
	Multi-Family 26 (MF-26)	33
	Multi-Family 34 (MF-34)	6
	North Shore Higher Density (HD-NS)	109
Mixed Use	Mixed Use (MX)	141
	North Shore Mixed-Use (MX-NS)	85
	Downtown Mixed-Use Low Rise (MX-LR)	41
	Downtown Mixed-Use Mid Rise (MX-MR)	55
Mixed Employment	Mixed Employment (ME)	235
	North Shore Mixed Employment (ME-NS)	99
Commercial	Neighborhood Commercial (NC)	2
	Community Commercial (CC)	63
	North Shore Commercial (C-NS)	54
	Regional Commercial (RC)	298

	Historic Main Street Core (HMSC)	17
Industrial	Heavy Industrial	545
Parks and Open Space	Neighborhood Park (NP) Special Use Park (SU) Open Space (OS)	1,343

[1]Total acres within each zoning designation are gross acres and inclusive of rights-of-way and infrastructure.

Overlays

In addition to the land use designations listed in Table 1, land use overlays further define appropriate uses and development standards for particular areas within the City. Overlays in Camas include an Airport Overlay and a Design Overlay. Development within all overlay areas must comply with the goals and policies of the underlying land use designation and the specific standards included in the overlay.

The Airport Overlay area applies to land adjacent to Grove Field, an airport owned and operated by the Port of Camas-Washougal and located northeast of Lacamas Lake. Grove Field adjoins the City's UGA and is proposed to be included in the UGA with this update. The Airport Overlay is designated to ensure land uses adjacent to the airport are compatible with air traffic and do not interfere with safe air navigation. For example, the comprehensive plan designation of lands adjacent to the airport is generally Mixed Employment, rather than residential, and the Airport Overlay area restricts uses tending to have higher concentrations of people, such as schools or hospitals.

The Design Overlay is a new overlay with the 2025 update and replaces the Gateways and Corridors Overlay included in the prior plan. The Design Overlay generally applies to the following locations. The specific extents of the overlay are included on the Camas Zoning Map.

- 6th Avenue
- 3rd Avenue
- Everett Street
- 38th Avenue
- Lake Road
- Green Mountain - Goodwin
- Brady Road
- Union Street
- Parker Street

The Design Overlay is intended to enhance the walkability, pedestrian experience, and design of the corridors it covers. Development/redevelopment within a designated Design Overlay must adhere to the Design Overlay goals and policies included in this element. See Goal LU-6 and Policies LU-6.1 – 6.7.

Figure 2 Comprehensive Plan Map

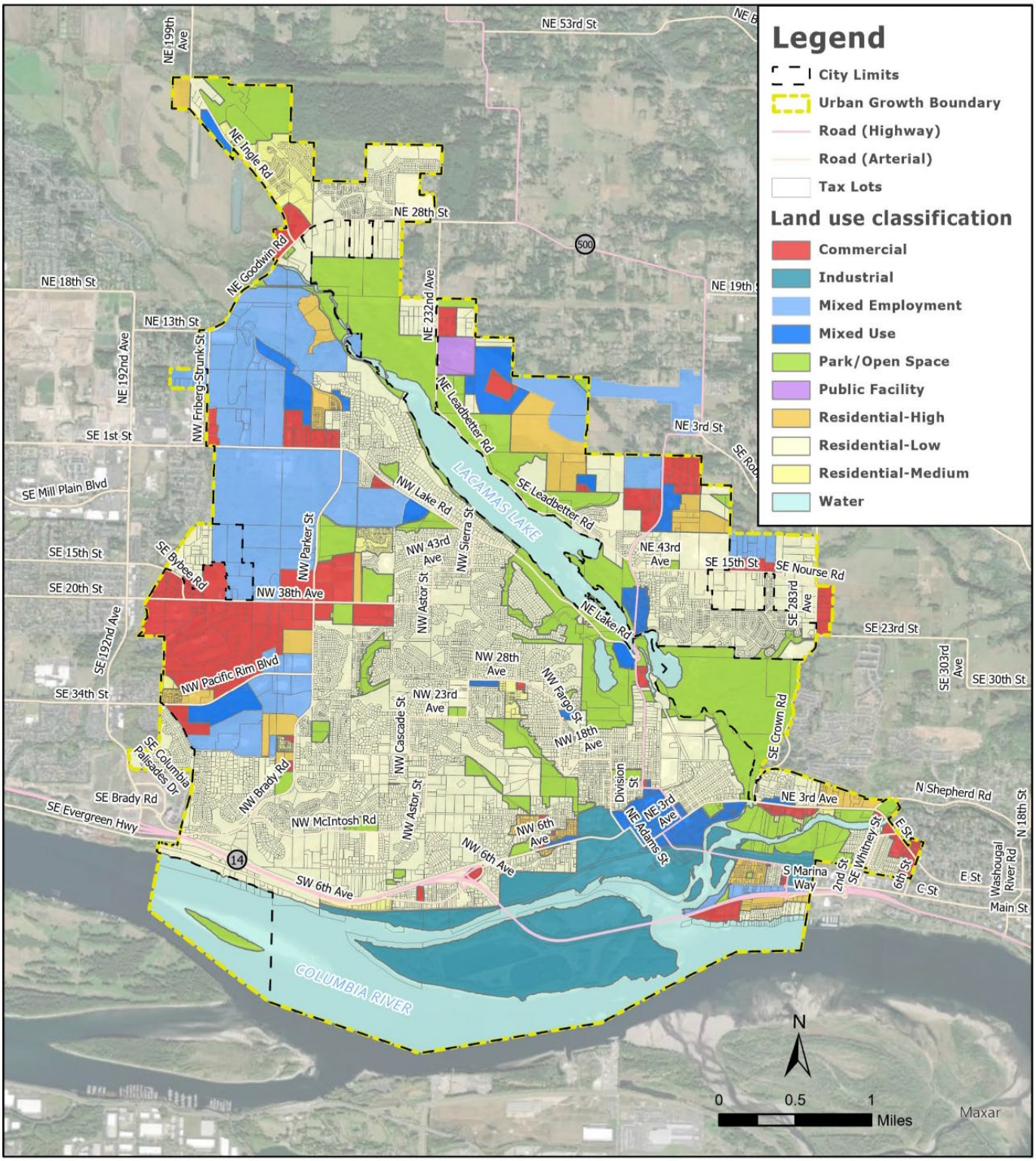
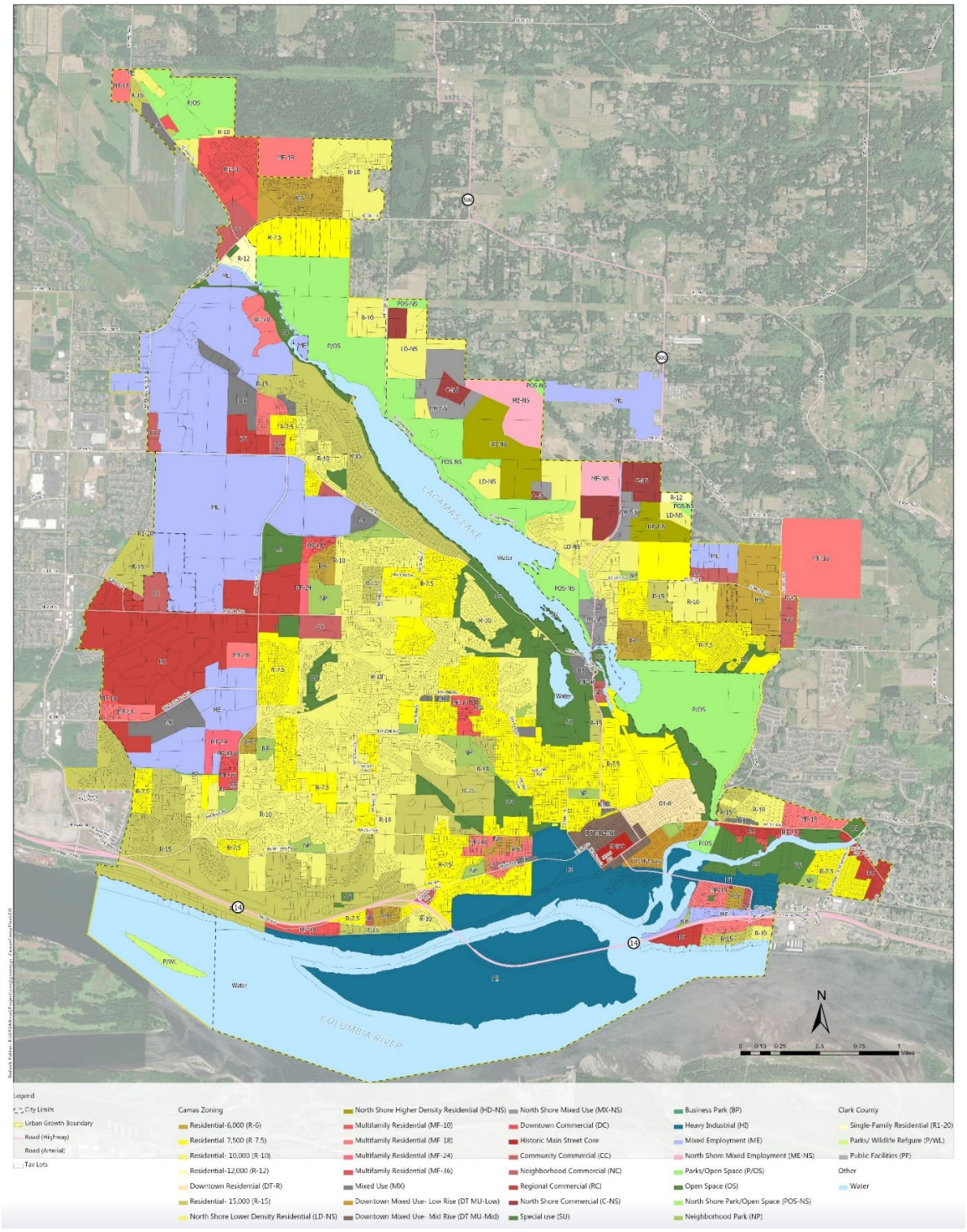


Figure 3 Zoning Map



Land Use Goals and Policies

Goal LU-1 Citywide Land Use

Maintain a land use pattern that respects the natural environment and existing uses while accommodating a mix of housing and employment opportunities to meet the City's growth projections in coordination with the capital improvement plan.

Policy LU-1.1 Ensure the appropriate mix of commercial, residential, and industrial zoned land accommodates the City's share of the regional population and employment projections for the 20-year planning horizon.

Policy LU-1.2 Coordinate with Clark County, the state, and special districts to identify future needs for essential public facilities such as airports, state education facilities, state and regional transportation facilities, state and local correctional facilities, solid waste handling facilities, regional parks and others as identified in RCW 36.70A.200. (See policies ED-3.1, 3.2, and 3.3 regarding Grove Field airport, policy TR-2.1 regarding transportation, and policy PFS-4.27 regarding solid waste.)

Policy LU-1.3 Implement design standards for new development, redevelopment, and infill that consider the surrounding built and natural environments and support a natural transition between uses.

Policy LU-1.4 Ensure that park and recreation land is distributed equitably throughout the City and work to achieve park and continuous trail corridors from Green Mountain to the Columbia River. (See policies PFS-2.1 and 2.4 regarding increasing connectivity to natural areas and continuous trail around Lacamas Lake.)

Policy LU-1.5 Ensure adequate public facilities, including roads, emergency services, utilities, and schools, exist to serve new development, and mitigate potential impacts to current residents. Establish and maintain policies for impact fees for new development.

Policy LU-1.6 Ensure consistency with County-wide planning policies.

Policy LU-1.7 Evaluate and improve design and building standards for new and redeveloped sites in high-risk natural hazard areas.

Policy LU-1.8 Incorporate sustainable and low climate impact design into development codes and standards.

Policy LU-1.9 Encourage high density concentrations of housing, commercial, and other uses needed in daily life along major transportation corridors to support the reduction in vehicle miles traveled and opportunities to increase physical activity.

Policy LU-1.10 Protect the viability of the airport as a significant economic resource to the community by encouraging compatible land uses and densities, and reducing hazards that may endanger the lives and property of the public and aviation users consistent with state laws RCW 36.701A.510 and RCW 36.70547.

Goal LU-2 Employment Land

Create a diversified economy and serve Camas residents, businesses, and tourists by providing sufficient land throughout the City to support a variety of business types and employment opportunities.

Policy LU-2.1 Protect employment land to ensure an adequate supply of commercial and industrial land to meet 20-year employment projections. Encourage a balance of new and existing commercial, light industrial, knowledge-based business, medical, and high-tech uses.

Policy LU-2.2 Encourage mixed-use developments (residential and commercial) that support adjacent uses, reduce vehicle miles traveled, and balance job creation.

Policy LU-2.3 Implement development and landscaping standards to ensure industrial development and other employment lands integrate with the surrounding neighborhoods.

Goal LU-3 Neighborhoods

Create vibrant, stable, and livable neighborhoods with a variety of housing choices that meet all stages in the life cycle and the range of affordability.

Policy LU-3.1 Encourage connectivity between neighborhoods and adjoining natural areas and trails to increase access to recreation amenities. (See policies PFS-2.1 and 2.2)

Policy LU-3.2 Discourage exclusive neighborhoods, privacy walls, and gated communities.

Policy LU-3.3 Provide commercial zoning within a half mile of residential areas for the development of food retailers (grocery stores and farmers' markets) to improve food access.

Goal LU-4 Natural Environment

Develop an interconnected network of parks, trails, and open space to enhance the quality of life for Camas residents and visitors and support and preserve wildlife corridors and natural resources.

Policy LU-4.1 Maintain development regulations that encourage the preservation of trees and natural areas, including the use of density bonuses and other tools to protect sensitive areas and encourage tree replacement. (See policy NE-4.1)

Policy LU-4.2 Support the purchase and preservation of open space by the City and private owners. Encourage careful consideration and integration of the natural environment in planning activities to maintain the park-like setting of Camas.

Policy LU-4.3 Encourage connectivity and increase access to regional trails throughout the City to support multi-modal transportation and physical activity. (See policies PFS-2.1)

Policy LU-4.4 Protect the quality and quantity of groundwater used for public water supplies through conservation of water usage and treatment of runoff.

Goal LU-5 Mixed-Use Areas

Foster economically and socially diverse mixed-use neighborhoods that meet the multi-modal transportation, housing, employment, education, recreation, and health needs of the community.

Policy LU-5.1 Mixed-use developments should be unique to the area in which they are located, encourage small business development, provide a mix of housing types to ensure affordability, increase pedestrian and transit connections, and include design that is sensitive to the natural environment.

Policy LU-5.2 Develop mixed-use areas that are oriented to the public street and scaled and designed to integrate with surrounding land uses.

Policy LU-5.3 Create a mixed-use zone that requires developments to include a minimum percentage of commercial space in both vertical and horizontal mixed-use settings.

Goal LU-6 Design Overlay Areas

Create attractive and welcoming areas in the City and distinguish Camas from adjacent jurisdictions through the development of design overlays.

Policy LU-6.1 Encourage development and redevelopment along the design overlay corridors that respects the historic character of the areas, improves pedestrian mobility/safety, and supports small-scale retail and commercial services.

Policy LU-6.2 Encourage development of commercial uses and multi-family residential within the NE 6th Avenue and NE 3rd Avenue design overlay corridors to support downtown businesses (such as through the Downtown subarea plan). Consider rezoning low-density residential land to support the downtown area. Consider rezoning low-density residential land to support the downtown area.

Policy LU-6.3 Orient building entrances toward the street and provide pedestrian connections from building entrances to the sidewalk. Encourage landscaping, rather than parking, between the building and the street to create a welcoming streetscape.

Policy LU-6.4 Collaborate with partners to support community events, public art, and infrastructure investments that celebrate cultural heritage, provide community amenities, and strengthen community branding. Develop area identities through events, festivals,

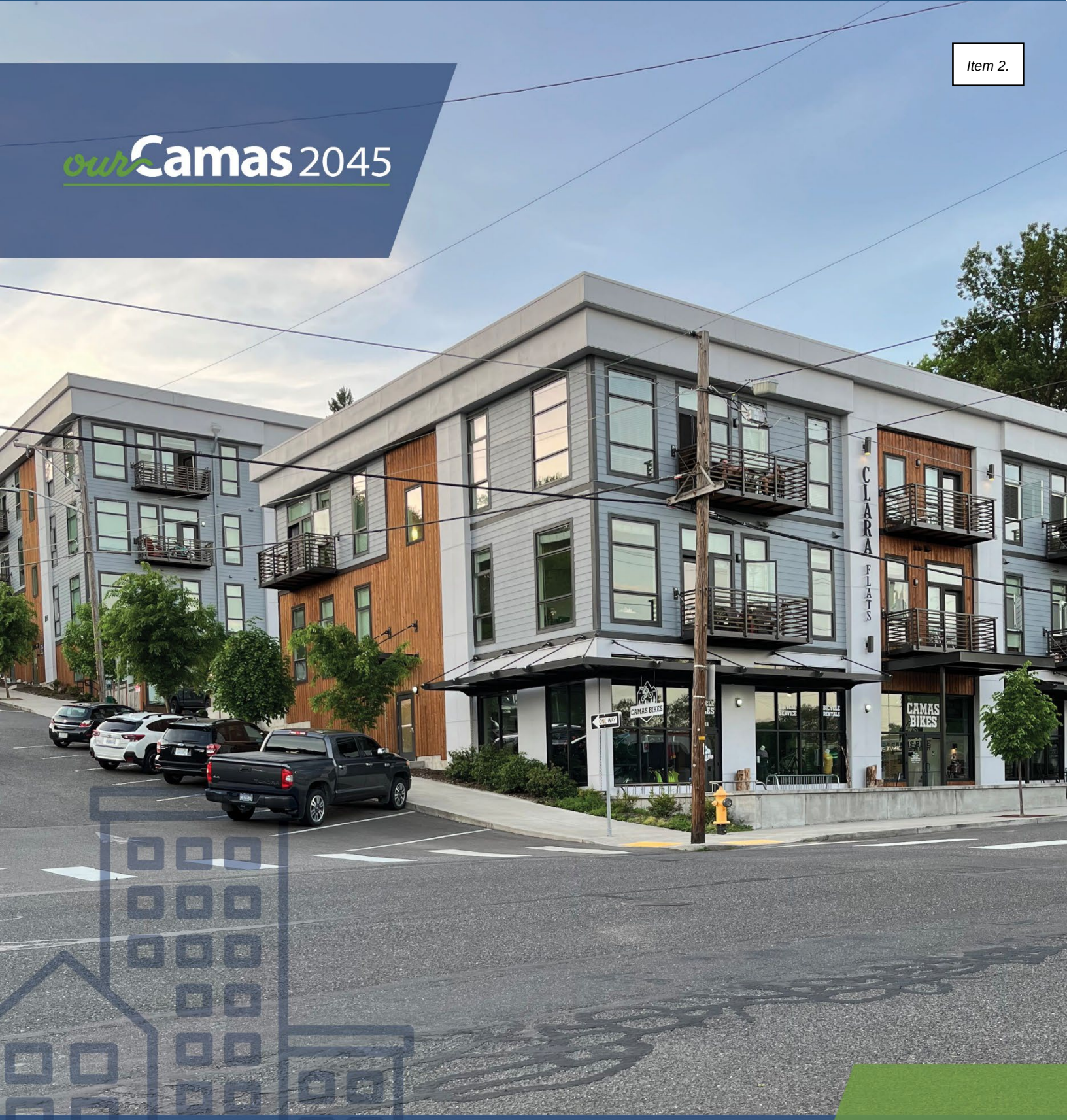
signage, and other improvements that help establish or enhance existing character within the overlay areas.

Policy LU-6.5 Encourage the designation and development of design overlay features in strategic areas to create a distinct pedestrian scale identity and attract visitors.

Policy LU-6.6 Identify streets in the design overlay areas as public places to encourage pedestrian and bicycle mobility and to reinforce the connection between the corridors and the surrounding neighborhoods.

Policy LU-6.7 Improve and increase wayfinding signage in design overlay areas to nearby recreational and other amenities.

ourCamas 2045



Housing

05

05. Housing

Vision

In the year 2045, residents of Camas continue to appreciate their safe, diverse, and welcoming community. Those raised in Camas will return for living-wage jobs and to ultimately retire here. Camas is a well-planned and connected city where residents enjoy pedestrian and bicycle paths between neighborhoods and to downtown. Camas provides a wide variety of housing options that meets the needs of all residents and provides a range of housing for all ages, abilities, needs, preferences, and income levels.

Background

This element of the comprehensive plan sets out the vision, goals, and policies to address current and projected housing needs for the next 20 years (2025 to 2045), inclusive of the diverse needs of the whole community across the income spectrum. Camas is facing housing challenges that could benefit from improved access to more housing options including more housing for seniors and young adults, smaller housing, more rental units, and affordable homeownership opportunities, all of which the City can have a role in supporting.

The housing element is supported by a housing needs assessment (provided below) that quantifies existing housing stock and projected housing needed to accommodate projected growth. Housing analysis is an important exercise as the housing needs in Camas tend to continually evolve based on changes in the broader economy, local demographics, and the regulatory environment. In addition to an assessment of housing needs based on the best available existing data, the housing element goals and policies reflect community input, state legislative requirements, and City of Camas' priorities.

The following section provides background on the planning framework and highlights the analytical findings associated with current and projected housing including details on Camas' community demographics, housing stock, housing market dynamics, expected housing demand, and special housing needs. The insights from this analysis help to build a factual basis for the housing policy updates.

Housing Challenges

Camas is facing housing challenges that could benefit from improved access to more housing options including more housing for seniors and young adults, smaller housing, more rental units, and affordable homeownership opportunities, all of which the City can have a role in supporting.

Planning Framework

In Clark County, RCW 36.70A.040 requires all cities to "fully plan" for the Elements of a Comprehensive Plan, including land use, housing, capital facilities, utilities, transportation, and climate change.[1] The current update process is part of a periodic update also required by the Growth Management Act (GMA), as part of an established schedule by the County.

At the state level, the GMA requires local jurisdictions to adopt Housing Elements that are consistent with statewide goals and objectives. The Housing Element must include an inventory and analysis of existing and projected housing needs that identifies the number of housing units by income level necessary to manage projected growth including permanent supportive and emergency housing.

Recent state legislation calls for cities to expand middle housing allowances in single family residential zones (HB 1110) and support Accessory Dwelling Unit development (HB 1337). These changes require cities to allow up to two Accessory Dwelling Units (ADUs) on all lots zoned to allow single-family homes. Lots with critical areas or their buffers are exempt from the requirements of both HB 1110 and HB 1337. In addition, via HB 1220, the Washington State Department of Commerce instructed local governments to "plan for and accommodate" housing affordable to all income levels.

MIDDLE HOUSING POLICY IN WA

'Middle housing' refers to moderate-density housing types between single-family detached homes and larger multifamily housing. HB 1110 became effective in July 2023 and requires that designated Growth Management Act (GMA) planning cities in Washington must allow certain minimum densities for middle housing within 6 months after their periodic update due date.

Camas is counted as a Tier 2 city under this policy, which must allow for 2 dwelling units per lot or higher in predominantly residential zones, as well as 4 dwelling units per lot within a quarter mile of major transit stops and for affordable housing (ESHB 1110, Sec. 3(1)(c)).

The Clark County Countywide Planning Policies provide helpful guidance on the Comprehensive Plan update. Clark County is currently in the process of updating its Comprehensive Plan and its Countywide Planning Policies. The existing 20-year growth plan spans 2015-2035 and includes a Housing Element with relevant policies for jurisdictions within the County. Please see Appendix X for a summary of the existing relevant Clark County Countywide Planning Policies.

Lastly, the City of Camas completed its Housing Action Plan (HAP) in 2021, including a housing needs assessment and a thorough community engagement process focused on learning about housing experiences and identifying ways to meet housing needs and overcome core challenges. The engagement included two virtual public meetings, seven focus groups and

[1] The GMA includes other optional Elements for economic development, parks and recreation, conservation, energy, sub areas, and ports.

interviews, a housing survey with over 300 responses, a project website, and written public comments. Key findings helped to shape the updates to the Camas Housing Element.

Community Engagement

The project team held interactive open houses and interviewed stakeholders to learn about housing challenges, opportunities, and actions. Engagement activities identified the following themes that could contribute to future decision-making related to housing in Camas.

Housing Insights

- **North Shore:** Need infill development.
- **General:** Are there model cities Camas would strive to look like? (Lake Oswego, Bend, etc.) Compare plans with cities that have experienced similar growth? What did they do well?
- **Housing:** Allow work/live housing along and around UGA/schools and major transportation corridors. Ensure workforce housing is available for current and future workers. Having diverse housing options will lead to a more diverse city.
- **Barriers to development and safety issues for pedestrians:** Height restrictions and fees are challenging, since rents are lower it is harder to make a project pencil, and need for safer crossings on 3rd Ave and difficult to cross 5th in some areas.

Public Engagement Findings Regarding Housing Strategies

- Citywide: Maintain the strength, vitality, and stability of all neighborhoods and promote the development of a variety of housing choices that meet the needs of all members of the community. This goal seems very wide and difficult to achieve. More focused on affordability?
- More moderate density in and near Downtown with good connectivity (Safe, lit, easy).
- Be intentional- positive in messaging about adding middle housing and moderate density so community gets accustomed to why it is so important for our community and culture to include all. Show that it's not scary.
- Consider incentivizing housing developers through zoning, taxes and fees, and partnerships.
- Partnerships: Partner with Vancouver Housing Authority and other organizations to develop affordable housing. Partner with habitat for humanity and housing authority. Proud ground for moderate- and low-income housing.
- Attract a large senior housing project.
- More 4-5 story multi-family units, especially Downtown.
- Builder incentives to focus on mixed use/ apartments.
- Don't forget the bike paths.
- Make it easy to build ADUs in backyards.
- Support yes in my backyard policies.

- Incentivize small developers (housing & economic development combined!).

Housing Action Plan

The City of Camas completed its Housing Action Plan (HAP) in 2021, including a housing needs assessment and a thorough community engagement process focused on learning about housing experiences and identifying ways to meet housing needs and overcome core challenges. The engagement included two virtual public meetings, seven focus groups and interviews, a housing survey with over 300 responses, a project website, and written public comments. Key findings about community priorities and HAP goals and strategies are summarized below.

HAP Goals

- **Develop Housing to Accommodate Growth.** Thoughtful changes to Camas' zoning and development regulations can allow the City to better accommodate projected growth.
- **Diversify the Mix.** A greater variety of housing types can better serve young families, small households, seniors, people with disabilities, and people with diverse incomes.
- **Increase Housing Affordability.** Young families, seniors, and people who work in Camas may have difficulty finding affordable housing in Camas.
- **Preserve Existing Affordable Housing.** Camas should adopt strategies to preserve its existing affordable housing and prevent the displacement of residents. Community members noted concern for preserving existing affordable housing, particularly smaller single-family properties, in older neighborhoods near Downtown.

STRATEGY	GOALS			
	DEVELOP HOUSING	DIVERSIFY HOUSING MIX	INCREASE HOUSING AFFORDABILITY	PRESERVE AFFORDABLE HOUSING
Strategy 1: Expand housing opportunity in mixed use and downtown commercial districts	♦	♦		
Strategy 2: Consider making targeted rezones during Comprehensive Plan updates	♦			
Strategy 3: Diversify allowed housing types and update related lot and dimensional standards	♦	♦	♦	
Strategy 4: Focus on key areas with residential development or redevelopment potential. Expand more mixed-use areas throughout the city.	♦	♦		
Strategy 5: Continue community conversations around housing and housing for all	♦	♦	♦	♦
Strategy 6: Communicate available affordable housing resources			♦	
Strategy 7: Build partnerships to develop and preserve affordable housing for individuals, families, and seniors. Explore expansion of the MFTE program.			♦	♦
Strategy 8: Explore funding source and cost reduction options for affordable housing	♦	♦	♦	♦

Housing Targets

Planning for future housing demand is critical to ensure that the City can meet demand driven by population growth. This section summarizes projected future housing demand for Camas to provide context for the City's housing policies.

Population and Housing Allocations

Table 2 below demonstrates the City of Camas and Clark County's anticipated population forecast between 2023 and 2045. Since 2000, Camas has grown at a faster rate than the County overall with an Average Annual Growth Rate (AAGR) of 5.2% in the City (including annexations), compared to the County's AAGR of 2.4% (Housing Appendix). However, the County's estimates assume a slower growth scenario for the City in the next 22 years. With this assumption, new population growth in Camas is estimated to comprise 4.05% of growth in Clark County overall.

The population growth forecast indicates that the City of Camas will make up 4.05 percent of new growth population in Clark County between 2023 and 2045 with an AAGR of 1.2% in the City. The County's methodology also acknowledges Washington State Department of Commerce's HAPT estimates for current housing supply in Camas and allocates a number of net new units for the Urban Growth Area(s).

Table 2 Population Growth Forecast, Camas and Clark County, 2023 to 2045

Source: Clark County Interim Population Allocations and Clark County Comprehensive Plan 2025 Update, 2025 Population, Housing, and Employment Allocation – Issue Paper 5.

Jurisdiction	2023 Est. Population	Vacant Buildable Land Model Percent Capacity	2023-2045 Growth	2045 Estimate	Change (percent)	AAGR
City of Camas	**29,352**	**4.26%**	**7,729** ***(4.05% of total growth)***	**37,080**	**26%**	**1.2%**
Clark County	527,400	100%	190,754 *(100% of total growth)*	718,154	36%	1.6%

In May 2024, Clark County adopted housing allocations for jurisdictions located within county boundaries. In total, this shows an estimated 4,226 housing units needed by 2045 in the City of Camas and UGA(s).[2] The City would add about 311 new units to meet the new permanent

[2] The Washington State Department of Commerce Housing for All Planning Tool (HAPT) provides two allocation methods for determining the share of a County's housing supply to be met by jurisdictions. Method A assumes all housing needs will be accommodated through new housing production. Method B assumes all jurisdictions will accommodate equivalent shares of the total countywide housing need at each income level, proportional to their size, in the projection year. Clark County elected to use a hybrid method of 75/25 for Camas.

supportive housing target and 1,766 units affordable to low-income households below 80% of AMI by 2045. Camas currently has 143 units of housing affordable for households at or below 30% of AMI that are not Permanently Supportive Housing (PSH)[3] and 14 emergency units[4] according to the HAPT estimate. With this allocation, the City will need to accommodate 172 new units of temporary emergency housing by 2045.[5]

HOUSING ALLOCATIONS

In 2021, HB 1220 created a new way that communities in the state are required to plan for housing needs. This legislation requires that jurisdictions plan for sufficient land capacity for housing needs, including all economic segments of the population (moderate, low, very low and extremely low income, as well as emergency housing and permanent supportive housing).

- **Since 2000, the City of Camas had an average annual growth rate of 221 new housing units per year.**
- **Comparatively, the City will need to add an average of 195 new housing units per year between 2024 and 2045 to reach its allocation of net new units.**

[3] Permanent Supportive Housing is defined as: "subsidized, leased housing with no limit on length of stay that prioritizes people who need comprehensive support services to retain tenancy and utilizes admissions practices designed to use lower barriers to entry than would be typical for other subsidized or unsubsidized rental housing, especially related to rental history, criminal history, and personal behaviors" Washington RCW 36.70A.030(31).

[4] Temporary emergency housing is defined as: "temporary indoor accommodations for individuals or families who are homeless or at imminent risk of becoming homeless that is intended to address the basic health, food, clothing, and personal hygiene needs of individuals or families. Emergency housing may or may not require occupants to enter into a lease or an occupancy agreement." – Washington RCW 36.70A.030(14).

[5] Clark County's interim allocations do not include designated temporary emergency housing units at the City level. Estimates in this section for the City of Camas are derived directly from the Department of Commerce HAPT tool.

Figure 4 Housing Unit Allocations by Income, Camas and its UGA, 2024-2045

Source: Washington State Department of Commerce HAPT, Clark County Interim Housing Allocations, City of Camas
Note: Current supply includes both the estimate from the HAPT with the addition of 599 additional units since its calibration in 2020.



4,226 new homes will be needed over the next 20 years in the City of Camas

In addition, there will also need to be:

172 Emergency housing beds (temporary housing)

	0-30% AMI		>30-50% AMI	>50-80% AMI	>80-100% AMI	>100-120% AMI	>120% AMI	Total	Emergency housing beds
	Non-PSH	PSH							
2024: Current Housing Supply Estimate	143	0	458	1,874	1,182	1,965	4,201	**9,832**	14
2024-2045: New Housing Unit Needed for the Allocation	**564**	**331**	**811**	**955**	**516**	**249**	**799**	**4,226**	172
2045: Total Target Supply	707	331	1,269	2,811	1,627	2,214	4,499	**13,459**	186

Residential Capacity

Residential capacity is generally defined as the amount of existing housing units plus new housing a city can accommodate based on city zoning regulations (e.g., residential density requirements in the zoning code) and land available for new development. Residential capacity relates to residential growth allocations in a number of ways. Evaluating residential growth capacity is necessary to determine whether the housing growth allocation (determined by the

county) can be accommodated within the City of Camas and its UGA. Sufficient capacity is available if residential growth capacity is equal to or greater than the City's allocation. If sufficient capacity is not available, the shortfall must be addressed by rezoning, or revising allowable density, or by modifying or creating a new UGA or annexed area to provide additional area for residential growth capacity. The Vacant Buildable Lands Model (VBLM) for Clark County provided a basis for the available housing capacity in the City of Camas based on available buildable land (including both vacant and underutilized land) and current zoning. The existing zoning and UGA showed insufficient housing capacity.

The City of Camas is proposing zoning modifications that would allow for more residential capacity. Consequently, another analysis was completed to consider future modifications to select zones. According to the housing capacity estimates, Camas would have capacity for 5,329 housing units which would result in a surplus over the 2045 housing target of 4,226 housing units. Results (summarized below) from the updated capacity analysis show sufficient residential growth capacity to meet the 2045 housing target. The estimates depend on the final preferred alternative which could be refined further.

Summary of Housing Analysis Findings

A summary of key findings from the housing data analysis is provided below to help describe key insights to inform Comprehensive Plan policy updates (Technical Appendix provides the full findings).

Community Demographic Trends

- **Since 2000, Camas has grown at a faster rate than Clark County or Washington State overall, more than doubling in size by 2023 from 12,462 to 27,420 persons.** As population increases, the demand for housing also rises and affects planning.
- **In terms of land, Camas has expanded incrementally over time through annexations.** In the 2000's and early 2010's, the City added large new areas on the north side of Lacamas Lake, with a large portion of this area zoned for multifamily housing alongside employment and commercial areas.
- **Camas is becoming a more diverse community.** The share of people of color increased from 13% in 2012 to 24% in 2022 and is slightly more diverse than the county (21% were people of color in 2022).
- **Camas is seeing a larger share of couples and families with children (39%) and has a higher share of both groups than the County or State (24%, 22%, respectively).** The City also had a larger median household size (almost 3 persons) compared to the county (2.65 persons).
- **Median household income in Camas is higher than both Clark County and the state at $133,000 in 2022.** Adjusting for inflation, median income in the City still increased by 31 percentage

points since 2012 which is primarily due to growth in high-income households earning over $100,000 per year.[6]

- **Four out of five households in Camas owned their homes in 2018-2022, at a higher rate than either Clark County or Washington.** The share of renter households stayed the same in Camas since 2012, showing less than a 1% increase over this time period.
- **County-level trends indicate that homeownership disparities exist for some groups by race and ethnicity in Clark County,** with households who are Black or African American, American Indian or Alaska Native, Native Hawaiian or Pacific Islander, Hispanic or Latino, or mixed/other races having lower rates of homeownership.
- **At the County level, income levels also vary by race and ethnicity.** Households who were Black or African American, Native Hawaiian or Pacific Islander, Hispanic or Latino, two or more races, or another race had lower median household incomes than the overall average.
- **Overall levels of housing cost burden are decreasing, but more renters and low-income households experience higher rates.** Around 24% of all Camas households experienced cost burden (2022) with a higher share of renter households experienced cost burden compared to homeowners and with 100% of households earning less than $20,000 experienced severe cost burden (paying at least half of their monthly income towards housing). Although cost burden is generally lower for homeowners, more people of color in Camas who own their homes experience cost burden compared to white, non-Hispanic homeowners.

Existing Housing Inventory

- **Camas has seen growth in their number of housing units in the past two decades,** with a 108% change between 2000 and 2023 (annually this equates with an average of 221 new homes). The City of Camas' growth in housing units was lower than its population change (120%), indicating that the City has not been keeping pace by adding to its supply to meet the rising demand.
- **Camas has steadily low vacancy rates for all housing units in total** (4% in 2022 with little change over the last decade). This level of vacancy is indicative of a healthy housing market with natural rates of turnover; however, the slight decrease could begin to indicate constrained supply of housing.
- **For two-bedroom multifamily units, Camas has seen spikes in vacancy, but these align with new construction trends** which can temporarily raise vacancy rates for newly delivered units but do not indicate long-term vacancy. In 2023, the City saw over 200 new housing units delivered, likely accounting for the fluctuation in vacancies, as well as deliveries in 2017 and 2020.
- **Since 2015, the City has permitted 2,763 new housing units.** Single detached homes have accounted for the largest share (70%) of new permits in the City of Camas, and another 8 percent

[6] The median income in Camas is above the area median income (AMI) for 2023. HUD determined the AMI to be $114,400 for a family of four in the Portland-Vancouver-Hillsboro, OR-WA MSA (including Camas). This is lower than median income in Camas itself which was $133,000 in 2022 (Exhibit 14) and has been consistently lower than the City over time.

were made up of attached townhomes. While apartments, condos, and units in mixed-use buildings made up 20 percent of new permits between 2015-2024, middle housing types like duplexes, triplexes, quadplexes, and accessory dwelling units (ADUs) were only 2 percent of all permits.

- **Median home sale prices in Camas has increased over the last ten years,** with Camas' average prices generally remaining higher than the County. In 2023, the average home sale price in the City was **$704,000,** increasing by 119% since 2013 which is more expensive than the average home in the City of Portland (by $196,000) or Clark County (by $173,000).
- **Prices are also increasing quickly in Camas and Clark County for the average 2-bedroom multifamily rental.** The average 2-bedroom apartment rent was over $1,800 in the City and over $1,700 in Clark County (2024 year-to-date), indicating a 35% increase since 2010. Average 2-bedroom multifamily rents in Portland tracked closely with Camas in the 2010's, while rents in Vancouver remained lower (generally following countywide trends).
- **Compared with home sale price and rent increases in Camas, only households earning over 150% or more of AMI would be able to afford the average home in the City as of 2023.** However, the average 2-bedroom apartment is still affordable to households between 50 and 80% AMI in Camas.
- **The City of Camas had 98 units of regulated affordable housing in 6 buildings** according to data from Oregon Metro and the City. Approximately half of these units are affordable respectively for residents between 30-50% of AMI and 50-80% of AMI. The City also has several long-term care residential facilities for older adults providing 135 units.

Future Housing Demand

- **Since 2000, Camas has grown at a faster rate than Clark County overall but is expected to slow based on County estimates for 2045.** The County's projections assume that new population growth in Camas is estimated to grow at an annual rate of 1.2% to account for 4.05% of county growth.
- **County allocations show the need for 4,226 new housing units in Camas by 2045, adding around 211 new housing units per year.**
- **The City would add about 331 new units to meet the new permanent supportive housing target and 1,766 units affordable to low-income households below 80% of AMI by 2045.**
- **Camas residents with disabilities may require additional housing features for accessibility.** Around 8% of residents in Camas had at least one disability (2022), with the most common being cognitive difficulties, followed by ambulatory and vision difficulties. These disabilities can require housing accommodations such as zero-step entryways, ramps, lifts, or other accessibility features.

Housing Goals and Policies

Goal H-1 Citywide Housing

Promote safe, attractive, and vibrant neighborhoods with access to housing, jobs, services, schools, amenities, and healthy active living that meet the needs of all members of the community.

Policy H-1.1 Provide a range of housing choices and options to support all ages and income levels. Provide an adequate supply of land to accommodate the City's housing growth target.

Policy H-1.2 Support low impact development (LID) in residential development that minimizes both impervious areas and site grading to retain the natural contours of the land. LID strategies include conserving native vegetation, narrower streets, stormwater gardens, and other landscape practices that store and filter runoff.

Policy H-1.3 Promote the use of flexible development options (e.g., planned residential developments and development agreements) to create a variety of accessible housing types within new developments.

Policy H-1.4 Require new residential developments to demonstrate how proposed lot, street, and utility layouts can accommodate development of single-story dwellings, duplexes, and attached or detached accessory dwelling units.

Policy H-1.5 Ensure housing in mixed-use buildings (or developments) will complement the commercial and retail portion of the development and increase local living-wage jobs. Amend the municipal code to support mixed-use and middle housing development in the Downtown Subarea and near other community hubs.

Policy H-1.6 Support in-fill housing development on vacant or underutilized sites, subject to design review guidelines, that have adequate urban services. Ensure development compatibility with the surrounding neighborhood.

Policy H-1.7 Require all new housing developments to provide a range of housing types and sizes that are evaluated through the land use approval process and stipulated on the final plat.

Policy H-1.8 Support the maintenance, repair, and rehabilitation of Camas' existing housing stock by promoting resources that provide financial and other assistance to community members to maintain or repair health and safety features of their home.

Policy H-1.9 Support investment in existing neighborhoods to enhance livability, safety, and accessibility in a way that preserves unique physical character.

Policy H-1.10 Develop objective design standards to ensure new development is compatible in scale, architectural style, and landscape composition with existing and planned neighborhoods.

Policy H-1.11 Provide ongoing education and community engagement regarding Camas' housing needs, including available programs and incentives. Provide permit process support to affordable housing developers.

Policy H-1.12 Achieve and sustain the housing targets by income group allocation for Camas as adopted by the Clark County Council. Monitor and assess the City's progress in meeting housing needs at least every five years.

Policy H-1.13 Support and encourage housing legislation at the county, state, and federal levels that promotes and supports the City's housing goals and policies.

Goal H-2 Housing Choice and Affordability

Create a diversified housing stock that meets the needs of all lifestyles and economic segments of the community through new developments, preservation, and collaborative partnerships.

Policy H-2.1 Support and encourage a wide variety of housing types throughout the City to provide choice, diversity, and affordability and promote homeownership.

Policy H-2.2 Promote the preservation and rehabilitation of the City's existing affordable housing stock of all types, including low-cost rentals and

affordable owner-occupied single-family homes. Support measures that preserve affordable housing, such as home repair programs with partners to rehabilitate existing housing that serve low to moderate-income households.

Policy H-2.3 Create opportunities for ownership housing in a variety of settings, styles, sizes, and affordability levels throughout Camas.

Policy H-2.4 Provide incentives and bonuses for the development of affordable housing and middle housing. Ensure that any affordable housing built with the support of city incentives or bonuses (including, but not limited to, public funds, through development agreements, incentives, or by regulation) remains affordable for the longest possible term.

Policy H-2.5 Participate in collaborative partnerships with local and regional public and non-profit housing groups to ensure that affordable housing and supportive services are provided throughout the City.

Policy H-2.6 Encourage and support collaborations between for-profit and non-profit developers to expand affordable housing options.

Policy H-2.7 Evaluate the existing Multifamily Tax Exemption (MFTE) program provisions and participation. Consider changes and expansions to program options and associated costs and benefits that support housing production and affordable housing targets.

Policy H-2.8 Review and update the Camas Municipal Code to be consistent with State guidelines for housing and residential use.

Policy H-2.9 Plan for and accommodate Camas' allocated share of countywide future housing needs for moderate-, low-, very low-, and extremely low-income households as well as manufactured housing, multifamily housing, group homes, foster care facilities, emergency housing, emergency shelters, and permanent supportive housing.

Goal H-3 Housing Accessibility and Livability

Encourage and support a variety of housing opportunities for those with special needs, particularly those with challenges relating to age, health, or disability.

Policy H-3.1 Encourage and incentivize special needs and senior housing to be dispersed throughout the community and close to public transportation, shopping, medical clinics, and other essential services.

Policy H-3.2 Encourage, support, and work with partners, such as the Clark County Health District, that support social and health service organizations and offer programs and facilities to help persons with special needs remain in the community.

Policy H-3.3 Treat residential structures occupied by persons with disabilities the same as residential structures occupied by a family or by non-disabled unrelated individuals.

Policy H-3.4 Encourage the creation and retrofitting of senior housing and accessible housing types that allow residents to "age in place" to support aging populations and allow residents to continue living in Camas.

Policy H-3.5 Develop and implement a strategy or action plan to work with partners to secure grants and loans by agencies, private developers, and nonprofit organizations that are tied to the provision of permanent supportive housing, emergency shelter beds, transitional housing, and other housing serving at-risk populations.

Policy H-3.6 Work with other jurisdictions and health and social service organizations to develop a coordinated, regional approach to address the impacts of displacement and people at risk of becoming homeless.

Policy H-3.7 Promote the use of universal design principles for new development or redevelopment housing projects to ensure housing is designed for all people and abilities.

Goal H-4 Streamlining Permitting for Housing

Support the development of quality and sustainable housing in Camas with streamlined regulations and permitting processes.

Policy H-4.1 Periodically review and update the City's residential zoning regulations, design standards, and permitting procedures to promote quality development with timely and predictable outcomes.

Policy H-4.2 Create regulations and procedures that balance clarity and objectivity with flexibility for design innovation.

Policy H-4.3 Study the impacts of land use policy decisions and zoning code amendments and minimize the negative impacts to housing supply and affordability.

Policy H-4.4 Classify the development of middle housing and accessory dwelling units as permitted uses in lower density residential zones, consistent with the Growth Management Act.

Policy H-4.5 Review and update policies, codes, and ordinances to allow for a mix of housing types and variable lot and unit sizes in new subdivisions and development projects to promote housing choice diversity and affordability.

Policy H-4.6 Annually review the number and type of housing units built in Camas and permit timelines associated with new housing developments to inform additional changes to permitting, incentives, and housing programs.

ourCamas 2045



06 Natural Environment

06. Natural Environment

Nature in Camas

Camas has an abundance of natural areas that make it an ideal place to live. This element balances Camas' natural environment with the demands of a growing city.

Vision

Camas embraces its connection to nature and enjoys a wealth of outdoor recreational opportunities. Access to forests, clean water, parks, and trails is foundational to Camas' quality of life. The community shares a deep reverence for Camas' beauty, scenery, and tranquility, and is committed to preserving and enhancing its natural resources and tree canopy. Through proactive planning, the City mitigates the effects of changing climate conditions and natural hazards, ensuring a resilient community for generations to come.

Natural Setting

Camas is blessed with an abundance of natural areas and physical features, making it a highly attractive place for people to call home. Residents and businesses who seek an exceptional quality of life are buoyed by the natural surroundings of Camas and enjoy such amenities as Lacamas, Round and Fallen Leaf Lakes, Lacamas Creek, and the Washougal River greenway. Residents also enjoy the beauty and quiet of the open space and greenbelt network throughout the community, stitched together by the City through many decades of planning and implementation.

As envisioned decades ago and to be held in perpetuity as natural, legacy lands along Lacamas Lake, Fallen Leaf Lake, and near Green Mountain are treasured for their mature stands of evergreen and deciduous trees and offer a respite for many in the community. When people think of Camas, they think of a place that values the natural environment on par with other facets of the community. Camas is a place where stewardship of greenbelts, natural areas, and open space is an essential fiber in the fabric of the community.

Overview

The natural environment element of the comprehensive plan provides a policy framework for the identification, protection, and improvement of Camas' natural environment. Goals and policies include those for environmental stewardship, the protection of

environmentally sensitive lands (critical areas), natural areas and open space, shorelines, and landscaping and tree enhancement.

Environmental stewardship refers to the City's role as chief steward of the environment for the Camas community. A chief steward in this context means how the City, on behalf of the residents, establishes a responsible relationship between the people and the land they inhabit.

Stewardship has three prongs for the benefit of all community members. The first prong relates to compliance with the Growth Management Act (GMA) and the identification, designation, and protection of certain environmentally sensitive lands, which, in GMA, are known as critical areas. The second prong relates to the community and its steadfast approach to keeping Camas a place that balances growth with preservation of a natural areas and open space network. Camas has longed placed a premium on its open space network of environmentally sensitive lands, with or without GMA requirements. The third prong is an ethic of volunteerism and stewardship from the community's citizenry, which manifests in many ways including active volunteer groups, active boards and committees, and public involvement on issues related to the environment.

The City of Camas has preserved over 700 acres of open space across 31 sites, including forests, wetlands, riparian corridors, and steep slopes, with nearly half of this land concentrated around Lacamas Lake. These natural areas, distinct from developed parks, are managed to protect ecosystem functions, water quality, native vegetation, and wildlife habitats, while allowing for limited public access through trails and modest amenities. The City prioritizes conservation and restoration of high-value landscapes such as waterfronts, forested hillsides, and sensitive wetlands, balancing environmental stewardship with recreational use. Key efforts include protecting watercourses within three major watersheds, regulating development on steep slopes and wetlands, and maintaining resilient forest lands to support biodiversity and ecological health.

Environmental Stewardship

One of the most demanding roles the City of Camas must fulfill is that of chief steward of the community's environment while also accommodating growth. The City has the duty to implement land use policies via development regulations and the responsibility to comply with federal and state statutes related to the environment.

Facing federal and state mandates, the City strives to ensure that its environment is managed in compliance with applicable laws and does so in a wise manner. While simultaneously accommodating growth, the City encourages the preservation, restoration, and improvement of the natural environment in all development.

Goal NE-1 Environmental Stewardship

Preserve Camas' natural environment citywide by developing a sustainable urban environment and protecting natural areas and open space, including critical areas.

Policy NE-1.1 Support a cleanup of the Camas Mill and other contaminated sites to protect natural resources and the city's water supply.

Policy NE-1.2 Support programs and regulations that monitor, maintain, conserve and protect water quality in Camas, including watersheds, Lacamas Lake Basin, Columbia River Basin, and Washougal River Basin.

Policy NE-1.3 Encourage restoration and protection of natural areas through the removal of invasive species.

Policy NE-1.4 Support and implement actions identified in adopted plans, including adaptive management of natural resources that is consistent with best available science and climate guidance to improve climate resiliency.

Policy NE-1.5 Protect and restore natural resources, valuable historic and cultural areas, climate refugia, habitat areas and corridors to provide biological and hydrological connectivity that fosters resilience to climate impacts.

Policy NE-1.6 Create and support natural resource management plans that consider climate change impacts and guide adaptive management.

Policy NE-1.7 Include immediate and long-term environmental impacts in the policy and regulatory decision-making process. Identify and quantify the ecosystem services benefits of natural systems and include these natural capital assets in cost-benefit assessments for community and development planning.

Policy NE-1.8 Promote and incentivize public and private landowners to restore and create local habitats and corridors to increase the availability throughout the city.

Policy NE-1.9 Regulate land use and development to protect natural topographic, geologic, vegetative, and hydrologic features of undeveloped properties.

Policy NE-1.10 Promote soil stability and minimize and control soil erosion using best management practices, best available science, ecologically sustainable site design, natural drainage systems and protection of existing native vegetation.

Critical Areas

The natural environment includes specific environmentally sensitive areas that the GMA requires the City to identify, designate, and protect. Referred to in statute (RCW 36.70A) as *critical areas.* Under GMA, critical areas include wetlands, critical aquifer recharge areas, frequently flooded areas, geologically hazardous areas, and fish and wildlife habitat conservation areas. Each of these critical areas is present in the City. The law further requires that the City use best available science (BAS) when developing policies and regulations to designate and protect critical areas. GMA also recognizes that salmonids (salmon and trout) play an important role in the ecosystem and are vital cultural and economic resources, which require jurisdictions to give 'special consideration to conservation and protection measures necessary to preserve or enhance anadromous fisheries'.

Functions of Critical Areas

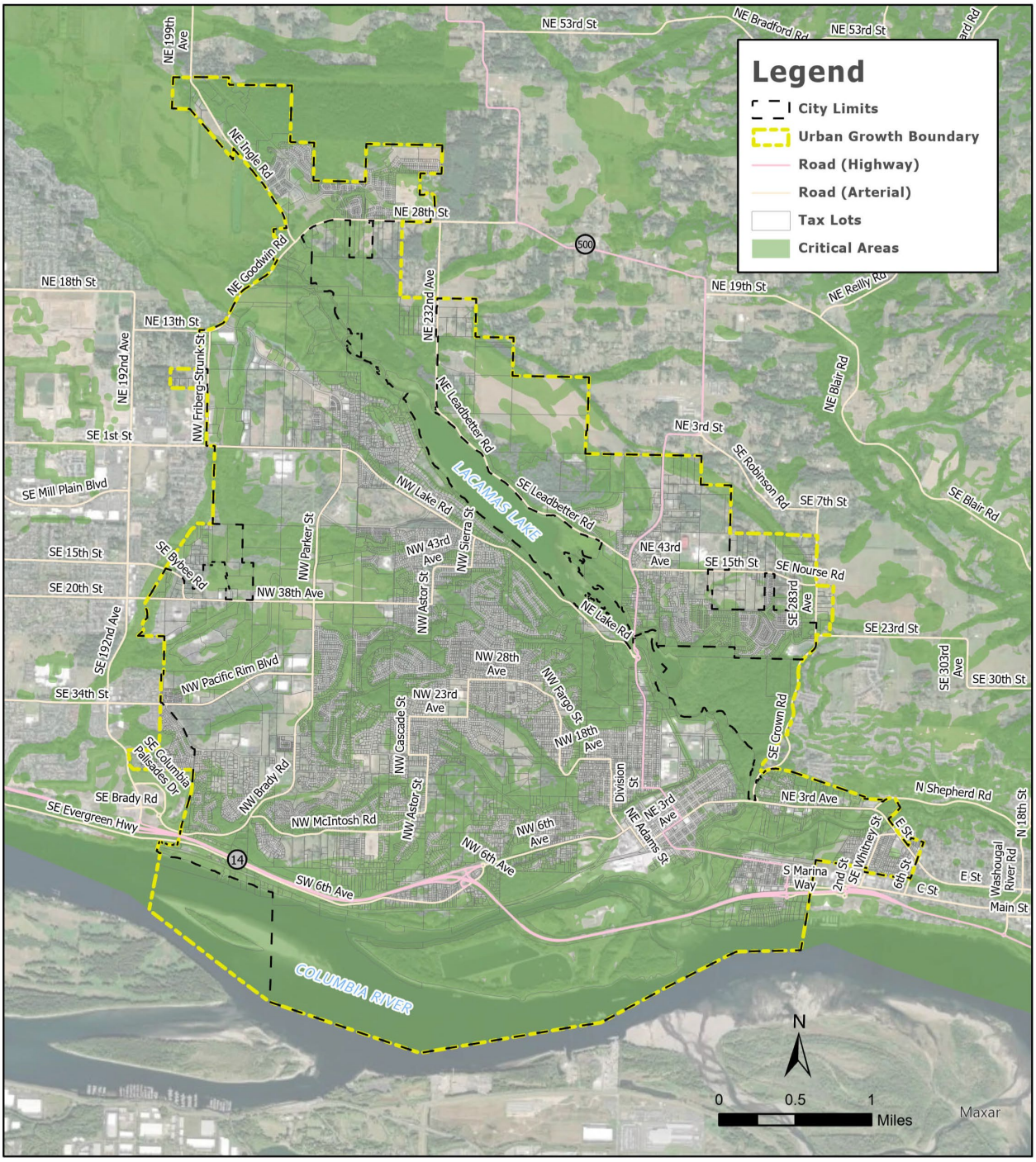
Critical areas perform key functions that enhance the environment and protect us from natural hazards. The beneficial functions and values that critical areas provide include, but are not limited to, water quality protection and enhancement; fish and wildlife habitat; food chain support; flood storage, conveyance, and attenuation of flood waters; groundwater recharge and discharge; drinking water quality and quantity; erosion control; protection from natural hazards; historical, cultural, archaeological, and aesthetic value; and recreation. Identifying the functions and values of local critical areas is essential to defining the purpose of a critical areas protection program.

Each type of critical area performs different functions and each community assesses the values of the critical areas in its environment differently. Therefore, the purpose of protecting critical areas is unique for each community. Critical areas protection is necessary to protect the public's health and safety and is essential to comply with state laws in Washington. It may also provide compliance with federal laws for such things as water quality and endangered species. There are also economic reasons to protect critical areas. For example, protection of drinking water quality and quantity supports sustainable growth, and critical areas support resource industries, such as salmon and other fisheries.

Critical areas are environmentally sensitive and hazardous areas that the State and City have identified for certain development considerations or restrictions to protect their functions and values, while allowing for reasonable use of property. Critical areas protection is regulated through the Camas Municipal Code (CMC) Title 16, which identifies five types of critical areas: wetlands, fish and wildlife habitat conservation areas, geologically hazardous areas (steep

slopes, erosion hazard areas, and seismic hazard areas), critical aquifer recharge areas (CARAs), and frequently flooded areas.

Figure 5 6Critical Areas



Wetlands

Wetlands are defined as those areas, designated in accordance with the approved federal wetland delineation manual and applicable regional supplements, which are inundated or

saturated by surface or ground water at a frequency and duration, and under normal circumstances do support, a prevalence of vegetation adapted for life in saturated soil conditions. Wetlands in the community are generally located in and around the Grass Valley area in west Camas, Lacamas Lake, Lacamas Creek, and the Washougal River greenway. The largest mapped wetland is located around the south end of Lacamas Lake, identified as lake habitat. NWI does not identify mapped wetlands in downtown Camas.

Critical Aquifer Recharge Areas

Critical aquifer recharge areas (CARAs) are those areas with a critical recharging effect on aquifers used for potable water, including areas where an aquifer that is a source of drinking water is vulnerable to contamination that would affect the potability of the water, or is susceptible to reduced recharge. The quality and quantity of groundwater in an aquifer is inextricably linked to its recharge area. To determine the threat to groundwater quality, existing land use activities and their potential to lead to contamination should be evaluated.

The goal of establishing CARAs is to protect the functions and values of the community's drinking water supply by preventing pollution and/or contamination of the supply directly or recharge areas indirectly.

Frequently Flooded Areas

Floodplains and other areas subject to flooding perform important hydrologic functions and may present a risk to persons and property. Classifications of frequently flooded areas should include, at a minimum, the 100-year floodplain designations of the Federal Emergency Management Agency (FEMA) and the National Flood Insurance Program (NFIP), known as the 'special flood hazard area', which is defined further as having a special flood, mudflow, or flood-related erosion hazards and shown on Flood Insurance Rate Maps (FIRM), which also includes the regulatory floodway.

Geologically Hazardous Areas

In the physical context of Camas, geologically hazardous areas include areas susceptible to erosion hazard, seismic hazard, mine hazard, and other geological events. Geologically hazardous areas in Camas include severe erosion hazard areas adjacent to Lacamas Lake, north of the Columbia River, and to the east along the Washougal River.

Fish and Wildlife Habitat Conservation Areas

Fish and Wildlife Habitat Conservation Areas (FWHCAs) are critical ecological zones that support essential habitats and species necessary for maintaining ecosystem integrity and biodiversity. These areas may include rare ecosystems, high-density wildlife zones, breeding and migration corridors, and habitats for endangered or sensitive species. Their designation plays a key role in guiding land use planning, urban growth boundaries, and conservation strategies. FWHCAs must be identified using the best available science, considering factors such as habitat connectivity, human activity levels, riparian and salmonid protection, and the impact of

surrounding land uses. Buffer zones are also recommended to minimize conflicts between development and habitat preservation.

Aquatic and Riparian Habitat

Fish and wildlife habitat conservation areas in Camas include habitats for state or federally listed endangered, threatened, or sensitive species, as well as areas associated with state priority species identified by the Washington Department of Fish and Wildlife. These areas encompass naturally occurring ponds under twenty acres, classified state waters, and water bodies stocked with game fish by governmental or tribal entities. Key aquatic habitats in Camas include the Columbia and Washougal Rivers, Lacamas Creek, Camas Slough, Lacamas Lake, and various streams, ponds, and wetlands, all often bordered by riparian zones. Lacamas Lake is the largest aquatic habitat in the city aside from the Columbia River system.

Terrestrial Habitat

Terrestrial habitats in Camas, like aquatic ones, include areas supporting state or federally listed endangered, threatened, or sensitive species, as well as state priority species identified by the Washington Department of Fish and Wildlife (WDFW), State Natural Area Preserves, and locally important habitats. Locally designated habitats include Oregon white oak trees and stands, and Camas lily fields of specific sizes. While much of the city is mapped as "cave rich" by WDFW, actual cave presence is limited, though caves are considered a priority habitat feature. The Camas biodiversity corridor, which includes mature timber and sightings of Vaux swifts, runs through parts of the city. Oak woodland habitat is primarily found near Lacamas Lake, and the northern part of Camas including the Lacamas Prairie Natural Area Preserve, which protects rare Willamette Valley wet prairie habitat and several endangered plant species, including Bradshaw's lomatium.

Critical Areas Goals & Policies

Preserve, maintain, and restore the City's critical areas to protect their function and value.

Policy NE-2.1 Use best management practices and best available science to preserve, protect, and restore the biological health and diversity of Camas' critical areas.

Policy NE-2.2 Preserve and restore aquatic and riparian habitats consistent with applicable regulations.

Policy NE-2.3 Preserve and avoid development of areas with endangered, threatened, and sensitive species and species of local importance as required by local, state, and federal laws.

Policy NE-2.4 Ensure that development throughout the City meets or exceeds standards and practices for long-term wetland protection and mitigation.

Shorelines

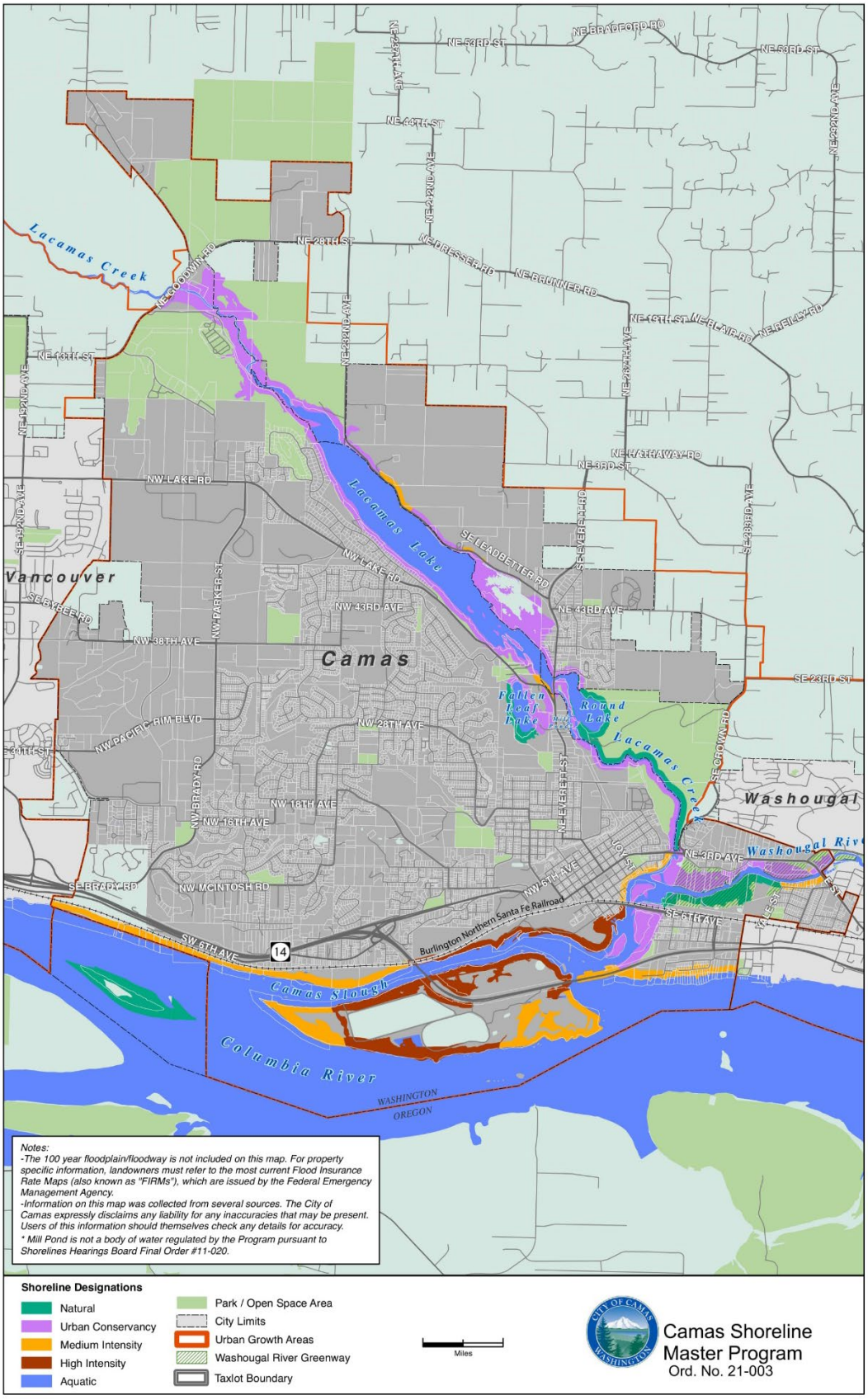
Overview

The Shoreline Management Act, enacted in 1972, created a collaborative framework between Washington State and local governments to manage and protect shorelines. Under this law, local jurisdictions are required to develop Shoreline Master Programs (SMPs) tailored to their specific needs.

Camas encompasses 946 acres of shoreline across 26 miles, including areas along Lacamas Creek, several lakes, and the Columbia and Washougal Rivers. The SMP outlines strategies to minimize flood risks, enhance recreational opportunities, and ensure sustainable shoreline use through voluntary programs and regulatory measures.

To guide development and conservation, Camas assigns specific shoreline designations based on land use, ecological characteristics, and community vision. These designations—Aquatic, Natural, Urban Conservancy, Medium Intensity, and High Intensity—are aligned with state guidelines and the city's comprehensive plan. Each designation comes with tailored policies and development regulations, such as height and setback limits. For example, High Intensity areas support industrial use, while Natural areas prioritize ecological preservation. These designations help ensure that shoreline development aligns with environmental protection and long-term community goals.

Figure 7 Shoreline Map



Shoreline Goals and Policies

Goal NE-3 Shorelines

Use the full potential of shoreline in accordance with the opportunities presented by their relationship to the surrounding area their natural resource values, and their unique aesthetic qualities offered by water, topography, and views. Develop a physical environment that is both ordered and diversified, and which integrates water and shoreline uses while achieving a net gain of ecological function.

Policy NE-3.1 Adopt the goals and policies as outlined in the current Camas Shoreline Master Program.

Landscape Enhancement and Tree Preservation

The natural landscape and existing tree cover are important aspects of Camas' natural environment. Native, mature landscaping and trees contribute to the City's ecological health, supply valuable animal habitat, and enhance the community's natural beauty.

Goal NE-4 Landscape Enhancement and Tree Preservation

Preserve existing natural landscapes and tree canopy. Support opportunities for increasing native and climate resilient landscaping and tree canopy.

Policy NE-4.1 Develop and implement a program to prioritize retention of existing trees and planting of new trees within development sites to maximize cooling and energy savings. Encourage planting of hardy and climate resilient native trees.

Policy NE-4.2 Develop an urban forestry program that articulates a long-term strategy for future-proofing the City's tree canopy, including actions for tree protection, management, education, and collecting and maintaining data on citywide tree canopy.

Policy NE-4.3 Require the use of native and climate resilient plants in residential, commercial, and industrial landscapes to support the implementation of low impact development.

Policy NE-4.4 Develop and implement a program to mitigate and compensate for tree canopy loss when retention of mature trees within development sites is impractical.

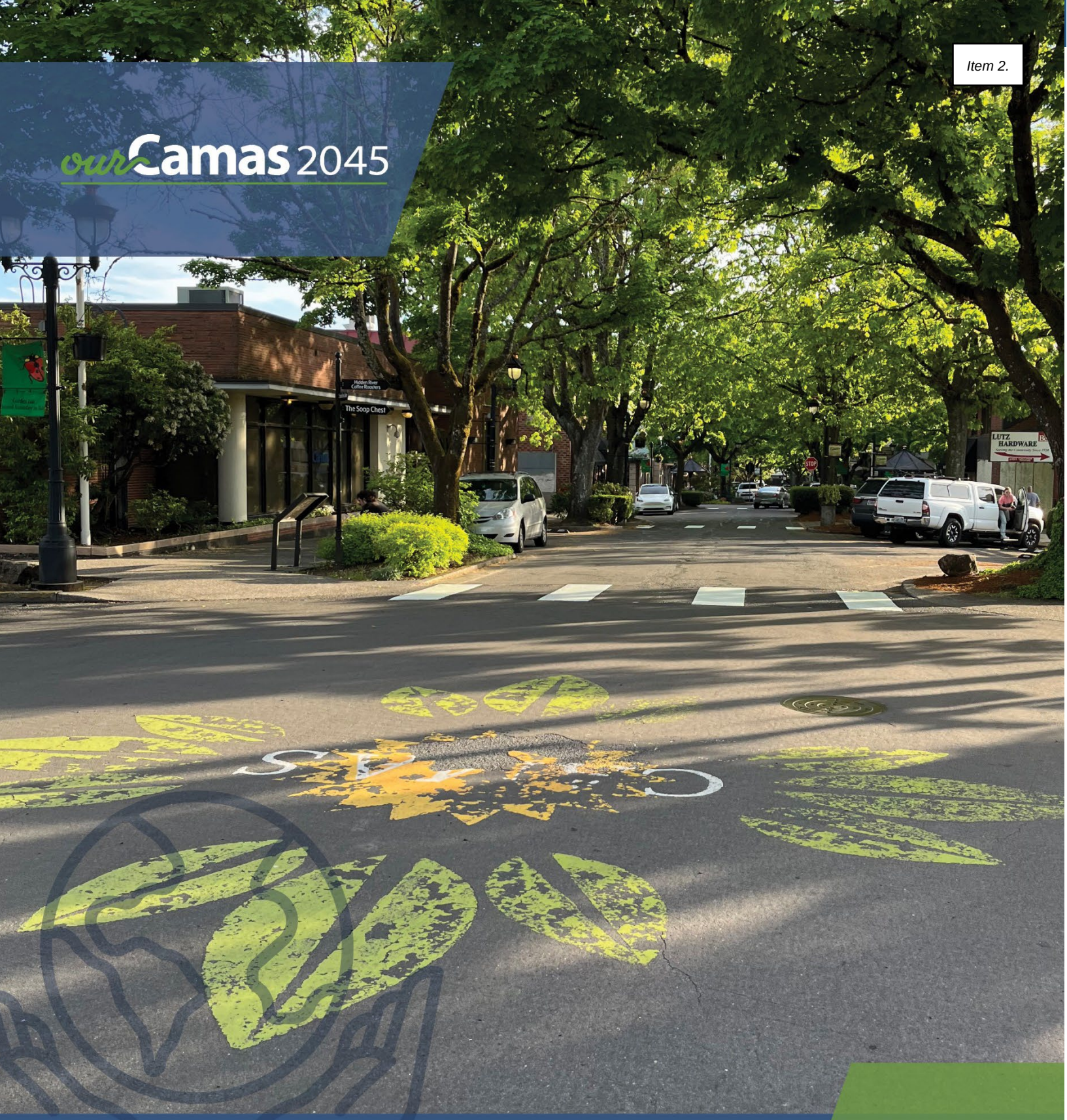
Policy NE-4.5 Develop and implement a program to prioritize retention of existing trees and planting of new trees within development sites to maximize cooling and energy savings. Encourage planting of hardy and climate resilient native trees.

Policy NE-4.6 Develop an urban forestry program that articulates a long-term strategy for future-proofing the City's tree canopy, including actions for tree protection, management, education, and collection and maintaining data on citywide tree canopy.

Policy NE-4.7 Require the use of native and climate resilient plants in residential, commercial, and industrial landscapes to support the implementation of low impact development.

Policy NE-4.8 Develop and implement a program to mitigate and compensate for tree canopy loss when retention of mature trees within development sites is impractical.

ourCamas 2045



Climate Change & Resliency

07

07. Climate Change & Resiliency

Community Impacts from Climate Change

Climate hazards (i.e., natural hazards exacerbated by climate change) of the highest concern and priority are extreme heat and precipitation. Camas can address anticipated impacts by reducing GHG emissions and building community resiliency.

Vision

In 2045, Camas has proactive plans to reduce greenhouse gas (GHG) emissions and mitigate the effects of changing climate conditions and natural hazards, ensuring a resilient community for generations to come. The most vulnerable communities are protected, and climate planning contributes to improvements in community health and well-being.

Introduction

The City developed this climate change and resiliency element consistent with House Bill 1181, signed into law in 2023. This new state law integrates climate planning into Washington's GMA and requires cities and counties to include a climate element in their comprehensive plans.

Climate change refers to long-term shifts in temperatures and weather patterns. The burning of fossil fuels and other human activities are increasing emissions of greenhouse gases (GHGs) that trap heat in the atmosphere and contribute to global and local climate change. Negative effects include impacts on the community caused by natural hazards that are exacerbated by climate change (e.g., the increased frequency and severity of drought conditions). Natural hazards are also referred to as "climate hazards" in this element as climate change is anticipated to affect the frequency and intensity of natural hazards.

The purpose of this climate element is twofold: to reduce contributions to climate change (i.e., GHG emissions) and to build community resilience to climate change.

To support these two overarching goals, the City formed a Climate Policy Advisory Group (CPAT) to advise on the creation of this new element. The 17 CPAT members included community members, City staff, City Council and Planning Commission liaisons, and representatives from the Port of Camas-Washougal, Clark Public Utilities, NW Natural, and the Camas School District. CPAT members held five meetings between early 2024 and early 2025.

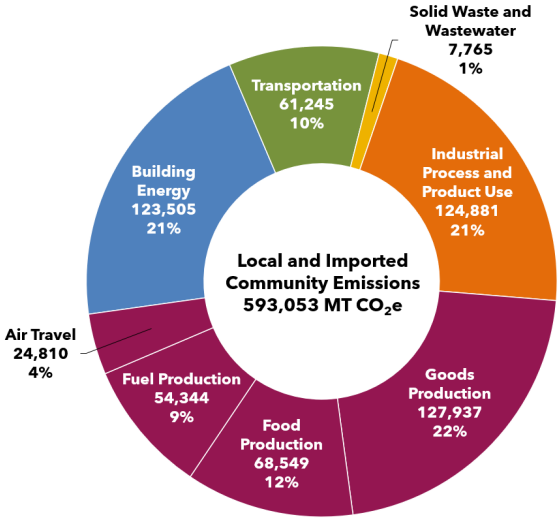
The CPAT was instrumental in the identification and development of climate goals and policies.

Climate Overview

Greenhouse Gas Emissions

The GHG reduction subelement identifies actions to reduce GHG emissions and decrease per capita vehicle miles traveled (VMT). One of the requirements of the GHG reduction subelement is to meet the GHG reduction requirements in RCW 36.70a.070(9)(d), including reducing per capita VMT within Camas but without increasing GHG emissions elsewhere in the state. To identify actions for VMT reduction, Clark County worked with local cities to prepare a VMT study and travel market assessment to understand baseline travel patterns and strategies for VMT reduction. According to the VMT study, data from the Highway Performance Monitoring System shows that the city's estimated per capita VMT, which represents the average weekday VMT within Camas divided by the city's population, is 11.1. The travel market assessment identified key travel destinations in the city for short trips (i.e., trips 3 miles or less), showing that areas near Lacamas Lake, Camas high school, and Downtown Camas are popular destinations. Both assessments will help inform a regional target for VMT, which will be established outside the climate element/comprehensive plan framework. In addition to VMT reduction, Clark County's Countywide Planning Policies establish requirements for cities to reach net-zero emissions by 2050 (14.1.2) in alignment with statewide GHG emission reductions (RCW 70A.45.020(1)) and set interim (5-year) objectives or targets (14.1.4). A GHG inventory for Camas was also prepared to inform GHG reduction strategies. The inventory provides an estimate of the city's carbon footprint from local emissions (building energy, transportation, solid waste and wastewater, and industrial process and product use) and imported emissions (consumption of goods). Figure 8 Camas Emissions, 2022 shows the combined and per capita emissions for the city.

Figure 8 Camas Emissions, 2022



With a population of 27,250, all 2022 GHG emissions combined (local and imported) for City of Camas totaled

593,035 MT CO_2e

21.8 MT CO_2e Per Capita

Local emissions include sector-based emissions that are generated within Camas. Imported emissions are generated outside of Camas to produce and provide the goods, food, services, air travel, and production of transport of fuels consumed by households. Additionally, wildfires have become one of the largest sources of carbon emissions in Washington state. From 2014 to 2018, wildfires in the state generated 39,200,000 MT CO_2e.

Figure 9 Local and Imported Emissions in Camas

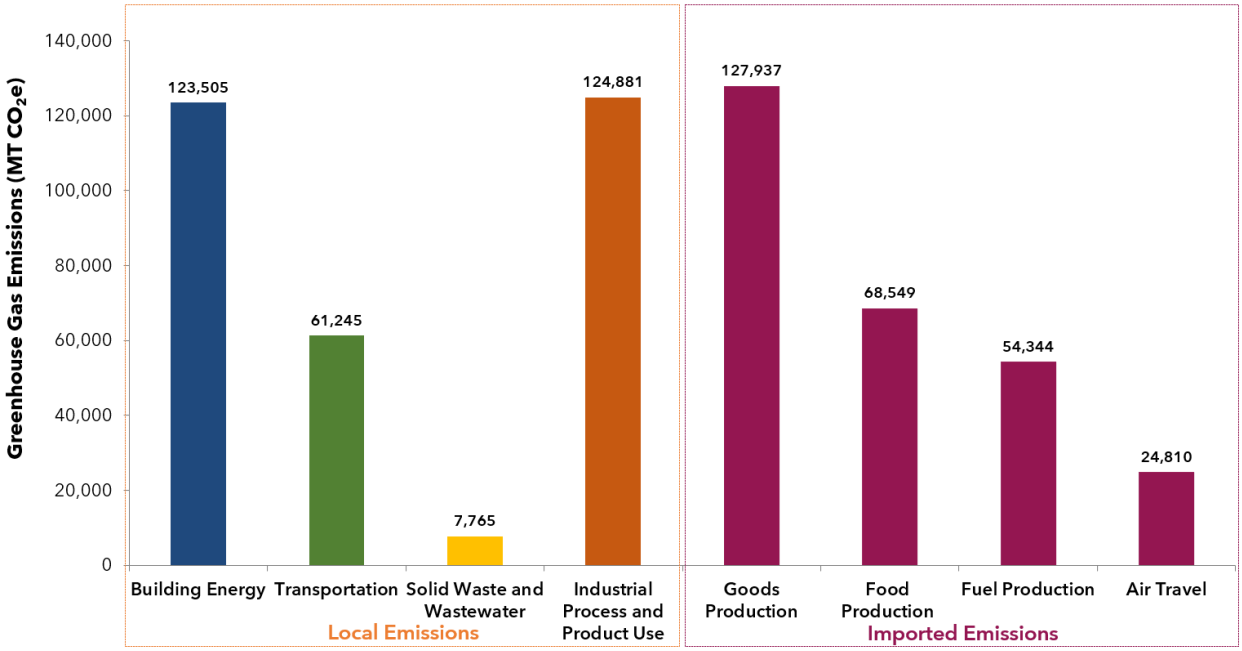


Figure 9 shows a breakdown of the sources of local and imported emissions in Camas. Most sources of local emissions include **industrial process and product use** and **building energy**, which accounts for **78%** of local emissions. Emissions from the industrial process and product use sector generally involve facilities with silicon semiconductor manufacturing. While emissions from these facilities contribute to a large share of local emissions, demand for these goods is global and not specific to Camas. Therefore, goals and policies target reducing local emissions and support existing GHG reduction strategies or targets that are being implemented by businesses and industries in Camas.

Climate Resiliency

Community resiliency is the ongoing process of preparing for, anticipating, and responding to natural hazards created or aggravated by climate change.

Natural hazards relevant to Camas are identified in the 2023 Clark County Natural Hazard Mitigation Plan (NHMP) (CRESA 2023). Table 3 Natural Hazards in Camas lists hazards of concern in order of ranking and their priority, which were evaluated as part of the risk assessment in the NHMP. The risk rating reflects the probability of a hazard weighted against its potential impact on people, property, and the economy. The table also shows the projected climate impacts for each hazard and how hazards have affected the community in the past.

Table 3 Natural Hazards in Camas

Natural Hazard (NHMP Rating[7])	Projected Changes by 2050[8]	Effects on the Community[9]
Extreme Heat (High)	40+ days per year that feel hotter than 90 degrees.	Increased demand for air conditioning, higher utility bills, heat-related illness for sensitive populations and youth at school playgrounds and sports fields, disruption of outdoor activities.
Extreme Precipitation (High)	12% increase in total annual precipitation	Overflowing of streams or rivers, unsafe driving and walking conditions.
Landslide (Medium)	13% increase in heavy rain events	Physical damage to residential and commercial property, energy infrastructure, communication infrastructure, and transportation infrastructure.
Flood (Medium)	17% increase in peak streamflow in Washougal River	Property damage, particularly for older buildings and low-income housing near the floodplain, and temporary or permanent displacement. Temporary closures of businesses and other services.
Wildfire (Medium)	9+ days per year that have high fire danger	Wildfire smoke can impact human health, particularly people with respiratory illnesses or diseases. Increased health risks and property damage for communities near the wildland-urban interface[10].

[7] 2023 CRESA Regional Natural Hazard Mitigation Plan Volume 2 – Planning Partner Annexes
[8] University of Washington's Climate Mapping for a Resilient Washington webtool. Projections are based on a "business as usual" emissions scenario.
[9] Includes effects identified by the Camas community in a 2025 survey.
[10] Clark County Code (15.13.030) defines the wildland-urban interface as areas with elevation in excess of 500 feet and one or more of the following conditions: (a) slope equal to or greater than 25%, (b) forest type vegetation, and (c) outside of an organized fire protection district.

Drought (Low)	14% decrease in summer rains	Impacts to water quality and quantity, decrease in habitat quality and quantity for salmon and other aquatic species.

Vulnerability

Vulnerable Communities

Climate change can impact certain groups of people (vulnerable populations) and areas of the city (overburdened communities) differently. Vulnerable populations are groups of people who are more vulnerable to environmental harms due to socioeconomic factors and other health risk factors (RCW 70A.02.010(14)). Overburdened communities are areas where vulnerable populations experience environmental harms and health impacts (RCW 70A.02.010(11)). Together, vulnerable and overburdened communities are disproportionately impacted by climate change due to the concentration of environmental harms (e.g., air pollution near major roadways) and socioeconomic characteristics (e.g., low income, youth and children). People and communities in Camas who are vulnerable to climate hazards are generally described in the *Our Camas 2045* Equity Framework (see **Introduction** for a description of Equity Communities in Camas).

In addition to communities described in the Equity Framework, CPAT members identified additional communities that could be more vulnerable to climate hazards. These communities include areas that are located near floodplains (such as Lacamas Lake and the Columbia River), near mobile sources of air pollution (such as major roadways), near steep slopes and steep road grades, and/or near the wildland urban interface (e.g., homes adjacent to forested areas).

Vulnerable Assets

In Camas, the impact of climate hazards can depend on the proximity of people and buildings to each hazard. The approximate location of these hazards is shown in Figure 10 Wildfire Hazard Areas and Figure 11 Flood and Landslide Hazard Areas. Climate hazard locations are based on data from publicly available sources such as Clark County's Open Data Hub and include approximate areas of increased risk. While this information provides a visualization of higher risk areas, data may not include all potential risks and data gaps may exist depending on when data was published. Therefore, these figures provide a conceptual understanding of the location of climate hazards and potential effects on the community.

Figure 10 Wildfire Hazard Areas

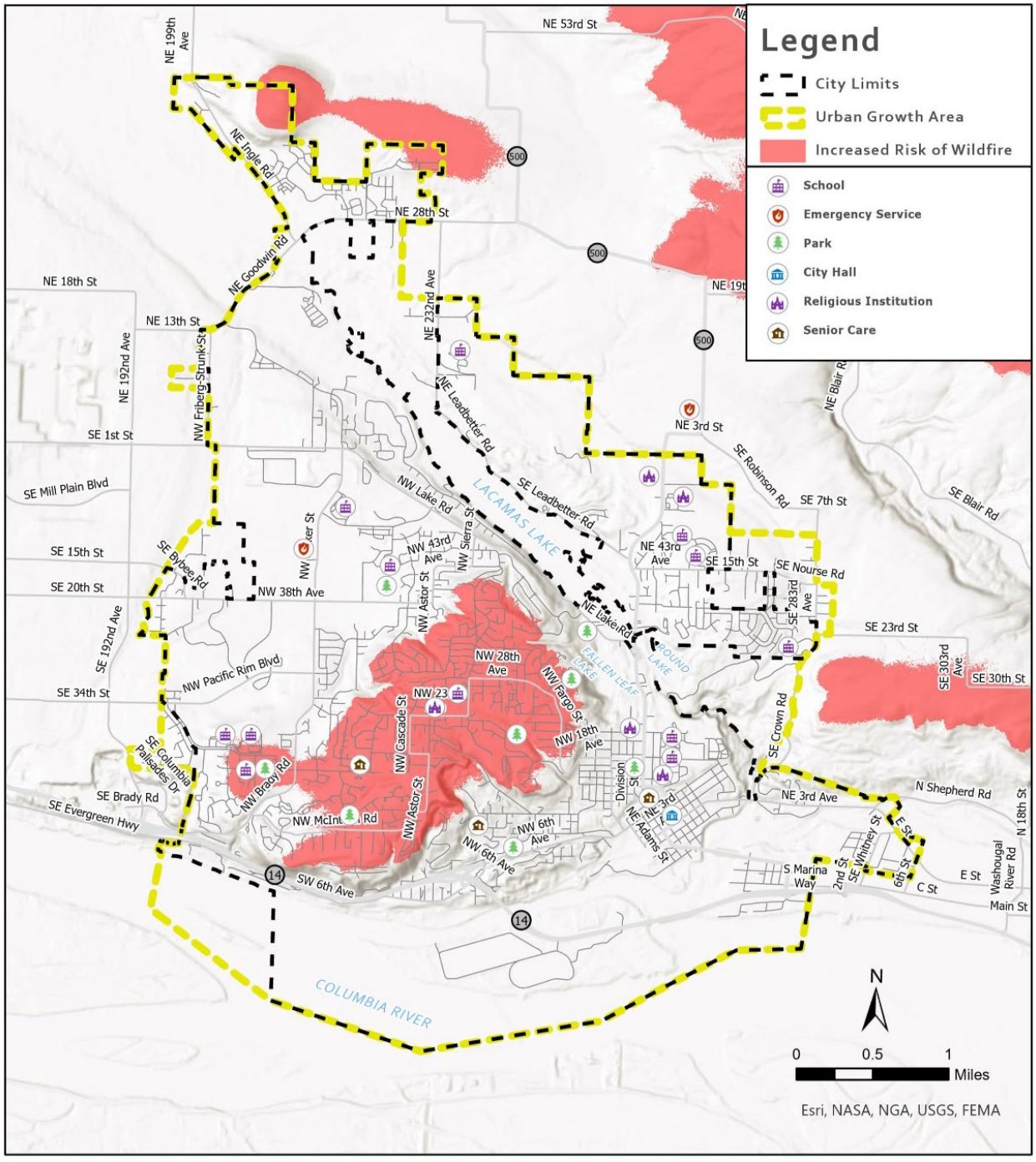
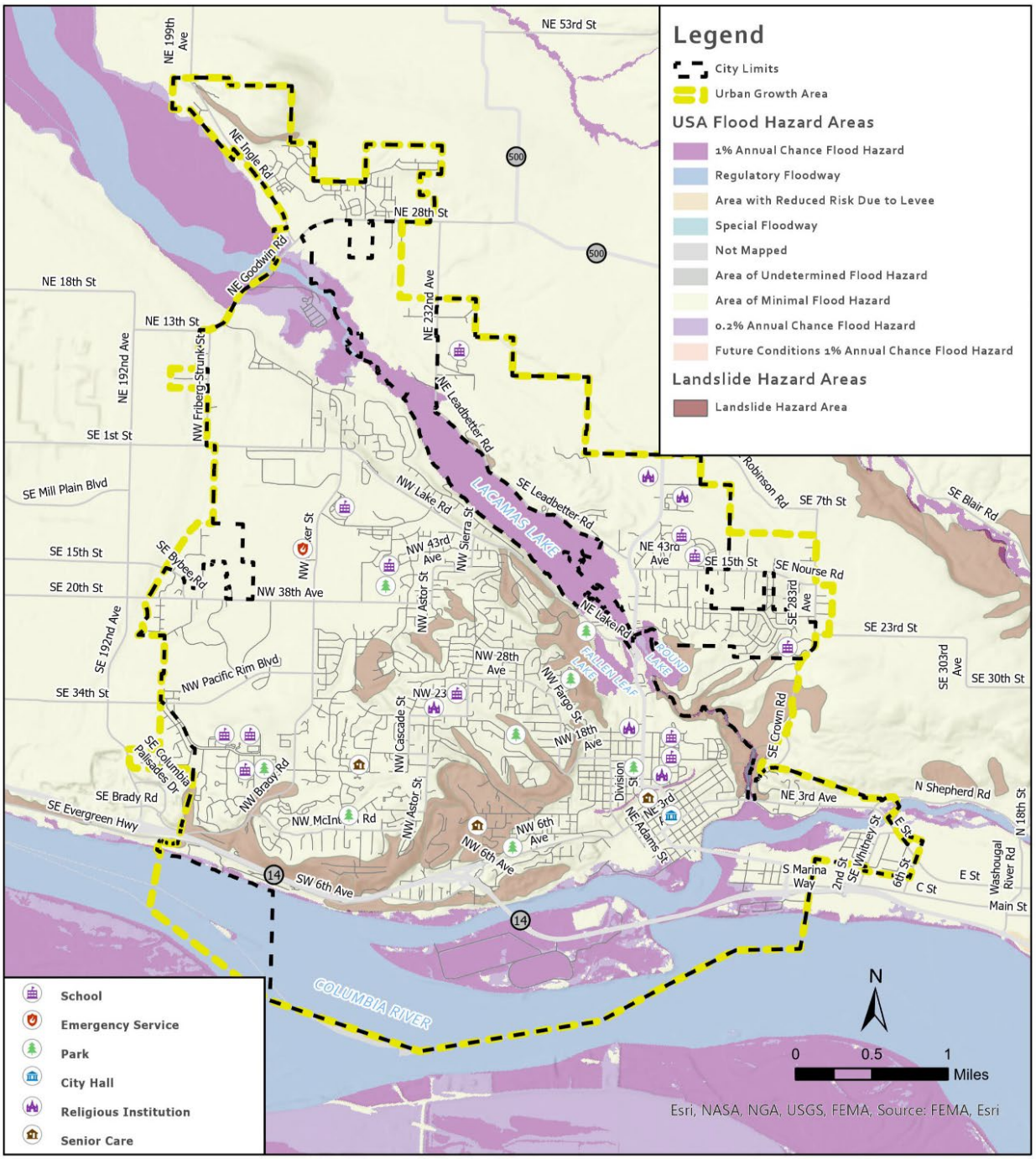


Figure 11 Flood and Landslide Hazard Areas



In Camas, buildings and infrastructure that could be vulnerable to climate hazards include aging water and sewer lines, buildings constructed before adopted seismic codes (e.g., city hall, public works operations center), and high-pressure natural gas lines. High tension power lines may also be vulnerable to severe storms (i.e., wind and ice), homes along the Washougal and Columbia Rivers, including the Georgia Pacific paper mill, may be susceptible to flooding, and the dam at Lacamas Lake could be impacted by an earthquake or flooding.

Extreme heat is one of the highest rated hazards for Camas. Buildings and impervious surfaces such as streets are factors in the urban heat island effect, where urban areas are warmer than surrounding rural or less developed areas. The County's department of public health collected heat data on one day in July 2024 and prepared a heat watch summary report describing how urban heat varies across neighborhoods in the county and how landscape features affect temperature and humidity. Across the county, areas with more buildings and paved surfaces tend to be hotter during the afternoon and evening. In Camas, the hottest areas of the city during the afternoon and evening are near Downtown Camas while cooler areas with more vegetation and shade are in west Camas, northeast of downtown, and near Lacamas Lake.

Vulnerability Assessment

A vulnerability and risk assessment prepared for Camas evaluated the risk of extreme heat on outdoor recreation sites, including (1) Lakes, (2) Parks & Trails, (3) School Playgrounds & Sport Fields, and (4) Downtown Camas. Both vulnerability (sensitivity and adaptive capacity) and risk (probability and magnitude) were evaluated.

The assessment produced composite scores for vulnerability and risk. For the lakes, Lacamas Lake and Round Lake scored high and Fallen Leaf Lake scored low. Under parks and trails, seven scored low, two scored medium, and 11 scored high. School playgrounds and sports fields scored medium (6) and high (6). Lastly, Downtown Camas scored high as it features the hottest area of the city.

To reduce vulnerability and risk, this element includes policies to mitigate the impacts of extreme heat.

Climate Change and Resiliency Goals and Policies

Climate goals and policies are established to meet the State's vision to reduce greenhouse gas emissions, plan for resilience, and support environmental justice. While these goals and policies directly focus on emissions and resiliency, additional policies in other elements of the plan tangentially support these goals. Those policies are noted with a leaf symbol.

Goal CL-1 Energy

Ensure that development and redevelopment projects, including buildings and energy infrastructure (generation, storage, and transmission) are designed to accommodate and use renewable energy, conservation, and efficiency technologies and practices to reduce GHG emissions and increase resiliency to natural hazards.

Policy CL-1.1 Support residents' efforts to improve energy efficiency and resiliency in existing and new residences.

Policy CL-1.2 Encourage renewable energy sources for new and existing buildings.

Policy CL-1.3 Provide commercial buildings, particularly restaurants and food services, with incentives to retrofit buildings for energy efficiency (e.g., grant programs, reduce permit fees, etc.).

Policy CL-1.4 Incentivize and streamline the review process for renewable resource projects.

Goal CL-2 Transportation

Improve the efficiency and resiliency of the transportation system to achieve GHG reduction goals and better withstand natural hazards.

Policy CL-2.1 Promote and complement state and utility incentives to provide electric vehicle charging infrastructure throughout the city, particularly at existing and new multi-family buildings and large employers.

Policy CL-2.2 Provide homeowners and renters information on state and federal tax credits/rebates for electric vehicles, renewable resources and energy efficiency.

Policy CL-2.3 Incorporate projected hydrologic climate impacts into the design and maintenance of water-crossing structures (e.g., climate-smart culverts and bridges).

Goal CL-3 Local Agency Sustainability and Preparedness

Support agencies, districts, and businesses in establishing and achieving their own sustainability goals, initiatives, and programs.

Policy CL-3.1 Support the sustainability initiatives of local agencies, districts, and businesses.

Policy CL-3.2 Support local businesses efforts to bolster climate preparedness and continuity of operations (e.g., develop on-site electricity storage to reduce energy demand during peak hours, incentives to install backup power, building retrofits).

Policy CL-3.3 Support the local economy's resilience to climate disruptions by providing information and resources on how to prepare for extreme heat, flooding, and wildfire.

Policy CL-3.4 Support economic opportunities for green jobs in Camas, including businesses that produce goods or services that benefit the environment and jobs that support business production processes to be more environmentally friendly or use fewer natural resources.

Policy CL-3.5 Develop a sustainable purchasing policy and sustainable construction standards for the City of Camas.

Goal CL-4 Community Health

Protect community health and well-being from the impacts of climate-exacerbated hazards and ensure that the most vulnerable residents do not bear disproportionate health impacts.

Policy CL-4.1 Promote the use of health impact assessments and other tools to identify and address the impacts on health and equity from climate change.

Policy CL-4.2 Develop and implement an urban heat resilience strategy that addresses land use, urban design, urban greening, and waste heat reduction actions.

Goal CL-5 Emergency Preparedness

Enhance emergency preparedness, response, and recovery efforts to mitigate risks and impacts associated with natural hazards.

Policy CL-5.1 Create accessible evacuation plans and outreach materials to help residents plan and practice actions that make evacuation and reunification quicker and safer during a natural hazard event (e.g., notification alerts).

Policy CL-5.2 Develop a comprehensive, communitywide wildfire resilience strategy to improve emergency response capabilities, create fire-resilient landscapes, promote fire-adapted communities, and support the development of community wildfire protection plans.

Policy CL-5.3 Support enhanced data collection for hazard events of all magnitudes to provide a fuller understanding of the community's hazard characteristics.

Policy CL-5.4 Develop resiliency hubs, such as community-serving facilities that support residents, coordinate communication, distribute resources, and enhance quality of life.

Policy CL-5.5 Prepare, plan, and provide ongoing training for those responding to adverse environmental events.

Goal CL-6 Water Resources

Protect and preserve the long-term quality and quantity of Camas' water, and natural and cultural resources from climate change hazards such asdrought and extreme participation.

Policy CL-6.1 Develop and implement a comprehensive drought resilience strategy that factors in projected climate impacts and sets action levels for different drought stages.

Policy CL-6.2 Evaluate the long-term adequacy of water delivery and storage infrastructure to ensure projected changes in hydrological conditions can be anticipated and managed effectively.

Policy CL-6.3 Implement actions recommended by the Lacamas, Round, and Fallen Leaf Lakes Management Plan to reduce the frequency of harmful algae blooms in lakes due to water pollution and projected changes in climate conditions, including higher temperatures.

Policy CL-6.4 Identify funding mechanisms for mitigation measures recommended by the Lake Management Plan to address the impacts of climate hazards on Lacamas, Round, and Fallen Leaf Lakes.

Policy CL-6.5 Introduce adaptive cooling features at local parks and school playgrounds and sports fields to help mitigate the effects of extreme heat on vulnerable park users and young children.

ourCamas 2045



Transportation

08

08. Transportation

GMA Planning Goal

Encourage efficient multimodal transportation systems that will reduce greenhouse gas emissions and per capita vehicle miles traveled, and are based on regional priorities and coordinated with county and city comprehensive plans.

Vision

In 2045, residents of Camas continue to appreciate their safe transportation infrastructure that equitably serves all users.

Introduction

As part of the comprehensive plan periodic update, the City of Camas reviewed and updated its Transportation System Plan (TSP). The TSP is adopted by reference and included as Appendix X. The TSP is a long-range plan to guide transportation investments for Camas and its UGA for the planning horizon to 2045. The TSP provides the following:

- Inventory of the current transportation system for all modes of travel
- Summary of land use assumptions used for estimating travel demands
- Summary of level of service (LOS) standards
- List of actions to address deficiencies
- Forecast of traffic demand for twenty years
- System needs to meet the current and forecasted demand
- Six-year Transportation Improvement Plan (TIP)

These items are foundational to a comprehensive plan and integral to implementing the Land Use plan.

The transportation element is one of the main parts of the comprehensive plan and is an effective tool for shaping the city's future development patterns. Growth and development patterns have a major influence on the fiscal health of local governments and on the economic performance of the community. The nature of public streets can shape the level of traffic congestion, the use of multiple modes, and the character of neighborhoods. Related requirements, such as parking and loading, will influence the cost to develop in a community and can present both opportunities and barriers to how people can access homes, schools, recreational opportunities, and businesses within the community and in the region.

Ownership, control, development, and the operation and maintenance of streets and public rights-of-way are primary functions of local governments. A transportation system is one of the most expensive facilities a community will construct, operate and maintain. Each new facility adds an asset to the city's portfolio, but it also must be managed, resulting in an incremental increase in operating costs and a new set of maintenance, preservation, and rehabilitation obligations.

Decisions about transportation facilities greatly influence the safety and security of the community. How the streets, roads and other transportation facilities are designed, built and maintained will influence safety in multiple ways for all users.

Federal, state, county and city transportation systems are interrelated, so coordination with other units of government is essential. Responsibility for transportation systems spans all levels of government. The Camas transportation network connects to state highways, neighboring city streets and adjacent county roads and indirectly to federal and interstate highways. It also interacts with transportation facilities operated by other special purpose districts like C-TRAN and for-profit businesses. Moreover, the public does not experience the transportation system as a series of separate systems, but as a single, unified system, and it expects all the parts to function in an integrated fashion.

The GMA requires the transportation element to implement and be consistent with the land use element. Counties and cities should use consistent land use assumptions, population forecasts, and planning periods for both elements. Coordination of the land use and transportation elements must be dynamic and iterative with an ongoing feedback loop coordinating land use and transportation in the plan development and in local implementation. The transportation element is also required to be consistent with state and regional plans. The transportation element is certified by the regional transportation organization, which is the Southwest Washington Regional Transportation Council (RTC), to ensure consistency with the regional transportation plan (RTP).

Performance Standards

Level of Service (LOS)

The TSP includes level of service as a measure of performance standards for motor vehicles. A LOS "D" and a vehicle to capacity (v/c) ratio not higher than 0.85 is the minimum performance standard during the highest one-hour period of the day for signalized, all-way stop and roundabout controlled intersections under City jurisdiction. These standards shall be applied to the intersection as a whole.

A LOS "E" and a v/c ratio not higher than 0.90 is the minimum performance standard during the highest one-hour period of the day for two-way stop and yield controlled intersections under City jurisdiction. These standards shall be applied to all intersection approaches serving more than 20 vehicles. Mobility standards do not apply to approaches at intersections serving 20 vehicles or fewer during the highest one-hour period of the day8. This mobility standard allows

more flexibility in the tension between larger intersection and street designs that are sometimes needed to accommodate peak vehicle demands, and the desire to maintain smaller designs that encourage slower vehicle speeds and tend to be more accommodating to pedestrian and bicycle users.

Level of Service for Highways of Statewide Significance is set by the State. In Clark County, the standard is set as LOS "D" for urban areas, including SR 14. Level of Service for regional state highway facilities (not part of the HSS), including SR 500 in Camas, is set through the Southwest Washington RTC. The Southwest Washington RTC Board adopted LOS 'E' or better for non-HSS urban state highway facilities.

As part of the City's TSP update, forecasted 2045 motor vehicle volumes for peak hour conditions were utilized to determine areas on the baseline roadway network that will be congested and may require future investments to accommodate forecasted growth. The corridors recommended to prioritize for improvements include:

- SR 500-NE Everett Street between NE 23rd Avenue and SE Leadbetter Road
- NW 6th Avenue between Norwood Street and Adams Street
- NE 3rd Avenue between NE Dallas Street and SE Lechner Street

Level of Traffic Stress (LTS)

The TSP includes Level of Traffic Stress (LTS) to measure the comfort of those who are walking, biking or rolling on streets shared with vehicles. The best way to make these facilities comfortable to use while walking, biking and rolling is with space, separation, and visibility. The specific application depends on the conditions of each street. LTS is measured on a scale of one to four. A road with an LTS of 1 is best and is suitable for all users. A road with an LTS of 4 has the highest level of stress for a user and is typically used by those with a high level of confidence or those who don't have an alternative option. The TSP indicates LTS 2 is the standard, meaning streets should be comfortable for most adults, including most adults experiencing disabilities. There may be some separation between pedestrians and vehicles, though no physical barrier.

Travel Demands and Characteristics

The number of people who choose to walk, bike, ride transit, or drive alone with the distances they travel is important for assessing how well existing transportation facilities serve the needs of users. Available data on travel demand, travel mode choice, and trip length are used to better understand travel behavior in the community and inform the needs analysis for the transportation system. This data is largely derived from the US Census Bureau on employment-based trips; however, no other travel data is available from this source. The following sections provide a summary of travel demands and characteristics in the City's planning area.

Commuter Trips

Much of the traffic in the Camas planning area, especially during the more congested weekday peak periods, is related to employment. In other words, how do people get to and from work

from their place of residence. People who live in Camas and who are employed overwhelmingly commute to work outside of the planning area (87 percent), while jobs in the planning area are overwhelmingly filled by people who live outside of the planning area (83 percent).[11]

In terms of the predominant travel mode, on average, almost 75 percent of employed residents in the Camas planning area commute to work using single-occupant motor vehicles. About 8 percent of residents carpool to work and the remaining 17 percent work from home, walk, bike, take transit, or use some other means of travel[12].

About 11 percent of employed residents in the Camas planning area worked from home pre-COVID, and that figure likely increased due to COVID-19. It seems likely that a higher percentage of workers will continue a hybrid work schedule that includes teleworking, at least part time. Any increase in the hybrid work week (e.g. 2-3 days in an office with the balance at home or some other remote location) will change the demand on the transportation network, including when and how people travel.

Transportation Demand by Mode

Pedestrian, bicycle, and motor vehicle traffic counts were conducted at key intersections throughout Camas on typical weekdays[13]. This information indicates where and when travel demand is highest for each mode of travel. It also provides a basis for assessing how well existing transportation facilities are able to meet the needs of users during peak demand periods.

- Pedestrian volumes during the PM peak hour are generally highest near downtown Camas, including along NE 3rd Avenue and NE Adams Street (the traffic count summary is included in the appendix). The highest hourly pedestrian activity during the evening peak occurred at the NW Sierra Drive intersection with NW 28th Avenue, near Dorothy Fox Elementary school, with 30 pedestrian crossings in the one-hour period. Other study intersections with more than 15 pedestrian crossings during the one-hour period included many downtown locations such as NE 6th Avenue at NE Adams Street, NE 3rd Avenue at NE Dallas Street, NE 3rd Avenue at NE 4th Street, and Weir Road at NE 3rd Avenue, near the border of Camas and Washougal.
- Bicycle volumes indicate limited biking, with the highest volumes along NW Lake Road, and NW Sierra Street (the traffic count summary is included in the appendix). During the evening peak hour, 20 of the 50 study intersections had no observed bicyclists during the one-hour period. The NE Lake Road at SR 500, NW Lake Road at NW Sierra Street, NW Lake Road at NW Leadbetter Drive, NW Sierra Street at NW 45th Avenue, and NE 6th Avenue at NE Garfield Street intersections had the highest observed bicycle volumes, with 4 or more bicyclists counted during the single hour at each of the intersections.

[11] US Census Bureau, OnTheMap. Home/Work Distance/Direction Analysis, 2015.
[12] US Census Bureau, 2012-2016 American Community Survey
[13] Based on counts conducted in April of 2018.

- Motor vehicle volumes on the roadways in Camas (the traffic count summary is included in the appendix) most commonly peak during weekday evenings between 4:50 and 5:50 p.m. The highest hourly motor vehicle volumes during the evening peak occurred along the NW 6th Avenue corridor between the SR 14 ramps and NE Adams Street, with more than 1,300 trips during the one-hour period. This corridor is the primary entrance into Camas from eastbound travel. The NE Lake Road at NE Everett Street, and NW 6th Avenue at SR 14 Ramps intersections had the highest observed volumes, with more than 1,800 entering vehicle trips during the single hour at each of the intersections.

Active Transportation Networks

Camas is a community with an active citizenry and, therefore, requires a fairly robust active transportation system that includes pedestrian and biking facilities. The TSP inventoried the pedestrian and biking facilities, listed gaps in the systems, and assessed the facilities for how a pedestrian and bicyclist experiences them.

Multimodal Network Design

The design of the streets in the City's planning area is based on the network classifications and area designation. All streets in the planning area are multimodal and include travel lanes and on-street parking for vehicles, sidewalks for pedestrians, and on-street or separated facilities for bicyclists. Accommodating these modes varies by the functional classification and area designations. For a typical street cross-section, the functional classification determines the minimum design requirements for the number of vehicle travel way lanes and on-street parking, and the minimum acceptable bike facility, and the area designation is used to determine the minimum acceptable design for pedestrian facilities, and the minimum travel lane and median/turn lane width. Together, these cross-section standards identify the design characteristics needed to meet the function and demand for each facility type for streets in the City's planning area. Since the actual design of a roadway can vary from segment to segment due to adjacent land uses and demands, this system allows standardization of key characteristics to provide consistency.

The typical designs are intended to be implemented in newly developing or redeveloping areas of the City's planning area, where constrained conditions do not limit the ability to construct the typical cross-section. A variety of physical and natural constraints may prevent adherence to the multimodal network design requirements. A deviation to the street standards may be requested from the City Engineer or City Engineer's designee with justification of constraints to consider a constrained cross-section or other adjustments.

Pedestrian Network

Walking supports healthy lifestyles, is an easy and economical way to travel, and is well-suited for people of all ages and abilities. In this plan, "walking" and "pedestrian" are terms that include people who walk independently or use canes, wheelchairs, or other walking aids, or strollers. Approximately two percent of commuters in the city walk to work, with three percent

utilizing public transportation, which often includes walking at the beginning or end of the trip.[14] In addition to the work commute trips, walking trips are made to and from recreational areas, shopping areas, schools, and other key destinations in the community. Continuous and direct sidewalk connections to all key destinations and along all streets, in addition to safe crossing opportunities along major roadways, are essential to encourage walking and transit use.

A pedestrian network assessment of streets, showing the extent to which the walking network on collector and arterial streets provides a level of comfort and safety for users, was completed throughout the city. About 30 percent of the collector and arterial street miles in Camas were rated "good (i.e., level of traffic stress (LTS) 2)" or "excellent (i.e., LTS 1)" for pedestrians. However, over 35 percent of the collector and arterial street miles rate poorly (i.e., LTS 4). Most of the street miles rated "poor" are located in high growth areas, be that housing or business growth. The pedestrian network in these areas is largely unimproved due to the once rural nature of the surrounding land use. As future urban development occurs, pedestrian facilities will improve in those areas. Overall, the pedestrian network rates relatively high near downtown, and generally poorer towards the edges of the city. See Figure 13 for an inventory of the pedestrian network.

Bicycle Network

Cycling is important for both transportation and recreation in the Camas planning area. This includes people who bike to work and school, bike for recreation or running errands. Approximately one percent of commuters in the city bicycle to work[15]. Riding bicycles also plays a key role in the transportation system's ability to support healthy and active lifestyles and provide a viable alternative to the automobile. Continuous bicycle connections between all activity generators and arterial/collector roadways are desirable to allow for safe and attractive non-motorized travel options.

The bicycle network in the City's planning area, shown in

Figure 12, is composed of bike lanes, roadway shoulders, shared roadways, and shared-use paths.

- Bike lanes are portions of the roadway designated specifically for bicycle travel via a striped lane and pavement stencils. Bike lanes are most appropriate for arterials and collectors, where high traffic volumes and speeds warrant greater separation of the travel modes. Significant segments of continuous bicycle lanes exist along portions of NW Lake Road, NW 38th Avenue, NW Parker Street, NW Friberg-Strunk Street, and SR 500.
- Shoulder bikeways are paved with striped shoulders wide enough for bicycle travel. A six-foot paved shoulder is desired to adequately provide for bicyclists, with a four-foot minimum width in constrained areas. Roadways with shoulders less than four feet are

[14] US Census Bureau, 2012-2016 American Community Survey
[15] US Census Bureau, 2012-2016 American Community Survey

considered shared roadways. Some shoulder bikeways are signed to alert motorists to expect bicycle travel along the roadway

- Shared roadways include those on which bicyclists and motorists share the same travel lane. The most suitable roadways for shared bicycle use are those with low speeds (25 mph or less) and low traffic volumes (3,000 vehicles or fewer per day). Shared roadways, often signed as bicycle routes, serve to provide continuity to other bicycle facilities (e.g., bicycle lanes) or can be designated as a preferred route through the community. Shared roadways can have signs that highlight a special route or provide directional information in bicycling minutes or distance. Most local roadways in the city are considered shared roadways, but do not have signs or pavement markings, although some are planned to be improved in the TSP.
- Shared-use paths provide off-street travel for bicyclists and pedestrians, and are wider than an average sidewalk (e.g., 10 – 14 feet). Shared-use paths are typically paved (asphalt or concrete) but may also consist of an unpaved smooth surface, such as compacted gravel, as long as it meets Americans with Disabilities Act (ADA) standards. Paved shared-use paths exist along portions of NW Parker Street, NW 18th Avenue, Lacamas Lake, Washougal River, and scattered throughout the residential neighborhoods.

A bicycle network assessment of streets in Camas shows the extent to which the bicycle network on collector and arterial streets provides a level of comfort and safety for users. About 20 percent of the collector and arterial street miles' in Camas rate "good (i.e., LTS 2)" or "excellent (i.e., LTS1)" for bicyclists. However, about 65 percent of the collector and arterial street miles' rate poorly (i.e., LTS 4) for bicyclists.

Overall, the bicycle network rates relatively high on the northwest side of the city and poor on the south and east side. The streets with the lowest ratings are the streets important for local and regional through travel (e.g. portions of NW 6th Avenue, NE 3rd Avenue, and SR 500), where many businesses and services are located. These streets rate low due to the relatively high motor vehicle traffic volumes and speeds and lack of separated bicycle facilities.

Transition Plan for Transportation

Title II of the Americans with Disabilities Act requires cities to establish a transition plan for transportation. The plan shall, at a minimum:

1. Identify physical obstacles in Camas' facilities that limit the accessibility of its programs or activities to individuals with disabilities;
2. Describe in detail the methods that will be used to make the facilities accessible;
3. Specify the schedule for taking the steps necessary to achieve compliance and, if the time period of the transition plan is longer than one year, identify steps that will be taken during each year of the transition period; and
4. Indicate the official responsible for implementation of the plan.

Camas has a relatively well-developed pedestrian network that is also potentially suitable for those who use mobility devices. The network is composed of sidewalks, shared-use paths and pedestrian trails, and other accessways. A large part of downtown Camas was developed prior to 1950, a time in which sidewalks were incorporated into the design of neighborhoods and streets. Although most areas incorporated into Camas over the following decades have sidewalk coverage, a few areas have noticeable gaps that do not make for a complete sidewalk network. These gaps are most significant in southwest, southeast, and northeast Camas, and on roadway segments outside city limits. Paved shared-use paths exist along portions of NW Parker Street, NW 18th Avenue, Lacamas Lake, Washougal River, and scattered throughout residential neighborhoods. Unpaved pedestrian only trails are scattered throughout the city.

Many intersections in older parts of the city lack ADA-compliant ramps, which provide important connections between sidewalks, making it easier to cross streets and handle the vertical drop at curbs. Knowing these conditions, the city has been recently installing new curb ramps in many of these locations. The presence of curb ramps is fairly consistent along streets in downtown Camas, and in the newer neighborhoods in the city. Additional work is required by the City to ensure all existing and future sidewalks have curb ramps.

About 38 percent of street miles (including City arterial, collector and local streets) lack sidewalk coverage along one or both sides (see Figure 13). These gaps are more common along arterial streets than collector streets, at 40 and 23 percent, respectively, of the street miles with no sidewalk on either side. These numbers do not incorporate off-street shared-use paths that may run alongside some roadways. Any future streets constructed in association with development projects will be required to construct sidewalks with curb ramps, increasing the overall sidewalk supply.

Transportation Projects and Priorities

This section describes the transportation system improvement projects- multimodal street improvement, intersection improvement, pedestrian/bike improvement, transit enhancement, and demand/system management – to address the system needs identified in earlier text.

The list of projects was developed through three main sources including stakeholders, relying on previous plans (such as the North Shore Subarea Plan), and independent project team evaluation.

The full list of projects is identified to improve the transportation network along major streets in the City's planning area, regardless of their priority or their likelihood of being funded. The TSP focuses on streets in the planning area with a functional classification of Collector or higher. Additional improvements will occur with private development in the planning area, including the build-out of the local street network consistent with the applicable standards.

The planning process from the TSP screens candidate projects to set aside those that may not be feasible due to environmental or existing development limitations. The remaining projects

are a combination of new and previous ideas for the transportation system that seek to address the gaps and deficiencies in the city.

The full project list, included as Appendix X, includes 99 projects totaling over $180 million in total investments. For the purposes of cost estimates, project design elements are identified, however, the actual design elements for any project are subject to change and will ultimately be determined through a preliminary and final design process and are subject to City, WSDOT, Clark County, and/or other partner agency approval. The projects were assigned to one of several categories:

- Multimodal Street Improvement - these projects will improve or construct new multimodal streets throughout the planning area, each with facilities for motorists, pedestrians, and bicyclists. A total of 29 projects have been identified that, as of 2024, will cost an estimated $72 million to complete.
- Intersection Improvement – these projects will improve safety and mobility at intersections throughout the planning area. A total of 19 projects were identified to construct new or improve existing intersections that, as of 2024, will cost an estimated $64 million to complete.
- Pedestrian/Bike Improvement – these projects include stand-alone sidewalk, path and roadway crossing improvements, and an integrated network of bicycle lanes, marked on-street routes and shared-use paths to facilitate safe and convenient travel citywide. A total of 39 pedestrian and bicycle projects were identified that, as of 2024, will cost an estimated $38 million to complete.
- Transit Enhancement – these projects will enhance the quality and convenience for transit passengers. One transit project was identified that, as of 2024, will cost an estimated $1 million.
- Demand/System Management – this will encourage more efficient usage of the transportation system. Two projects were identified that, as of 2024, will cost an estimated $450,000.

Transportation Facility Maps

Figure 12 Bicycle Facilities

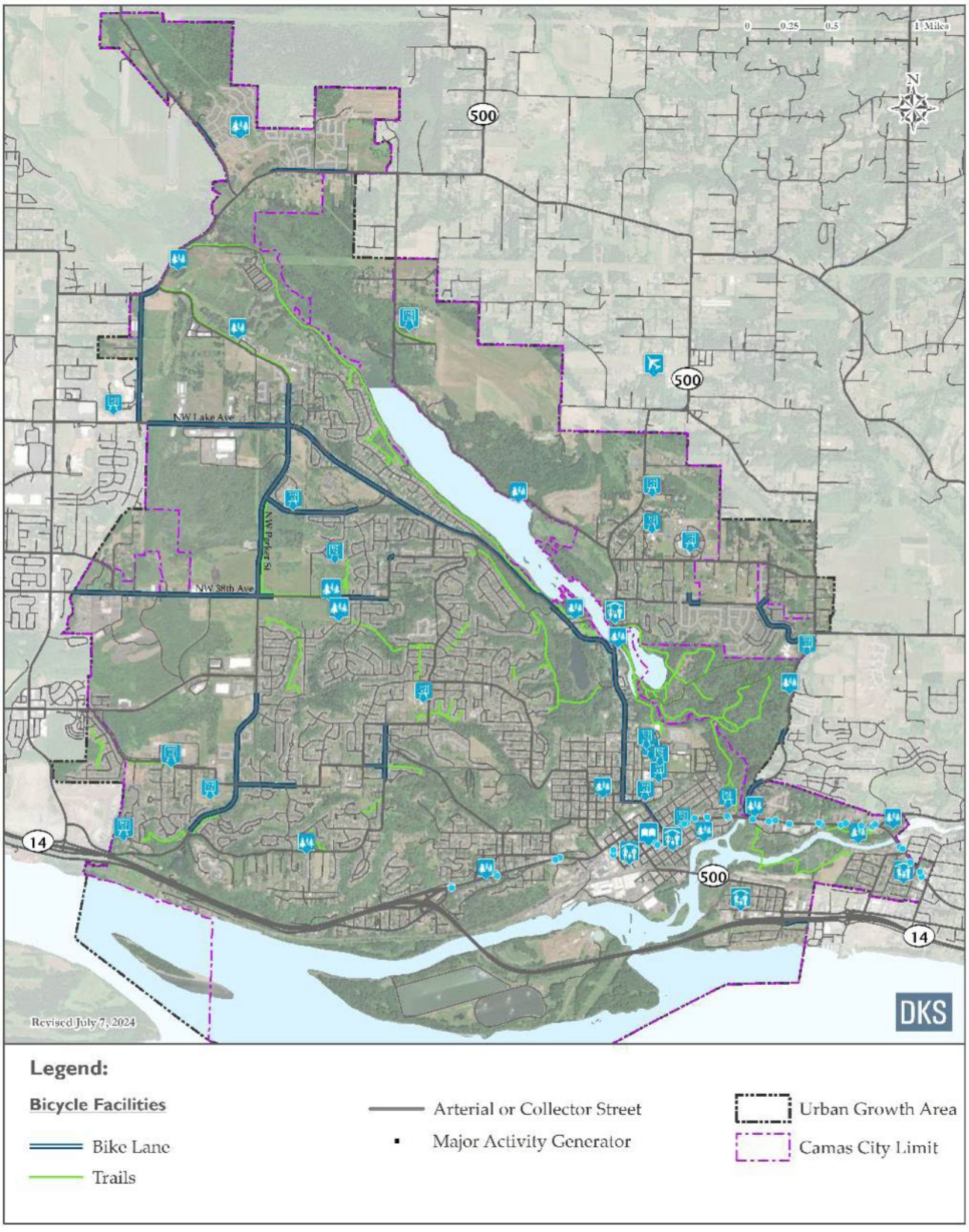


Figure 13 Pedestrian Facilities

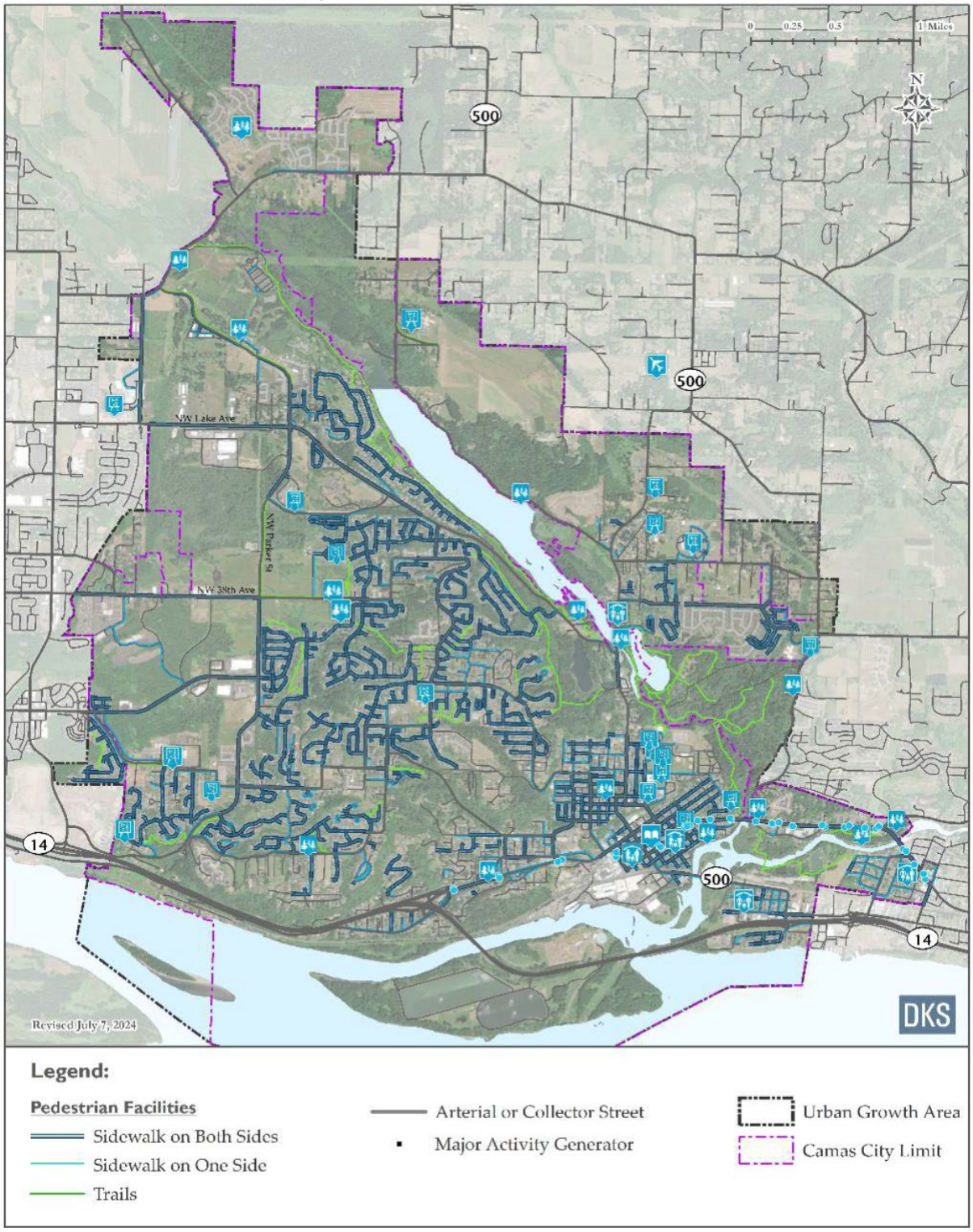


Figure 14 Street Network

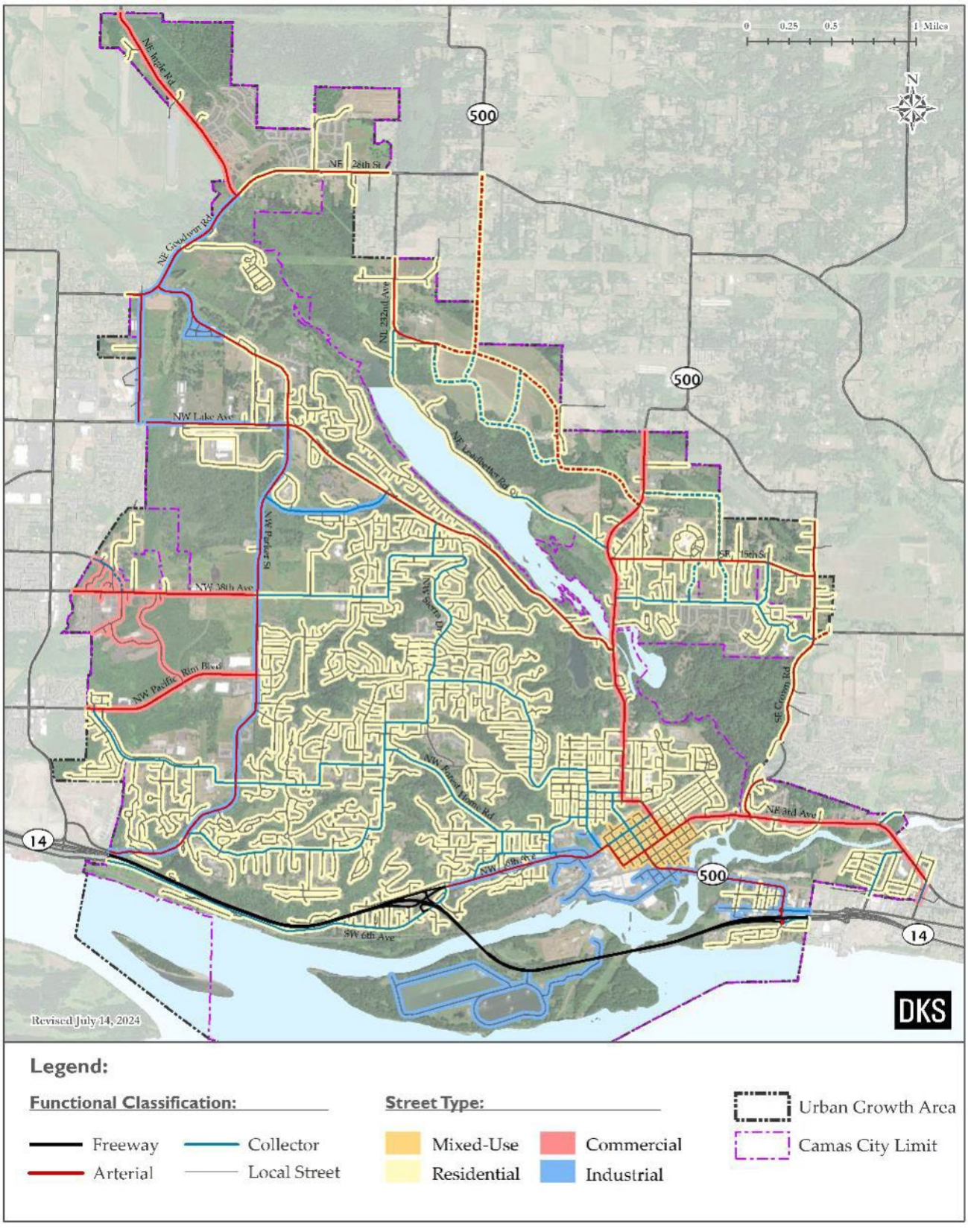
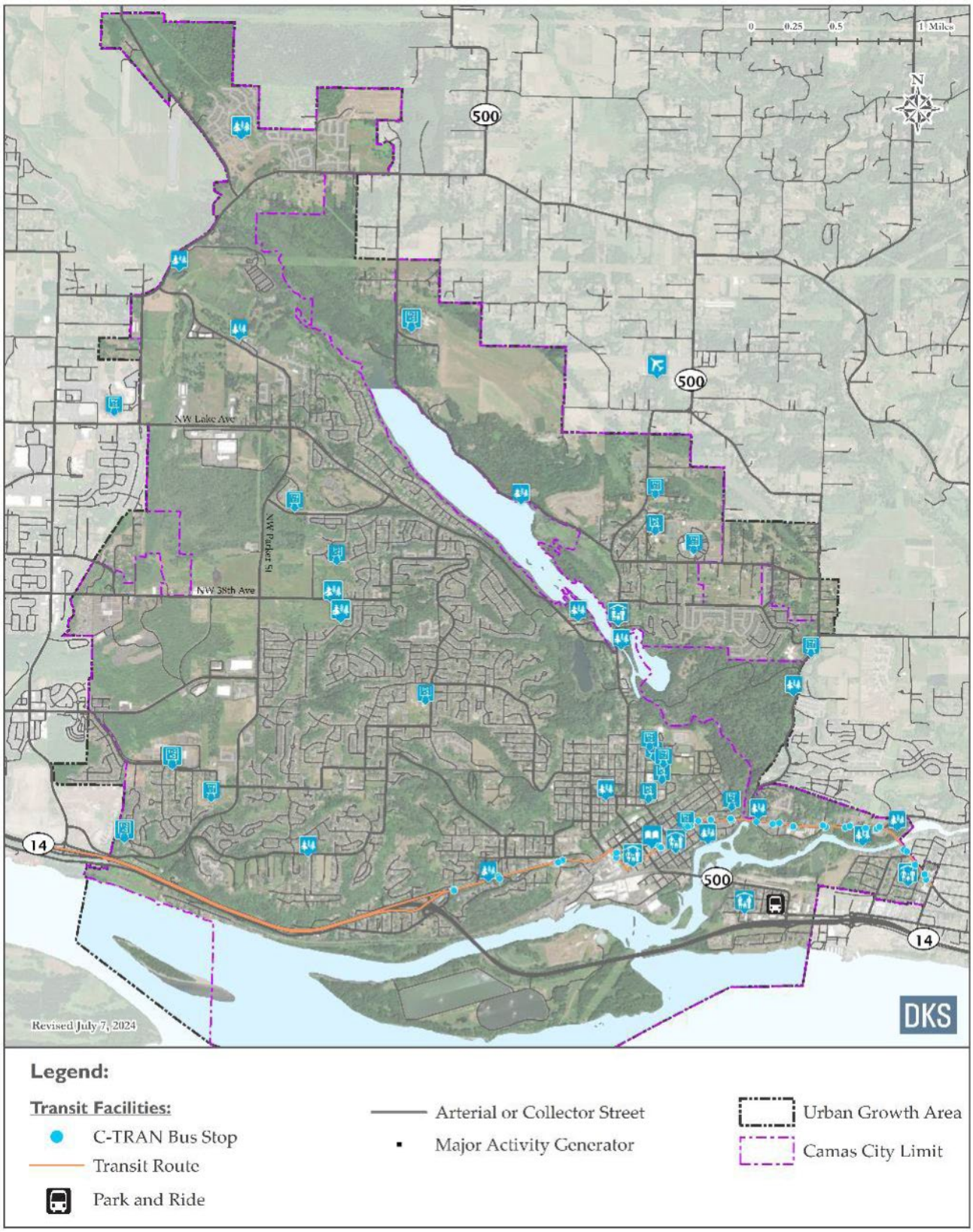


Figure 15 Transit Facilities



Transportation Goals and Policies

Goal TR-1 Complete Streets

Streets will function for all users of all abilities including bicyclists, pedestrians, transit users, and motorists.

Policy TR-1.1 Implement the Transportation System Plan (TSP) to maintain the livability of Camas and guide decision-making for transportation-related projects, policies, and design. Ensure consistency between the TSP, the Parks, Recreation and Open Space Plan and the 6-year street plan.

Policy TR-1.2 Maintain the transportation system to enhance safety and efficiency for all users, facility aesthetics, access management measures and the overall integrity of the system.

Policy TR-1.3 Construct streets that are interconnected and avoid long cul-de-sacs or dead ends. Block lengths should be less than 1,000 feet. Include pedestrian and bicycle linkages in the construction of cul-de-sacs and other forms of dead-end streets. Existing dead-end streets should be retrofitted to provide bicycle and pedestrian linkages as practicable.

Policy TR-1.4 Develop and implement design standards that provide attractive streetscapes, encourage appropriate traffic volumes and speeds, and support multi-modal safety. Include enhanced roadway features such as roundabouts, decorative lighting, and landscaping in gateways and design overlay areas.

Policy TR-1.5 Minimize access to new development and redevelopment along City arterials and consolidate access points when spacing is insufficient.

Policy TR-1.6 Provide routes designed for active transportation to encourage mode shift for short trips. Route planning should seek shortcuts and other opportunities that provide advantages to active transportation users. Public investments should support active transportation routes such as street lighting, safe crosswalks, and protected bike lanes.

Policy TR-1.7 Coordinate with Camas School District to implement a safe routes to school program to encourage the use of alternative and active transportation.

Policy TR-1.8 Develop and implement Complete Streets design in all new and retrofit street projects to support the use of alternative travel modes. Adopt engineering design standards consistent with Complete Streets goals.

Policy TR-1.9 Increase wayfinding signage for outdoor destinations throughout the City.

Policy TR-1.10 Inventory current bicycle and pedestrian networks to identify gaps in route coverage. Support filling in network gaps as new development and redevelopment occurs to create a bicycle and pedestrian network that is safe, comfortable, and accessible to people of all ages and abilities.

Policy TR-1.11 Minimize cut and fill roadway design and, where feasible, minimize restructuring the natural contours of the land.

Policy TR-1.12 Encourage the inclusion of low impact development (LID) design features (e.g. rain gardens, grass pavers, pervious pavement) in the design of road surfaces.

Policy TR-1.13 Require LED lights in new development and replace existing inventory that lack LED features.

Goal TR-2 Local and Regional Transit

Regional transit will provide safe, efficient, and dependable service to the Camas community for a variety of trips within and outside of the city.

Policy TR-2.1 Coordinate with local municipalities, Washington Department of Transportation, adjacent counties, and C-TRAN to ensure that minimum roadway and multi-modal design standards are consistent.

Policy TR-2.2 Partner with C-Tran to advocate for and develop transit options that are safe, convenient, frequent, and accessible for Camas residents.

Goal TR-3 Traffic Safety

Design and construct safe transportation facilities that meet applicable requirements.

Policy TR-3.1 Encourage traffic safety through education, enforcement, and engineering. Use traffic calming, traffic diversion, and other available tools such as landscaping, trees, and art to ensure a comfortable and safe environment for all users.

Policy TR-3.2 Provide adequate access for emergency vehicles throughout the city.

Policy TR-3.3 Develop safe pedestrian and bicycle routes between residential areas, schools, and public facilities.

Policy TR-3.4 Require new development to implement designs standards using the Neighborhood Traffic Management Plan.

Policy TR-3.5 Identify high accident areas and implement specific measures to reduce accident occurrences.

Goal TR-4 Transportation Demand Management

Transportation planning will achieve the efficient use of transportation infrastructure, increase its person carrying capacity, and accommodate and facilitate future growth consistent with land use objectives.

Policy TR-4.1 Require large employers to implement a commute trip reduction program for employees, as mandated by state law.

Policy TR-4.2 Support intergovernmental development review.

Policy TR-4.3 Support the Regional Transportation Council (RTC) with funding and staff participation to the extent possible.

Goal TR-5 Concurrency and Level of Service

The City will maintain the adopted LOS standards for all arterial streets and transit routes.

Policy TR-5.1 Encourage growth in areas with existing or planned infrastructure capacity.

Policy TR-5.2 Require new development to demonstrate that adequate person trips are available, or that multi-modal improvements to the transportation system will be made to accommodate the impacts concurrent with the development.

Policy TR-5.3 Utilize traffic impact fee studies, development traffic impact analyses, and corridor studies to identify deficiencies and plan improvements to maintain or improve LOS standards.

Policy TR-5.4 Take the following actions (in no priority order) if the probable funding falls short of meeting identified needs: 1) delay development until programs, facilities, or services can be funded; 2) obtain the revenue needed or revise the transportation plan to reflect known financial resources; or 3) change the transportation LOS standard, which is a last resort measure.

Goal TR-6 Transportation Revenue

Maximize the use of state and federal funds for transportation capital, operating, service, and demand improvements.

Policy TR-6.1 Maintain a capital improvement plan (CIP) that identifies construction and improvement priorities and funding.

Policy TR-6.2 Ensure that the transportation impact fee program responds to land use changes, supports connectivity, and requires new development to pay its proportionate share of needed capacity.

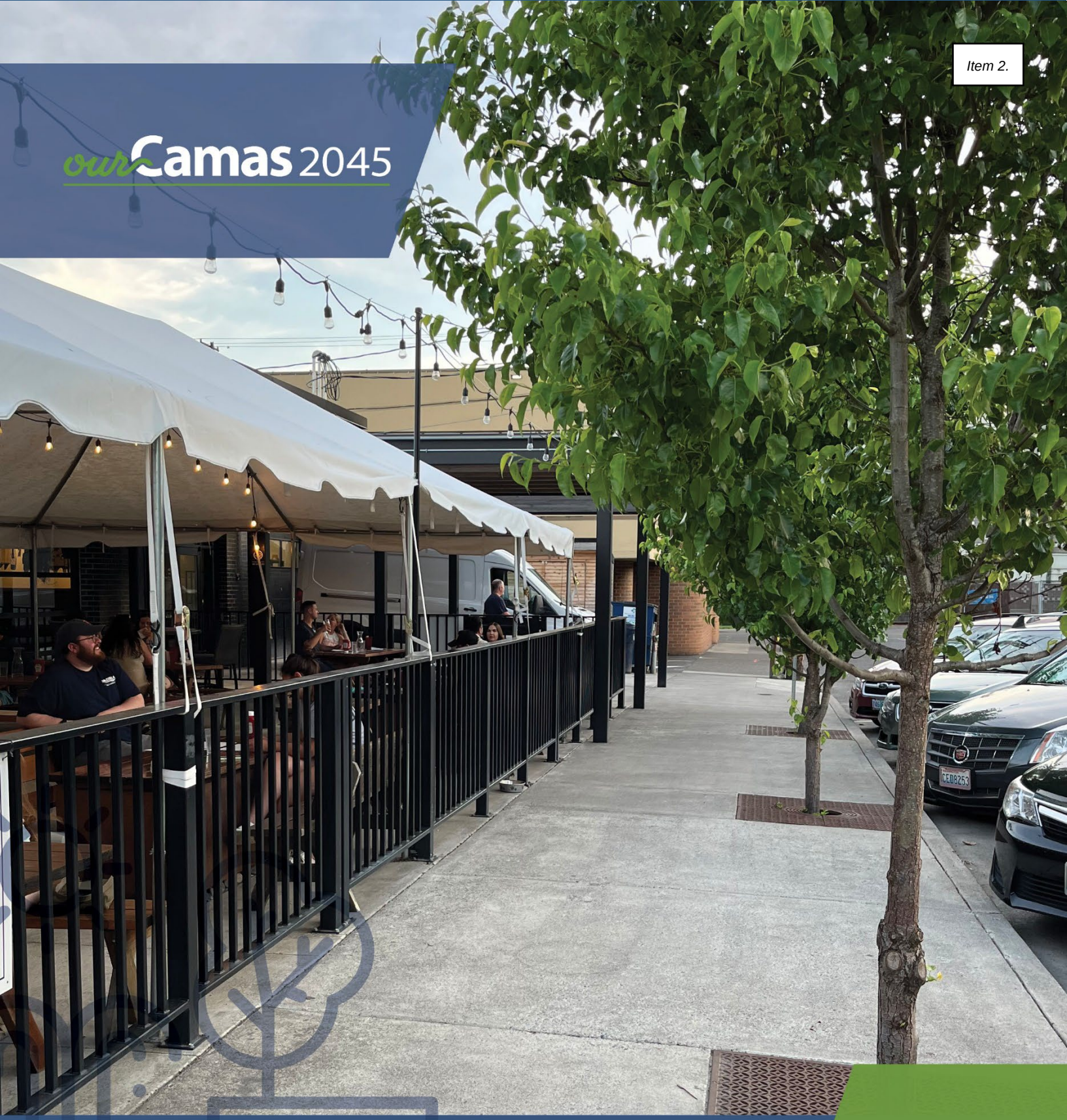
Policy TR-6.3 Support the Pavement Asset Management System and other maintenance programs to ensure cost-effective maintenance of transportation facilities and efficient use of public funds.

Policy TR-6.4 Develop equitable transportation impact fees to assess developers a fair-share contributions for any transportation improvements.

Policy TR-6.5 Prioritize transportation funding for multi-modal improvements that will enhance safety and access between infill areas, schools, and employment centers.

Policy TR-6.6 Focus transportation projects in economic development areas to act as catalysts for job growth.

ourCamas 2045



Public Facilities & Services

09

09. Public Facilities & Services

Purpose

Plan for adequate facilities that are consistent with the other elements, goals and policies of Our Camas 2045, can accommodate the projected population and employment growth and land use plan, and based on sound fiscal policies for the City.

Vision

In 2045, Camas residents enjoy the city's parks, trails, community centers, and other recreational opportunities. The school district draws families to the community and the library continues its vital role as a place of learning. Residents value accessible police, fire, and emergency response services. Proficient government agencies maintain existing City assets and coordinate future development.

Introduction

The City of Camas is a full-service community that offers a breadth of public facilities, services, and utilities. Public facilities include such things as City Hall, the Camas Public Library, the Public Works Operation Center, Lacamas Lodge, the Community Center, the Camas Police Department headquarters, and Fire Stations 41 and 42. The majority of the City's functions and services are carried out from these facilities.

General government services include such departments as Administration and Human Resources, Community Development, Finance, Information Technology, and the Camas Public Library. General services include but are not limited to utility billing, human resources, city clerk functions, building and engineering permits and inspection, and activities of the City Council and city boards and commissions.

Other city services include Fire and Emergency Medical Services (EMS), Police, and Parks and Recreation. Fire and EMS services are provided in Camas and, via intergovernmental agreements, beyond Camas city limits. The Camas Police Station dispatches law enforcement services throughout the community. Parks and Recreation services are housed in several facilities including Lacamas Lodge, the Community Center, and through a myriad of parks, trails, open spaces, and special use buildings.

Public utilities, administered by the Public Works Department, includes the city's sewer system, water system, and municipal stormwater system. These systems have a variety of assets that support them and are scattered throughout the city.

Public Works also operates solid waste service. Garbage trucks are dispatched from the Operations Center, the hub of Public Works' activities, and the solid waste is transported to an off-site transfer station and then to a landfill in eastern Washington. The City budgets money for capital equipment, however, the solid waste system does not require the same kinds of investments that the sewer, water, and stormwater systems require.

The public facilities and services element is divided into four sections:

- Public Facilities and Services including fire, emergency medical and police services, parks and open space, and City owned facilities
- Public and Franchise Utilities including water, sewer, stormwater, solid waste, electricity, natural gas, and telecommunications
- Capital Improvement Plan
- School Districts

Related to this element is the City's Capital Facilities Plan (CFP) (Appendix X), which provides a comprehensive project list and schedule guiding the investment of city resources in facilities and infrastructure. These resources are made up of local revenues as well as State, Federal and other sources. The CFP identifies those projects which have secured funding as well as a list of projects which have not yet been funded. The projects included in the overall CFP have largely been identified through other planning documents and efforts which are all incorporated into the City's comprehensive plan.

Level of Service (LOS) Standards

Under the GMA, adequate provisions for urban governmental services must be provided in the UGA. The goals and policies in this element are provided to address anticipated growth and maintain adopted LOS standards.

Public Facilities and Services

Many of the public facilities and services listed in this element have strategic plans and actions that guide maintenance and service improvements. The identified goals and policies were given consideration based on a framework of budgetary and operational guidelines as well as these strategic plans.

Fire Protection, Emergency Medical Services, and Police Protection

The city is served by the Camas-Washougal Fire Department (CWFD), which covers 20 square miles and 33,000 residents for fire protection and 80 square miles and 65,000 residents for emergency medical services. The Camas and Washougal fire departments consolidated in 2011 through a joint contract for service to improve efficiency and lower costs. CWFD averages approximately 5,000 fire and medical calls annually. The CWFD is the only fire department in

Clark County to provide ambulance transport services, which requires additional training for the firefighters in addition to fire suppression techniques.

Camas Fire and EMS operates out of two stations – Station 41 located in City Hall on NE Fourth Avenue and Station 42 located off NW Parker Street. Station 42 is relatively new, while Station 41 is many decades old.

Voters approved a capital construction bond in August of 2024 for a new downtown station and headquarters to replace Station 41. It will be located on the property occupied by the City Hall Annex building just west of City Hall on NE Fourth Avenue. When the new Station 41 is completed, there will be vacated space in the City Hall building. Future uses for the vacated space have not been determined.

A Facility Conditions Assessment (Appendix X) was completed in 2021 and lists some deficiencies in Station 42 in the form of HVAC, plumbing, electrical, and interior finishes that will be addressed with funding from a general obligation bond.

The Camas Police Department operates a full-service police department from one location near the downtown core. This 15,000 square-foot facility was built in 1998 and includes a 1,500 square-foot community/training room. Services include police response, community engagement, school resource officers, investigative follow-up, parking enforcement, code enforcement, and records services.

The City is currently investing over $400,000 in upgrades to the Camas Police Station by replacing end-of-life mechanical equipment. This investment will make it more cost-effective and environmentally resilient.

Parks, Trails, and Open Space

Camas' Comprehensive Parks, Recreation, and Open Space (PROS) plan , updated in March 2022, outlines a community vision for Camas that includes a high-quality park and recreation system, with a comprehensive open space and trail system linking all recreational sites to the regional trail network. The PROS plan is adopted by reference and included as Appendix X.

Parks and recreational opportunities in Camas include neighborhood parks that serve individual neighborhoods, natural open space areas that preserve resources throughout the community, and special use areas for specific recreation needs. Supplementing these are public and private sites and facilities, such as school sites, regional parks, and privately-owned recreation facilities.

In response to the community's feedback on the PROS plan, the City is currently working on a Parks and Open Space Management Plan (POSMP). The purpose of the POSMP is to maintain the existing facilities, fill gaps and improve trail connections, and develop and improve existing parks. The POSMP will outline a strategic vision for the thoughtful management of parks and open spaces within the city, ensuring that they continue to serve as resources for all users. The City will need to coordinate the POSMP with the comprehensive plan to ensure consistency.

During the City's review of land use designations, the PROS plan was reviewed to ensure that sufficient land is designated as Park, Open Space/Green Space, and NS-Parks/Open Space. Because the North Shore Subarea Plan was adopted after the last comprehensive plan update, this update includes revisions that incorporate the new NS-Parks/Open Space designation.

Camas receives impact fees paid by new development for park, trail, and open space improvements that increase the capacity of the system. The expenditure of the collected fees will be applied to the total costs of implementing projects that are identified in the PROS Plan project list, and as further refined by the City's Capital Improvements Plan.

City Facilities

The comprehensive FCA reviewed 17 publicly owned buildings located at 11 different sites. The total square footage of the surveyed buildings is just under 276,000 square feet.

The FCA report notes the total replacement value of all facilities at $61 million in 2022 dollars. The reported deficiencies for the years 2022-2027 total $17 million with the priority needs (life safety and code issue deficiencies) at $6.3 million. Long-term needs would require $18 million for major maintenance projects.

Recently, the City appropriated funding, through limited general obligation bonds, to pay for many of the items listed as priority needs in the FCA. This approximately $7 million has allowed the City to attend to some of the high priority deficiencies.

Noteworthy on the list is Station 41 and the City Hall Annex. With passage of a voter approved bond in 2024 specifically to replace Station 41, the City Hall Annex building will be demolished, and the site will house the new Station 41, which will also serve as the Fire Department's headquarters.

The Camas Public Library, located across the street from City Hall on NE Fourth Avenue, provides library services to the community at-large. According to the FCA, the library is in need of priority improvements to address immediate deficiencies. Since the date of the report, the City is funding a number of deficiencies through a general obligation bond.

City and Franchise Utilities

Water

The City owns and operates a multi-source municipal water system which includes supply, treatment, storage, and distribution of potable water to residential and commercial customers. The City currently obtains its water from ten groundwater wells and two surface water sources that are treated to provide high quality water to customers. The City owns over 143 miles of pipelines in its water transmission and distribution system. Service is provided to customers across five major pressure zones and 18 subzones. Eight booster pumping stations are used to move water between pressure zones. Seven storage facilities, with a combined total of 8.45 million gallons (MG), provide storage for normal and emergency conditions, such as fire

suppression. Additionally, distribution system includes numerous meters, isolation valves, and hydrants. Additional information regarding Camas Water Service, including capacity analysis, is available in Appendix X, Water System Plan (2019).

Sewer

The majority of the 7,700-acre UGA and the sewage collecting infrastructure inside the city limits is owned and operated by the City of Camas. The collecting system consists of traditional gravity sewers, pump stations, force mains, and septic tank effluent systems. The system includes 38,260 linear feet of force main, 29 lift stations, and 236,200 linear feet of gravity mains. Approximately half of the city is served by septic tank effluent systems and the other half by a traditional collection system. The City gathers, treats, and discharges wastewater into the Columbia River at the Camas Wastewater Treatment Plant (WWTP).

The City of Camas Sewer Division serves residences and commercial buildings, with approximately 8,500 customers, comprised of industrial, commercial, and residential users.

A collection system flow metering and projection was conducted in 2018/2019 to evaluate the collection system using the City's hydraulic model. The results of this analysis are available in Appendix X, General Sewer Plan (2022), which develops a management plan for the system over the next 20 years.

Stormwater

The stormwater runoff generated from approximately 7,500 acres across the city of Camas is managed through 75 miles of stormwater conveyance pipe and 1,800 stormwater inlets and catch basins. The stormwater conveyance system is owned and maintained by the City. The City also owns and maintains stormwater facilities, including underground treatment vaults, detention ponds, biofiltration swales, wet ponds, drainage ditches, and culverts. These have been geolocated on the City's Stormwater Management Action Plan (SMAP) Public Input Map. The SMAP identifies actions to protect and improve receiving waters' water quality. Commercial and residential stormwater facilities are privately owned and maintained per stormwater code CMC 14.02.200 Ownership and Maintenance. These privately owned facilities within the city are geolocated on the SMAP Public Input Map. Additional details on stormwater management in Camas can be found in Appendix X, Stormwater Management Program (2024).

Solid Waste

The City owns and operates its own solid waste utility which provides for the collection and transfer of solid waste refuse to the Clark County-owned Washougal Transfer Station. The City is responsible for managing garbage collection within the Camas boundaries. The City has established universal compulsory solid waste collection, requiring all residents and businesses to maintain solid waste service. The City contracts with Waste Connections of Washington to provide recycling and yard debris management, collection, and disposal. The City also contracts with Waste Connections to provide large container service (larger than 2 cubic yards) to those with greater solid waste handling needs.

All cities and towns in Clark County have delegated responsibility for solid waste transfer and disposal planning to the County, including Camas. The currently adopted Clark County Solid Waste Management Plan (CSWMP) of 2015 is undergoing updates and anticipated to be adopted by the end of 2025. Agreements between Clark County and its cities commit each to the plan and to the plan's waste disposal system.

Franchise Utilities

There are several other utilities, some of which are provided by public entities and others by private entities, that contribute to the functionality and prosperity of the community. The main utilities include electricity, natural gas, and telecommunications. Electricity is provided by Clark Public Utilities (CPU), a customer-owned public utility; natural gas is provided by Northwest Natural; and telecommunications, including high-speed internet, are provided by a variety of companies (e.g. Comcast, Verizon, Frontier, etc.). No detailed inventory regarding the capacity of these utilities is available.

Electrical

Clark Public Utilities (CPU) (https://www.clarkpublicutilities.com/) provides electricity to Camas and throughout Clark County. CPU balances strategic planning for the future with present rate and service stability in compliance with changing requirements at the local, state, and federal levels. CPU is led by an elected board to plan for integration of new technologies and has indicated there is ample capacity to meet existing demand for areas within both the incorporated City limits and the UGA. Power supplies are provided through a combination of power supply contracts and purchases from the generating system.

Natural Gas

Delivery of natural gas to Camas and its UGA is provided by Northwest Natural (https://www.nwnatural.com/). The delivery of natural gas is governed by the Federal Energy Regulatory Commission, the National Office of Pipeline Safety, and the Washington Utilities and Transportation Commission (WUTC). The City's regulations include safety and emergency provisions, LOS standards, and rate limitations. Northwest Natural provides natural gas service to all of Clark County. The alignment of the main pipeline crosses the Columbia River at the area of the Port of Camas-Washougal. Additionally, Northwest Natural is improving its backbone through the City with the installation of a large-diameter high-pressure gas main connecting Lake Road and Pacific Rim Boulevard.

Telecommunications

Verizon provides local telephone service to the City and its UGA. Many of the telecommunication facilities, including aerial and underground, are co-located with those of the electrical power provider. Frontier Communications also provides telecommunications to a large number of customers in the Camas area. Contact information for telecommunication utility providers is available on the City of Camas website (https://www.cityofcamas.us/utilities/page/new-resident-information).

Capital Improvement Plan

The 6-year Capital Improvement Plan (CIP) is a significant component of the financing plan and is adopted as part of the biennial budget. It includes a list of projects, project start dates, estimated cost, and funding. The CIP is a shorter term funding plan that directs available resources to specific projects including street preservation and improvements, fire and EMS, parks and recreation, stormwater, water, and sewer projects. The 2025-2026 CIP is included as Appendix X.

The first two years of the capital facilities plan are typically consistent with the adopted City budget. However, since capital expenditures often impact multiple years after funding has been committed, it is prudent to plan ahead for the expenditure of funds for at least four years or longer. Additionally, some of the City's adopted plans include longer term expenditure plans in which resources are actively being pursued when opportunities arise.

School Districts

Public schools are recognized as one of the largest public services within the community. Education serves one of the most important roles in community health as the quality of education today impacts the skill levels, employment rates, labor supply, and wages of tomorrow.

The Camas School District has the most, and some of largest, public facilities in the Camas Urban Growth Area. The UGA spans two school districts. Camas and Evergreen School Districts are responsible for facility planning and service levels of the districts and coordination with the city's overall development. Both school districts are currently evaluating school facilities and overall needs to serve the community.

The Camas School District has prepared a 2022 Capital Facilities Plan (CFP) to provide the County and the Cities with a schedule and financing program for capital improvement needs over a six year period (2022-2028) to ensure that adequate facilities are available to serve new growth and development.

The collection of school impact fees generates partial funding for construction of public facilities needed to accommodate new development. School impact fees are collected by the cities and County on behalf of the District at the time plats are approved or building permits are issued. Impact fees are calculated based on a formula, which includes the portion of District construction resulting in increased capacity in schools. The districts submit their capital facilities plans every other year, accompanied by impact fee calculations. The plans describe the existing and planned school facilities and services.

Anticipated property acquisition and new construction is based on the enrollment forecast, capacity, the District's educational standards and the community's support of finance tools to fund improvements.

Public Facilities and Services Goals and Policies

Goal PFS-1 Fire Protection, Emergency Medical Services, Police Protection

Provide fire protection, emergency medical services, and police protection to Camas and accommodate growth in the community.

Policy PFS-1.1 Plan for fire and emergency medical services to include adequate land, building, and equipment to effectively serve the geographic area of the city north of Lacamas Lake (North Shore).

Policy PFS-1.2 Assess the level of service needs and provide fire, advanced life support emergency medical, and police services that meet the community demand. Maintain service levels as growth occurs.Ensure

Policy PFS-1.3 Ensure the installation of commercial fire sprinklers where required by code and strongly encourage their use when installation is optional.Require

Policy PFS-1.4 Pursue funding to maintain fire facilities, including all fire apparatus at levels that best serve the community. Fire apparatus includes fire suppression equipment such as engine, water tenders, brush trucks and command officer vehicles.

Policy PFS-1.5 Require all new residences to install fire sprinkler systems.

Policy PFS-1.6 Plan police annex facilities at strategic locations throughout the City.

Goal PFS-2 Parks, Trails and Open Space

A network of parks, trails, and open space will connect neighborhoods, wildlife corridors, and natural resources and enhance the quality of life for residents and visitors. Refer to the Camas PROS plan for additional goals and policies.

Policy PFS-2.1 Provide and maintain an active transportation network to increase connectivity to natural areas, wildlife corridors, and other natural resources in Camas.

Policy PFS-2.2 Ensure every neighborhood has access to a park within a 15-minute walk or roll.

Policy PFS-2.3 Provide safe and maintained parks, natural areas, and other recreational spaces that are accessible for all ages and abilities.

Policy PFS-2.4 Provide a continuous trail network around Lacamas Lake with ample access points, prioritizing active transportation users. Consider new public access points through dedications, easements, and acquisitions. Partner with transit agencies to plan and implement transit service to Lacamas and Round Lake.X

Policy PFS-2.5 Explore the development of dog parks within special use park areas to balance the needs of pet owners and other park users.

Policy PFS-2.6 Encourage the development of parks and playgrounds that have ample facilities for all users.

Policy PFS-2.7 Work with the Camas Parks & Recreation Department to acquire land for parks, trails, recreational uses, and habitat conservation.

Policy PFS-2.8 Enhance water conservation methods and technologies in development of irrigation infrastructure within parks and recreation areas.

Goal PFS-3 City Facilities and Services

Provide facilities and services to support the functions of City government and the community, including cemetery, animal control, and the public library.

Policy PFS-3.1 Develop an expansion plan (e.g., new municipal facility, meeting space) to accommodate additional personnel.

Policy PFS-3.2 Ensure that the municipal building and primary services remain downtown.

Policy PFS-3.3 Incorporate sustainable and low climate impact design into city buildings. Promote LEED certification (or similar) for all publicly owned facilities.

Policy PFS-3.4 Utilize the City's capital improvement program to develop alternative transportation facilities and electric vehicle charging infrastructure for public facilities.

Policy PFS-3.5 Maximize the developed and undeveloped property for cemetery use to meet future burial needs and trends and meet residents' service expectations.

Policy PFS-3.6 Provide economic stability to the cemetery fund by reducing dependency on the general fund.

Policy PFS-3.7 Develop a strong volunteer and donation program for the cemetery.

Policy PFS-3.8 Continue animal control partnership with the City of Washougal.

Policy PFS-3.9 Maintain funding and support for library services that meet the demands of current and future residents.

Policy PFS-3.10 Assess need and solutions for additional library services throughout the growing City.

Goal PFS-4 City and Franchise Utilities

Provide utility services, including energy and communication facilities and their services, to all businesses, residents, and properties in the City limits.

General Utilities Policy

Policy PFS-4.1 Maintain and improve City utility systems through preventative maintenance and regular assessments and improvements to meet regulatory standards.

Policy PFS-4.2 Where service is available, require connection to public water for domestic and irrigation needs and connection to sewer systems. Promote connection to sewer and water before system failure of private well or septic.

Policy PFS-4.3 The City should be the sole provider of urban services, including water and sewer, within the UGA for sewer service and the Water Service Area for water. Require all new construction connect to city systems. Prohibit construction of new private wells and subsurface sewage disposal systems in new developments.

Policy PFS-4.4 Do not extend utilities without annexation or commitments for annexation. Exceptions may be made in cases where human

health is threatened. In areas where utilities presently extend beyond City limits, but are within UGAs, plan development jointly with the County. A joint development must be consistent with City standards.

Policy PFS-4.5 Coordinate plans for providing public utility services in UGAs and rural areas with plans for transitioning undeveloped land to urban uses.

Policy PFS-4.6 Plan public utility services so that service provision maximizes efficiency and cost effectiveness and ensures concurrency. Coordinate with other entities to provide services within the urban area.

Water Service Policy

Policy PFS-4.7 Extend adequate public water service throughout the City's urban areas that meets state requirements and provides minimum fire flow as required by the Fire Marshal.

Policy PFS-4.8 Conserve and protect groundwater resources to provide safe, clean, high quality drinking water to residents.

Policy PFS-4.9 Ensure water infrastructure is designed to City standards and is in place prior to land development.

Policy PFS-4.10 Coordinate with Clark County and other purveyors to eliminate private systems in accordance with the Clark County Coordinated Water System Plan.

Policy PFS-4.11 Coordinate with the County and the cities of Vancouver and Washougal to protect groundwater from contamination.

Policy PFS-4.12 Expand municipal reclaimed water systems and allow onsite non-potable water systems to reduce water demand in private-sector commercial and residential buildings.

Policy PFS-4.13 Eliminate the introduction of groundwater and surface water into the sewer system.

Sewer Services Policy

Policy PFS-4.14 Extend public sanitary sewer service, as required, throughout urban areas. Service may be provided outside urban areas to serve areas where imminent health hazards exist.

Policy PFS-4.15 Use traditional gravity sewer systems (in lieu of STEP systems) to serve future customers and reduce maintenance and power costs.

Policy PFS-4.16 Coordinate with Clark County to eliminate septic systems.

Stormwater Policy

Policy PFS-4.17 Provide a stable funding source to meet National Pollutant Discharge Elimination Systems (NPDES) Phase II requirements to manage and control stormwater runoff.

Policy PFS-4.18 Inspect homeowner association and other private facilities and provide directions and standards for repair.

Policy PFS-4.19 Meet water quality standards by providing best management practices for development activities.

Policy PFS-4.20 Establish baseline flows on each drainage basin or sub-basin for the analysis of deficiencies.

Policy PFS-4.21 Consider stormwater impacts during land use review processes and develop standards that would reduce the amount of impervious surface on existing and new development, including the creation and adoption of low-impact development standards and the use of green infrastructure, to address increased storm intensities and stormwater runoff.

Policy PFS-4.22 Require new development or redevelopment to comply with the Camas Stormwater Design Standards Manual and design criteria.

Policy PFS-4.23 Protect natural stream courses for water quality.

Policy PFS-4.24 Manage stormwater to safely pass surface water and maintain water quality of lakes, streams, and rivers.

Solid Waste Policy

Policy PFS-4.25 Provide for solid waste service throughout the City through continuance of self-collection of solid waste and contracting with private waste management companies to provide recycling and yard debris collection options.

Policy PFS-4.26 Continue a system of universal compulsory solid waste collection.

Policy PFS-4.27 Coordinate with the County to implement the Clark County Solid Waste Management Plan (CSWMP). Reduce the total production of waste, increase the recycling rate of waste that is produced, and properly manage and dispose of waste that is not recycled. Provide education and outreach to businesses and the public on benefits and opportunities for waste reduction and recycling. Focus on residential recycling rates to improve participation rates similar to the rest of the County.

Policy PFS-4.28 Work with solid waste utility companies to determine if household food waste/compost can be accommodated in yard waste bins.

Franchise Utility Policy

Policy PFS-4.29 Minimize the effects on adjacent properties, the environment, and the visual quality of the community of siting, developing, operating, and maintaining facilities.

Policy PFS-4.30 Coordinate to provide reliable service through partnerships and agreements with utility companies.

Policy PFS-4.31 Promote the conservation of energy resources through the adoption of appropriate energy codes and efficient land use and transportation systems.

Policy PFS-4.32 Work with energy utilities to improve the safety and reliability of infrastructure vulnerable to climate change (e.g., undergrounding transmission lines).

Goal PFS-5 Capital Improvement Plan

Maintain and implement the Capital Improvement Plan in coordination with the biennial budget.

Policy PFS-5.1 Update the capital improvement plan biannually and include a statement of projected costs and sources of revenue.

Policy PFS-5.2 Ensure capital improvements enhance the community and add physical value to the City.

Policy PFS-5.3 Apply earnings from bond proceeds toward the debt service fund reserved for the future repayment of debt directly for enhancement of the project.

Policy PFS-5.4 Dedicate all or a portion of the first year of property taxes generated from newly incorporated areas to the Capital Fund.

Policy PFS-5.5 Dedicated funds and bonds may be used to fund essential capital improvement projects such as police, fire, and general municipal structures.

Policy PFS-5.6 Use voted, general obligation debt for discretionary projects such as recreation and library facilities.

Policy PFS-5.7 Prioritize projects that support the core services provided by the City.

Policy PFS-5.8 Ensure consistency of capital improvement plans with the adopted comprehensive plan map and evaluate if funding is adequate to provide necessary public facilities and services to implement the plan.

Goal PFS-6 School Districts

Support access to quality education and public schools through partnerships and investments.

Policy PFS-6.1 Encourage the Camas School District, Clark County, and the City of Camas to invest in mutual use facilities that support intergenerational and intercultural use.

Policy PFS-6.2 Coordinate planning between the Camas School District and the City of Camas to reflect school facility needs in response to growth forecasts.

Policy PFS-6.3 Ensure equitable access to schools and educational programs, specifically considering those in underserved areas, where needs and abilities may differ.

ourCamas 2045



Economic Development

10

10. Economic Development

Boosting the Local Economy

The economic health and well-being of the City of Camas is supported by providing a wide range of employment opportunities throughout the community and a setting and quality of life that is attractive to businesses and residents.

Vision

In 2045, Camas has cultivated a diverse and thriving economy with stable employment opportunities and living-wage jobs across various sectors, including technology, healthcare, manufacturing, retail, recreation, and professional services. Camas residents have access to a wide range of services and amenities in their community, while benefiting from excellent regional connectivity and the city's proximity to Portland International Airport. Camas is a gateway to nature and recreational opportunities, supporting regional tourism in the area. Camas is home to a thriving economy and diverse businesses, affording residents ample employment opportunities. Neighborhood commercial hubs connect residents to daily services and amenities through a network of sidewalks and bike lanes, improving access and connectivity. Professional office, medical, and industrial uses typify western Camas, with retail businesses supporting these firms and nearby residents. The North Shore area will fulfill the employment and retail needs of the growing population on the northeast side, and reduce trips outside the city. Downtown Camas anchors the community with a dynamic economic landscape and retains its historic atmosphere as a walkable, attractive place to shop, dine, and gather. Inclusive housing options within the city's core contributes to a town center that supports local businesses.

Approach for Updating this Element

The approach for updating the economic development element for the 2025 to 2045 planning horizon was informed by community input (outlined below), state legislation requirements, priorities, and a comprehensive economic profile. This profile integrated the best available information from public and private data sources to assess the city's economic trajectory, opportunities, challenges, and economic conditions and competitiveness. These insights help build a factual basis for the updates.

Community Engagement Insights

Interactive open houses and interviews with stakeholders provided information about economic development strengths,

challenges, opportunities, and actions in Downtown Camas and other areas in the City. Engagement activities identified the following themes that could contribute to future decision-making related to economic development in Camas.

Economic Development

- **North Shore:** Need infill development.
- **Grass Valley:** Needs mixed/light industrial park with athlete fields/parks. Why no Grass Valley Subarea Plan? Be clear on what kinds of businesses would be most beneficial to Camas in Grass Valley to build awareness when talking with prospective businesses.
- **General:** Need more commercial space, more manufacturing jobs, and a dedicated economic development director or staff person (apply for grant), and plan. Focus on tourism and bring in money. Are there model cities Camas would strive to look like? (Lake Oswego, Bend, etc.) Compare plans with cities that have experienced similar growth? What did they do well?
- **Housing:** Allow work/live housing along and around UGA/schools and major transportation corridors. Ensure workforce housing is available for current and future workers. Having diverse housing options will lead to a more diverse city.

Downtown Strengths

- **Strong sense of place:** Downtown stakeholders feel supported by Camas community. They discussed the quaint, small-town character, with unique features attracting visitors and services and how the mix of new and old/established businesses contributes to vitality of Downtown.
- **Positive support for businesses**: Good interactions with the DCA, overall good experience working with the City and business owners cultivate a collaborative environment.
- **Increases in housing density seen as a positive direction:** New housing is opportunity for more amenities to support the growth and expansion of amenities can make Downtown more walkable.

Downtown Opportunities

- **Improvements to public realm** to increase / improve street lighting, address issues with street trees (some interfere with sidewalks, other infrastructure), improve the civic area of Fire Dept. plan, add connectivity to adjacent residential neighborhoods, and open spaces, and provide outdoor dining spilling out onto sidewalk.
- **Community gathering spaces**: Need more meeting places indoor/outdoor and outdoor spaces for children/families, should expand Downtown Core beyond 4th Ave, support redevelopment of underutilized land on 3rd and 5th Ave, and should create more spaces for retail that extends walkability of Downtown, cohesiveness.
- **Development potential:** Explore more ways to activate ground floors and embrace walkability / modern parking standards.

Downtown Challenges

- **Parking is a concern for some:** Two-hour duration (especially difficult for employees) and Mill property / parking lot.
- **Pace of development:** Concern over what new development will mean for current businesses and need for balance between new development and preserving historic structures in Downtown.
- **Growth opportunities are limited:** Need to expand the definition of Downtown (beyond just 4th Ave) to expand and provide more amenities. There is limited space on 4th Ave where businesses would like to locate.
- **Barriers to development and safety issues for pedestrians:** Height restrictions and fees are challenging, since rents are lower it is harder to make a project pencil, and need for safer crossings on 3rd Ave and difficult to cross 5th in some areas.

Public Engagement Findings Regarding Strategies

- **Need more responsive permitting and ongoing maintenance to the public realm** since this supports the success of Downtown.
- **More partnerships between City and Downtown businesses:** City can increase interaction and build relationships with business / property owners.
- **Identify ways to keep local presence and restore historic structures:** Some expressed concern over losing historic structures and asked for ways to balance preservation with new development. The City could provide incentives for existing business owners who would like to expand or stay in Downtown Camas as new development continues.
- **Explore ways to address underutilized property**: For example, opportunities at GP parking lot.
- **Pedestrian Safety and Connectivity:** Address 3rd and 5th Avenue pedestrian safety and improve connections to and from Downtown. Focus on pedestrian activation through plazas and public spaces. Address accessibility needs both with ADA and beyond.
- **Improvements:** Expand character of Downtown to the broader boundary defined in the plan. Accommodate a flexibility of spaces and variety of uses through use of public space (sidewalks, parking, etc.). Define the historic character of 4th Avenue through specific streetscape elements.

City of Camas Competitive Position

The city's competitive position can be summarized in terms of strengths, weaknesses, opportunities, and threats. These represent internal and external factors that can have positive or negative impacts on economic outcomes in Camas. Several ideas added to the summary below are based on feedback received through community engagement activities. Table 4 below outlines key findings associated with economic growth and development.

Table 4 Strengths, Weaknesses, Opportunities, and Threats Summary Analysis

STRENGTHS

- High quality of life amenities like parks and recreation opportunities including new City investments in capital projects.
- Downtown experiencing high visitation and high demand for retail spaces (increasing rents, low vacancy).
- Responsive permitting, ongoing maintenance of the public realm.
- No Washington State income tax.
- Proximity to Portland International Airport.
- Well regarded public schools.
- The Downtown Camas Association is completing a comprehensive Downtown lighting plan with a state grant to support safety.

WEAKNESSES

- Rising housing costs, purchasing a home is unaffordable for those under 120% AMI.
- High industrial rents and very low industrial real estate vacancies.
- Development standards related to height was cited as a barrier by stakeholders.
- Need Downtown development to be feasible to build (pencil).
- Highly constrained lands may be difficult to develop for commercial or industrial land uses (such as in Washougal).

OPPORTUNITIES

- Attract highly skilled workers with locational flexibility.
- Develop pathways for youth to gain skills and seek jobs in Camas.
- Identify target industries for managing land capacity and expected growth.
- Incentives for existing business owners, wishing to expand their operations.
- Opportunities for Downtown redevelopment and partnerships with Downtown businesses and nonprofits (such as Downtown Camas Association, the Port, Chamber, Farmers Market, and more).
- Develop mill ditch into a compelling, easy, and beautiful trail system that is clear to connect with from Downtown and improve the trails to encourage local resident activity and to attract visitors.
- Need more hotels and conference space.
- City should partner more with the Downtown Camas Association on incentive programs.
- Improve pedestrian safety throughout downtown.

THREATS

- Unequal rates of homeownership by race and ethnicity indicating unequal economic opportunities.
- Disparities between remote and non-remote workers.
- Anchor employer changes.
- Safety threats that could be supported by better lighting, street tree improvements, safer crossings for pedestrians in the Downtown.
- Need to balance preserving historic features with new development in Downtown.

Broad Planning Context

Comprehensive planning in Washington is guided by the Growth Management Act (GMA), a series of statutes first adopted in 1990 which requires cities and towns within the state's most populous counties to fully plan for future growth (RCW 36.70A) and develop mandatory comprehensive plan elements. State provisions set limits on what actions cities and counties can take to support economic development. Article 8, Section 7 of the state constitution specifies that "No county, city, town or other municipal corporation shall hereafter give any money, property, or loan its money, or credit to or in aid of any individual, association, company or corporation, except for the necessary support of the poor and infirm."[16] Given this limitation, cities generally cannot directly use public funds to attract private development and instead target policies that facilitate economic growth through land use, infrastructure, tourism, marketing, and partnerships with nonprofit community-based organizations.

Cities in Washington also coordinate with county-level Associate Development Organizations (ADOs) that represent each of Washington's counties, funded in part by the state Department of Commerce. The Columbia River Economic Development Council (CREDC) represents Clark County and presents a baseline of goals and objectives for the region. Their former 2018-2023 Comprehensive Economic Development Plan outlined goals and actions based on a vision and set of values and guiding principles identified through extensive engagement with local partners, which have carried through and expanded with the more recent 2024 Comprehensive Economic Development Plan with new supplemental actions to encourage economic development for communities within Clark County.

New objectives in CREDC's regional economic development plan expand on support for entrepreneurship, placemaking investments, fostering development and redevelopment projects, and expanding equitable employment opportunities. The Plan also recognizes the growing role of smaller cities like Camas outside of Vancouver which are seeing fast population growth and opportunities to develop their own employment bases.

[16] RCW 35.21.703 does allow cities to contract with nonprofit corporations to advance economic development.

Table 5 Goals and Objectives from 2018-2023 CREDC Comprehensive Economic Development Plan

Source: CREDC

	2018 Plan Objectives	2024 Update Objectives
Expand the Existing Base	• Become Industry Experts • Strategically Market Industry Clusters • Build a Start-Up Ecosystem	• Reduce Site Infrastructure Hurdles • Grow Start-Up Ecosystem • Support Permitting Consistency • Explore Commercial Code Flexibility • Foster Small Business Networking
Support People	• Foster Skills Development • Prepare Youth for Economic Opportunity • Launch a Brain Gain Initiative	• Align Workforce with Employer Needs • Enhance Access to Career Pathways • Support Talent Retention
Create Place	• Each Community Creates a Placemaking Strategy • Embrace Economic Opportunity in Urban Center • CREDC Tells the Story of Place • Make Areas Desired by Industry Clusters Shovel-Ready • Determine All Transportation Needs on a Regional Level	• Leverage Placemaking Investments • Encourage Infrastructure Investments That Cross Municipal Boundaries

The Clark Countywide Planning Policies provide guidance on economic development across incorporated and unincorporated areas of the County (the County also distinguishes policies specifically for unincorporated areas, but not for jurisdictions and their UGAs). These policies (adopted in 2015) are currently being updated. The updated version will be reviewed as a part of the policy and goal development stage of the Comprehensive Plan update.

Buildable Land Capacity and Employment Capacity

Cities fully planning for adequate land capacity to meet the needs of the community must understand their current employment base, development trends, workforce housing availability, income segments of the population, and future projections. To fully plan for growth and meet community needs in compliance with state provisions, more suburban cities like Camas that are

growing in terms of employment must understand the dynamics of the local and regional economy, consider where employment is concentrated and how residents and workers access employment opportunities, what industries are growing or declining, and whether there is sufficient space to fulfill anticipated employment land needs alongside other uses.

Washington's Review and Evaluation Program (the Buildable Lands Program, RCW 36.70A.215) requires certain counties, including Clark County, to establish their own buildable lands programs and review past development and density patterns to see if local policies are effective and prepare to plan for the next 20 years of growth, through a "Buildable Lands Report" released before a Comprehensive Plan update.

Clark County has updated its Vacant Buildable Lands Model (VBLM) as a part of their 2025 periodic update of their Comprehensive Plan. This VBLM provides a basis for the available employment capacity in the City of Camas based on available buildable land (including both vacant and underutilized land), current zoning, and market and employment density assumptions. Table 6 below shows the County's current allocation of jobs for the City of Camas and the Camas Urban Growth Area (UGA) and the 2023 Vacant Buildable Lands Model (VBLM) capacity and yield calculations.[17]

This analysis shows that the City of Camas has a job target of 13,658 jobs, with a preliminary estimated capacity showing availability for 11,363 jobs, as well as additional assumptions for work from home, construction, and government jobs which have specific land need considerations documented in Clark County's 2025 Population, Housing and Employment Allocation memorandum.[18]

Evaluating employment capacity is necessary to determine whether the job growth allocation (determined by the county) can be accommodated within the City of Camas and Camas UGA(s). Sufficient capacity is available if employment growth capacity is equal to or greater than the City's allocation. If sufficient capacity is not available, the shortfall must be addressed by rezoning, or revising allowable density, or by modifying or creating a new UGA or annexed area to provide additional area for employment growth capacity. To help provide geographic context for this analysis, a map of the City of Camas and its existing and proposed Urban Growth Areas was created see Figure 16.

[17] This has been modified since the County's 2020 Buildable Lands Report, which identified 963 net buildable acres (296 on commercial land, 667 on industrial land) in the Camas UGA (Clark County Buildable Lands Report, 2023).

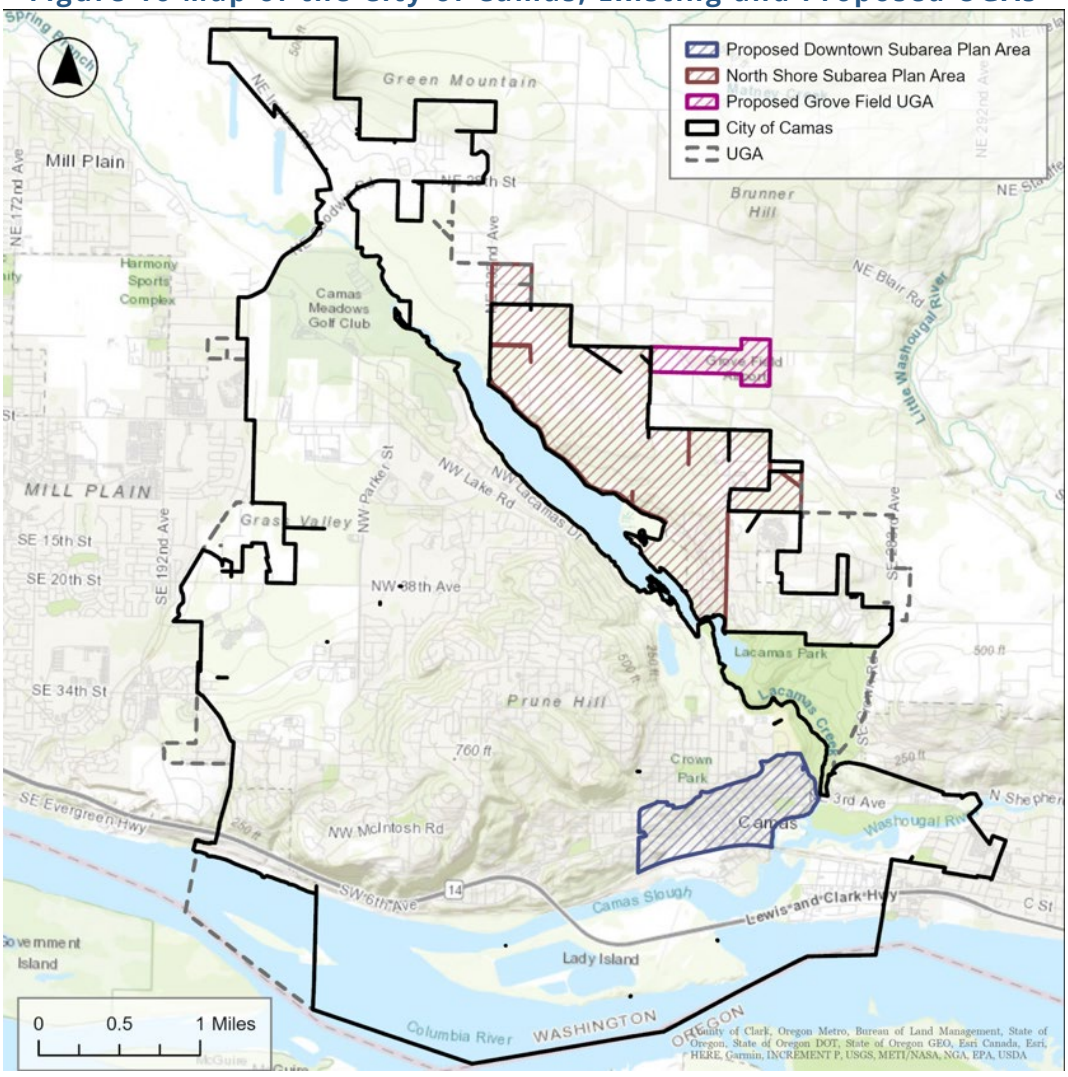
[18] Clark County Community Planning, 'Clark County Comprehensive Plan 2025 Update 2025 Population, Housing and Employment Allocation – Issue Paper 5,' April 2024, https://clark.wa.gov/sites/default/files/media/document/2024-04/issue_paper_5_pop-emp_alloc_4_17_24.pdf.

Table 6 Employment Capacity and Allocation by UGA, Clark County

Source: VBLM 2023, Capacity and Yield by Jurisdiction. Note: The County total estimate is 88,100 jobs accounting for government, construction, rural, and work from home jobs.

Jurisdiction	2023-2045 Employment Allocation	2023 VBLM Capacity	Assumptions		
			Work from Home	Construction	Government
City of Camas and Camas UGA	**13,658 jobs**	**11,363 jobs**	615 jobs	879 jobs	549 jobs
Total Clark County UGAs and Cities	**83,695 jobs**	65,091 jobs	3,524 jobs	5,038 jobs	8,600 jobs

Figure 16 Map of the City of Camas, Existing and Proposed UGAs



Additional analysis refining the employment capacity is underway that is based on key City of Camas zoning and UGA modifications. The City of Camas is proposing zoning modifications and the addition of a new UGA that would allow for additional employment capacity. According to these refined employment capacity estimates, Camas would have capacity for 12,273 jobs which would almost meet the 2045 employment target of 13,658 jobs. The finalized estimates will depend on the final preferred alternative.

CLARK COUNTY'S BUILDABLE LANDS REPORT, 2023, KEY FINDINGS

Clark County's Buildable Lands Report was adopted in June 2022 to update the methodology and Vacant Buildable Lands Model (VBLM) and updated with 2023 data.

- The Clark County Buildable Lands Report and employment allocations and City of Camas estimates indicate that there is sufficient employment capacity for employment growth in the county through 2045.
- Camas has the second largest share of total projected jobs in Clark County (17.5%) after the City of Vancouver and the Vancouver Unincorporated Urban Area (U). The City of Camas is expected to have capacity to accommodate 11,363 jobs, with about half (55%) of new employment on commercial land and half on industrial (45%).

City of Camas Profile

More than 10,000 years ago, Native Americans occupied the Columbia River Valley in the area where Camas is now situated. Before Camas was incorporated, a paper mill owned by the LaCamas Colony Company was established in 1883 to help supply newsprint for The Oregonian. Shortly thereafter, the City of Camas became an incorporated city in 1906. The City is named after the camas lily, a deep blue flowered plant with edible onion-like bulbs valued by various Columbia river Native American Tribes.[19] The paper mill expanded in the early 20th Century playing an important role in the local economy and grew to become Clark County's largest manufacturing company with 2,700 employees by 1971.[20] Located in the western edge of Downtown Camas along the Columbia River, the mill then experienced a downturn beginning in the 1980s that continued into the 21st Century, resulting in a reduced workforce. More recently, in 2018, the mill now owned by Georgia-Pacific, shut down several facilities and all but one of its paper machines and downsized its workforce to roughly 150 workers. In 2024, the mill continues to operate with a reduced workforce.

[19] City of Camas history: https://www.cityofcamas.us/community/page/camas-history
[20] Source: https://www.camaspostrecord.com/news/2023/sep/07/camas-mill-celebrates-its-140th-birthday/#:~:text=An%20entire%20wall%20of%20photos,built%20the%20mill%20to%20produce

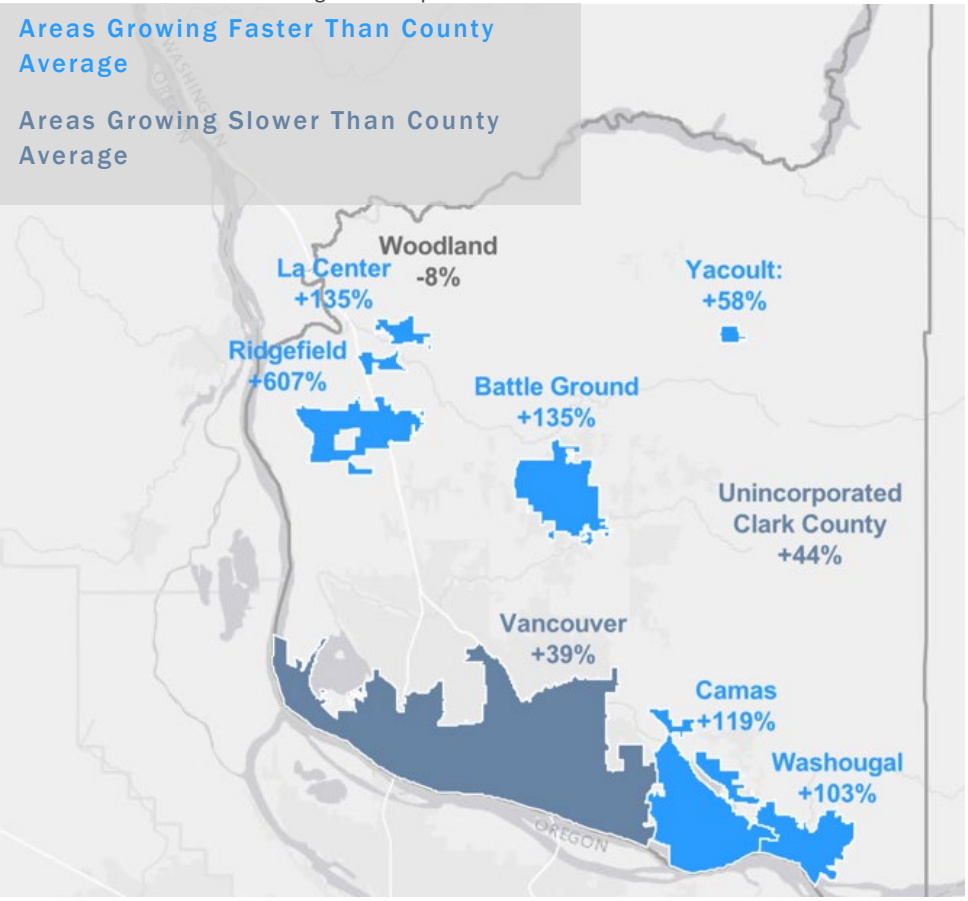
The early economy in Camas was at first dominated by manufacturing but has shifted and diversified over time. The 2015 Comp Plan describes a transition where the City's past economic health was closely tied to the paper mill and then shifted to become more diversified supporting many technology and manufacturing firms, as well as a growing school system and professional offices. In the last four decades, the family-friendly City with close ties to the Portland Metropolitan Region has continued to attract more residents especially from 1990 to 2000 by almost doubling in size to almost 13,000 people, increasing to a little over 19,000 people in 2010, and then reaching 27,420 people by 2023. Similar to the City of Vancouver, Camas has experienced high population growth over the last two decades, with an average annual growth rate of 5.2% which is double the rate in Clark County and Washington State.

Today, the City of Camas is a highly desirable place to live, offering a prime location nearby the growing cities and employment centers of Vancouver and Portland, and the smaller cities of Washougal and Battle Ground in south Clark County. The City of Camas is sandwiched between the City of Vancouver (sharing a border on the west side of Camas) to the west and the City of Washougal to the east. At a regional level, the City is interconnected to the Portland Metropolitan region, located northeast of Portland (see map below).

Camas has been working to advance its economic development goals in recent years while investing in quality-of-life amenities that make it as competitive location for attracting workers and residents. Recently, the City adopted a North Shore subarea plan (2022) to support community vibrancy and economic development strategies and the City is working to adopt a new Downtown subarea plan as a part of the 2025 Comprehensive Plan periodic update project. The City has also been expanding its inventory of parks space by leveraging the County's Legacy Lands program to expand its offerings of natural areas and recreation facilities. As larger economic trends increase locational flexibility (especially for professional services and traditionally office-based jobs), these types of investments will be critical for cities in the region to continue drawing in and retaining a residential base and workforce. The Port of Camas-Washougal manages an airport that is outside City limits, but most of the developable land in the North Shore area is within the airport influence area.

Figure 17 Camas Compared to Clark County Cities

Source: Office of Financial Management Population Estimates



Economic Development Overview

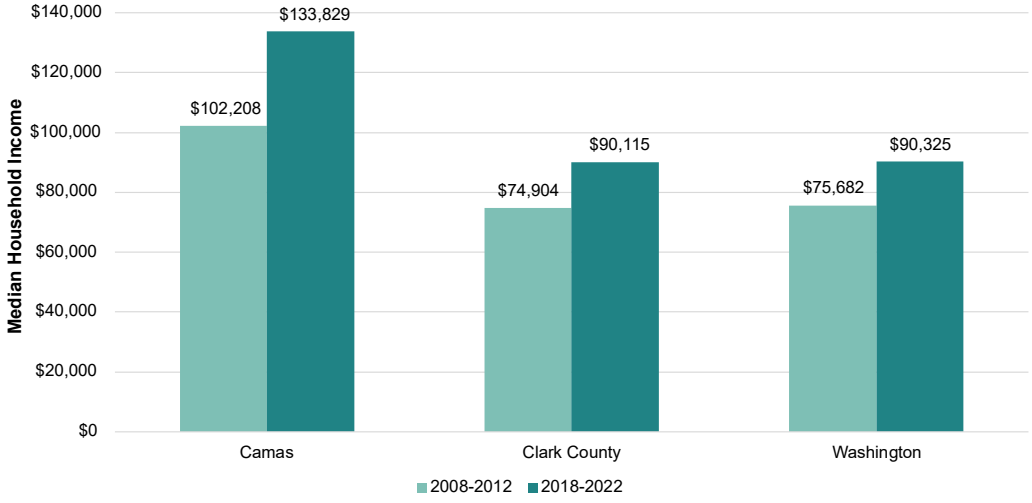
Economic development for the City of Camas is the creation and sustenance of a diverse array of employment opportunities, ensuring the tax base currently enjoyed by the City endures and is strengthened. The economic health and well-being of the City are tied to commitments to promote a wide range of employment opportunities for the citizens of the community and to provide a setting and quality of life that attract businesses and residents.

Planning a diverse and vibrant economy must start by understanding current economic conditions in the City and Clark County. While the City's past economic health was closely tied to the paper mill, in more recent years, the City's economy has diversified and now supports many technology and manufacturing firms, as well as a growing school system and professional offices. The figures below compare the median household income for Camas, Clark County, and Washington as well as employment and related trends over time.

As illustrated in Figure 18 when compared with Clark County, wages in Camas are higher and have grown over the last decade. Higher wages can have positive impacts on other aspects of the economy, and community members have expressed their desire to support living-wage jobs, particularly in healthcare and high technology.

Figure 18 Median Household Income, Camas, Clark County, and Washington

Source: U.S. Census Bureau, 2008-2012 and 2018-2022 ACS 5-Year Estimates
Note: 2008-2012 values are adjusted for inflation. Median household incomes are shown in 2022 $.



Growth in employment, population, and housing are interconnected. In general, communities with a high ratio of population to jobs can be characterized as "bedroom" or commuter communities, where there are fewer jobs than residents in the city. In Camas, there are roughly three residents for every one employee, indicating a continued trend from the past decade.

The ratio of jobs to housing has slightly increased from 0.9 to 1.0, indicating a healthy balance of housing units in comparison with employment and meeting the jobs-to-housing ratio of 1:1 adopted by Clark County (Resolution 2016-03-01). As the City grows, maintaining this trend can help to ensure there is adequate housing for those who work in Camas.

Table 7 Population, Employment, and Jobs Comparison Ratios, Camas, 2010-2021

Source: OFM, LEHD-LODES. Note: Employment data is currently only available at the City level through 2021.

	Trends			Ratios	
	Population	Employment	Housing Units	Population : Jobs	Jobs : Housing
2010	19,355	6,508	7,072	3.0	0.9
2021	26,870	9,558	9,586	2.8	**1.0**

Overall, Clark County has seen fluctuations in employment since 2000, with the most notable decline in employment in the wake of the 2008 recession and at the onset of the COVID-19 in 2020. However, the County has also seen a rapid rebound from pandemic trends, with sharp employment growth after 2020. The City has generally seen positive growth in employment over the last two decades. The City saw less of a decrease during 2020 compared to Clark County overall, which may reflect Camas' growth in remote workers during this period (Figure 19).

Figure 19 Total Covered Employment Change YOY, Clark County (2001-2022)

Source: Washington Employment Security Department

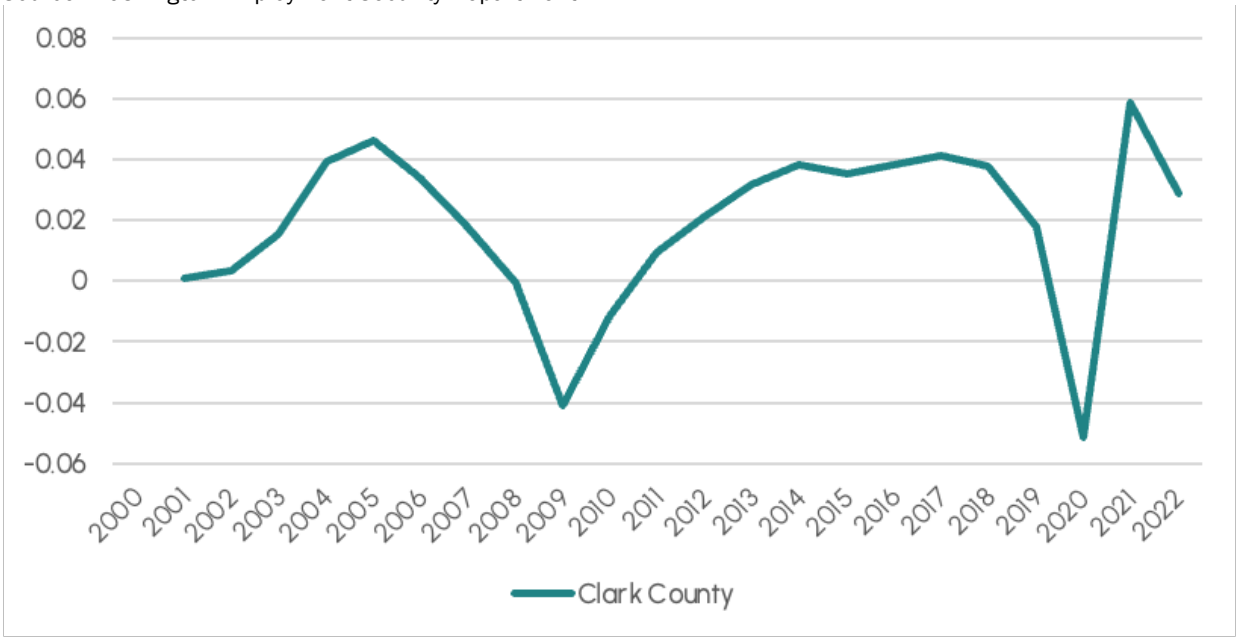
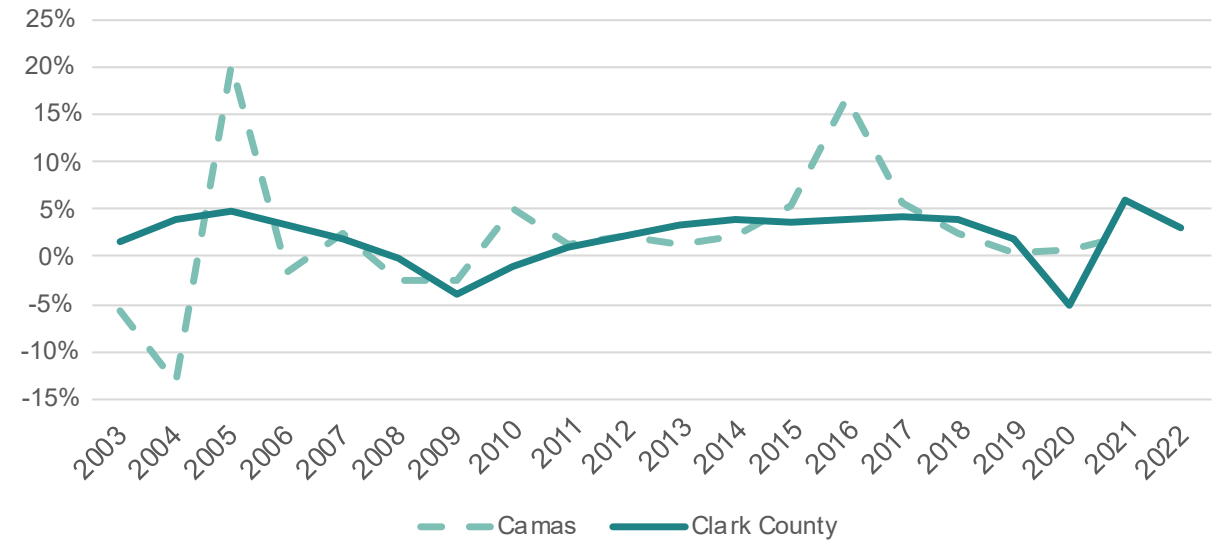


Figure 20 Total Employment Change YOY (Primary Jobs), Camas and Clark County

Source: Washington Employment Security Department, LEHD-LODES. Note: LEHD-LODES data for the City of Camas only available through 2021



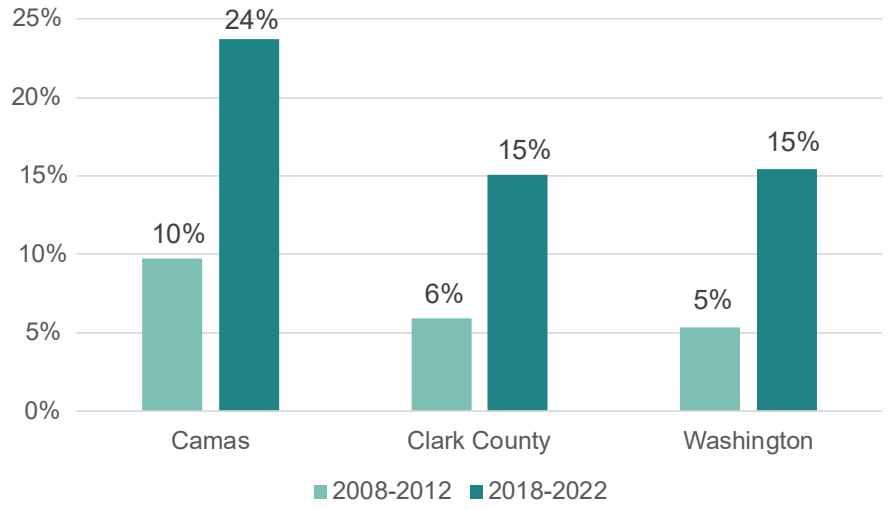
The Economic Development Element establishes goals and policies that seek to maintain the diversification of employment opportunities and support the continued growth of the Camas economy and attainment of the jobs target by 2045.

The City is targeting businesses that provide a greater proportion of living-wage jobs. Increasing retail services in support of residential, industrial, and professional business growth

is highly desirable. Camas is also seeing an increasing share of remote workers at a higher rate than the County or State, with nearly a quarter of workers falling into this category in 2022.

Figure 21 Share of Remote Workers, Camas, Clark County, and Washington, 2012-2022

Source: ACS, 2008-2012, 2018-2022



Summary of Demographic and Economic Trends

A summary of key findings from this Economic Development Element analysis is provided below to help describe key insights regarding the economic context, economic opportunities and challenges informing plan updates (Technical Appendix provides the full findings).

- **Camas has an aging population with a median age of 40 years in 2022 and a growing share of residents aged 60 years and over.** This group typically represents late-career workers or retirees. Median age in Camas is higher than Clark County overall and quickly growing since 2012, likely indicating a combination of natural growth and in-migration of older adults.
- **Camas has a higher share of residents 25 or older with at least a college level bachelor degree compared to Clark County or Washington State**, with 79% of residents holding these degrees in 2022. This share of residents rose quickly from only 37% in 2012.
- **Median household income for all households in Camas was nearly $134,000 in 2022, higher than Clark County or Washington State.** Since 2012, median income for residents of Camas increased by about 30% (in nominal dollars, not adjusted for inflation), more than either the County or State.
- **The City of Camas has seen generally positive trends in employment growth over the last two decades,** with notable increases in the number of workers in 2005, 2010, and 2016. The City of Camas employment grew from approximately 6,584 to 9,558 between 2011 and 2021.

- **The current employment to housing ratio in Camas was 1.0 in 2021, meaning that there is about one employee working in the City for every housing unit.** This ratio indicates that Camas has a well-balanced housing stock to accommodate workers in the City.
- **In 2021, the top five industries by employment in Camas were Finance and Insurance; Manufacturing; Educational Services; Professional, Scientific, and Technical Services; and Wholesale Trade.** Four of these five top industries paid above average wages (all except Educational Services paid below average wages). Finance and Insurance was the City's fastest growing industry (with an average annual growth rate of about 33%).
- **Top employers also reflect many of the County's largest industries, including professional services like finance and insurance, technology, manufacturing, and health care. Four of the City's top ten employers were in the manufacturing industry as of 2020.** Within Camas, employment has concentrated at two nodes, including the Downtown area to the southeast and corporate campuses in the Grass Valley near the border with the City of Vancouver.
- **Camas is part of an interconnected region, with more residents commuting out of Camas for work (8,159) than employees commuting in (6,982) as of 2021. Approximately 9,102 people are employed in Camas and among this total nearly 90% live in Camas (8,159) but work outside of the city and the remaining 10% live and work in Camas (943 people).** Top commuting destinations for Camas residents are primarily nearby, larger cities with employment hubs like Vancouver and Portland, while only 10% remained in the City. Nearly 59% commute less than 10 miles. The fourth most common destination for residents was Seattle, likely indicating remote workers at companies based in the Puget Sound area. Workers commuting to Camas originated from similar destinations, with one quarter coming from Vancouver.
- **Washington State Employment Security Department projections for future employment growth estimated that the Southwest Washington region will grow by about 19% overall by 2031.** The sectors expected to see the greatest increase in their share of employment are Professional/ Business Services, Leisure/ Hospitality, Education/ Health Services, Information, and Other Services.
- **Camas has a larger share of remote workers compared with Clark County and Washington State.** In 2022 one in four workers in Camas was a remote employee, compared to 15% in both the County and State overall. The share of remote workers in Camas has grown since 2012.
- **Since 2020, the City has issued 8,652 new business permits, with the largest volume of new permits in 2020 and a decreasing amount annually after 2020.** General business establishments accounted for the largest portion of these permits (74%), followed by home occupations (25%), and nonprofits (1%).
- **Camas' taxable retail sales were higher than those in most comparable jurisdictions in Clark County over the past decade**, competing primarily with the City of Battle

Ground for the highest annual sales. In 2022, total taxable retail sales reached an all-time high of over $600 million.

- **Retail rents in Camas had slight upward growth since 2014 while vacancies trended downward, indicating increasing demand for retail. Industrial real estate in the City of Camas is also performing well compared to Clark County in 2024.** The City is home to only about 3.9% of Clark County's industrial real estate in square footage but saw a sharp increase of industrial rents PSF in 2022, growing by over 200% year-over-year (YOY) to $23. Vacancy rates for industrial real estate were also extremely low in Camas in 2024 YTD at 1.7%, indicating high demand in the industrial market.

Implementation Tools and Strategies

Realizing the City of Camas economic development goals requires building on the City's potential while overcoming existing constraints. The following implementation strategies will generate positive momentum toward creating a more balanced and healthy economy.

Programmatic Strategies

- **Economic Development Committee:** Establish a mayor-appointed committee to help refine and implement Camas' economic development goals and strategies. The committee will:
  - Convene government, private sector, and nonprofit partners to leverage resources or secure financial support for economic development initiatives that benefit Camas and the broader region. In addition, this committee would help provide input on the Economic Development Strategy.
- **Economic Development Strategy**: Create an Economic Development Strategic Plan involving the Economic Development Committee, local businesses, community groups, school districts, and city leadership that further identifies priorities for job creation in targeted industries, infrastructure needs, reducing regulatory barriers, and incentives to attract needed and desired businesses.
  - Promote the development of an economic development strategy that will capitalize on the creation and retention of industries that provide living-wage jobs.
  - Future economic development strategy planning should capitalize on existing facilities and infrastructure and include a mix of uses that are trail- and transit-oriented and designed with high-quality streetscape appeal.
  - Lead an economic development strategy update every 1 to 3 years.

Financial Strategies

- **Leverage Grant Dollars**: Utilize federal, state, and county grants to support the establishment and expansion of small local businesses and infrastructure improvements benefiting economic development areas.
- **Incentives**: Explore incentives to encourage mixed-use development and provide affordable housing options (such as TIF, LID, MFTE changes).

- **Partnership**: Coordinate with the Columbia River Economic Development Council (CREDC) or other relevant organizations, to explore collaborative opportunities in promoting regional workforce development.
- **Opportunity Site Inventory**: Identify sites where the city can participate in cost-sharing mechanisms for infrastructure development.
    - Establish a policy that prioritizes capital investments to or on opportunities sites or other capital projects that better connect commercial nodes. This could include sidewalks, trails, bike paths, etc.

Regulatory Strategies

- **Code Audit**: Ensure the zoning code supports/incentivizes a broad range of needed and desired businesses in various zones.
    - **Study Allowed Uses:** Ensure needed and desired businesses are allowed in certain zones, including accessory uses which can support home-based businesses.
    - **Design standards**: Consider revisiting existing design standards to ensure they adequately support efforts to maintain and enhance existing character without compromising development feasibility.
    - **Flexible parking standards:** Develop flexible parking standards that can respond to site conditions.
    - **Revised Gateway Corridor Design Standards:** Update the design standards and allowed uses for gateway corridors to enhance its natural beauty but deemphasize its auto-oriented environment.

Procedural Strategies

- **Capacity Building**: Leverage increased tax revenue from population growth to support Camas' economic development strategy.
- **Clear and Objective Development Standards**: Establish clear and objective development standards for all development types, reducing the need for conditional use processes or other discretionary review processes.
- **Monitoring**: Monitor the performance of economic development such as with business retention and attrition, changes in tax revenues, and permitting of employment facilities. Monitor the financial impact of new programs, policies, and regulatory requirements on development feasibility by providing a report update every 1-3 years describing key metrics such as development changes and infrastructure projects.

Economic Development Goals and Policies

Goal ED-1 Citywide Economic Development

Maintain a diverse range of employment opportunities to support all residents, provide sufficient land supporting employment needs, and provide a setting and quality of life that attract and retain living-wage jobs[21] throughout the community.

Policy ED-1.1 Work with partners to identify strategies to proactively recruit businesses and ensure that tools and incentives are in place to attract sustainable and innovative industries to expand and provide stable living-wage employment.

Policy ED-1.2 Work with partners (such as the Chamber of Commerce, education programs, Workforce SW WA, CREDC) to provide apprenticeships, internships, vocational training schools, entrepreneurship programs, equitable opportunities, and on-the-job training in targeted industry sectors.

Policy ED-1.3 Encourage appropriate reuse, environmental cleanup, and redevelopment of older and deteriorating commercial areas and industrial brownfield sites. Identify opportunities to support place-based economic development, provide connections to the waterfront, diversify the economy, and support mixed-use development.

Policy ED-1.4 Foster and expand year-round recreational services, lodging, conference spaces, dining, and retail options to support tourism, benefit residents and employers, leverage Camas' strong parks and open space assets, and connect to the waterfront.

Policy ED-1.5 Participate in regional recruitment organizations to ensure the availability of an adequate supply of commercial and industrial employment land to support the City's economic development goals. Evaluate city resources to support economic development

[21] A living-wage job is one that pays an income sufficient to cover basic living expenses without financial hardship, allowing an individual or family to afford essential needs such as housing, food, healthcare, transportation, childcare, and other necessities without relying on public assistance. MIT Living wage calculation (2024): https://livingwage.mit.edu/counties/53053.

planning and implementation by designating a point-of-contact for economic development programs and serving as a liaison to the business community.

Policy ED-1.6 Support and encourage employees to use the Commute Trip Reduction Program. Encourage businesses to support remote work to reduce trips and implement a trip reduction program with incentives for carpooling, transit ridership, and other options beyond single-occupancy vehicles.

Policy ED-1.7 Encourage mixed-use development and complementary businesses throughout the City to support industry clusters and leverage resources.

Policy ED-1.8 Review regulatory design standards and planning procedures for industrial and commercial facilities and provide economic incentives to promote private investment in start-ups, incubator businesses, and businesses relocating to Camas.

Policy ED-1.9 Coordinate with Clark County and evaluate adding a Grove Field Urban Growth Area (UGA) for employment purposes to support employment targets.

Policy ED-1.10 Explore ways to support remote workers such as community hubs and third places and code revisions for co-working spaces.

Policy ED-1.11 Implement the Downtown Camas subarea plan and the associated goals and actions (see downtown subarea element).

Policy ED-1.12 Promote the growth of residential development in the North Shore as described in the Camas North Shore Subarea Plan.

Goal ED-2 Local Business Development

Promote business creation, expansion, retention, and diversification throughout the community to create a consistent and reliable tax base and a healthy, diversified local economy.

Policy ED-2.1 Identify and plan for infrastructure (such as the capital facilities plan) to nurture and incubate new businesses. Explore financing tools such as tax increment financing to fund infrastructure to support development and investment in targeted areas.

Policy ED-2.2 Support retention, expansion, and recruitment of local businesses in Camas.

Policy ED-2.3 Support development standards that promote high-quality building and site design, encourage businesses to operate in a sustainable and environmentally responsible manner and integrate energy efficient design features.

Policy ED-2.4 Collaborate with partners and agencies (such as CREDC and the Port of Camas Washougal) to develop economic strategies that promote diversification of business and industry in the city and facilitate opportunities for entrepreneurship.

Policy ED-2.5 Work with partners to proactively recruit and promote the growth of businesses and industries that provide, at a minimum, cost-of-living wages and economic diversity in alignment with the CREDC regional economic development plan.

Policy ED-2.6 Explore the creation of an economic development grant program for local businesses in connection with local partners.

Policy ED-2.7 Facilitate an environment for the success and growth of small businesses to maintain a strong, diverse, and resilient local economy.

Policy ED-2.8 Encourage investments and programs that provide resources and support to minority-owned and woman-owned businesses.

Policy ED-2.9 Increase the number of neighborhood business districts to expand local access to goods and services. Consider expanding mixed-use zoning options with ground floor commercial uses that allow residents to walk or roll from home.

Policy ED-2.10 Encourage shopping local to support Camas businesses.

Goal ED-3 Mixed Use and Commercial Areas

Encourage efficient and innovative development that thoughtfully mixes commercial and residential land uses that are pedestrian-friendly and consider the context of the surrounding area.

Policy ED-3.1 Develop commercial and mixed-use areas that are safe, comfortable, and attractive to pedestrians.

Policy ED-3.2 Encourage efficient land use in the mixed-use land use designation by facilitating compact, high-density development and minimizing the amount of land that is needed for surface parking.

Policy ED-3.3 Promote the growth of businesses such as grocery stores, medical offices, and restaurants that meet the retail and service needs of the community.

Policy ED-3.4 Encourage new developments to provide neighborhood parks and shared use paths to encourage greater physical activity and connect residential areas to commercial centers, public transit, and community facilities.

Goal ED-4 Mixed Employment and Industrial Areas

Providing a mix of traditional industrial and non-industrial land uses to maximize opportunities and partnerships and facilitate employers to remain, expand, or locate in Camas.

Policy ED-4.1 Evaluate the costs and benefits associated with adding the Grove Field Urban Growth Area to the North Shore Subarea Plan.

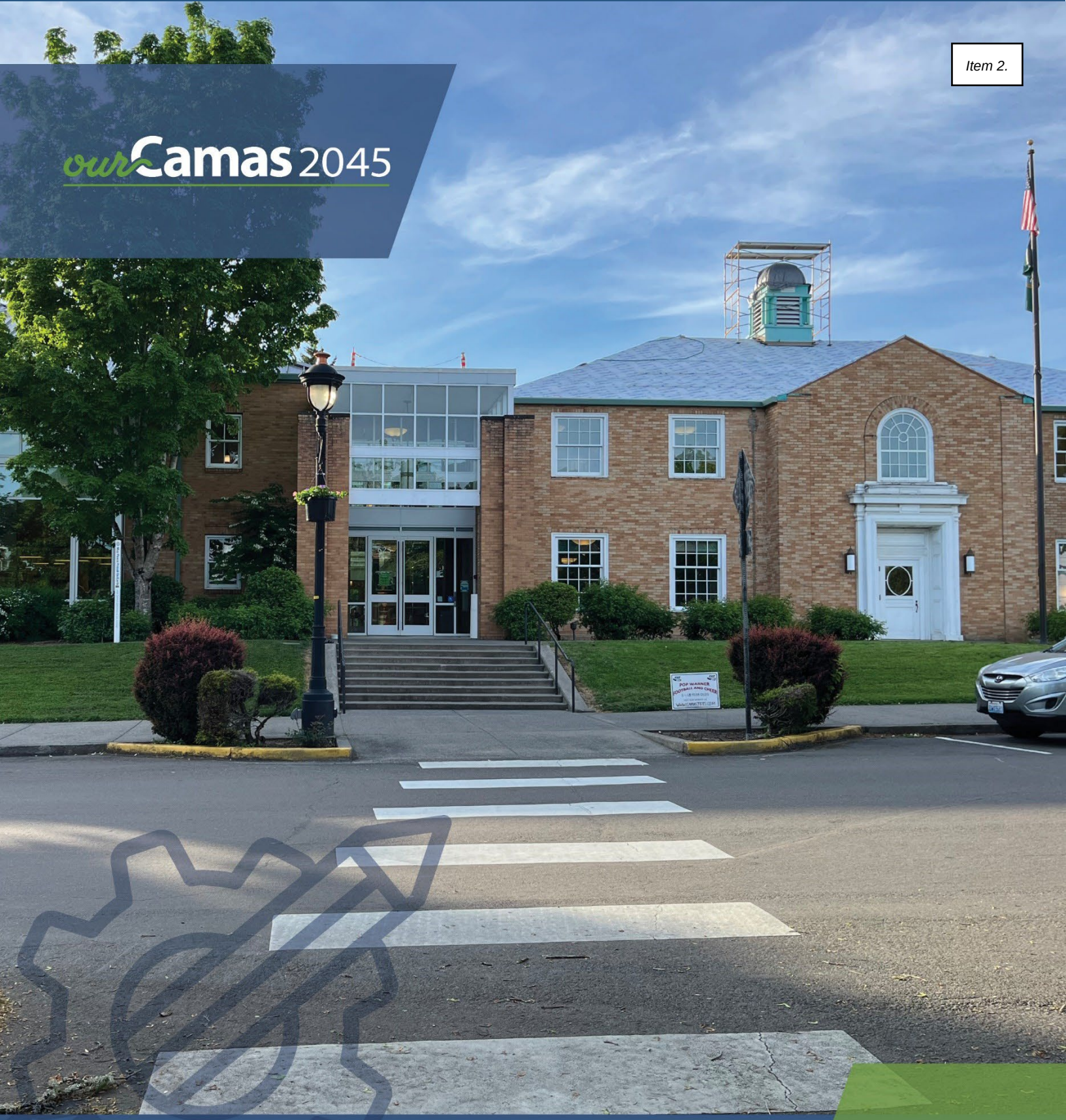
Policy ED-4.2 Preserve large tracts of land for large industry and master-planned commercial development within mixed employment land use areas.

Policy ED-4.3 Support a mix of light industrial, research and development, manufacturing, and office spaces through flexible zoning that allows for evolving business needs.

Policy ED-4.4 Support the development of business parks, incubators, and innovation hubs that integrate industrial and high-tech employment uses.

Policy ED-4.5 Ensure zoning and development regulations support both large-scale employers and small businesses, including start-ups and maker spaces.

ourCamas 2045



Technical Appendices

11

11. Technical Appendices

[Appendices to be included in future draft]

2025-2026 Capital Improvement Project List

6-Year Street Plan

Camas General Sewer Plan (2022)

Camas School District Capital Facilities Plan (2022)

Camas Stormwater Management Plan (2024)

Camas Water System Plan (2019)

Capital Facilities Plan

Clark County Comprehensive Plan (2025)

Economic Opportunity Analysis (2024)

Engagement Summary

Facility Conditions Assessment, Volumes 1 and 2

Housing Action Plan (2021)

Housing Needs Assessment (2024)

Parks and Open Space Management Plan (POSMP) (2025)

Parks, Recreation & Open Space Plan (2022)

Transportation System Plan (2025)

APPENDIX D

CAMAS FLOW MONITORING REPORT 2025

Camas Flow Monitoring 2025

Final Report Submitted to **Carollo Engineers** May 28, 2025



ADS ENVIRONMENTAL SERVICES

846 Industry Dr.
Tukwila, WA 98188

800-633-7246
www.adsenv.com

May 28, 2025

Max Mozer

Carollo Engineers

1200 5th Avenue Suite 900

Seattle, WA 98101

SUBJECT: Camas Flow Monitoring 2025

Dear Mr. Mozer,

ADS is pleased to submit the report for the project referenced above completed on behalf of Carollo Engineers. The metering was conducted at four (4) flow monitoring locations and one (1) rain monitoring location. The study was conducted during the period of Wednesday, 15 January 2025 to Tuesday, 29 April 2025.

The report contains depth, velocity, and quantity hydrographs as well as daily long tables for the metering period. An Excel file containing depth, quantity, and velocity entities for the monitoring location in 15-minute format was provided previously.

In addition, we would be happy to further explain any details about the report that may seem unclear. Should you have any questions or comments, you may contact the Project Manager, Cody Mahaffey at (425) 620-6412.

It has been our pleasure to be of service to you in the performance of this project. Thank you for choosing ADS products and services to meet your flow monitoring needs.

Sincerely,
ADS ENVIRONMENTAL SERVICES

Justin Hatch
Hydraulic Data Analyst

Camas Flow Monitoring 2025

Prepared For:

Max Mozer
Carollo Engineers
1200 5th Avenue Suite 900
Seattle, WA 98101

Prepared By:

ADS, LLC
846 Industry Dr.
Tukwila, WA 98188

Scope and Methodology

Introduction

Carollo Engineers entered into an agreement with ADS Environmental Services to conduct flow monitoring at (4) four flow locations and (1) one rainfall gauging location in Camas, Washington. The study was scheduled for a period of (105) one-hundred and five days. Once in place, the flow monitoring equipment was to be used to measure depth, velocity, and to quantify flows. Data obtained from the study will be used for inflow and infiltration analysis.

Project Scope

The scope of this study involved using a flow monitor to quantify wastewater flow at the designated locations for the study period. Specifically, the study included the following key components.

- Investigate the proposed flow-monitoring site for adequate hydraulic conditions
- Flow monitor installation
- Flow monitor confirmations and data collections
- Flow data analysis

Additionally, temporary rain gauge monitors were used to measure and record rainfall at the designated locations. Specifically, the study involved the following key components.

- Investigate the proposed rain gauge sites for sufficient exposure and security
- Rain Gauge installations
- Manually confirming rain gauge tipping bucket operation and date collections
- Rain data analysis

Equipment installation was completed on January 14, 2025. The monitoring period began on January 15, 2025 and was completed on April 29, 2025. Upon completion of the study, equipment was removed from the system.

Flow Monitoring Equipment



The ***ADS Triton+*** monitor was selected for this project. This flow monitor is an area velocity flow monitor that uses both the Continuity and Manning's equations to measure flow.

The ADS Triton+ monitor consists of data acquisition sensors and a battery-powered microcomputer. The microcomputer includes a processor unit, data storage, and an on-board clock to control and synchronize the sensor recordings. The monitor was programmed to acquire and store depth of flow and velocity readings at 5-minute intervals.

The Triton+ monitor features cross-checking using multiple technologies in each sensor for continuous running of comparisons and tolerances. The Triton+ monitor can support two (2) sets of sensors. The sensor option used for this project was:

The Peak Combo Sensor installed at the bottom of the pipe includes three types of data acquisition technologies

The ***up looking ultrasonic depth*** uses sound waves from two independent transceivers to measure the distance from the sensor upward toward the flow surface; applying the speed of sound in the water and the temperature measured by sensor to calculate depth.

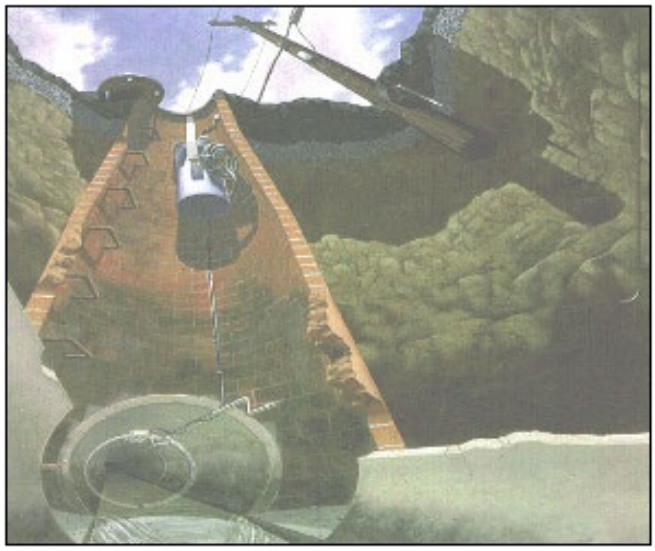
The ***pressure depth*** is calculated by using a piezo-resistive crystal to determine the difference between hydrostatic and atmospheric pressure. The pressure sensor is temperature compensated and vented to the atmosphere through a desiccant filled breather tube.

To obtain ***peak velocity*****,** the sensor sends an ultrasonic signal at an angle upward through the widest cross-section of the oncoming flow. The signal is reflected by suspended particles, air bubbles, or organic matter with a frequency shift proportional to the velocity of the reflecting objects. The reflected signal is received by the sensor and processed using digital spectrum analysis to determine the peak flow velocity.

Installation

Installation of flow monitoring equipment typically proceeds in four steps. First, the site is investigated for safety and to determine physical and hydraulic suitability for the flow monitoring equipment. Second, the equipment is physically installed at the selected location. Third, the monitor is tested to assure proper operation of the velocity and depth of flow sensors and verify that the monitor clock is operational and synchronized to the master computer clock. Fourth, the depth and velocity sensors are confirmed and line confirmations are performed.

In pipes up to 42 inches in diameter, the sensors were mounted on expandable stainless-steel rings, inserted at least a foot upstream into influent pipes and tightened against the inside walls of the pipes. Influent pipe installations reduce the influences of turbulence and backwater often caused by changes in channel geometry in manholes.





Data Collection, Confirmation, and Quality Assurance

Data collects were done remotely via wireless connect on a weekly basis. As needed, during the monitoring period, field crews visit each monitoring location to verify proper monitor operation and document field conditions. The following quality assurance steps are taken to assure the integrity of the collected data:

Measure power supplies: monitors were powered by dry cell battery packs. Voltages were recorded and battery packs replaced, as necessary. Separate batteries provided back-up power to memory allowing primary batteries to be replaced without loss of data.

Clock synchronization: Field crews synchronized monitor clocks to master clocks.

Confirm depth and velocity readings: Field crews descended into meter manholes to manually measure depths and velocities and compare the meter readings to confirm that they agreed. The site met the criteria for confirmation for depth and velocity unless noted otherwise in the site commentary section. They also measured silt levels, if any, in the inverts of the pipes. Silt areas were subtracted from flow areas to compute true areas of flow.

Confirm average velocities through cross-sectional velocity profiles: Since ADS velocity sensors measure peak velocity, field crews collected cross-sectional velocity profiles in order to develop a relationship between peak and average velocity in lines that meet the hydraulic criteria.

Upload and Review Data: Data collected from the monitors were uploaded and reviewed by a Data Analyst for completeness, outliers and deviations in the flow patterns, which indicate system anomalies or equipment failure.

Rainfall Logging Equipment



The ***ADS RainAlert III*** monitor was selected for this project. This monitor provides rainfall data acquisition and intelligent alarming to support wastewater capital improvement.

The ADS RainAlert III monitor measures rainfall using a tipping bucket containing a funnel and a small tipping mechanism that can collect a specific amount of rainfall. Once the tipping mechanism is full it empties and records that a tip has occurred. Typically, each tip is equivalent to 0.01 inches (or 0.2mm) of rainfall. The monitor records the number of tips that occur over each 5-minute interval to calculate discrete rainfall amounts for each of those 5-minute intervals.

Installation

Installation of rainfall logging equipment typically proceeds in five steps. First, investigating and selecting the appropriate location to install the tipping bucket and monitor. Second, installing the Sun Shield involves properly placing the sun shield and securing it to an appropriate structure or surface, or mounting it to a pole, as applicable. Third, involves mounting the tipping bucket on the sun shield at the designated rainfall collection location and connecting the wires from the monitor to the tipping bucket. Fourth, involves testing and adjusting the tipping bucket and internal tipping mechanism to ensure it accurately measures rainfall amounts. The final step involves installing the monitor at the appropriate location.

Flow Quantification Methods

There are two main equations used to measure open channel flow: the ***Continuity Equation*** and the ***Manning Equation.*** The Continuity Equation, which is considered the most accurate, can be used if both depth of flow and velocity are available. In cases where velocity measurements are not available or not practical to obtain, the Manning Equation can be used to estimate velocity from the depth data based on certain physical characteristics of the pipe (i.e. the slope and roughness of the pipe being measured). However, the Manning equation assumes uniform, steady flow hydraulic conditions with non-varying roughness, which are typically invalid assumptions in most sanitary sewers. The Continuity Equation was used exclusively for this study.

Continuity Equation

The Continuity Equation states that the flow quantity (Q) is equal to the wetted area (A) multiplied by the average velocity (V) of the flow.

$$Q = A * V$$

This equation is applicable in a variety of conditions including backwater, surcharge, and reverse flow.

Data Analysis and Presentation

Data Analysis

A flow monitor is typically programmed to collect data at 5-minute intervals throughout the monitoring period. The monitor stores raw data consisting of (1) the ultrasonic depth, (2) the peak velocity and (3) the pressure depth. The data is imported into ADS's proprietary software and is examined by a data analyst to verify its integrity. The data analyst also reviews the daily field reports and site visit records to identify conditions that would affect the collected data.

Velocity profiles and the line confirmation data developed by the field personnel are reviewed by the data analyst to identify inconsistencies and verify data integrity. Velocity profiles are reviewed and an average to peak velocity ratio is calculated for the site. This ratio is used in converting the peak velocity measured by the sensor to the average velocity used in the Continuity equation. The data analyst selects which depth sensor entity will be used to calculate the final depth information. Silt levels present at each site visit are reviewed and representative silt levels established.

Occasionally the velocity sensor's performance may be compromised resulting in invalid readings sporadically during the monitoring period. This is generally caused by excessive debris (silt) blocking the sensor's crystals, shallow flows (~< 1") that may drop below the top of the sensor or very clear flows lacking the particles needed to measure rate. In order to use the Continuity equation to quantify the flow during these periods, a Data Analyst and/or Engineer will use the site's historical pipe curve (depth vs. velocity) data along with valid field confirmations to reconstitute and replace the false velocity recordings with expected velocity readings for a given historical depth along the curve.

Selections for the above parameters can be constant or can change during the monitoring period. While the data analysis process is described in a linear manner, it often requires an iterative approach to accurately complete.

Data Presentation

This type of flow monitoring project generates a large volume of data. To facilitate review of the data, results have been provided in graphical and tabular formats. The flow data is presented graphically in the form of scattergraphs and hydrographs.
Hydrographs are based on 15-minute data. Tables are provided in daily average format. These tables show the flow rate for each day, along with the daily minimum and maximums, the times they were observed, the total daily flow, and total flow for the month (or monitoring period). The following explanation of terms may aid in interpretation of the flow data table and hydrograph.

DFINAL - Final calculated depth measurement (in inches)

QFINAL - Final calculated flow rate (in MGD)

VFINAL - Final calculated flow velocity (in feet per second)

RAIN – Final calculated rainfall (in inches)

REPORT TOTAL - Total volume of flow recorded for the indicated time period (in MG)

CAM_100290

Site Commentary

SITE INFORMATION

Pipe	Elliptical (19 in H x 19.5 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was located upstream of site CAM_51123. A review of flow balancing indicated no problems

Average flow depth, velocity, and quantity data observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	3.24	2.00	0.326
Minimum	1.34	1.05	0.049
Maximum	9.57	3.56	1.941
Min Time	04/29/2025 02:10:00	04/23/2025 00:55:00	04/29/2025 02:10:00
Max Time	02/23/2025 16:40:00	01/31/2025 09:25:00	02/23/2025 15:50:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the graphical reports are based on the fifteen minutes average and values in the Observed Flow Conditions and tabular report are based on the five-minute average.

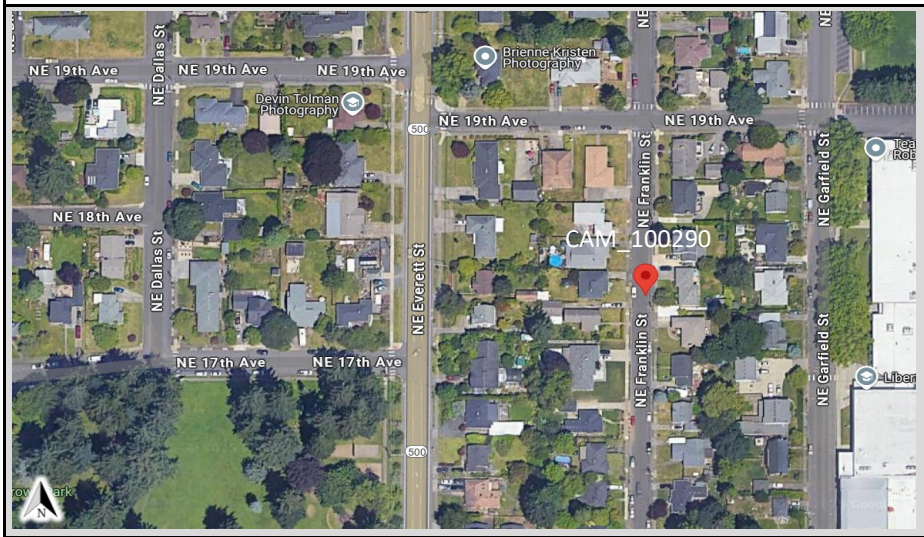
DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

Camas.Carollo.TFM.WA24		Site Name
Flow Monitoring Site Report	ADS ENVIRONMENTAL SERVICES®	CAM_100290

Site Address /Location:	1724 NE Franklin St, Camas, WA 98607			Monitor Series	Location Type
				TRITON+	Temporary
Site Access Details:	On Road	Latitude:	45.5919803	Pipe Size (H x W)	Pipe Shape
		Longitude:	-122.4042885	19.00 x 19.50	Circular



Manhole #	System Characteristics
100290	Residential
Access	Traffic
Drive	None







ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23116.11.325

Installation Information

Installation Date:	Installation Type:
Tuesday, January 14, 2025	Doppler Special Installation
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi

Installation Confirmation:

Time	
12:14:00 PM	
Depth of Flow (Wet DOF) (in)	
2.50	
CS58 Physical Offset (in)	Measurement Confidence (in)
N/A	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.23	N/A
Silt (in)	Silt Type
0	

Manhole / Pipe Information:

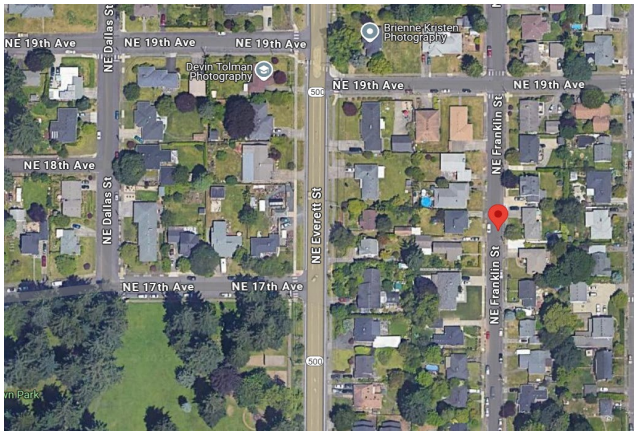
Manhole Depth (Approx. FT):	Manhole Configuration
13'	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
24	26
Manhole Cover	Manhole Frame
Steel	Normal
Active Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
PVC	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

Additional Photos

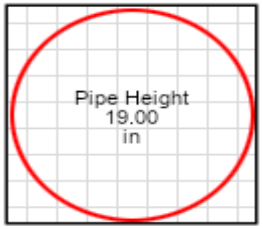
Monitoring Point Inlet	Outlet	
		
Top Down	**Location**	**Map**
		
	KEY	
	Flow Direction Monitoring Point	

Hydrograph Report

CAM_100290

Flow Monitor

CAM_100290



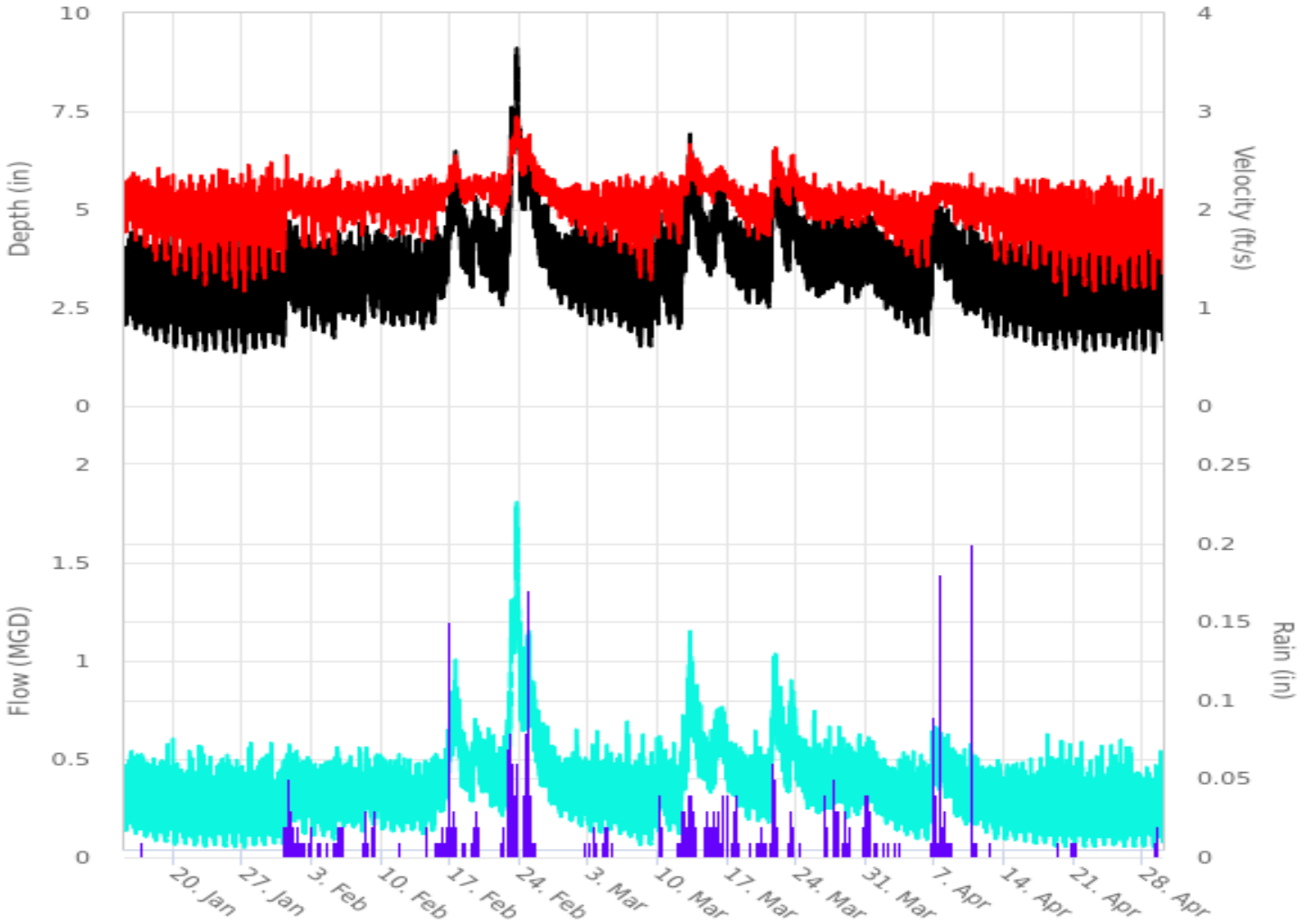
Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL





846 Industry Dr.
Tukwila, WA 98188

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Scattergraph Report

CAM_100290

Flow Monitor

CAM_100290

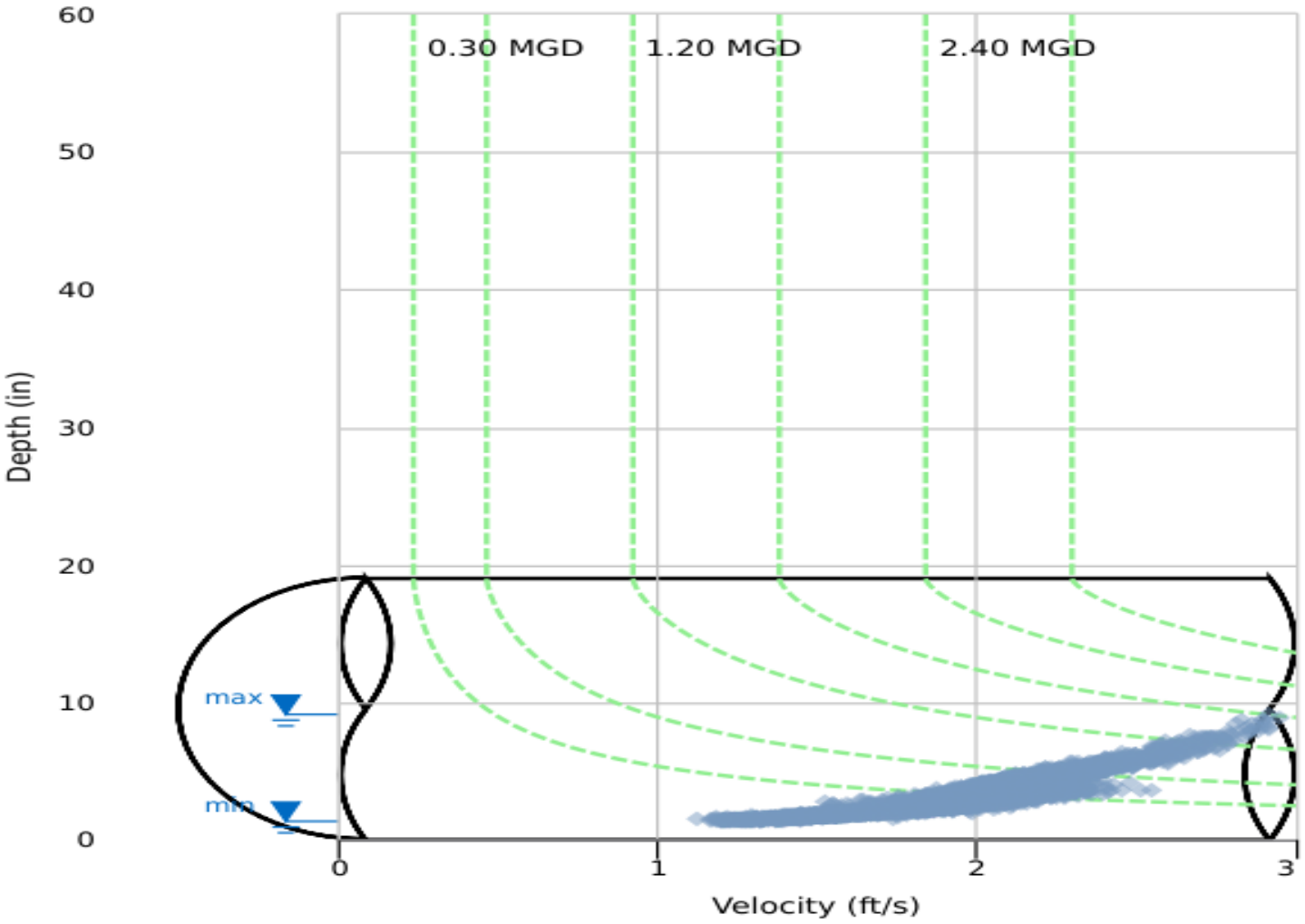
Pipe Height
19.00
in

Report Period

01/15/2025
To
04/29/2025

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth



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Tukwila, WA 98188

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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_100290 Pipe: Elliptical (19 in H x 19.5 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/15/2025	04:00	2.05	17:35	5.79	2.91	04:00	1.72	12:50	2.64	2.05	04:00	0.131	17:35	0.777	0.274	0.274	-
01/16/2025	03:45	1.95	17:20	5.64	2.78	03:30	1.67	14:35	2.65	2.01	03:30	0.118	17:20	0.766	0.256	0.256	0.01
01/17/2025	04:50	1.82	08:55	5.72	2.66	03:50	1.60	09:35	2.65	1.94	03:50	0.104	08:55	0.823	0.235	0.235	-
01/18/2025	03:35	1.66	15:10	5.61	2.61	04:05	1.38	21:50	2.67	1.90	04:05	0.078	15:10	0.752	0.228	0.228	-
01/19/2025	05:50	1.61	21:45	5.69	2.60	03:00	1.46	10:10	2.67	1.88	05:50	0.080	21:45	0.792	0.226	0.226	-
01/20/2025	03:10	1.48	08:50	5.26	2.58	03:00	1.32	19:10	2.65	1.87	03:10	0.063	15:55	0.700	0.222	0.222	-
01/21/2025	04:10	1.50	07:40	5.55	2.49	02:40	1.34	14:05	2.65	1.83	04:10	0.067	07:40	0.757	0.208	0.208	-
01/22/2025	03:15	1.42	10:40	5.50	2.46	05:05	1.28	19:00	2.61	1.81	03:30	0.058	17:15	0.705	0.203	0.203	-
01/23/2025	03:10	1.40	11:55	5.55	2.41	03:15	1.20	21:45	2.60	1.80	03:15	0.052	11:55	0.717	0.197	0.197	-
01/24/2025	03:40	1.44	21:35	5.46	2.48	03:05	1.33	13:30	2.67	1.83	03:50	0.062	21:35	0.802	0.207	0.207	-
01/25/2025	05:10	1.37	09:30	5.59	2.47	04:50	1.25	06:30	2.75	1.80	04:50	0.053	09:30	0.746	0.207	0.207	-
01/26/2025	04:05	1.37	18:40	5.56	2.48	04:05	1.18	16:35	2.58	1.79	04:05	0.050	18:40	0.741	0.207	0.207	-
01/27/2025	03:05	1.34	10:10	5.32	2.44	02:35	1.15	10:15	2.88	1.81	03:10	0.049	09:25	0.712	0.203	0.203	-
01/28/2025	05:20	1.45	13:35	5.60	2.48	02:40	1.17	20:45	2.80	1.81	02:40	0.055	20:45	0.790	0.206	0.206	-
01/29/2025	04:05	1.49	08:25	5.63	2.50	03:55	1.25	19:20	2.99	1.82	03:55	0.060	19:20	0.884	0.211	0.211	-
01/30/2025	05:00	1.56	20:55	5.05	2.46	05:15	1.37	10:00	2.95	1.83	05:15	0.070	10:00	0.682	0.202	0.202	-
01/31/2025	02:00	1.50	16:35	5.68	3.25	00:45	1.34	09:25	3.56	2.05	01:50	0.065	09:25	1.079	0.328	0.328	0.60
02/01/2025	06:40	2.37	10:00	5.76	3.09	03:45	1.90	20:15	2.55	2.08	06:40	0.180	10:00	0.736	0.296	0.296	0.12
02/02/2025	03:50	2.02	20:45	5.43	2.96	03:35	1.56	15:20	2.60	1.98	03:35	0.117	15:20	0.791	0.273	0.273	0.07
02/03/2025	03:05	1.91	07:20	5.57	2.82	04:25	1.60	18:10	2.66	1.97	04:25	0.111	07:20	0.704	0.253	0.253	0.02
02/04/2025	03:45	1.86	07:55	5.46	2.75	04:30	1.60	14:20	2.57	1.96	04:30	0.107	07:55	0.718	0.245	0.245	0.01
02/05/2025	04:30	1.71	12:15	5.74	2.93	04:10	1.52	12:10	2.55	1.99	04:10	0.090	12:15	0.824	0.273	0.273	0.19
02/06/2025	04:30	2.21	21:30	5.44	3.02	03:40	1.70	15:20	2.55	2.03	03:40	0.150	20:30	0.679	0.282	0.282	-
02/07/2025	04:55	2.16	07:10	5.58	2.89	04:55	1.80	00:35	2.51	2.01	04:55	0.148	07:10	0.722	0.264	0.264	-
02/08/2025	01:55	2.02	11:05	5.93	3.17	01:45	1.73	11:05	2.33	2.06	01:55	0.129	11:05	0.812	0.309	0.309	0.25
02/09/2025	04:40	2.25	20:30	5.60	3.14	17:30	1.83	14:20	2.45	2.07	04:25	0.162	20:30	0.709	0.303	0.303	0.05
02/10/2025	03:10	2.10	07:40	5.61	2.98	02:50	1.76	07:35	2.71	2.04	04:00	0.141	07:40	0.778	0.279	0.279	-
02/11/2025	05:00	2.04	07:40	5.65	2.90	02:40	1.70	15:20	2.57	2.00	04:35	0.131	07:40	0.738	0.265	0.265	0.01
02/12/2025	03:55	2.05	07:05	5.48	2.90	00:20	1.69	13:50	2.52	2.00	03:30	0.131	07:05	0.690	0.264	0.264	-
02/13/2025	03:50	2.09	06:40	5.37	2.95	03:20	1.74	15:05	2.49	2.02	03:20	0.137	06:40	0.678	0.272	0.272	-
02/14/2025	05:10	1.95	08:55	5.54	2.87	05:00	1.66	08:50	2.56	1.98	05:00	0.117	08:55	0.770	0.261	0.261	0.07
02/15/2025	06:10	2.10	11:30	5.53	3.08	03:35	1.65	00:25	2.58	2.02	03:35	0.130	08:40	0.734	0.291	0.291	0.09
02/16/2025	01:45	2.76	21:35	6.26	3.77	04:55	1.90	20:30	2.43	2.18	04:55	0.229	21:35	0.902	0.412	0.412	0.77
02/17/2025	23:35	3.96	11:45	6.94	5.05	02:20	2.17	12:20	2.65	2.34	23:35	0.429	11:45	1.090	0.657	0.657	0.39
02/18/2025	23:30	3.21	06:40	6.08	4.00	14:05	2.02	20:45	2.42	2.20	23:30	0.309	06:40	0.852	0.445	0.445	0.02
02/19/2025	05:00	3.01	08:55	6.23	4.25	07:05	2.06	08:55	2.43	2.23	05:00	0.281	08:55	0.904	0.495	0.495	0.40
02/20/2025	23:55	3.15	02:50	5.75	3.82	07:55	2.08	18:05	2.40	2.21	23:55	0.307	09:40	0.788	0.420	0.420	-
02/21/2025	23:15	2.78	23:20	5.80	3.45	16:05	2.01	08:05	2.54	2.16	23:15	0.245	08:10	0.793	0.357	0.357	0.04
02/22/2025	05:40	2.55	23:30	6.71	3.69	06:45	1.91	23:00	2.49	2.16	06:45	0.207	23:30	0.988	0.402	0.402	0.84
02/23/2025	00:00	5.10	16:40	9.57	7.24	00:00	2.35	15:55	3.00	2.71	00:00	0.663	15:50	1.941	1.246	1.246	1.07
02/24/2025	10:35	4.91	23:25	7.52	5.85	05:45	2.34	15:35	2.86	2.54	10:35	0.633	19:35	1.324	0.874	0.874	0.87
02/25/2025	23:40	3.80	00:40	6.97	5.08	11:05	2.14	00:00	2.77	2.40	23:40	0.409	00:40	1.145	0.682	0.682	0.03
02/26/2025	23:55	3.25	06:45	6.02	3.98	15:30	2.11	06:45	2.49	2.22	23:55	0.314	06:45	0.886	0.448	0.448	-
02/27/2025	23:55	2.81	19:55	5.67	3.54	16:45	1.97	06:20	2.46	2.14	23:55	0.240	19:55	0.766	0.367	0.367	-
02/28/2025	03:25	2.59	14:55	5.80	3.32	13:50	1.88	14:55	2.37	2.05	03:20	0.202	14:55	0.799	0.323	0.323	-
03/01/2025	03:20	2.45	19:55	5.73	3.23	04:15	1.82	23:00	2.35	2.02	04:15	0.185	14:25	0.770	0.310	0.310	-
03/02/2025	06:20	2.29	14:00	5.53	3.17	04:00	1.73	08:25	2.29	1.97	04:00	0.155	20:10	0.709	0.295	0.295	0.05
03/03/2025	03:55	2.07	19:00	5.90	3.04	04:05	1.66	21:10	2.30	1.93	04:00	0.128	19:00	0.793	0.277	0.277	0.07
03/04/2025	04:20	2.05	16:25	5.79	3.09	03:20	1.62	16:20	2.39	1.97	03:55	0.124	16:25	0.801	0.290	0.290	0.12
03/05/2025	04:10	2.14	20:15	5.47	3.03	03:30	1.65	22:25	2.42	1.97	03:35	0.137	20:50	0.701	0.279	0.279	0.01
03/06/2025	03:20	2.02	22:15	5.72	2.85	02:55	1.55	13:25	2.50	1.90	03:15	0.116	22:15	0.785	0.250	0.250	-
03/07/2025	23:55	1.85	16:35	5.47	2.68	03:40	1.51	21:30	2.45	1.87	03:40	0.101	16:35	0.729	0.230	0.230	-
03/08/2025	04:20	1.50	17:25	5.66	2.60	04:05	1.29	10:35	2.41	1.81	04:05	0.062	17:25	0.767	0.220	0.220	-
03/09/2025	04:20	1.51	07:45	5.47	2.73	05:00	1.27	15:00	2.49	1.85	05:05	0.062	07:45	0.742	0.240	0.240	0.20
03/10/2025	23:05	2.29	06:20	5.91	3.41	00:00	1.81	07:35	2.58	2.11	00:00	0.164	06:20	0.811	0.344	0.344	0.22
03/11/2025	23:30	2.06	06:40	5.64	2.92	01:55	1.62	19:10	2.53	2.01	01:55	0.133	16:25	0.766	0.270	0.270	0.02
03/12/2025	03:25	1.96	23:15	6.33	3.68	02:15	1.64	23:15	2.41	2.10	03:10	0.117	23:15	0.917	0.398	0.398	0.83
03/13/2025	23:50	4.25	03:05	7.64	5.44	22:35	2.20	05:00	2.73	2.40	23:50	0.484	05:00	1.283	0.749	0.749	0.49
03/14/2025	23:40	3.51	01:00	6.11	4.27	04:20	2.15	01:00	2.55	2.26	23:40	0.369	01:00	0.924	0.502	0.502	0.16
03/15/2025	06:25	3.30	20:15	6.13	4.13	13:15	2.04	20:15	2.46	2.25	06:20	0.327	20:15	0.895	0.479	0.479	0.60
03/16/2025	23:35	3.62	04:50	6.35	4.73	21:10	2.11	07:10	2.60	2.28	23:35	0.378	07:10	0.995	0.584	0.584	0.16
03/17/2025	23:40	3.11	02:55	5.79	3.87	14:45	2.01	15:20	2.60	2.18	23:40	0.284	02:55	0.808	0.421	0.421	0.19
03/18/2025	23:05	2.71	06:40	5.83	3.51	23:55	1.77	12:40	2.35	2.04	23:55	0.203	06:40	0.776	0.348	0.348	0.02
03/19/2025	04:25	2.60	20:55	5.97	3.47	04:40	1.68	18:45	2.39	1.97	01:45	0.190	18:45	0.832	0.334	0.334	0.07
03/20/2025	03:25	2.60	06:45	5.86	3.38	01:30	1.67	03:50	2.27	1.93	01:30	0.182	06:45	0.774	0.316	0.316	0.11
03/21/2025	03:20	2.49	15:25	7.29	4.60	02:45	1.73	15:55	2.76	2.19	03:20	0.176	15:25	1.249	0.577	0.577	1.12
03/22/2025	23:00	3.51	05:40	6.54	4.75	23:00	2.07	04:10	2.62	2.28	23:00	0.344	05:40	1.031	0.590	0.590	-
03/23/2025	02:40	3.42	09:50	6.72	4.53	03:15	2.03	09:50	2.74	2.26	04:05	0.329	09:50	1.132	0.551	0.551	0.44
03/24/2025	23:55	3.16	06:10	6.03	3.99	23:10	2.00	15:55	2.44	2.17	23:55	0.288	15:55	0.855	0.439	0.439	0.01

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/25/2025	04:25	2.94	20:10	5.99	3.58	16:25	1.85	18:45	2.42	2.07	02:40	0.241	18:45	0.851	0.363	0.363	-
03/26/2025	04:25	2.76	06:25	5.96	3.53	17:00	1.77	06:25	2.38	2.05	04:20	0.224	06:25	0.834	0.354	0.354	0.20
03/27/2025	03:50	2.95	06:45	5.94	3.62	01:45	1.76	06:45	2.33	2.01	01:45	0.238	06:45	0.812	0.357	0.357	0.24
03/28/2025	23:55	2.79	03:25	6.14	3.78	23:10	1.87	06:30	2.37	2.06	23:55	0.225	06:30	0.862	0.388	0.388	0.17
03/29/2025	01:45	2.62	15:55	5.90	3.59	03:25	1.78	06:05	2.36	2.01	01:30	0.198	06:05	0.797	0.355	0.355	0.12
03/30/2025	02:00	2.74	08:55	5.83	3.57	04:05	1.81	09:30	2.34	2.02	04:05	0.216	09:30	0.793	0.354	0.354	0.23
03/31/2025	23:50	2.91	12:40	6.05	3.74	23:50	1.87	12:40	2.38	2.07	23:50	0.237	12:40	0.852	0.384	0.384	0.10
04/01/2025	23:55	2.49	01:35	5.59	3.34	23:55	1.72	14:00	2.39	1.99	23:55	0.174	01:35	0.751	0.318	0.318	0.03
04/02/2025	23:25	2.33	16:55	5.70	3.15	23:05	1.60	00:25	2.32	1.92	23:25	0.152	16:55	0.749	0.283	0.283	0.05
04/03/2025	23:25	2.18	00:55	5.66	2.98	23:25	1.55	19:15	2.26	1.86	23:25	0.129	19:15	0.726	0.259	0.259	0.02
04/04/2025	02:40	2.00	14:05	5.65	2.85	04:20	1.51	23:25	2.30	1.83	02:10	0.112	14:05	0.741	0.241	0.241	-
04/05/2025	03:15	1.84	14:15	5.67	2.75	05:10	1.40	22:20	2.38	1.80	05:10	0.092	14:15	0.748	0.229	0.229	-
04/06/2025	04:35	1.80	22:35	6.10	3.29	03:10	1.39	12:10	2.36	1.91	04:40	0.091	21:00	0.840	0.319	0.319	0.71
04/07/2025	23:45	3.31	00:40	6.20	4.18	01:25	1.92	23:50	2.32	2.15	10:35	0.314	00:40	0.850	0.464	0.464	0.37
04/08/2025	23:50	2.80	06:45	6.01	3.74	00:20	1.94	07:20	2.39	2.13	23:50	0.233	06:45	0.819	0.394	0.394	0.07
04/09/2025	23:10	2.49	15:20	5.69	3.30	15:10	1.79	07:40	2.46	2.04	23:10	0.187	07:40	0.759	0.319	0.319	-
04/10/2025	02:15	2.32	06:10	5.60	3.18	04:10	1.73	05:05	2.45	2.04	02:25	0.164	06:10	0.699	0.305	0.305	0.27
04/11/2025	23:10	2.28	06:05	5.51	3.07	23:55	1.76	19:15	2.34	2.00	23:55	0.157	06:05	0.732	0.284	0.284	0.01
04/12/2025	23:55	1.94	06:05	5.40	2.95	23:50	1.59	06:05	2.34	1.93	23:50	0.113	06:05	0.716	0.266	0.266	0.01
04/13/2025	03:05	1.78	08:30	5.37	2.89	04:40	1.47	08:30	2.53	1.90	02:50	0.092	08:30	0.769	0.258	0.258	-
04/14/2025	03:15	1.77	06:40	5.62	2.77	02:20	1.40	06:40	2.42	1.87	02:20	0.088	06:40	0.782	0.240	0.240	-
04/15/2025	02:50	1.74	18:50	5.27	2.73	02:30	1.47	05:45	2.43	1.86	02:25	0.088	18:50	0.669	0.233	0.233	-
04/16/2025	23:55	1.63	15:15	5.54	2.60	01:35	1.43	07:00	2.45	1.84	23:55	0.079	15:15	0.719	0.217	0.217	-
04/17/2025	01:40	1.53	06:20	5.34	2.59	01:35	1.33	00:00	2.67	1.83	01:35	0.067	06:20	0.679	0.218	0.218	-
04/18/2025	02:45	1.56	15:10	5.61	2.53	03:00	1.42	00:10	2.45	1.80	02:25	0.073	12:50	0.764	0.209	0.209	-
04/19/2025	02:55	1.43	15:10	5.55	2.51	00:35	1.24	16:10	2.46	1.76	02:55	0.056	13:10	0.726	0.206	0.206	0.01
04/20/2025	03:50	1.46	10:55	5.52	2.59	03:30	1.09	10:50	2.49	1.76	03:30	0.051	10:55	0.765	0.215	0.215	0.05
04/21/2025	03:00	1.54	17:10	5.56	2.56	00:15	1.33	20:30	2.53	1.80	02:25	0.068	10:45	0.718	0.212	0.212	0.02
04/22/2025	02:45	1.38	19:10	5.57	2.49	02:55	1.21	14:35	2.34	1.75	02:55	0.052	19:10	0.740	0.202	0.202	-
04/23/2025	03:35	1.41	07:00	5.56	2.52	00:55	1.05	09:30	2.33	1.76	00:55	0.050	07:00	0.705	0.206	0.206	-
04/24/2025	03:35	1.53	19:30	5.64	2.49	03:00	1.22	12:30	2.62	1.77	03:00	0.063	19:30	0.756	0.201	0.201	-
04/25/2025	01:30	1.46	15:20	5.44	2.49	00:55	1.24	15:20	2.35	1.73	01:30	0.057	15:20	0.724	0.200	0.200	-
04/26/2025	02:30	1.42	14:20	5.51	2.50	05:25	1.17	18:25	2.54	1.75	02:30	0.055	14:20	0.747	0.205	0.205	-
04/27/2025	04:00	1.42	07:20	5.24	2.58	02:55	1.18	20:20	2.47	1.75	04:00	0.053	07:20	0.667	0.212	0.212	-
04/28/2025	01:40	1.41	08:35	5.40	2.51	01:50	1.19	12:40	2.56	1.76	01:40	0.052	08:35	0.688	0.204	0.204	-
04/29/2025	02:10	1.34	10:55	5.61	2.52	02:00	1.19	21:10	2.47	1.74	02:10	0.049	10:55	0.759	0.205	0.205	0.13

01/15/2025 00:00 - 04/29/2025 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			34.250	13.62
Average	3.24	2.00	0.326	

CAM_51123

Site Commentary

SITE INFORMATION

Pipe	Elliptical (20 in H x 20.13 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was located downstream of site CAM_100290. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	7.07	2.37	1.132
Minimum	3.27	1.07	0.162
Maximum	19.05	3.74	5.203
Min Time	04/28/2025 03:45:00	04/28/2025 03:45:00	04/28/2025 03:45:00
Max Time	02/23/2025 16:05:00	02/23/2025 15:45:00	02/23/2025 16:30:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the graphical reports are based on the fifteen minutes average and values in the Observed Flow Conditions and tabular report are based on the five-minute average.

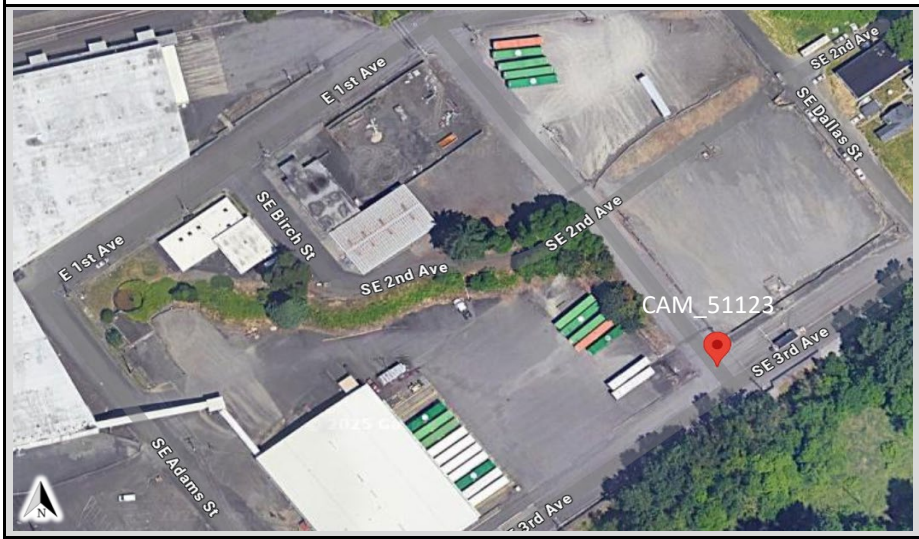
DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
DFINAL (in)	99.653
VFINAL (ft/s)	99.653
QFINAL (MGD - Total MG)	99.653

Camas.Carollo.TFM.WA24		Site Name
Flow Monitoring Site Report	ADS ENVIRONMENTAL SERVICES®	CAM_51123

Site Address /Location:	SE Cedar St and SE 3rd Ave, Camas, WA 98607			Monitor Series: TRITON+	Location Type: Temporary
Site Access Details:	On Road	Latitude:	45.5829094	Pipe Size (H x W): 20.00 X 20.13	Pipe Shape: Circular
		Longitude:	-122.4010296		



Manhole #	System Characteristics
51123	Industrial
Access	Traffic
Drive	None





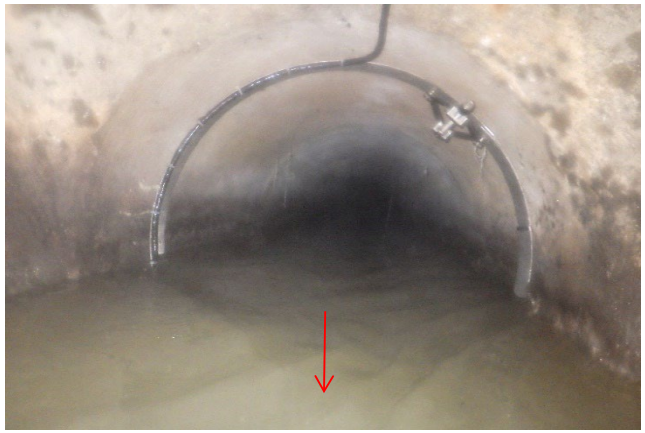


Installation Information	
Installation Date:	Installation Type:
Wednesday, January 15, 2025	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi
Installation Confirmation:	
Time	
8:23:00 AM	
Depth of Flow (Wet DOF) (in)	
7.75	
CS58 Physical Offset (in)	Measurement Confidence (in)
N/A	0.38"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.77	N/A
Silt (in)	Silt Type
0	

Manhole / Pipe Information:	
Manhole Depth (Approx. FT):	Manhole Configuration
16'	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
24	26
Manhole Cover	Manhole Frame
Steel	Normal
Active Connections	Air Quality:
Yes, Inside	Normal
Pipe Material	Pipe Condition:
Concrete	Good
Communication Information:	
Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole
Additional Site Info. / Comments:	

ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23116.11.325

Additional Photos

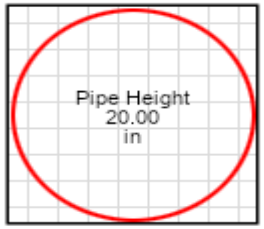
Monitoring Point Inlet	Outlet	
		
Top Down	**Location**	**Map**
		
	KEY	
	Flow Direction Monitoring Point	

Hydrograph Report

CAM_51123

Flow Monitor

CAM_51123



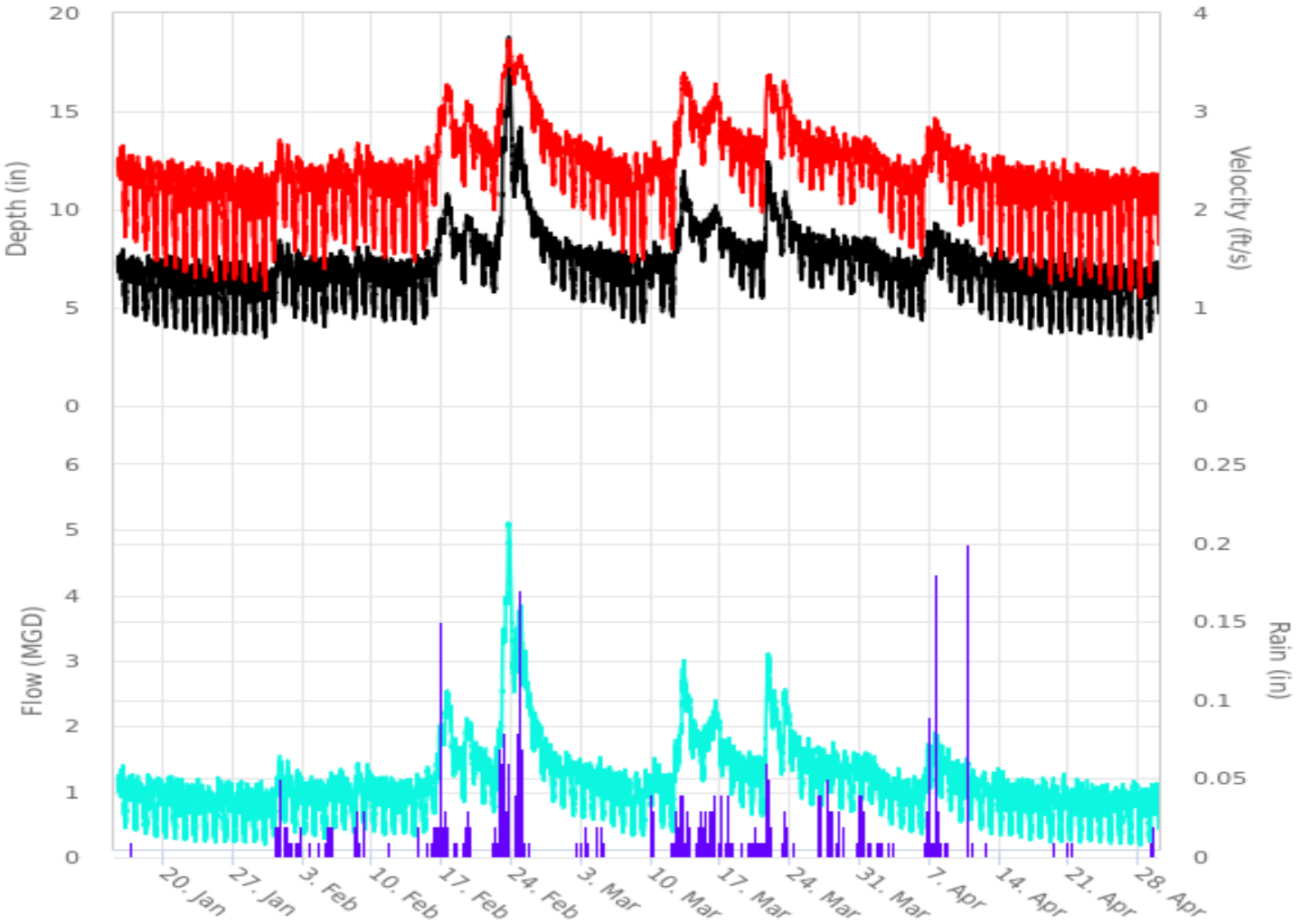
Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL





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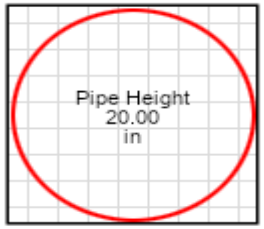
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Scattergraph Report

CAM_51123

Flow Monitor

CAM_51123



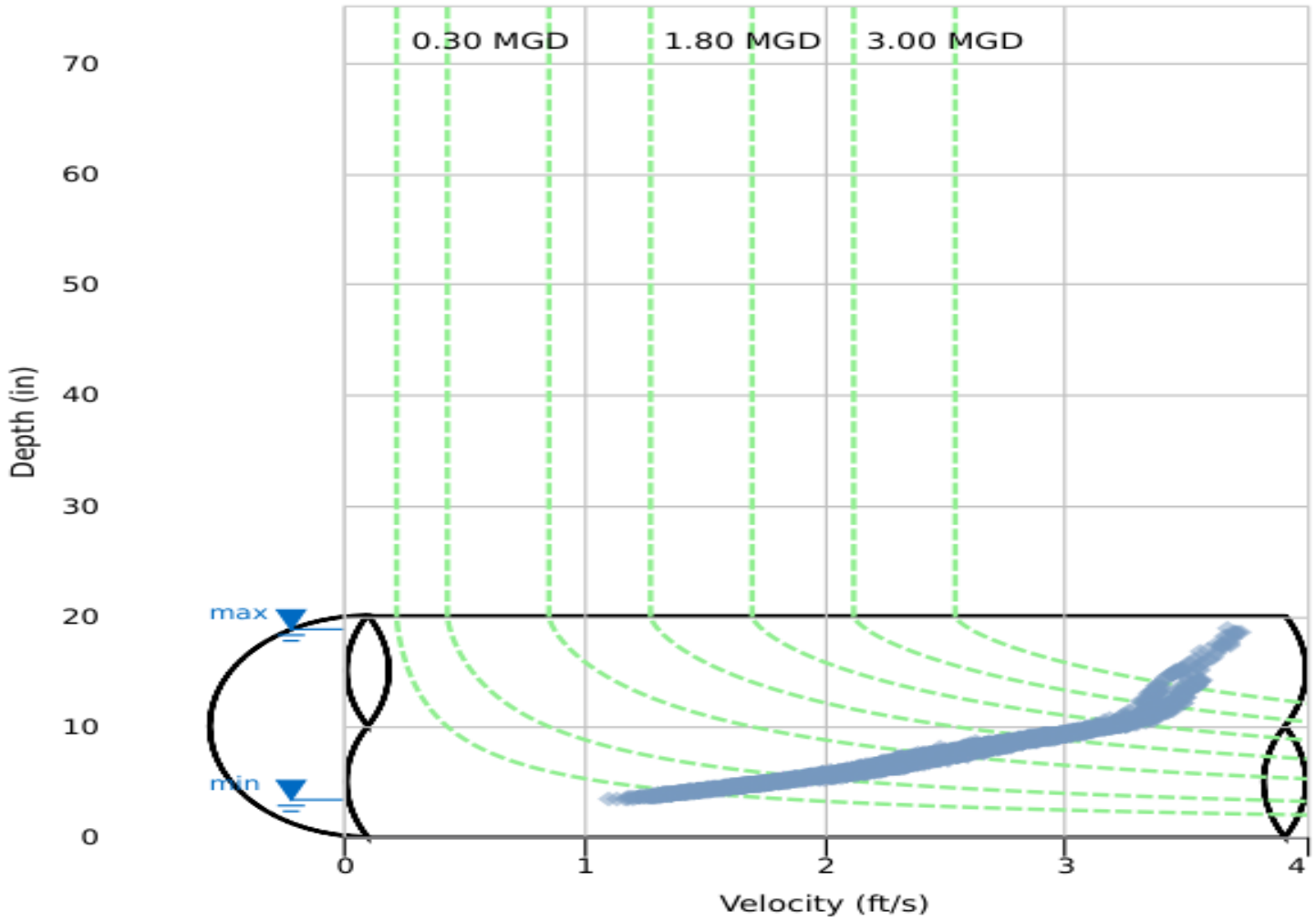
Report Period

01/15/2025
To
04/29/2025

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth

ADS ENVIRONMENTAL SERVICES



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Tukwila, WA 98188

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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_51123 Pipe: Elliptical (20 in H x 20.13 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/15/2025	23:50	5.80	21:30	8.39	7.16	23:50	2.17	21:30	2.69	2.45	23:50	0.742	21:30	1.522	1.123	0.710	-
01/16/2025	03:30	4.69	17:40	8.36	6.47	03:30	1.70	17:40	2.60	2.26	03:30	0.431	17:40	1.464	0.914	0.914	0.01
01/17/2025	04:30	4.46	09:15	7.96	6.27	04:30	1.62	09:15	2.59	2.21	04:30	0.383	09:15	1.367	0.858	0.858	-
01/18/2025	03:35	4.21	09:55	7.89	6.14	03:35	1.52	19:00	2.59	2.16	03:35	0.330	19:00	1.330	0.825	0.825	-
01/19/2025	05:05	4.01	10:00	7.93	6.07	05:05	1.44	10:00	2.57	2.12	05:05	0.292	10:00	1.348	0.802	0.802	-
01/20/2025	04:35	3.95	17:50	8.08	6.12	04:35	1.41	19:35	2.57	2.13	04:35	0.280	10:00	1.363	0.812	0.812	-
01/21/2025	05:25	3.91	20:45	8.03	5.89	05:25	1.39	20:45	2.54	2.07	05:25	0.271	20:45	1.352	0.749	0.749	-
01/22/2025	04:00	3.72	08:15	7.89	5.84	03:10	1.31	20:55	2.51	2.05	04:00	0.240	20:55	1.285	0.738	0.738	-
01/23/2025	04:05	3.64	21:00	7.78	5.80	04:05	1.27	12:20	2.50	2.05	04:05	0.224	21:00	1.257	0.728	0.728	-
01/24/2025	04:10	3.64	11:05	7.86	5.75	04:10	1.28	11:05	2.52	2.04	04:10	0.226	11:05	1.303	0.715	0.715	-
01/25/2025	04:35	3.55	09:50	8.22	5.72	03:45	1.24	11:10	2.56	2.02	04:35	0.211	09:50	1.396	0.712	0.712	-
01/26/2025	05:00	3.58	10:40	7.91	5.81	05:00	1.24	11:15	2.57	2.04	05:00	0.214	10:40	1.323	0.739	0.739	-
01/27/2025	02:40	3.65	18:55	8.00	5.77	02:40	1.26	18:55	2.56	2.03	02:40	0.223	18:55	1.359	0.719	0.719	-
01/28/2025	02:45	3.53	08:45	7.64	5.62	02:45	1.24	08:50	2.45	1.98	02:45	0.209	08:45	1.215	0.679	0.679	-
01/29/2025	04:00	3.61	19:45	7.87	5.65	02:30	1.23	19:45	2.54	1.98	02:30	0.216	19:45	1.321	0.681	0.681	-
01/30/2025	03:40	3.44	09:10	7.52	5.58	03:35	1.17	08:10	2.44	1.96	03:40	0.191	09:10	1.175	0.665	0.665	-
01/31/2025	00:55	4.02	18:35	8.72	6.76	00:55	1.39	16:20	2.74	2.29	00:55	0.283	18:35	1.618	1.008	1.008	0.60
02/01/2025	04:10	5.01	10:20	8.59	6.63	04:05	1.79	10:20	2.74	2.28	04:05	0.499	10:20	1.599	0.952	0.952	0.12
02/02/2025	05:45	4.47	12:50	8.36	6.47	05:45	1.55	10:45	2.61	2.20	05:45	0.367	12:50	1.442	0.906	0.906	0.07
02/03/2025	03:15	4.30	19:40	8.08	6.25	04:15	1.50	21:30	2.64	2.15	04:15	0.338	19:40	1.372	0.838	0.838	0.02
02/04/2025	04:40	4.08	08:20	8.08	6.03	03:55	1.43	08:20	2.54	2.09	04:40	0.298	08:20	1.361	0.779	0.779	0.01
02/05/2025	03:55	3.97	20:15	7.96	6.28	04:55	1.38	20:45	2.58	2.15	03:55	0.278	20:15	1.356	0.857	0.857	0.19
02/06/2025	04:05	4.70	19:15	8.20	6.49	04:50	1.67	19:55	2.71	2.24	04:50	0.426	19:15	1.436	0.912	0.912	-
02/07/2025	04:20	4.62	18:05	8.12	6.18	03:30	1.64	18:05	2.56	2.17	04:20	0.408	18:05	1.382	0.825	0.825	-
02/08/2025	03:25	4.41	10:25	8.28	6.59	03:25	1.54	11:25	2.70	2.26	03:25	0.358	10:25	1.482	0.955	0.955	0.25
02/09/2025	04:10	4.62	11:35	8.31	6.60	04:10	1.63	11:00	2.69	2.27	04:10	0.405	11:05	1.478	0.953	0.953	0.05
02/10/2025	03:45	4.52	22:30	8.01	6.33	04:10	1.59	19:40	2.51	2.18	03:40	0.385	22:30	1.329	0.861	0.861	-
02/11/2025	04:25	4.23	19:40	7.90	6.18	04:25	1.48	20:45	2.56	2.14	04:25	0.323	19:40	1.333	0.822	0.822	0.01
02/12/2025	04:10	4.27	07:30	7.92	6.12	04:55	1.50	07:25	2.58	2.13	04:10	0.338	07:25	1.350	0.806	0.806	-
02/13/2025	04:20	4.32	19:55	7.86	6.20	04:20	1.52	09:20	2.54	2.16	04:20	0.342	19:55	1.303	0.835	0.835	-
02/14/2025	05:15	4.09	10:10	8.06	6.15	05:15	1.43	11:05	2.58	2.14	05:15	0.297	11:05	1.310	0.825	0.825	0.07
02/15/2025	04:15	4.40	10:50	8.30	6.46	04:15	1.58	12:00	2.69	2.24	04:15	0.366	12:00	1.485	0.921	0.921	0.09
02/16/2025	03:30	5.49	20:45	9.65	7.62	05:25	2.00	19:50	3.09	2.56	03:30	0.637	20:45	2.066	1.317	1.317	0.77
02/17/2025	23:15	8.39	10:25	11.12	9.70	23:15	2.79	16:55	3.31	3.09	23:15	1.578	10:25	2.661	2.116	2.116	0.39
02/18/2025	23:40	7.27	08:10	9.37	8.28	23:50	2.46	08:40	2.94	2.71	23:40	1.152	08:10	1.918	1.507	1.507	0.02
02/19/2025	04:45	6.10	09:45	9.95	8.58	04:45	2.21	10:20	3.14	2.80	04:45	0.810	09:45	2.192	1.658	1.658	0.40
02/20/2025	03:55	7.11	08:20	9.14	8.13	12:45	2.32	19:05	2.91	2.65	03:55	1.089	08:20	1.821	1.442	1.442	-
02/21/2025	05:15	6.03	08:30	9.07	7.41	05:15	2.17	08:30	2.84	2.49	05:15	0.783	08:30	1.779	1.199	1.199	0.04
02/22/2025	04:00	5.59	23:55	11.23	7.72	03:45	1.99	23:50	3.26	2.59	04:00	0.646	23:50	2.678	1.351	1.351	0.84
02/23/2025	00:05	10.43	16:05	19.05	15.02	00:05	3.26	15:45	3.74	3.50	00:05	2.439	16:30	5.203	3.978	3.978	1.07
02/24/2025	04:05	10.51	19:25	14.53	12.43	05:20	3.25	19:50	3.59	3.44	05:20	2.464	19:25	3.923	3.191	3.191	0.87
02/25/2025	23:55	9.12	00:20	12.77	10.78	23:40	2.97	00:30	3.50	3.33	23:40	1.874	00:20	3.349	2.601	2.601	0.03
02/26/2025	23:55	7.91	03:10	10.25	9.11	23:20	2.66	03:15	3.21	2.96	23:55	1.400	03:10	2.346	1.864	1.864	-
02/27/2025	04:25	6.91	08:10	9.35	8.19	04:25	2.39	08:40	2.95	2.70	04:25	1.041	08:10	1.914	1.481	1.481	-
02/28/2025	02:40	5.95	08:10	9.19	7.57	03:35	2.20	08:10	2.85	2.55	02:40	0.786	08:10	1.812	1.266	1.266	-
03/01/2025	04:20	5.79	09:20	8.95	7.36	05:25	2.14	11:30	2.83	2.51	03:15	0.733	09:20	1.729	1.206	1.206	-
03/02/2025	04:10	5.27	20:00	8.28	7.13	05:25	1.95	19:35	2.78	2.47	05:25	0.584	19:35	1.538	1.137	1.137	0.05
03/03/2025	03:25	5.12	19:25	8.40	6.91	03:25	1.95	08:10	2.75	2.41	03:25	0.559	19:25	1.547	1.066	1.066	0.07
03/04/2025	03:55	5.13	19:45	8.46	6.94	04:40	1.88	19:45	2.76	2.38	03:55	0.541	19:45	1.574	1.059	1.059	0.12
03/05/2025	04:30	5.15	20:05	8.27	6.77	04:30	1.87	20:10	2.66	2.34	04:30	0.540	20:05	1.470	1.004	1.004	0.01
03/06/2025	03:55	4.82	20:55	8.32	6.57	03:55	1.72	20:55	2.61	2.25	03:55	0.452	20:55	1.460	0.931	0.931	-
03/07/2025	03:30	4.38	08:30	8.15	6.34	03:30	1.53	08:35	2.58	2.17	03:30	0.351	08:30	1.402	0.857	0.857	-
03/08/2025	04:00	4.11	17:45	7.86	6.17	04:00	1.39	11:30	2.59	2.14	04:00	0.291	11:30	1.335	0.822	0.822	-
03/09/2025	04:15	3.93	11:05	8.22	6.30	04:15	1.37	11:05	2.64	2.18	04:15	0.269	11:05	1.451	0.869	0.869	0.20
03/10/2025	23:55	5.43	09:00	8.53	7.24	23:55	1.98	07:20	2.72	2.44	23:55	0.617	07:20	1.563	1.138	1.138	0.22
03/11/2025	02:55	4.69	16:45	8.03	6.51	03:00	1.68	20:40	2.59	2.24	03:00	0.425	20:40	1.369	0.915	0.915	0.02
03/12/2025	03:50	4.50	23:00	9.76	7.62	03:50	1.57	23:00	3.08	2.51	03:50	0.376	23:00	2.116	1.312	1.312	0.83
03/13/2025	23:25	8.95	07:05	12.07	10.44	23:25	2.91	07:10	3.40	3.24	23:25	1.788	07:05	3.041	2.437	2.437	0.49
03/14/2025	23:40	7.92	07:40	9.77	9.01	23:40	2.58	07:20	3.16	2.89	23:40	1.352	07:20	2.169	1.795	1.795	0.16
03/15/2025	04:40	7.19	22:05	10.06	8.76	03:25	2.39	22:10	3.15	2.81	04:40	1.113	22:05	2.245	1.695	1.695	0.60
03/16/2025	23:55	7.87	09:40	10.53	9.47	23:55	2.58	10:35	3.32	3.04	23:55	1.336	10:35	2.505	2.018	2.018	0.16
03/17/2025	23:35	7.19	07:15	9.24	8.40	04:05	2.46	18:50	2.96	2.75	23:35	1.131	07:15	1.878	1.560	1.560	0.19
03/18/2025	23:50	6.16	07:10	8.86	7.77	23:50	2.22	07:10	2.84	2.61	23:50	0.825	07:10	1.725	1.335	1.335	0.02
03/19/2025	02:40	5.74	19:05	8.73	7.39	01:45	2.15	19:45	2.84	2.54	02:40	0.725	19:05	1.677	1.221	1.221	0.07
03/20/2025	03:30	5.47	19:45	8.61	7.24	02:20	2.01	18:45	2.78	2.47	02:20	0.635	19:45	1.622	1.161	1.161	0.11
03/21/2025	03:05	5.41	15:45	12.74	9.27	03:05	1.95	19:10	3.38	2.86	03:05	0.602	15:40	3.207	1.943	1.943	1.12
03/22/2025	23:55	8.30	09:00	11.00	9.75	23:55	2.69	11:10	3.29	3.07	23:55	1.498	09:00	2.618	2.112	2.112	-
03/23/2025	02:30	7.45	10:05	11.31	9.37	02:55	2.50	08:30	3.36	2.96	02:30	1.203	10:05	2.708	1.955	1.955	0.44
03/24/2025	23:20	7.24	07:40	9.54	8.59	23:55	2.46	07:40	2.99	2.75	23:20	1.142	07:40	1.995	1.606	1.606	0.01

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/25/2025	23:40	6.19	18:00	9.34	7.88	01:05	2.22	19:10	2.95	2.60	23:40	0.850	18:00	1.900	1.362	1.362	-
03/26/2025	02:45	5.80	06:45	9.16	7.56	00:35	2.14	20:30	2.88	2.55	02:45	0.730	20:25	1.776	1.266	1.266	0.20
03/27/2025	03:25	5.93	07:05	9.04	7.56	03:25	2.17	07:05	2.86	2.54	03:25	0.765	07:05	1.781	1.256	1.256	0.24
03/28/2025	23:55	6.20	06:50	9.39	7.83	23:55	2.26	06:50	2.92	2.59	23:55	0.848	06:50	1.909	1.340	1.340	0.17
03/29/2025	01:25	5.73	09:45	8.88	7.46	02:10	2.05	09:45	2.83	2.49	01:25	0.699	09:45	1.724	1.220	1.220	0.12
03/30/2025	02:25	5.57	17:20	8.76	7.39	04:10	2.02	17:25	2.77	2.47	02:25	0.654	17:20	1.649	1.195	1.195	0.23
03/31/2025	03:00	6.05	13:00	8.93	7.68	03:55	2.19	13:00	2.80	2.54	03:00	0.795	13:00	1.720	1.283	1.283	0.10
04/01/2025	23:55	5.76	10:30	8.75	7.25	23:30	2.07	10:35	2.71	2.43	23:55	0.705	10:35	1.614	1.137	1.137	0.03
04/02/2025	01:35	5.43	08:25	8.27	6.87	01:30	1.88	07:50	2.59	2.34	01:30	0.588	08:30	1.422	1.019	1.019	0.05
04/03/2025	02:55	4.97	19:35	8.09	6.56	02:50	1.76	19:35	2.60	2.26	02:55	0.484	19:35	1.399	0.925	0.925	0.02
04/04/2025	04:05	4.69	18:35	8.36	6.32	04:05	1.69	10:20	2.49	2.19	04:05	0.428	18:35	1.371	0.858	0.858	-
04/05/2025	03:45	4.41	08:10	8.43	6.22	03:45	1.54	08:15	2.61	2.15	03:45	0.356	08:10	1.479	0.833	0.833	-
04/06/2025	05:00	4.27	19:20	9.00	6.97	02:25	1.48	19:25	2.88	2.33	02:30	0.331	19:25	1.780	1.081	1.081	0.71
04/07/2025	03:35	6.81	11:15	9.59	8.28	03:35	2.37	11:15	2.99	2.67	03:35	1.010	11:15	2.010	1.488	1.488	0.37
04/08/2025	23:55	6.16	07:05	9.12	7.75	23:55	2.20	07:05	2.84	2.53	23:55	0.817	07:05	1.793	1.293	1.293	0.07
04/09/2025	02:30	5.66	17:30	8.69	7.15	23:15	2.01	19:50	2.67	2.39	23:15	0.666	17:35	1.539	1.101	1.101	-
04/10/2025	02:30	5.06	06:30	8.55	7.01	01:40	1.81	20:15	2.69	2.35	02:30	0.516	19:40	1.528	1.061	1.061	0.27
04/11/2025	02:30	5.10	07:05	8.11	6.76	02:30	1.82	07:40	2.57	2.29	02:30	0.519	07:05	1.370	0.978	0.978	0.01
04/12/2025	04:00	4.62	09:40	8.21	6.51	04:00	1.63	09:55	2.65	2.22	04:00	0.403	09:40	1.409	0.912	0.912	0.01
04/13/2025	03:30	4.34	20:15	8.25	6.44	03:30	1.50	19:20	2.61	2.20	03:30	0.341	19:20	1.428	0.898	0.898	-
04/14/2025	03:15	4.26	07:50	8.82	6.25	03:15	1.46	07:50	2.74	2.15	03:15	0.323	07:50	1.654	0.839	0.839	-
04/15/2025	02:30	4.12	06:10	7.98	6.10	02:30	1.44	19:45	2.52	2.11	02:30	0.303	06:10	1.293	0.796	0.796	-
04/16/2025	02:20	4.01	18:40	7.96	6.06	03:10	1.36	06:55	2.50	2.10	02:20	0.279	18:40	1.293	0.786	0.786	-
04/17/2025	03:50	3.81	06:45	7.84	5.98	03:45	1.31	06:45	2.46	2.07	03:45	0.248	06:45	1.271	0.764	0.764	-
04/18/2025	02:00	3.84	07:40	8.08	5.88	02:00	1.31	09:40	2.57	2.05	02:00	0.250	07:45	1.368	0.737	0.737	-
04/19/2025	02:50	3.60	11:25	7.81	5.85	02:50	1.21	09:50	2.49	2.03	02:50	0.210	11:25	1.253	0.733	0.733	0.01
04/20/2025	04:50	3.71	11:20	7.89	5.96	04:50	1.27	11:25	2.53	2.06	04:50	0.230	11:20	1.316	0.769	0.769	0.05
04/21/2025	03:00	3.64	17:30	7.90	5.82	03:00	1.24	17:30	2.50	2.03	03:00	0.219	17:30	1.301	0.724	0.724	0.02
04/22/2025	02:55	3.56	10:55	7.73	5.75	02:55	1.18	20:45	2.45	2.01	02:55	0.202	10:55	1.241	0.707	0.707	-
04/23/2025	02:15	3.58	19:55	7.83	5.71	02:15	1.21	20:00	2.49	1.99	02:15	0.208	20:00	1.279	0.693	0.693	-
04/24/2025	02:15	3.44	19:50	7.87	5.69	02:15	1.15	19:50	2.47	1.99	02:15	0.186	19:50	1.279	0.690	0.690	-
04/25/2025	03:25	3.51	18:25	7.41	5.68	03:25	1.16	07:45	2.41	1.99	03:25	0.195	17:05	1.137	0.686	0.686	-
04/26/2025	02:40	3.49	08:05	7.89	5.72	02:40	1.16	10:00	2.44	1.99	02:40	0.193	08:10	1.240	0.701	0.701	-
04/27/2025	03:40	3.41	11:00	7.70	5.83	03:40	1.13	09:35	2.47	2.01	03:40	0.182	11:00	1.230	0.732	0.732	-
04/28/2025	03:45	3.27	08:55	7.48	5.68	03:45	1.07	08:55	2.38	1.97	03:45	0.162	08:55	1.156	0.686	0.686	-
04/29/2025	01:50	3.54	18:50	8.02	5.78	01:50	1.17	18:55	2.49	2.00	01:50	0.199	18:55	1.314	0.706	0.706	0.13

01/15/2025 00:00 - 04/29/2025 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			118.475	13.62
Average	7.07	2.37	1.132	

CAM_52167

Site Commentary

SITE INFORMATION

Pipe	Elliptical (18.13 in H x 18.13 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

Average flow depth, velocity, and quantity data observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	1.63	3.33	0.221
Minimum	0.54	0.43	0.006
Maximum	5.26	5.50	1.536
Min Time	01/22/2025 04:45:00	04/22/2025 03:30:00	01/22/2025 04:45:00
Max Time	02/18/2025 09:55:00	02/18/2025 09:55:00	02/18/2025 09:55:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the graphical reports are based on the fifteen minutes average and values in the Observed Flow Conditions and tabular report are based on the five-minute average.

DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

Camas.Carollo.TFM.WA24		Site Name
Flow Monitoring Site Report	ADS ENVIRONMENTAL SERVICES®	CAM_52167

Site Address /Location:	SE Dallas St and SE 3rd Ave, Camas, WA 98607			Monitor Series	Location Type
				TRITON+	Temporary
Site Access Details:	On Road	Latitude:	45.5833078	Pipe Size (H x W)	Pipe Shape
		Longitude:	-122.4001589	18.13 X 18.13	Circular



Manhole #	System Characteristics
52167	Industrial
Access	Traffic
Drive	None







ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23116.11.325

Installation Information

Installation Date:	Installation Type:
Tuesday, January 14, 2025	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4), Smart Depth (CS5)	0 - 5 psi

Installation Confirmation:

Time	
2:43:00 PM	
Depth of Flow (Wet DOF) (in)	
1.25	
CS58 Physical Offset (in)	Measurement Confidence (in)
1.38	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.82	N/A
Silt (in)	Silt Type
0	

Manhole / Pipe Information:

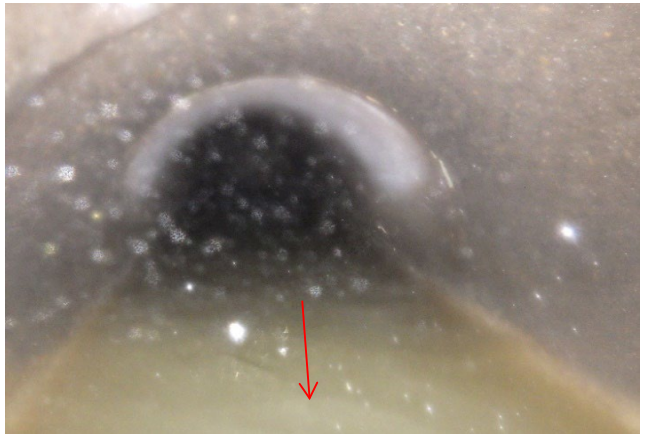
Manhole Depth (Approx. FT):	Manhole Configuration
17.5'	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
24	26
Manhole Cover	Manhole Frame
Steel	Normal
Active Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
Hollow Tile	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

Additional Photos

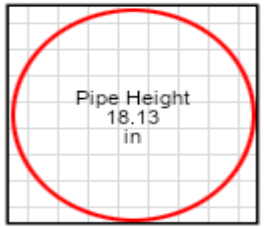
Monitoring Point Inlet	Outlet	NW inlet connection
		
Top Down	**Location**	**Map**
		
	KEY	
	Flow Direction Monitoring Point	

Hydrograph Report

CAM_52167

Flow Monitor

CAM_52167



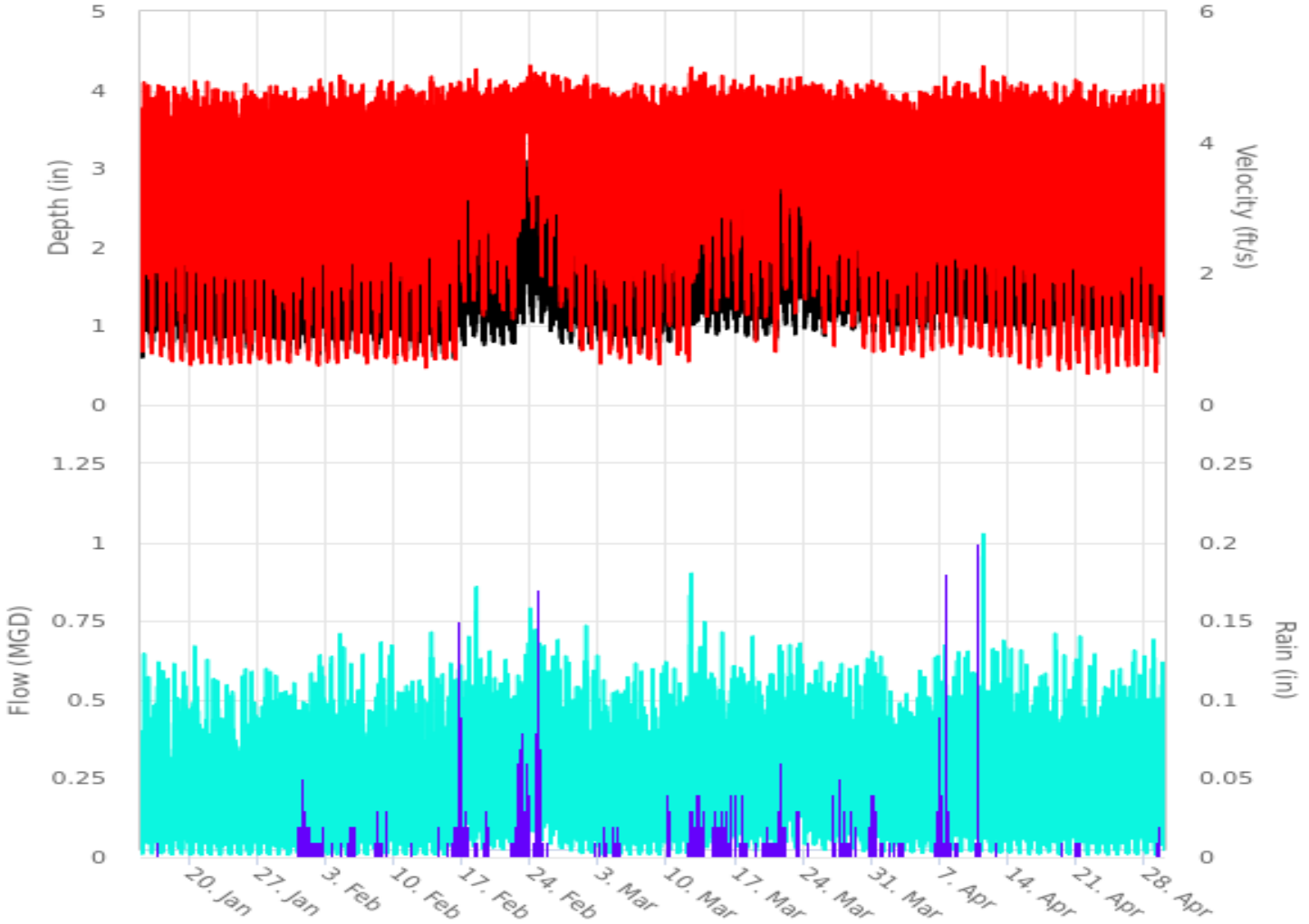
Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL

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Scattergraph Report

CAM_52167

Flow Monitor

CAM_52167

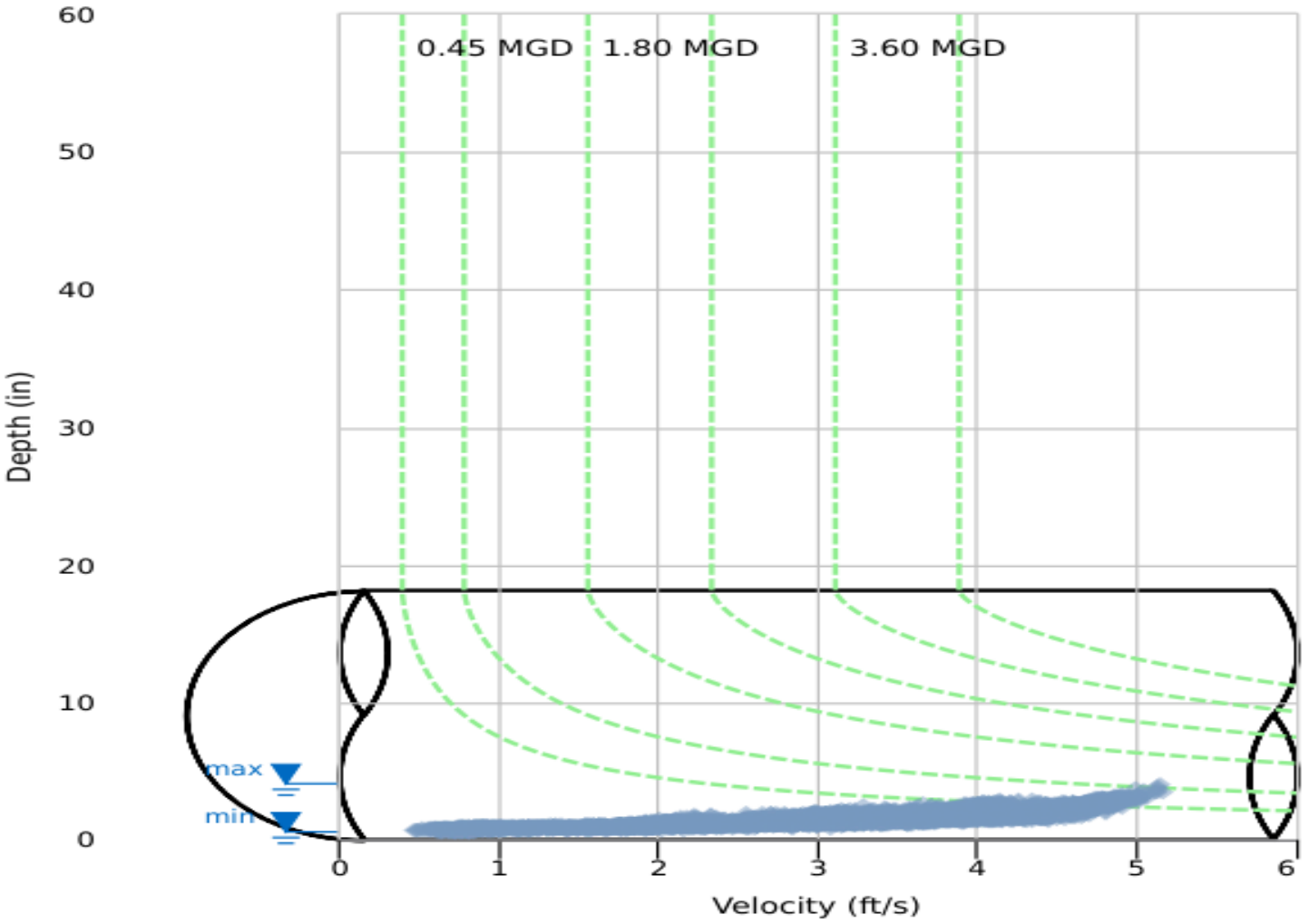
Pipe Height
18.13
in

Report Period

01/15/2025
To
04/29/2025

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth



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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_52167 Pipe: Elliptical (18.13 in H x 18.13 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/15/2025	04:55	0.55	08:30	3.97	1.60	05:45	0.66	08:30	5.21	3.36	04:55	0.008	08:30	0.981	0.214	0.214	-
01/16/2025	03:55	0.63	08:05	4.32	1.59	04:50	0.74	20:00	5.28	3.33	03:55	0.009	08:05	1.118	0.213	0.213	0.01
01/17/2025	06:00	0.68	20:05	4.16	1.51	03:45	0.73	20:05	5.28	3.15	06:00	0.011	20:05	1.057	0.189	0.189	-
01/18/2025	04:30	0.65	10:15	4.26	1.53	06:50	0.63	10:15	5.28	3.13	04:30	0.009	10:15	1.096	0.197	0.197	-
01/19/2025	04:15	0.70	09:25	4.17	1.56	06:40	0.64	16:40	5.26	3.20	04:15	0.010	11:30	1.046	0.203	0.203	-
01/20/2025	03:55	0.59	13:00	4.22	1.53	04:00	0.58	13:00	5.30	3.15	03:55	0.007	13:00	1.084	0.198	0.198	-
01/21/2025	02:50	0.54	18:10	4.14	1.47	05:25	0.61	18:10	5.24	3.09	05:25	0.007	18:10	1.044	0.182	0.182	-
01/22/2025	04:45	0.54	23:35	3.98	1.48	04:45	0.58	12:00	5.15	3.13	04:45	0.006	23:35	0.965	0.186	0.186	-
01/23/2025	05:00	0.55	21:25	4.33	1.45	05:00	0.59	21:25	5.31	3.04	05:00	0.006	21:25	1.129	0.179	0.179	-
01/24/2025	03:45	0.61	08:55	3.95	1.45	05:30	0.60	08:55	5.10	3.09	05:30	0.008	08:55	0.951	0.179	0.179	-
01/25/2025	05:45	0.66	10:20	4.19	1.48	03:30	0.62	10:20	5.31	3.08	04:55	0.009	10:20	1.076	0.189	0.189	-
01/26/2025	05:05	0.63	14:25	4.18	1.46	03:45	0.60	10:35	5.29	3.09	05:15	0.008	14:25	1.064	0.184	0.184	-
01/27/2025	01:25	0.65	21:20	4.06	1.49	04:40	0.66	21:20	5.33	3.08	01:30	0.010	21:20	1.033	0.191	0.191	-
01/28/2025	02:00	0.65	08:00	4.06	1.44	05:35	0.63	08:00	5.26	2.96	03:25	0.009	08:00	1.018	0.178	0.178	-
01/29/2025	04:15	0.65	10:05	4.15	1.41	04:00	0.66	10:05	5.26	2.92	04:10	0.009	10:05	1.051	0.171	0.171	-
01/30/2025	03:55	0.57	20:25	3.97	1.41	05:40	0.57	20:25	5.19	2.94	04:00	0.007	20:25	0.976	0.171	0.171	-
01/31/2025	01:35	0.68	19:40	4.05	1.52	02:40	0.76	19:40	5.22	3.25	02:40	0.013	19:40	1.010	0.197	0.197	0.60
02/01/2025	06:45	0.68	21:45	3.97	1.49	05:45	0.63	19:35	5.18	3.04	05:45	0.010	21:45	0.971	0.187	0.187	0.12
02/02/2025	02:55	0.61	12:05	3.95	1.57	05:45	0.55	10:00	5.25	3.18	05:45	0.007	10:00	0.972	0.211	0.211	0.07
02/03/2025	05:30	0.62	13:20	4.03	1.46	04:00	0.59	13:20	5.14	3.03	04:00	0.008	13:20	0.988	0.181	0.181	0.02
02/04/2025	03:55	0.67	19:30	4.00	1.51	03:55	0.61	19:30	5.20	3.09	03:55	0.008	19:30	0.988	0.194	0.194	0.01
02/05/2025	04:50	0.60	14:05	3.61	1.48	04:35	0.69	17:55	5.09	3.09	05:00	0.008	14:05	0.831	0.188	0.188	0.19
02/06/2025	04:35	0.62	17:25	3.99	1.51	04:35	0.72	19:35	5.16	3.15	04:35	0.009	19:35	0.972	0.194	0.194	-
02/07/2025	03:25	0.59	12:25	3.81	1.44	04:55	0.60	09:55	5.13	2.99	04:55	0.008	12:25	0.906	0.175	0.175	-
02/08/2025	02:10	0.62	22:45	4.02	1.49	05:05	0.68	16:20	5.18	3.07	05:15	0.010	22:45	0.986	0.192	0.192	0.25
02/09/2025	02:30	0.66	18:15	4.05	1.58	05:20	0.62	18:15	5.29	3.27	05:20	0.009	18:15	1.023	0.210	0.210	0.05
02/10/2025	05:50	0.61	16:10	3.93	1.50	03:05	0.62	16:10	5.26	3.17	03:05	0.008	16:10	0.974	0.193	0.193	-
02/11/2025	02:20	0.62	19:55	3.94	1.48	05:10	0.65	19:55	5.20	3.13	02:45	0.009	19:55	0.964	0.188	0.188	0.01
02/12/2025	05:45	0.61	19:05	4.18	1.45	02:50	0.67	19:05	5.29	3.06	02:50	0.009	19:05	1.068	0.184	0.184	-
02/13/2025	06:00	0.64	19:50	4.14	1.48	05:50	0.55	19:50	5.29	3.17	06:00	0.007	19:50	1.054	0.191	0.191	-
02/14/2025	02:00	0.59	19:55	4.18	1.41	04:55	0.64	19:55	5.26	3.00	04:55	0.008	19:55	1.063	0.180	0.180	0.07
02/15/2025	03:25	0.58	19:55	4.17	1.41	05:05	0.56	19:55	5.28	3.11	05:05	0.007	19:55	1.064	0.178	0.178	0.09
02/16/2025	03:40	0.58	20:15	4.10	1.55	06:45	0.66	18:25	5.27	3.39	06:45	0.008	20:15	1.009	0.219	0.219	0.77
02/17/2025	04:40	0.70	07:50	4.25	1.74	04:00	1.03	07:50	5.35	3.80	04:00	0.016	07:50	1.108	0.262	0.262	0.39
02/18/2025	03:35	0.79	09:55	5.26	1.80	04:45	1.22	09:55	5.50	3.78	04:45	0.022	09:55	1.536	0.281	0.281	0.02
02/19/2025	05:25	0.70	19:45	4.44	1.75	04:10	0.93	19:45	5.40	3.84	05:25	0.015	19:45	1.190	0.271	0.271	0.40
02/20/2025	03:30	0.70	16:55	4.22	1.69	04:45	1.02	08:05	5.36	3.72	04:45	0.016	16:55	1.073	0.252	0.252	-
02/21/2025	05:15	0.69	08:40	4.15	1.65	04:35	0.91	15:35	5.36	3.59	04:35	0.013	08:40	1.017	0.239	0.239	0.04
02/22/2025	04:20	0.65	16:55	3.98	1.66	05:05	0.78	19:35	5.13	3.65	05:05	0.011	16:55	0.956	0.241	0.241	0.84
02/23/2025	05:25	0.92	15:55	4.46	2.16	02:35	1.93	10:50	5.39	4.46	04:55	0.047	15:55	1.157	0.385	0.385	1.07
02/24/2025	06:05	0.90	19:45	4.29	2.03	05:40	1.71	08:35	5.42	4.30	05:40	0.039	08:35	1.122	0.344	0.344	0.87
02/25/2025	03:45	0.90	13:10	4.31	1.91	03:45	1.64	13:10	5.44	4.17	03:45	0.035	13:10	1.146	0.304	0.304	0.03
02/26/2025	05:45	0.80	21:05	4.18	1.82	00:55	1.61	06:55	5.25	3.95	00:55	0.031	21:05	1.041	0.282	0.282	-
02/27/2025	05:45	0.70	23:15	3.98	1.69	03:50	0.85	22:00	5.23	3.69	03:50	0.014	22:00	0.977	0.244	0.244	-
02/28/2025	04:05	0.70	15:40	3.43	1.62	03:25	0.86	15:40	5.07	3.61	03:25	0.014	15:40	0.773	0.222	0.222	-
03/01/2025	05:40	0.69	11:25	4.47	1.60	05:40	0.73	11:25	5.37	3.52	05:40	0.010	11:25	1.191	0.221	0.221	-
03/02/2025	05:40	0.71	19:45	4.32	1.64	04:50	0.70	11:00	5.22	3.50	04:50	0.011	19:45	1.098	0.230	0.230	0.05
03/03/2025	04:00	0.67	11:45	4.11	1.59	03:55	0.57	11:45	5.24	3.46	03:55	0.008	11:45	1.035	0.213	0.213	0.07
03/04/2025	05:20	0.68	21:05	4.23	1.55	02:15	0.70	21:05	5.30	3.35	02:15	0.011	21:05	1.088	0.207	0.207	0.12
03/05/2025	03:55	0.65	08:10	4.05	1.54	03:55	0.67	19:50	5.31	3.29	03:55	0.009	08:10	1.019	0.207	0.207	0.01
03/06/2025	04:25	0.62	22:10	4.19	1.52	04:20	0.63	18:15	5.28	3.23	04:25	0.008	22:10	1.067	0.201	0.201	-
03/07/2025	04:00	0.64	08:30	4.09	1.47	01:50	0.69	08:30	5.20	3.10	01:50	0.009	08:30	1.020	0.185	0.185	-
03/08/2025	04:10	0.64	12:00	3.85	1.48	03:00	0.62	09:10	5.21	3.12	03:00	0.009	12:00	0.920	0.185	0.185	-
03/09/2025	04:25	0.65	18:00	4.24	1.58	03:00	0.59	20:35	5.34	3.20	03:00	0.008	10:50	1.090	0.211	0.211	0.20
03/10/2025	05:15	0.79	17:15	4.14	1.59	06:10	1.01	17:15	5.26	3.29	06:10	0.018	17:15	1.046	0.209	0.209	0.22
03/11/2025	02:10	0.71	07:10	3.79	1.54	02:10	0.75	20:45	5.14	3.22	02:10	0.011	19:20	0.877	0.196	0.196	0.02
03/12/2025	03:55	0.70	09:45	4.33	1.82	03:55	0.65	09:45	5.43	3.58	03:55	0.010	09:45	1.154	0.281	0.281	0.83
03/13/2025	04:50	0.92	14:35	4.42	1.83	04:45	1.41	14:35	5.41	3.83	04:50	0.032	14:35	1.183	0.279	0.279	0.49
03/14/2025	01:20	0.80	21:05	4.19	1.80	01:20	0.90	21:05	5.33	3.71	01:20	0.016	21:05	1.080	0.270	0.270	0.16
03/15/2025	04:45	0.85	15:50	4.19	1.78	04:45	0.86	15:50	5.27	3.70	04:45	0.017	15:50	1.070	0.264	0.264	0.60
03/16/2025	06:20	0.81	18:35	4.35	1.85	04:05	0.98	18:35	5.37	3.79	04:05	0.018	18:35	1.148	0.284	0.284	0.16
03/17/2025	02:00	0.83	19:20	4.36	1.77	02:00	0.99	19:20	5.33	3.67	02:00	0.019	19:20	1.144	0.261	0.261	0.19
03/18/2025	03:40	0.77	18:30	4.20	1.72	03:05	0.90	18:30	5.28	3.58	03:40	0.017	18:30	1.074	0.246	0.246	0.02
03/19/2025	03:20	0.79	13:10	4.17	1.67	01:55	0.82	13:10	5.37	3.50	01:55	0.016	13:10	1.083	0.232	0.232	0.07
03/20/2025	02:50	0.79	19:15	4.12	1.65	02:50	0.70	13:20	5.32	3.47	02:50	0.012	19:15	1.029	0.228	0.228	0.11
03/21/2025	02:15	0.78	15:45	4.33	1.82	04:05	0.77	15:45	5.35	3.76	04:05	0.014	15:45	1.137	0.277	0.277	1.12
03/22/2025	23:20	0.94	13:30	4.22	1.89	03:40	1.44	20:55	5.32	3.92	03:40	0.035	13:30	1.072	0.295	0.295	-
03/23/2025	02:10	0.83	15:15	4.36	1.88	02:10	0.96	15:15	5.39	3.92	02:10	0.018	15:15	1.156	0.295	0.295	0.44
03/24/2025	00:40	0.89	13:50	4.13	1.80	01:45	1.32	04:30	5.18	3.77	01:45	0.029	13:50	1.010	0.268	0.268	0.01

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/25/2025	03:55	0.86	19:00	4.30	1.76	23:50	1.09	19:00	5.26	3.67	23:50	0.023	19:00	1.105	0.254	0.254	-
03/26/2025	01:10	0.83	06:55	4.34	1.73	03:10	0.80	10:05	5.28	3.58	03:10	0.016	06:55	1.111	0.245	0.245	0.20
03/27/2025	00:30	0.85	23:40	3.85	1.73	01:55	0.79	06:35	5.27	3.54	01:55	0.016	12:15	0.929	0.242	0.242	0.24
03/28/2025	03:05	0.91	12:25	4.30	1.74	01:40	1.09	15:10	5.34	3.55	05:05	0.025	12:25	1.117	0.247	0.247	0.17
03/29/2025	01:45	0.89	19:25	4.06	1.74	01:45	0.87	19:25	5.18	3.50	01:45	0.018	19:25	1.003	0.243	0.243	0.12
03/30/2025	01:00	0.88	11:45	4.29	1.73	02:30	0.76	11:45	5.26	3.43	02:30	0.016	11:45	1.104	0.240	0.240	0.23
03/31/2025	04:30	0.87	07:15	4.01	1.71	04:30	0.75	07:15	5.24	3.35	04:30	0.015	07:15	0.997	0.231	0.231	0.10
04/01/2025	04:35	0.87	21:05	4.20	1.63	03:40	0.79	21:05	5.20	3.25	01:10	0.016	21:05	1.056	0.212	0.212	0.03
04/02/2025	03:45	0.85	20:50	4.04	1.59	03:45	0.84	20:50	5.15	3.17	03:45	0.017	20:50	0.991	0.199	0.199	0.05
04/03/2025	03:00	0.82	13:05	3.65	1.58	05:00	0.71	18:15	5.02	3.09	01:55	0.014	13:05	0.831	0.194	0.194	0.02
04/04/2025	03:35	0.75	21:30	4.15	1.55	03:35	0.68	23:10	5.20	3.07	03:35	0.011	21:30	1.041	0.189	0.189	-
04/05/2025	04:35	0.79	16:25	4.20	1.58	04:35	0.67	16:25	5.24	3.09	04:35	0.012	16:25	1.066	0.196	0.196	-
04/06/2025	03:15	0.85	10:45	4.21	1.73	04:15	0.82	16:20	5.30	3.44	03:15	0.016	16:20	1.079	0.238	0.238	0.71
04/07/2025	04:25	0.88	06:35	4.34	1.78	03:30	0.77	06:35	5.32	3.47	03:30	0.017	06:35	1.131	0.249	0.249	0.37
04/08/2025	05:00	0.91	16:40	4.40	1.74	03:30	0.76	16:40	5.36	3.44	03:30	0.017	16:40	1.163	0.241	0.241	0.07
04/09/2025	02:25	0.92	06:35	4.02	1.76	02:20	0.72	14:00	5.23	3.39	02:25	0.017	14:00	0.997	0.242	0.242	-
04/10/2025	01:35	0.87	12:00	4.13	1.71	04:05	0.72	12:00	5.24	3.35	03:15	0.016	12:00	1.039	0.228	0.228	0.27
04/11/2025	05:10	0.88	09:35	5.07	1.82	02:45	0.73	09:35	5.34	3.41	02:45	0.015	09:35	1.416	0.266	0.266	0.01
04/12/2025	03:40	0.85	08:05	4.30	1.67	05:40	0.73	18:45	5.31	3.33	02:45	0.015	08:05	1.109	0.224	0.224	0.01
04/13/2025	04:30	0.78	19:05	4.31	1.66	04:30	0.64	19:05	5.31	3.28	04:30	0.011	19:05	1.122	0.227	0.227	-
04/14/2025	02:25	0.78	19:10	4.26	1.63	02:25	0.71	19:10	5.27	3.28	02:25	0.012	19:10	1.093	0.217	0.217	-
04/15/2025	03:00	0.73	09:20	4.06	1.64	03:00	0.52	09:20	5.20	3.18	03:00	0.008	09:20	1.009	0.216	0.216	-
04/16/2025	02:55	0.72	18:45	3.92	1.58	02:55	0.55	18:45	5.10	3.08	02:55	0.008	18:45	0.942	0.196	0.196	-
04/17/2025	03:10	0.75	18:45	4.03	1.59	03:10	0.54	18:45	5.22	3.00	03:10	0.009	18:45	1.003	0.201	0.201	-
04/18/2025	04:55	0.87	21:45	4.25	1.61	01:50	0.75	21:45	5.29	3.03	01:50	0.015	21:45	1.093	0.199	0.199	-
04/19/2025	04:10	0.79	16:30	4.10	1.60	04:10	0.52	16:30	5.19	2.92	04:10	0.009	16:30	1.019	0.196	0.196	0.01
04/20/2025	05:10	0.73	21:20	4.29	1.65	05:10	0.53	21:20	5.27	3.07	05:10	0.008	21:20	1.102	0.214	0.214	0.05
04/21/2025	02:35	0.73	07:30	4.17	1.58	02:35	0.58	07:30	5.29	2.94	02:35	0.009	07:30	1.064	0.196	0.196	0.02
04/22/2025	03:30	0.68	20:20	4.40	1.60	03:30	0.43	20:20	5.26	2.99	03:30	0.006	20:20	1.141	0.201	0.201	-
04/23/2025	03:55	0.76	20:55	4.05	1.57	03:55	0.53	20:55	5.18	2.92	03:55	0.009	20:55	1.001	0.187	0.187	-
04/24/2025	03:35	0.65	06:20	4.10	1.61	03:35	0.47	06:20	5.18	2.93	03:35	0.006	06:20	1.017	0.200	0.200	-
04/25/2025	03:40	0.67	10:50	4.33	1.57	03:40	0.58	10:50	5.27	2.88	03:40	0.008	10:50	1.121	0.189	0.189	-
04/26/2025	05:10	0.78	21:15	4.33	1.62	05:10	0.57	21:15	5.27	2.98	05:10	0.010	21:15	1.120	0.202	0.202	-
04/27/2025	05:15	0.71	18:10	3.91	1.63	05:15	0.58	18:10	5.22	2.97	05:15	0.009	18:10	0.958	0.210	0.210	-
04/28/2025	03:05	0.75	20:15	4.35	1.57	03:05	0.55	20:15	5.31	2.97	03:05	0.009	20:15	1.136	0.194	0.194	-
04/29/2025	02:50	0.67	15:10	3.95	1.55	02:25	0.49	15:10	5.20	2.95	02:50	0.007	15:10	0.968	0.190	0.190	0.13

01/15/2025 00:00 - 04/29/2025 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			23.166	13.62
Average	1.63	3.33	0.221	

CAM_81189

Site Commentary

SITE INFORMATION

Pipe	Elliptical (12.13 in H x 12.13 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were experienced during the study. Backwater conditions were observed.

Average flow depth, velocity, and quantity data observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	2.07	1.91	0.117
Minimum	0.98	0.37	0.017
Maximum	4.16	2.85	0.295
Min Time	04/11/2025 02:50:00	02/21/2025 04:30:00	04/22/2025 02:20:00
Max Time	04/23/2025 08:25:00	04/01/2025 10:45:00	02/06/2025 15:30:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the graphical reports are based on the fifteen minutes average and values in the Observed Flow Conditions and tabular report are based on the five-minute average.

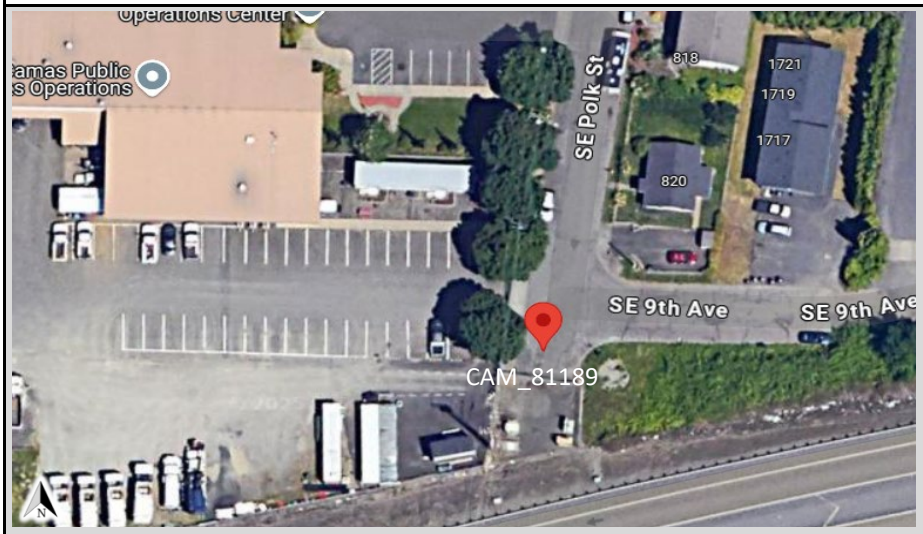
DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

Camas.Carollo.TFM.WA24		Site Name
Flow Monitoring Site Report	ADS ENVIRONMENTAL SERVICES®	CAM_81189

Site Address /Location:	820 SE Polk St, Camas, WA 98607			Monitor Series	Location Type
				TRITON+	Temporary
Site Access Details:	On Road	Latitude:	45.580146	Pipe Size (H x W)	Pipe Shape
		Longitude:	-122.39157	12.13 x 12.13	Circular



Manhole #	System Characteristics
81189	Residential
Access	Traffic
Drive	None





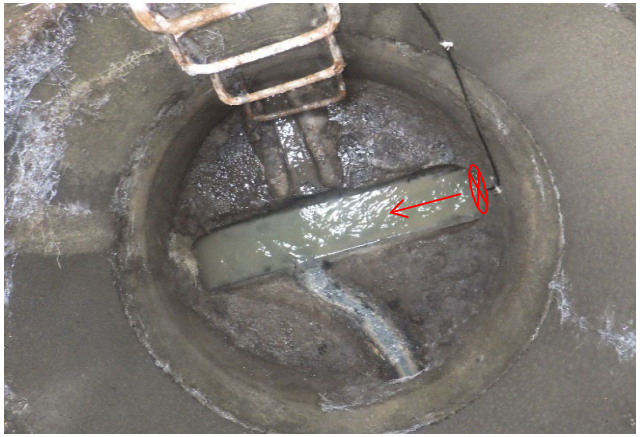
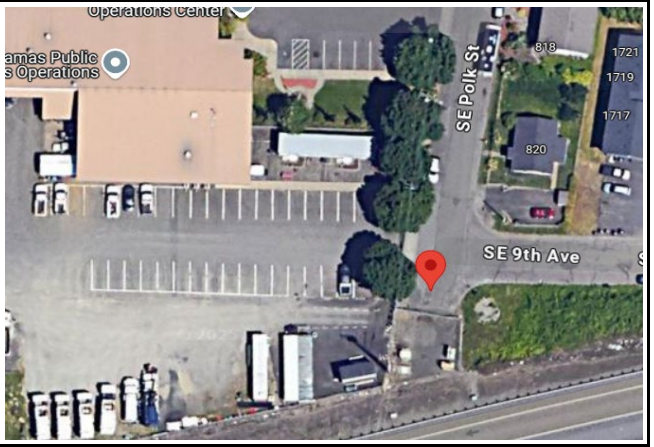


ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23116.11.325

Installation Information	
Installation Date:	Installation Type:
Tuesday, January 14, 2025	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi
Installation Confirmation:	
Time	
10:17:00 AM	
Depth of Flow (Wet DOF) (in)	
2.50	
CS58 Physical Offset (in)	Measurement Confidence (in)
N/A	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.57	N/A
Silt (in)	Silt Type
0	

Manhole / Pipe Information:	
Manhole Depth (Approx. FT):	Manhole Configuration
7.5	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
24	26
Manhole Cover	Manhole Frame
Steel	Normal
Active Connections	Air Quality:
Yes, Inside	Normal
Pipe Material	Pipe Condition:
Concrete	Good
Communication Information:	
Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole
Additional Site Info. / Comments:	

Additional Photos

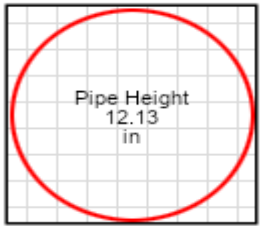
Monitoring Point Inlet	Outlet	West connection
		
Top Down	**Location**	**Map**
		
East Connection	**KEY**	
	Flow Direction Monitoring Point	

Hydrograph Report

CAM_81189

Flow Monitor

CAM_81189



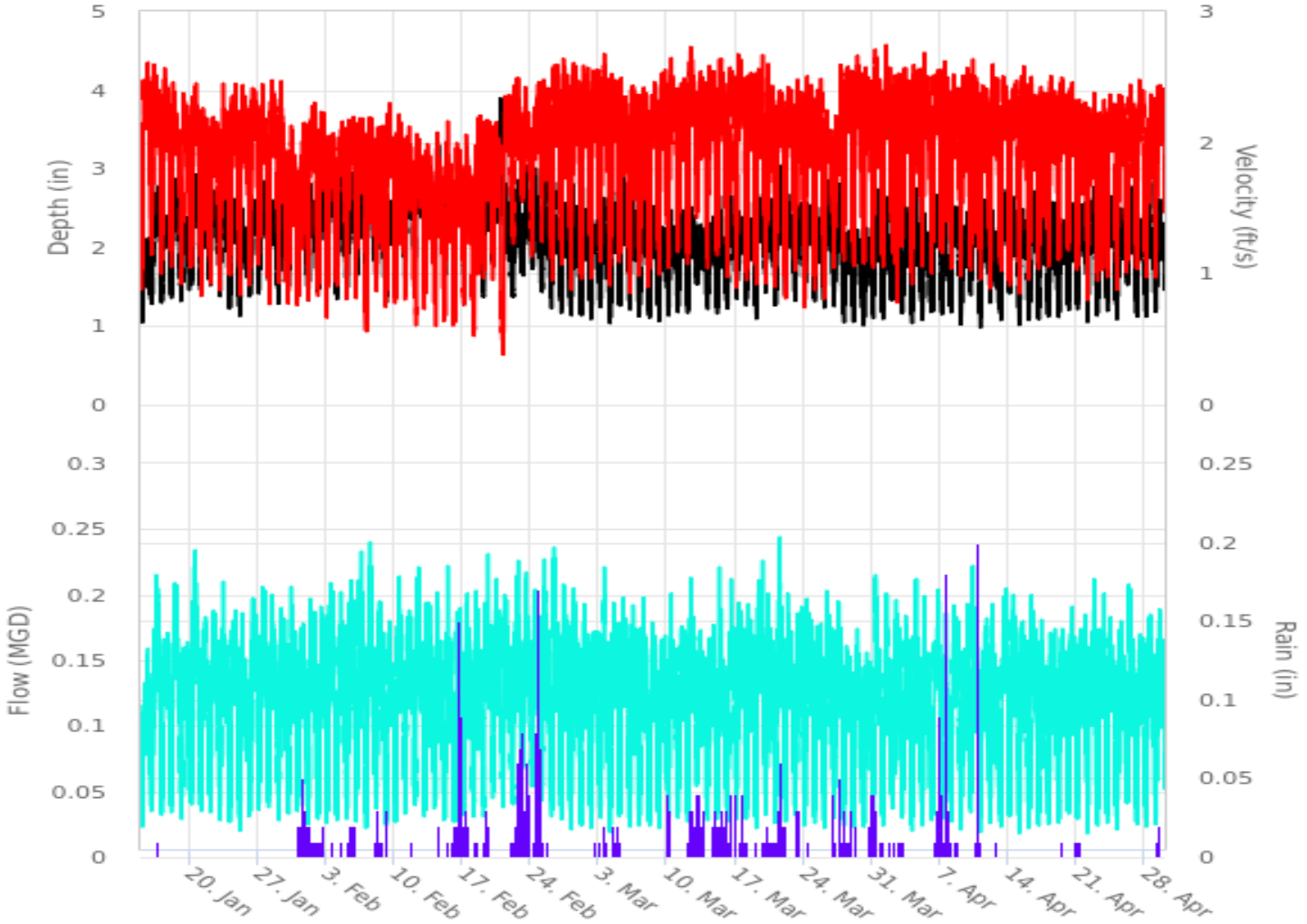
Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL

ADS ENVIRONMENTAL SERVICES



Scattergraph Report

CAM_81189

Flow Monitor

CAM_81189

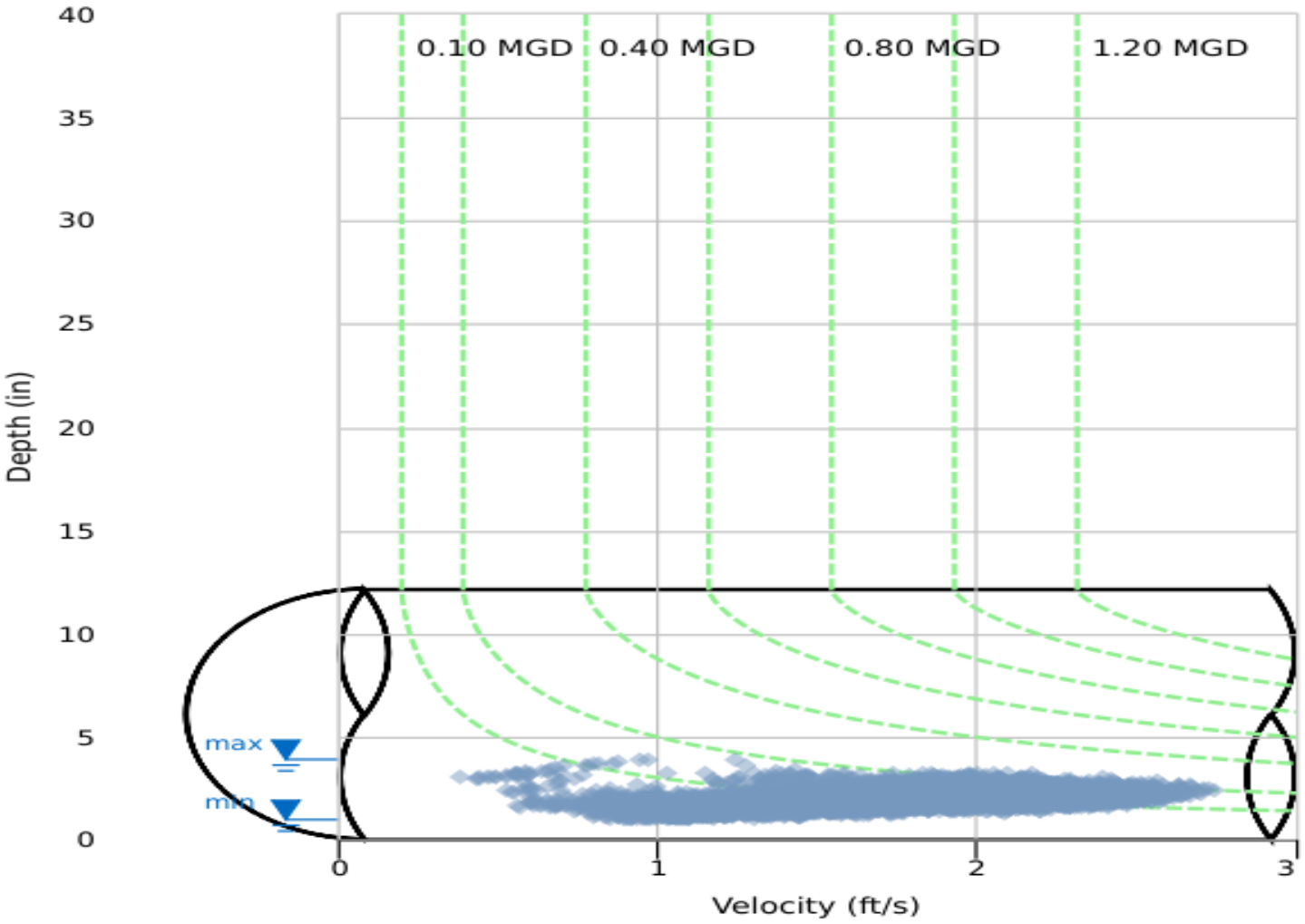
Pipe Height
12.13
in

Report Period

01/15/2025
To
04/29/2025

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth



846 Industry Dr.
Tukwila, WA 98188

800-633-7246
www.adsenv.com

Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_81189 Pipe: Elliptical (12.13 in H x 12.13 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/15/2025	04:55	1.03	09:30	2.34	1.63	02:55	0.86	15:35	2.71	2.08	04:55	0.022	15:35	0.168	0.090	0.090	-
01/16/2025	04:20	1.26	18:25	2.91	2.11	04:35	0.89	09:15	2.65	2.09	04:35	0.026	14:20	0.217	0.133	0.133	0.01
01/17/2025	05:05	1.26	13:55	2.70	1.97	03:45	0.95	11:30	2.66	2.03	05:05	0.030	12:20	0.203	0.115	0.115	-
01/18/2025	04:20	1.31	12:00	2.93	2.19	04:20	1.03	04:25	2.50	1.92	04:20	0.031	12:00	0.226	0.129	0.129	-
01/19/2025	03:05	1.30	16:40	2.70	1.92	06:20	0.87	16:40	2.60	1.82	05:15	0.028	16:40	0.224	0.101	0.101	-
01/20/2025	04:15	1.49	13:45	3.00	2.27	06:15	0.92	11:35	2.63	1.94	06:15	0.037	11:35	0.253	0.137	0.137	-
01/21/2025	03:50	1.41	14:55	2.97	2.09	06:00	0.77	08:20	2.35	1.82	04:25	0.031	15:30	0.196	0.112	0.112	-
01/22/2025	03:55	1.48	15:05	3.08	2.22	05:15	0.74	11:25	2.30	1.78	03:55	0.032	12:05	0.203	0.121	0.121	-
01/23/2025	03:20	1.37	12:55	3.26	2.17	04:15	0.86	11:30	2.60	1.84	04:15	0.028	11:30	0.234	0.121	0.121	-
01/24/2025	02:50	1.22	14:20	2.77	2.05	04:40	0.90	14:15	2.61	1.91	04:40	0.025	14:15	0.222	0.118	0.118	-
01/25/2025	04:45	1.09	11:05	2.53	1.85	04:45	0.80	18:05	2.50	1.91	04:45	0.019	11:05	0.194	0.101	0.101	-
01/26/2025	05:10	1.37	19:55	2.69	2.10	02:30	0.90	08:10	2.51	1.94	02:45	0.030	13:50	0.205	0.123	0.123	-
01/27/2025	03:25	1.39	20:20	2.89	2.21	03:25	1.02	11:30	2.51	1.86	03:25	0.034	11:35	0.224	0.125	0.125	-
01/28/2025	06:25	1.52	18:20	2.94	2.10	05:35	0.63	11:45	2.50	1.91	03:25	0.037	11:50	0.206	0.117	0.117	-
01/29/2025	03:05	1.22	20:50	3.16	2.18	22:25	0.80	10:10	2.52	1.72	03:05	0.024	10:10	0.204	0.113	0.113	-
01/30/2025	05:10	1.47	09:25	3.13	2.34	03:15	0.73	06:10	2.19	1.55	05:10	0.029	10:45	0.209	0.114	0.114	-
01/31/2025	02:20	1.72	15:20	3.07	2.38	04:30	0.70	19:55	2.30	1.57	02:20	0.034	15:55	0.207	0.116	0.116	0.60
02/01/2025	05:00	1.30	09:50	2.89	2.13	05:05	0.78	14:05	2.39	1.80	05:05	0.024	14:05	0.206	0.116	0.116	0.12
02/02/2025	03:55	1.42	19:10	2.99	2.18	05:15	0.79	18:55	2.60	1.74	05:20	0.028	12:00	0.215	0.117	0.117	0.07
02/03/2025	03:45	1.50	16:05	3.30	2.41	02:40	0.64	18:55	2.27	1.66	02:40	0.024	14:35	0.236	0.128	0.128	0.02
02/04/2025	03:45	1.31	13:10	3.19	2.15	01:20	0.88	17:25	2.59	1.73	03:40	0.028	13:15	0.249	0.114	0.114	0.01
02/05/2025	04:10	1.39	15:35	3.41	2.24	02:55	0.75	20:00	2.27	1.77	02:55	0.028	15:35	0.233	0.124	0.124	0.19
02/06/2025	02:55	1.38	15:30	3.78	2.30	02:55	0.78	19:40	2.33	1.76	02:55	0.025	15:30	0.295	0.127	0.127	-
02/07/2025	05:45	1.49	15:10	3.53	2.40	05:05	0.55	08:05	2.44	1.60	02:30	0.022	13:25	0.252	0.125	0.125	-
02/08/2025	02:05	1.55	17:45	3.26	2.44	04:55	0.74	20:10	2.33	1.58	04:55	0.033	20:10	0.228	0.121	0.121	0.25
02/09/2025	05:00	1.27	23:05	2.81	2.02	03:20	0.71	09:20	2.51	1.70	05:00	0.021	13:25	0.196	0.104	0.104	0.05
02/10/2025	02:50	1.36	15:20	3.24	2.32	02:15	0.77	12:10	2.27	1.71	04:00	0.025	10:45	0.229	0.126	0.126	-
02/11/2025	02:45	1.57	18:20	2.95	2.38	04:45	0.72	13:05	2.24	1.61	04:45	0.029	13:10	0.207	0.121	0.121	0.01
02/12/2025	03:05	1.75	12:40	3.28	2.55	05:55	0.60	07:00	2.15	1.55	03:05	0.034	12:00	0.230	0.129	0.129	-
02/13/2025	04:10	1.58	13:40	3.20	2.43	02:40	0.72	07:45	2.01	1.50	02:40	0.030	07:45	0.207	0.116	0.116	-
02/14/2025	04:30	1.61	13:35	3.65	2.38	06:55	0.55	10:30	2.11	1.48	02:50	0.028	10:25	0.207	0.111	0.111	0.07
02/15/2025	06:20	1.62	12:05	3.12	2.38	02:05	0.61	12:05	2.20	1.45	06:20	0.026	12:05	0.232	0.109	0.109	0.09
02/16/2025	03:00	1.60	15:45	3.32	2.40	01:30	0.54	10:30	2.12	1.45	06:10	0.025	10:30	0.207	0.113	0.113	0.77
02/17/2025	03:25	1.62	12:30	3.15	2.46	03:25	0.70	09:05	2.20	1.46	03:25	0.029	09:05	0.215	0.116	0.116	0.39
02/18/2025	23:15	1.81	14:20	3.31	2.40	04:50	0.48	16:10	2.29	1.53	03:35	0.028	10:35	0.219	0.112	0.112	0.02
02/19/2025	04:05	1.35	15:15	3.34	2.22	04:05	0.82	17:45	2.27	1.75	04:05	0.026	15:20	0.238	0.121	0.121	0.40
02/20/2025	04:35	1.74	21:45	3.99	2.55	22:55	0.63	09:15	2.25	1.60	05:50	0.040	12:05	0.221	0.127	0.127	-
02/21/2025	23:40	1.63	00:00	3.38	2.45	04:30	0.37	10:00	2.53	1.64	04:30	0.036	12:45	0.224	0.112	0.112	0.04
02/22/2025	04:45	1.33	19:35	3.08	2.08	05:25	1.15	08:25	2.56	1.99	04:45	0.036	17:15	0.235	0.124	0.124	0.84
02/23/2025	06:20	1.59	14:00	3.11	2.25	23:15	1.35	11:10	2.43	1.94	06:20	0.057	11:40	0.226	0.131	0.131	1.07
02/24/2025	04:50	1.66	12:45	3.09	2.19	05:30	1.06	20:25	2.52	1.95	04:50	0.046	12:40	0.215	0.128	0.128	0.87
02/25/2025	04:20	1.39	11:55	3.24	2.08	23:05	1.11	08:25	2.55	2.00	04:20	0.037	11:55	0.251	0.124	0.124	0.03
02/26/2025	03:50	1.21	10:05	2.96	2.08	04:55	0.91	17:50	2.72	2.11	03:50	0.030	10:05	0.264	0.132	0.132	-
02/27/2025	03:25	1.14	12:40	2.87	2.01	04:35	0.98	08:30	2.68	2.10	03:25	0.026	11:05	0.225	0.125	0.125	-
02/28/2025	05:00	1.11	09:35	3.31	1.96	03:30	0.86	10:10	2.71	2.04	05:00	0.021	11:25	0.215	0.118	0.118	-
03/01/2025	03:55	1.12	22:00	2.89	1.91	05:15	0.83	09:35	2.67	2.07	05:15	0.020	12:00	0.202	0.115	0.115	-
03/02/2025	04:30	1.08	19:50	2.40	1.88	04:30	0.93	11:10	2.65	2.08	04:30	0.021	12:15	0.185	0.114	0.114	0.05
03/03/2025	04:30	1.21	13:50	2.77	1.95	01:50	1.03	13:05	2.73	2.13	04:30	0.028	13:50	0.237	0.121	0.121	0.07
03/04/2025	03:50	1.02	08:45	3.19	1.95	03:40	0.89	13:20	2.70	2.02	03:40	0.019	21:55	0.214	0.115	0.115	0.12
03/05/2025	02:25	1.25	12:25	3.34	2.09	02:15	1.05	07:15	2.65	1.94	02:15	0.031	12:50	0.219	0.121	0.121	0.01
03/06/2025	04:40	1.20	12:15	2.75	2.07	04:35	0.85	10:45	2.53	1.90	04:35	0.023	12:10	0.198	0.117	0.117	-
03/07/2025	02:35	1.10	14:55	2.65	1.96	23:30	0.71	11:50	2.57	1.91	02:35	0.023	14:35	0.203	0.110	0.110	-
03/08/2025	05:00	1.09	13:15	2.72	1.89	04:45	0.86	13:40	2.53	1.99	04:45	0.021	13:10	0.198	0.109	0.109	-
03/09/2025	04:20	1.06	12:25	2.40	1.83	04:20	0.98	12:25	2.59	2.05	04:20	0.022	12:25	0.188	0.107	0.107	0.20
03/10/2025	03:45	1.12	10:15	2.52	1.91	03:40	0.99	10:15	2.71	2.09	03:40	0.024	10:15	0.211	0.115	0.115	0.22
03/11/2025	01:45	1.16	14:05	2.55	1.95	01:45	1.00	09:50	2.62	2.08	01:45	0.025	10:20	0.189	0.117	0.117	0.02
03/12/2025	02:40	1.16	10:00	2.63	1.94	02:35	1.07	09:50	2.80	2.15	02:35	0.027	10:00	0.230	0.122	0.122	0.83
03/13/2025	23:50	1.30	18:15	2.34	1.89	23:50	1.25	19:20	2.62	2.12	23:50	0.037	10:50	0.180	0.112	0.112	0.49
03/14/2025	04:05	1.20	11:00	2.52	1.89	04:05	0.98	08:05	2.76	2.04	04:05	0.026	18:15	0.203	0.111	0.111	0.16
03/15/2025	03:20	1.16	08:35	2.68	1.89	00:45	1.08	11:15	2.71	2.12	03:25	0.028	08:30	0.225	0.116	0.116	0.60
03/16/2025	04:20	1.21	13:15	2.88	1.93	04:45	0.89	15:20	2.63	2.06	04:45	0.025	13:15	0.238	0.116	0.116	0.16
03/17/2025	03:30	1.33	08:25	2.63	2.00	02:00	0.80	13:40	2.79	2.12	03:30	0.026	13:45	0.206	0.124	0.124	0.19
03/18/2025	02:30	1.25	08:20	2.61	1.95	03:30	0.91	10:10	2.79	2.05	02:30	0.028	08:20	0.199	0.116	0.116	0.02
03/19/2025	03:40	1.09	08:20	2.76	2.06	03:20	0.85	18:45	2.79	2.02	03:20	0.021	18:45	0.236	0.126	0.126	0.07
03/20/2025	02:15	1.40	12:30	2.67	2.04	02:00	0.90	08:15	2.71	1.96	02:00	0.030	08:15	0.214	0.117	0.117	0.11
03/21/2025	01:25	1.24	13:50	3.12	2.15	02:35	0.81	12:20	2.52	1.93	02:35	0.024	13:45	0.256	0.127	0.127	1.12
03/22/2025	02:40	1.38	08:40	2.72	2.09	03:35	0.69	09:30	2.53	1.93	03:35	0.024	08:35	0.205	0.121	0.121	-
03/23/2025	02:20	1.28	11:15	2.61	2.07	02:20	0.97	09:10	2.49	1.96	02:20	0.028	11:15	0.197	0.121	0.121	0.44
03/24/2025	03:35	1.31	16:15	2.64	2.10	02:00	0.71	09:00	2.60	1.96	03:35	0.022	18:10	0.202	0.124	0.124	0.01

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/25/2025	03:15	1.30	08:15	2.67	1.98	03:35	0.84	09:05	2.65	1.98	03:35	0.025	10:40	0.205	0.115	0.115	-
03/26/2025	02:40	1.22	07:40	3.02	2.15	02:35	0.77	07:40	2.37	1.81	02:35	0.021	07:40	0.239	0.120	0.120	0.20
03/27/2025	01:50	1.22	12:05	2.90	2.08	01:50	1.00	18:55	2.65	1.89	01:50	0.027	12:10	0.209	0.117	0.117	0.24
03/28/2025	03:35	1.03	19:55	2.55	1.78	03:35	1.04	13:05	2.71	2.11	03:35	0.022	09:00	0.169	0.105	0.105	0.17
03/29/2025	02:10	1.04	11:00	2.38	1.75	03:30	1.04	09:55	2.70	2.14	03:30	0.023	12:25	0.178	0.105	0.105	0.12
03/30/2025	02:55	0.99	11:00	2.42	1.65	04:35	1.01	18:30	2.66	2.08	04:35	0.021	11:00	0.181	0.093	0.093	0.23
03/31/2025	03:40	1.09	13:30	2.79	1.91	02:05	0.99	07:50	2.77	2.10	03:45	0.023	08:50	0.218	0.116	0.116	0.10
04/01/2025	03:25	1.08	13:50	2.88	1.80	03:25	1.02	10:45	2.85	2.06	03:25	0.023	10:45	0.225	0.105	0.105	0.03
04/02/2025	02:50	1.29	14:05	3.92	2.03	14:20	0.69	16:20	2.72	1.99	02:50	0.035	11:15	0.211	0.115	0.115	0.05
04/03/2025	03:55	1.14	10:45	2.65	1.87	02:25	1.18	17:25	2.65	2.08	02:25	0.030	08:05	0.200	0.110	0.110	0.02
04/04/2025	02:55	1.02	10:20	2.89	1.91	02:55	0.91	23:00	2.71	2.02	02:55	0.019	10:20	0.235	0.113	0.113	-
04/05/2025	03:55	1.06	09:05	2.49	1.77	02:45	1.00	08:45	2.73	2.09	03:55	0.023	09:05	0.207	0.103	0.103	-
04/06/2025	01:05	1.13	19:10	2.83	1.95	03:35	0.94	19:45	2.64	2.10	03:35	0.024	19:45	0.219	0.120	0.120	0.71
04/07/2025	04:15	1.15	14:00	2.99	1.73	13:30	0.91	11:15	2.65	2.10	04:25	0.024	13:55	0.199	0.098	0.098	0.37
04/08/2025	03:45	1.17	14:55	2.57	2.02	02:35	0.97	04:25	2.61	2.03	02:35	0.025	09:20	0.199	0.122	0.122	0.07
04/09/2025	02:45	1.01	18:15	2.50	1.86	02:15	0.96	18:15	2.68	2.03	02:50	0.021	18:15	0.206	0.108	0.108	-
04/10/2025	03:25	1.38	09:25	2.89	2.11	03:25	1.02	11:45	2.77	2.06	03:25	0.033	08:30	0.236	0.130	0.130	0.27
04/11/2025	02:50	0.98	13:55	2.71	1.96	02:45	0.95	06:30	2.47	1.97	02:50	0.019	17:50	0.193	0.114	0.114	0.01
04/12/2025	23:55	1.19	09:05	2.52	1.83	02:10	0.88	09:00	2.66	2.02	02:25	0.026	09:00	0.207	0.104	0.104	0.01
04/13/2025	05:40	1.07	20:05	2.79	2.06	05:20	0.99	10:20	2.58	1.99	05:20	0.023	20:00	0.215	0.124	0.124	-
04/14/2025	01:50	1.38	12:55	2.68	2.02	03:30	0.86	19:25	2.58	2.01	03:30	0.029	14:15	0.207	0.119	0.119	-
04/15/2025	02:35	1.01	10:50	2.55	1.87	02:35	0.83	13:30	2.70	1.98	02:35	0.017	10:50	0.195	0.108	0.108	-
04/16/2025	01:55	1.05	14:05	2.85	1.99	01:55	0.90	08:30	2.56	1.98	01:55	0.020	08:30	0.206	0.116	0.116	-
04/17/2025	02:50	1.04	14:00	2.61	1.88	02:45	0.96	07:45	2.57	1.98	02:50	0.021	09:00	0.188	0.106	0.106	-
04/18/2025	02:20	1.10	13:45	2.79	1.88	02:15	0.92	06:40	2.68	2.04	02:15	0.021	13:40	0.193	0.110	0.110	-
04/19/2025	03:40	1.10	15:15	2.41	1.91	05:35	1.08	10:55	2.59	2.05	02:20	0.026	10:55	0.180	0.113	0.113	0.01
04/20/2025	04:25	1.16	13:05	2.74	2.00	02:35	0.94	07:10	2.50	2.01	02:35	0.026	13:05	0.211	0.118	0.118	0.05
04/21/2025	02:15	1.16	07:20	2.90	2.08	01:05	0.99	06:55	2.44	1.94	02:15	0.025	10:40	0.197	0.120	0.120	0.02
04/22/2025	02:35	1.05	18:35	2.87	2.07	02:20	0.73	11:05	2.45	1.88	02:20	0.017	18:35	0.226	0.117	0.117	-
04/23/2025	00:40	1.13	08:25	4.16	2.16	12:25	0.65	19:30	2.35	1.78	03:40	0.019	19:35	0.210	0.117	0.117	-
04/24/2025	03:30	1.18	08:55	2.97	2.01	01:30	0.93	09:55	2.57	1.91	03:30	0.025	08:55	0.210	0.113	0.113	-
04/25/2025	02:45	1.08	11:15	2.58	1.98	02:40	0.82	08:20	2.50	1.92	02:40	0.019	08:25	0.191	0.112	0.112	-
04/26/2025	04:05	1.40	10:35	3.07	2.16	02:40	0.87	11:20	2.53	1.95	04:05	0.031	10:35	0.231	0.126	0.126	-
04/27/2025	02:15	1.11	20:15	2.51	1.92	02:20	0.88	09:30	2.51	2.00	02:20	0.021	12:30	0.182	0.112	0.112	-
04/28/2025	01:30	1.07	10:55	2.93	2.03	03:15	0.92	12:50	2.50	1.92	01:30	0.021	12:50	0.216	0.116	0.116	-
04/29/2025	01:00	1.15	11:35	2.83	2.00	02:25	0.96	10:45	2.50	2.04	02:25	0.025	11:35	0.218	0.119	0.119	0.13

01/15/2025 00:00 - 04/29/2025 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			12.250	13.62
Average	2.07	1.91	0.117	

CAM_RG

Site Commentary

SITE INFORMATION

Rain Collector Dimensions	8”

OBSERVATIONS

A review of the hydrograph indicates CAM_RG functioned under normal conditions during the study.

The total rainfall recorded during the monitoring period was 13.62 inches.

DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
Rain	100

Camas.Carollo.TFM.WA24

Rainfall Monitoring Site Report

ADS ENVIRONMENTAL SERVICES®

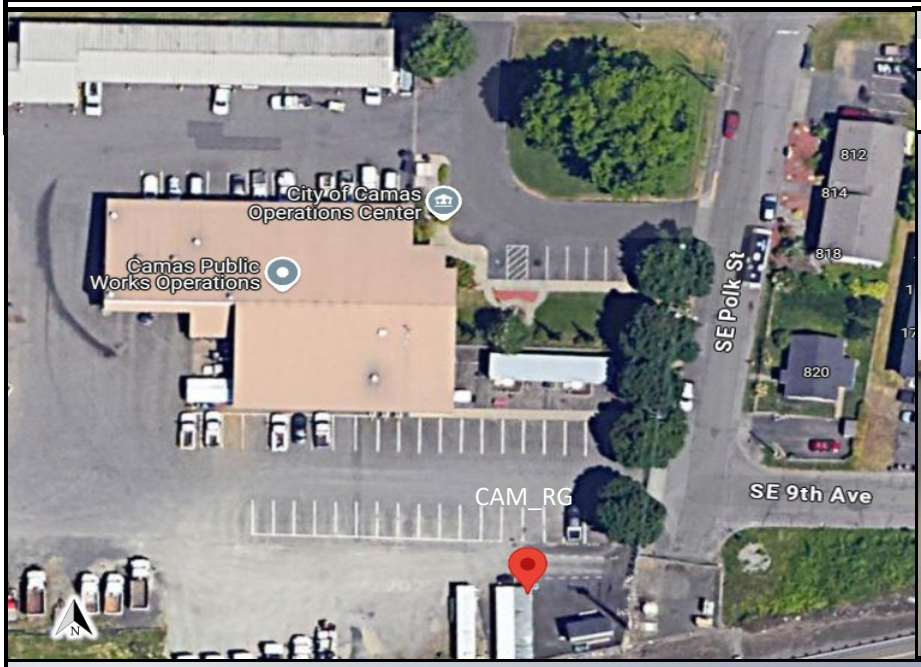
Site Name

CAM_RG

Site Address /Location:	1620 SE 8th Ave, Camas, WA 98607		
Site Access Details:	On Roof	Latitude:	45.5800529
		Longitude:	-122.3918594

Monitor Series	Location Type
Rain Alert III	Temporary
Installation Date	
1.14.2025	

Location	
On Roof	
Access	Traffic
Drive	None







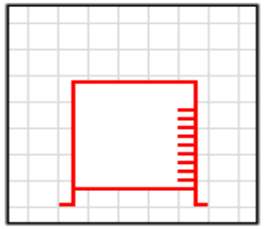
ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23081.11.325

Hydrograph Report

CAM_RG

Rain Gauge

CAM_RG

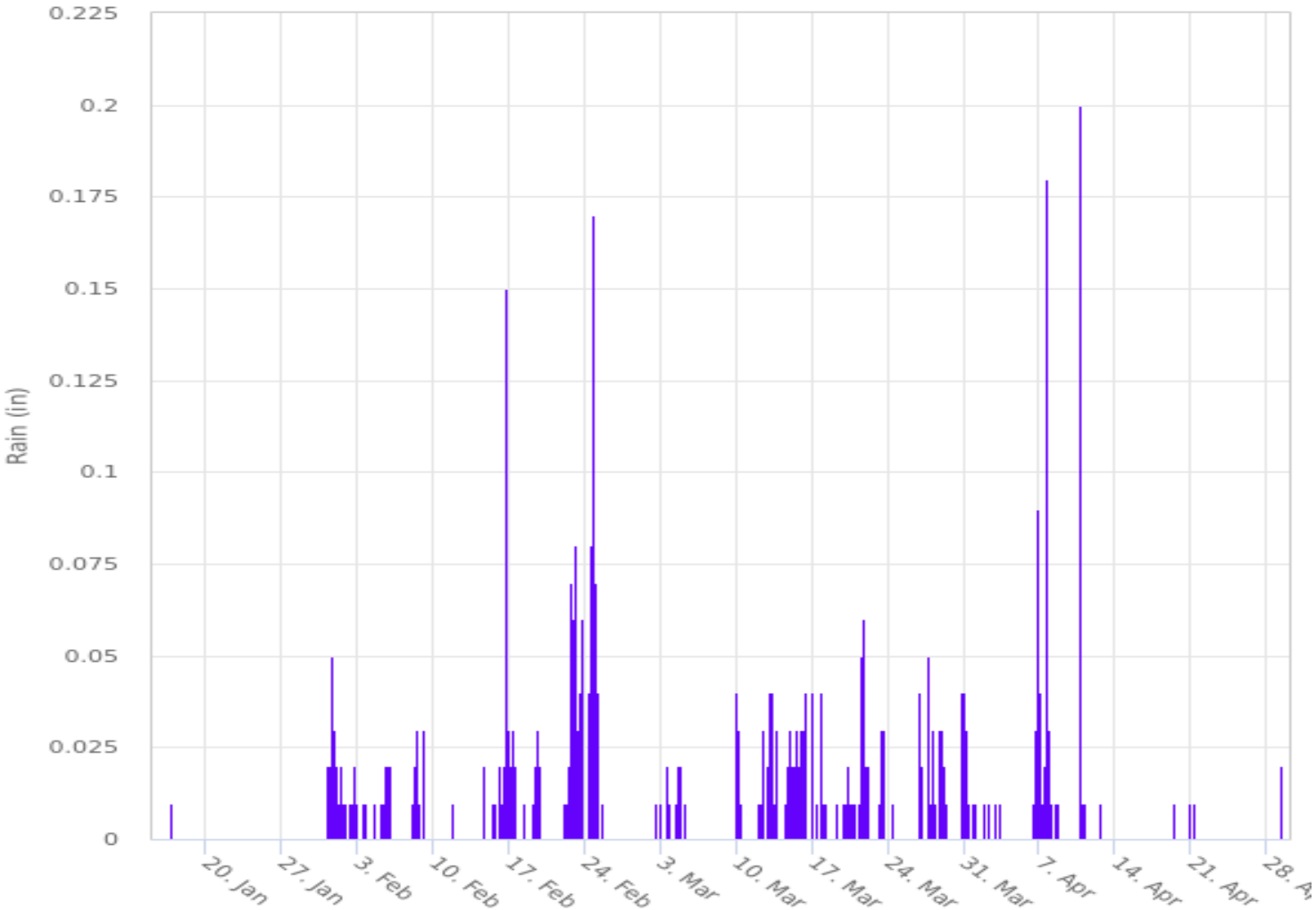


Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL



846 Industry Dr.
Tukwila, WA 98188

800-633-7246
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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_RG

	RAIN FINAL (in)
Date	Total
01/15/2025	-
01/16/2025	0.01
01/17/2025	-
01/18/2025	-
01/19/2025	-
01/20/2025	-
01/21/2025	-
01/22/2025	-
01/23/2025	-
01/24/2025	-
01/25/2025	-
01/26/2025	-
01/27/2025	-
01/28/2025	-
01/29/2025	-
01/30/2025	-
01/31/2025	0.60
02/01/2025	0.12
02/02/2025	0.07
02/03/2025	0.02
02/04/2025	0.01
02/05/2025	0.19
02/06/2025	-
02/07/2025	-
02/08/2025	0.25
02/09/2025	0.05
02/10/2025	-
02/11/2025	0.01
02/12/2025	-
02/13/2025	-
02/14/2025	0.07
02/15/2025	0.09
02/16/2025	0.77
02/17/2025	0.39
02/18/2025	0.02
02/19/2025	0.40
02/20/2025	-
02/21/2025	0.04
02/22/2025	0.84
02/23/2025	1.07
02/24/2025	0.87
02/25/2025	0.03
02/26/2025	-
02/27/2025	-
02/28/2025	-
03/01/2025	-
03/02/2025	0.05
03/03/2025	0.07
03/04/2025	0.12
03/05/2025	0.01
03/06/2025	-
03/07/2025	-
03/08/2025	-
03/09/2025	0.20
03/10/2025	0.22
03/11/2025	0.02
03/12/2025	0.83
03/13/2025	0.49
03/14/2025	0.16
03/15/2025	0.60
03/16/2025	0.16
03/17/2025	0.19
03/18/2025	0.02
03/19/2025	0.07
03/20/2025	0.11
03/21/2025	1.12
03/22/2025	-
03/23/2025	0.44
03/24/2025	0.01
03/25/2025	-

01/15/2025 00:00 - 04/29/2025 23:59

	RAIN FINAL (in)
Date	Total
03/26/2025	0.20
03/27/2025	0.24
03/28/2025	0.17
03/29/2025	0.12
03/30/2025	0.23
03/31/2025	0.10
04/01/2025	0.03
04/02/2025	0.05
04/03/2025	0.02
04/04/2025	-
04/05/2025	-
04/06/2025	0.71
04/07/2025	0.37
04/08/2025	0.07
04/09/2025	-
04/10/2025	0.27
04/11/2025	0.01
04/12/2025	0.01
04/13/2025	-
04/14/2025	-
04/15/2025	-
04/16/2025	-
04/17/2025	-
04/18/2025	-
04/19/2025	0.01
04/20/2025	0.05
04/21/2025	0.02
04/22/2025	-
04/23/2025	-
04/24/2025	-
04/25/2025	-
04/26/2025	-
04/27/2025	-
04/28/2025	-
04/29/2025	0.13

	RAIN FINAL (in)
Total	13.62
Average	

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15201 Springdale St • Huntington Beach, CA 92649
PHONE: 714.379.9778

TECHNICAL MEMORANDUM

Subject: Camas, WA Flow Monitoring Wet Weather Analysis

Prepared For: Carollo

Prepared By: Paul Mitchell, Regional Engineer

Date: May 23, 2025

Background

In addition to sewer flow monitoring and data delivery conducted as part of this temporary deployment of 4 flow monitors, ADS also conducted a wet weather analysis which also takes into account rain data collected from the single deployed temporary rain gauge. This wet weather analysis was conducted to assess Rainfall Dependent Infiltration and Inflow (RDII) attributed to each of the 4 monitored tributaries which could then be used to assist in relative prioritization of those tributary areas (or basins) based on computed and normalized RDII volume per inch rain per acre (converted to % rainfall ingress).

Methodology

The methodology used for this evaluation includes the following primary tasks:

- Evaluate the available data using ADS' Sliicer™ application for evaluating RDII. This includes determination of typical net average dry day flow (ADF).
- Determine RDII for each storm event meeting minimum criteria discussed herein and compute RDII volume associated with each rain event.
- Generate an RDII volume vs. rainfall volume chart (called a Q-vs-i chart) from each storm event data point for each evaluated site/basin and fit a regression line through the data on the Q-vs-i chart.
- Normalize the RDII using the Q-vs-i chart by dividing the slope of the regression line (Gallons RDII per inch rain) by acreage to generate values of % ingress attributed to each site/basin. Use this result to rank relative RDII performance of the site/basins.

Wet Weather Analysis

This section describes an evaluation of wet weather impacts on system flows, defined as Rainfall Dependent Infiltration and Inflow (RDII). This evaluation was based on available flow data provided during the approximate 3 month duration of the flow study. This is done by evaluating excess flow volumes from the studied sewer shed areas (basins) associated with each flow monitoring site during rain events that occurred during the available data periods at each of the 4 locations. This section also describes an evaluation of dry weather flow data for purposes of determining base wastewater flows (to compare wet weather flows against).

Each flow monitoring site represents a defined tributary area (or basin) and each was identified with a simple alpha-numeric ID – CAM_100290, CAM_51123, etc. The Sliicer™ application recognizes basins as having the same name as the monitors used to determine tributary flows (i.e. sites and basins have the same ID). One of the flow sites, CAM_51123, relied upon subtracting flow from a flow monitor upstream (CAM_100290) to define net flow for basin CAM_51123. Table 1 provides a summary of site/basins, site schematic defining each evaluated basin, and size of each basin (acres).

Dry Weather Flow

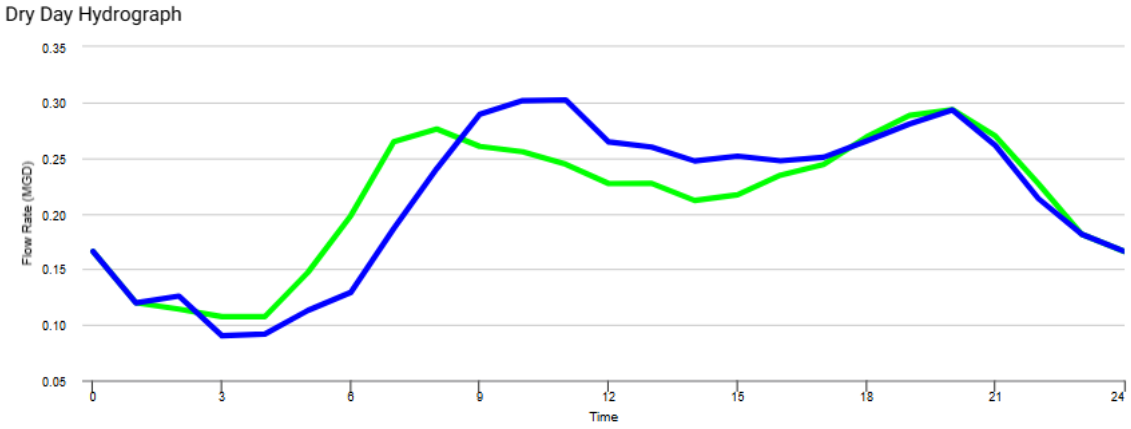
Prior to conducting a wet weather analysis, dry weather flow patterns must first be determined by reviewing data obtained during dry weather conditions at each location. For this analysis, a *dry day* is defined as any day in which there was less than 0.10 in. of rain in the previous day, less than 0.50 in. of rain in the previous three days, and less than 1.00 in. of rain in the previous five days. This process automatically eliminates the selection of most wet weather events and the periods associated with recovery from these events. Once the initial dry days are selected, they are compared to one another to make sure that the flow pattern for each day is repeatable. Any days that have an inconsistent flow pattern are removed from consideration. The resulting dry days are then averaged to establish an average diurnal flow pattern from the site, called an Average Dry day (ADF) pattern. The dry weather analysis evaluates the weekday pattern separate from the weekend pattern to account for differences often observed.

Dry weather flows were evaluated for each flow monitor location from the available data provided. Recorded flow rates from the sanitary sewer monitoring location for each dry day are overlaid on a hydrograph, enabling a hydrograph of the Average Dry day Flow (ADF) to be determined for Weekdays (green curve) and Weekends (blue curve) as depicted in Figure 1 for site/basin CAM_100290. ADF hydrographs for each site are included in Appendix A. Table 1 summarizes the ADF values (weekdays) for each site/basin.

Table 1
Basin Summary Data

Site/ Basin	Pipe Diameter (in)	Added or Upstream Subtracted FM Sites to Determine Net Basin Flow	Basin Size (Acres)	Gross ADDF Weekday (mgd)	Net ADDF Weekday (mgd)
CAM_100290	19	+(CAM_100290)	476	0.22	0.22
CAM_51123	20	+(CAM_51123) - (CAM_100290)	1159	0.77	0.55
CAM_52167	18	+(CAM_52167)	299	0.19	0.19
CAM_81189	12	+(CAM_81189)	136	0.12	0.12
		Total	2071		1.08

Figure 1
Average Dry Day Flow (ADF) Hydrograph – Site/Basin CAM_100290



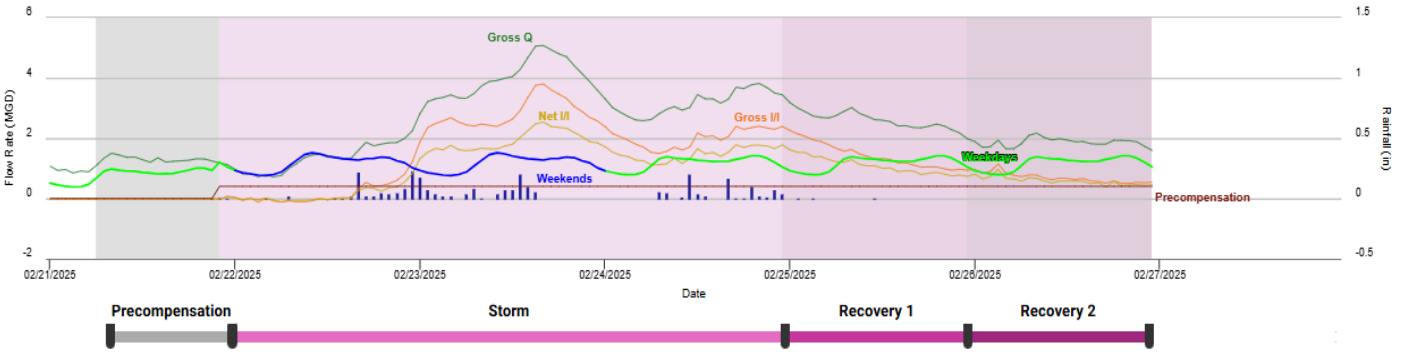
Wet Weather RDII Analysis

A wet weather RDII analysis is performed by comparing specific wet weather events to average dry weather flows (ADF). Based on criteria for a “storm” as being a rain event with at least 0.8 inch of rain with no rain interruption of more than 12 hours, there were 5 rain “storm” events captured during the flow study period. Captured storm volumes ranged from 1.15 inches (April 6, 2025) to 2.84 inches (February 21, 2025). Based on the concurrent periods of flow and rain “storm” data available at each site, an RDII analysis was conducted to characterize the impact of wet weather on flow measured in the basins.

Recorded flow rates for a specific storm event are plotted against average dry weather conditions. The difference observed represents the rain-dependent inflow and infiltration

(RDII or I/I) entering the sanitary sewer system upstream from each monitoring location and is called a storm hydrograph. Figure 2 depicts a storm hydrograph for site/basin CAM_51123 during the largest captured storm event period (from February 21 to 26, 2025).

Figure 2
Storm Hydrograph – Site/Basin CAM_51123



RDII calculations are made for each storm event (the ~5 day period depicted by purple colored bands above for the storm event starting February 21). The first period (shown as a 3 day duration in Figure 2) following the onset of rain is referred to as the Storm Period. The darker purple period following the Storm Period is referred to as Recovery 1, and the next period is referred to as Recovery 2. For purposes of this evaluation, the entire "Event" was used for this analysis which covers the Storm and both Recovery periods. Figure 2 also depicts precompensation which is an upward adjustment made to the ADF pattern so that pattern and the actual flow on storm onset were the same. This effectively compensates for flow that is already elevated leading into a given storm event; enabling a more accurate RDII response to be quantified only from the indicated storm under evaluation.

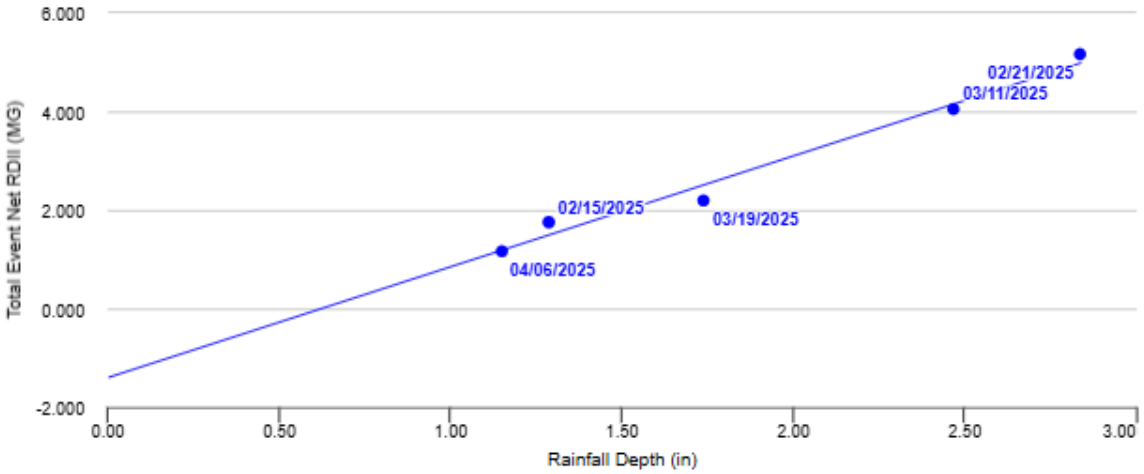
The storm hydrographs for this location showed excess flow responses (shown as "Gross I/I" in the above hydrograph) follow closely with a slight delay to the rainfall pattern. The Gross I/I is the difference between the actual recorded flow (shown as "Gross Q") minus the ADF weekend and weekday pattern. For cases where the net RDII for a basin is determined by subtraction of an upstream flow site (see Table 1), the hydrographs also show a "Net I/I" component as is the case for site/basin CAM_51123 above.

Also, in the case of CAM_51123, the delayed and significant yet muted or delayed response to rainfall may be indicative of predominantly indirect storm drainage pathways (i.e., the infiltration component of RDII). Storm hydrographs of the 5 selected storms for all locations are included in Appendix A.

Once the calculations were complete for each storm event, excess wet weather flow volumes were plotted as a function of rainfall volume on graphs commonly referred to as

Q-vs-i graphs; each with best fit regression lines drawn. The rain volume vs. excess flow volume Q-vs-i chart is shown in Figure 3 for site/basin CAM_51123. These charts for all other locations are included in Appendix A.

Figure 3
Q-vs-i graph for CAM_51123



These volume-based Q-vs-i graphs for the basins generally show a good visual (regression line) correlation between excess wastewater volume and rainfall. The Q-vs-i graph for CAM_51123 projects about 2 million gallons of I/I would be generated from about 1.5 inches of rain. However, there is an apparent threshold (X-intercept) of about 0.5 or 0.6 inches of rain in the above Q-vs-i graph; below which there is little to no RDII response. This means projected RDII vs rainfall volumes based on regression line slope will be greater than individual storm values. These graphs are included for all the site/basins in Appendix A. Caution is warranted in attempting to extrapolate higher rainfall responses from these Q-vs-i graphs since the linear extrapolation may not remain fully intact during significantly stronger storm events. A summary of individual RDII response data points (MG/inch) per storm is provided in Table 2.

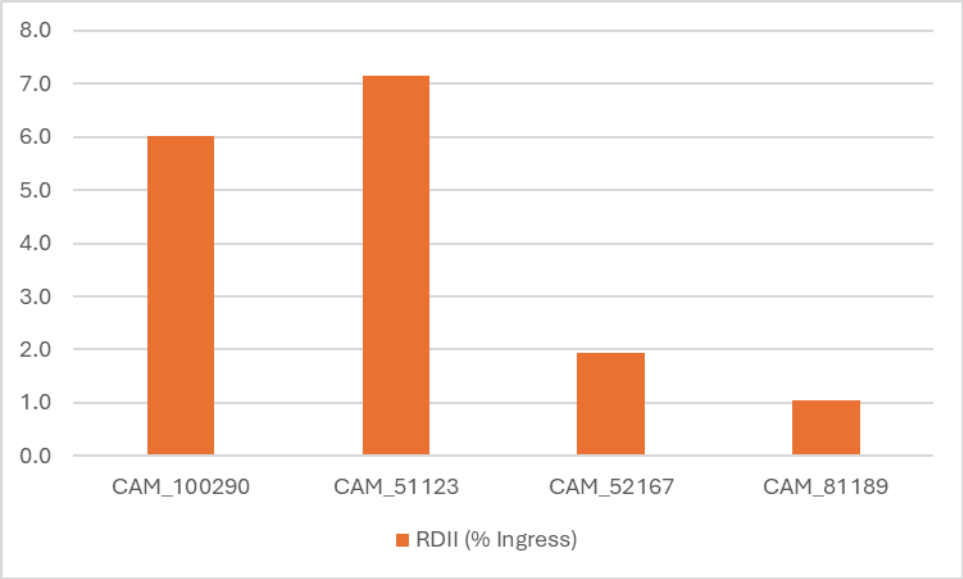
Table 2
Basin RDII Storm Response Summary

	Storm RDII (MG/inch)				
Site/ Basin	2/15/2025 (1.29")	2/21/2025 (2.84")	3/11/2025 (2.47")	3/19/2025 (1.74")	4/6/2025 (1.15")
CAM_100290	0.57	0.68	0.64	0.48	0.52
CAM_51123	1.36	1.82	1.64	1.26	1.01
CAM_52167	0.16	0.14	0.20	0.12	0.17
CAM_81189	0.01	0.03	0.01	0.03	0.00

To properly characterize relative I/I performance among the sites/basins evaluated, the wet weather I/I responses must also be normalized according to basin size. This is done by taking the slope of the Q-vs-i responses described above (gallons RDII / inch rain) and dividing by basin area (acres – see Table 1) to yield normalized values of RDII response in terms of projected % rainfall ingress. These rain and size normalized % ingress values based on Q-vs-i projected slopes are summarized in Figure 4.

As a general rule, basins may be considered to yield excessive RDII if such normalized values are much greater than 5. Two of the 4 site/basins evaluated slightly exceeded this value.

Figure 4
Projected RDII (% Rainfall Ingress)



The computed values for ADF and rain & area normalized projected RDII volumes (including % Ingress) are summarized in Table 3. Hydrographs of the flow monitoring period, dry day hydrographs, storm hydrographs, and volume-based Q vs i graphs are included in Appendix A.

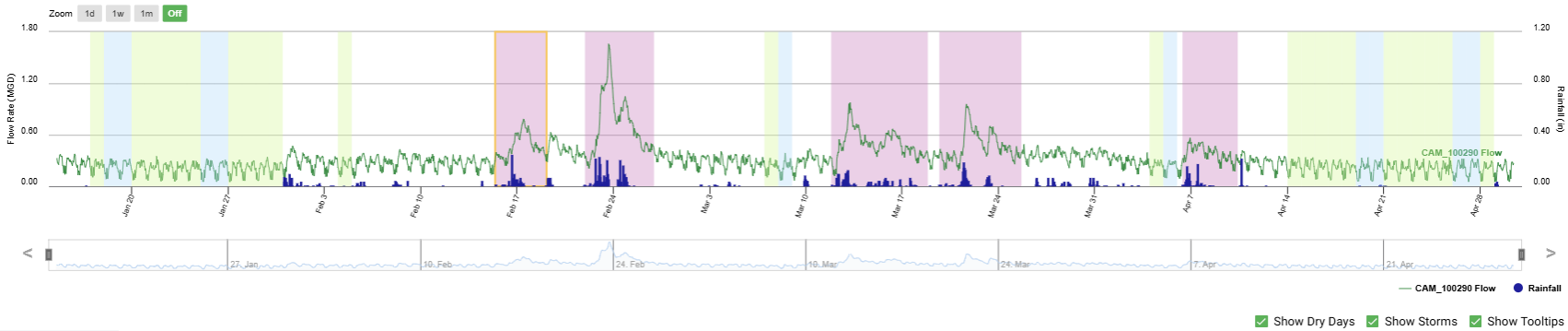
Table 3
Basin Dry and Wet Weather Performance Summary

Site/ Basin	Pipe Diameter (in)	Basin Size (Acres)	Net ADDF Weekday (mgd)	Projected Net RDII (MG/in)	Projected Net RDII (%rain ingress)
CAM_100290	19	476	0.22	0.78	6.0
CAM_51123	20	1159	0.55	2.25	7.1
CAM_52167	18	299	0.19	0.16	1.9
CAM_81189	12	136	0.12	0.04	1.0

Appendix A

Study period Hydrographs, ADF hydrographs, Storm hydrographs, and Q vs i graphs

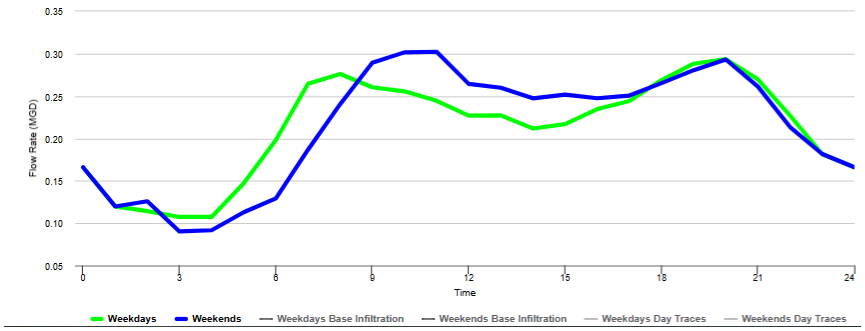
Hydrograph with Basin Rainfall: 01/14/2025 - 04/30/2025 | Basin CAM_100290 | Edit Dry Days

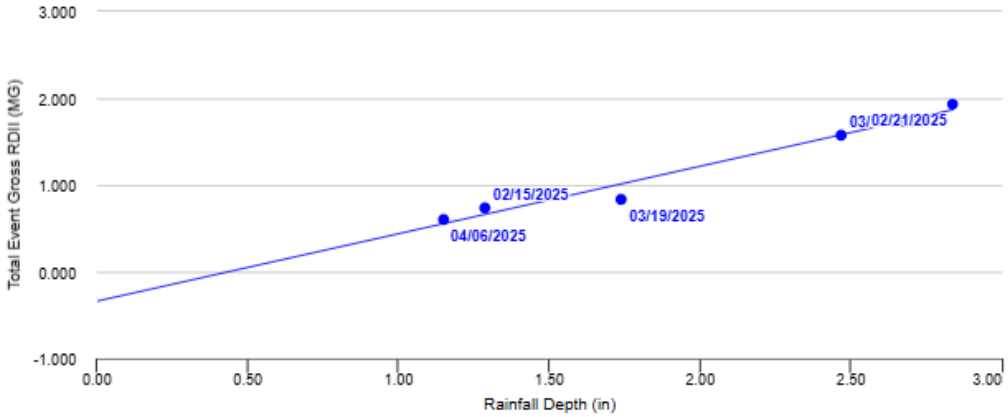


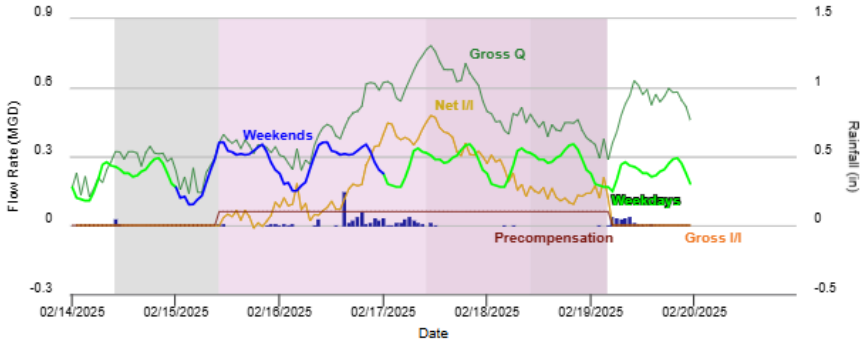
Show Dry Days | Show Storms | Show Tooltips

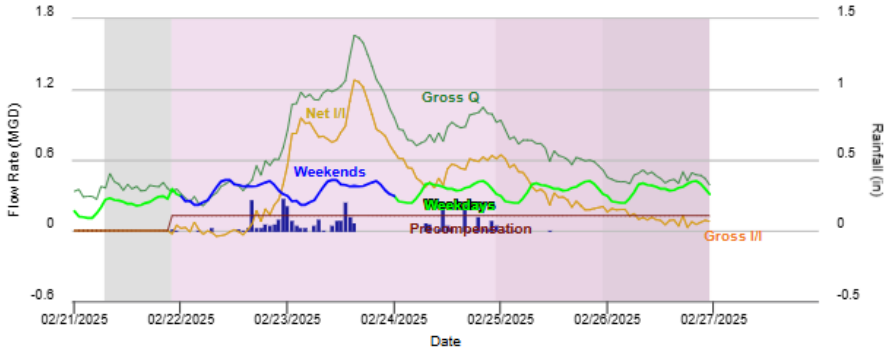
DRY DAYS | STORM EVENTS | STATISTICS

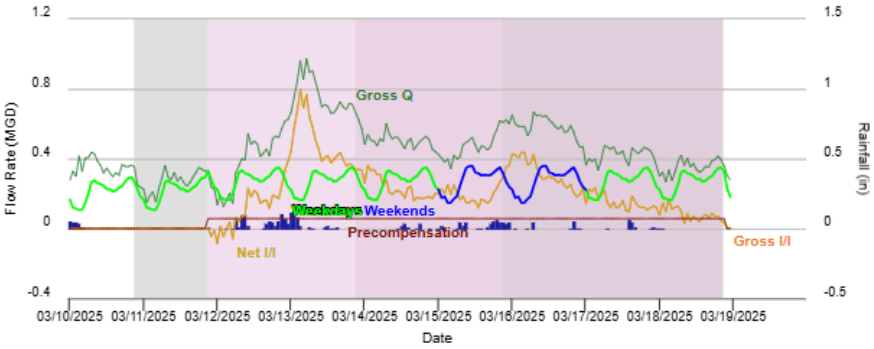
Dry Day Hydrograph

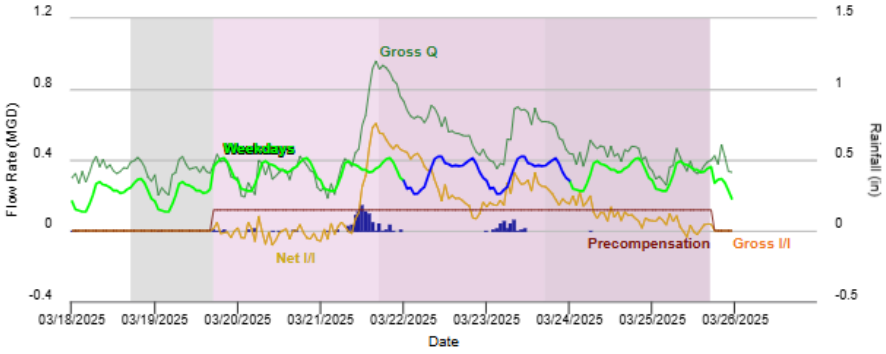


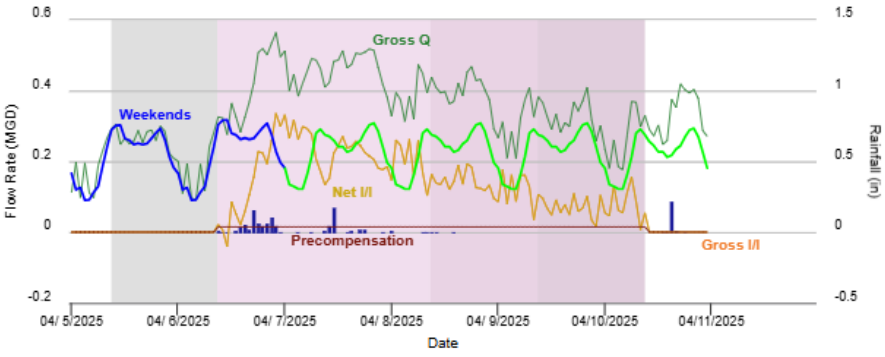



Gross Q
Net I/I
Weekends
Weekdays
Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
02/14/2025
02/15/2025
02/16/2025
02/17/2025
02/18/2025
02/19/2025
02/20/2025

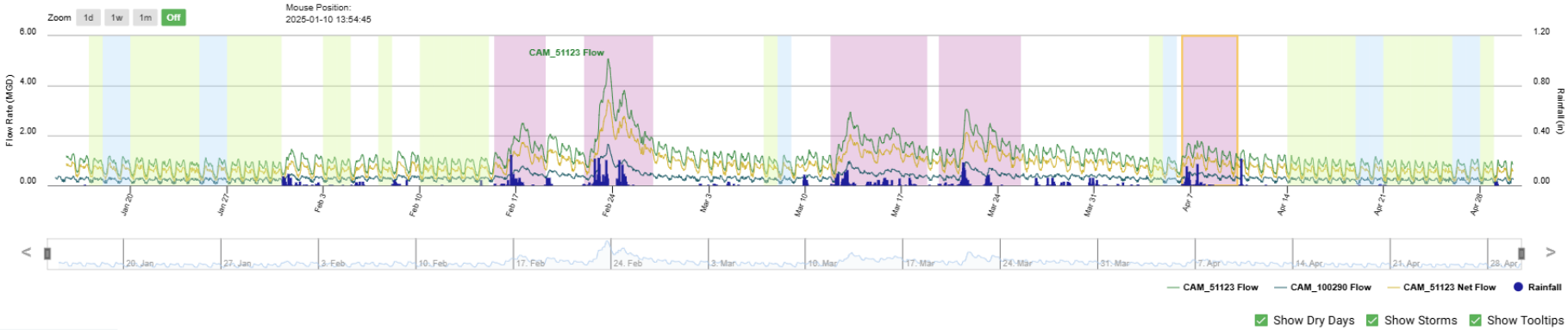

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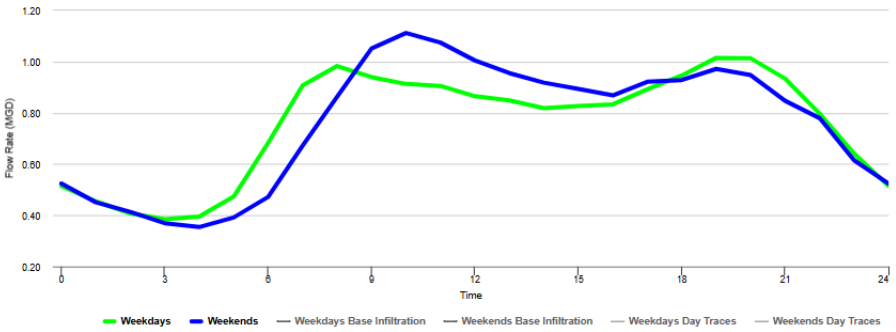

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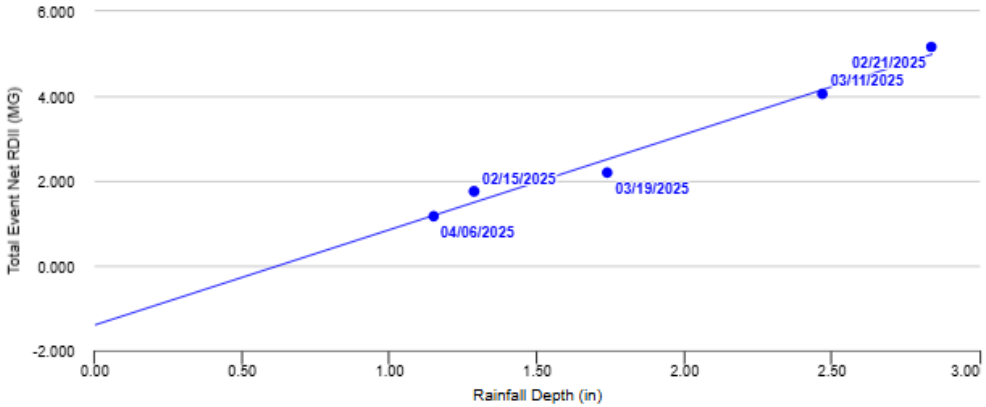
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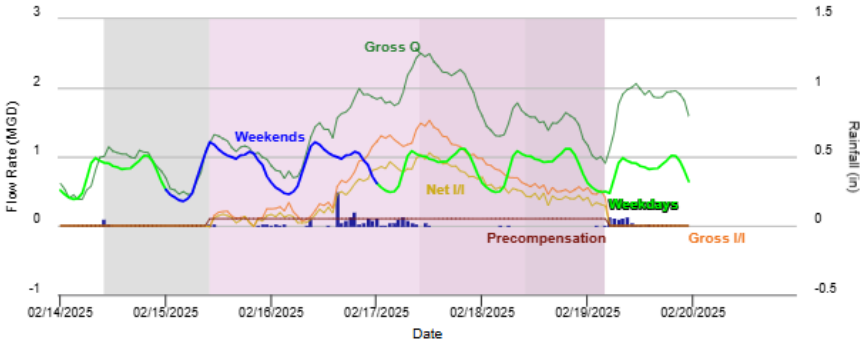


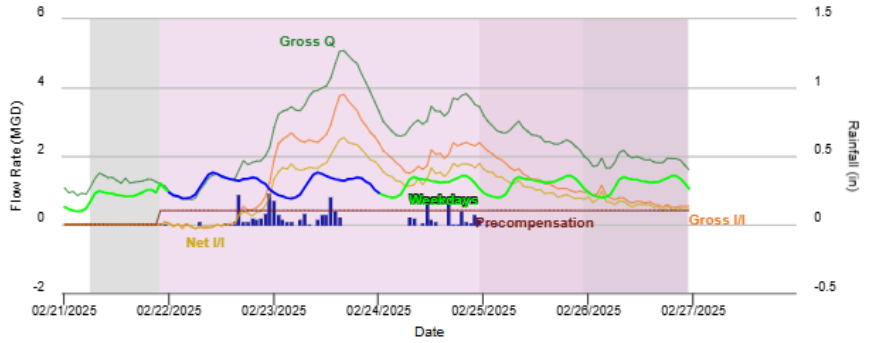
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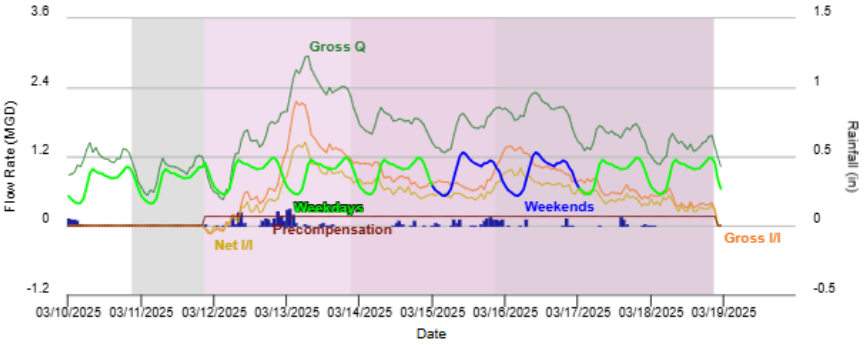
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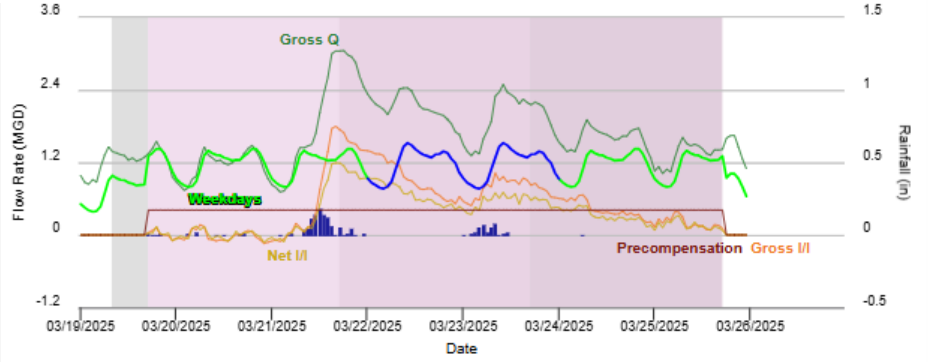


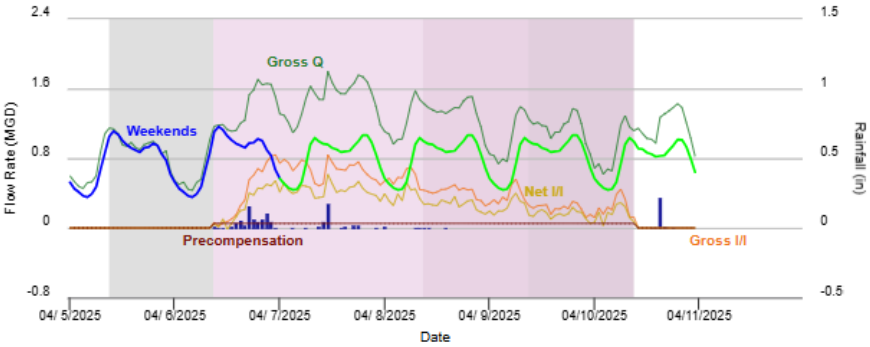



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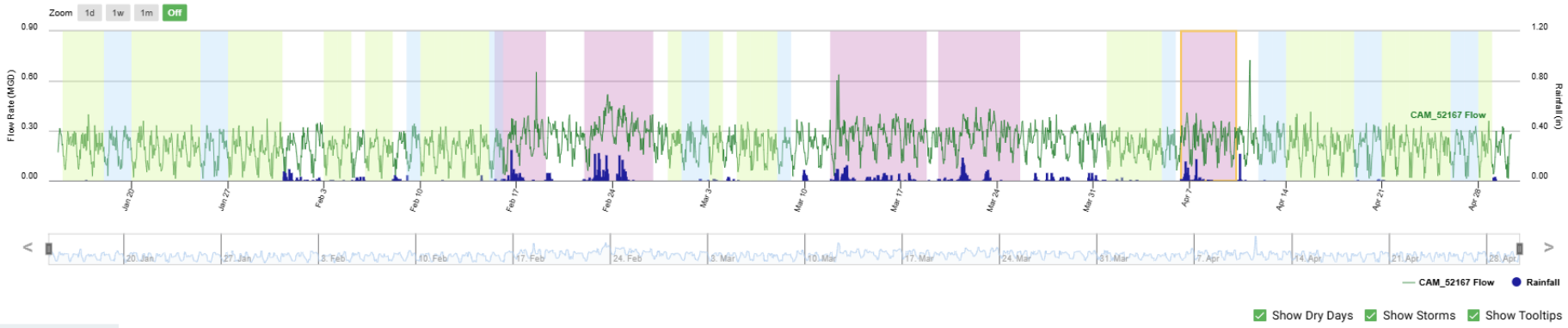

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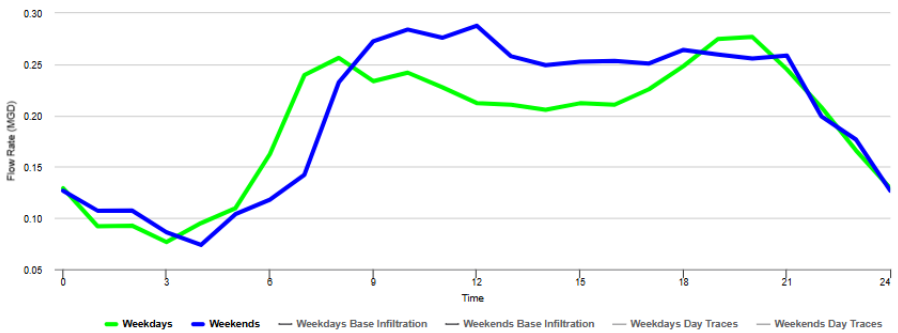
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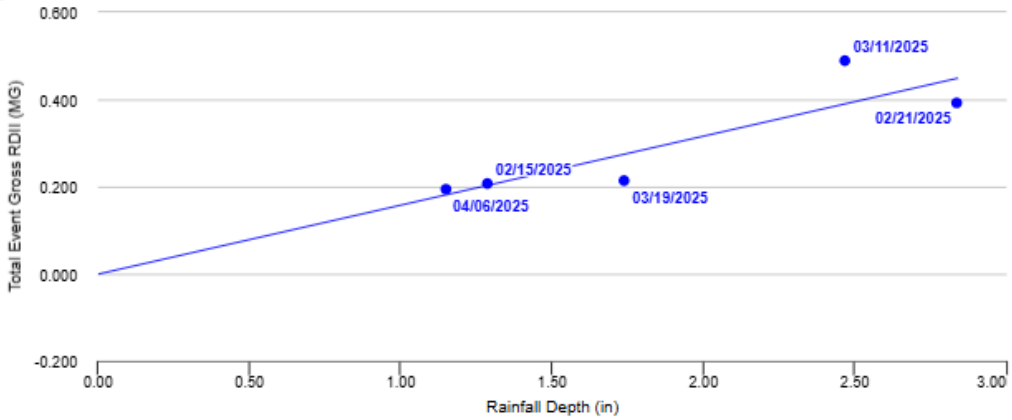


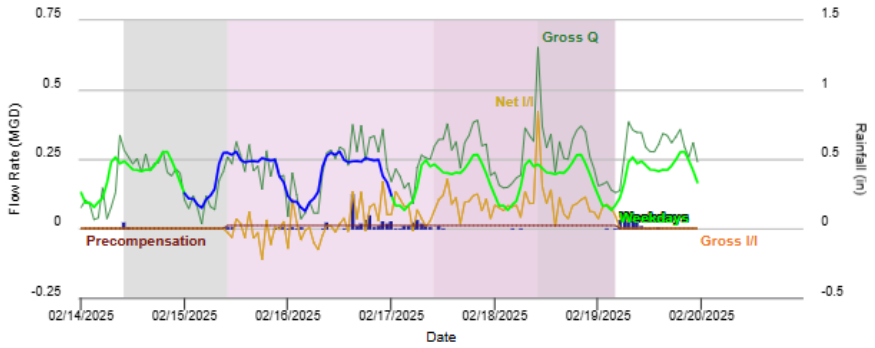
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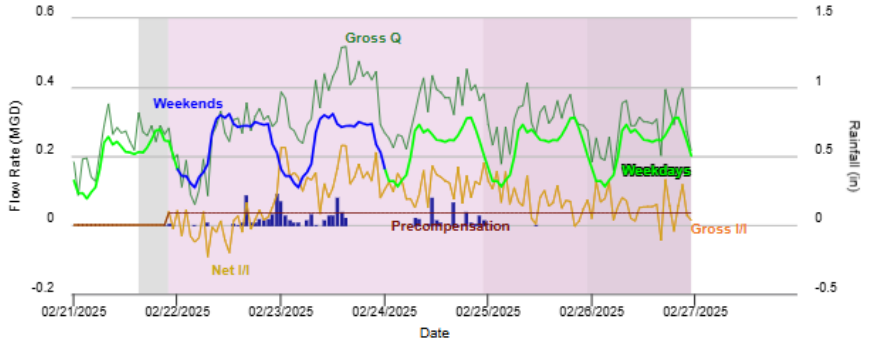
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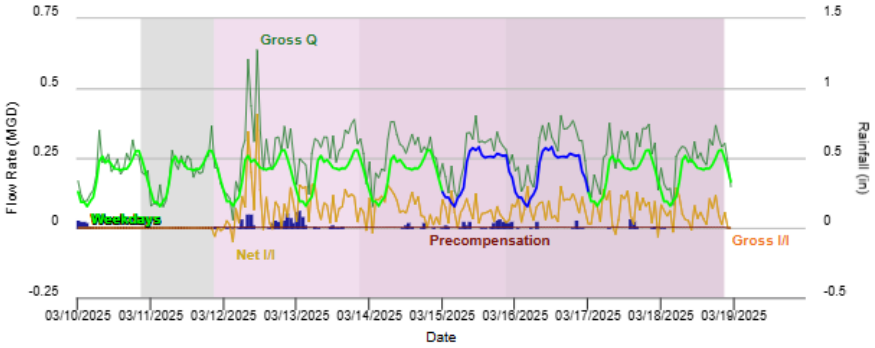
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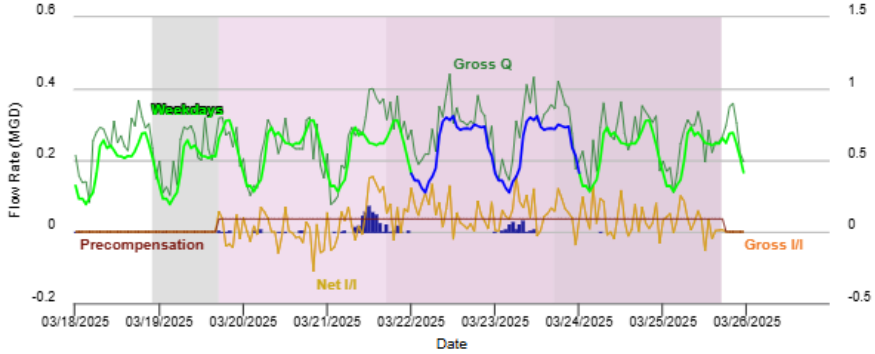


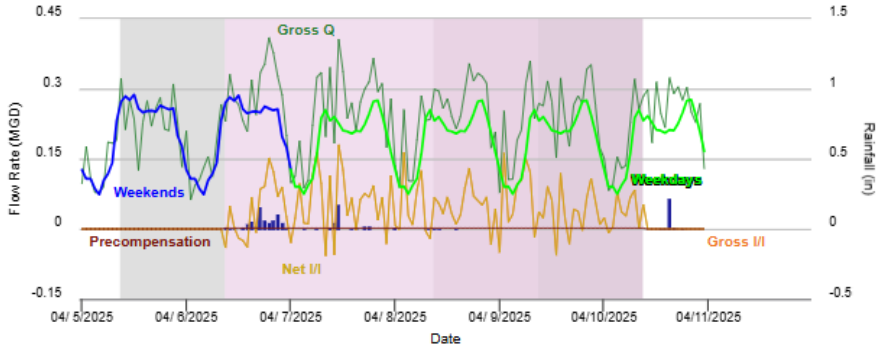



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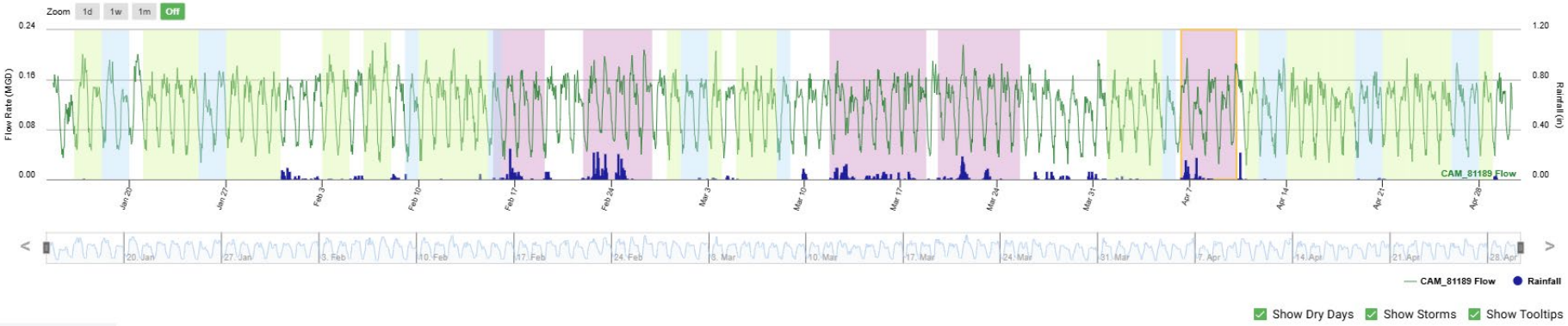

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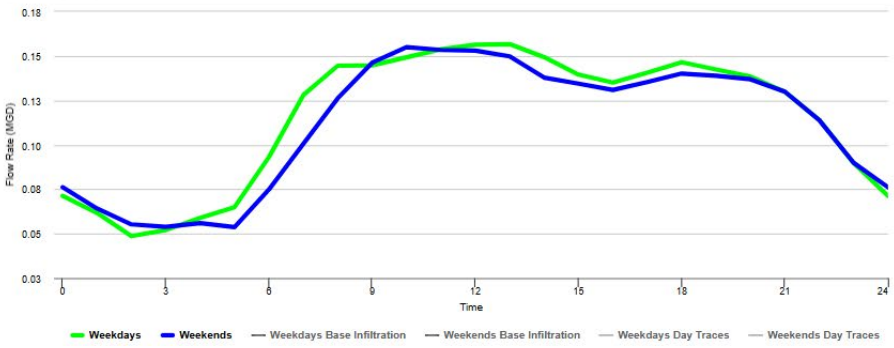

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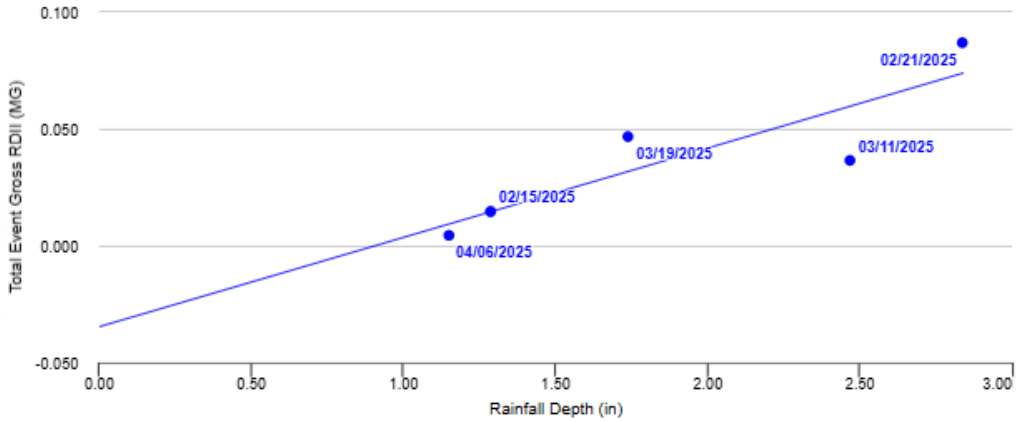
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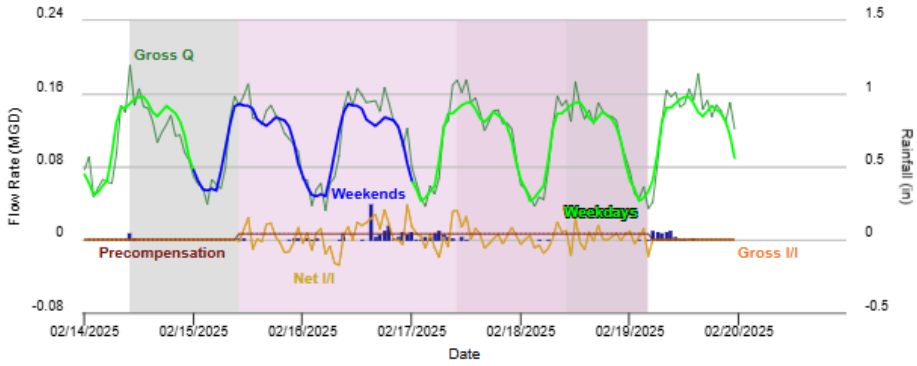


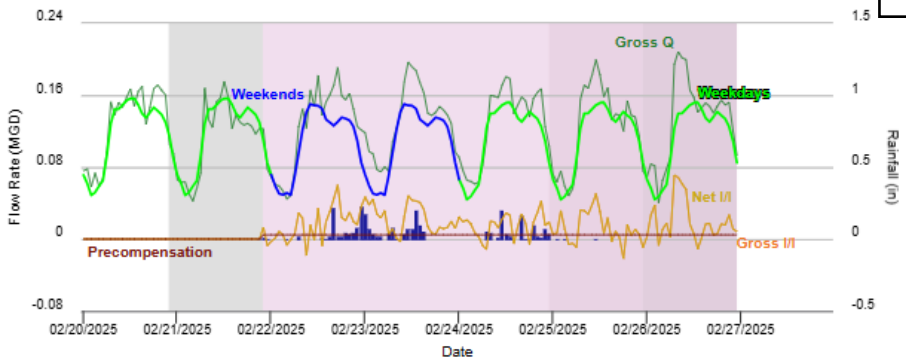
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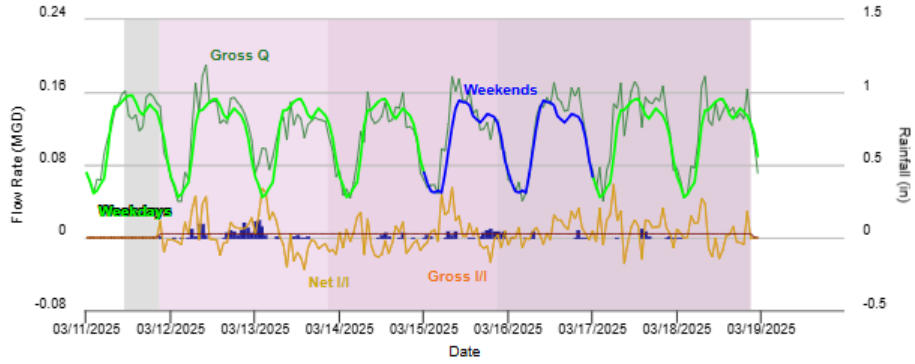
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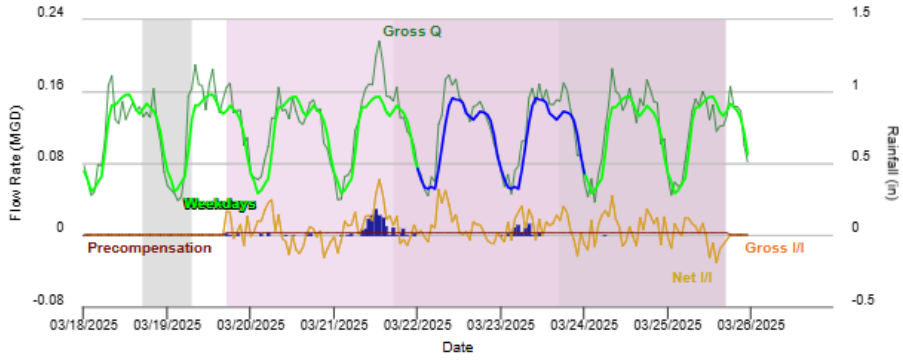


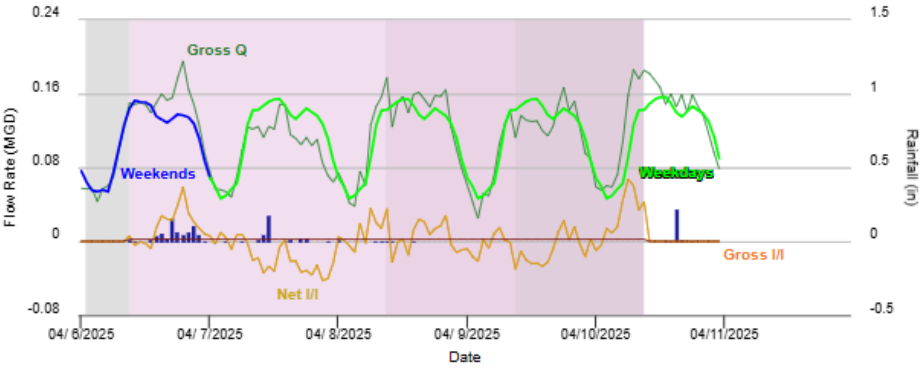



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APPENDIX E

HYDRAULIC MODEL UPDATE TECHNICAL MEMORANDUM

City of Camas WASHINGTON

General Sewer Plan



Hydraulic Model Update

August 2026 / DRAFT

carollo

General Sewer Plan

Hydraulic Model Update

August 2026 / DRAFT

This document is released for the purpose of information exchange review and planning only under the authority of Katherine M. Sun, August 2026, State of Washington PE No, 24001293.

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Abbreviations

ADWF	average dry weather flow
BWF	base wastewater flow
Carollo	Carollo Engineers
City	City of Camas
CIWEM	Chartered Institution of Water and Environmental Management
DWF	dry weather flows
FRC	fast response curve
GIS	geographic information system
gpad	gallons per acre per day
gpm	gallons per minute
GSP	General Sewer Plan
GWI	groundwater infiltration
LS	lift station
mgd	million gallons per day
RDI	rainfall dependent infiltration
RDII	rainfall derived inflows and infiltration
SCADA	supervisory control and data acquisition
SRC	slow response curve
STEP	septic tank effluent pumping
UDG	Urban Drainage Group
UGA	urban growth area
WWF	wet weather flow
WWTF	wastewater treatment facility

SECTION 1 INTRODUCTION

Sanitary sewer collection system models are valuable tools used to assess the performance of collection systems during dry and wet weather conditions, and to support planning for future improvements. These models provide a means to simulate the impact of different sized storms on the collection system and determine where system deficiencies are likely to occur. In addition, a well-calibrated model provides an easy way to test alternative improvement scenarios.

The previous iteration of the City of Camas (City) sewer collection system model was updated in 2019 for the 2024 General Sewer Plan (GSP) using MIKE URBAN software and represented the gravity sewer system. In 2023, the septic tank effluent pumping (STEP) system was developed as a separate model, in MIKE URBAN. For the 2025 GSP update, the gravity and STEP models were combined into a single model and converted to MIKE+ software, with additional system pipes added to reflect new infrastructure and updates since the original model development.

This report summarizes the City's sewer collection system hydraulic model update and calibration for use in the City's sewer system conveyance planning.

SECTION 2 STUDY AREA

The City's service area is shown in Figure 1. The service area is approximately 7,600 acres. The current service area includes the City limits, and the future service area extends to the urban growth area (UGA) which totals to 9,300 acres.

The modeled collection system consists of the gravity system and the STEP that is upstream of the gravity system. Table 1 shows a summary of the City's pipe infrastructure by type.

Table 1 Summary of Pipe Infrastructure by Type

Sewer Type	Modeled Pipe Length (feet)	Pipe Length (feet)	Percent of Modeled System (%)
Gravity Main	113,809	405,499	28.1
Force Main(1)(2)	51,677	65,218	79.2
STEP Main	44,531	290,019	15.4
Total	**210,016**	**760,736**	**27.6**

Notes:
(1) Force main pipe length was determined by using both existing GIS data and newly mapped force main segments in the North Shore area.
(2) The total force main length includes the dual force main installed in the North Shore area.
(3) This Includes STEP Transmission, STEP Main, STEF Main, and STEG Main.
GIS - geographic information system.

Figure 1 shows the current service area outlined by a dashed black line. The service area for the 2045 and buildout scenarios is outlined by a dotted purple line. Figure 2 shows the extent of the hydraulic model for the existing, 2045, and buildout systems.

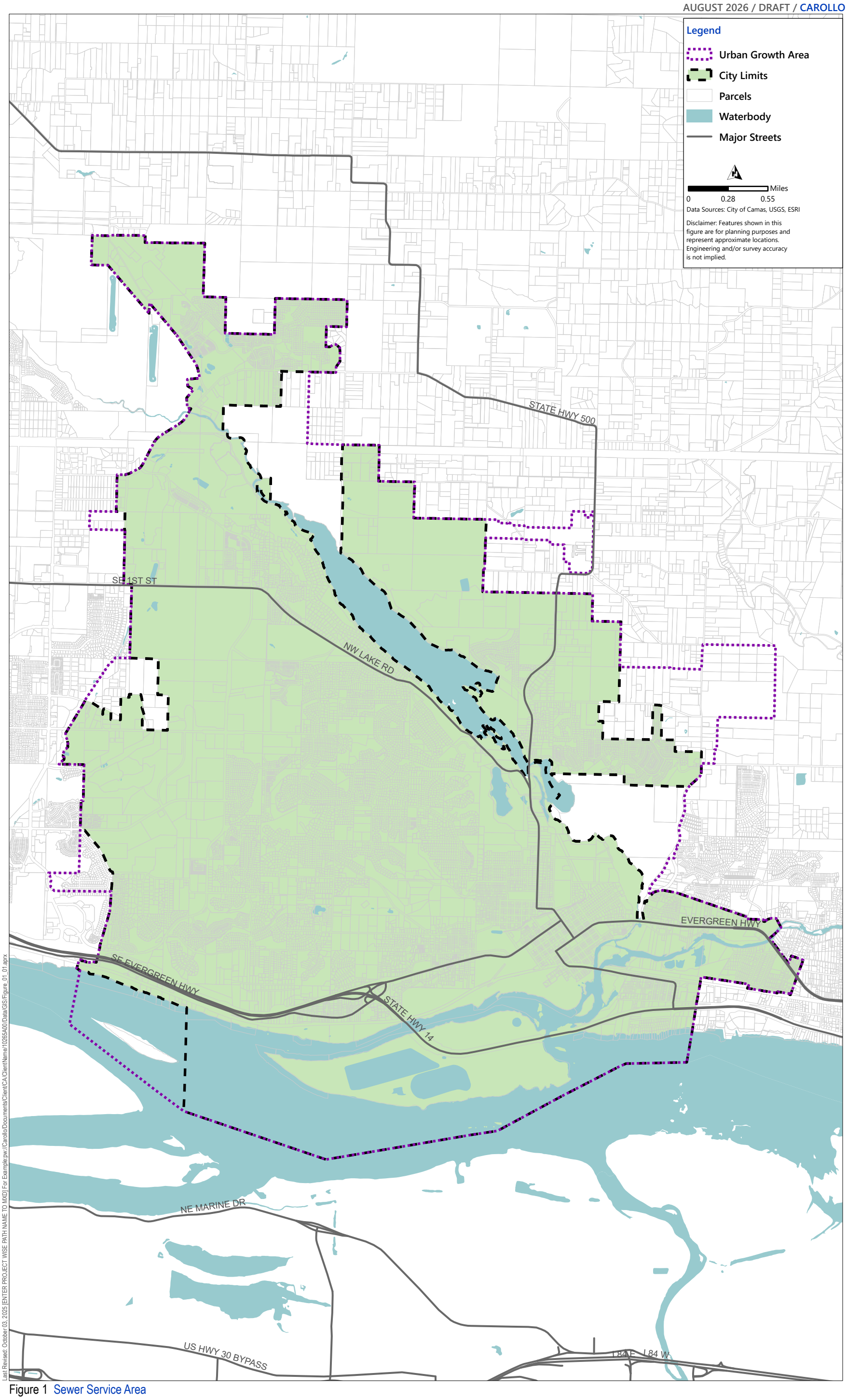


Figure 1 Sewer Service Area

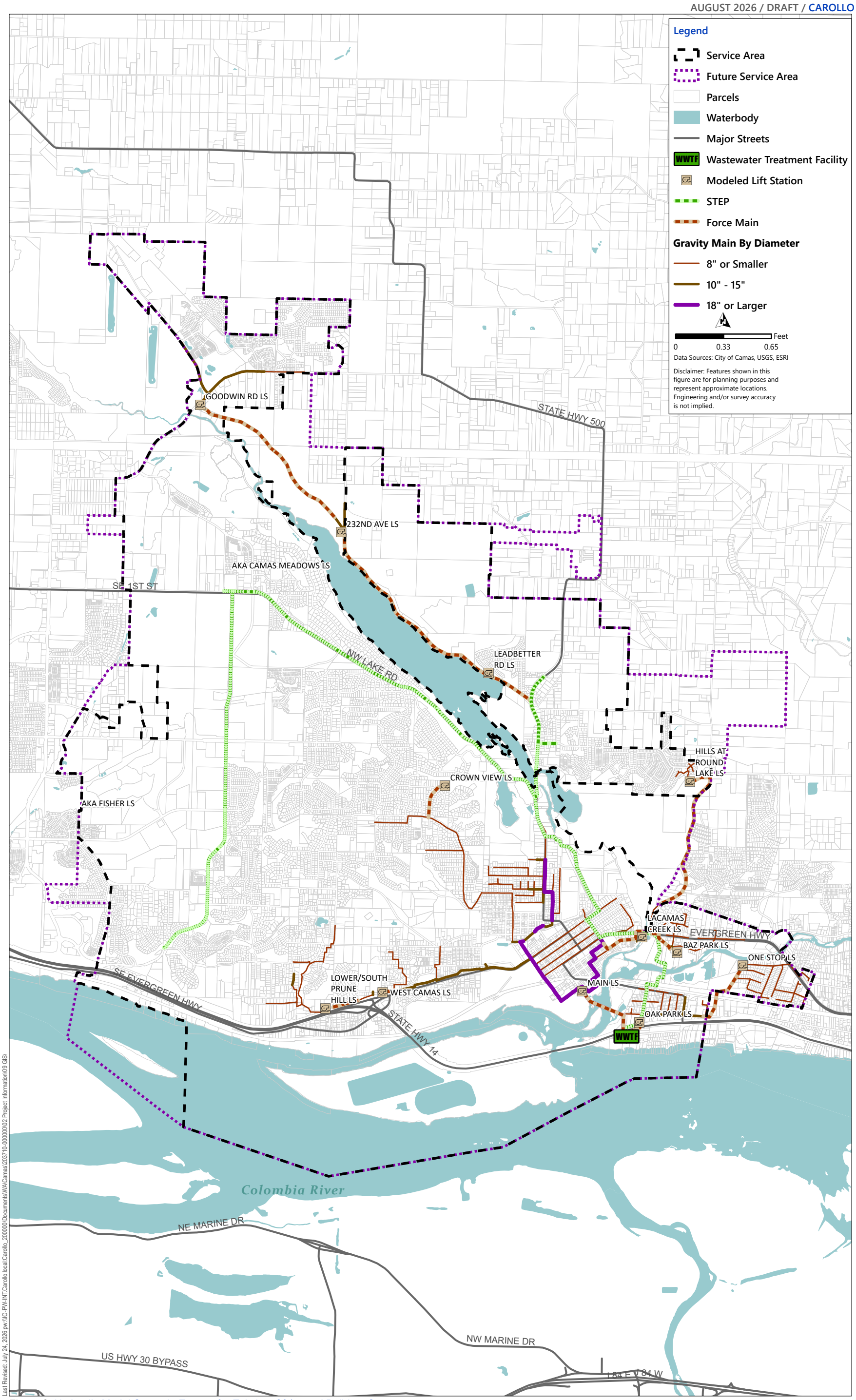


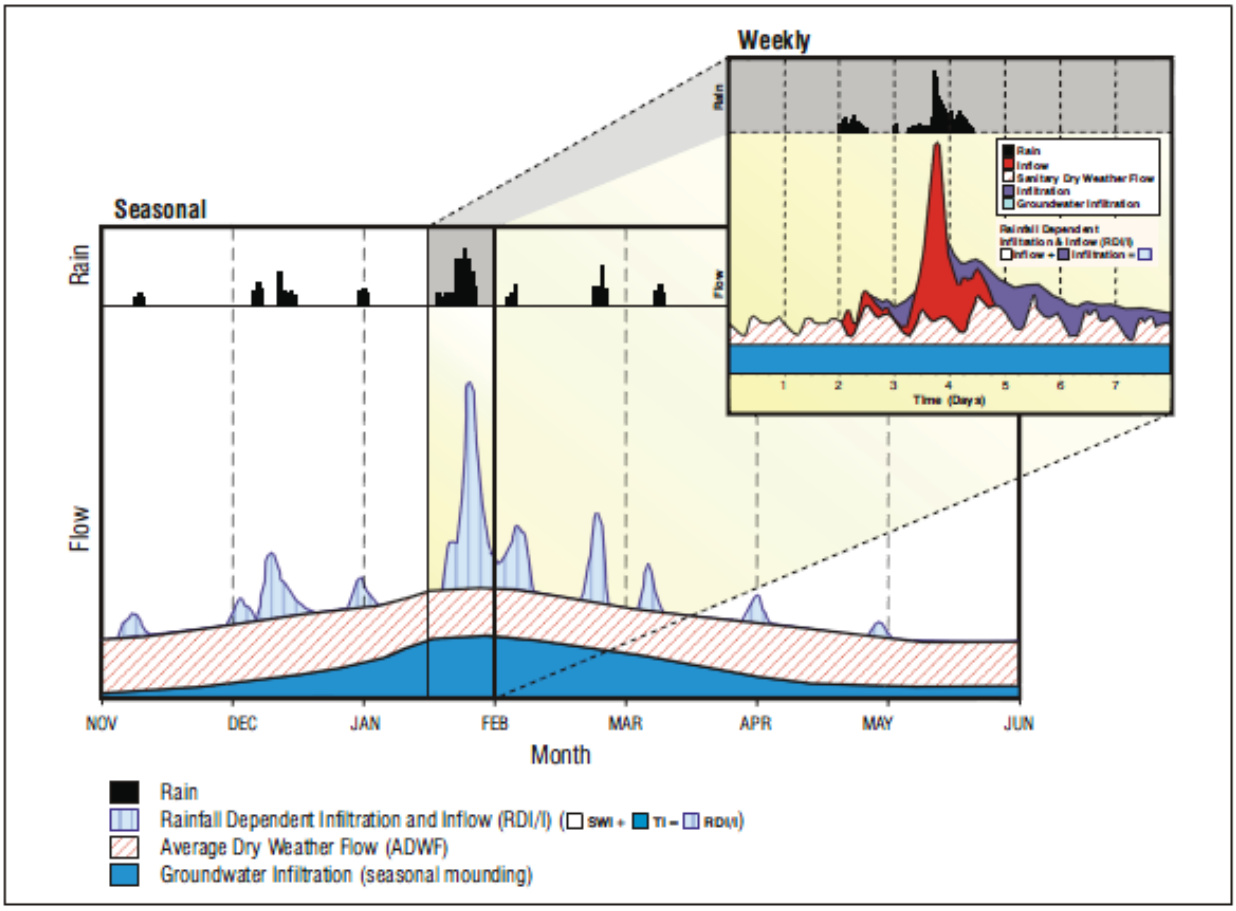
Figure 2 Hydraulic Model Scenario Extents for Existing, 2045, and Buildout Systems

SECTION 3 SEWER COLLECTION FLOWS

Sewer collection systems are intended to convey sanitary flows but frequently have additional flows from other sources. The different flow components are described in the section below and illustrated in Figure 3.

3.1 Dry Weather Flow Components

Average dry weather flow (ADWF) is the flow that is entering the collection system on a daily basis. There are two primary components of ADWF, base wastewater flow and dry weather groundwater infiltration (GWI). ADWF was estimated from an average of dry weather flow (DWF) data at each flow meter from January 15, 2025, to April 30, 2025. Section 4 describes the flow monitoring efforts performed by ADS, which went into determining the ADWF. The ADWF serves as the baseline flow in the hydraulic model.



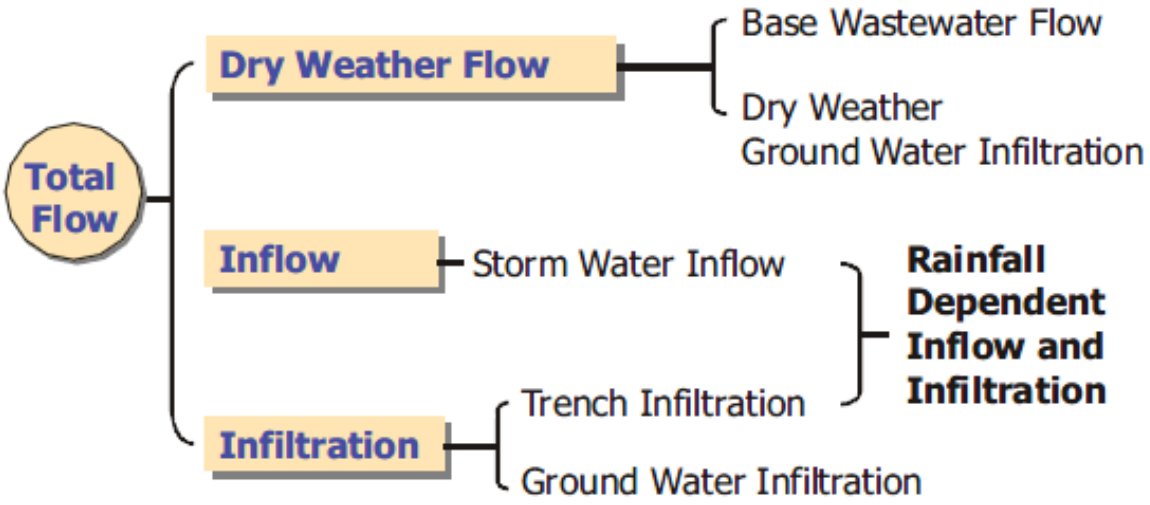


Figure 3 Typical Wastewater Flow Components

Note: This figure is not based on flow data specific to the City.

3.1.1 Base Wastewater Flow

The base wastewater flow (BWF) is the sanitary flow generated by routine water usage of the City's residential, commercial, and industrial customers. Conveying this flow is the primary function of the

collection system. The flow has a diurnal pattern that varies by individual customer's water use patterns. Typically, a residential diurnal pattern has two peaks with the more pronounced peak following the wake-up hours of the day, and a less pronounced peak occurring in the evening. Commercial and industrial patterns, though they vary depending on the type of use, typically have more consistent, higher flow patterns during business hours, and lower flows at night. Furthermore, the diurnal flow pattern of a weekend may vary from the diurnal flow experienced during a weekday. Diurnal (24-hour) patterns for both weekdays and weekends are applied to ADWF and cumulatively make up the flows experienced in the wastewater collection system. The diurnal patterns utilized for the City's collection system basins are developed in Section 4.2.1.

3.1.2 Dry Weather Groundwater Infiltration

Dry weather GWI will enter the sewer system when the relative depth of the groundwater table is higher than the depth of the pipeline and the sanitary sewer pipe allow infiltration through defects such as cracks, misaligned joints, and broken pipelines. Dry weather GWI (or base infiltration) cannot easily be separated from BWF by flow measurement techniques. Therefore, dry weather GWI is typically grouped with BWF.

3.2 Wet Weather Flow

Wet weather flow (WWF) includes two components:

1. Rainfall derived inflow and infiltration (RDII): The stormwater RDII response in the sewer system to rainfall is seen immediately (inflow) or within hours after the storm (infiltration).
2. GWI: Wet weather GWI is not specific to a single rainfall event, but rather to the effects on the sewer system over the entire wet weather season. The depth of the groundwater table rising above the pipe invert elevation causes GWI. Sewer pipes within close proximity to a body of water can be greatly influenced by groundwater effects.

3.2.1 Inflow and Infiltration

Inflow and infiltration are rainfall derived flows in the collection system from specific storm events. Inflow is stormwater that enters the sewer system via a direct connection to the system, such as roof drain and downspout connections, leaky manhole covers, and inappropriate storm drain connections. Infiltration is stormwater that enters the sewer system by percolating through the soil and enters through foundation drains, defects in pipelines, manholes, and joints. Some of the most common sources of RDII are shown in Figure 4. The adverse effect of RDII entering the sewer system is that it increases both the flow volume and peak flows such that the sewer system could be operating at or above its capacity, as illustrated in Figure 5. If too much RDII enter the sewer system, sanitary sewer overflows could occur.

3.2.2 Groundwater Infiltration

GWI, one of the components of RDII, is associated with extraneous water entering the sewer system through defects in pipes and manholes while the ground is saturated during the wet weather season. GWI is related to the condition of the sewer pipes, manholes, and groundwater levels. GWI may occur throughout the year, although rates are typically higher in the late winter and early spring in the Pacific Northwest.

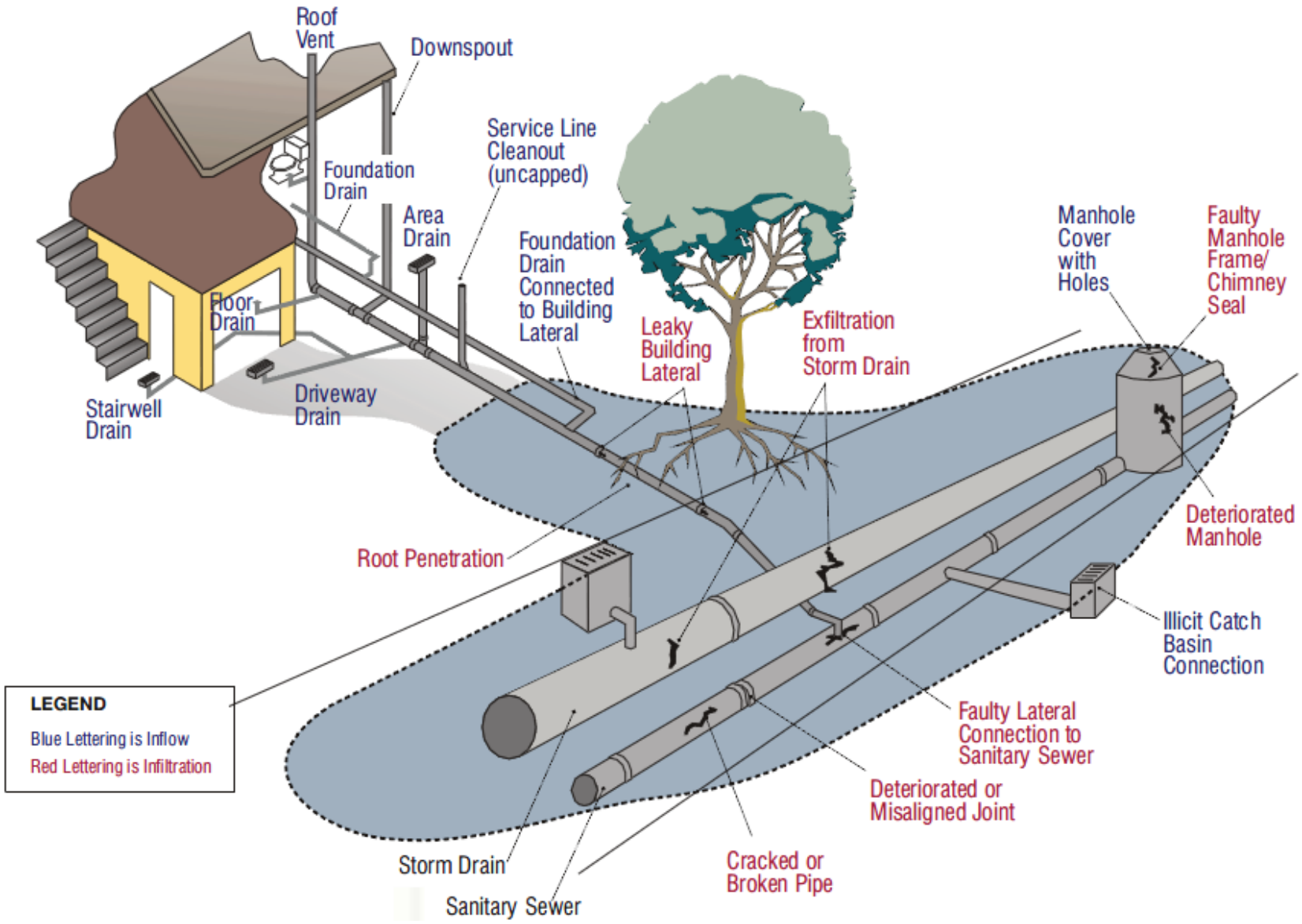


Figure 4 Typical Sources of Inflow and Infiltration

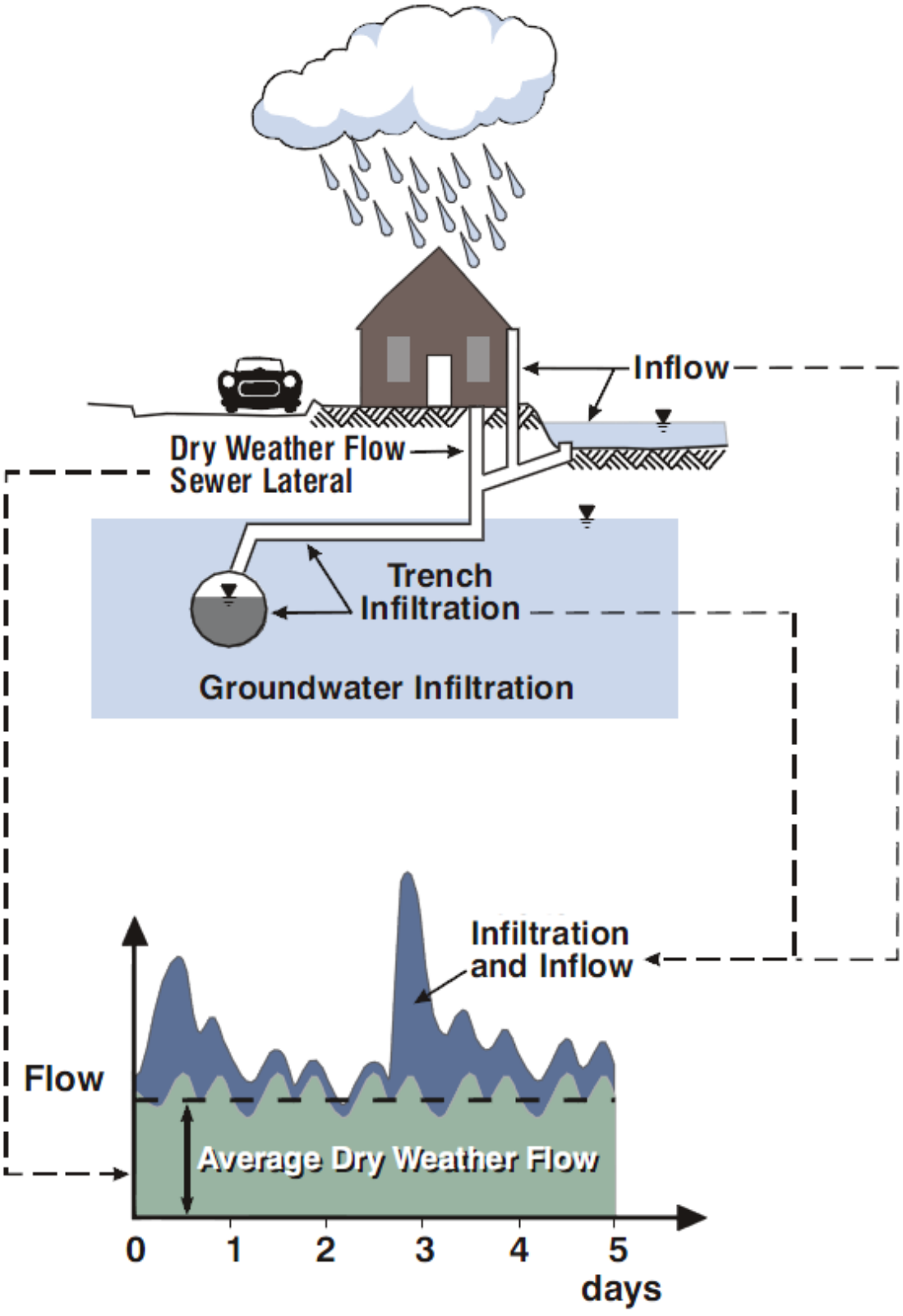


Figure 5 Typical Effects of Inflow and Infiltration

SECTION 4 FLOW MONITORING PROGRAM

As part of the Scope of Services for this GSP Update, Carollo Engineers (Carollo) contracted with ADS to conduct a temporary flow monitoring program within the City's sanitary sewer collection system. The purposes of the flow monitoring program were to correlate actual collection system flows to the hydraulic model predicted flows, evaluate the system's capacity, and estimate basin inflow and infiltration. The temporary flow monitoring data was collected for a period of approximately 105 days from January 15, 2025 to April 30, 2025. The *Camas Flow Monitoring Report 2025* prepared by ADS summarizes the flow monitoring program and was submitted to the City as a stand-alone report. A copy of the report is included in Attachment A.

4.1 Program Description

4.1.1 Flow Monitoring Sites and Tributary Areas

Four sewer basins were monitored during the flow monitoring period. The meter sites were selected to best isolate and model the critical areas and subareas within the sewer system. In addition to these meter basins, three other sewer basins were evaluated using the City's supervisory control and data acquisition (SCADA) data. One of these basins represents the City's STEP system, because this area was not directly monitored by ADS nor the City, flow from the STEP system was estimated using a mass-balance approach based on influent data from the wastewater treatment facility (WWTF). Two additional basins in the North Shore area located upstream in Basin 4-1-3 were also analyzed. These include the basin upstream of the Goodwin Road Lift Station (LS) and the Leadbetter Road LS basin which is located downstream of the Goodwin Road LS but still upstream of Basin 4-1-3.

These seven flow monitoring locations, as well as the area tributary to each site, are shown on Figure 6. Table 2 lists the flow monitoring locations and the diameters for the sewers where the meters were installed. Figure 7 provides a schematic illustrating the flow monitoring locations to help understand how the basins connect. Meter data quality was reviewed at all sites and deemed acceptable to use for model calibration. The quality of meter data and other trends in the flow can be determined from scattergraphs. Which plot the depth versus velocity as compared to the manning's curve for the pipe segment. Scattergraphs for each metered site can be found in the ADS Flow Monitoring Report, Attachment A.

Table 2 Flow Monitoring Locations

Basin ID	ADS Meter ID	Upstream Pipe ID	Upstream Basin Type	Upstream Pipe Slope (%)	Upstream Pipe Diameter (inch)
8-1-2	CAM_81189	SEWER-GMAIN-100313	Gravity	0.18	12
4-1-3	CAM_100290	SEWER-GMAIN-100740	Gravity	0.38	12
5-2-1	CAM_52167	SEWER-GMAIN-101019	Gravity	2.74	18
5-1-2	CAM_51123	SEWER-GMAIN-100236	Gravity	0.23	21
Goodwin Road(1)	-	SEWER-GMAIN-102279	Gravity	2.0	18
Leadbetter Road(1)	-	SEWER-FMAIN-100127	Gravity	0.29	18
STEP(2)	-	N/A	STEP	-	-
WWTF(3)		N/A	Gravity/STEP	-	-

Notes:
(1) Flow information was based on historical wet well flows provided by the City from February 1, 2025 to April 30, 2025.
(2) No upstream pipe ID information was available for the STEP basin. Flow for this area was therefore estimated using GIS-derived upstream drainage data and a mass balance approach using influent flow meter data at the WWTF.
(3) Flow meter information was provided from the City's SCADA system.

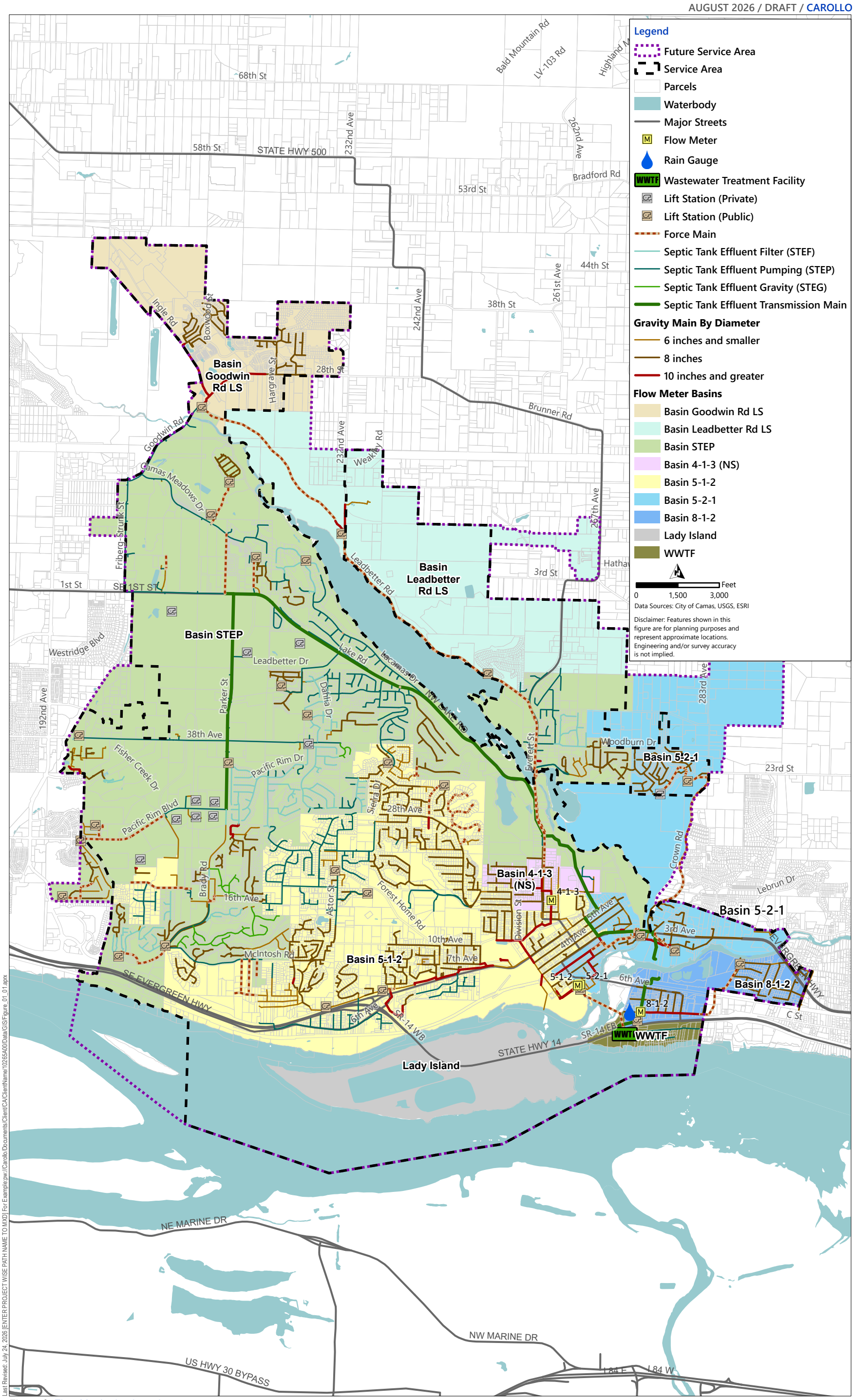


Figure 6 Flow Monitoring Locations

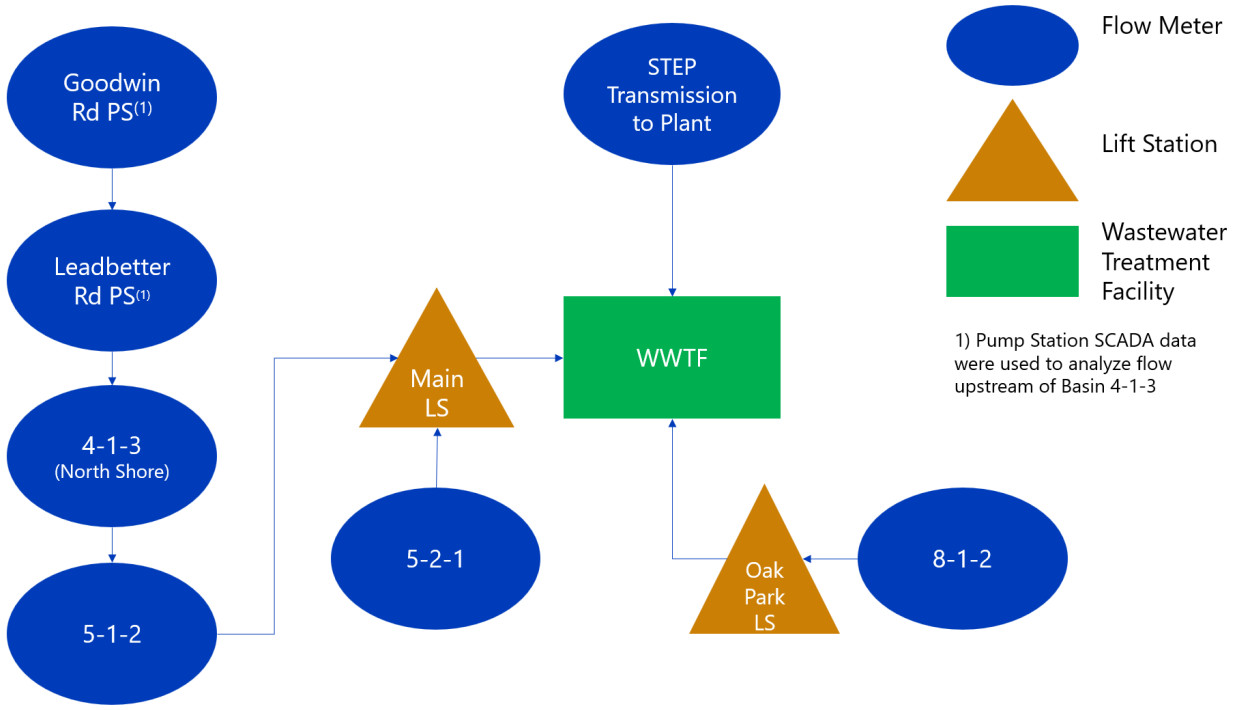


Figure 7 Flow Monitoring Schematic

4.1.2 Flow Meter Installation and Flow Calculation

The flow monitoring equipment used ADS Triton+ monitor. This flow monitor is an area velocity flow monitor that uses both the Continuity and Manning's equations to measure flow. The monitor includes data acquisition sensors and a battery-powered microcomputer with a processor, data storage, and an internal clock to synchronize readings. It was programmed to record flow depth and velocity every 5 minutes.

The Triton+ monitor also provides cross-checking between multiple sensor technologies to improve reliability and can support up to two sets of sensors.

For this project, the Peak Combo Sensor was installed at the bottom of the pipe. This sensor measures flow using three technologies:

- Ultrasonic depth which is measured by using sound waves,
- Pressure depth is determined from hydrostatic pressure, and
- Peak velocity is calculated from reflected ultrasonic signals using digital spectrum analysis.

ADS conducted an analysis of the data retrieved from each flow meter and made adjustments as needed for calibration based on the field measurements. The flow at each meter was then calculated at 15-minute intervals based on the continuity equation:

$$Q = V \times A$$

Where:

- Q = Pipeline flow rate, cubic feet per second.
- V = Average velocity, feet per second.
- A = Cross sectional flow area, square feet.

4.1.3 Rain Gauges

One rain gauge was installed by ADS to record rainfall that occurred throughout the flow monitoring program. The location of the rain gauge is shown in Figure 6.

4.2 Flow Monitoring Results

The flow monitoring program data were evaluated by components including DWF, rainfall, and WWF. Data collected from flow meter Basin 8-1-2 is presented throughout this report as an example of the type of data and the results from the flow monitoring program.

4.2.1 Dry Weather Flow Data

Base flow can be estimated for a wastewater collection system by comparing DWF and WWF at the flow monitoring locations. To estimate ADWF for more specific areas, such as individual wastewater basins, DWFs are typically estimated based on the area contributing to flows and flow coefficients developed for each land use type. This method is based on the assumption that areas with similar land uses, such as low-density residential parcels, produce equivalent quantities of wastewater flow on a per area basis. System-wide flows can be compared to known flows at flow monitors, or at the treatment plant to verify accuracy. This method of estimating base flows is an industry standard for planning and provides sufficiently accurate data for planning purposes. Table 3 shows the ADWF development summary for each flow meters.

Existing ADWFs for each basin were estimated using data from the Flow Monitoring Program for each of the flow monitoring basins. ADWF was developed using the driest days from the flow monitoring period based on the following set of minimum criteria:

- Less than 0.1 inches of rain in the previous day.
- Less than 0.4 inches of rain in the previous three days.
- Less than 1.0 inch of rain in the previous five days.
- In addition, those dry days that exhibited unusual flow patterns were not used to generate net dry day flow values for a basin.

Characteristic dry weather 24-hour diurnal flow patterns for each site were developed from hourly data. The hourly flow data were also used to calibrate the hydraulic model for the observed DWFs during the flow monitoring period. Hourly patterns for weekday and weekend flows vary and were separated to

better define DWF. An example of the DWF patterns from Flow Meter Basin 8-1-2, are shown in Figure 8. Additional patterns for all DWF development for all flow monitoring basins can be found in Attachment B.

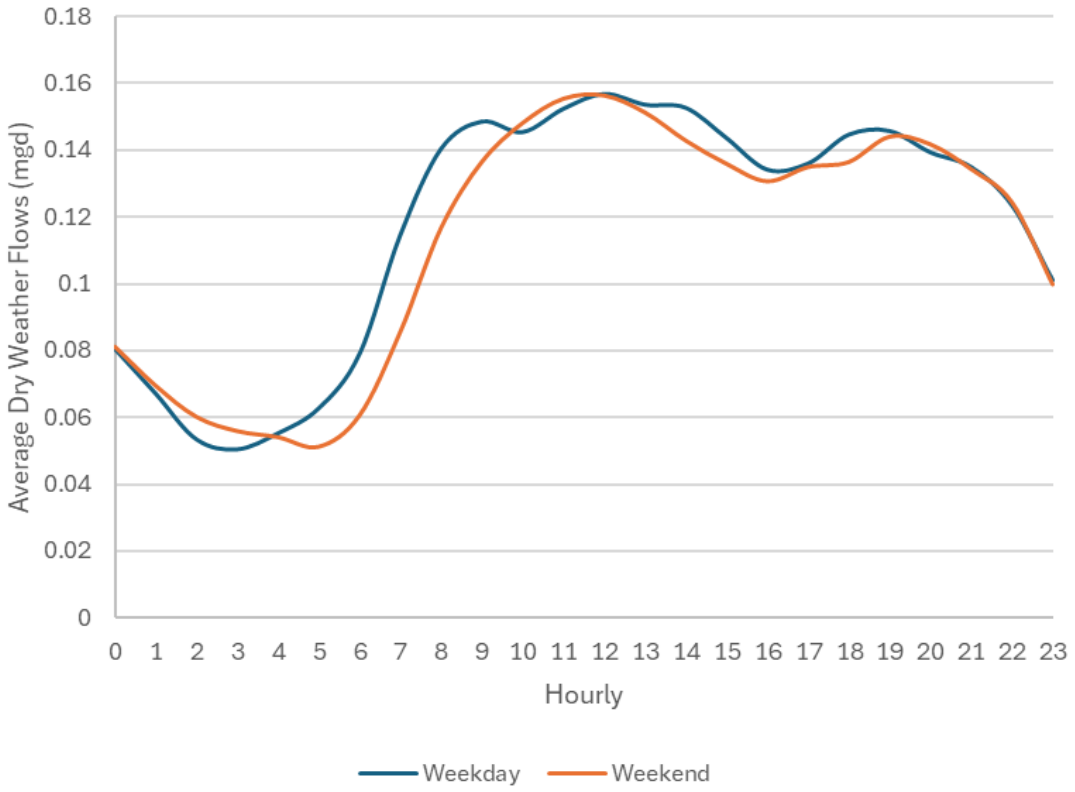


Figure 8 Typical Weekday vs Weekend Dry Weather Flows (Meter 5-1-2)

Carollo used the average weekday and weekend dry weather levels and velocities at each site from the data provided by ADS for use in the model calibration process.

Table 3 ADWF Development Summary

Meter ID	Weekday ADWF (mgd)	Weekend ADWF (mgd)	Weekday/Weekend Ratio	Gross ADWF (mgd)	Net ADWF (mgd)
Meter 8-1-2	0.12	0.11	1.09	0.12	0.12
Meter 4-1-3	0.24	0.24	1.00	0.24	0.11
Meter 5-2-1	0.20	0.21	0.95	0.20	0.20
Meter 5-1-2	0.86	0.84	1.02	0.85	0.61
Leadbetter Road	0.13	0.14	0.91	0.13	0.04
Goodwin Road	0.09	0.10	0.93	0.09	0.09
STEP(1)	-	-	1.00	1.63	1.63
WWTF	2.81	2.79	1.00	2.80	1.63

Notes:
(1) STEP flow was derived using the City's SCADA Data by subtracting the upstream metered flows from the total WWTF's influent flow.
mgd - million gallons per day.

4.2.2 Rainfall Data

An important part of the flow monitoring program is the collection and analysis of rainfall data. Three significant rainfall events occurred during the course of the flow monitoring period, as well as a few other relatively minor events. The storms recorded during the Temporary Flow Monitoring Program caused an RDII response in the collection system and were appropriate for RDII analysis and model calibration purposes. The rainfall data recorded over the course of the flow monitoring program is illustrated in Figure 9. Figure 10 illustrates the total accumulation of rainfall over the course of the flow monitoring period for the ADS tipping bucket type rain gauge. Table 4 summarizes a range of events that occurred during the course of the flow monitoring period available and recorded at the ADS rain gauge for calibration.

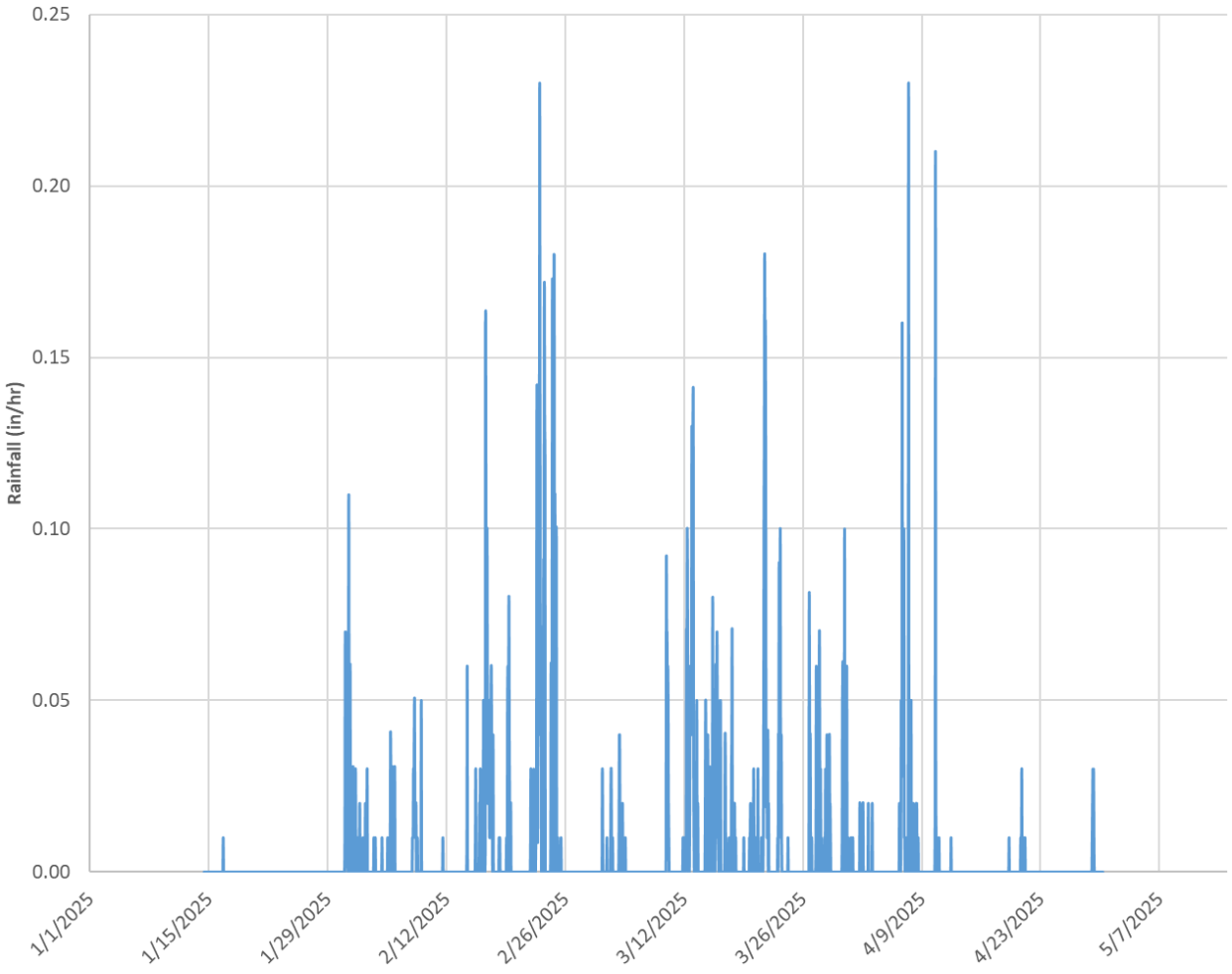


Figure 9 Rainfall Intensity

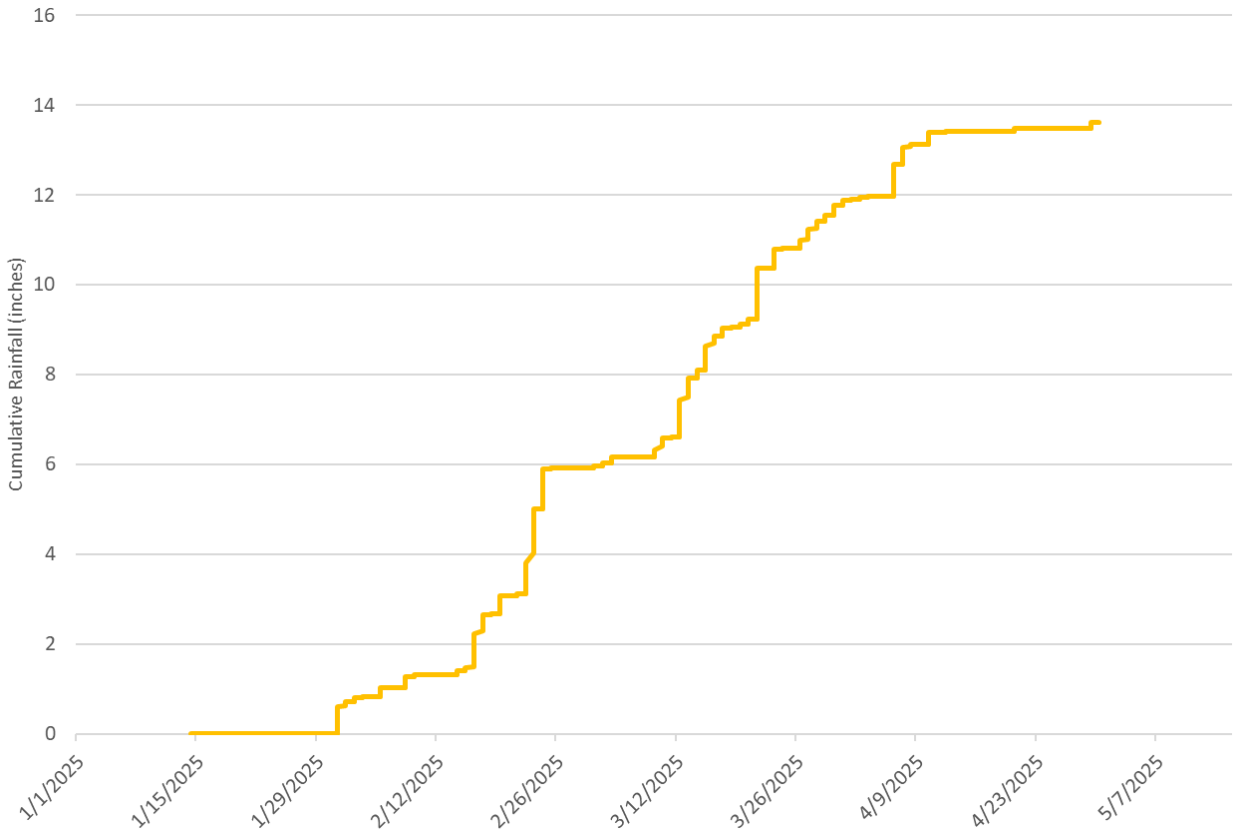


Figure 10 Cumulative Rainfall

Table 4 Identified Storm Events

Storm Event	Start Date	End Date	Total Event Rainfall (inch)	Total 24-hour Volume (inch)	Maximum Peak Intensity (inch/hour)
1	1/31/2025	2/5/2025	0.82	0.63	0.11
2	2/14/2025	2/19/2025	1.34	1.04	0.16
3	2/21/2025	2/25/2025	2.82	1.82	0.23
4	3/2/2025	3/5/2025	0.24	0.13	0.04
5	3/12/2025	3/19/2025	2.45	1.18	0.14
6	3/20/2025	4/1/2025	2.74	1.12	0.18
7	4/5/2025	4/9/2025	1.15	0.94	0.23

4.2.3 Wet Weather Flow Data

The flow monitoring data were also evaluated to determine how the collection system responds to wet weather events. As mentioned above, the flow monitoring program captured three main rainfall events. The rainfall event that occurred on February 23, 2025 was associated with the largest RDII response during the flow monitoring period and is the most appropriate to be used for RDII analysis.

Figure 11 shows an example of the wet weather response at Meter 5-1-2 during the February 23, 2025 rainfall event. This figure also illustrates the volume of RDII that entered the system from the collection system upstream of Meter 5-1-2. The blue line is the base sanitary flow while the yellow line shows the recorded rainfall during the storm event. As can be seen in the figure, the flow increased by 4 to 8 times ADWF due to RDII entering the system during wet weather events.

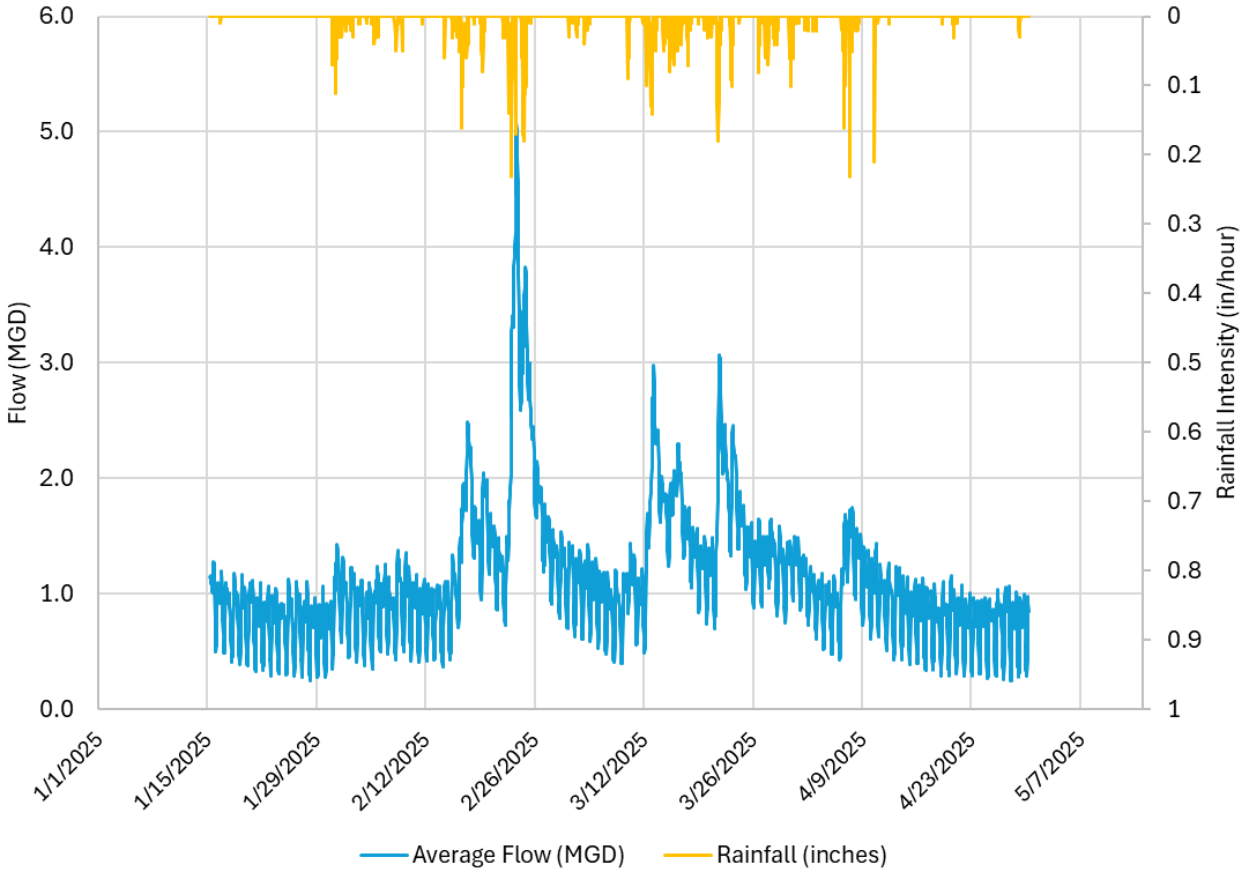


Figure 11 Example of Wet Weather Response (Meter 5-1-2)

SECTION 5 ZONING AND LAND USE DATA

Land use designations and regulations are important when evaluating existing sewer system capacity because they indicate the types and intensity of development that may occur in an area. These uses may include single family and multi-family residential development, as well as commercial and industrial development.

Land use is also an important factor in estimating wastewater flows. The type and intensity of development directly affect the volume of wastewater generated. The service area generally includes both sewered and unsewered areas. Sewered areas contribute flow to the collection system, while unsewered areas such as vacant, undeveloped parcels, or development such as parking facilities without a wastewater connections and do not currently contribute flow to the collection system. The following sections summarize the land use assumptions used for the existing sewer service area and the Study Area. For additional information on zoning and land use data, see Chapter 3 - Basis of Planning of the GSP.

SECTION 6 WASTEWATER FLOW FACTORS

The wastewater flow factors were developed using flow monitoring data, City's SCADA data, land use information, and basin-specific calibration of ADWF. For hydraulic model calibration, basin-specific flow factors were developed for each monitored basin. These basin specific factors were used during DWF calibration and subsequently combined into weighted average flow factors for use in projecting future wastewater flows.

The development of wastewater flow factors, allocation of flows to the collection system for hydraulic model development, and methodology used to project existing and future flows are described in Chapter 3 Section 3.4.3 of the GSP.

SECTION 7 HYDRAULIC MODEL OVERVIEW

A wastewater collection system model is a simplified representation of the real sewer system. Wastewater system models can assess the conveyance capacity of the collection system. The model can be used to size new infrastructure. In addition, sewer system models can perform "what if" scenarios to assess the impacts of future developments and land use changes. The City's collection system hydraulic model was updated and expanded using a multi-step process utilizing data from a variety of sources. This section summarizes the hydraulic model development process, including a description of the modeled collection system, the hydraulic model elements, and the model creation process.

7.1 Selected Hydraulic Modeling Software

The City's previous collection system hydraulic model was developed in MIKE URBAN, a hydraulic modeling software developed by DHI. Since DHI announced it would discontinue support for MIKE URBAN, the model was converted to MIKE+, which is now the current modeling platform. MIKE+ has a 1D engine which is a widely adopted tool for planning, analysis, and design related to stormwater runoff, combined sewers, sanitary sewers, and other drainage systems.

The latest version (2024) of MIKE+ was used for the hydraulic model update. More information about the modeling software can be found in the MIKE+ Collection System User Guide (0F[1]).

7.2 Modeled Collection System and Skeletonization

The City previously had two separate sewer models: a skeletonized model developed during the previous GSP and a model of the STEP system. Carollo combined these two models and extended the system to the North Shore area. Carollo also added gravity pipes larger than 6 inches in diameter, where information from GIS or as-builts was available. The added portions of the gravity collection system includes the downtown area, north of Lacamas Lake Park, Oak Park area, and the neighborhood surrounding

[1] Collection System User Guide, MIKE+ 2024.

Goot Park. As additional data become available and as the City's GIS database is developed, additional gravity system pipes can be added to the model.

Additionally, key sewers 8-inches in diameter and smaller are included in the City's hydraulic model where needed for connectivity, or where it was determined that the pipes in question were considered as primary collectors.

7.3 Elements of a Hydraulic Model

The following provides a brief overview of the various elements of the hydraulic model and the required input parameters associated with each:

- **Nodes:** Sewer manholes, cleanouts, and other locations where pipes begin, pipe sizes change or pipelines intersect are represented by junctions in the hydraulic model. Required inputs for junctions include rim elevation, invert elevation, diameter, and surcharge depth (used to represent pressurized systems). Two different node types are used in the model:
  - **Junctions:** Volume free nodes that function as simple hydraulic connection points between two or more links. Junction nodes are used where flow combines, splits, or transitions through the system and do not provide storage volume or significantly impact hydraulic routing.
  - **Manhole:** Nodes with assigned storage volume that represent physical sewer manholes in the collection system. Manhole nodes incorporate structure geometry into the hydraulic calculations and can influence flow routing, surcharge conditions, and system storage.
- **Pipes:** Gravity sewers and force mains are represented as pipes in the hydraulic model. Input parameters for pipes include length, friction factor (e.g., Manning's n for gravity mains, Hazen Williams C for force mains), invert elevations, diameter, shape, and whether or not the pipe is a force main.
- **Basin:** For collection system modeling, storage nodes typically are used to represent pump station wet wells (although other storage basins, etc., can be modeled as storage nodes). Input parameters for storage nodes include invert elevation, wet well depth, and wet well cross section or a depth-area relationship.
- **Pumps:** Pumps are included in the hydraulic model as links. Input parameters for pumps include pump curves and operational controls.
- **Outlets:** Outlets represent areas where flow can leave the system. For sewer system modeling, an outlet typically represents an overflow point or the connection to the WWTF.
- **Rain Gauges:** Rain gauges are locations where rainfall is input to the hydraulic model for simulation of WWF. The rain can be historical, projected, or theoretical hourly rainfall events.
- **Subcatchments:** Subcatchments represent areas of land whose topography and drainage characteristics direct flow to a single discharge point into the sewer system. Subcatchments can be used to define sanitary flows or to route a portion of the rainfall runoff into the system. Inflow conditions for the subcatchments are defined model inputs.
- **Inflows:** There are two primary flow sources that enter into the collection system, which are input through individual junctions (and storage nodes) in the model:
  - **Dry Weather:** Dry weather inflows simulate base sanitary wastewater flows and represent the average flow. The DWFs can be multiplied by up to four patterns that vary the flow by month, day,

hour, and day of the week (e.g., weekday or weekend). The dry weather diurnal patterns are adjusted during the dry weather calibration process to match the known typical daily flow fluctuations. Two diurnal patterns were developed for each basin, respectively representing weekday and weekend days (see Section 2.9.1).

» **RDII:** RDII are flows into the collection system originating from rainfall. Several models are available in MIKE URBAN to capture these effects. The models have a number of parameters that are adjusted during the wet weather calibration process (see Section 9.3.1) to model the flows into the collection during different storm events.

SECTION 8 HYDRAULIC MODEL EXPANSION AND REFINEMENT

8.1 Flow Monitoring Basins

To identify capacity requirements for specific facilities throughout the system, flows were developed for each flow monitoring basin. These basins are based on the local topography and trunk sewers that drain them. The basins have been defined within the current system boundaries and generally delineate large areas of the conveyance system network that ultimately flow to interceptors that convey the flow to the WWTF.

8.2 Primary Collectors

The City's hydraulic model was expanded and refined to match the latest GIS, which was provided by the City in January 2025. As part of the GSP update, Carollo identified the primary collectors to add to the hydraulic model for improved spatial capture of the City's area. Figure 12 illustrates the additional collection system areas that were added to the model. Approximately, 39.8 miles of pipes ranging from 6- to 36-inches were added to the hydraulic model, 9.8 miles of which were force mains. The model update also added six LSs:

- Goodwin Road LS.
- 232nd Avenue LS.
- Leadbetter Road LS.
- Hills at Round Lake LS.
- Oak Park LS.
- Baz Park LS.

This model updates total is 39.8 miles of the total collection system to the model. The City provided all the as-built drawings of their collection system, which includes the areas in North Shore and the seven LSs mentioned above. Adjustments to inverts and pipe diameter were made as needed. Some field verification was performed at flow meters 5-1-2 to ensure the geometry manhole drop downs was correct. Figure 14 shows the pipelines that were included in the hydraulic model.

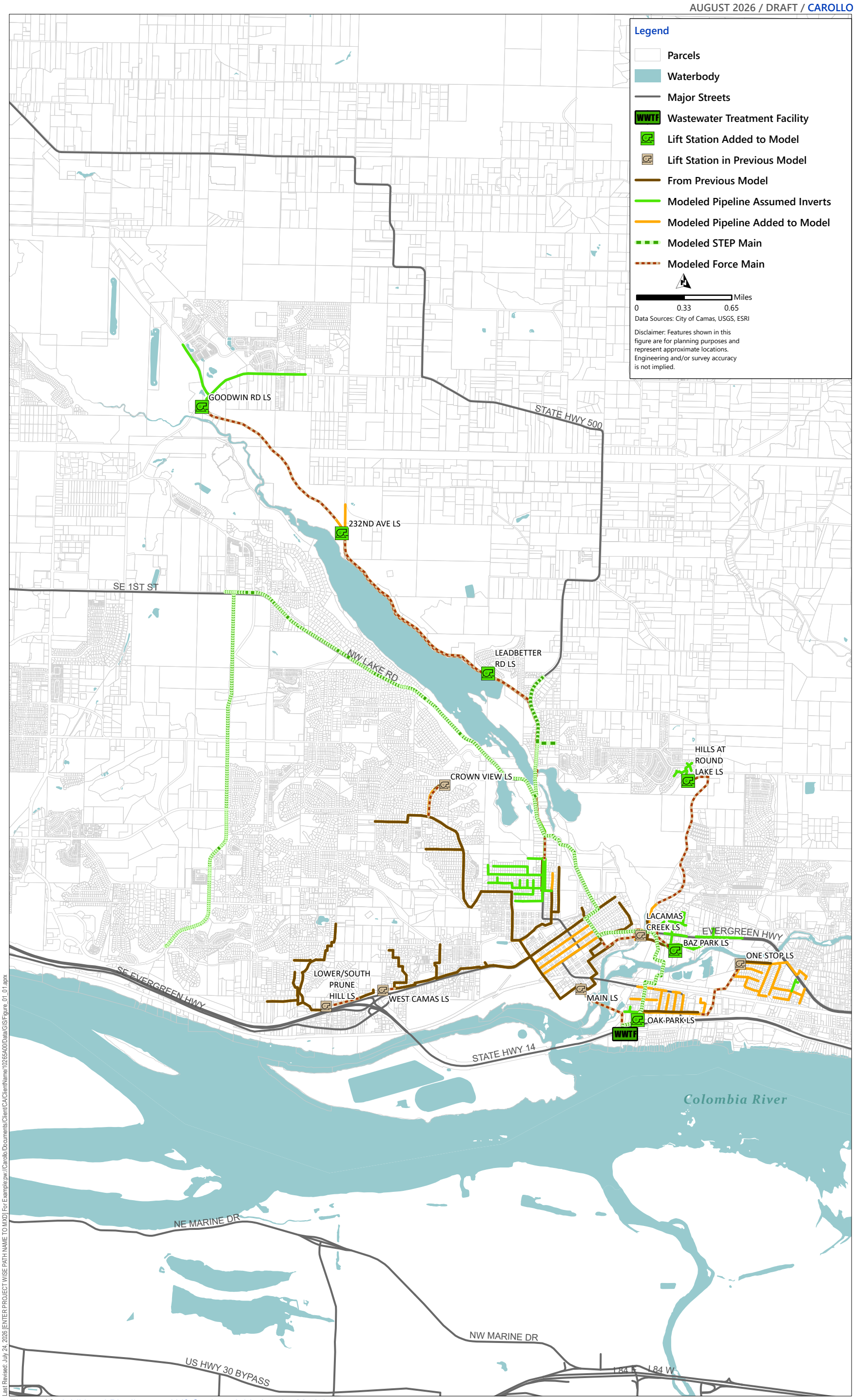


Figure 12 Additional Pipelines and Lift Stations Added to the Model

The modeled sewer system consists of approximately 8.4 miles of STEP pipelines ranging in diameter from 6-inches to 24-inches (or 13.7 percent of the total linear feet of pipes in the collection system) and approximately 21.6 miles gravity sewer pipelines ranging in 6-inches to 36-inches (or 28.1 percent of the total linear feet of pipes in the collection system). There are twelve pump stations in the hydraulic model, of which six were in the previous hydraulic model. The modeled pump station information is summarized Table 5. The pumps stations beyond the modeled system are implicitly included in the loading polygons where they are located. Neglecting the complete details of very small pump stations is common practice in skeletonized collection system models as their low flows are relatively small and steady. The force mains were not included in the model.

Table 6 summarizes the modeled sewer system by pipeline type, diameter, and length of pipe.

Table 5 Modeled Lift Stations

Name	No. of Pumps	Firm Capacity (gpm)	Total Capacity (gpm)	Pump 1 Start Level (feet)	Pump 2 Start Level (feet)	Pump 1 Stop Level (feet)	Pump 2 Stop Level (feet)
Crown View	2	222	444	520.0	516.0	521.0	516.0
Lacamas Creek	2	950	1,900	23.03	21.03	23.73	21.03
One Stop	2	231	462	19.97	16.97	20.97	16.97
South Prune Hills	2	600	1,200	134.53	130.53	135.53	130.53
West Camas	2	1,000	2,000	116.7	111.2	117.7	111.2
Goodwin Road(1)	2	340	680	179.08	177.08	179.58	177.08
232nd Avenue(1)	2	365	730	179.67	177.17	180.17	177.17
Leadbetter Road(1)	2	605	1,210	175.0	172.0	175.5	172.0
Main(2)	3	3,850	7,700	15.5	15.0	16.5	15.0
Hills at Round Lake	2	257	514	319.16	314.56	320.16	314.56
Oak Park	2	350	700	19.5	16.5	20	16.5
Baz Park	2	488	976	21.17	16.77	22.17	16.77

Notes:
(1) Lift Station designed with space for a third pump to be added in the future.
(2) Pump on/off level assumed.
gpm - gallons per minute.

Table 6 Modeled System Pipelines

Diameter (inches)	Gravity Modeled Pipe Length (feet)	STEP Modeled Pipe Length (feet)	Force Main Modeled Pipe Length (feet)	Total Pipe Lengths (feet)	Percent of Modeled System (%)
6	33	66	25,685	25,784	12.3%
8	80,974	3,254	17,752	101,979	48.6%
10	3,431	4,953	2,517	10,902	5.2%
12	17,201	343	3,375	20,919	10.0%
15	1,818	-	-	1,818	0.9%
18	5,913	-	2,348	8,261	3.9%
21	2,828	20,907	-	23,735	11.3%
24	1,238	15,008	-	16,246	7.7%
36	372	-	-	372	0.2%
Total	**113,809**	**44,531**	**51,677**	**210,016**	**100%**

8.3 Wastewater Flow Allocation

Defining the quantity of dry weather wastewater flows generated within a municipality and how the flows are distributed throughout the collection system is an important component of the hydraulic modeling process. Various techniques can be used to assign wastewater flows to individual model nodes, depending on the type of data that is available. Adequate estimates of the volume of sanitary wastewater flows are important in maintaining and sizing sewer system facilities, both for present and future conditions. Baseline wastewater flows were allocated (assigned to specific nodes) in the hydraulic model based on land use data provided by the City and wastewater flow coefficients developed previously in Section 6.

Sanitary sewer flows were developed based on analyses of the City's flow meter data described in Section 6. Measured ADWF for each meter basin was used to develop land use-specific flow factors (in gallons per acre per day [gpad]). The flow factors and land use data specific to each model basin were used to estimate an ADWF, as described below:

- **Step 1:** The City's seven basins were subdivided into 11,950 individual model subcatchments based on tax parcels excluding the right-of-way. Figure 13 shows the subcatchments developed to allocate flows within the hydraulic model. Each subcatchment represents the geographic area contributing flow to a single model node (i.e., trunk system manhole). Although the Camas wastewater model is a skeletonized model rather than an all-pipe model, tax parcels were still used as the basis for the model subcatchments to provide a more detailed distribution of loading throughout the system. In some cases, individual parcels were automatically split between adjacent loading polygons based on the model network layout and downstream assignment, resulting in portions of the same parcel contributing flow to different model nodes.
- **Step 2:** The ADWFs were calculated for each subcatchment using a GIS software program by multiplying the land use flow factors by the land use acreage.
- **Step 3:** The model used a base sewage flow of 2.10 mgd, with the remaining 0.75 mgd of the ADS-monitored flow assigned as groundwater infiltration and distributed among the basins based on pipe length. See Section 8.3.1 for additional details on the development and allocation of groundwater basin-specific infiltration.
- **Step 3:** The subcatchment DWF was allocated to the appropriate node in the sewer system model.
- **Step 4:** The allocated DWFs were adjusted along with the GWI as necessary during the DWF calibration process (see Section 9) to closely match the actual measured DWFs recorded during the flow monitoring period.

8.3.1 Systemwide Base Wastewater Flow and Groundwater Infiltration Allocation

During the 2025 winter flow monitoring period, ADS measured a systemwide ADWF of approximately 2.85 mgd. In comparison, the City's historical WWTF influent data indicated an average summer ADWF of 2.10 mgd. Because groundwater levels are typically higher during the winter, the 0.75 mgd difference was attributed to groundwater infiltration. Therefore, the model used 2.10 mgd as the base wastewater flow.

The estimated groundwater infiltration was allocated to each sewer basin based on its proportion of the system's total pipe length, assuming that basins with more pipes have greater potential for groundwater to enter through pipe defects, joints, and manholes. The infiltration assigned to each basin was then divided by the basin's contributing acreage to calculate a basin-specific infiltration rate in gpad. This rate was applied to the contributing area within each basin to distribute infiltration to the model loading locations. As a result, basins with a greater amount of sewer pipe relative to their contributing area received a higher infiltration rate.

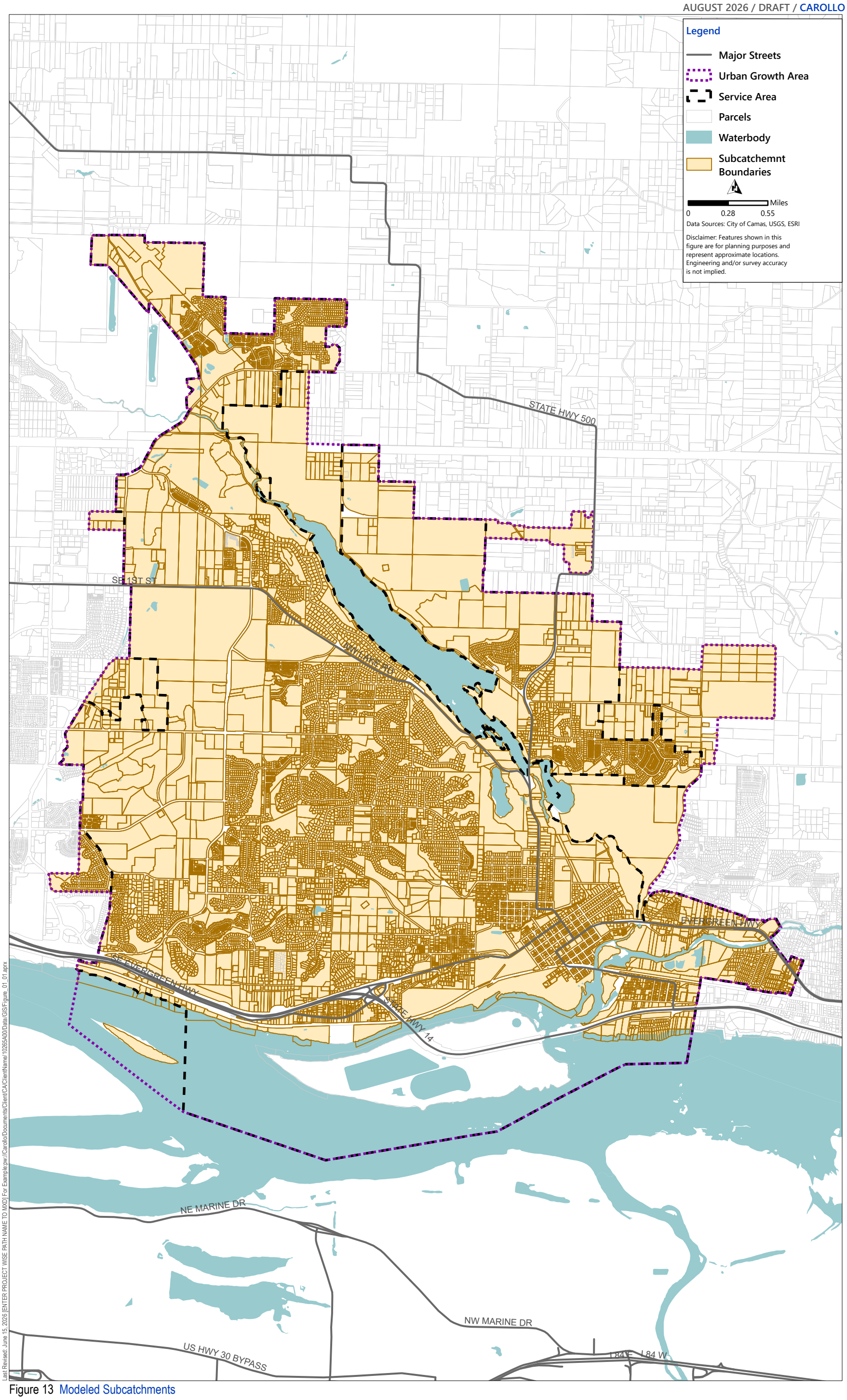


Figure 13 Modeled Subcatchments

8.4 Inflow and Infiltration: Time-Area A and RDI

MIKE+ has several modules to estimate the RDII in each basin. For this study, the Time-Area Model A (Inflow) and rainfall dependent infiltration (RDI) methods were chosen to model RDII, respectively. The Model A includes three primary factors including: time to concentration, a reduction factor representing flow losses, and an initial loss. The model also includes curves representing basin rain response. Basin rain response is essentially how fast flow from different parts of the catchment basin reaches the collection system.

The infiltration component of RDII flow comes from three sources, conceptually represented by different storage zones through the soil column. Figure 14 shows the conceptual RDI model, from DHI (2022). The three sources of flow that enter the collection system as RDI are Overland Flow that enters the system rapidly after a storm, Interflow with a medium response time, and Base Flow with a slower response, which is different than the sanitary Base Flow coming from wastewater customers. The volume of water stored in each zone, the response time, and how water moves between the zones are described by a series of related equations. The equations include 19 parameters that are not directly measurable and must be found through model calibration. An evapotranspiration term is included to simulate drying of the zones. Appendix D presents the resulting parameters after model calibration.

Two important RDII parameters are the areas of "connected pervious" and "connected impervious" land contributing flow to each basin's collection system. These areas represent the equivalent area of land accumulating rainfall to produce the WWF measured at the downstream flow meter. For example, if a flow meter measures a fast response to a storm event, there may be a lot of impervious land that is accumulating rainfall and contributing surface runoff to the collection system. Connected pervious land represents the equivalent amount of land absorbing rainfall and slowly contributing WWF to the collection system when the ground is saturated.

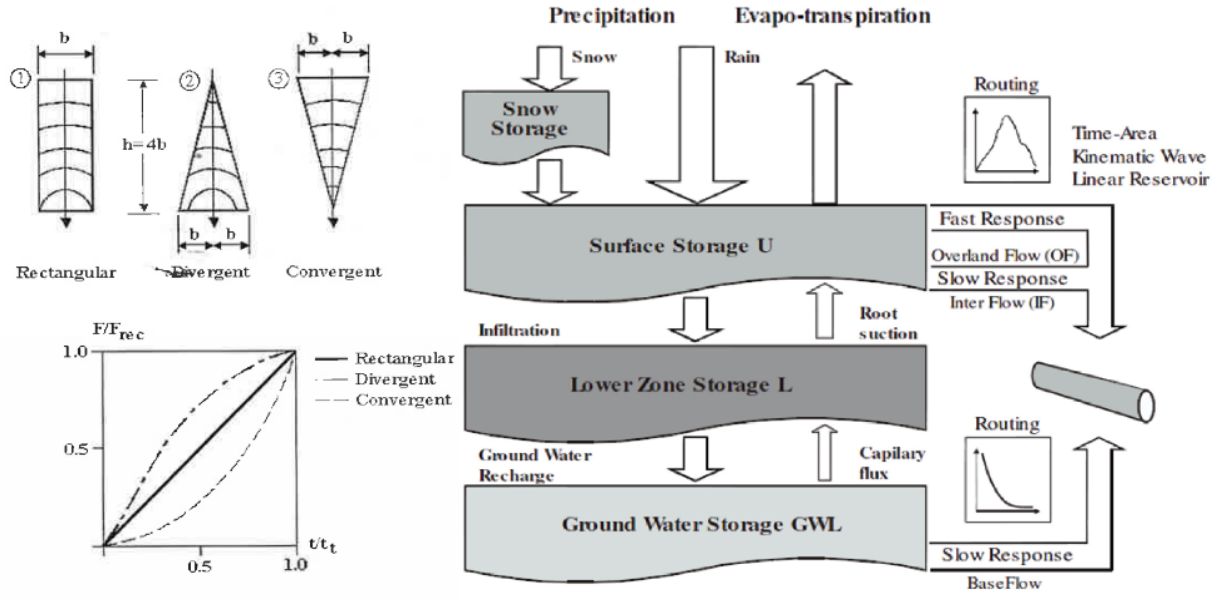


Figure 14 Model A and RDI

The RDI and Model A flow components combine to create a continuous hydrograph of RDII flow from each basin for each storm event. Often during wet periods, additional storms occur while tailing components of the preceding storm are still entering the system, creating complex hydrographs. The model is able to track subsurface groundwater storage through the wet season. Subsurface groundwater conditions are influenced by parameters affecting the interflow (horizontal leakage) and moisture interception by vegetation and root zone storage. Estimated evapotranspiration time series are also included in the model to further represent the physical processes that diminish the quantity of surface and sub-surface water.

8.5 Model Update Process

The City's hydraulic model combines information on the physical and operational characteristics of the wastewater collection system and performs calculations to solve a series of mathematical equations to simulate flows in pipes. The hydraulic model is a dynamic tool that can be changed and updated over time to represent the most recent data available to the City. The following steps outline the process used to update the hydraulic model:

- **Step 1:** The City's GIS shape files for the sewer collection system were obtained.
- **Step 2:** The GIS data were reviewed and deemed not accurate enough to rely on for model updates.
- **Step 3:** The collection system pipeline and facility data were updated based on available as-builts. Physical and operational data for the City's wastewater collection facilities were also updated and provided by the City.
  - Once all the relevant data was updated and input into the hydraulic model, the model was reviewed to verify that the model data was input correctly and that the flow direction and size of the modeled pipelines were logical. Additionally, the modeled pump stations were also checked to verify that they operated correctly.
- **Step 4:** Dry weather wastewater flows were then allocated to the appropriate model junctions. These flows were scaled up or down, as necessary, to match the ADWFs recorded during the flow monitoring period during the dry weather period.
- **Step 5:** The hydraulic model contains certain run parameters that need to be set by the user at the beginning of the project. These include run dates, time steps, reporting parameters, output units, and flow routing method. Once the run parameters were established, the model was debugged to ensure that it ran without errors or critical warnings.

SECTION 9 HYDRAULIC MODEL CALIBRATION

Hydraulic model calibration is a crucial component of the hydraulic modeling effort. Calibrating the model to match data collected during the flow monitoring program ensures the most accurate results possible. The calibration process consists of calibrating to both dry and wet weather conditions.

For this project, both dry and wet weather monitoring was conducted at the four metering sites presented and discussed in Section 4:

- DWF calibration ensures an accurate depiction of base wastewater flow generated within the study area, and diurnal fluctuations.
- WWF calibration consists of calibrating the hydraulic model to a specific storm event or events to accurately simulate the peak flow and volume of RDII into the sewer system. The amount of RDII is essentially the difference between the WWF and DWF components.

9.1 Calibration Standards

The hydraulic model was calibrated in accordance with international modeling recommendations. The Urban Drainage Group (UDG), formerly known as Wastewater Planning Users Group, a section of the Chartered Institution of Water and Environmental Management (CIWEM), has established generally agreed upon principles for model verification. The dry weather and wet weather calibration focused on meeting the recommendations on model verification contained in the "Code of Practice for the Hydraulic Modeling of Urban Drainage Systems," published by the CIWEM UDG[2], as summarized below.

9.1.1 Dry Weather Calibration Standards

Dry weather calibration should be carried out for two dry weather days, and the modeled flows and depths should be compared to the field-measured flows and depths. Both the modeled and field-measured flow hydrographs should closely follow each other in both shape and magnitude. In addition to the shape, the flow hydrographs should also meet the following criteria as a general guide:

- The timing of flow peaks and troughs should be within 1 hour.
- The peak flow rate should be within the range of ±10 percent.
- The volume of flow (or the average rate of flow) should be within the range of ±10 percent. If applicable, care should be taken to exclude periods of missing or inaccurate data.
- The unsurcharged depth should be within ±10 percent or ±4 inches, whichever is greater.

9.1.2 Wet Weather Calibration Standards

For each meter, three separate storms should be simulated with the model. For at least two storms out of the three events from the flow monitoring period, the model-simulated flows and depths should match the field-measured flows and depths within the accepted criteria. The modeled and field flow hydrographs for the calibration storms should closely follow each other in both shape and magnitude, until the flow has substantially returned to DWF rates.

In addition to the shape, the flow hydrographs should also meet the following criteria as a general guide:

- The timing of the peaks and troughs should be similar with regard to the duration of the events.
- The peak flow rates at significant peaks should be in the range of +25 percent to -15 percent and should be generally similar throughout.

[2] UDG, Code of Practice for the Hydraulic Modelling of Urban Drainage Systems, 1st Edition CIWEM 2017 www.ciwem.org.

- Modeled volume of flow should be within +20 percent to -10 percent of measured volume of flow.
- The depth of surcharge should be in the range of +20-inches to -4-inches.
- The difference between maximum unsurcharged depth should be within the range of ± 4-inches.

The Wet Weather calibration is focused more on the peak observed flows at the monitored location and generally overpredicted for the smaller storm events that generated a lesser peak and/or volume. In other words, if the flow monitoring program captured several back-to-back storms, it may be preferable to use the back-to-back storms events as the calibration storms, as opposed to calibrating to two separate storms that have occurred weeks or months apart. Model calibration simulations should be run for a duration long enough that the RDII response is no longer apparent in the measured data.

9.2 Dry Weather Flow Calibration

9.2.1 Dry Weather Calibration Process

The DWF calibration process consists of several elements, as outlined below:

- The first step in the calibration process was to divide the City into flow meter tributary areas. Seven tributary areas were created, one for each flow meter from the flow monitoring program, plus the treatment facility and the two pump stations in the North Shore area. A map showing the locations of each flow monitoring site and their associated tributary area is provided in Section 4 along with a schematic of the flow meters.
- The next step was to define the flow volumes within each area, which was accomplished in the flow allocation step.
- Create diurnal patterns to match the temporal distribution of flow. A diurnal curve is a pattern of hourly multipliers that are applied to the base flow to simulate the variation in flow that occurs throughout the day. Two diurnal curves were developed for each flow monitoring tributary area, one representing weekday flow and one representing weekend flow. The diurnal patterns were initially developed based on the flow monitoring data and adjusted as part of the calibration process until the model-simulated flows closely matched the field-measured flows. Figure 15 shows the calibrated weekday and weekend diurnal patterns for the area tributary to Meter 8-1-2. Similar diurnal curves were developed for each of the meters and its tributary area. These additional curves are available in Attachment E.

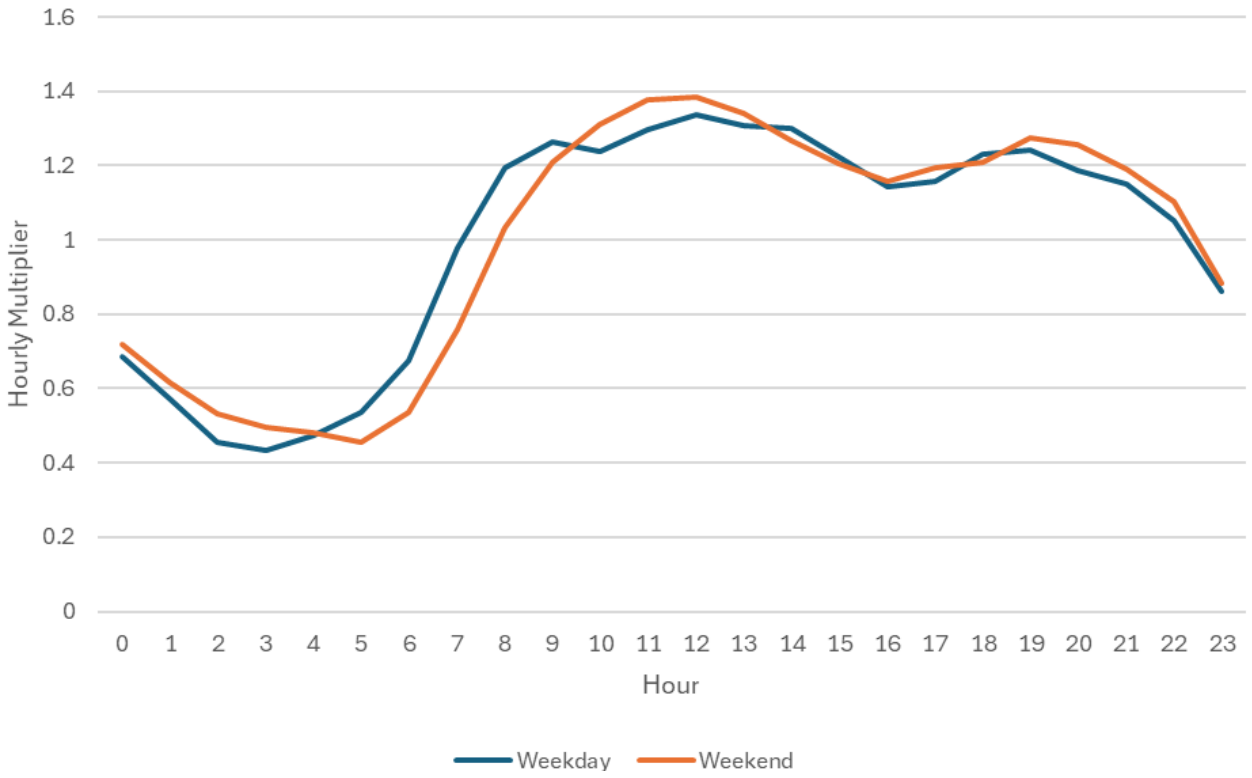


Figure 15 Example of Diurnal Pattern (Meter 8-1-2)

9.2.2 Dry Weather Calibration Discussion

Table 7 provides a summary of the DWF calibration using the average and daily peak flow results for both weekday and weekend conditions. As shown on Table 7, the model-simulated average and peak flows for both weekday and weekend DWF were all within 10 percent. In general, the percent difference between the overall modeled and measured DWF ranged between -2.2 and +7.7 percent, with most differences being less than 8 percent.

Attachment E contains a detailed DWF calibration summary sheet for each of the seven metering sites. Each calibration sheet provides plots that compare the model-simulated and field-measured flow data for both weekday and weekend conditions. An example of the dry weather calibration for Meter 8-1-2 is shown in Figure 16.

There is good overall correlation of the field-measured data to the model output results. All meters meet criteria for both level and velocity, indicating a well calibrated model for DWFs. Losses in the modeled manholes were minimized throughout the system to allow for minimal head loss and decrease in modeled levels to better match the measured data.

Table 7 DWF Calibration Results

Flow Meter ID	Weekday Average Flow Percent Error (%)	Weekday Peak Flow Percent Error (%)	Weekday Max Level Difference (inches)	Weekend Average Flow Percent Error (%)	Weekend Peak Flow Percent Error (%)	Weekday Max Level Difference (inches)	Percent Different (%)
Meter 4-1-3	-2.6%	0.7%	2.07	-1.1%	-0.4%	2.01	-2.2%
Meter 5-1-2	1.3%	-1.9%	1.35	0.9%	0.9%	1.32	1.2%
Meter 5-2-1	0.4%	-7.8%	0.21	-3.9%	3.0%	0.32	-0.9%
Meter 8-1-2	0.4%	-1.7%	0.37	4.1%	2.0%	0.30	1.4%
STEP/WWTF	2.2%	-0.4%		1.0%	-1.2%		1.8%
Leadbetter Road	10.0%	0.7%		-1.3%	-5.6%		6.5%
Goodwin Road	4.0%	2.8%		-3.3%	-4.2%		1.8%

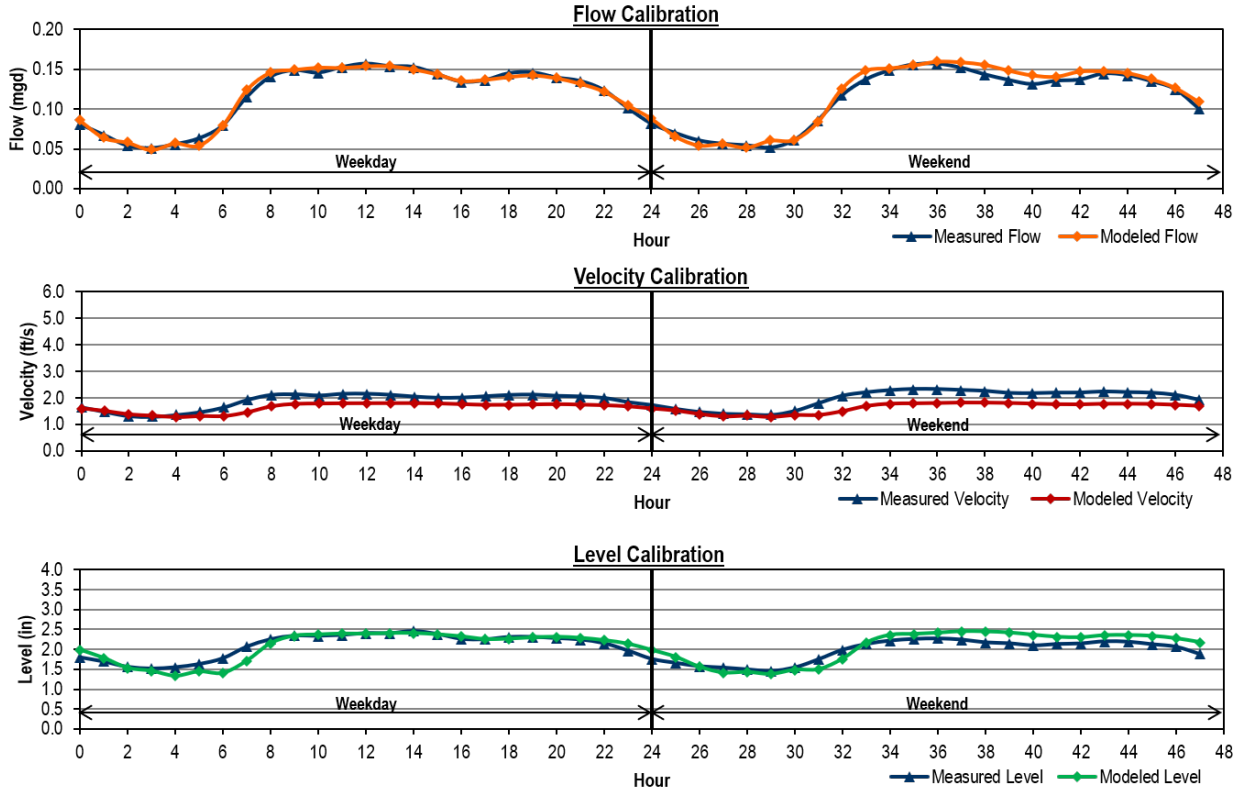


Figure 16 Example of DWF Calibration (Meter 8-1-2)

9.3 Wet Weather Flow Calibration

9.3.1 Wet Weather Flow Calibration Process

The WWF calibration enables the hydraulic model to accurately simulate RDII entering the collection system during storms. The WWF calibration process consists of running model simulations of historic

rainfall events based on data collected as part of a system flow monitoring program. The goal of any WWF monitoring program is to capture and characterize a system's response to a significant rainfall event, preferably during wet antecedent moisture conditions. As outlined below, the WWF calibration process consists of several elements:

- **Identify calibration rainfall events**. The WWF calibration process consists of running model simulations of historic rainfall events based on data collected as part of the flow monitoring program. The goal of any wet weather flow monitoring program is to capture and characterize a system's response to a significant rainfall event, preferably during wet antecedent moisture conditions.

  The selection of a particular calibration storm or group of storms is based on a review of the flow and rainfall data. There is a good range of different event types available for the different meters. Major rainfall events were identified as part of Section 4.2.2. For WWF calibration, the model was run from March 9 to April 13, 2025, because the rain events that occurred on these dates have shown the most response to the collection system. To run a model simulation for the period of these storms, minute rainfall data were input into the model for these events. Table 3 summarizes the three storms picked for calibration for each of the five sites. Figure 9 illustrates the storms used in the model calibration process.
- **Define RDII tributary areas**. For the WWF calibration, RDII flows are added on top of the DWF. The model calculates two types of response: a slow response corresponding mainly to infiltration, or slow response curve (SRC), and a fast response corresponding mainly to direct inflow, or fast response curve (FRC). Impervious area, which is the fraction of the catchment considered to contribute to FRC runoff, and RDI Area, which is the fraction of the total catchment area that contributes to the SRC RDI runoff component are two major model-specific data in the model calculation of WWFs. These values were initially set based on engineering judgment, as well as the previously used values, and then adjusted until the model-simulated flows (both peak flows and total volume) matched closely with the field-measured flows.
- **Create RDII parameter database and modify to match field-measured flows**. The main step in the WWF calibration process involves adjusting both Model A and RDI parameters for each flow monitoring tributary area. The most important parameters were described in Section 8.4 and Attachment D summarizes all calibrated parameters by flow monitoring site, for current conditions. As with the dry weather calibration, the wet weather calibration process compared the meter data with the model output. Comparisons were made of average and peak flows as well as the temporal distribution of flow until flows returned to their baseline levels. According to the CIWEM UDG, a hydraulic model is generally considered calibrated to WWF conditions if the modeled peak flows are within +25 percent to -15 percent of the field-measured data, and if the average modeled volumes are within +20 percent to -10 percent of the field-measured data. Calibration was performed for the depth of flow as well, this is considered calibrated when peak depths are with ± 4-inches when unsurcharged, and +20-inches to -4 inches when surcharged.
- **Adjust model variables to match field-measured velocity and flow depths**. Once the model-simulated flows matched the field-measured flows within the acceptable limits, the model-simulated velocity and flow depth were compared to the field-measured velocity and flow depth. Adjustments were made to various model parameters until the modeled and measured velocity and depth closely matched one another. The primary varied parameters for this process are node outlet head losses and pipeline roughness (Manning's n), although other parameters can also be

adjusted as calibration results are generated. Sediment buildup and movement in the pipe will also influence the level and depth, but these are very difficult to quantify and can change frequently, therefore they are not included in the calibration.

Manning's roughness coefficients, or n values, have industry accepted ranges based on a number of variables. Roughness coefficients increase over time depending on the construction methods, installation quality, system maintenance, and other environmental factors. There can be certain factors within the City's collection system that can result in roughness coefficients that differ from the typical range. These could include joint misalignment, cracks, and debris (e.g., root intrusion, etc.) that lead to increased turbulence in a pipe and an increase in the apparent Manning's n factor.

If the model is unable to reasonably match the field-measured flow depth and velocity using Manning's roughness coefficients within the range of 0.011 to 0.013, further investigation should be conducted to help determine the cause of the discrepancy. Some issues that could cause such a discrepancy can include errors in the slope or diameter of a pipeline, downstream blockages, pipeline sags, and, in some cases, influences from downstream pump station operations.

9.3.2 Wet Weather Calibration Results

Attachment F contains a detailed WWF calibration summary sheet for each of the seven-meter sites. The modeled outputs at each flow meter were compared to the data from three storms recorded during the flow monitoring period for calibration. Each calibration sheet provides plots that compare the model-simulated and field-measured flow, velocity, and level data for the calibration storms. An example of the wet weather calibration for Meter 5-1-2 is shown on Figure 17.

Table 8 provides a summary of the WWF calibration using the total volume and peak flow results. Of the seven meters, all had two or more storm event responses within calibration standards for volume and peak flows. As shown on Table 8, the model-simulated average and peak flows at all meter sites were within the acceptable tolerances for the calibration storms, and therefore the model was considered calibrated and ready to use for capacity analysis purposes.

As discussed in Section 9.1, it is critical that the hydraulic model is not only calibration to volume and peak flow, but also level data. This will ensure accuracy and trust in modeled results when evaluating capacity deficiencies, which are based on a hydraulic grade line criteria in the collection system.

Modeled data at all meters closely matched the recorded level information. Of the seven meters with level data, all seven met the level calibration standard with a maximum difference of 3.5 inches.

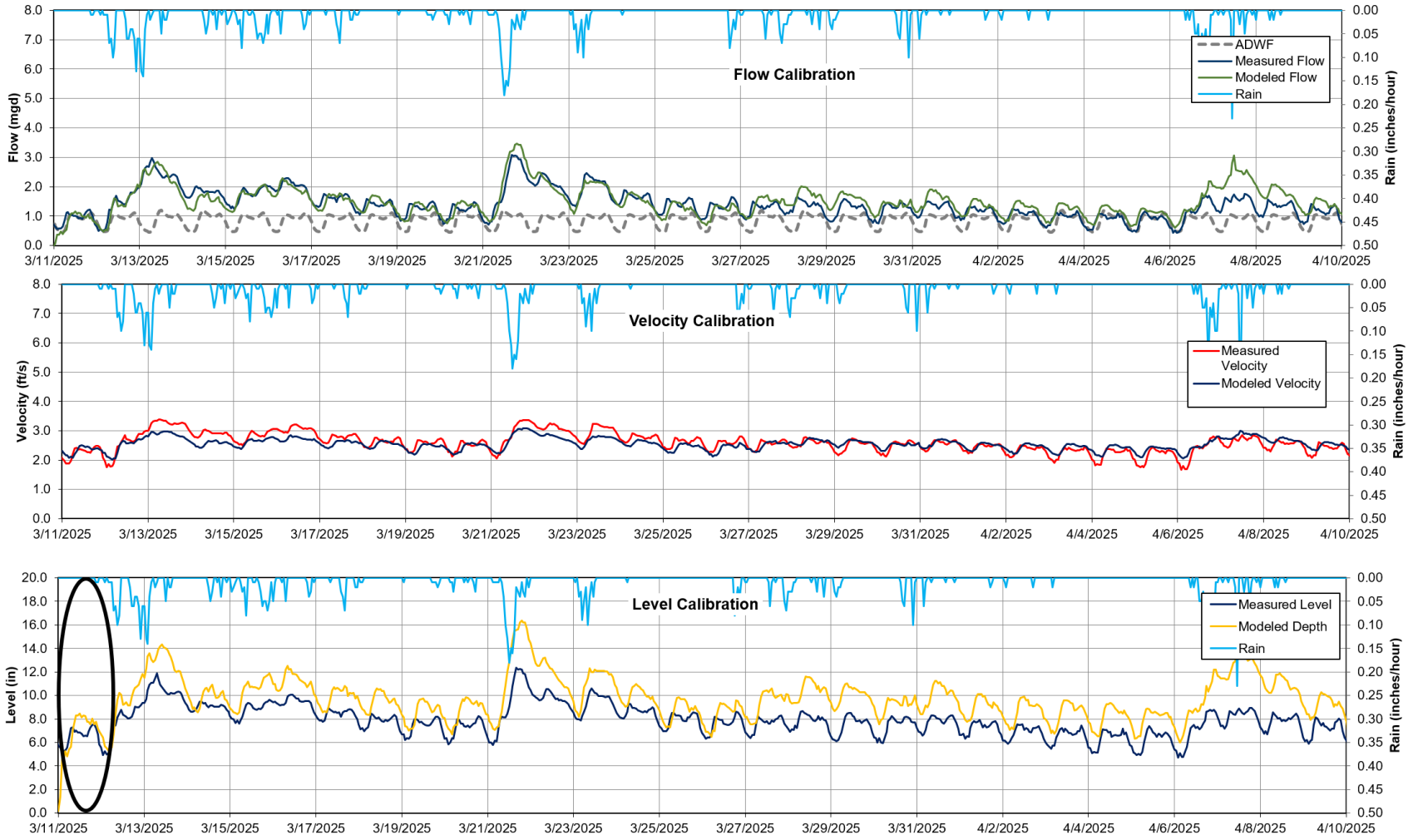


Figure 17 Example WWF Calibration (Meter 5-1-2)

Table 8 WWF Calibration Results

Flow Meter ID	Storm 1 Total Volume Percent Error (%)	Storm 1 Peak Flow Percent Error (%)	Storm 1 Max Level Difference (inches)	Storm 2 Total Volume Percent Error (%)	Storm 2 Peak Flow Percent Error (%)	Storm 2 Max Level Difference (inches)	Storm 3 Total Volume Percent Error (%)	Storm 3 Peak Flow Percent Error (%)	Storm 3 Max Level Difference (inches)
Meter 4-1-3	8.0%	13.0%	2.5	6.1%	12.0%	2.5	28.2%	81.1%	3.7
Meter 5-1-2	-4.2%	-4.6%	2.4	6.0%	12.8%	4.0	33.7%	74.8%	6.1
Meter 5-2-1	-18.9%	-49.3%	-0.3	-9.4%	-11.7%	1.3	1.9%	3.1%	1.1
Meter 8-1-2	6.5%	-1.8%	0.2	6.8%	3.3%	0.1	11.5%	13.4%	0.1
STEP	5.2%	0.8%		19.6%	13.0%		39.8%	53.5%	
Leadbetter Road	-8.2%	-28.3%		4.1%	-10.1%		6.2%	-4.6%	
Goodwin Road	-6.4%	-9.1%		3.2%	20.8%		7.1%	38.3%	

9.4 Hydraulic Model Calibration Summary

Calibration of the City's hydraulic model was a multi-step process that involved comparing model-simulated flow to the actual field-measured data for both dry and wet weather conditions. The model met all UDG standards for ADWF. Results showed the model met UDG standards for calculation of flows during peak wet weather flow. The UDG level standards were met at seven of the seven sites used for model calibration. These calibration results provide a high level of confidence in the model's accuracy such that the model can be considered calibrated and ready to use for subsequent capacity analysis.

ATTACHMENT A

CAMAS FLOW MONITORING REPORT 2025

Camas Flow Monitoring 2025

Final Report Submitted to **Carollo Engineers** May 28, 2025



ADS ENVIRONMENTAL SERVICES

846 Industry Dr.
Tukwila, WA 98188

800-633-7246
www.adsenv.com

May 28, 2025

Max Mozer

Carollo Engineers

1200 5th Avenue Suite 900

Seattle, WA 98101

SUBJECT: Camas Flow Monitoring 2025

Dear Mr. Mozer,

ADS is pleased to submit the report for the project referenced above completed on behalf of Carollo Engineers. The metering was conducted at four (4) flow monitoring locations and one (1) rain monitoring location. The study was conducted during the period of Wednesday, 15 January 2025 to Tuesday, 29 April 2025.

The report contains depth, velocity, and quantity hydrographs as well as daily long tables for the metering period. An Excel file containing depth, quantity, and velocity entities for the monitoring location in 15-minute format was provided previously.

In addition, we would be happy to further explain any details about the report that may seem unclear. Should you have any questions or comments, you may contact the Project Manager, Cody Mahaffey at (425) 620-6412.

It has been our pleasure to be of service to you in the performance of this project. Thank you for choosing ADS products and services to meet your flow monitoring needs.

Sincerely,
ADS ENVIRONMENTAL SERVICES

Justin Hatch
Hydraulic Data Analyst

Camas Flow Monitoring 2025

Prepared For:

Max Mozer
Carollo Engineers
1200 5th Avenue Suite 900
Seattle, WA 98101

Prepared By:

ADS, LLC
846 Industry Dr.
Tukwila, WA 98188

Scope and Methodology

Introduction

Carollo Engineers entered into an agreement with ADS Environmental Services to conduct flow monitoring at (4) four flow locations and (1) one rainfall gauging location in Camas, Washington. The study was scheduled for a period of (105) one-hundred and five days. Once in place, the flow monitoring equipment was to be used to measure depth, velocity, and to quantify flows. Data obtained from the study will be used for inflow and infiltration analysis.

Project Scope

The scope of this study involved using a flow monitor to quantify wastewater flow at the designated locations for the study period. Specifically, the study included the following key components.

- Investigate the proposed flow-monitoring site for adequate hydraulic conditions
- Flow monitor installation
- Flow monitor confirmations and data collections
- Flow data analysis

Additionally, temporary rain gauge monitors were used to measure and record rainfall at the designated locations. Specifically, the study involved the following key components.

- Investigate the proposed rain gauge sites for sufficient exposure and security
- Rain Gauge installations
- Manually confirming rain gauge tipping bucket operation and date collections
- Rain data analysis

Equipment installation was completed on January 14, 2025. The monitoring period began on January 15, 2025 and was completed on April 29, 2025. Upon completion of the study, equipment was removed from the system.

Flow Monitoring Equipment



The ***ADS Triton+*** monitor was selected for this project. This flow monitor is an area velocity flow monitor that uses both the Continuity and Manning's equations to measure flow.

The ADS Triton+ monitor consists of data acquisition sensors and a battery-powered microcomputer. The microcomputer includes a processor unit, data storage, and an on-board clock to control and synchronize the sensor recordings. The monitor was programmed to acquire and store depth of flow and velocity readings at 5-minute intervals.

The Triton+ monitor features cross-checking using multiple technologies in each sensor for continuous running of comparisons and tolerances. The Triton+ monitor can support two (2) sets of sensors. The sensor option used for this project was:

The Peak Combo Sensor installed at the bottom of the pipe includes three types of data acquisition technologies

The ***up looking ultrasonic depth*** uses sound waves from two independent transceivers to measure the distance from the sensor upward toward the flow surface; applying the speed of sound in the water and the temperature measured by sensor to calculate depth.

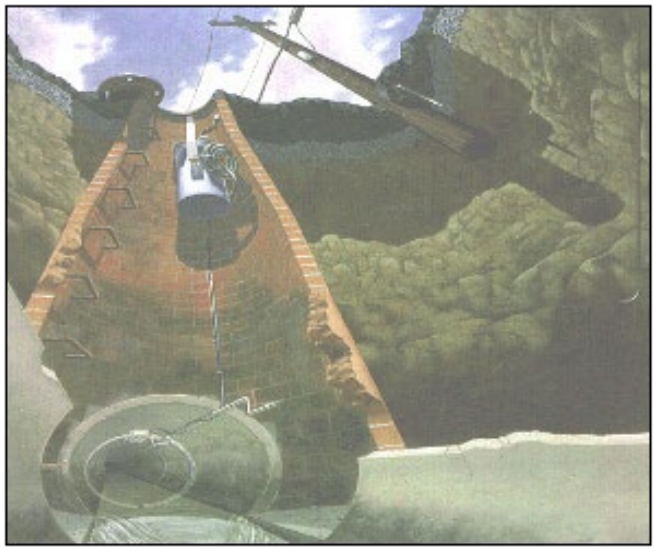
The ***pressure depth*** is calculated by using a piezo-resistive crystal to determine the difference between hydrostatic and atmospheric pressure. The pressure sensor is temperature compensated and vented to the atmosphere through a desiccant filled breather tube.

To obtain ***peak velocity*****,** the sensor sends an ultrasonic signal at an angle upward through the widest cross-section of the oncoming flow. The signal is reflected by suspended particles, air bubbles, or organic matter with a frequency shift proportional to the velocity of the reflecting objects. The reflected signal is received by the sensor and processed using digital spectrum analysis to determine the peak flow velocity.

Installation

Installation of flow monitoring equipment typically proceeds in four steps. First, the site is investigated for safety and to determine physical and hydraulic suitability for the flow monitoring equipment. Second, the equipment is physically installed at the selected location. Third, the monitor is tested to assure proper operation of the velocity and depth of flow sensors and verify that the monitor clock is operational and synchronized to the master computer clock. Fourth, the depth and velocity sensors are confirmed and line confirmations are performed.

In pipes up to 42 inches in diameter, the sensors were mounted on expandable stainless-steel rings, inserted at least a foot upstream into influent pipes and tightened against the inside walls of the pipes. Influent pipe installations reduce the influences of turbulence and backwater often caused by changes in channel geometry in manholes.





Data Collection, Confirmation, and Quality Assurance

Data collects were done remotely via wireless connect on a weekly basis. As needed, during the monitoring period, field crews visit each monitoring location to verify proper monitor operation and document field conditions. The following quality assurance steps are taken to assure the integrity of the collected data:

Measure power supplies: monitors were powered by dry cell battery packs. Voltages were recorded and battery packs replaced, as necessary. Separate batteries provided back-up power to memory allowing primary batteries to be replaced without loss of data.

Clock synchronization: Field crews synchronized monitor clocks to master clocks.

Confirm depth and velocity readings: Field crews descended into meter manholes to manually measure depths and velocities and compare the meter readings to confirm that they agreed. The site met the criteria for confirmation for depth and velocity unless noted otherwise in the site commentary section. They also measured silt levels, if any, in the inverts of the pipes. Silt areas were subtracted from flow areas to compute true areas of flow.

Confirm average velocities through cross-sectional velocity profiles: Since ADS velocity sensors measure peak velocity, field crews collected cross-sectional velocity profiles in order to develop a relationship between peak and average velocity in lines that meet the hydraulic criteria.

Upload and Review Data: Data collected from the monitors were uploaded and reviewed by a Data Analyst for completeness, outliers and deviations in the flow patterns, which indicate system anomalies or equipment failure.

Rainfall Logging Equipment



The ***ADS RainAlert III*** monitor was selected for this project. This monitor provides rainfall data acquisition and intelligent alarming to support wastewater capital improvement.

The ADS RainAlert III monitor measures rainfall using a tipping bucket containing a funnel and a small tipping mechanism that can collect a specific amount of rainfall. Once the tipping mechanism is full it empties and records that a tip has occurred. Typically, each tip is equivalent to 0.01 inches (or 0.2mm) of rainfall. The monitor records the number of tips that occur over each 5-minute interval to calculate discrete rainfall amounts for each of those 5-minute intervals.

Installation

Installation of rainfall logging equipment typically proceeds in five steps. First, investigating and selecting the appropriate location to install the tipping bucket and monitor. Second, installing the Sun Shield involves properly placing the sun shield and securing it to an appropriate structure or surface, or mounting it to a pole, as applicable. Third, involves mounting the tipping bucket on the sun shield at the designated rainfall collection location and connecting the wires from the monitor to the tipping bucket. Fourth, involves testing and adjusting the tipping bucket and internal tipping mechanism to ensure it accurately measures rainfall amounts. The final step involves installing the monitor at the appropriate location.

Flow Quantification Methods

There are two main equations used to measure open channel flow: the ***Continuity Equation*** and the ***Manning Equation.*** The Continuity Equation, which is considered the most accurate, can be used if both depth of flow and velocity are available. In cases where velocity measurements are not available or not practical to obtain, the Manning Equation can be used to estimate velocity from the depth data based on certain physical characteristics of the pipe (i.e. the slope and roughness of the pipe being measured). However, the Manning equation assumes uniform, steady flow hydraulic conditions with non-varying roughness, which are typically invalid assumptions in most sanitary sewers. The Continuity Equation was used exclusively for this study.

Continuity Equation

The Continuity Equation states that the flow quantity (Q) is equal to the wetted area (A) multiplied by the average velocity (V) of the flow.

$$Q = A * V$$

This equation is applicable in a variety of conditions including backwater, surcharge, and reverse flow.

Data Analysis and Presentation

Data Analysis

A flow monitor is typically programmed to collect data at 5-minute intervals throughout the monitoring period. The monitor stores raw data consisting of (1) the ultrasonic depth, (2) the peak velocity and (3) the pressure depth. The data is imported into ADS's proprietary software and is examined by a data analyst to verify its integrity. The data analyst also reviews the daily field reports and site visit records to identify conditions that would affect the collected data.

Velocity profiles and the line confirmation data developed by the field personnel are reviewed by the data analyst to identify inconsistencies and verify data integrity. Velocity profiles are reviewed and an average to peak velocity ratio is calculated for the site. This ratio is used in converting the peak velocity measured by the sensor to the average velocity used in the Continuity equation. The data analyst selects which depth sensor entity will be used to calculate the final depth information. Silt levels present at each site visit are reviewed and representative silt levels established.

Occasionally the velocity sensor's performance may be compromised resulting in invalid readings sporadically during the monitoring period. This is generally caused by excessive debris (silt) blocking the sensor's crystals, shallow flows (~< 1") that may drop below the top of the sensor or very clear flows lacking the particles needed to measure rate. In order to use the Continuity equation to quantify the flow during these periods, a Data Analyst and/or Engineer will use the site's historical pipe curve (depth vs. velocity) data along with valid field confirmations to reconstitute and replace the false velocity recordings with expected velocity readings for a given historical depth along the curve.

Selections for the above parameters can be constant or can change during the monitoring period. While the data analysis process is described in a linear manner, it often requires an iterative approach to accurately complete.

Data Presentation

This type of flow monitoring project generates a large volume of data. To facilitate review of the data, results have been provided in graphical and tabular formats. The flow data is presented graphically in the form of scattergraphs and hydrographs.
Hydrographs are based on 15-minute data. Tables are provided in daily average format. These tables show the flow rate for each day, along with the daily minimum and maximums, the times they were observed, the total daily flow, and total flow for the month (or monitoring period). The following explanation of terms may aid in interpretation of the flow data table and hydrograph.

DFINAL - Final calculated depth measurement (in inches)

QFINAL - Final calculated flow rate (in MGD)

VFINAL - Final calculated flow velocity (in feet per second)

RAIN – Final calculated rainfall (in inches)

REPORT TOTAL - Total volume of flow recorded for the indicated time period (in MG)

CAM_100290

Site Commentary

SITE INFORMATION

Pipe	Elliptical (19 in H x 19.5 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was located upstream of site CAM_51123. A review of flow balancing indicated no problems

Average flow depth, velocity, and quantity data observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	3.24	2.00	0.326
Minimum	1.34	1.05	0.049
Maximum	9.57	3.56	1.941
Min Time	04/29/2025 02:10:00	04/23/2025 00:55:00	04/29/2025 02:10:00
Max Time	02/23/2025 16:40:00	01/31/2025 09:25:00	02/23/2025 15:50:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the graphical reports are based on the fifteen minutes average and values in the Observed Flow Conditions and tabular report are based on the five-minute average.

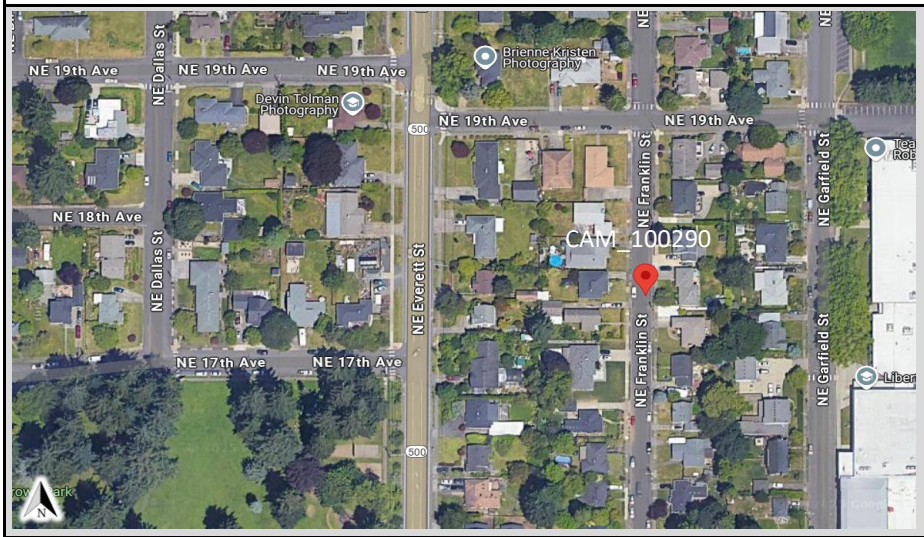
DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

Camas.Carollo.TFM.WA24		Site Name
Flow Monitoring Site Report	ADS ENVIRONMENTAL SERVICES®	CAM_100290

Site Address /Location:	1724 NE Franklin St, Camas, WA 98607			Monitor Series	Location Type
				TRITON+	Temporary
Site Access Details:	On Road	Latitude:	45.5919803	Pipe Size (H x W)	Pipe Shape
		Longitude:	-122.4042885	19.00 x 19.50	Circular



Manhole #	System Characteristics
100290	Residential
Access	Traffic
Drive	None







ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23116.11.325

Installation Information

Installation Date:	Installation Type:
Tuesday, January 14, 2025	Doppler Special Installation
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi

Installation Confirmation:

Time	
12:14:00 PM	
Depth of Flow (Wet DOF) (in)	
2.50	
CS58 Physical Offset (in)	Measurement Confidence (in)
N/A	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.23	N/A
Silt (in)	Silt Type
0	

Manhole / Pipe Information:

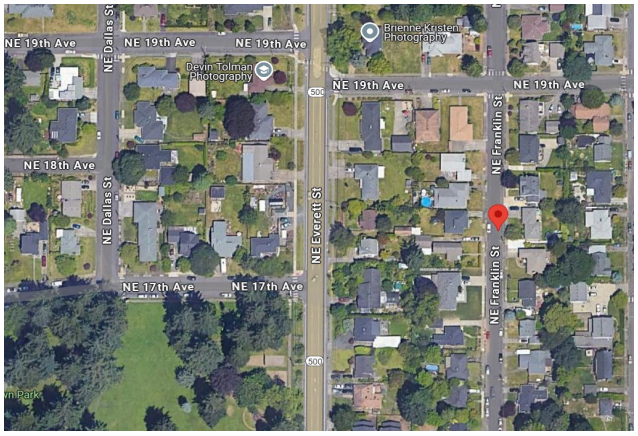
Manhole Depth (Approx. FT):	Manhole Configuration
13'	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
24	26
Manhole Cover	Manhole Frame
Steel	Normal
Active Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
PVC	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

Additional Photos

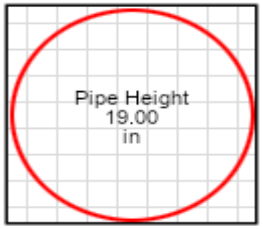
Monitoring Point Inlet	Outlet	
		
Top Down	**Location**	**Map**
		
	KEY	
	Flow Direction Monitoring Point	

Hydrograph Report

CAM_100290

Flow Monitor

CAM_100290



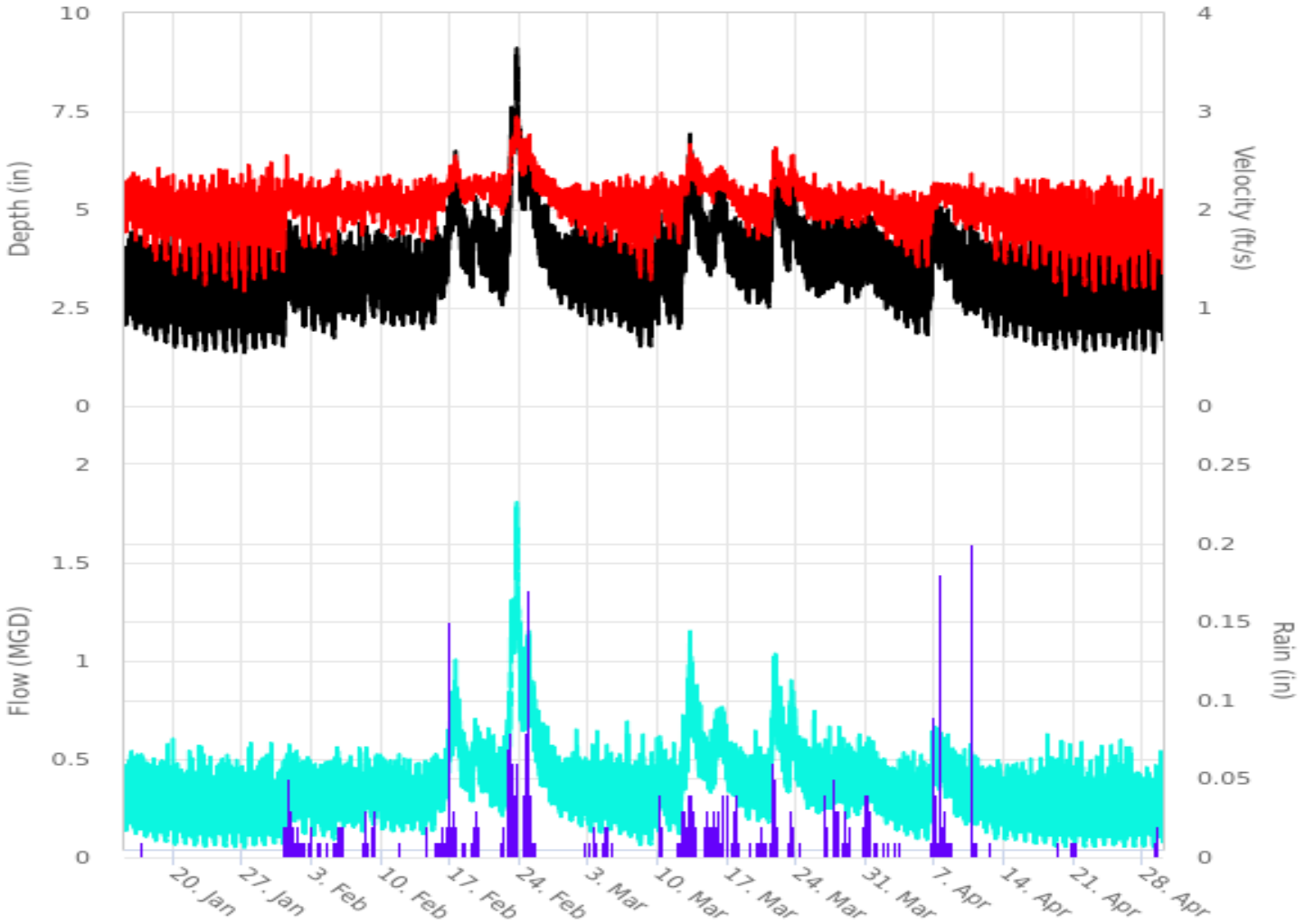
Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL





846 Industry Dr.
Tukwila, WA 98188

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Scattergraph Report

CAM_100290

Flow Monitor

CAM_100290

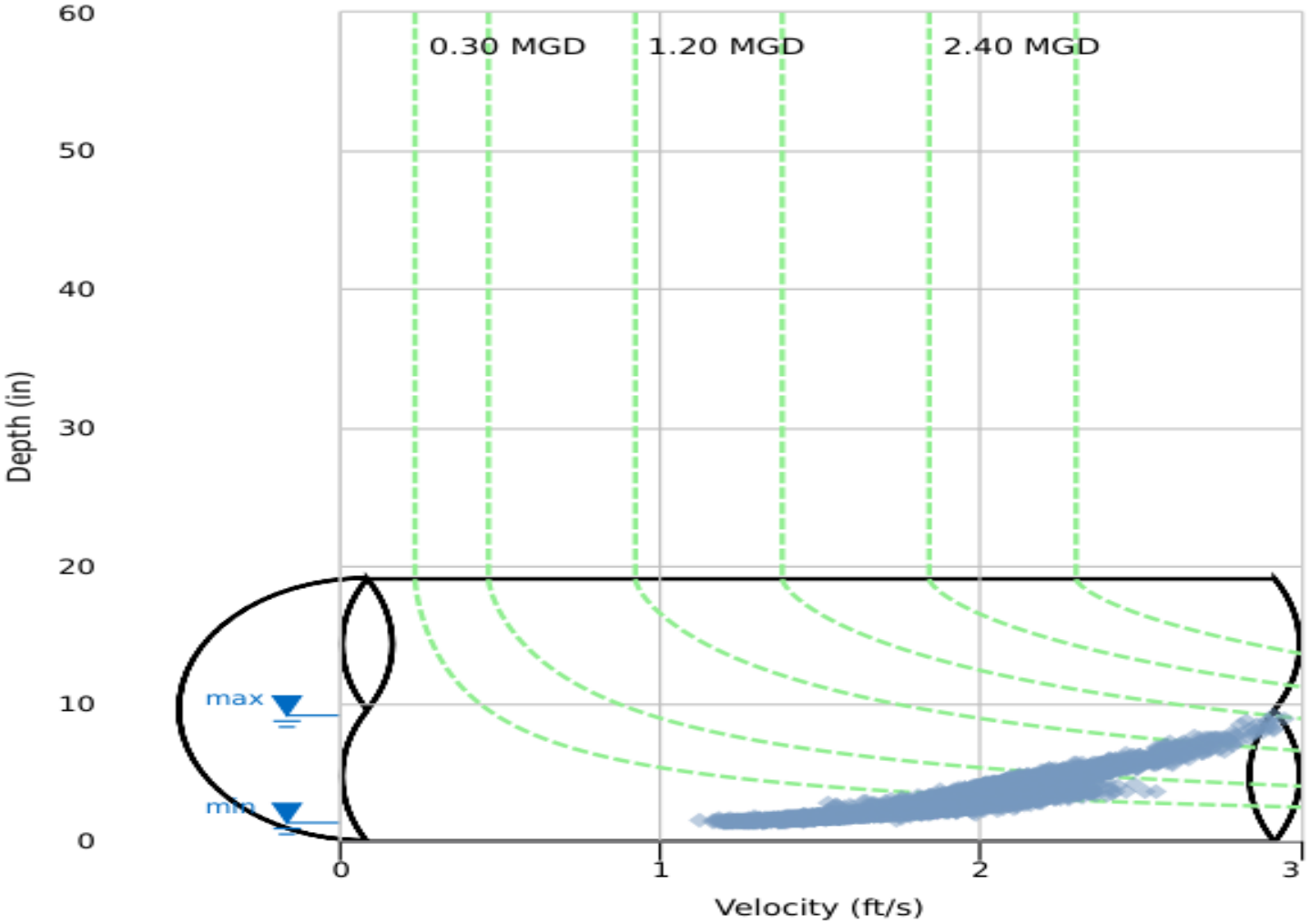
Pipe Height
19.00
in

Report Period

01/15/2025
To
04/29/2025

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth



846 Industry Dr.
Tukwila, WA 98188

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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_100290 Pipe: Elliptical (19 in H x 19.5 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/15/2025	04:00	2.05	17:35	5.79	2.91	04:00	1.72	12:50	2.64	2.05	04:00	0.131	17:35	0.777	0.274	0.274	-
01/16/2025	03:45	1.95	17:20	5.64	2.78	03:30	1.67	14:35	2.65	2.01	03:30	0.118	17:20	0.766	0.256	0.256	0.01
01/17/2025	04:50	1.82	08:55	5.72	2.66	03:50	1.60	09:35	2.65	1.94	03:50	0.104	08:55	0.823	0.235	0.235	-
01/18/2025	03:35	1.66	15:10	5.61	2.61	04:05	1.38	21:50	2.67	1.90	04:05	0.078	15:10	0.752	0.228	0.228	-
01/19/2025	05:50	1.61	21:45	5.69	2.60	03:00	1.46	10:10	2.67	1.88	05:50	0.080	21:45	0.792	0.226	0.226	-
01/20/2025	03:10	1.48	08:50	5.26	2.58	03:00	1.32	19:10	2.65	1.87	03:10	0.063	15:55	0.700	0.222	0.222	-
01/21/2025	04:10	1.50	07:40	5.55	2.49	02:40	1.34	14:05	2.65	1.83	04:10	0.067	07:40	0.757	0.208	0.208	-
01/22/2025	03:15	1.42	10:40	5.50	2.46	05:05	1.28	19:00	2.61	1.81	03:30	0.058	17:15	0.705	0.203	0.203	-
01/23/2025	03:10	1.40	11:55	5.55	2.41	03:15	1.20	21:45	2.60	1.80	03:15	0.052	11:55	0.717	0.197	0.197	-
01/24/2025	03:40	1.44	21:35	5.46	2.48	03:05	1.33	13:30	2.67	1.83	03:50	0.062	21:35	0.802	0.207	0.207	-
01/25/2025	05:10	1.37	09:30	5.59	2.47	04:50	1.25	06:30	2.75	1.80	04:50	0.053	09:30	0.746	0.207	0.207	-
01/26/2025	04:05	1.37	18:40	5.56	2.48	04:05	1.18	16:35	2.58	1.79	04:05	0.050	18:40	0.741	0.207	0.207	-
01/27/2025	03:05	1.34	10:10	5.32	2.44	02:35	1.15	10:15	2.88	1.81	03:10	0.049	09:25	0.712	0.203	0.203	-
01/28/2025	05:20	1.45	13:35	5.60	2.48	02:40	1.17	20:45	2.80	1.81	02:40	0.055	20:45	0.790	0.206	0.206	-
01/29/2025	04:05	1.49	08:25	5.63	2.50	03:55	1.25	19:20	2.99	1.82	03:55	0.060	19:20	0.884	0.211	0.211	-
01/30/2025	05:00	1.56	20:55	5.05	2.46	05:15	1.37	10:00	2.95	1.83	05:15	0.070	10:00	0.682	0.202	0.202	-
01/31/2025	02:00	1.50	16:35	5.68	3.25	00:45	1.34	09:25	3.56	2.05	01:50	0.065	09:25	1.079	0.328	0.328	0.60
02/01/2025	06:40	2.37	10:00	5.76	3.09	03:45	1.90	20:15	2.55	2.08	06:40	0.180	10:00	0.736	0.296	0.296	0.12
02/02/2025	03:50	2.02	20:45	5.43	2.96	03:35	1.56	15:20	2.60	1.98	03:35	0.117	15:20	0.791	0.273	0.273	0.07
02/03/2025	03:05	1.91	07:20	5.57	2.82	04:25	1.60	18:10	2.66	1.97	04:25	0.111	07:20	0.704	0.253	0.253	0.02
02/04/2025	03:45	1.86	07:55	5.46	2.75	04:30	1.60	14:20	2.57	1.96	04:30	0.107	07:55	0.718	0.245	0.245	0.01
02/05/2025	04:30	1.71	12:15	5.74	2.93	04:10	1.52	12:10	2.55	1.99	04:10	0.090	12:15	0.824	0.273	0.273	0.19
02/06/2025	04:30	2.21	21:30	5.44	3.02	03:40	1.70	15:20	2.55	2.03	03:40	0.150	20:30	0.679	0.282	0.282	-
02/07/2025	04:55	2.16	07:10	5.58	2.89	04:55	1.80	00:35	2.51	2.01	04:55	0.148	07:10	0.722	0.264	0.264	-
02/08/2025	01:55	2.02	11:05	5.93	3.17	01:45	1.73	11:05	2.33	2.06	01:55	0.129	11:05	0.812	0.309	0.309	0.25
02/09/2025	04:40	2.25	20:30	5.60	3.14	17:30	1.83	14:20	2.45	2.07	04:25	0.162	20:30	0.709	0.303	0.303	0.05
02/10/2025	03:10	2.10	07:40	5.61	2.98	02:50	1.76	07:35	2.71	2.04	04:00	0.141	07:40	0.778	0.279	0.279	-
02/11/2025	05:00	2.04	07:40	5.65	2.90	02:40	1.70	15:20	2.57	2.00	04:35	0.131	07:40	0.738	0.265	0.265	0.01
02/12/2025	03:55	2.05	07:05	5.48	2.90	00:20	1.69	13:50	2.52	2.00	03:30	0.131	07:05	0.690	0.264	0.264	-
02/13/2025	03:50	2.09	06:40	5.37	2.95	03:20	1.74	15:05	2.49	2.02	03:20	0.137	06:40	0.678	0.272	0.272	-
02/14/2025	05:10	1.95	08:55	5.54	2.87	05:00	1.66	08:50	2.56	1.98	05:00	0.117	08:55	0.770	0.261	0.261	0.07
02/15/2025	06:10	2.10	11:30	5.53	3.08	03:35	1.65	00:25	2.58	2.02	03:35	0.130	08:40	0.734	0.291	0.291	0.09
02/16/2025	01:45	2.76	21:35	6.26	3.77	04:55	1.90	20:30	2.43	2.18	04:55	0.229	21:35	0.902	0.412	0.412	0.77
02/17/2025	23:35	3.96	11:45	6.94	5.05	02:20	2.17	12:20	2.65	2.34	23:35	0.429	11:45	1.090	0.657	0.657	0.39
02/18/2025	23:30	3.21	06:40	6.08	4.00	14:05	2.02	20:45	2.42	2.20	23:30	0.309	06:40	0.852	0.445	0.445	0.02
02/19/2025	05:00	3.01	08:55	6.23	4.25	07:05	2.06	08:55	2.43	2.23	05:00	0.281	08:55	0.904	0.495	0.495	0.40
02/20/2025	23:55	3.15	02:50	5.75	3.82	07:55	2.08	18:05	2.40	2.21	23:55	0.307	09:40	0.788	0.420	0.420	-
02/21/2025	23:15	2.78	23:20	5.80	3.45	16:05	2.01	08:05	2.54	2.16	23:15	0.245	08:10	0.793	0.357	0.357	0.04
02/22/2025	05:40	2.55	23:30	6.71	3.69	06:45	1.91	23:00	2.49	2.16	06:45	0.207	23:30	0.988	0.402	0.402	0.84
02/23/2025	00:00	5.10	16:40	9.57	7.24	00:00	2.35	15:55	3.00	2.71	00:00	0.663	15:50	1.941	1.246	1.246	1.07
02/24/2025	10:35	4.91	23:25	7.52	5.85	05:45	2.34	15:35	2.86	2.54	10:35	0.633	19:35	1.324	0.874	0.874	0.87
02/25/2025	23:40	3.80	00:40	6.97	5.08	11:05	2.14	00:00	2.77	2.40	23:40	0.409	00:40	1.145	0.682	0.682	0.03
02/26/2025	23:55	3.25	06:45	6.02	3.98	15:30	2.11	06:45	2.49	2.22	23:55	0.314	06:45	0.886	0.448	0.448	-
02/27/2025	23:55	2.81	19:55	5.67	3.54	16:45	1.97	06:20	2.46	2.14	23:55	0.240	19:55	0.766	0.367	0.367	-
02/28/2025	03:25	2.59	14:55	5.80	3.32	13:50	1.88	14:55	2.37	2.05	03:20	0.202	14:55	0.799	0.323	0.323	-
03/01/2025	03:20	2.45	19:55	5.73	3.23	04:15	1.82	23:00	2.35	2.02	04:15	0.185	14:25	0.770	0.310	0.310	-
03/02/2025	06:20	2.29	14:00	5.53	3.17	04:00	1.73	08:25	2.29	1.97	04:00	0.155	20:10	0.709	0.295	0.295	0.05
03/03/2025	03:55	2.07	19:00	5.90	3.04	04:05	1.66	21:10	2.30	1.93	04:00	0.128	19:00	0.793	0.277	0.277	0.07
03/04/2025	04:20	2.05	16:25	5.79	3.09	03:20	1.62	16:20	2.39	1.97	03:55	0.124	16:25	0.801	0.290	0.290	0.12
03/05/2025	04:10	2.14	20:15	5.47	3.03	03:30	1.65	22:25	2.42	1.97	03:35	0.137	20:50	0.701	0.279	0.279	0.01
03/06/2025	03:20	2.02	22:15	5.72	2.85	02:55	1.55	13:25	2.50	1.90	03:15	0.116	22:15	0.785	0.250	0.250	-
03/07/2025	23:55	1.85	16:35	5.47	2.68	03:40	1.51	21:30	2.45	1.87	03:40	0.101	16:35	0.729	0.230	0.230	-
03/08/2025	04:20	1.50	17:25	5.66	2.60	04:05	1.29	10:35	2.41	1.81	04:05	0.062	17:25	0.767	0.220	0.220	-
03/09/2025	04:20	1.51	07:45	5.47	2.73	05:00	1.27	15:00	2.49	1.85	05:05	0.062	07:45	0.742	0.240	0.240	0.20
03/10/2025	23:05	2.29	06:20	5.91	3.41	00:00	1.81	07:35	2.58	2.11	00:00	0.164	06:20	0.811	0.344	0.344	0.22
03/11/2025	23:30	2.06	06:40	5.64	2.92	01:55	1.62	19:10	2.53	2.01	01:55	0.133	16:25	0.766	0.270	0.270	0.02
03/12/2025	03:25	1.96	23:15	6.33	3.68	02:15	1.64	23:15	2.41	2.10	03:10	0.117	23:15	0.917	0.398	0.398	0.83
03/13/2025	23:50	4.25	03:05	7.64	5.44	22:35	2.20	05:00	2.73	2.40	23:50	0.484	05:00	1.283	0.749	0.749	0.49
03/14/2025	23:40	3.51	01:00	6.11	4.27	04:20	2.15	01:00	2.55	2.26	23:40	0.369	01:00	0.924	0.502	0.502	0.16
03/15/2025	06:25	3.30	20:15	6.13	4.13	13:15	2.04	20:15	2.46	2.25	06:20	0.327	20:15	0.895	0.479	0.479	0.60
03/16/2025	23:35	3.62	04:50	6.35	4.73	21:10	2.11	07:10	2.60	2.28	23:35	0.378	07:10	0.995	0.584	0.584	0.16
03/17/2025	23:40	3.11	02:55	5.79	3.87	14:45	2.01	15:20	2.60	2.18	23:40	0.284	02:55	0.808	0.421	0.421	0.19
03/18/2025	23:05	2.71	06:40	5.83	3.51	23:55	1.77	12:40	2.35	2.04	23:55	0.203	06:40	0.776	0.348	0.348	0.02
03/19/2025	04:25	2.60	20:55	5.97	3.47	04:40	1.68	18:45	2.39	1.97	01:45	0.190	18:45	0.832	0.334	0.334	0.07
03/20/2025	03:25	2.60	06:45	5.86	3.38	01:30	1.67	03:50	2.27	1.93	01:30	0.182	06:45	0.774	0.316	0.316	0.11
03/21/2025	03:20	2.49	15:25	7.29	4.60	02:45	1.73	15:55	2.76	2.19	03:20	0.176	15:25	1.249	0.577	0.577	1.12
03/22/2025	23:00	3.51	05:40	6.54	4.75	23:00	2.07	04:10	2.62	2.28	23:00	0.344	05:40	1.031	0.590	0.590	-
03/23/2025	02:40	3.42	09:50	6.72	4.53	03:15	2.03	09:50	2.74	2.26	04:05	0.329	09:50	1.132	0.551	0.551	0.44
03/24/2025	23:55	3.16	06:10	6.03	3.99	23:10	2.00	15:55	2.44	2.17	23:55	0.288	15:55	0.855	0.439	0.439	0.01

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/25/2025	04:25	2.94	20:10	5.99	3.58	16:25	1.85	18:45	2.42	2.07	02:40	0.241	18:45	0.851	0.363	0.363	-
03/26/2025	04:25	2.76	06:25	5.96	3.53	17:00	1.77	06:25	2.38	2.05	04:20	0.224	06:25	0.834	0.354	0.354	0.20
03/27/2025	03:50	2.95	06:45	5.94	3.62	01:45	1.76	06:45	2.33	2.01	01:45	0.238	06:45	0.812	0.357	0.357	0.24
03/28/2025	23:55	2.79	03:25	6.14	3.78	23:10	1.87	06:30	2.37	2.06	23:55	0.225	06:30	0.862	0.388	0.388	0.17
03/29/2025	01:45	2.62	15:55	5.90	3.59	03:25	1.78	06:05	2.36	2.01	01:30	0.198	06:05	0.797	0.355	0.355	0.12
03/30/2025	02:00	2.74	08:55	5.83	3.57	04:05	1.81	09:30	2.34	2.02	04:05	0.216	09:30	0.793	0.354	0.354	0.23
03/31/2025	23:50	2.91	12:40	6.05	3.74	23:50	1.87	12:40	2.38	2.07	23:50	0.237	12:40	0.852	0.384	0.384	0.10
04/01/2025	23:55	2.49	01:35	5.59	3.34	23:55	1.72	14:00	2.39	1.99	23:55	0.174	01:35	0.751	0.318	0.318	0.03
04/02/2025	23:25	2.33	16:55	5.70	3.15	23:05	1.60	00:25	2.32	1.92	23:25	0.152	16:55	0.749	0.283	0.283	0.05
04/03/2025	23:25	2.18	00:55	5.66	2.98	23:25	1.55	19:15	2.26	1.86	23:25	0.129	19:15	0.726	0.259	0.259	0.02
04/04/2025	02:40	2.00	14:05	5.65	2.85	04:20	1.51	23:25	2.30	1.83	02:10	0.112	14:05	0.741	0.241	0.241	-
04/05/2025	03:15	1.84	14:15	5.67	2.75	05:10	1.40	22:20	2.38	1.80	05:10	0.092	14:15	0.748	0.229	0.229	-
04/06/2025	04:35	1.80	22:35	6.10	3.29	03:10	1.39	12:10	2.36	1.91	04:40	0.091	21:00	0.840	0.319	0.319	0.71
04/07/2025	23:45	3.31	00:40	6.20	4.18	01:25	1.92	23:50	2.32	2.15	10:35	0.314	00:40	0.850	0.464	0.464	0.37
04/08/2025	23:50	2.80	06:45	6.01	3.74	00:20	1.94	07:20	2.39	2.13	23:50	0.233	06:45	0.819	0.394	0.394	0.07
04/09/2025	23:10	2.49	15:20	5.69	3.30	15:10	1.79	07:40	2.46	2.04	23:10	0.187	07:40	0.759	0.319	0.319	-
04/10/2025	02:15	2.32	06:10	5.60	3.18	04:10	1.73	05:05	2.45	2.04	02:25	0.164	06:10	0.699	0.305	0.305	0.27
04/11/2025	23:10	2.28	06:05	5.51	3.07	23:55	1.76	19:15	2.34	2.00	23:55	0.157	06:05	0.732	0.284	0.284	0.01
04/12/2025	23:55	1.94	06:05	5.40	2.95	23:50	1.59	06:05	2.34	1.93	23:50	0.113	06:05	0.716	0.266	0.266	0.01
04/13/2025	03:05	1.78	08:30	5.37	2.89	04:40	1.47	08:30	2.53	1.90	02:50	0.092	08:30	0.769	0.258	0.258	-
04/14/2025	03:15	1.77	06:40	5.62	2.77	02:20	1.40	06:40	2.42	1.87	02:20	0.088	06:40	0.782	0.240	0.240	-
04/15/2025	02:50	1.74	18:50	5.27	2.73	02:30	1.47	05:45	2.43	1.86	02:25	0.088	18:50	0.669	0.233	0.233	-
04/16/2025	23:55	1.63	15:15	5.54	2.60	01:35	1.43	07:00	2.45	1.84	23:55	0.079	15:15	0.719	0.217	0.217	-
04/17/2025	01:40	1.53	06:20	5.34	2.59	01:35	1.33	00:00	2.67	1.83	01:35	0.067	06:20	0.679	0.218	0.218	-
04/18/2025	02:45	1.56	15:10	5.61	2.53	03:00	1.42	00:10	2.45	1.80	02:25	0.073	12:50	0.764	0.209	0.209	-
04/19/2025	02:55	1.43	15:10	5.55	2.51	00:35	1.24	16:10	2.46	1.76	02:55	0.056	13:10	0.726	0.206	0.206	0.01
04/20/2025	03:50	1.46	10:55	5.52	2.59	03:30	1.09	10:50	2.49	1.76	03:30	0.051	10:55	0.765	0.215	0.215	0.05
04/21/2025	03:00	1.54	17:10	5.56	2.56	00:15	1.33	20:30	2.53	1.80	02:25	0.068	10:45	0.718	0.212	0.212	0.02
04/22/2025	02:45	1.38	19:10	5.57	2.49	02:55	1.21	14:35	2.34	1.75	02:55	0.052	19:10	0.740	0.202	0.202	-
04/23/2025	03:35	1.41	07:00	5.56	2.52	00:55	1.05	09:30	2.33	1.76	00:55	0.050	07:00	0.705	0.206	0.206	-
04/24/2025	03:35	1.53	19:30	5.64	2.49	03:00	1.22	12:30	2.62	1.77	03:00	0.063	19:30	0.756	0.201	0.201	-
04/25/2025	01:30	1.46	15:20	5.44	2.49	00:55	1.24	15:20	2.35	1.73	01:30	0.057	15:20	0.724	0.200	0.200	-
04/26/2025	02:30	1.42	14:20	5.51	2.50	05:25	1.17	18:25	2.54	1.75	02:30	0.055	14:20	0.747	0.205	0.205	-
04/27/2025	04:00	1.42	07:20	5.24	2.58	02:55	1.18	20:20	2.47	1.75	04:00	0.053	07:20	0.667	0.212	0.212	-
04/28/2025	01:40	1.41	08:35	5.40	2.51	01:50	1.19	12:40	2.56	1.76	01:40	0.052	08:35	0.688	0.204	0.204	-
04/29/2025	02:10	1.34	10:55	5.61	2.52	02:00	1.19	21:10	2.47	1.74	02:10	0.049	10:55	0.759	0.205	0.205	0.13

01/15/2025 00:00 - 04/29/2025 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			34.250	13.62
Average	3.24	2.00	0.326	

CAM_51123

Site Commentary

SITE INFORMATION

Pipe	Elliptical (20 in H x 20.13 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was located downstream of site CAM_100290. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	7.07	2.37	1.132
Minimum	3.27	1.07	0.162
Maximum	19.05	3.74	5.203
Min Time	04/28/2025 03:45:00	04/28/2025 03:45:00	04/28/2025 03:45:00
Max Time	02/23/2025 16:05:00	02/23/2025 15:45:00	02/23/2025 16:30:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the graphical reports are based on the fifteen minutes average and values in the Observed Flow Conditions and tabular report are based on the five-minute average.

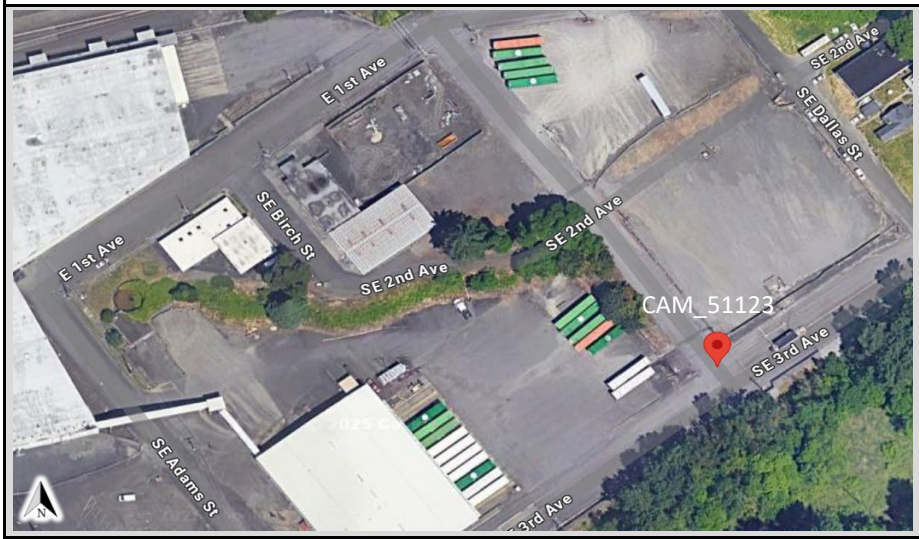
DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
DFINAL (in)	99.653
VFINAL (ft/s)	99.653
QFINAL (MGD - Total MG)	99.653

Camas.Carollo.TFM.WA24		Site Name
Flow Monitoring Site Report	ADS ENVIRONMENTAL SERVICES®	CAM_51123

Site Address /Location:	SE Cedar St and SE 3rd Ave, Camas, WA 98607			Monitor Series: TRITON+	Location Type: Temporary
Site Access Details:	On Road	Latitude:	45.5829094	Pipe Size (H x W): 20.00 X 20.13	Pipe Shape: Circular
		Longitude:	-122.4010296		



Manhole #	System Characteristics
51123	Industrial
Access	Traffic
Drive	None





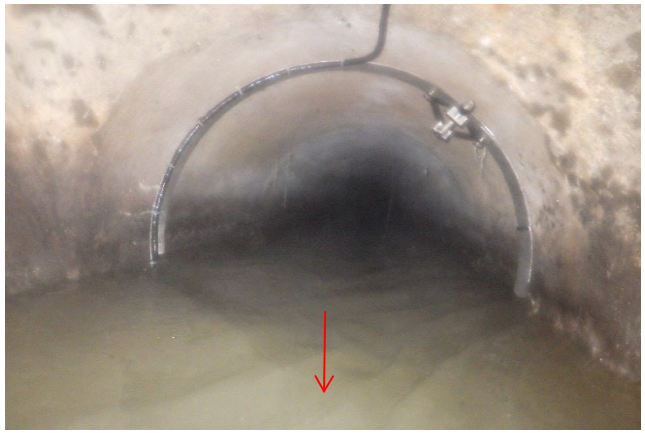


Installation Information	
Installation Date:	Installation Type:
Wednesday, January 15, 2025	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi
Installation Confirmation:	
Time	
8:23:00 AM	
Depth of Flow (Wet DOF) (in)	
7.75	
CS58 Physical Offset (in)	Measurement Confidence (in)
N/A	0.38"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.77	N/A
Silt (in)	Silt Type
0	

Manhole / Pipe Information:	
Manhole Depth (Approx. FT):	Manhole Configuration
16'	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
24	26
Manhole Cover	Manhole Frame
Steel	Normal
Active Connections	Air Quality:
Yes, Inside	Normal
Pipe Material	Pipe Condition:
Concrete	Good
Communication Information:	
Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole
Additional Site Info. / Comments:	

ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23116.11.325

Additional Photos

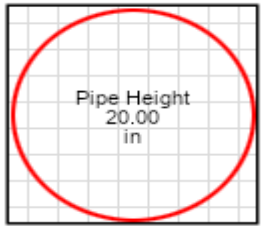
Monitoring Point Inlet	Outlet	
		
Top Down	**Location**	**Map**
		
	KEY	
	Flow Direction Monitoring Point	

Hydrograph Report

CAM_51123

Flow Monitor

CAM_51123



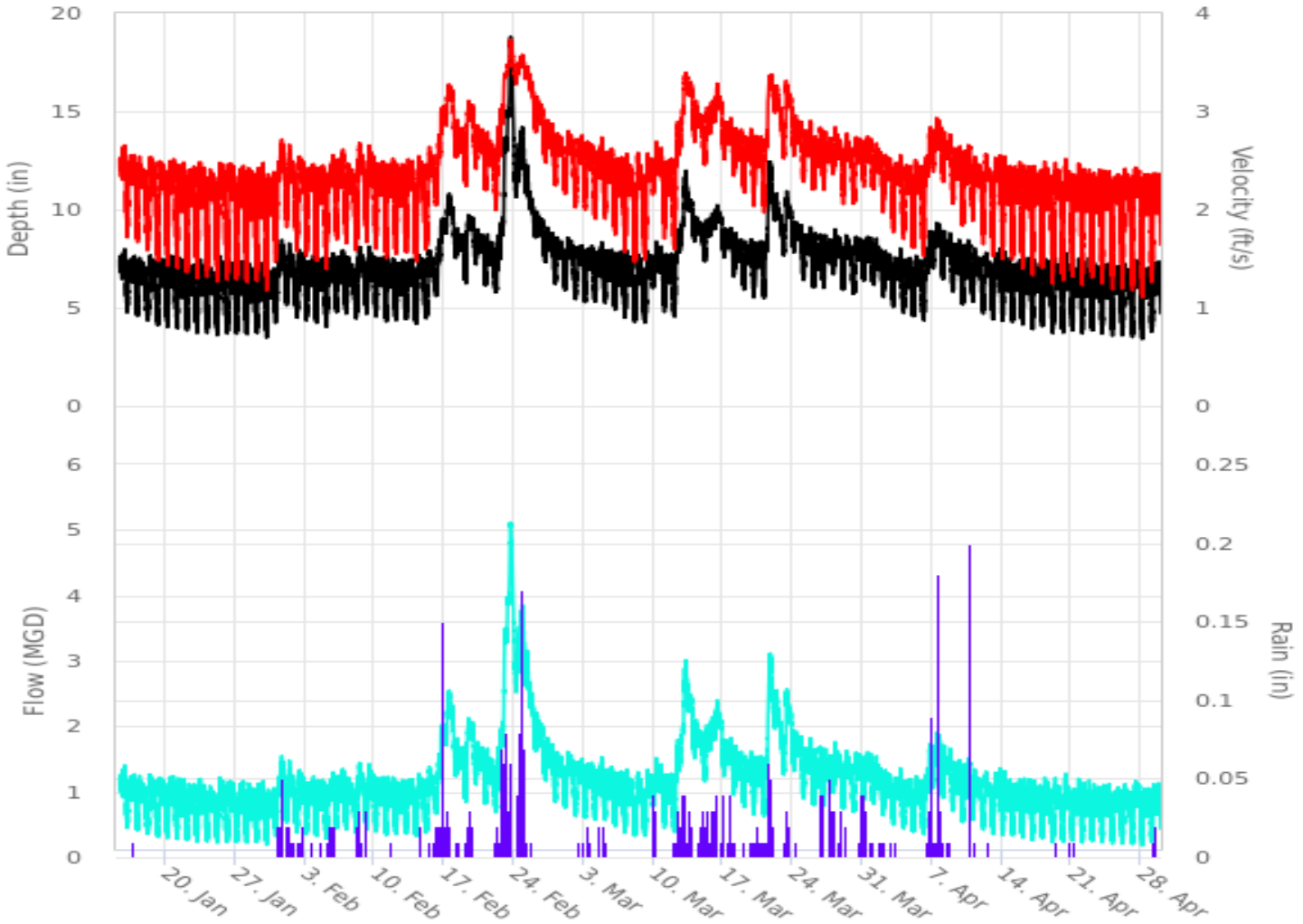
Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL





846 Industry Dr.
Tukwila, WA 98188

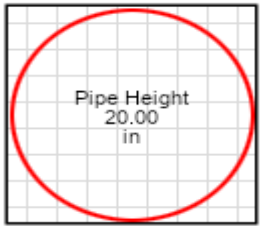
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Scattergraph Report

CAM_51123

Flow Monitor

CAM_51123

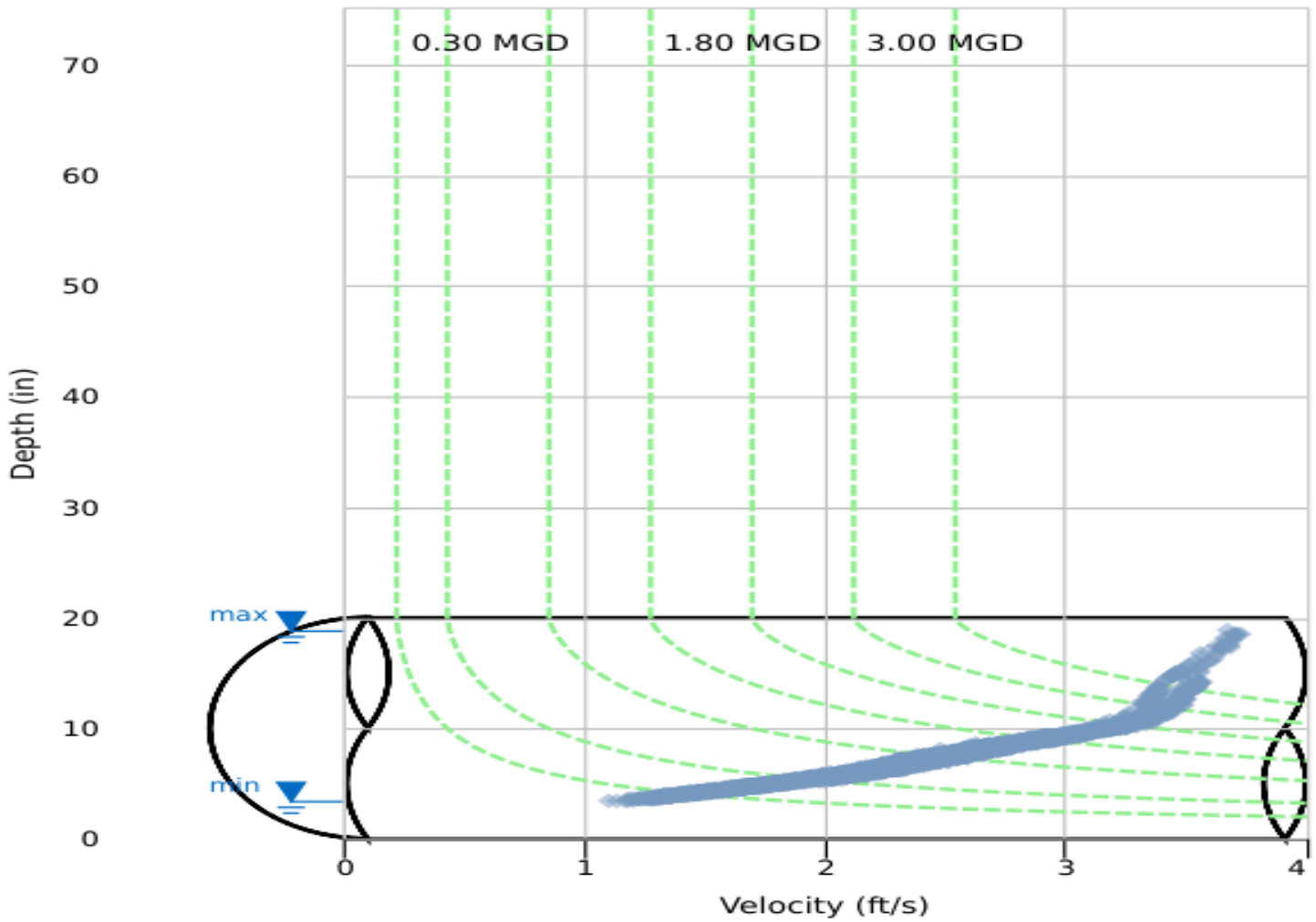


Report Period

01/15/2025
To
04/29/2025

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth



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Tukwila, WA 98188

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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_51123 Pipe: Elliptical (20 in H x 20.13 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/15/2025	23:50	5.80	21:30	8.39	7.16	23:50	2.17	21:30	2.69	2.45	23:50	0.742	21:30	1.522	1.123	0.710	-
01/16/2025	03:30	4.69	17:40	8.36	6.47	03:30	1.70	17:40	2.60	2.26	03:30	0.431	17:40	1.464	0.914	0.914	0.01
01/17/2025	04:30	4.46	09:15	7.96	6.27	04:30	1.62	09:15	2.59	2.21	04:30	0.383	09:15	1.367	0.858	0.858	-
01/18/2025	03:35	4.21	09:55	7.89	6.14	03:35	1.52	19:00	2.59	2.16	03:35	0.330	19:00	1.330	0.825	0.825	-
01/19/2025	05:05	4.01	10:00	7.93	6.07	05:05	1.44	10:00	2.57	2.12	05:05	0.292	10:00	1.348	0.802	0.802	-
01/20/2025	04:35	3.95	17:50	8.08	6.12	04:35	1.41	19:35	2.57	2.13	04:35	0.280	10:00	1.363	0.812	0.812	-
01/21/2025	05:25	3.91	20:45	8.03	5.89	05:25	1.39	20:45	2.54	2.07	05:25	0.271	20:45	1.352	0.749	0.749	-
01/22/2025	04:00	3.72	08:15	7.89	5.84	03:10	1.31	20:55	2.51	2.05	04:00	0.240	20:55	1.285	0.738	0.738	-
01/23/2025	04:05	3.64	21:00	7.78	5.80	04:05	1.27	12:20	2.50	2.05	04:05	0.224	21:00	1.257	0.728	0.728	-
01/24/2025	04:10	3.64	11:05	7.86	5.75	04:10	1.28	11:05	2.52	2.04	04:10	0.226	11:05	1.303	0.715	0.715	-
01/25/2025	04:35	3.55	09:50	8.22	5.72	03:45	1.24	11:10	2.56	2.02	04:35	0.211	09:50	1.396	0.712	0.712	-
01/26/2025	05:00	3.58	10:40	7.91	5.81	05:00	1.24	11:15	2.57	2.04	05:00	0.214	10:40	1.323	0.739	0.739	-
01/27/2025	02:40	3.65	18:55	8.00	5.77	02:40	1.26	18:55	2.56	2.03	02:40	0.223	18:55	1.359	0.719	0.719	-
01/28/2025	02:45	3.53	08:45	7.64	5.62	02:45	1.24	08:50	2.45	1.98	02:45	0.209	08:45	1.215	0.679	0.679	-
01/29/2025	04:00	3.61	19:45	7.87	5.65	02:30	1.23	19:45	2.54	1.98	02:30	0.216	19:45	1.321	0.681	0.681	-
01/30/2025	03:40	3.44	09:10	7.52	5.58	03:35	1.17	08:10	2.44	1.96	03:40	0.191	09:10	1.175	0.665	0.665	-
01/31/2025	00:55	4.02	18:35	8.72	6.76	00:55	1.39	16:20	2.74	2.29	00:55	0.283	18:35	1.618	1.008	1.008	0.60
02/01/2025	04:10	5.01	10:20	8.59	6.63	04:05	1.79	10:20	2.74	2.28	04:05	0.499	10:20	1.599	0.952	0.952	0.12
02/02/2025	05:45	4.47	12:50	8.36	6.47	05:45	1.55	10:45	2.61	2.20	05:45	0.367	12:50	1.442	0.906	0.906	0.07
02/03/2025	03:15	4.30	19:40	8.08	6.25	04:15	1.50	21:30	2.64	2.15	04:15	0.338	19:40	1.372	0.838	0.838	0.02
02/04/2025	04:40	4.08	08:20	8.08	6.03	03:55	1.43	08:20	2.54	2.09	04:40	0.298	08:20	1.361	0.779	0.779	0.01
02/05/2025	03:55	3.97	20:15	7.96	6.28	04:55	1.38	20:45	2.58	2.15	03:55	0.278	20:15	1.356	0.857	0.857	0.19
02/06/2025	04:05	4.70	19:15	8.20	6.49	04:50	1.67	19:55	2.71	2.24	04:50	0.426	19:15	1.436	0.912	0.912	-
02/07/2025	04:20	4.62	18:05	8.12	6.18	03:30	1.64	18:05	2.56	2.17	04:20	0.408	18:05	1.382	0.825	0.825	-
02/08/2025	03:25	4.41	10:25	8.28	6.59	03:25	1.54	11:25	2.70	2.26	03:25	0.358	10:25	1.482	0.955	0.955	0.25
02/09/2025	04:10	4.62	11:35	8.31	6.60	04:10	1.63	11:00	2.69	2.27	04:10	0.405	11:05	1.478	0.953	0.953	0.05
02/10/2025	03:45	4.52	22:30	8.01	6.33	04:10	1.59	19:40	2.51	2.18	03:40	0.385	22:30	1.329	0.861	0.861	-
02/11/2025	04:25	4.23	19:40	7.90	6.18	04:25	1.48	20:45	2.56	2.14	04:25	0.323	19:40	1.333	0.822	0.822	0.01
02/12/2025	04:10	4.27	07:30	7.92	6.12	04:55	1.50	07:25	2.58	2.13	04:10	0.338	07:25	1.350	0.806	0.806	-
02/13/2025	04:20	4.32	19:55	7.86	6.20	04:20	1.52	09:20	2.54	2.16	04:20	0.342	19:55	1.303	0.835	0.835	-
02/14/2025	05:15	4.09	10:10	8.06	6.15	05:15	1.43	11:05	2.58	2.14	05:15	0.297	11:05	1.310	0.825	0.825	0.07
02/15/2025	04:15	4.40	10:50	8.30	6.46	04:15	1.58	12:00	2.69	2.24	04:15	0.366	12:00	1.485	0.921	0.921	0.09
02/16/2025	03:30	5.49	20:45	9.65	7.62	05:25	2.00	19:50	3.09	2.56	03:30	0.637	20:45	2.066	1.317	1.317	0.77
02/17/2025	23:15	8.39	10:25	11.12	9.70	23:15	2.79	16:55	3.31	3.09	23:15	1.578	10:25	2.661	2.116	2.116	0.39
02/18/2025	23:40	7.27	08:10	9.37	8.28	23:50	2.46	08:40	2.94	2.71	23:40	1.152	08:10	1.918	1.507	1.507	0.02
02/19/2025	04:45	6.10	09:45	9.95	8.58	04:45	2.21	10:20	3.14	2.80	04:45	0.810	09:45	2.192	1.658	1.658	0.40
02/20/2025	03:55	7.11	08:20	9.14	8.13	12:45	2.32	19:05	2.91	2.65	03:55	1.089	08:20	1.821	1.442	1.442	-
02/21/2025	05:15	6.03	08:30	9.07	7.41	05:15	2.17	08:30	2.84	2.49	05:15	0.783	08:30	1.779	1.199	1.199	0.04
02/22/2025	04:00	5.59	23:55	11.23	7.72	03:45	1.99	23:50	3.26	2.59	04:00	0.646	23:50	2.678	1.351	1.351	0.84
02/23/2025	00:05	10.43	16:05	19.05	15.02	00:05	3.26	15:45	3.74	3.50	00:05	2.439	16:30	5.203	3.978	3.978	1.07
02/24/2025	04:05	10.51	19:25	14.53	12.43	05:20	3.25	19:50	3.59	3.44	05:20	2.464	19:25	3.923	3.191	3.191	0.87
02/25/2025	23:55	9.12	00:20	12.77	10.78	23:40	2.97	00:30	3.50	3.33	23:40	1.874	00:20	3.349	2.601	2.601	0.03
02/26/2025	23:55	7.91	03:10	10.25	9.11	23:20	2.66	03:15	3.21	2.96	23:55	1.400	03:10	2.346	1.864	1.864	-
02/27/2025	04:25	6.91	08:10	9.35	8.19	04:25	2.39	08:40	2.95	2.70	04:25	1.041	08:10	1.914	1.481	1.481	-
02/28/2025	02:40	5.95	08:10	9.19	7.57	03:35	2.20	08:10	2.85	2.55	02:40	0.786	08:10	1.812	1.266	1.266	-
03/01/2025	04:20	5.79	09:20	8.95	7.36	05:25	2.14	11:30	2.83	2.51	03:15	0.733	09:20	1.729	1.206	1.206	-
03/02/2025	04:10	5.27	20:00	8.28	7.13	05:25	1.95	19:35	2.78	2.47	05:25	0.584	19:35	1.538	1.137	1.137	0.05
03/03/2025	03:25	5.12	19:25	8.40	6.91	03:25	1.95	08:10	2.75	2.41	03:25	0.559	19:25	1.547	1.066	1.066	0.07
03/04/2025	03:55	5.13	19:45	8.46	6.94	04:40	1.88	19:45	2.76	2.38	03:55	0.541	19:45	1.574	1.059	1.059	0.12
03/05/2025	04:30	5.15	20:05	8.27	6.77	04:30	1.87	20:10	2.66	2.34	04:30	0.540	20:05	1.470	1.004	1.004	0.01
03/06/2025	03:55	4.82	20:55	8.32	6.57	03:55	1.72	20:55	2.61	2.25	03:55	0.452	20:55	1.460	0.931	0.931	-
03/07/2025	03:30	4.38	08:30	8.15	6.34	03:30	1.53	08:35	2.58	2.17	03:30	0.351	08:30	1.402	0.857	0.857	-
03/08/2025	04:00	4.11	17:45	7.86	6.17	04:00	1.39	11:30	2.59	2.14	04:00	0.291	11:30	1.335	0.822	0.822	-
03/09/2025	04:15	3.93	11:05	8.22	6.30	04:15	1.37	11:05	2.64	2.18	04:15	0.269	11:05	1.451	0.869	0.869	0.20
03/10/2025	23:55	5.43	09:00	8.53	7.24	23:55	1.98	07:20	2.72	2.44	23:55	0.617	07:20	1.563	1.138	1.138	0.22
03/11/2025	02:55	4.69	16:45	8.03	6.51	03:00	1.68	20:40	2.59	2.24	03:00	0.425	20:40	1.369	0.915	0.915	0.02
03/12/2025	03:50	4.50	23:00	9.76	7.62	03:50	1.57	23:00	3.08	2.51	03:50	0.376	23:00	2.116	1.312	1.312	0.83
03/13/2025	23:25	8.95	07:05	12.07	10.44	23:25	2.91	07:10	3.40	3.24	23:25	1.788	07:05	3.041	2.437	2.437	0.49
03/14/2025	23:40	7.92	07:40	9.77	9.01	23:40	2.58	07:20	3.16	2.89	23:40	1.352	07:20	2.169	1.795	1.795	0.16
03/15/2025	04:40	7.19	22:05	10.06	8.76	03:25	2.39	22:10	3.15	2.81	04:40	1.113	22:05	2.245	1.695	1.695	0.60
03/16/2025	23:55	7.87	09:40	10.53	9.47	23:55	2.58	10:35	3.32	3.04	23:55	1.336	10:35	2.505	2.018	2.018	0.16
03/17/2025	23:35	7.19	07:15	9.24	8.40	04:05	2.46	18:50	2.96	2.75	23:35	1.131	07:15	1.878	1.560	1.560	0.19
03/18/2025	23:50	6.16	07:10	8.86	7.77	23:50	2.22	07:10	2.84	2.61	23:50	0.825	07:10	1.725	1.335	1.335	0.02
03/19/2025	02:40	5.74	19:05	8.73	7.39	01:45	2.15	19:45	2.84	2.54	02:40	0.725	19:05	1.677	1.221	1.221	0.07
03/20/2025	03:30	5.47	19:45	8.61	7.24	02:20	2.01	18:45	2.78	2.47	02:20	0.635	19:45	1.622	1.161	1.161	0.11
03/21/2025	03:05	5.41	15:45	12.74	9.27	03:05	1.95	19:10	3.38	2.86	03:05	0.602	15:40	3.207	1.943	1.943	1.12
03/22/2025	23:55	8.30	09:00	11.00	9.75	23:55	2.69	11:10	3.29	3.07	23:55	1.498	09:00	2.618	2.112	2.112	-
03/23/2025	02:30	7.45	10:05	11.31	9.37	02:55	2.50	08:30	3.36	2.96	02:30	1.203	10:05	2.708	1.955	1.955	0.44
03/24/2025	23:20	7.24	07:40	9.54	8.59	23:55	2.46	07:40	2.99	2.75	23:20	1.142	07:40	1.995	1.606	1.606	0.01

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/25/2025	23:40	6.19	18:00	9.34	7.88	01:05	2.22	19:10	2.95	2.60	23:40	0.850	18:00	1.900	1.362	1.362	-
03/26/2025	02:45	5.80	06:45	9.16	7.56	00:35	2.14	20:30	2.88	2.55	02:45	0.730	20:25	1.776	1.266	1.266	0.20
03/27/2025	03:25	5.93	07:05	9.04	7.56	03:25	2.17	07:05	2.86	2.54	03:25	0.765	07:05	1.781	1.256	1.256	0.24
03/28/2025	23:55	6.20	06:50	9.39	7.83	23:55	2.26	06:50	2.92	2.59	23:55	0.848	06:50	1.909	1.340	1.340	0.17
03/29/2025	01:25	5.73	09:45	8.88	7.46	02:10	2.05	09:45	2.83	2.49	01:25	0.699	09:45	1.724	1.220	1.220	0.12
03/30/2025	02:25	5.57	17:20	8.76	7.39	04:10	2.02	17:25	2.77	2.47	02:25	0.654	17:20	1.649	1.195	1.195	0.23
03/31/2025	03:00	6.05	13:00	8.93	7.68	03:55	2.19	13:00	2.80	2.54	03:00	0.795	13:00	1.720	1.283	1.283	0.10
04/01/2025	23:55	5.76	10:30	8.75	7.25	23:30	2.07	10:35	2.71	2.43	23:55	0.705	10:35	1.614	1.137	1.137	0.03
04/02/2025	01:35	5.43	08:25	8.27	6.87	01:30	1.88	07:50	2.59	2.34	01:30	0.588	08:30	1.422	1.019	1.019	0.05
04/03/2025	02:55	4.97	19:35	8.09	6.56	02:50	1.76	19:35	2.60	2.26	02:55	0.484	19:35	1.399	0.925	0.925	0.02
04/04/2025	04:05	4.69	18:35	8.36	6.32	04:05	1.69	10:20	2.49	2.19	04:05	0.428	18:35	1.371	0.858	0.858	-
04/05/2025	03:45	4.41	08:10	8.43	6.22	03:45	1.54	08:15	2.61	2.15	03:45	0.356	08:10	1.479	0.833	0.833	-
04/06/2025	05:00	4.27	19:20	9.00	6.97	02:25	1.48	19:25	2.88	2.33	02:30	0.331	19:25	1.780	1.081	1.081	0.71
04/07/2025	03:35	6.81	11:15	9.59	8.28	03:35	2.37	11:15	2.99	2.67	03:35	1.010	11:15	2.010	1.488	1.488	0.37
04/08/2025	23:55	6.16	07:05	9.12	7.75	23:55	2.20	07:05	2.84	2.53	23:55	0.817	07:05	1.793	1.293	1.293	0.07
04/09/2025	02:30	5.66	17:30	8.69	7.15	23:15	2.01	19:50	2.67	2.39	23:15	0.666	17:35	1.539	1.101	1.101	-
04/10/2025	02:30	5.06	06:30	8.55	7.01	01:40	1.81	20:15	2.69	2.35	02:30	0.516	19:40	1.528	1.061	1.061	0.27
04/11/2025	02:30	5.10	07:05	8.11	6.76	02:30	1.82	07:40	2.57	2.29	02:30	0.519	07:05	1.370	0.978	0.978	0.01
04/12/2025	04:00	4.62	09:40	8.21	6.51	04:00	1.63	09:55	2.65	2.22	04:00	0.403	09:40	1.409	0.912	0.912	0.01
04/13/2025	03:30	4.34	20:15	8.25	6.44	03:30	1.50	19:20	2.61	2.20	03:30	0.341	19:20	1.428	0.898	0.898	-
04/14/2025	03:15	4.26	07:50	8.82	6.25	03:15	1.46	07:50	2.74	2.15	03:15	0.323	07:50	1.654	0.839	0.839	-
04/15/2025	02:30	4.12	06:10	7.98	6.10	02:30	1.44	19:45	2.52	2.11	02:30	0.303	06:10	1.293	0.796	0.796	-
04/16/2025	02:20	4.01	18:40	7.96	6.06	03:10	1.36	06:55	2.50	2.10	02:20	0.279	18:40	1.293	0.786	0.786	-
04/17/2025	03:50	3.81	06:45	7.84	5.98	03:45	1.31	06:45	2.46	2.07	03:45	0.248	06:45	1.271	0.764	0.764	-
04/18/2025	02:00	3.84	07:40	8.08	5.88	02:00	1.31	09:40	2.57	2.05	02:00	0.250	07:45	1.368	0.737	0.737	-
04/19/2025	02:50	3.60	11:25	7.81	5.85	02:50	1.21	09:50	2.49	2.03	02:50	0.210	11:25	1.253	0.733	0.733	0.01
04/20/2025	04:50	3.71	11:20	7.89	5.96	04:50	1.27	11:25	2.53	2.06	04:50	0.230	11:20	1.316	0.769	0.769	0.05
04/21/2025	03:00	3.64	17:30	7.90	5.82	03:00	1.24	17:30	2.50	2.03	03:00	0.219	17:30	1.301	0.724	0.724	0.02
04/22/2025	02:55	3.56	10:55	7.73	5.75	02:55	1.18	20:45	2.45	2.01	02:55	0.202	10:55	1.241	0.707	0.707	-
04/23/2025	02:15	3.58	19:55	7.83	5.71	02:15	1.21	20:00	2.49	1.99	02:15	0.208	20:00	1.279	0.693	0.693	-
04/24/2025	02:15	3.44	19:50	7.87	5.69	02:15	1.15	19:50	2.47	1.99	02:15	0.186	19:50	1.279	0.690	0.690	-
04/25/2025	03:25	3.51	18:25	7.41	5.68	03:25	1.16	07:45	2.41	1.99	03:25	0.195	17:05	1.137	0.686	0.686	-
04/26/2025	02:40	3.49	08:05	7.89	5.72	02:40	1.16	10:00	2.44	1.99	02:40	0.193	08:10	1.240	0.701	0.701	-
04/27/2025	03:40	3.41	11:00	7.70	5.83	03:40	1.13	09:35	2.47	2.01	03:40	0.182	11:00	1.230	0.732	0.732	-
04/28/2025	03:45	3.27	08:55	7.48	5.68	03:45	1.07	08:55	2.38	1.97	03:45	0.162	08:55	1.156	0.686	0.686	-
04/29/2025	01:50	3.54	18:50	8.02	5.78	01:50	1.17	18:55	2.49	2.00	01:50	0.199	18:55	1.314	0.706	0.706	0.13

01/15/2025 00:00 - 04/29/2025 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			118.475	13.62
Average	7.07	2.37	1.132	

CAM_52167

Site Commentary

SITE INFORMATION

Pipe	Elliptical (18.13 in H x 18.13 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

Average flow depth, velocity, and quantity data observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	1.63	3.33	0.221
Minimum	0.54	0.43	0.006
Maximum	5.26	5.50	1.536
Min Time	01/22/2025 04:45:00	04/22/2025 03:30:00	01/22/2025 04:45:00
Max Time	02/18/2025 09:55:00	02/18/2025 09:55:00	02/18/2025 09:55:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the graphical reports are based on the fifteen minutes average and values in the Observed Flow Conditions and tabular report are based on the five-minute average.

DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

Camas.Carollo.TFM.WA24		Site Name
Flow Monitoring Site Report	ADS ENVIRONMENTAL SERVICES®	CAM_52167

Site Address /Location:	SE Dallas St and SE 3rd Ave, Camas, WA 98607			Monitor Series	Location Type
				TRITON+	Temporary
Site Access Details:	On Road	Latitude:	45.5833078	Pipe Size (H x W)	Pipe Shape
		Longitude:	-122.4001589	18.13 X 18.13	Circular



Manhole #	System Characteristics
52167	Industrial
Access	Traffic
Drive	None







ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23116.11.325

Installation Information

Installation Date:	Installation Type:
Tuesday, January 14, 2025	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4), Smart Depth (CS5)	0 - 5 psi

Installation Confirmation:

Time	
2:43:00 PM	
Depth of Flow (Wet DOF) (in)	
1.25	
CS58 Physical Offset (in)	Measurement Confidence (in)
1.38	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.82	N/A
Silt (in)	Silt Type
0	

Manhole / Pipe Information:

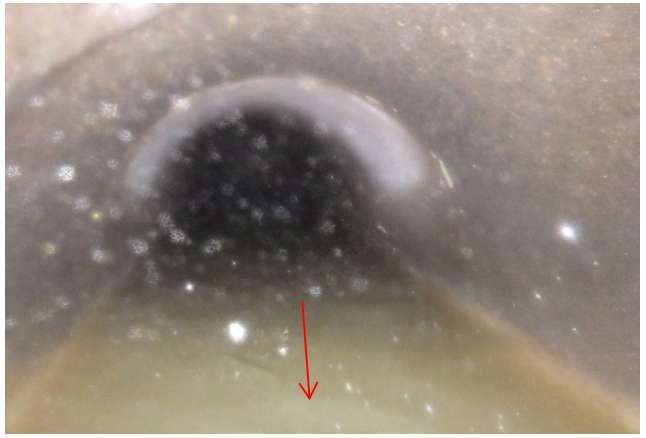
Manhole Depth (Approx. FT):	Manhole Configuration
17.5'	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
24	26
Manhole Cover	Manhole Frame
Steel	Normal
Active Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
Hollow Tile	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

Additional Photos

Monitoring Point Inlet	Outlet	NW inlet connection
		
Top Down	**Location**	**Map**
		
	KEY	
	Flow Direction Monitoring Point	

Hydrograph Report

CAM_52167

Flow Monitor

CAM_52167

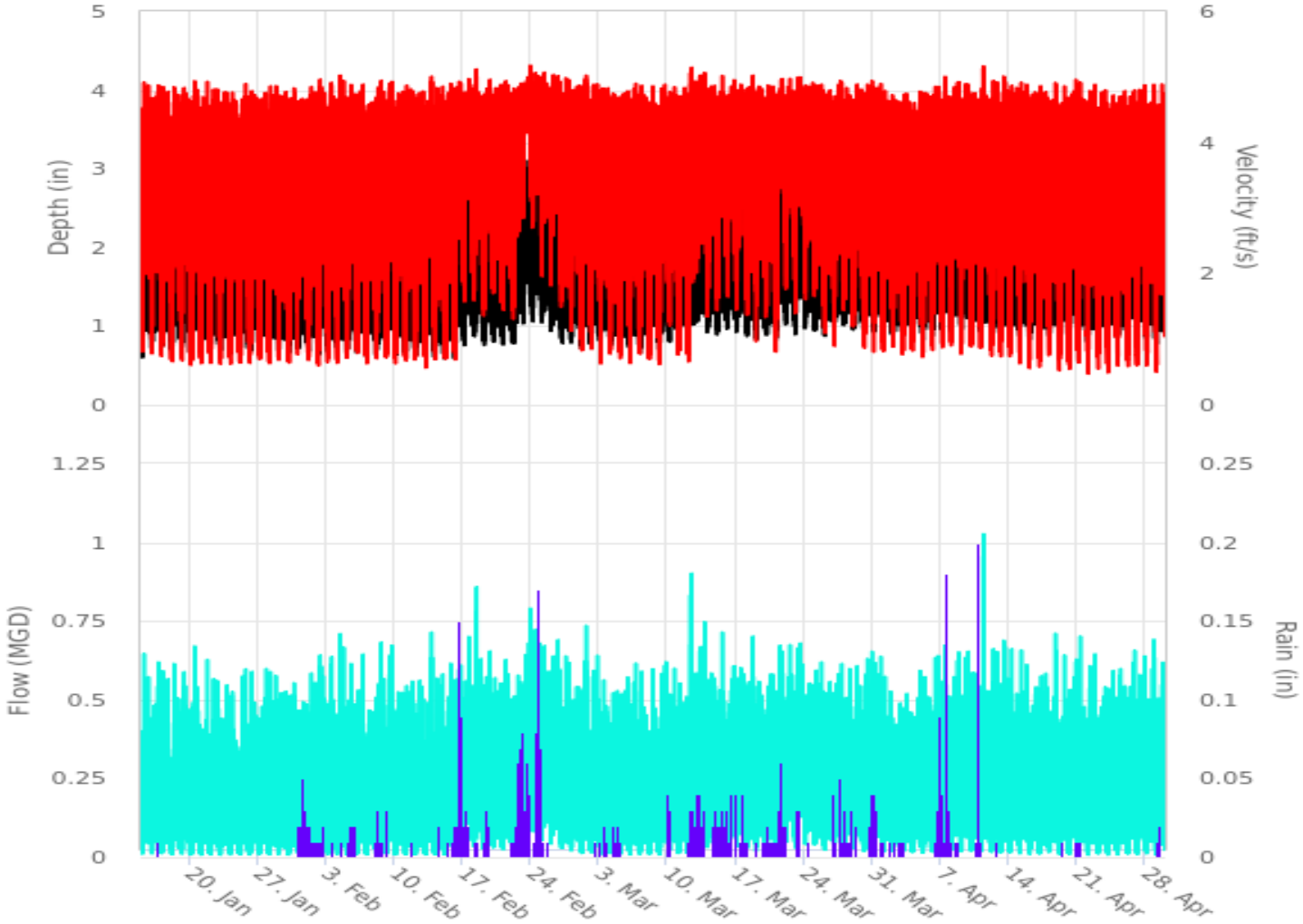
Pipe Height
18.13
in

Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL



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Scattergraph Report

CAM_52167

Flow Monitor

CAM_52167

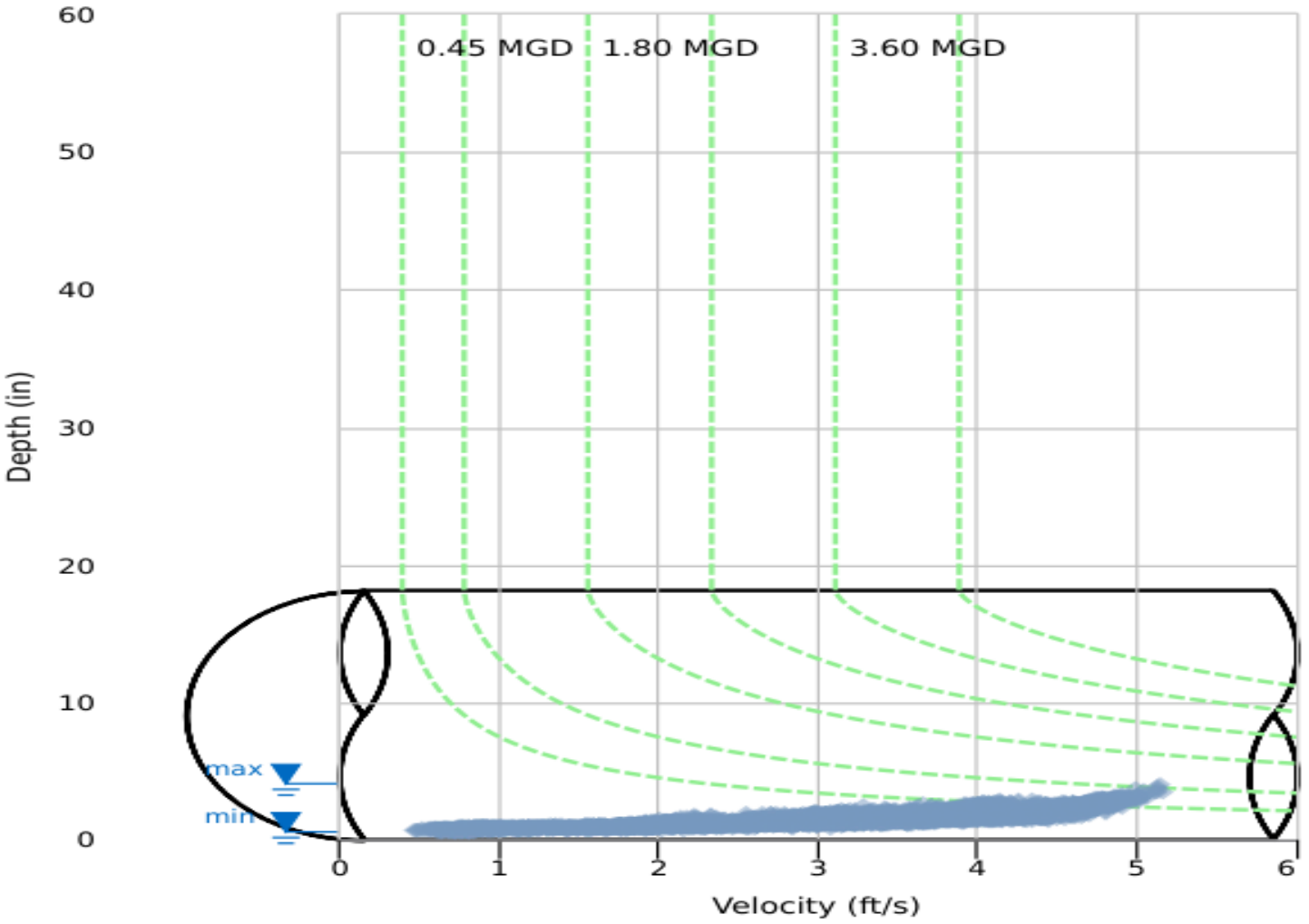
Pipe Height
18.13
in

Report Period

01/15/2025
To
04/29/2025

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth



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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_52167 Pipe: Elliptical (18.13 in H x 18.13 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/15/2025	04:55	0.55	08:30	3.97	1.60	05:45	0.66	08:30	5.21	3.36	04:55	0.008	08:30	0.981	0.214	0.214	-
01/16/2025	03:55	0.63	08:05	4.32	1.59	04:50	0.74	20:00	5.28	3.33	03:55	0.009	08:05	1.118	0.213	0.213	0.01
01/17/2025	06:00	0.68	20:05	4.16	1.51	03:45	0.73	20:05	5.28	3.15	06:00	0.011	20:05	1.057	0.189	0.189	-
01/18/2025	04:30	0.65	10:15	4.26	1.53	06:50	0.63	10:15	5.28	3.13	04:30	0.009	10:15	1.096	0.197	0.197	-
01/19/2025	04:15	0.70	09:25	4.17	1.56	06:40	0.64	16:40	5.26	3.20	04:15	0.010	11:30	1.046	0.203	0.203	-
01/20/2025	03:55	0.59	13:00	4.22	1.53	04:00	0.58	13:00	5.30	3.15	03:55	0.007	13:00	1.084	0.198	0.198	-
01/21/2025	02:50	0.54	18:10	4.14	1.47	05:25	0.61	18:10	5.24	3.09	05:25	0.007	18:10	1.044	0.182	0.182	-
01/22/2025	04:45	0.54	23:35	3.98	1.48	04:45	0.58	12:00	5.15	3.13	04:45	0.006	23:35	0.965	0.186	0.186	-
01/23/2025	05:00	0.55	21:25	4.33	1.45	05:00	0.59	21:25	5.31	3.04	05:00	0.006	21:25	1.129	0.179	0.179	-
01/24/2025	03:45	0.61	08:55	3.95	1.45	05:30	0.60	08:55	5.10	3.09	05:30	0.008	08:55	0.951	0.179	0.179	-
01/25/2025	05:45	0.66	10:20	4.19	1.48	03:30	0.62	10:20	5.31	3.08	04:55	0.009	10:20	1.076	0.189	0.189	-
01/26/2025	05:05	0.63	14:25	4.18	1.46	03:45	0.60	10:35	5.29	3.09	05:15	0.008	14:25	1.064	0.184	0.184	-
01/27/2025	01:25	0.65	21:20	4.06	1.49	04:40	0.66	21:20	5.33	3.08	01:30	0.010	21:20	1.033	0.191	0.191	-
01/28/2025	02:00	0.65	08:00	4.06	1.44	05:35	0.63	08:00	5.26	2.96	03:25	0.009	08:00	1.018	0.178	0.178	-
01/29/2025	04:15	0.65	10:05	4.15	1.41	04:00	0.66	10:05	5.26	2.92	04:10	0.009	10:05	1.051	0.171	0.171	-
01/30/2025	03:55	0.57	20:25	3.97	1.41	05:40	0.57	20:25	5.19	2.94	04:00	0.007	20:25	0.976	0.171	0.171	-
01/31/2025	01:35	0.68	19:40	4.05	1.52	02:40	0.76	19:40	5.22	3.25	02:40	0.013	19:40	1.010	0.197	0.197	0.60
02/01/2025	06:45	0.68	21:45	3.97	1.49	05:45	0.63	19:35	5.18	3.04	05:45	0.010	21:45	0.971	0.187	0.187	0.12
02/02/2025	02:55	0.61	12:05	3.95	1.57	05:45	0.55	10:00	5.25	3.18	05:45	0.007	10:00	0.972	0.211	0.211	0.07
02/03/2025	05:30	0.62	13:20	4.03	1.46	04:00	0.59	13:20	5.14	3.03	04:00	0.008	13:20	0.988	0.181	0.181	0.02
02/04/2025	03:55	0.67	19:30	4.00	1.51	03:55	0.61	19:30	5.20	3.09	03:55	0.008	19:30	0.988	0.194	0.194	0.01
02/05/2025	04:50	0.60	14:05	3.61	1.48	04:35	0.69	17:55	5.09	3.09	05:00	0.008	14:05	0.831	0.188	0.188	0.19
02/06/2025	04:35	0.62	17:25	3.99	1.51	04:35	0.72	19:35	5.16	3.15	04:35	0.009	19:35	0.972	0.194	0.194	-
02/07/2025	03:25	0.59	12:25	3.81	1.44	04:55	0.60	09:55	5.13	2.99	04:55	0.008	12:25	0.906	0.175	0.175	-
02/08/2025	02:10	0.62	22:45	4.02	1.49	05:05	0.68	16:20	5.18	3.07	05:15	0.010	22:45	0.986	0.192	0.192	0.25
02/09/2025	02:30	0.66	18:15	4.05	1.58	05:20	0.62	18:15	5.29	3.27	05:20	0.009	18:15	1.023	0.210	0.210	0.05
02/10/2025	05:50	0.61	16:10	3.93	1.50	03:05	0.62	16:10	5.26	3.17	03:05	0.008	16:10	0.974	0.193	0.193	-
02/11/2025	02:20	0.62	19:55	3.94	1.48	05:10	0.65	19:55	5.20	3.13	02:45	0.009	19:55	0.964	0.188	0.188	0.01
02/12/2025	05:45	0.61	19:05	4.18	1.45	02:50	0.67	19:05	5.29	3.06	02:50	0.009	19:05	1.068	0.184	0.184	-
02/13/2025	06:00	0.64	19:50	4.14	1.48	05:50	0.55	19:50	5.29	3.17	06:00	0.007	19:50	1.054	0.191	0.191	-
02/14/2025	02:00	0.59	19:55	4.18	1.41	04:55	0.64	19:55	5.26	3.00	04:55	0.008	19:55	1.063	0.180	0.180	0.07
02/15/2025	03:25	0.58	19:55	4.17	1.41	05:05	0.56	19:55	5.28	3.11	05:05	0.007	19:55	1.064	0.178	0.178	0.09
02/16/2025	03:40	0.58	20:15	4.10	1.55	06:45	0.66	18:25	5.27	3.39	06:45	0.008	20:15	1.009	0.219	0.219	0.77
02/17/2025	04:40	0.70	07:50	4.25	1.74	04:00	1.03	07:50	5.35	3.80	04:00	0.016	07:50	1.108	0.262	0.262	0.39
02/18/2025	03:35	0.79	09:55	5.26	1.80	04:45	1.22	09:55	5.50	3.78	04:45	0.022	09:55	1.536	0.281	0.281	0.02
02/19/2025	05:25	0.70	19:45	4.44	1.75	04:10	0.93	19:45	5.40	3.84	05:25	0.015	19:45	1.190	0.271	0.271	0.40
02/20/2025	03:30	0.70	16:55	4.22	1.69	04:45	1.02	08:05	5.36	3.72	04:45	0.016	16:55	1.073	0.252	0.252	-
02/21/2025	05:15	0.69	08:40	4.15	1.65	04:35	0.91	15:35	5.36	3.59	04:35	0.013	08:40	1.017	0.239	0.239	0.04
02/22/2025	04:20	0.65	16:55	3.98	1.66	05:05	0.78	19:35	5.13	3.65	05:05	0.011	16:55	0.956	0.241	0.241	0.84
02/23/2025	05:25	0.92	15:55	4.46	2.16	02:35	1.93	10:50	5.39	4.46	04:55	0.047	15:55	1.157	0.385	0.385	1.07
02/24/2025	06:05	0.90	19:45	4.29	2.03	05:40	1.71	08:35	5.42	4.30	05:40	0.039	08:35	1.122	0.344	0.344	0.87
02/25/2025	03:45	0.90	13:10	4.31	1.91	03:45	1.64	13:10	5.44	4.17	03:45	0.035	13:10	1.146	0.304	0.304	0.03
02/26/2025	05:45	0.80	21:05	4.18	1.82	00:55	1.61	06:55	5.25	3.95	00:55	0.031	21:05	1.041	0.282	0.282	-
02/27/2025	05:45	0.70	23:15	3.98	1.69	03:50	0.85	22:00	5.23	3.69	03:50	0.014	22:00	0.977	0.244	0.244	-
02/28/2025	04:05	0.70	15:40	3.43	1.62	03:25	0.86	15:40	5.07	3.61	03:25	0.014	15:40	0.773	0.222	0.222	-
03/01/2025	05:40	0.69	11:25	4.47	1.60	05:40	0.73	11:25	5.37	3.52	05:40	0.010	11:25	1.191	0.221	0.221	-
03/02/2025	05:40	0.71	19:45	4.32	1.64	04:50	0.70	11:00	5.22	3.50	04:50	0.011	19:45	1.098	0.230	0.230	0.05
03/03/2025	04:00	0.67	11:45	4.11	1.59	03:55	0.57	11:45	5.24	3.46	03:55	0.008	11:45	1.035	0.213	0.213	0.07
03/04/2025	05:20	0.68	21:05	4.23	1.55	02:15	0.70	21:05	5.30	3.35	02:15	0.011	21:05	1.088	0.207	0.207	0.12
03/05/2025	03:55	0.65	08:10	4.05	1.54	03:55	0.67	19:50	5.31	3.29	03:55	0.009	08:10	1.019	0.207	0.207	0.01
03/06/2025	04:25	0.62	22:10	4.19	1.52	04:20	0.63	18:15	5.28	3.23	04:25	0.008	22:10	1.067	0.201	0.201	-
03/07/2025	04:00	0.64	08:30	4.09	1.47	01:50	0.69	08:30	5.20	3.10	01:50	0.009	08:30	1.020	0.185	0.185	-
03/08/2025	04:10	0.64	12:00	3.85	1.48	03:00	0.62	09:10	5.21	3.12	03:00	0.009	12:00	0.920	0.185	0.185	-
03/09/2025	04:25	0.65	18:00	4.24	1.58	03:00	0.59	20:35	5.34	3.20	03:00	0.008	10:50	1.090	0.211	0.211	0.20
03/10/2025	05:15	0.79	17:15	4.14	1.59	06:10	1.01	17:15	5.26	3.29	06:10	0.018	17:15	1.046	0.209	0.209	0.22
03/11/2025	02:10	0.71	07:10	3.79	1.54	02:10	0.75	20:45	5.14	3.22	02:10	0.011	19:20	0.877	0.196	0.196	0.02
03/12/2025	03:55	0.70	09:45	4.33	1.82	03:55	0.65	09:45	5.43	3.58	03:55	0.010	09:45	1.154	0.281	0.281	0.83
03/13/2025	04:50	0.92	14:35	4.42	1.83	04:45	1.41	14:35	5.41	3.83	04:50	0.032	14:35	1.183	0.279	0.279	0.49
03/14/2025	01:20	0.80	21:05	4.19	1.80	01:20	0.90	21:05	5.33	3.71	01:20	0.016	21:05	1.080	0.270	0.270	0.16
03/15/2025	04:45	0.85	15:50	4.19	1.78	04:45	0.86	15:50	5.27	3.70	04:45	0.017	15:50	1.070	0.264	0.264	0.60
03/16/2025	06:20	0.81	18:35	4.35	1.85	04:05	0.98	18:35	5.37	3.79	04:05	0.018	18:35	1.148	0.284	0.284	0.16
03/17/2025	02:00	0.83	19:20	4.36	1.77	02:00	0.99	19:20	5.33	3.67	02:00	0.019	19:20	1.144	0.261	0.261	0.19
03/18/2025	03:40	0.77	18:30	4.20	1.72	03:05	0.90	18:30	5.28	3.58	03:40	0.017	18:30	1.074	0.246	0.246	0.02
03/19/2025	03:20	0.79	13:10	4.17	1.67	01:55	0.82	13:10	5.37	3.50	01:55	0.016	13:10	1.083	0.232	0.232	0.07
03/20/2025	02:50	0.79	19:15	4.12	1.65	02:50	0.70	13:20	5.32	3.47	02:50	0.012	19:15	1.029	0.228	0.228	0.11
03/21/2025	02:15	0.78	15:45	4.33	1.82	04:05	0.77	15:45	5.35	3.76	04:05	0.014	15:45	1.137	0.277	0.277	1.12
03/22/2025	23:20	0.94	13:30	4.22	1.89	03:40	1.44	20:55	5.32	3.92	03:40	0.035	13:30	1.072	0.295	0.295	-
03/23/2025	02:10	0.83	15:15	4.36	1.88	02:10	0.96	15:15	5.39	3.92	02:10	0.018	15:15	1.156	0.295	0.295	0.44
03/24/2025	00:40	0.89	13:50	4.13	1.80	01:45	1.32	04:30	5.18	3.77	01:45	0.029	13:50	1.010	0.268	0.268	0.01

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/25/2025	03:55	0.86	19:00	4.30	1.76	23:50	1.09	19:00	5.26	3.67	23:50	0.023	19:00	1.105	0.254	0.254	-
03/26/2025	01:10	0.83	06:55	4.34	1.73	03:10	0.80	10:05	5.28	3.58	03:10	0.016	06:55	1.111	0.245	0.245	0.20
03/27/2025	00:30	0.85	23:40	3.85	1.73	01:55	0.79	06:35	5.27	3.54	01:55	0.016	12:15	0.929	0.242	0.242	0.24
03/28/2025	03:05	0.91	12:25	4.30	1.74	01:40	1.09	15:10	5.34	3.55	05:05	0.025	12:25	1.117	0.247	0.247	0.17
03/29/2025	01:45	0.89	19:25	4.06	1.74	01:45	0.87	19:25	5.18	3.50	01:45	0.018	19:25	1.003	0.243	0.243	0.12
03/30/2025	01:00	0.88	11:45	4.29	1.73	02:30	0.76	11:45	5.26	3.43	02:30	0.016	11:45	1.104	0.240	0.240	0.23
03/31/2025	04:30	0.87	07:15	4.01	1.71	04:30	0.75	07:15	5.24	3.35	04:30	0.015	07:15	0.997	0.231	0.231	0.10
04/01/2025	04:35	0.87	21:05	4.20	1.63	03:40	0.79	21:05	5.20	3.25	01:10	0.016	21:05	1.056	0.212	0.212	0.03
04/02/2025	03:45	0.85	20:50	4.04	1.59	03:45	0.84	20:50	5.15	3.17	03:45	0.017	20:50	0.991	0.199	0.199	0.05
04/03/2025	03:00	0.82	13:05	3.65	1.58	05:00	0.71	18:15	5.02	3.09	01:55	0.014	13:05	0.831	0.194	0.194	0.02
04/04/2025	03:35	0.75	21:30	4.15	1.55	03:35	0.68	23:10	5.20	3.07	03:35	0.011	21:30	1.041	0.189	0.189	-
04/05/2025	04:35	0.79	16:25	4.20	1.58	04:35	0.67	16:25	5.24	3.09	04:35	0.012	16:25	1.066	0.196	0.196	-
04/06/2025	03:15	0.85	10:45	4.21	1.73	04:15	0.82	16:20	5.30	3.44	03:15	0.016	16:20	1.079	0.238	0.238	0.71
04/07/2025	04:25	0.88	06:35	4.34	1.78	03:30	0.77	06:35	5.32	3.47	03:30	0.017	06:35	1.131	0.249	0.249	0.37
04/08/2025	05:00	0.91	16:40	4.40	1.74	03:30	0.76	16:40	5.36	3.44	03:30	0.017	16:40	1.163	0.241	0.241	0.07
04/09/2025	02:25	0.92	06:35	4.02	1.76	02:20	0.72	14:00	5.23	3.39	02:25	0.017	14:00	0.997	0.242	0.242	-
04/10/2025	01:35	0.87	12:00	4.13	1.71	04:05	0.72	12:00	5.24	3.35	03:15	0.016	12:00	1.039	0.228	0.228	0.27
04/11/2025	05:10	0.88	09:35	5.07	1.82	02:45	0.73	09:35	5.34	3.41	02:45	0.015	09:35	1.416	0.266	0.266	0.01
04/12/2025	03:40	0.85	08:05	4.30	1.67	05:40	0.73	18:45	5.31	3.33	02:45	0.015	08:05	1.109	0.224	0.224	0.01
04/13/2025	04:30	0.78	19:05	4.31	1.66	04:30	0.64	19:05	5.31	3.28	04:30	0.011	19:05	1.122	0.227	0.227	-
04/14/2025	02:25	0.78	19:10	4.26	1.63	02:25	0.71	19:10	5.27	3.28	02:25	0.012	19:10	1.093	0.217	0.217	-
04/15/2025	03:00	0.73	09:20	4.06	1.64	03:00	0.52	09:20	5.20	3.18	03:00	0.008	09:20	1.009	0.216	0.216	-
04/16/2025	02:55	0.72	18:45	3.92	1.58	02:55	0.55	18:45	5.10	3.08	02:55	0.008	18:45	0.942	0.196	0.196	-
04/17/2025	03:10	0.75	18:45	4.03	1.59	03:10	0.54	18:45	5.22	3.00	03:10	0.009	18:45	1.003	0.201	0.201	-
04/18/2025	04:55	0.87	21:45	4.25	1.61	01:50	0.75	21:45	5.29	3.03	01:50	0.015	21:45	1.093	0.199	0.199	-
04/19/2025	04:10	0.79	16:30	4.10	1.60	04:10	0.52	16:30	5.19	2.92	04:10	0.009	16:30	1.019	0.196	0.196	0.01
04/20/2025	05:10	0.73	21:20	4.29	1.65	05:10	0.53	21:20	5.27	3.07	05:10	0.008	21:20	1.102	0.214	0.214	0.05
04/21/2025	02:35	0.73	07:30	4.17	1.58	02:35	0.58	07:30	5.29	2.94	02:35	0.009	07:30	1.064	0.196	0.196	0.02
04/22/2025	03:30	0.68	20:20	4.40	1.60	03:30	0.43	20:20	5.26	2.99	03:30	0.006	20:20	1.141	0.201	0.201	-
04/23/2025	03:55	0.76	20:55	4.05	1.57	03:55	0.53	20:55	5.18	2.92	03:55	0.009	20:55	1.001	0.187	0.187	-
04/24/2025	03:35	0.65	06:20	4.10	1.61	03:35	0.47	06:20	5.18	2.93	03:35	0.006	06:20	1.017	0.200	0.200	-
04/25/2025	03:40	0.67	10:50	4.33	1.57	03:40	0.58	10:50	5.27	2.88	03:40	0.008	10:50	1.121	0.189	0.189	-
04/26/2025	05:10	0.78	21:15	4.33	1.62	05:10	0.57	21:15	5.27	2.98	05:10	0.010	21:15	1.120	0.202	0.202	-
04/27/2025	05:15	0.71	18:10	3.91	1.63	05:15	0.58	18:10	5.22	2.97	05:15	0.009	18:10	0.958	0.210	0.210	-
04/28/2025	03:05	0.75	20:15	4.35	1.57	03:05	0.55	20:15	5.31	2.97	03:05	0.009	20:15	1.136	0.194	0.194	-
04/29/2025	02:50	0.67	15:10	3.95	1.55	02:25	0.49	15:10	5.20	2.95	02:50	0.007	15:10	0.968	0.190	0.190	0.13

01/15/2025 00:00 - 04/29/2025 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			23.166	13.62
Average	1.63	3.33	0.221	

CAM_81189

Site Commentary

SITE INFORMATION

Pipe	Elliptical (12.13 in H x 12.13 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were experienced during the study. Backwater conditions were observed.

Average flow depth, velocity, and quantity data observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	2.07	1.91	0.117
Minimum	0.98	0.37	0.017
Maximum	4.16	2.85	0.295
Min Time	04/11/2025 02:50:00	02/21/2025 04:30:00	04/22/2025 02:20:00
Max Time	04/23/2025 08:25:00	04/01/2025 10:45:00	02/06/2025 15:30:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the graphical reports are based on the fifteen minutes average and values in the Observed Flow Conditions and tabular report are based on the five-minute average.

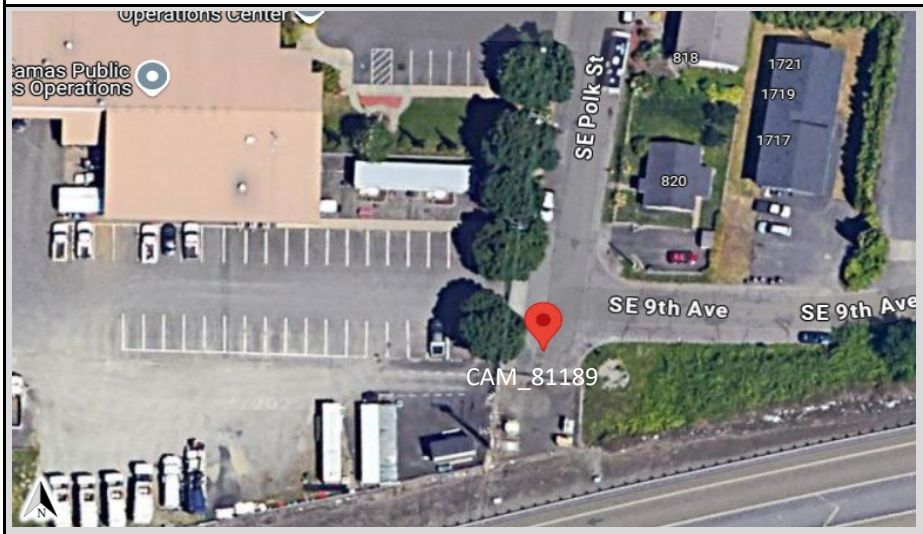
DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

Camas.Carollo.TFM.WA24		Site Name
Flow Monitoring Site Report	ADS ENVIRONMENTAL SERVICES®	CAM_81189

Site Address /Location:	820 SE Polk St, Camas, WA 98607			Monitor Series	Location Type
				TRITON+	Temporary
Site Access Details:	On Road	Latitude:	45.580146	Pipe Size (H x W)	Pipe Shape
		Longitude:	-122.39157	12.13 x 12.13	Circular



Manhole #	System Characteristics
81189	Residential
Access	Traffic
Drive	None





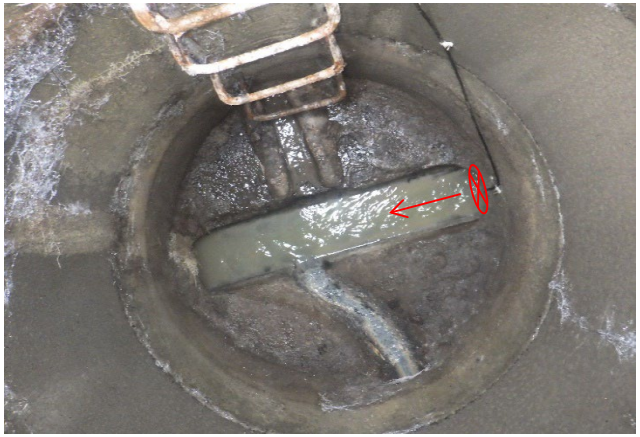
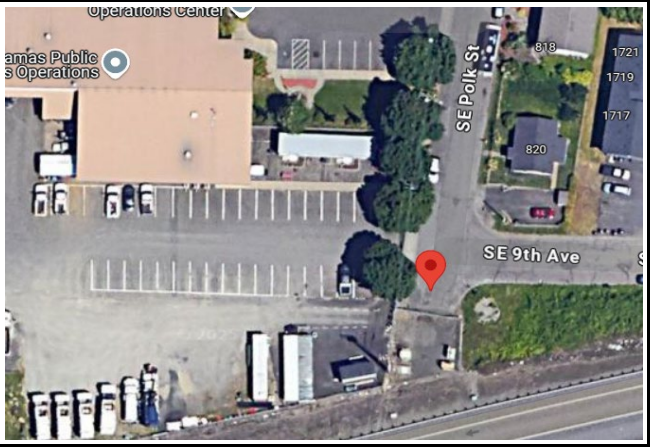


ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23116.11.325

Installation Information	
Installation Date:	Installation Type:
Tuesday, January 14, 2025	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi
Installation Confirmation:	
Time	
10:17:00 AM	
Depth of Flow (Wet DOF) (in)	
2.50	
CS58 Physical Offset (in)	Measurement Confidence (in)
N/A	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.57	N/A
Silt (in)	Silt Type
0	

Manhole / Pipe Information:	
Manhole Depth (Approx. FT):	Manhole Configuration
7.5	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
24	26
Manhole Cover	Manhole Frame
Steel	Normal
Active Connections	Air Quality:
Yes, Inside	Normal
Pipe Material	Pipe Condition:
Concrete	Good
Communication Information:	
Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole
Additional Site Info. / Comments:	

Additional Photos

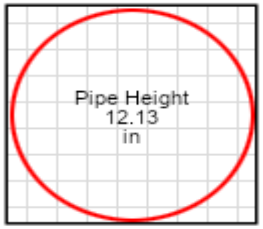
Monitoring Point Inlet	Outlet	West connection
		
Top Down	**Location**	**Map**
		
East Connection	**KEY**	
	Flow Direction Monitoring Point	

Hydrograph Report

CAM_81189

Flow Monitor

CAM_81189



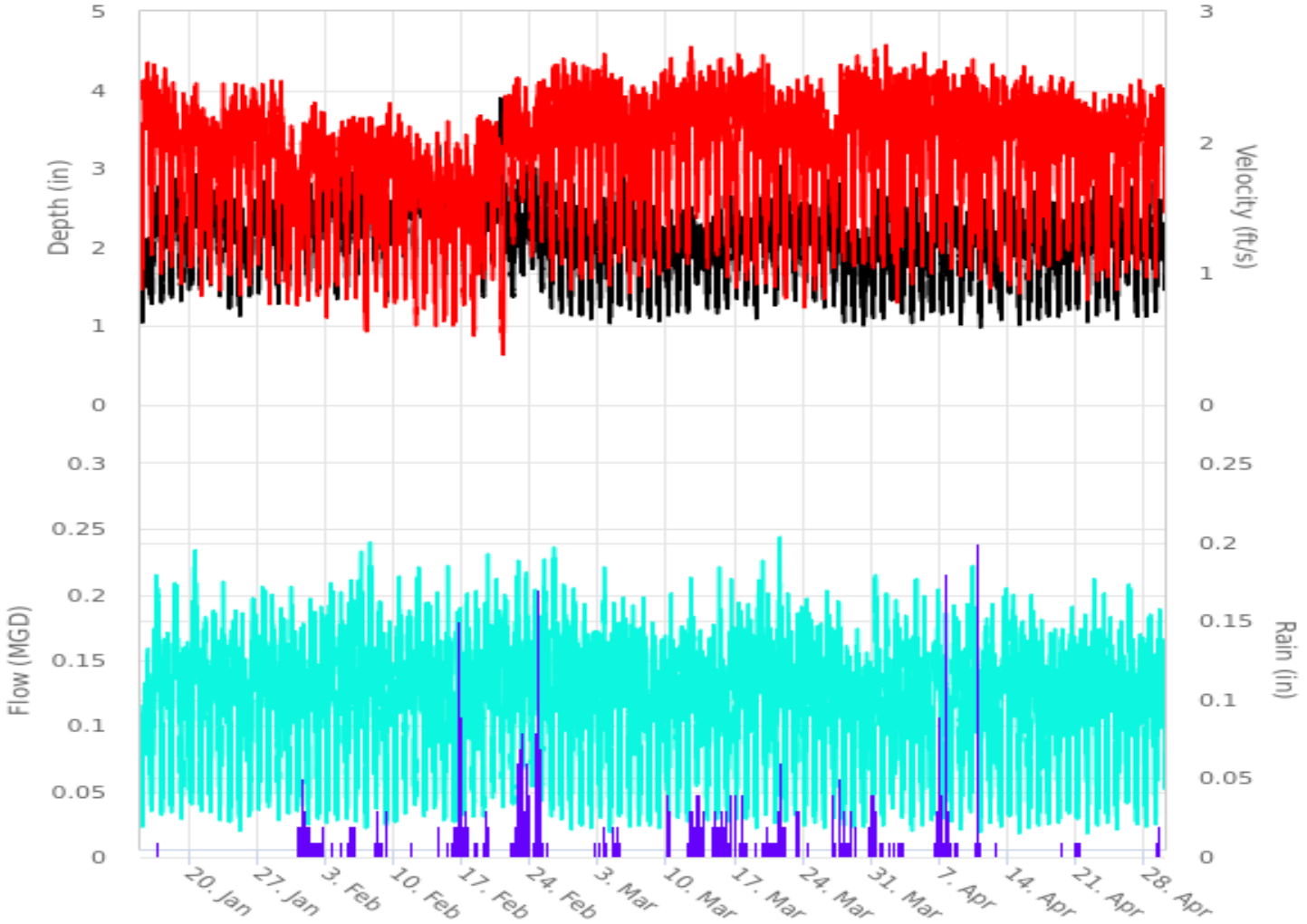
Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL

ADS ENVIRONMENTAL SERVICES



Scattergraph Report

CAM_81189

Flow Monitor

CAM_81189

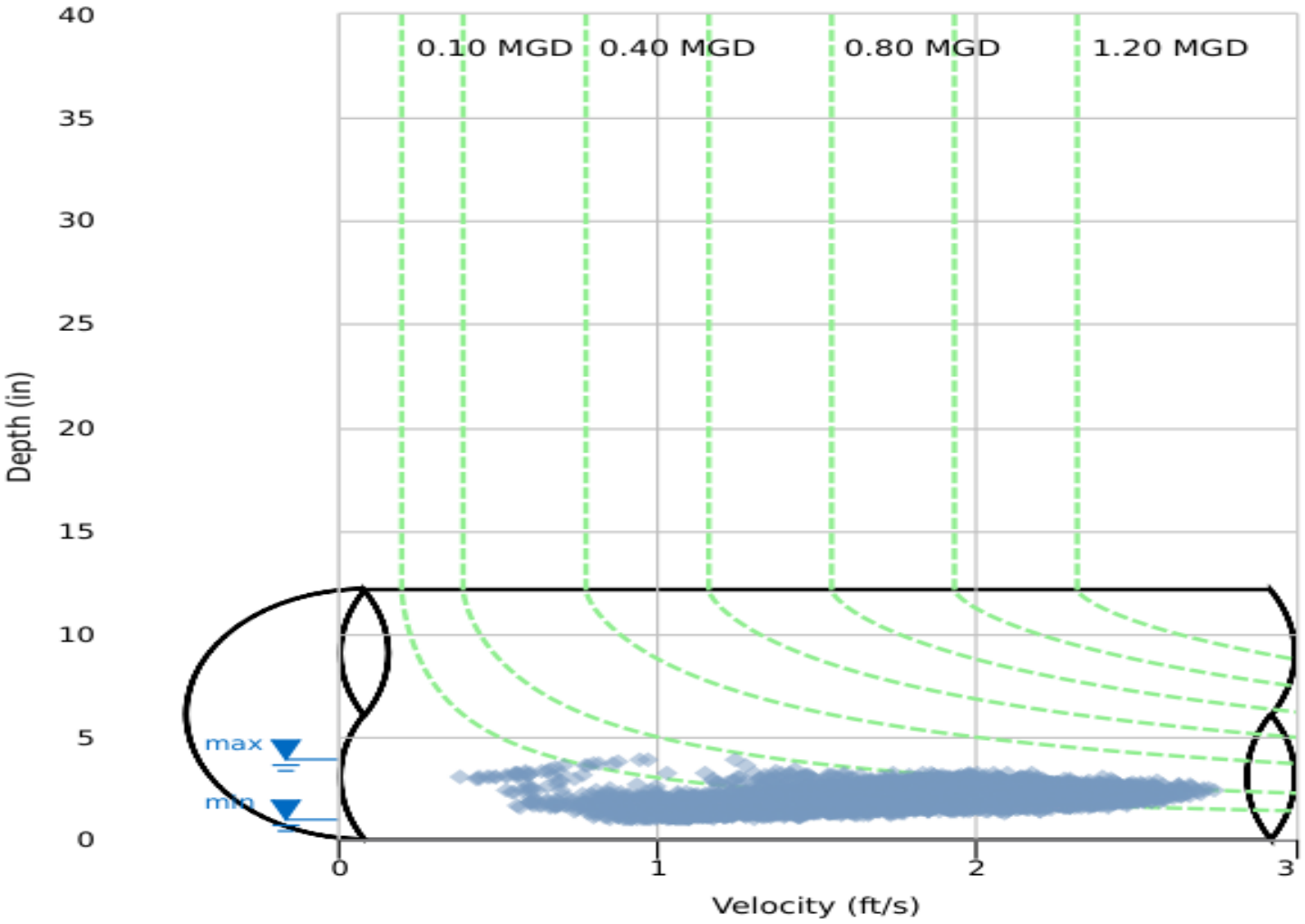
Pipe Height
12.13
in

Report Period

01/15/2025
To
04/29/2025

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth



846 Industry Dr.
Tukwila, WA 98188

800-633-7246
www.adsenv.com

Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_81189 Pipe: Elliptical (12.13 in H x 12.13 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/15/2025	04:55	1.03	09:30	2.34	1.63	02:55	0.86	15:35	2.71	2.08	04:55	0.022	15:35	0.168	0.090	0.090	-
01/16/2025	04:20	1.26	18:25	2.91	2.11	04:35	0.89	09:15	2.65	2.09	04:35	0.026	14:20	0.217	0.133	0.133	0.01
01/17/2025	05:05	1.26	13:55	2.70	1.97	03:45	0.95	11:30	2.66	2.03	05:05	0.030	12:20	0.203	0.115	0.115	-
01/18/2025	04:20	1.31	12:00	2.93	2.19	04:20	1.03	04:25	2.50	1.92	04:20	0.031	12:00	0.226	0.129	0.129	-
01/19/2025	03:05	1.30	16:40	2.70	1.92	06:20	0.87	16:40	2.60	1.82	05:15	0.028	16:40	0.224	0.101	0.101	-
01/20/2025	04:15	1.49	13:45	3.00	2.27	06:15	0.92	11:35	2.63	1.94	06:15	0.037	11:35	0.253	0.137	0.137	-
01/21/2025	03:50	1.41	14:55	2.97	2.09	06:00	0.77	08:20	2.35	1.82	04:25	0.031	15:30	0.196	0.112	0.112	-
01/22/2025	03:55	1.48	15:05	3.08	2.22	05:15	0.74	11:25	2.30	1.78	03:55	0.032	12:05	0.203	0.121	0.121	-
01/23/2025	03:20	1.37	12:55	3.26	2.17	04:15	0.86	11:30	2.60	1.84	04:15	0.028	11:30	0.234	0.121	0.121	-
01/24/2025	02:50	1.22	14:20	2.77	2.05	04:40	0.90	14:15	2.61	1.91	04:40	0.025	14:15	0.222	0.118	0.118	-
01/25/2025	04:45	1.09	11:05	2.53	1.85	04:45	0.80	18:05	2.50	1.91	04:45	0.019	11:05	0.194	0.101	0.101	-
01/26/2025	05:10	1.37	19:55	2.69	2.10	02:30	0.90	08:10	2.51	1.94	02:45	0.030	13:50	0.205	0.123	0.123	-
01/27/2025	03:25	1.39	20:20	2.89	2.21	03:25	1.02	11:30	2.51	1.86	03:25	0.034	11:35	0.224	0.125	0.125	-
01/28/2025	06:25	1.52	18:20	2.94	2.10	05:35	0.63	11:45	2.50	1.91	03:25	0.037	11:50	0.206	0.117	0.117	-
01/29/2025	03:05	1.22	20:50	3.16	2.18	22:25	0.80	10:10	2.52	1.72	03:05	0.024	10:10	0.204	0.113	0.113	-
01/30/2025	05:10	1.47	09:25	3.13	2.34	03:15	0.73	06:10	2.19	1.55	05:10	0.029	10:45	0.209	0.114	0.114	-
01/31/2025	02:20	1.72	15:20	3.07	2.38	04:30	0.70	19:55	2.30	1.57	02:20	0.034	15:55	0.207	0.116	0.116	0.60
02/01/2025	05:00	1.30	09:50	2.89	2.13	05:05	0.78	14:05	2.39	1.80	05:05	0.024	14:05	0.206	0.116	0.116	0.12
02/02/2025	03:55	1.42	19:10	2.99	2.18	05:15	0.79	18:55	2.60	1.74	05:20	0.028	12:00	0.215	0.117	0.117	0.07
02/03/2025	03:45	1.50	16:05	3.30	2.41	02:40	0.64	18:55	2.27	1.66	02:40	0.024	14:35	0.236	0.128	0.128	0.02
02/04/2025	03:45	1.31	13:10	3.19	2.15	01:20	0.88	17:25	2.59	1.73	03:40	0.028	13:15	0.249	0.114	0.114	0.01
02/05/2025	04:10	1.39	15:35	3.41	2.24	02:55	0.75	20:00	2.27	1.77	02:55	0.028	15:35	0.233	0.124	0.124	0.19
02/06/2025	02:55	1.38	15:30	3.78	2.30	02:55	0.78	19:40	2.33	1.76	02:55	0.025	15:30	0.295	0.127	0.127	-
02/07/2025	05:45	1.49	15:10	3.53	2.40	05:05	0.55	08:05	2.44	1.60	02:30	0.022	13:25	0.252	0.125	0.125	-
02/08/2025	02:05	1.55	17:45	3.26	2.44	04:55	0.74	20:10	2.33	1.58	04:55	0.033	20:10	0.228	0.121	0.121	0.25
02/09/2025	05:00	1.27	23:05	2.81	2.02	03:20	0.71	09:20	2.51	1.70	05:00	0.021	13:25	0.196	0.104	0.104	0.05
02/10/2025	02:50	1.36	15:20	3.24	2.32	02:15	0.77	12:10	2.27	1.71	04:00	0.025	10:45	0.229	0.126	0.126	-
02/11/2025	02:45	1.57	18:20	2.95	2.38	04:45	0.72	13:05	2.24	1.61	04:45	0.029	13:10	0.207	0.121	0.121	0.01
02/12/2025	03:05	1.75	12:40	3.28	2.55	05:55	0.60	07:00	2.15	1.55	03:05	0.034	12:00	0.230	0.129	0.129	-
02/13/2025	04:10	1.58	13:40	3.20	2.43	02:40	0.72	07:45	2.01	1.50	02:40	0.030	07:45	0.207	0.116	0.116	-
02/14/2025	04:30	1.61	13:35	3.65	2.38	06:55	0.55	10:30	2.11	1.48	02:50	0.028	10:25	0.207	0.111	0.111	0.07
02/15/2025	06:20	1.62	12:05	3.12	2.38	02:05	0.61	12:05	2.20	1.45	06:20	0.026	12:05	0.232	0.109	0.109	0.09
02/16/2025	03:00	1.60	15:45	3.32	2.40	01:30	0.54	10:30	2.12	1.45	06:10	0.025	10:30	0.207	0.113	0.113	0.77
02/17/2025	03:25	1.62	12:30	3.15	2.46	03:25	0.70	09:05	2.20	1.46	03:25	0.029	09:05	0.215	0.116	0.116	0.39
02/18/2025	23:15	1.81	14:20	3.31	2.40	04:50	0.48	16:10	2.29	1.53	03:35	0.028	10:35	0.219	0.112	0.112	0.02
02/19/2025	04:05	1.35	15:15	3.34	2.22	04:05	0.82	17:45	2.27	1.75	04:05	0.026	15:20	0.238	0.121	0.121	0.40
02/20/2025	04:35	1.74	21:45	3.99	2.55	22:55	0.63	09:15	2.25	1.60	05:50	0.040	12:05	0.221	0.127	0.127	-
02/21/2025	23:40	1.63	00:00	3.38	2.45	04:30	0.37	10:00	2.53	1.64	04:30	0.036	12:45	0.224	0.112	0.112	0.04
02/22/2025	04:45	1.33	19:35	3.08	2.08	05:25	1.15	08:25	2.56	1.99	04:45	0.036	17:15	0.235	0.124	0.124	0.84
02/23/2025	06:20	1.59	14:00	3.11	2.25	23:15	1.35	11:10	2.43	1.94	06:20	0.057	11:40	0.226	0.131	0.131	1.07
02/24/2025	04:50	1.66	12:45	3.09	2.19	05:30	1.06	20:25	2.52	1.95	04:50	0.046	12:40	0.215	0.128	0.128	0.87
02/25/2025	04:20	1.39	11:55	3.24	2.08	23:05	1.11	08:25	2.55	2.00	04:20	0.037	11:55	0.251	0.124	0.124	0.03
02/26/2025	03:50	1.21	10:05	2.96	2.08	04:55	0.91	17:50	2.72	2.11	03:50	0.030	10:05	0.264	0.132	0.132	-
02/27/2025	03:25	1.14	12:40	2.87	2.01	04:35	0.98	08:30	2.68	2.10	03:25	0.026	11:05	0.225	0.125	0.125	-
02/28/2025	05:00	1.11	09:35	3.31	1.96	03:30	0.86	10:10	2.71	2.04	05:00	0.021	11:25	0.215	0.118	0.118	-
03/01/2025	03:55	1.12	22:00	2.89	1.91	05:15	0.83	09:35	2.67	2.07	05:15	0.020	12:00	0.202	0.115	0.115	-
03/02/2025	04:30	1.08	19:50	2.40	1.88	04:30	0.93	11:10	2.65	2.08	04:30	0.021	12:15	0.185	0.114	0.114	0.05
03/03/2025	04:30	1.21	13:50	2.77	1.95	01:50	1.03	13:05	2.73	2.13	04:30	0.028	13:50	0.237	0.121	0.121	0.07
03/04/2025	03:50	1.02	08:45	3.19	1.95	03:40	0.89	13:20	2.70	2.02	03:40	0.019	21:55	0.214	0.115	0.115	0.12
03/05/2025	02:25	1.25	12:25	3.34	2.09	02:15	1.05	07:15	2.65	1.94	02:15	0.031	12:50	0.219	0.121	0.121	0.01
03/06/2025	04:40	1.20	12:15	2.75	2.07	04:35	0.85	10:45	2.53	1.90	04:35	0.023	12:10	0.198	0.117	0.117	-
03/07/2025	02:35	1.10	14:55	2.65	1.96	23:30	0.71	11:50	2.57	1.91	02:35	0.023	14:35	0.203	0.110	0.110	-
03/08/2025	05:00	1.09	13:15	2.72	1.89	04:45	0.86	13:40	2.53	1.99	04:45	0.021	13:10	0.198	0.109	0.109	-
03/09/2025	04:20	1.06	12:25	2.40	1.83	04:20	0.98	12:25	2.59	2.05	04:20	0.022	12:25	0.188	0.107	0.107	0.20
03/10/2025	03:45	1.12	10:15	2.52	1.91	03:40	0.99	10:15	2.71	2.09	03:40	0.024	10:15	0.211	0.115	0.115	0.22
03/11/2025	01:45	1.16	14:05	2.55	1.95	01:45	1.00	09:50	2.62	2.08	01:45	0.025	10:20	0.189	0.117	0.117	0.02
03/12/2025	02:40	1.16	10:00	2.63	1.94	02:35	1.07	09:50	2.80	2.15	02:35	0.027	10:00	0.230	0.122	0.122	0.83
03/13/2025	23:50	1.30	18:15	2.34	1.89	23:50	1.25	19:20	2.62	2.12	23:50	0.037	10:50	0.180	0.112	0.112	0.49
03/14/2025	04:05	1.20	11:00	2.52	1.89	04:05	0.98	08:05	2.76	2.04	04:05	0.026	18:15	0.203	0.111	0.111	0.16
03/15/2025	03:20	1.16	08:35	2.68	1.89	00:45	1.08	11:15	2.71	2.12	03:25	0.028	08:30	0.225	0.116	0.116	0.60
03/16/2025	04:20	1.21	13:15	2.88	1.93	04:45	0.89	15:20	2.63	2.06	04:45	0.025	13:15	0.238	0.116	0.116	0.16
03/17/2025	03:30	1.33	08:25	2.63	2.00	02:00	0.80	13:40	2.79	2.12	03:30	0.026	13:45	0.206	0.124	0.124	0.19
03/18/2025	02:30	1.25	08:20	2.61	1.95	03:30	0.91	10:10	2.79	2.05	02:30	0.028	08:20	0.199	0.116	0.116	0.02
03/19/2025	03:40	1.09	08:20	2.76	2.06	03:20	0.85	18:45	2.79	2.02	03:20	0.021	18:45	0.236	0.126	0.126	0.07
03/20/2025	02:15	1.40	12:30	2.67	2.04	02:00	0.90	08:15	2.71	1.96	02:00	0.030	08:15	0.214	0.117	0.117	0.11
03/21/2025	01:25	1.24	13:50	3.12	2.15	02:35	0.81	12:20	2.52	1.93	02:35	0.024	13:45	0.256	0.127	0.127	1.12
03/22/2025	02:40	1.38	08:40	2.72	2.09	03:35	0.69	09:30	2.53	1.93	03:35	0.024	08:35	0.205	0.121	0.121	-
03/23/2025	02:20	1.28	11:15	2.61	2.07	02:20	0.97	09:10	2.49	1.96	02:20	0.028	11:15	0.197	0.121	0.121	0.44
03/24/2025	03:35	1.31	16:15	2.64	2.10	02:00	0.71	09:00	2.60	1.96	03:35	0.022	18:10	0.202	0.124	0.124	0.01

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/25/2025	03:15	1.30	08:15	2.67	1.98	03:35	0.84	09:05	2.65	1.98	03:35	0.025	10:40	0.205	0.115	0.115	-
03/26/2025	02:40	1.22	07:40	3.02	2.15	02:35	0.77	07:40	2.37	1.81	02:35	0.021	07:40	0.239	0.120	0.120	0.20
03/27/2025	01:50	1.22	12:05	2.90	2.08	01:50	1.00	18:55	2.65	1.89	01:50	0.027	12:10	0.209	0.117	0.117	0.24
03/28/2025	03:35	1.03	19:55	2.55	1.78	03:35	1.04	13:05	2.71	2.11	03:35	0.022	09:00	0.169	0.105	0.105	0.17
03/29/2025	02:10	1.04	11:00	2.38	1.75	03:30	1.04	09:55	2.70	2.14	03:30	0.023	12:25	0.178	0.105	0.105	0.12
03/30/2025	02:55	0.99	11:00	2.42	1.65	04:35	1.01	18:30	2.66	2.08	04:35	0.021	11:00	0.181	0.093	0.093	0.23
03/31/2025	03:40	1.09	13:30	2.79	1.91	02:05	0.99	07:50	2.77	2.10	03:45	0.023	08:50	0.218	0.116	0.116	0.10
04/01/2025	03:25	1.08	13:50	2.88	1.80	03:25	1.02	10:45	2.85	2.06	03:25	0.023	10:45	0.225	0.105	0.105	0.03
04/02/2025	02:50	1.29	14:05	3.92	2.03	14:20	0.69	16:20	2.72	1.99	02:50	0.035	11:15	0.211	0.115	0.115	0.05
04/03/2025	03:55	1.14	10:45	2.65	1.87	02:25	1.18	17:25	2.65	2.08	02:25	0.030	08:05	0.200	0.110	0.110	0.02
04/04/2025	02:55	1.02	10:20	2.89	1.91	02:55	0.91	23:00	2.71	2.02	02:55	0.019	10:20	0.235	0.113	0.113	-
04/05/2025	03:55	1.06	09:05	2.49	1.77	02:45	1.00	08:45	2.73	2.09	03:55	0.023	09:05	0.207	0.103	0.103	-
04/06/2025	01:05	1.13	19:10	2.83	1.95	03:35	0.94	19:45	2.64	2.10	03:35	0.024	19:45	0.219	0.120	0.120	0.71
04/07/2025	04:15	1.15	14:00	2.99	1.73	13:30	0.91	11:15	2.65	2.10	04:25	0.024	13:55	0.199	0.098	0.098	0.37
04/08/2025	03:45	1.17	14:55	2.57	2.02	02:35	0.97	04:25	2.61	2.03	02:35	0.025	09:20	0.199	0.122	0.122	0.07
04/09/2025	02:45	1.01	18:15	2.50	1.86	02:15	0.96	18:15	2.68	2.03	02:50	0.021	18:15	0.206	0.108	0.108	-
04/10/2025	03:25	1.38	09:25	2.89	2.11	03:25	1.02	11:45	2.77	2.06	03:25	0.033	08:30	0.236	0.130	0.130	0.27
04/11/2025	02:50	0.98	13:55	2.71	1.96	02:45	0.95	06:30	2.47	1.97	02:50	0.019	17:50	0.193	0.114	0.114	0.01
04/12/2025	23:55	1.19	09:05	2.52	1.83	02:10	0.88	09:00	2.66	2.02	02:25	0.026	09:00	0.207	0.104	0.104	0.01
04/13/2025	05:40	1.07	20:05	2.79	2.06	05:20	0.99	10:20	2.58	1.99	05:20	0.023	20:00	0.215	0.124	0.124	-
04/14/2025	01:50	1.38	12:55	2.68	2.02	03:30	0.86	19:25	2.58	2.01	03:30	0.029	14:15	0.207	0.119	0.119	-
04/15/2025	02:35	1.01	10:50	2.55	1.87	02:35	0.83	13:30	2.70	1.98	02:35	0.017	10:50	0.195	0.108	0.108	-
04/16/2025	01:55	1.05	14:05	2.85	1.99	01:55	0.90	08:30	2.56	1.98	01:55	0.020	08:30	0.206	0.116	0.116	-
04/17/2025	02:50	1.04	14:00	2.61	1.88	02:45	0.96	07:45	2.57	1.98	02:50	0.021	09:00	0.188	0.106	0.106	-
04/18/2025	02:20	1.10	13:45	2.79	1.88	02:15	0.92	06:40	2.68	2.04	02:15	0.021	13:40	0.193	0.110	0.110	-
04/19/2025	03:40	1.10	15:15	2.41	1.91	05:35	1.08	10:55	2.59	2.05	02:20	0.026	10:55	0.180	0.113	0.113	0.01
04/20/2025	04:25	1.16	13:05	2.74	2.00	02:35	0.94	07:10	2.50	2.01	02:35	0.026	13:05	0.211	0.118	0.118	0.05
04/21/2025	02:15	1.16	07:20	2.90	2.08	01:05	0.99	06:55	2.44	1.94	02:15	0.025	10:40	0.197	0.120	0.120	0.02
04/22/2025	02:35	1.05	18:35	2.87	2.07	02:20	0.73	11:05	2.45	1.88	02:20	0.017	18:35	0.226	0.117	0.117	-
04/23/2025	00:40	1.13	08:25	4.16	2.16	12:25	0.65	19:30	2.35	1.78	03:40	0.019	19:35	0.210	0.117	0.117	-
04/24/2025	03:30	1.18	08:55	2.97	2.01	01:30	0.93	09:55	2.57	1.91	03:30	0.025	08:55	0.210	0.113	0.113	-
04/25/2025	02:45	1.08	11:15	2.58	1.98	02:40	0.82	08:20	2.50	1.92	02:40	0.019	08:25	0.191	0.112	0.112	-
04/26/2025	04:05	1.40	10:35	3.07	2.16	02:40	0.87	11:20	2.53	1.95	04:05	0.031	10:35	0.231	0.126	0.126	-
04/27/2025	02:15	1.11	20:15	2.51	1.92	02:20	0.88	09:30	2.51	2.00	02:20	0.021	12:30	0.182	0.112	0.112	-
04/28/2025	01:30	1.07	10:55	2.93	2.03	03:15	0.92	12:50	2.50	1.92	01:30	0.021	12:50	0.216	0.116	0.116	-
04/29/2025	01:00	1.15	11:35	2.83	2.00	02:25	0.96	10:45	2.50	2.04	02:25	0.025	11:35	0.218	0.119	0.119	0.13

01/15/2025 00:00 - 04/29/2025 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			12.250	13.62
Average	2.07	1.91	0.117	

CAM_RG

Site Commentary

SITE INFORMATION

Rain Collector Dimensions	8”

OBSERVATIONS

A review of the hydrograph indicates CAM_RG functioned under normal conditions during the study.

The total rainfall recorded during the monitoring period was 13.62 inches.

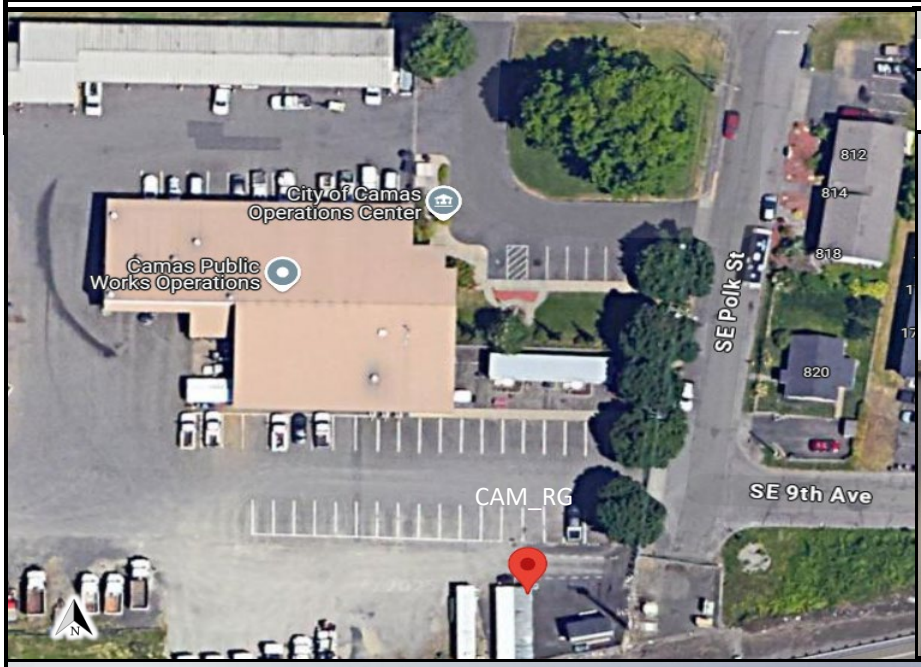
DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
Rain	100

Camas.Carollo.TFM.WA24		Site Name
Rainfall Monitoring Site Report	ADS ENVIRONMENTAL SERVICES®	CAM_RG

Site Address /Location:	1620 SE 8th Ave, Camas, WA 98607			Monitor Series	Location Type
				Rain Alert III	Temporary
Site Access Details:	On Roof	Latitude:	45.5800529	Installation Date	
		Longitude:	-122.3918594	1.14.2025	



Location	
On Roof	
Access	Traffic
Drive	None





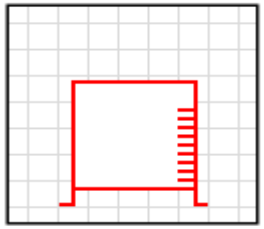
ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23081.11.325

Hydrograph Report

CAM_RG

Rain Gauge

CAM_RG

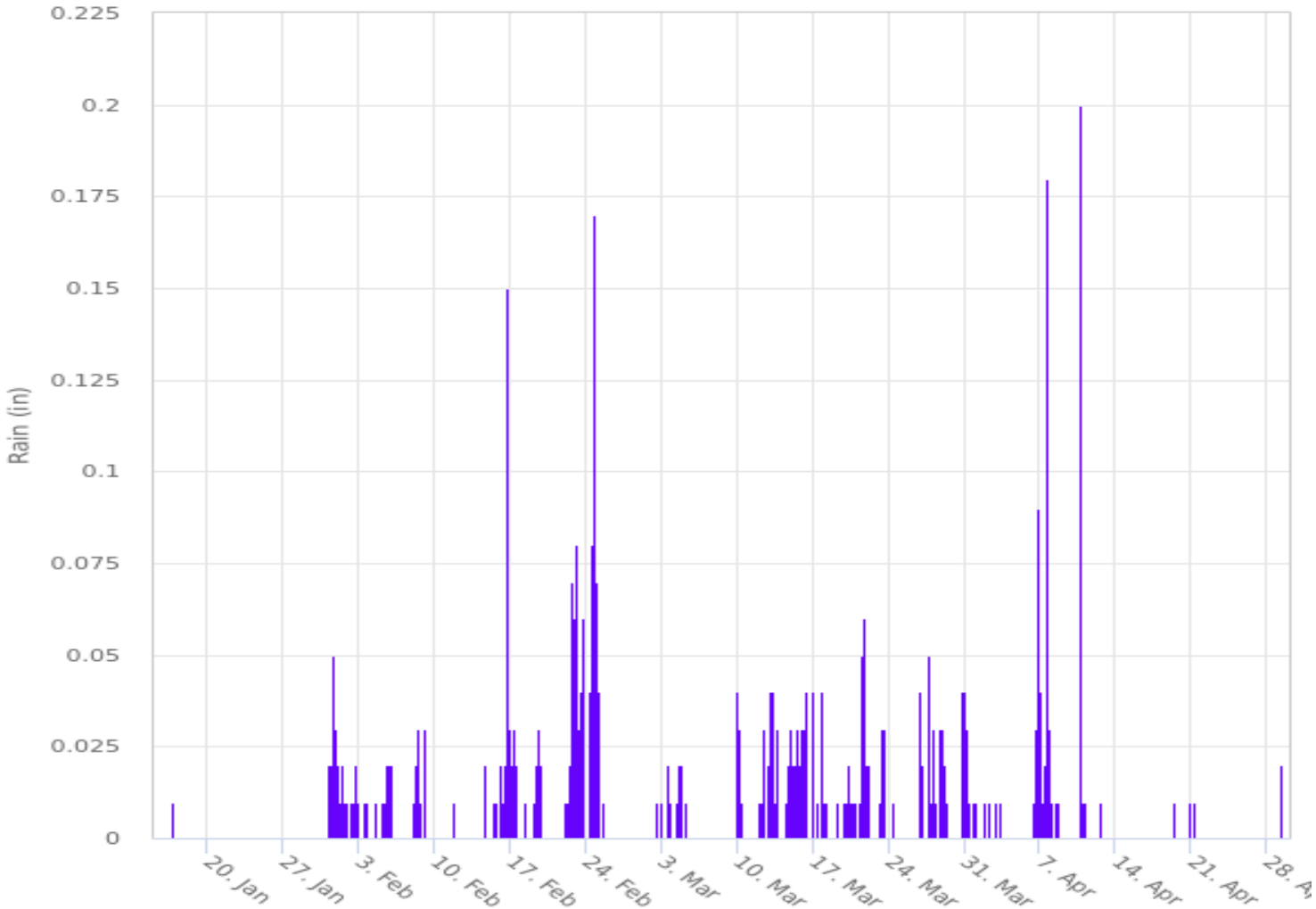


Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL



846 Industry Dr.
Tukwila, WA 98188

800-633-7246
www.adsenv.com

Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_RG

Date	RAIN FINAL (in) Total
01/15/2025	-
01/16/2025	0.01
01/17/2025	-
01/18/2025	-
01/19/2025	-
01/20/2025	-
01/21/2025	-
01/22/2025	-
01/23/2025	-
01/24/2025	-
01/25/2025	-
01/26/2025	-
01/27/2025	-
01/28/2025	-
01/29/2025	-
01/30/2025	-
01/31/2025	0.60
02/01/2025	0.12
02/02/2025	0.07
02/03/2025	0.02
02/04/2025	0.01
02/05/2025	0.19
02/06/2025	-
02/07/2025	-
02/08/2025	0.25
02/09/2025	0.05
02/10/2025	-
02/11/2025	0.01
02/12/2025	-
02/13/2025	-
02/14/2025	0.07
02/15/2025	0.09
02/16/2025	0.77
02/17/2025	0.39
02/18/2025	0.02
02/19/2025	0.40
02/20/2025	-
02/21/2025	0.04
02/22/2025	0.84
02/23/2025	1.07
02/24/2025	0.87
02/25/2025	0.03
02/26/2025	-
02/27/2025	-
02/28/2025	-
03/01/2025	-
03/02/2025	0.05
03/03/2025	0.07
03/04/2025	0.12
03/05/2025	0.01
03/06/2025	-
03/07/2025	-
03/08/2025	-
03/09/2025	0.20
03/10/2025	0.22
03/11/2025	0.02
03/12/2025	0.83
03/13/2025	0.49
03/14/2025	0.16
03/15/2025	0.60
03/16/2025	0.16
03/17/2025	0.19
03/18/2025	0.02
03/19/2025	0.07
03/20/2025	0.11
03/21/2025	1.12
03/22/2025	-
03/23/2025	0.44
03/24/2025	0.01
03/25/2025	-

01/15/2025 00:00 - 04/29/2025 23:59

	RAIN FINAL (in)
Date	Total
03/26/2025	0.20
03/27/2025	0.24
03/28/2025	0.17
03/29/2025	0.12
03/30/2025	0.23
03/31/2025	0.10
04/01/2025	0.03
04/02/2025	0.05
04/03/2025	0.02
04/04/2025	-
04/05/2025	-
04/06/2025	0.71
04/07/2025	0.37
04/08/2025	0.07
04/09/2025	-
04/10/2025	0.27
04/11/2025	0.01
04/12/2025	0.01
04/13/2025	-
04/14/2025	-
04/15/2025	-
04/16/2025	-
04/17/2025	-
04/18/2025	-
04/19/2025	0.01
04/20/2025	0.05
04/21/2025	0.02
04/22/2025	-
04/23/2025	-
04/24/2025	-
04/25/2025	-
04/26/2025	-
04/27/2025	-
04/28/2025	-
04/29/2025	0.13

	RAIN FINAL (in)
Total	13.62
Average	

ADS ENVIRONMENTAL SERVICES®
15201 Springdale St • Huntington Beach, CA 92649
PHONE: 714.379.9778

TECHNICAL MEMORANDUM

Subject: Camas, WA Flow Monitoring Wet Weather Analysis

Prepared For: Carollo

Prepared By: Paul Mitchell, Regional Engineer

Date: May 23, 2025

Background

In addition to sewer flow monitoring and data delivery conducted as part of this temporary deployment of 4 flow monitors, ADS also conducted a wet weather analysis which also takes into account rain data collected from the single deployed temporary rain gauge. This wet weather analysis was conducted to assess Rainfall Dependent Infiltration and Inflow (RDII) attributed to each of the 4 monitored tributaries which could then be used to assist in relative prioritization of those tributary areas (or basins) based on computed and normalized RDII volume per inch rain per acre (converted to % rainfall ingress).

Methodology

The methodology used for this evaluation includes the following primary tasks:

- Evaluate the available data using ADS' Sliicer™ application for evaluating RDII. This includes determination of typical net average dry day flow (ADF).
- Determine RDII for each storm event meeting minimum criteria discussed herein and compute RDII volume associated with each rain event.
- Generate an RDII volume vs. rainfall volume chart (called a Q-vs-i chart) from each storm event data point for each evaluated site/basin and fit a regression line through the data on the Q-vs-i chart.
- Normalize the RDII using the Q-vs-i chart by dividing the slope of the regression line (Gallons RDII per inch rain) by acreage to generate values of % ingress attributed to each site/basin. Use this result to rank relative RDII performance of the site/basins.

Wet Weather Analysis

This section describes an evaluation of wet weather impacts on system flows, defined as Rainfall Dependent Infiltration and Inflow (RDII). This evaluation was based on available flow data provided during the approximate 3 month duration of the flow study. This is done by evaluating excess flow volumes from the studied sewer shed areas (basins) associated with each flow monitoring site during rain events that occurred during the available data periods at each of the 4 locations. This section also describes an evaluation of dry weather flow data for purposes of determining base wastewater flows (to compare wet weather flows against).

Each flow monitoring site represents a defined tributary area (or basin) and each was identified with a simple alpha-numeric ID – CAM_100290, CAM_51123, etc. The Sliicer™ application recognizes basins as having the same name as the monitors used to determine tributary flows (i.e. sites and basins have the same ID). One of the flow sites, CAM_51123, relied upon subtracting flow from a flow monitor upstream (CAM_100290) to define net flow for basin CAM_51123. Table 1 provides a summary of site/basins, site schematic defining each evaluated basin, and size of each basin (acres).

Dry Weather Flow

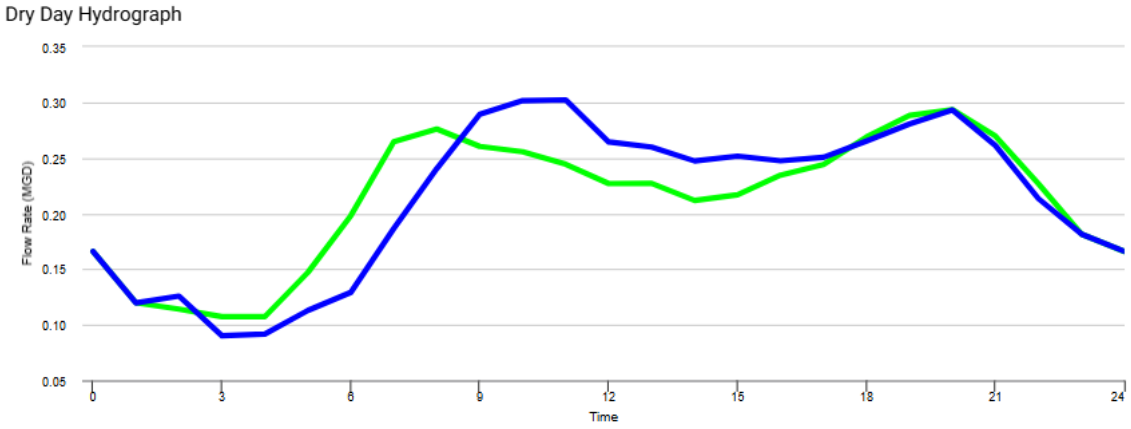
Prior to conducting a wet weather analysis, dry weather flow patterns must first be determined by reviewing data obtained during dry weather conditions at each location. For this analysis, a *dry day* is defined as any day in which there was less than 0.10 in. of rain in the previous day, less than 0.50 in. of rain in the previous three days, and less than 1.00 in. of rain in the previous five days. This process automatically eliminates the selection of most wet weather events and the periods associated with recovery from these events. Once the initial dry days are selected, they are compared to one another to make sure that the flow pattern for each day is repeatable. Any days that have an inconsistent flow pattern are removed from consideration. The resulting dry days are then averaged to establish an average diurnal flow pattern from the site, called an Average Dry day (ADF) pattern. The dry weather analysis evaluates the weekday pattern separate from the weekend pattern to account for differences often observed.

Dry weather flows were evaluated for each flow monitor location from the available data provided. Recorded flow rates from the sanitary sewer monitoring location for each dry day are overlaid on a hydrograph, enabling a hydrograph of the Average Dry day Flow (ADF) to be determined for Weekdays (green curve) and Weekends (blue curve) as depicted in Figure 1 for site/basin CAM_100290. ADF hydrographs for each site are included in Appendix A. Table 1 summarizes the ADF values (weekdays) for each site/basin.

Table 1
Basin Summary Data

Site/ Basin	Pipe Diameter (in)	Added or Upstream Subtracted FM Sites to Determine Net Basin Flow	Basin Size (Acres)	Gross ADDF Weekday (mgd)	Net ADDF Weekday (mgd)
CAM_100290	19	+(CAM_100290)	476	0.22	0.22
CAM_51123	20	+(CAM_51123) - (CAM_100290)	1159	0.77	0.55
CAM_52167	18	+(CAM_52167)	299	0.19	0.19
CAM_81189	12	+(CAM_81189)	136	0.12	0.12
		Total	2071		1.08

Figure 1
Average Dry Day Flow (ADF) Hydrograph – Site/Basin CAM_100290



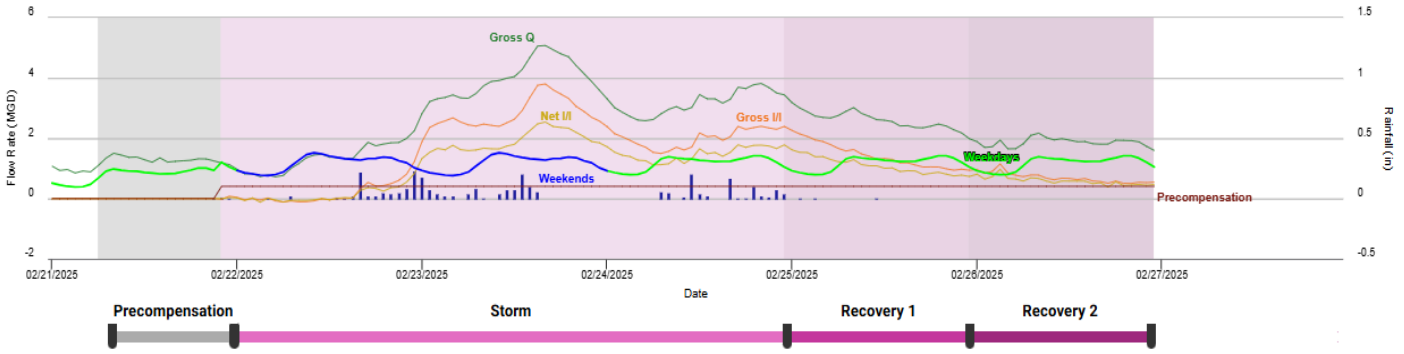
Wet Weather RDII Analysis

A wet weather RDII analysis is performed by comparing specific wet weather events to average dry weather flows (ADF). Based on criteria for a “storm” as being a rain event with at least 0.8 inch of rain with no rain interruption of more than 12 hours, there were 5 rain “storm” events captured during the flow study period. Captured storm volumes ranged from 1.15 inches (April 6, 2025) to 2.84 inches (February 21, 2025). Based on the concurrent periods of flow and rain “storm” data available at each site, an RDII analysis was conducted to characterize the impact of wet weather on flow measured in the basins.

Recorded flow rates for a specific storm event are plotted against average dry weather conditions. The difference observed represents the rain-dependent inflow and infiltration

(RDII or I/I) entering the sanitary sewer system upstream from each monitoring location and is called a storm hydrograph. Figure 2 depicts a storm hydrograph for site/basin CAM_51123 during the largest captured storm event period (from February 21 to 26, 2025).

Figure 2
Storm Hydrograph – Site/Basin CAM_51123



RDII calculations are made for each storm event (the ~5 day period depicted by purple colored bands above for the storm event starting February 21). The first period (shown as a 3 day duration in Figure 2) following the onset of rain is referred to as the Storm Period. The darker purple period following the Storm Period is referred to as Recovery 1, and the next period is referred to as Recovery 2. For purposes of this evaluation, the entire "Event" was used for this analysis which covers the Storm and both Recovery periods. Figure 2 also depicts precompensation which is an upward adjustment made to the ADF pattern so that pattern and the actual flow on storm onset were the same. This effectively compensates for flow that is already elevated leading into a given storm event; enabling a more accurate RDII response to be quantified only from the indicated storm under evaluation.

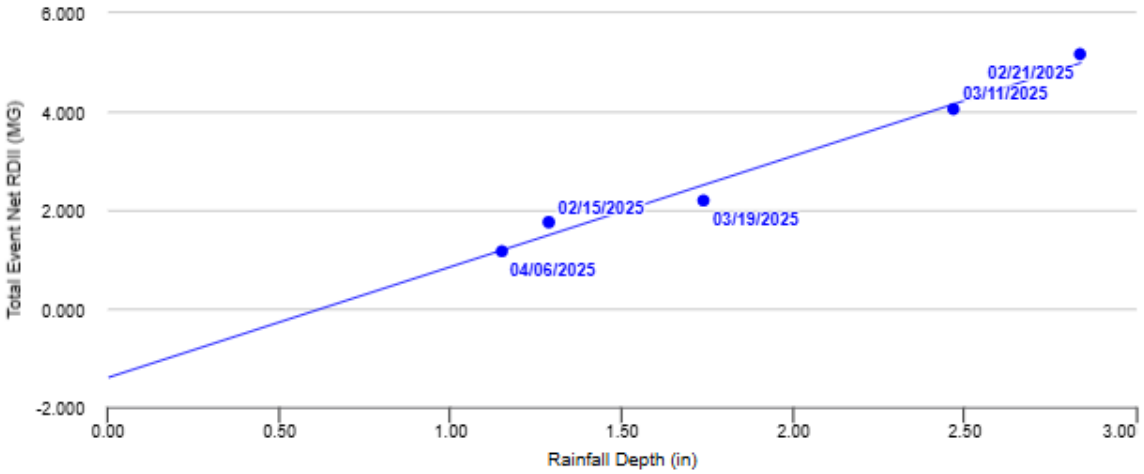
The storm hydrographs for this location showed excess flow responses (shown as "Gross I/I" in the above hydrograph) follow closely with a slight delay to the rainfall pattern. The Gross I/I is the difference between the actual recorded flow (shown as "Gross Q") minus the ADF weekend and weekday pattern. For cases where the net RDII for a basin is determined by subtraction of an upstream flow site (see Table 1), the hydrographs also show a "Net I/I" component as is the case for site/basin CAM_51123 above.

Also, in the case of CAM_51123, the delayed and significant yet muted or delayed response to rainfall may be indicative of predominantly indirect storm drainage pathways (i.e., the infiltration component of RDII). Storm hydrographs of the 5 selected storms for all locations are included in Appendix A.

Once the calculations were complete for each storm event, excess wet weather flow volumes were plotted as a function of rainfall volume on graphs commonly referred to as

Q-vs-i graphs; each with best fit regression lines drawn. The rain volume vs. excess flow volume Q-vs-i chart is shown in Figure 3 for site/basin CAM_51123. These charts for all other locations are included in Appendix A.

Figure 3
Q-vs-i graph for CAM_51123



These volume-based Q-vs-i graphs for the basins generally show a good visual (regression line) correlation between excess wastewater volume and rainfall. The Q-vs-i graph for CAM_51123 projects about 2 million gallons of I/I would be generated from about 1.5 inches of rain. However, there is an apparent threshold (X-intercept) of about 0.5 or 0.6 inches of rain in the above Q-vs-i graph; below which there is little to no RDII response. This means projected RDII vs rainfall volumes based on regression line slope will be greater than individual storm values. These graphs are included for all the site/basins in Appendix A. Caution is warranted in attempting to extrapolate higher rainfall responses from these Q-vs-i graphs since the linear extrapolation may not remain fully intact during significantly stronger storm events. A summary of individual RDII response data points (MG/inch) per storm is provided in Table 2.

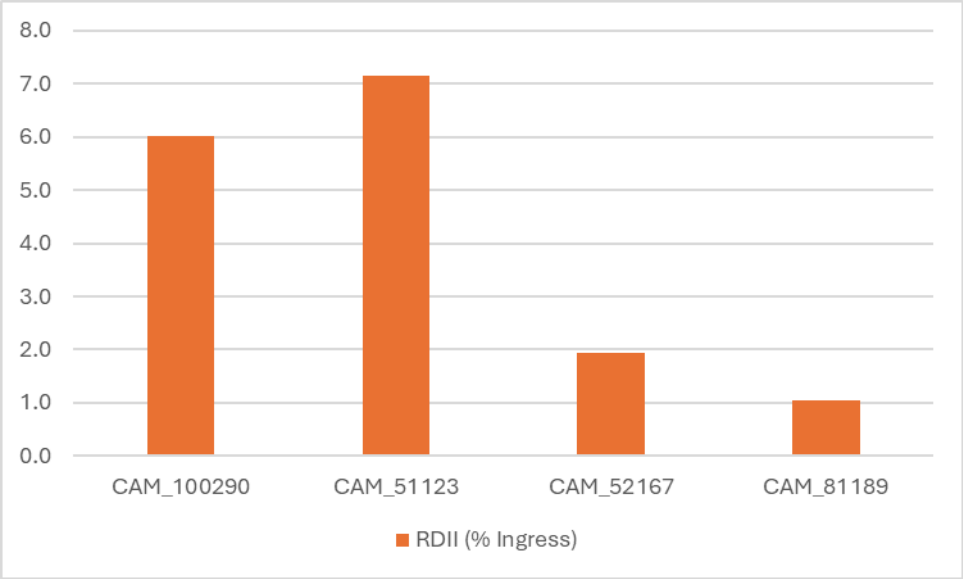
Table 2
Basin RDII Storm Response Summary

	Storm RDII (MG/inch)				
Site/ Basin	2/15/2025 (1.29")	2/21/2025 (2.84")	3/11/2025 (2.47")	3/19/2025 (1.74")	4/6/2025 (1.15")
CAM_100290	0.57	0.68	0.64	0.48	0.52
CAM_51123	1.36	1.82	1.64	1.26	1.01
CAM_52167	0.16	0.14	0.20	0.12	0.17
CAM_81189	0.01	0.03	0.01	0.03	0.00

To properly characterize relative I/I performance among the sites/basins evaluated, the wet weather I/I responses must also be normalized according to basin size. This is done by taking the slope of the Q-vs-i responses described above (gallons RDII / inch rain) and dividing by basin area (acres – see Table 1) to yield normalized values of RDII response in terms of projected % rainfall ingress. These rain and size normalized % ingress values based on Q-vs-i projected slopes are summarized in Figure 4.

As a general rule, basins may be considered to yield excessive RDII if such normalized values are much greater than 5. Two of the 4 site/basins evaluated slightly exceeded this value.

Figure 4
Projected RDII (% Rainfall Ingress)



The computed values for ADF and rain & area normalized projected RDII volumes (including % Ingress) are summarized in Table 3. Hydrographs of the flow monitoring period, dry day hydrographs, storm hydrographs, and volume-based Q vs i graphs are included in Appendix A.

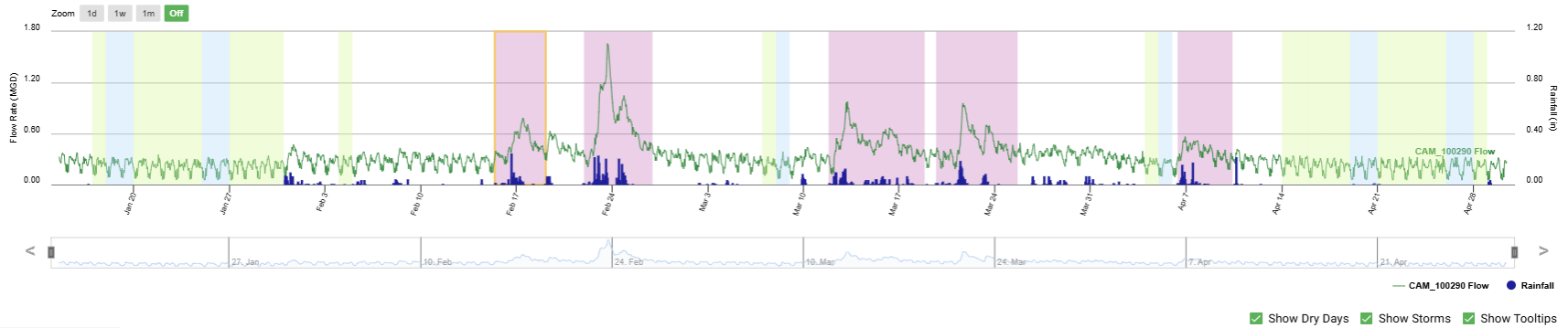
Table 3
Basin Dry and Wet Weather Performance Summary

Site/ Basin	Pipe Diameter (in)	Basin Size (Acres)	Net ADDF Weekday (mgd)	Projected Net RDII (MG/in)	Projected Net RDII (%rain ingress)
CAM_100290	19	476	0.22	0.78	6.0
CAM_51123	20	1159	0.55	2.25	7.1
CAM_52167	18	299	0.19	0.16	1.9
CAM_81189	12	136	0.12	0.04	1.0

Appendix A

Study period Hydrographs, ADF hydrographs, Storm hydrographs, and Q vs i graphs

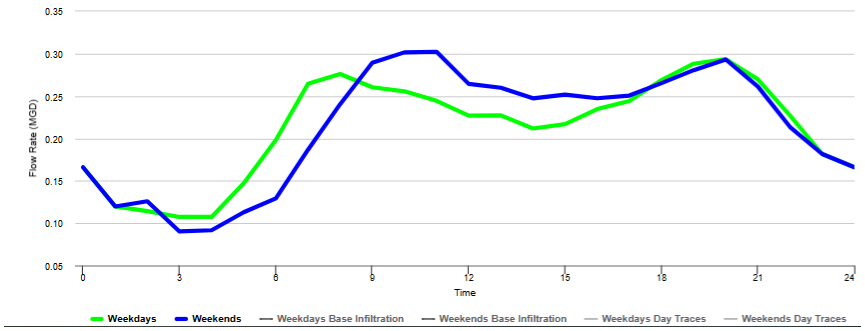
Hydrograph with Basin Rainfall: 01/14/2025 - 04/30/2025 | Basin CAM_100290 | Edit Dry Days

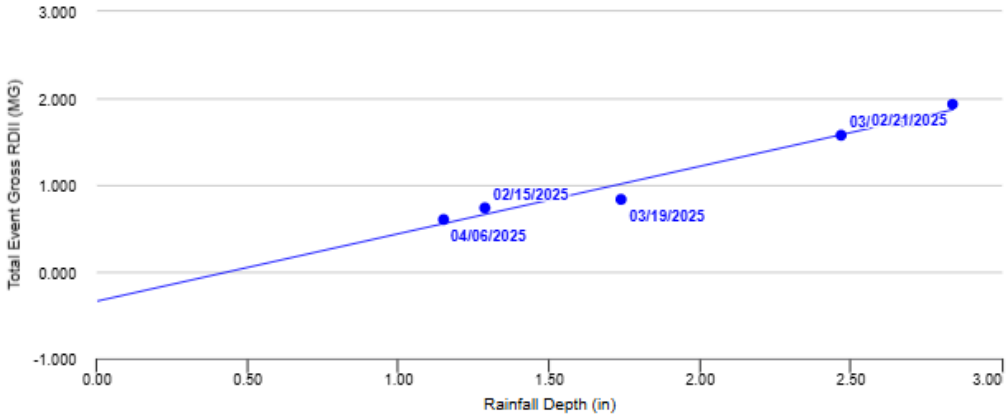


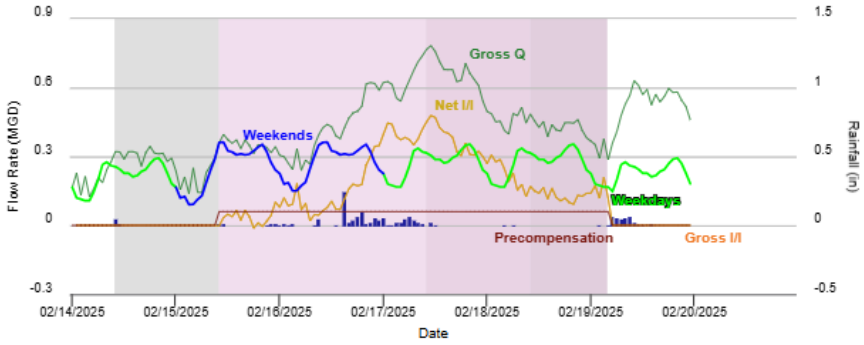
Show Dry Days | Show Storms | Show Tooltips

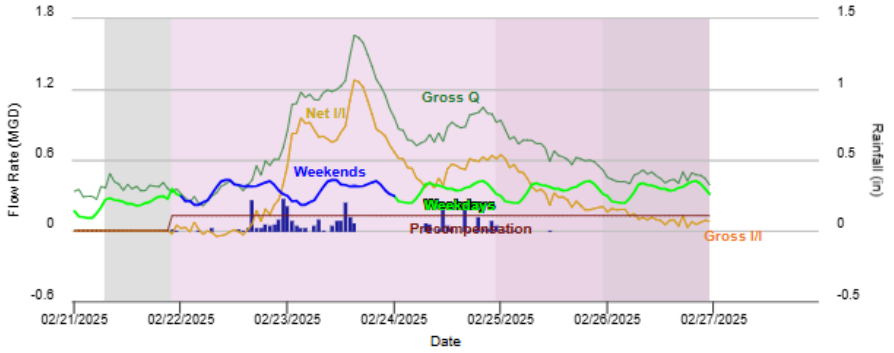
DRY DAYS | STORM EVENTS | STATISTICS

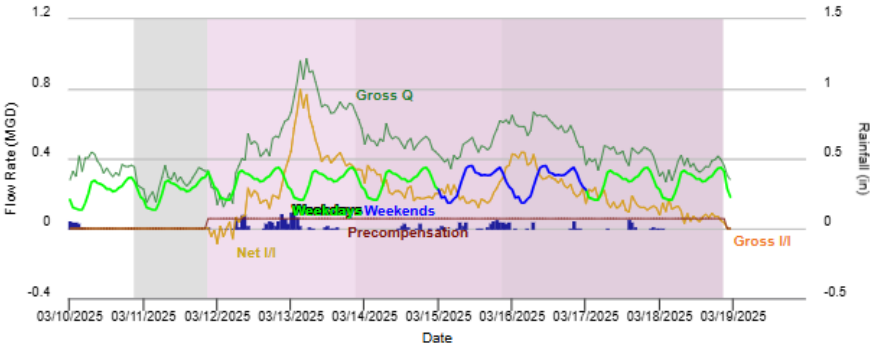
Dry Day Hydrograph

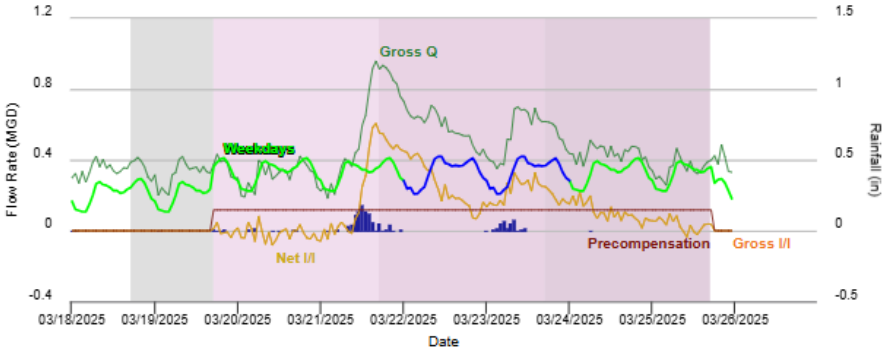


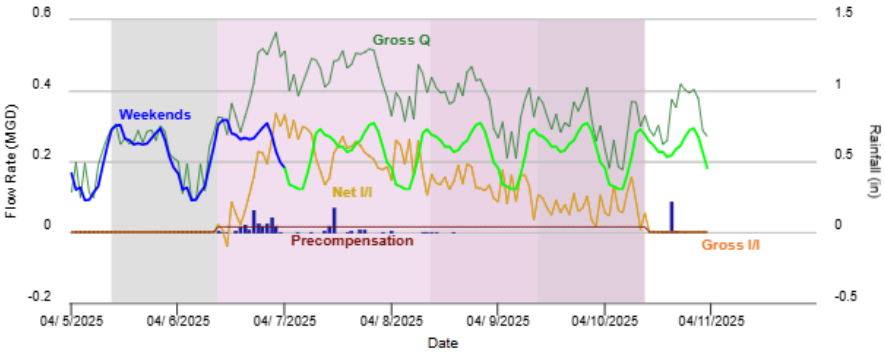



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Net I/I
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Weekdays
Precompensation
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Flow Rate (MGD)
Rainfall (in)
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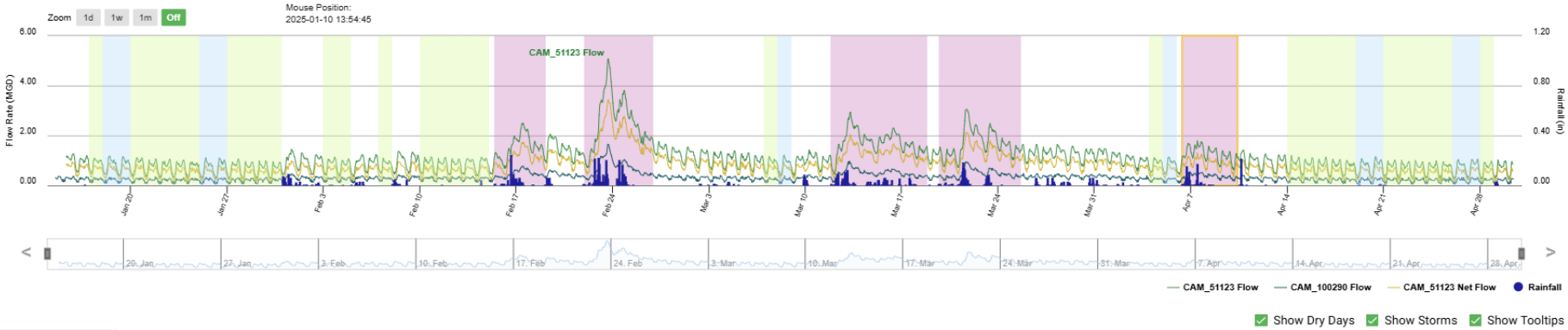

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Gross I/I
Flow Rate (MGD)
Rainfall (in)
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Gross Q
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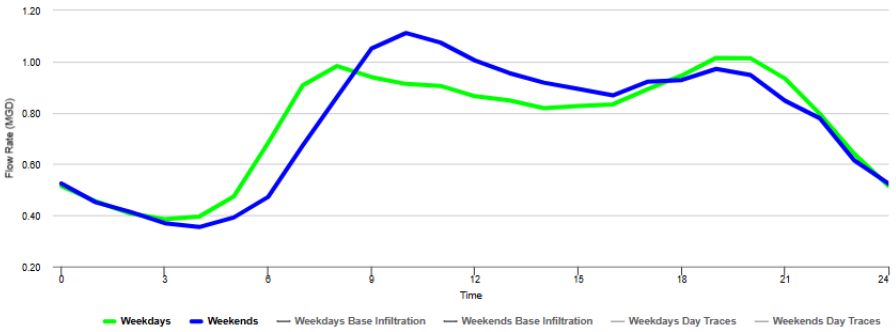

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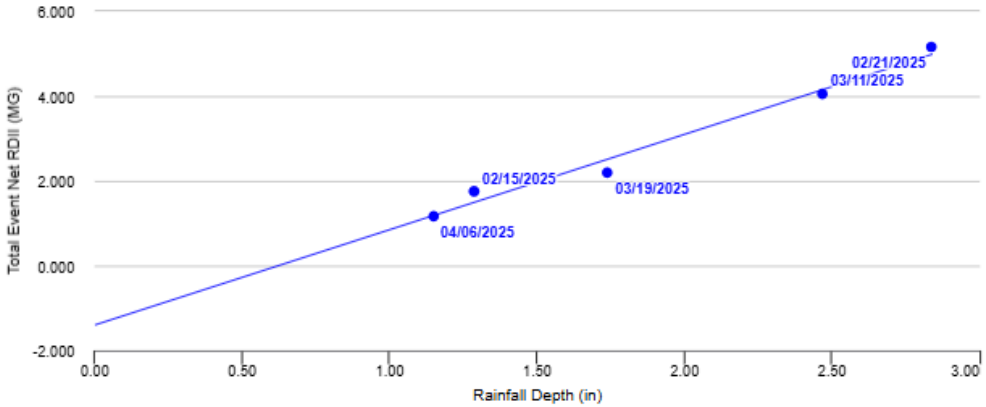
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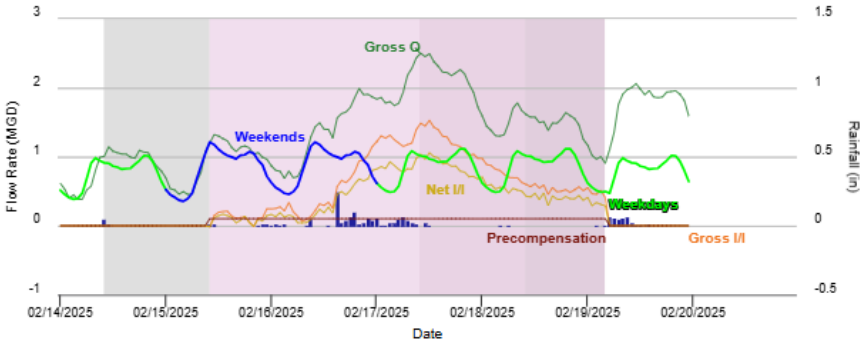


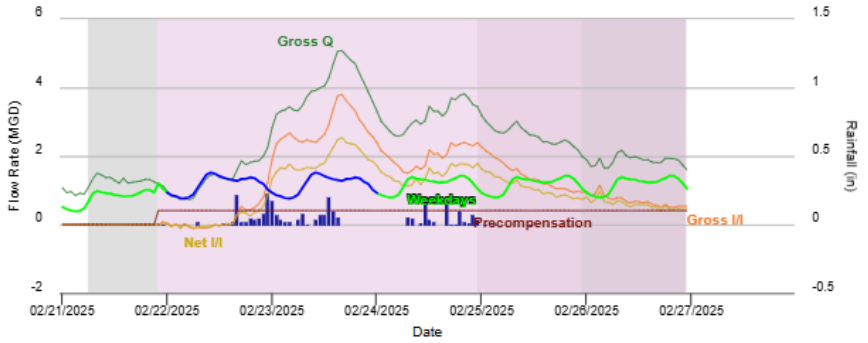
DRY DAYS | STORM EVENTS | STATISTICS

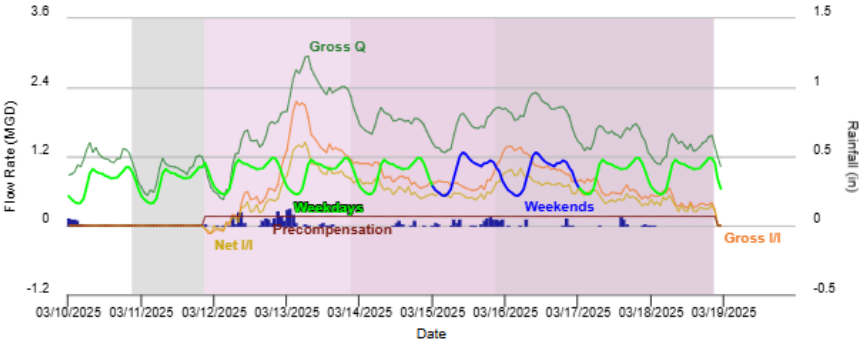
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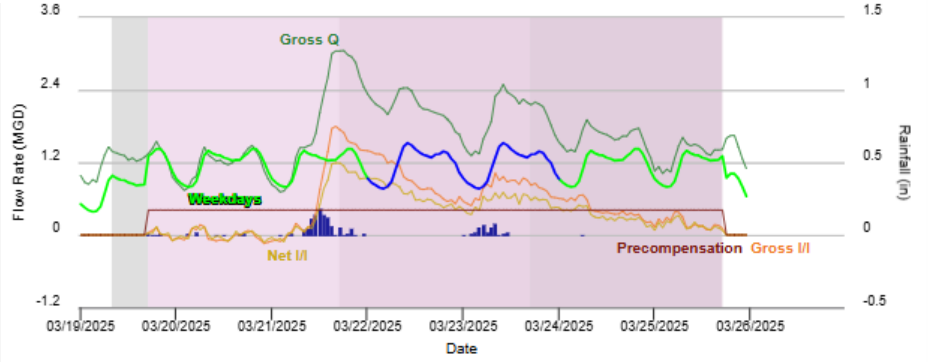


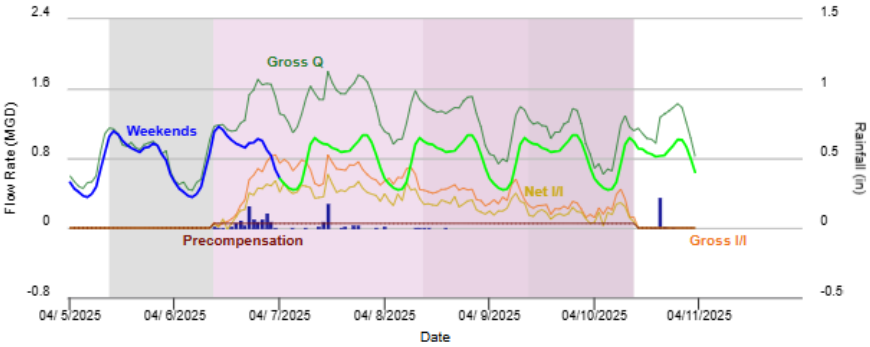



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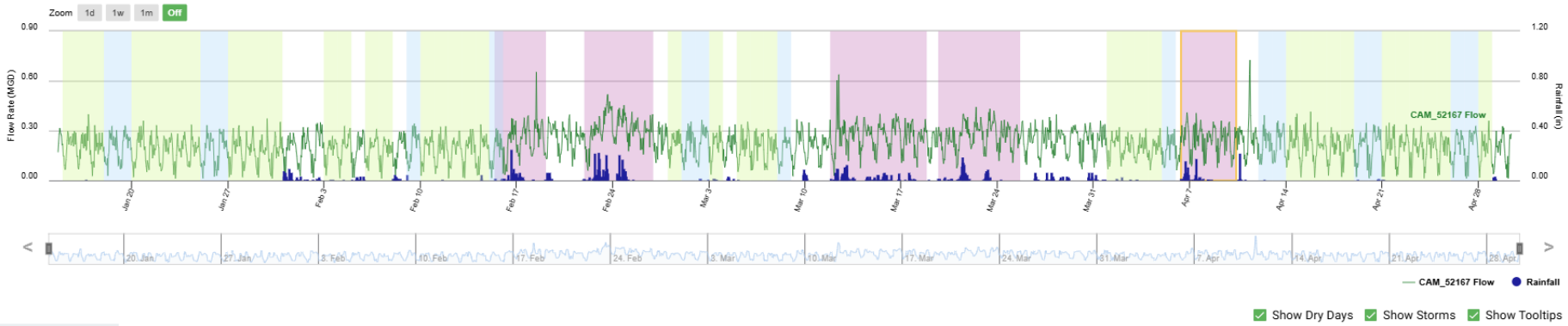

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Flow Rate (MGD)
Rainfall (in)
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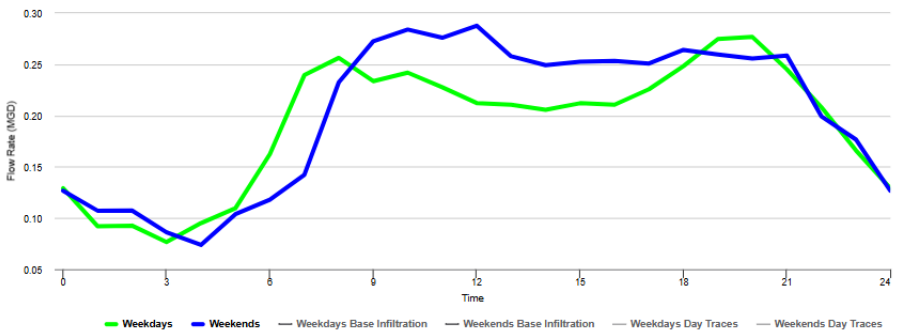
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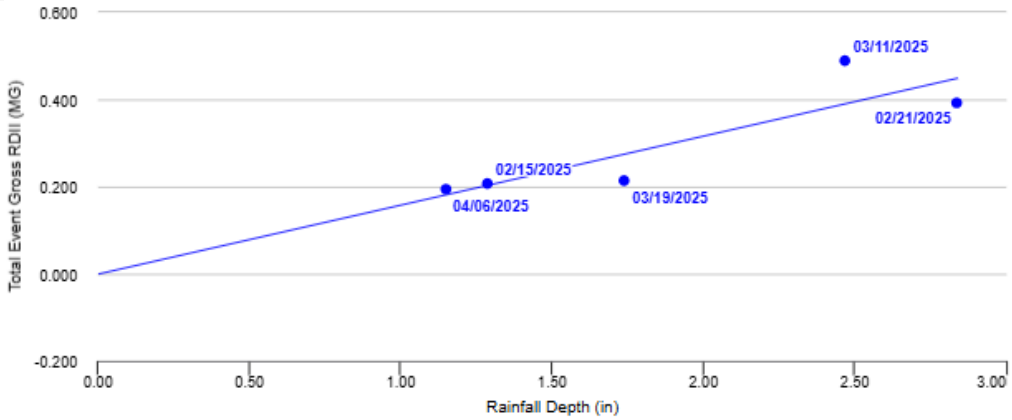


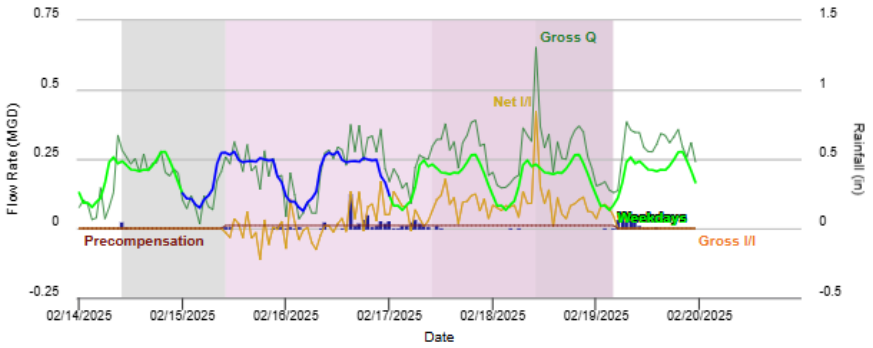
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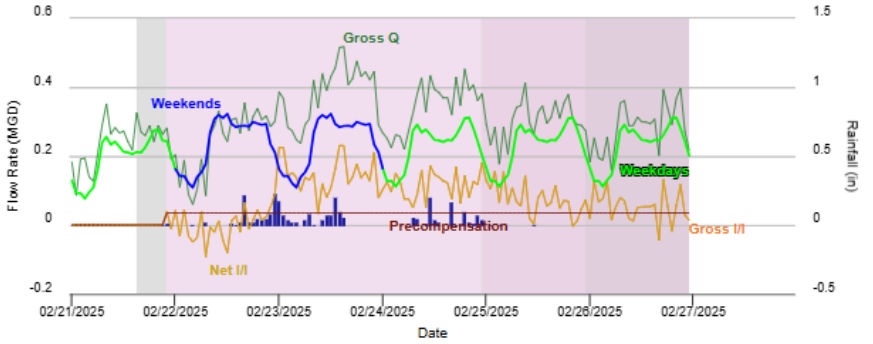
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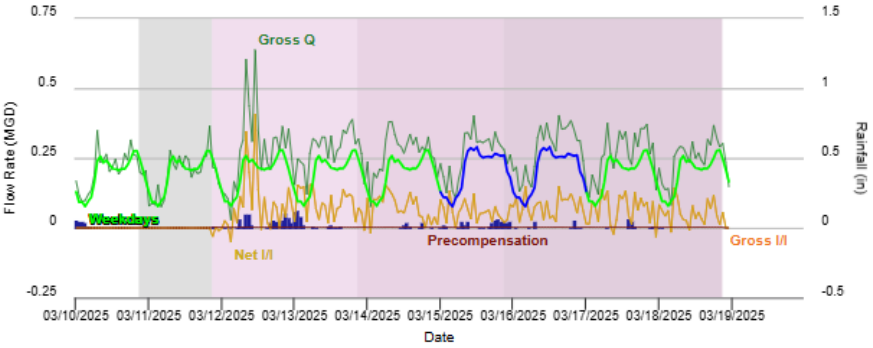
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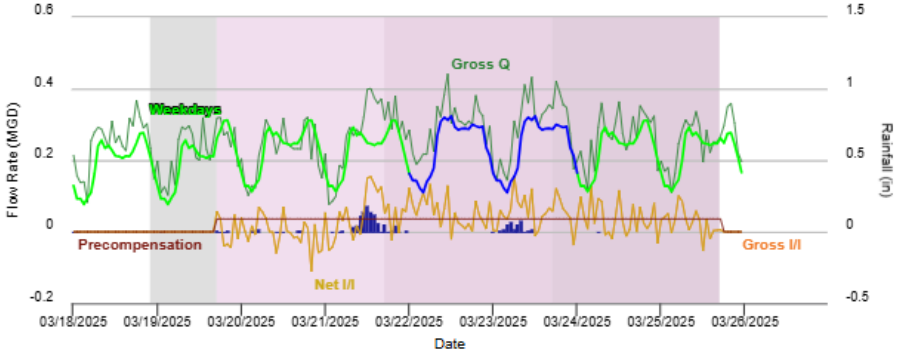


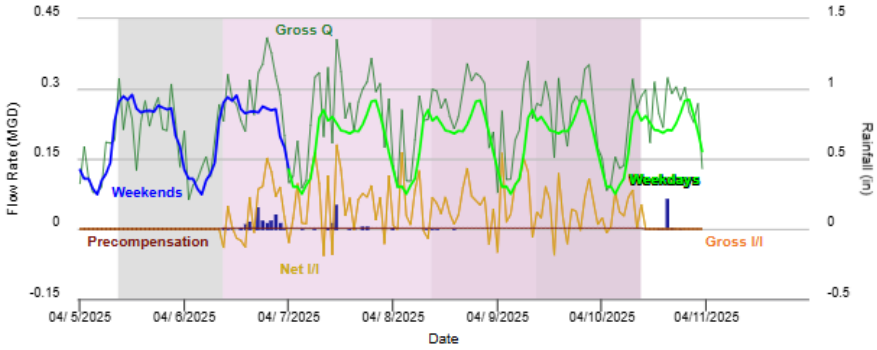



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Flow Rate (MGD)
Rainfall (in)
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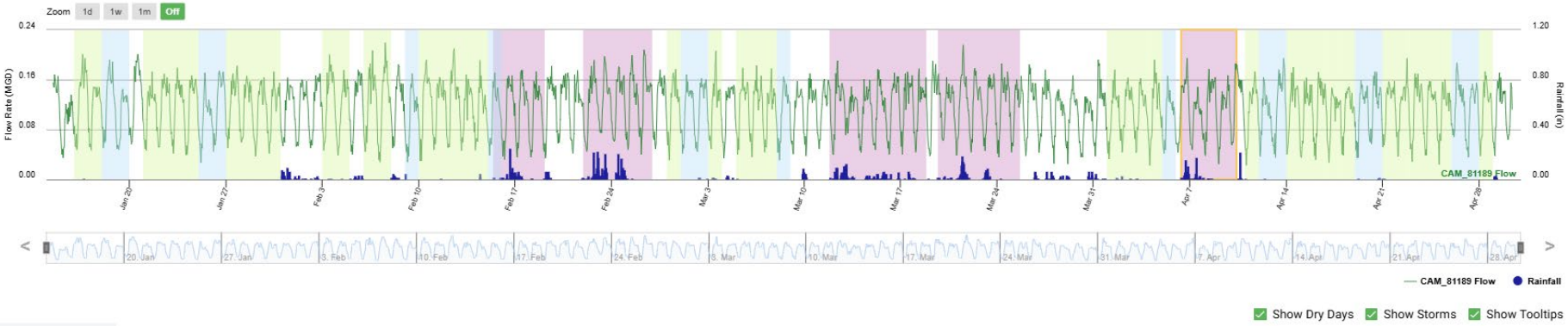

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Precompensation
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Flow Rate (MGD)
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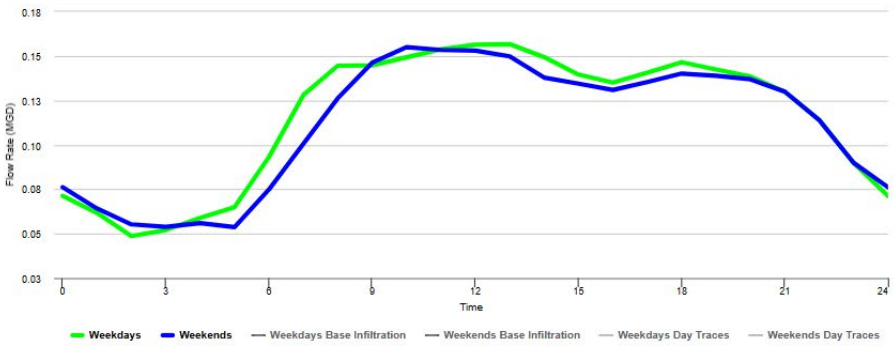

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Rainfall (in)
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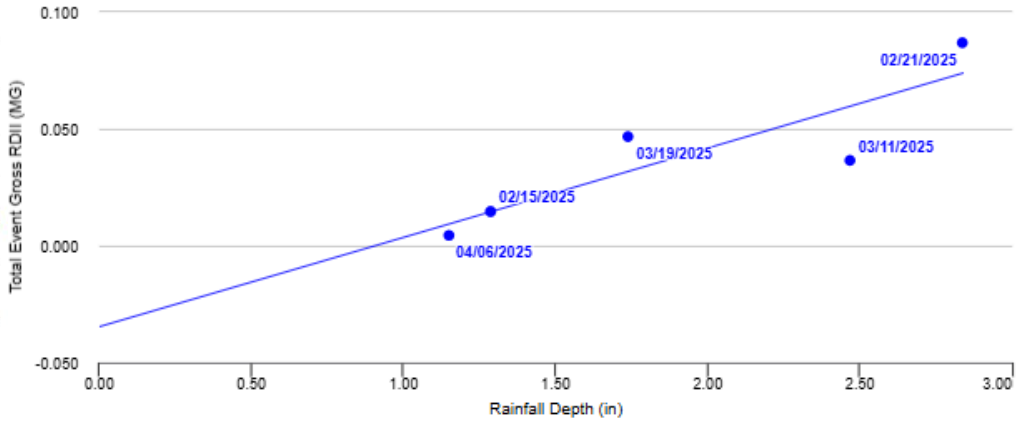
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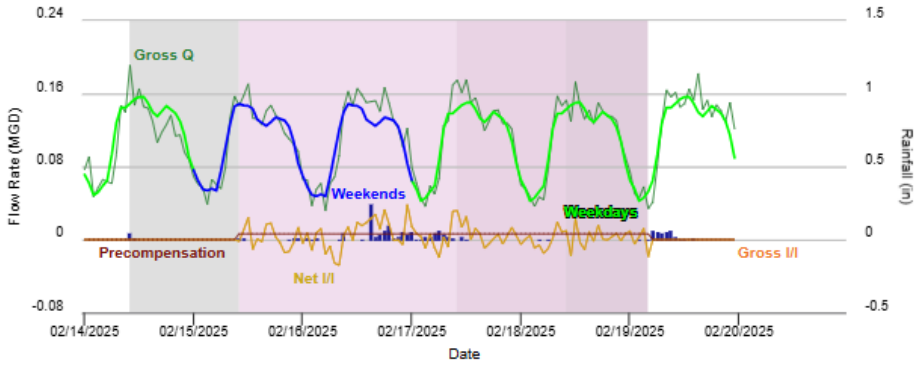


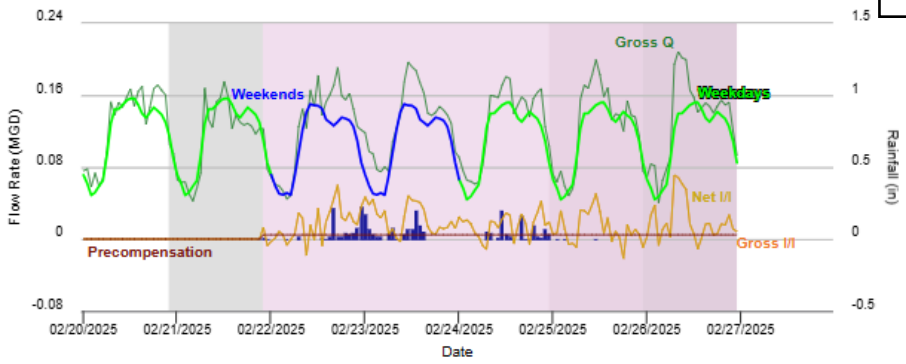
DRY DAYS | STORM EVENTS | STATISTICS

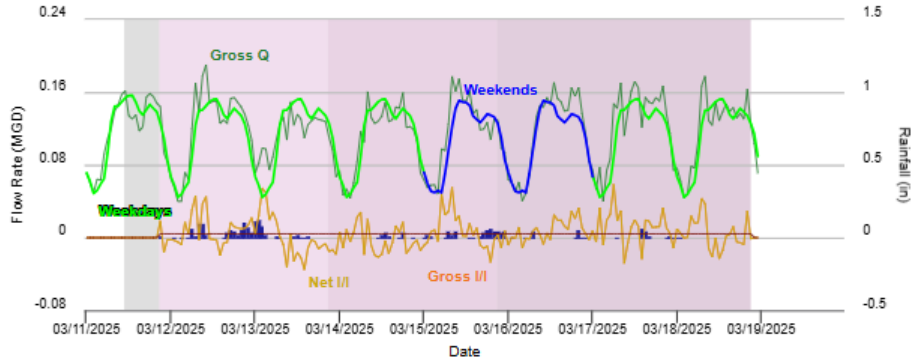
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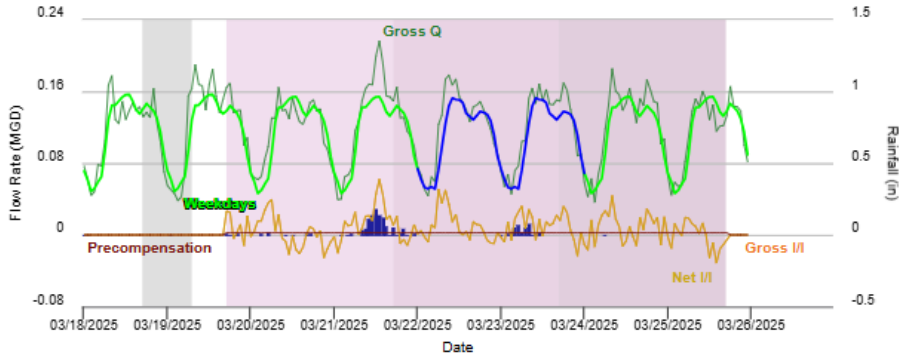


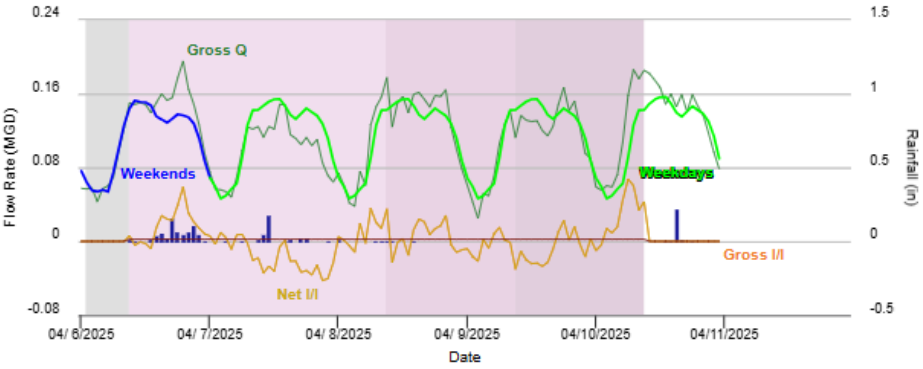



Gross Q
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Flow Rate (MGD)
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Gross Q
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ATTACHMENT B

ADWF DEVELOPMENT REVIEW PACKET

ADWF DEVELOPMENT REVIEW PACKET

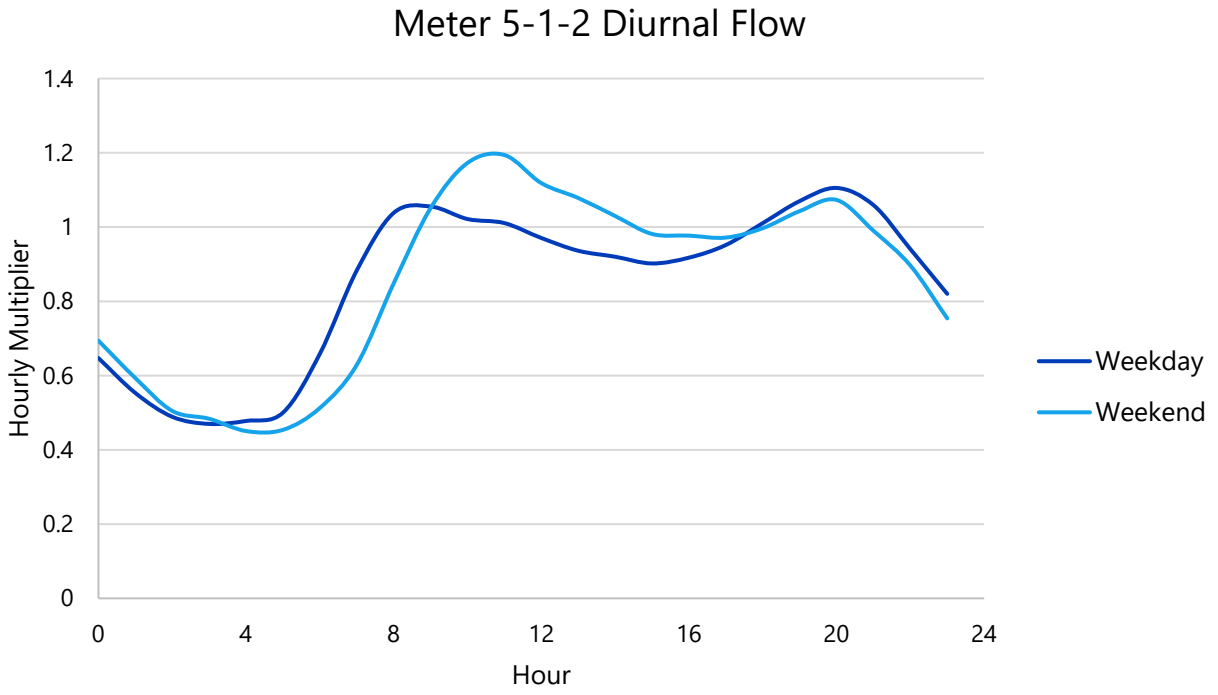


Figure B.1 Meter 5-1-2 Diurnal Flow

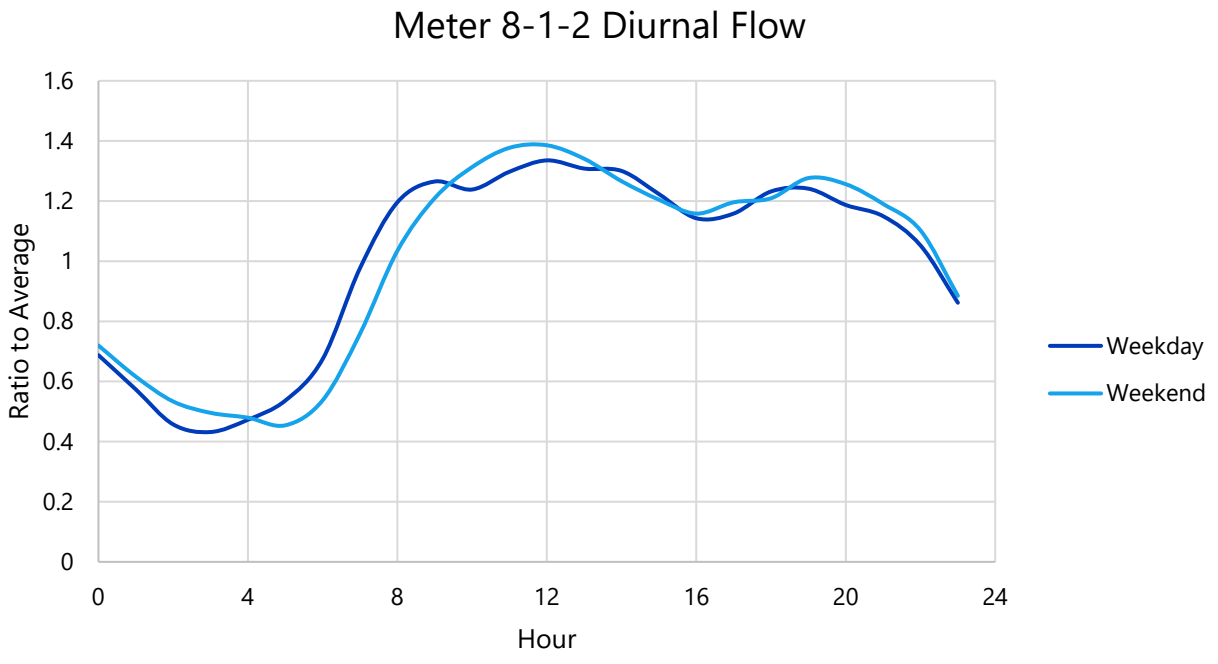


Figure B.2 Meter 8-1-2 Diurnal Flow

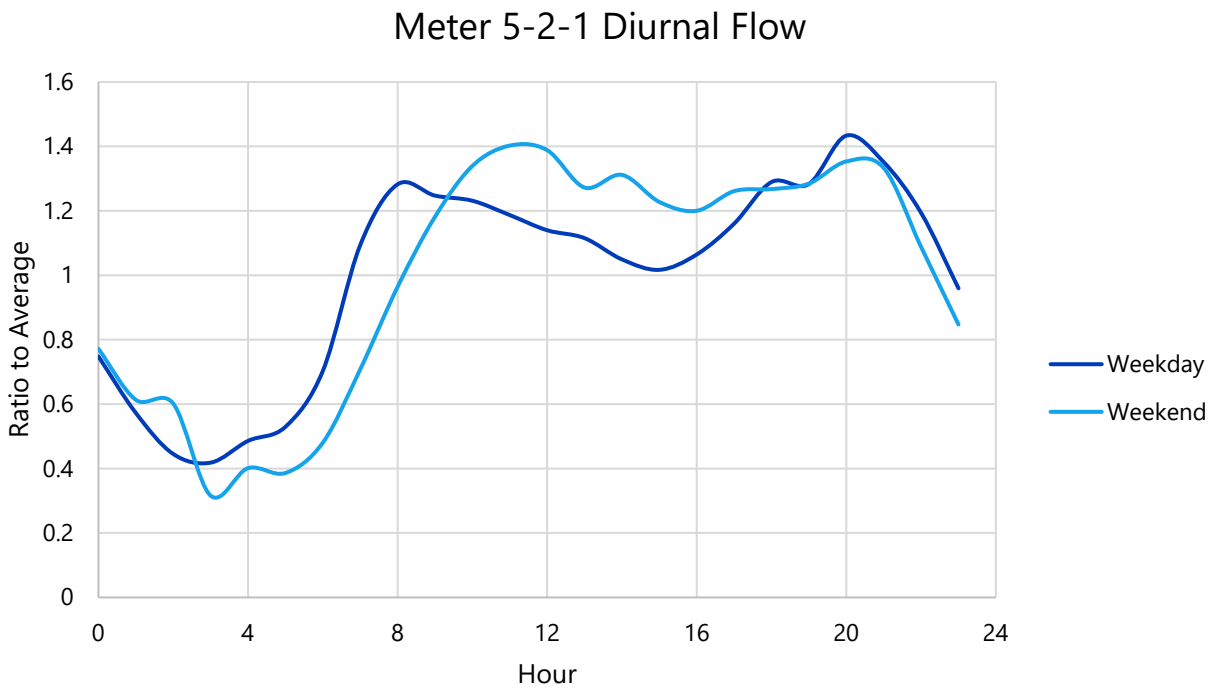


Figure B.3 Meter 5-2-1 Dry Weather Flow

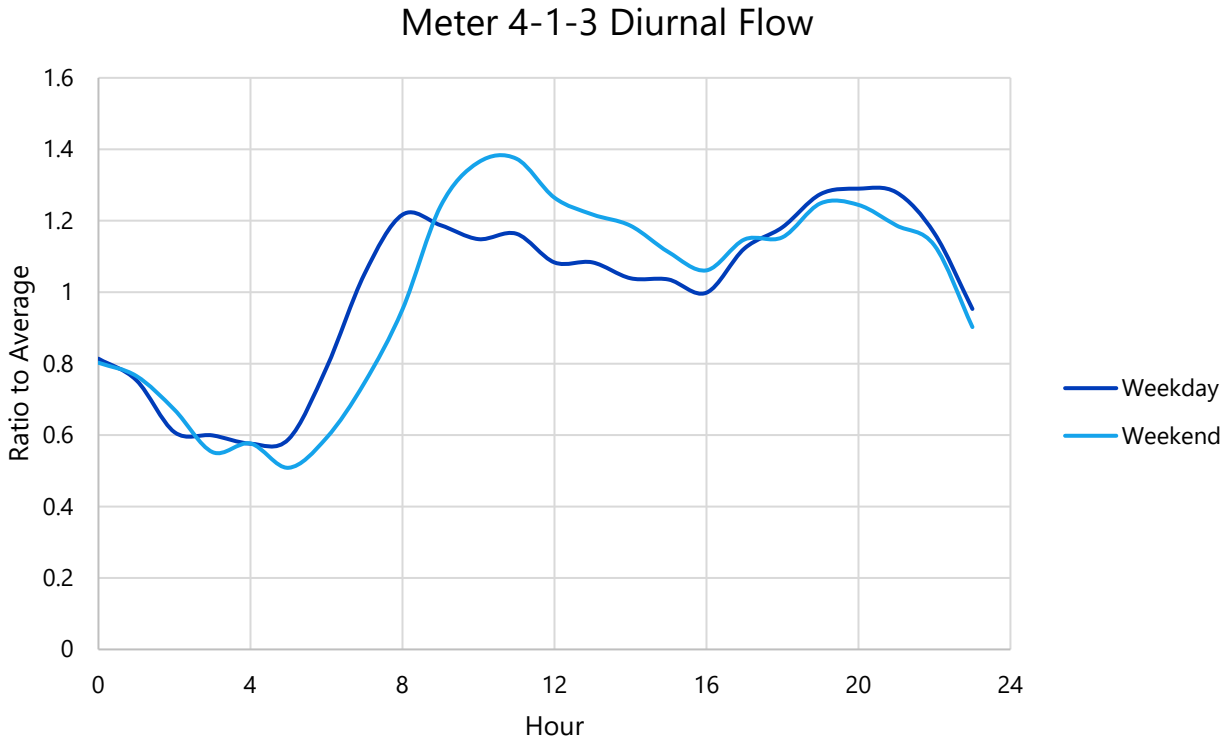


Figure B.4 Meter 4-1-3 Diurnal Flow

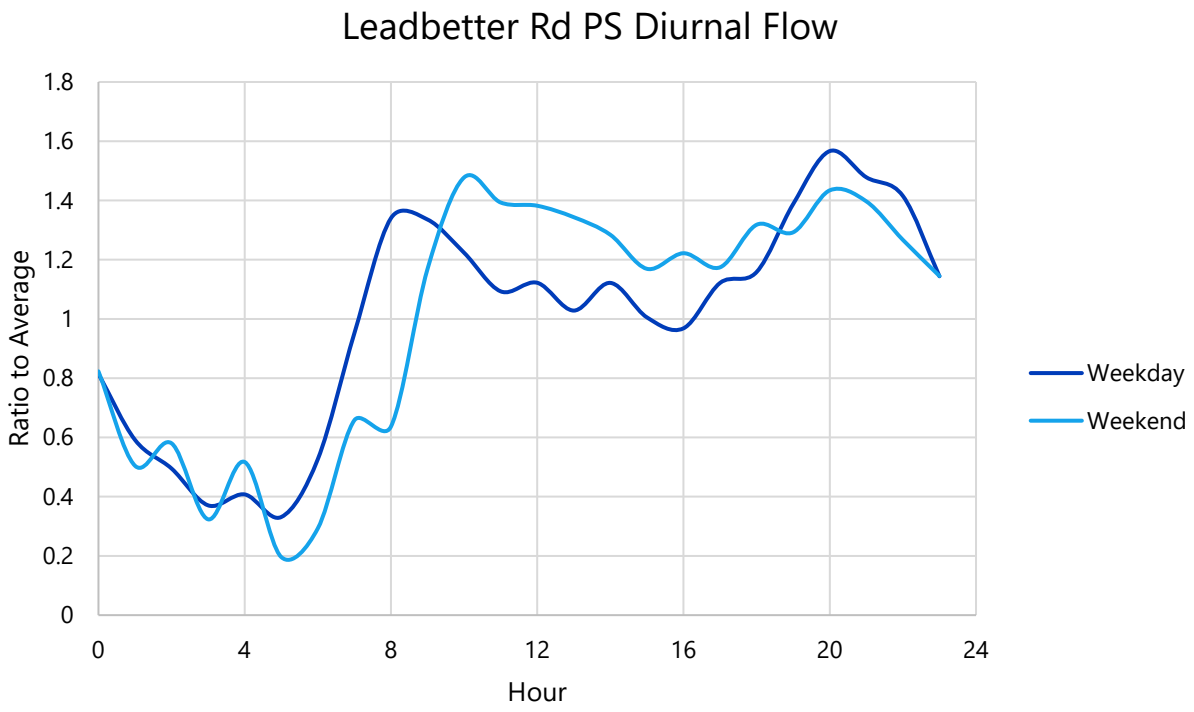


Figure B.5 Leadbetter Rd PS Diurnal Flow

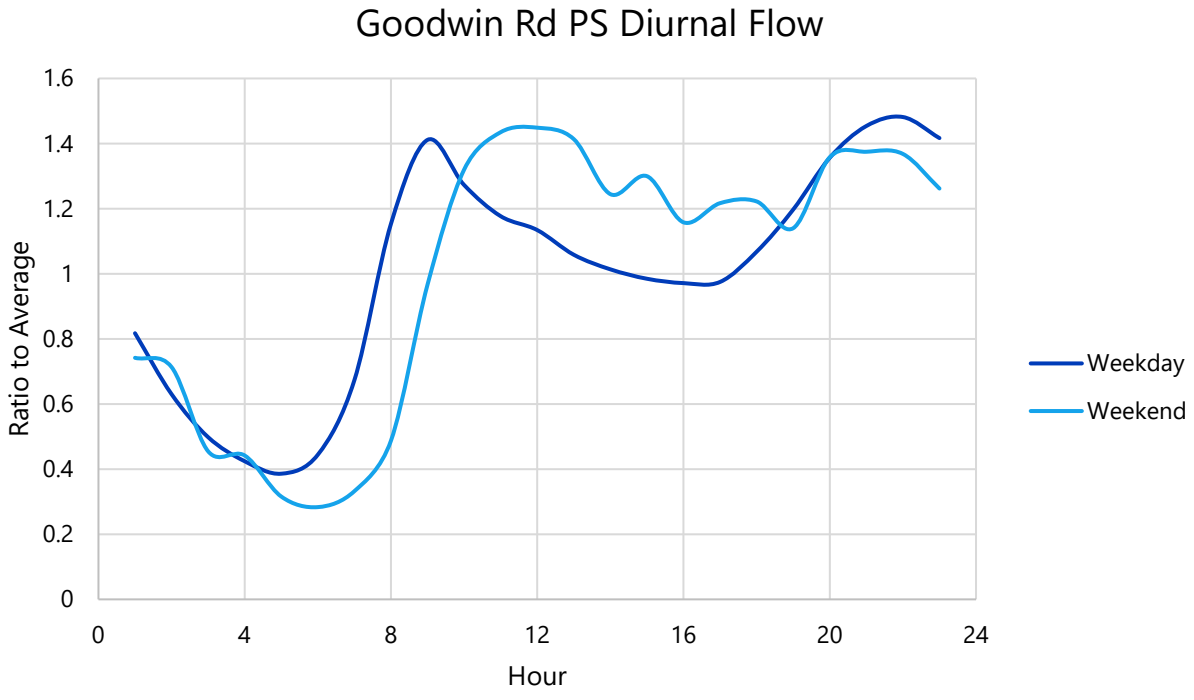


Figure B.6 Goodwin Rd PS Diurnal Flow

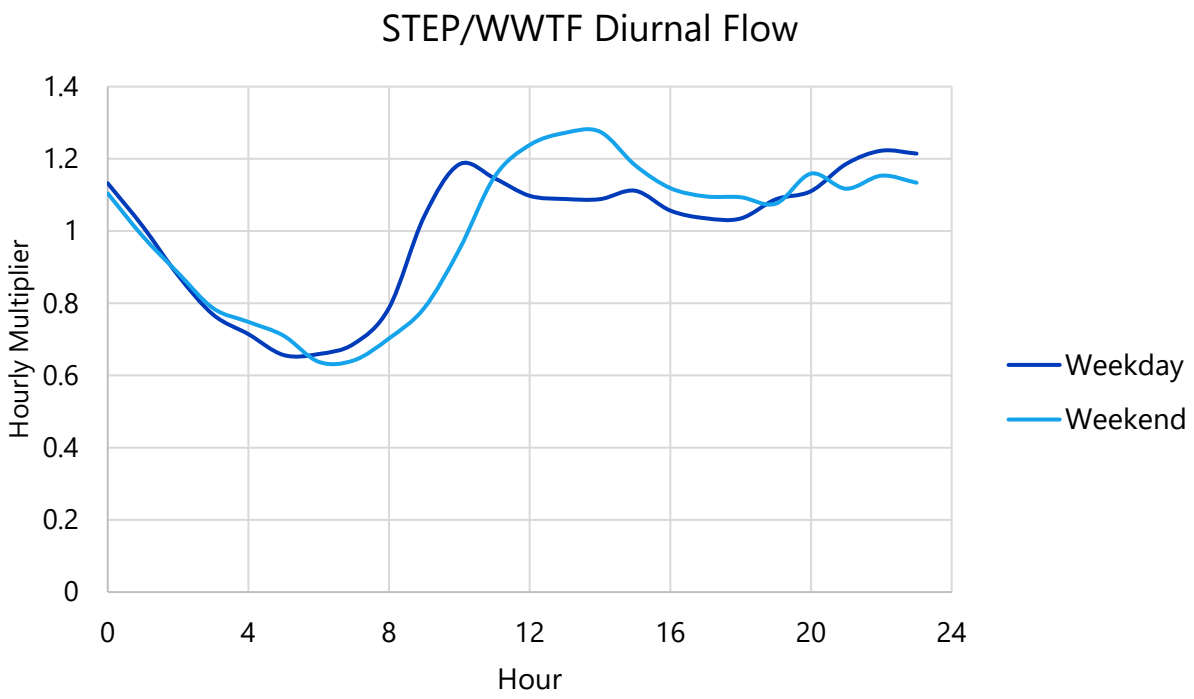


Figure B.7 STEP/WWTF Diurnal Flow

ATTACHMENT C

DRAFT 2045 COMPREHENSIVE PLAN



ourCamas 2045

DRAFT - *Last Updated July 2025*

Comprehensive Plan

ourCamas 2045

Acknowledgements

Thank you to the members of the Camas community for sharing your time and insights in the development of Our Camas 2045.

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John Svilarich

Camas Planning Commission
Troy Hull, Chair
Geoerl Nile, Vice Chair
Marlo Maroon
Joe Walsh
Shawn High
Mahsa Eshghi
Paul Anderson

Community Advisory Committee (CAC)
Samantha Horner
Betty Peng
Jason Irving
Kim Sogge
Carrie Schulstad
Brian K. Kuhta
Matthew Clarkson
Heidi Buhman-McNeley
Stephanie O'Dell
Alicia Brazington
Greg K Anderson
Carol Collier
Rick Melching
Colin Casad
Marlo Maroon

Climate Policy Advisory Team (CPAT)
Morgan Van Fleet
Nelson Holmberg
Cassi Marshall
Amy Hyland
Kaitlin Lee
Kimberly Lottig
Robert Carter
Paul Anderson
Dan Davis
Diana Rutherford

City Administrator
Doug Quinn

City of Camas Staff
Alan Peters, Community Development Director
Robert Maul, Planning Manager
Lauren Hollenbeck, Senior Planner
Yvette Sennewald, Senior Planner
Madeline Coulter, Planner
Carey Certo, Administrative Support Assistant
Rob Charles, Interim Public Works Director and Utilities Manager
Curleigh Carothers, Engineering Manager
Bryan Rachal, Communications Director
Ken Pearrow, GIS Coordinator

Consultant Team
WSP USA, Inc.
3J Consulting, Inc.
DKS Associates
ECOnorthwest
SERA Architects

ourCamas 2045

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ourCamas 2045



Vision

01

01. Vision

Our Camas Vision Statement

This vision is written in the present tense, as if describing the city as it exists in 2045. Some aspects of the vision can be found in Camas today, while others represent aspirations. The vision provides a framework for the goals and policies of every element of Our Camas 2045.

Our Community



Camas is an inclusive community where residents experience a sense of belonging and connection. Community-wide events foster civic pride, strong bonds among neighbors and a welcoming atmosphere for new residents. Community amenities and recreation facilities throughout Camas promote active lifestyles and social interaction. Camas is recognized for excellent schools and its commitment to lifelong learning. The City promotes a strong culture of public safety, transparent communication, and good governance, allowing residents to thrive in their neighborhoods and engage in decision-making that shapes their community.

Our Environment



Camas embraces its connection to nature and enjoys a wealth of outdoor recreational opportunities. Access to forests, clean water, parks, and trails is foundational to Camas' quality of life. The community shares a deep reverence for Camas' beauty, scenery, and tranquility, and is committed to preserving and enhancing its natural resources and tree canopy. Through proactive planning, the City mitigates the effects of changing climate conditions and natural hazards, ensuring a resilient community for generations to come.

Our Neighborhoods



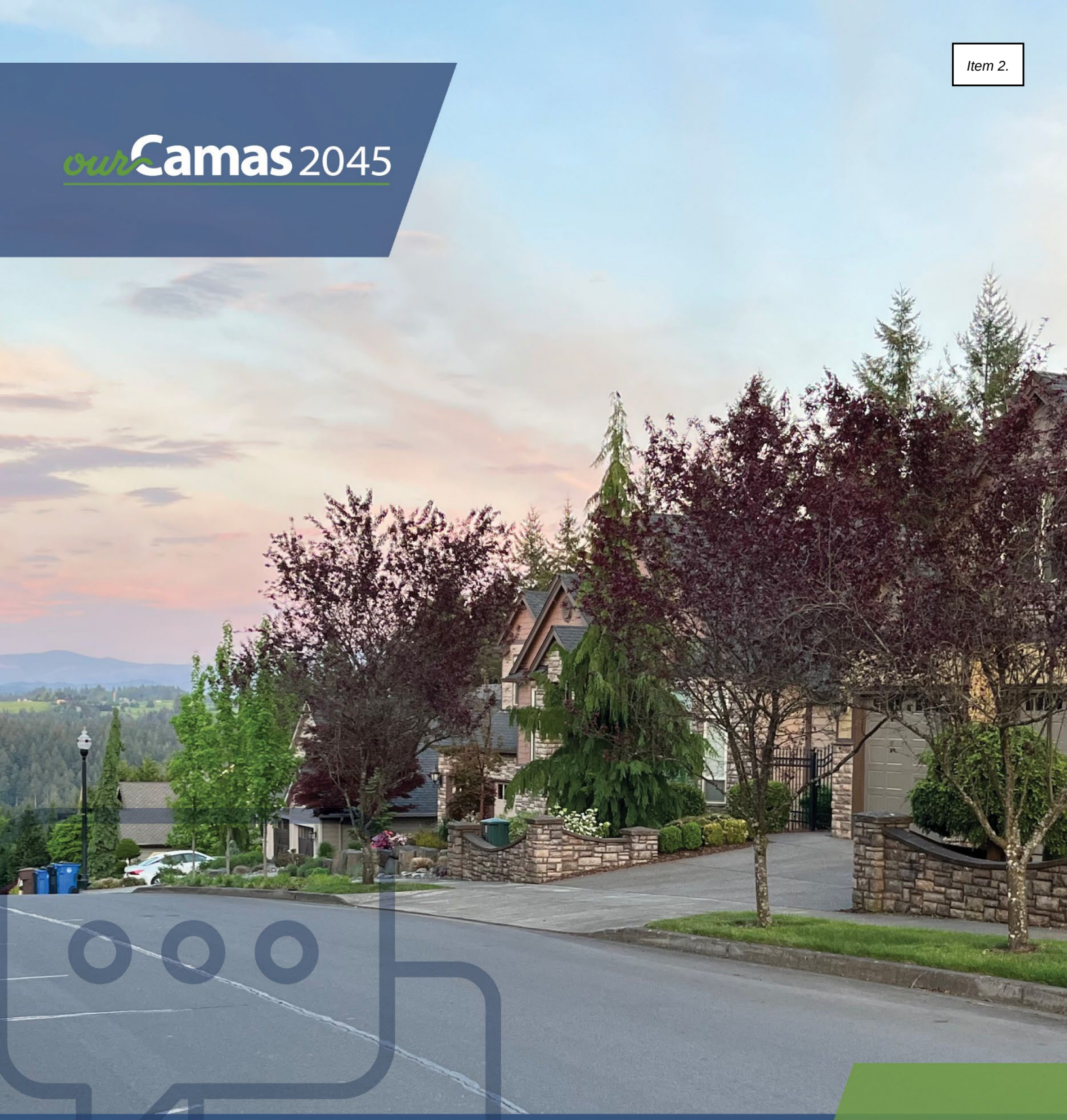
Camas embraces its small-town feel while responsibly managing growth, ensuring a prosperous and livable future for all. Camas provides a variety of housing options that meet the needs of all residents, while ensuring the town's charm and livability are sustained. Camas is home to a thriving economy and diverse businesses, affording residents ample employment opportunities and access to high wage jobs. Neighborhood commercial hubs connect residents to daily services and amenities through a network of sidewalks and bike lanes, improving access and connectivity.

Our Downtown



Charming, vibrant, and walkable, Downtown Camas is the city's living room. Downtown's history is complemented by new businesses and inclusive housing options. Expansion, resiliency and a dynamic economic landscape are critical to its success. Downtown Camas anchors the community while fostering a culture of pride, support, and connection.

ourCamas 2045



Introduction

02

02. Introduction

Our Camas 2045

Our Camas 2045 is a roadmap for the future of the city and guides land use development and public facility investment decisions between now and 2045.

Camas has a long and rich history. More than 10,000 years ago, Native Americans occupied the Columbia River Valley. The Lewis and Clark Corps of Discovery camped by the river in 1806. In the late 1800s, the La Camas Colony Company of Portland purchased 2,600 acres and began planning the construction of a paper mill to supply newsprint for The Oregonian. The construction of the mill brought the platting of the town and the City of Camas was incorporated in 1906. Today, Camas is a vibrant and diverse community that occupies approximately 16 square miles and is home to over 27,000 people.

Our Camas 2045 is an update to the prior City of Camas comprehensive plan, Camas 2035. This update incorporates new state legislation to support additional housing and climate planning and establishes a new vision for the community's future.

The history of Camas comprehensive planning dates back to 1963 when the first plan was prepared. In 1990, the state adopted the Growth Management Act (GMA) with the goal of managing the growth of cities that had previously grown in an uncoordinated fashion. GMA requires municipalities to update their comprehensive plans every 10 years to ensure future growth can be accommodated with housing and jobs, and public services and facilities are available to serve new residential, commercial, and employment areas.

The last major update to the City's comprehensive plan was in 2016. Since that time, the city has grown by over 5,000 people, added new residential areas in Grass Valley and Green Mountain, and completed the North Shore Subarea Plan, which established a new vision and zoning for the North Shore of Lacamas Lake and sets the stage for future residential, mixed use, and employment development. In conjunction with Our Camas 2045, the city prepared a downtown subarea plan. Our Downtown 2045 establishes a detailed vision and action plan to catalyze public and private investment in the historic downtown. Both plans work together to guide future development and ensure Camas' future remains as vibrant as its past.

What is a Comprehensive Plan?

Our Camas 2045 guides land use development and public facility investment decisions between now and 2045. Our Camas 2045 has eight elements that work together to achieve the community's vision and ensure long-term economic vitality:

- Community Character
- Land Use
- Housing
- Natural Environment
- Climate Change & Resiliency
- Transportation
- Public Facilities & Services
- Economic Development

Each element sets goals that will implement the vision and expresses policies that will guide land use and infrastructure decisions for the 20-year planning horizon. The elements are supported by the comprehensive plan map, which identifies land use designations throughout the City and within its urban growth area.1

Why Plan?

Planning is choosing what to do and how and when to do it. Planning is part of our everyday lives. We plan our vacations, our budgets, and even our trips to the grocery store. The detailed planning of our daily lives derives from a set of goals that we want to accomplish – in a day, in the next six months, or the next two years.

In the same way and for the same purpose, the City's plan is the basis of coordinated action – it enables public and private interests to undertake projects with a clear understanding of community goals and policies.

Our Camas 2045 helps the City identify deficiencies and take steps to remedy them. Planning can find desirable and reasonable solutions before the problem is beyond the community's economic capabilities. The plan is crucial to avoiding uncoordinated activities as the City adapts to changing conditions and experiences the population growth that is anticipated.

The plan is not intended as a rigid system of goals and development policies; rather, it is:

- Long range – looks ahead 20 years to anticipate growth and resulting community needs.
- Comprehensive – relates and integrates all types of uses and necessary public facilities.
- General – establishes general locations and areas for the elements and indicates their relationships to each other and the population they serve.
- Responsive – through regular updates, adjusts to changing conditions, unforeseen circumstances, and local and regional trends.

How is a Comprehensive Plan Related to Other Plans?

Our Camas 2045 is part of a family of state, regional, and local plans. Some, like statewide GMA and Clark County's Comprehensive Growth Management Plan, set the overall planning framework and guide the content of the Camas comprehensive plan.

Others, like plans that are specific to particular subareas, supply more detailed information about individual topics or smaller parts of the City.

Growth Management Act

The GMA establishes state goals, sets deadlines for compliance, and offers direction on how to prepare comprehensive plans and development regulations. GMA also establishes requirements for early and continuous public participation. GMA requires state and local governments to manage growth by identifying and protecting critical areas and natural resource lands, designating urban growth areas, and preparing comprehensive plans and implementing them through capital investments and development regulations.

The GMA legislation, which is Chapter 36.70A of the Revised Code of Washington (RCW), contains 15 goals.

For a community's plan to be valid, it must meet the requirements of the GMA through consistency with state statutory goals, countywide policies, and the plans of adjacent jurisdictions.

The fifteen statutory goals identified in the GMA (RCW 36.70A) are:

1. **Urban growth**. Encourage development in urban areas where adequate public facilities and services exist or can be provided in an efficient manner.
2. **Reduce sprawl.** Reduce the inappropriate conversion of undeveloped land into sprawling, low-density development.
3. **Transportation.** Encourage efficient multimodal transportation systems that will reduce greenhouse gas emissions and per capita vehicle miles traveled, and are based on regional priorities and coordinated with county and city comprehensive plans.
4. **Housing.** Plan for and accommodate housing affordable to all economic segments of the population of this state, promote a variety of residential densities and housing types, and encourage preservation of existing housing stock.
5. **Economic development.** Encourage economic development throughout the state that is consistent with adopted comprehensive plans, promote economic opportunity for all citizens of this state, especially for unemployed and for disadvantaged persons, promote the retention and expansion of existing businesses and recruitment of new businesses, recognize regional differences impacting economic development opportunities, and encourage growth in areas experiencing insufficient economic growth, all within the capacities of the state's natural resources, public services, and public facilities.
6. **Property rights.** Private property shall not be taken for public use without just compensation having been made. The property rights of landowners shall be protected from arbitrary and discriminatory actions.
7. **Permits.** Applications for both state and local government permits should be processed in a timely and fair manner to ensure predictability.

8. **Natural resource industries.** Maintain and enhance natural resource-based industries, including productive timber, agricultural, and fisheries industries. Encourage the conservation of productive forestlands and productive agricultural lands, and discourage incompatible uses.
9. **Open space and recreation.** Retain open space and green space, enhance recreational opportunities, enhance fish and wildlife habitat, increase access to natural resource lands and water, and develop parks and recreation facilities.
10. **Environment.** Protect and enhance the environment and enhance the state's high quality of life, including air and water quality, and the availability of water.
11. **Citizen participation and coordination.** Encourage the involvement of citizens in the planning process, including the participation of vulnerable populations and overburdened communities, and ensure coordination between communities and jurisdictions to reconcile conflicts.
12. **Public facilities and services.** Ensure that those public facilities and services necessary to support development shall be adequate to serve the development at the time the development is available for occupancy and use without decreasing current service levels below locally established minimum standards.
13. **Historic preservation.** Identify and encourage the preservation of lands, sites, and structures, that have historical or archaeological significance.
14. **Climate change and resiliency.** Ensure that comprehensive plans, development regulations, and regional policies, plans, and strategies under RCW 36.70A.210 and chapter 47.80 RCW adapt to and mitigate the effects of a changing climate; support reductions in greenhouse gas emissions and per capita vehicle miles traveled; prepare for climate impact scenarios; foster resiliency to climate impacts and natural hazards; protect and enhance environmental, economic, and human health and safety; and advance environmental justice.
15. **Shorelines of the state.** For shorelines of the state, the goals and policies of the shoreline management act as set forth in RCW 90.58.020 shall be considered an element of the county's or city's comprehensive plan.

Urban Growth Areas

An urban growth area is a defined area of land adjacent to city limits within which urban growth is encouraged and beyond which growth can occur only if it is not urban in nature.

Each county that adopts a comprehensive plan under the GMA must designate urban growth areas. The City of Camas has 11,848 acres of land within the urban growth areas. This land, combined with the vacant land available within the City limits, must accommodate the City's population and employment projections as established by the state's Office of Financial Management. The population and employment projections for the City for the year 2045 are 37,080 people and 11,615 jobs. The City is proposing urban growth area expansion to accommodate increased job capacity (see the Land Use Element for additional details).

County Planning Goals and Policies

The Comprehensive Growth Management Plan, adopted by Clark County and its cities and last updated in 2016, guides local jurisdictions as they work to decide questions of regional land use and services.

Clark County is in the final stages of fully updating this plan for 2025 through 2045. As County and city plans were developed, representatives of the City of Camas met on a regular basis over the span of two years with officials of the County and its cities to coordinate efforts. This level of communication helps ensure that the plans and capital projects of these jurisdictions are consistent when adopted. Our Camas 2045 is consistent with the concepts put forward in the County's Comprehensive Growth Management Plan, and the initial drafts of its pending comprehensive plan, and the countywide planning policies as required by RCW 36.70A.100 and 210, WAC 365-196-305; 400(2)(c); 510 and 520.

Local Plans

The goals and policies included in Our Camas 2045 are implemented through development regulations established in the Camas Zoning Code (Title 18 of the Camas Municipal Codes) as well as the standards set forth in existing plans and policy documents.

Our Camas 2045 has been developed to ensure consistency with all other relevant local plans as listed below:

- Strategic Plan (updated annually)
- Legacy Lands Master Plan (in development)
- Lake Management Plan (2024)
- North Shore Subarea Plan (October 2022)
- Camas Water System Plan (October 2019)
- Camas General Sewer Plan (June 2022)
- Camas General Sewer/Wastewater Facility Plan (November 2011)
- City of Camas Parks, Recreation, and Open Space Comprehensive Plan (March 2022)
- Camas Design Standards Manual–Engineering (adopted October 20, 2014, Res. 1308, updated annually)
- Camas Design Review Manual (May 2, 2016)
- Camas Shoreline Master Program (spring 2021)
- Downtown Design Manual (revision in process, to be adopted with Our Downtown Camas 2045, the Downtown Subarea Plan)
- Camas Stormwater Design Standards Manual (June 2022)
- Six-Year Street Plan (Updated annually)
- 2025–2030 Capital Facilities Plan Project List (to be updated with Our Camas 2045)
- Transportation Impact Fee Update (May 2012)

Amending a Comprehensive Plan

The City is required to review its comprehensive plan at least every ten years. However, the City's comprehensive plan and development regulations are reviewed and evaluated regularly.

Our Camas 2045 is based on the best available information. As years go by, new information or changing circumstances – for instance, a revised sewer or water plan – may prompt changes to this plan. By state law, amending a comprehensive plan can occur only once a year and must follow the procedures that are set forth in RCW 36.70A.130.

Amendments to a comprehensive plan require legislative action, which entails the adoption of a resolution or ordinance following notice and public hearing indicating, at a minimum, a finding that a review and evaluation has occurred and identifying the revisions made, or that a revision was not needed and the reasons.

The review and evaluation must include the consideration of critical area ordinances, population projections, and other plans and policies in effect.

Under certain circumstances, amendments can occur more frequently:

- The initial adoption of a subarea plan. Subareas must clarify, supplement, or implement jurisdiction-wide comprehensive plan policies, and may only be adopted if the cumulative impacts of the proposed plan are addressed by appropriate environmental review under chapter 43.21C RCW.
- The development of an initial subarea plan for economic development located outside of the 100 year floodplain in a county that has completed a state-funded pilot project that is based on watershed characterization and local habitat assessment
- The adoption or amendment of a shoreline master program under the procedures set forth in Chapter 90.58 RCW.
- The amendment of the capital facilities element of a comprehensive plan that occurs concurrently with the adoption or amendment of a county or city budget.
- The adoption of comprehensive plan amendments necessary to enact a planned action under RCW 43.21C.440, provided that amendments are considered in accordance with the public participation program established by the county or city under this subsection (2)(a) and all persons who have requested notice of a comprehensive plan update are given notice of the amendments and an opportunity to comment.

Developing Our Camas 2045

Our Camas 2045 began with a citywide outreach process to better understand the community's vision and priorities related to Camas' future. The Our Camas Visioning process reached over 1,000 community members through community conversations, community events, an online survey, online mapping tools, and the project website.

The City hosted two Community Summits. The first, held in June 2024, was an open house event where members of the public could provide feedback on the draft vision statement and goals, as well as provide ideas to achieve the vision and goals. The second Community Summit was held in October 2024 and provided a forum for community members to provide feedback on the draft land use alternatives, development scales, review development concepts for downtown, and learn about the County's climate planning efforts and greenhouse gas inventory.

There were several advisory committees that participated in the development of the plan.

- Project Advisory Committee (PAC) – technical stakeholders, agency partners, service providers
- Community Advisory Community (CAC) – broad cross-section of community interests

- Climate Policy Advisory Team (CPAT) – community members advising on climate goals and policies
- Existing advisory bodies that consulted on the vision, goals, policies, and plan:
    - Downtown Camas Association (DCA)
    - City Council
    - Planning Commission

Following preparation of the draft plan, the City hosted pop-up events throughout the summer and fall of 2025 to seek input on the preferred alternative map and draft goals and policies.

In addition to the outreach efforts described above, the City maintained a public engagement website throughout the visioning process and the development of Our Camas 2045. During spring 2024, a community survey and interactive map gathered feedback from the community on things they like about Camas, things they would change in the future, important topics to address in the plan, and areas of opportunity or concern both downtown and in the wider Camas community. A second online survey accompanied the second community summit to seek input on the draft land use alternatives and development concepts for downtown. The City prepared a Story Map in Spring 2025 to present and obtain feedback on the preferred land use alternative and proposed zoning and comprehensive plan land use designation changes.

The City of Camas values residents' opinions and is committed to being responsive. The final comprehensive plan incorporates the contributions and comments from those who participated in the project engagement. A summary of all engagement activities is included in Appendix X.

ourCamas 2045



03 Community Character

Community Character

This element integrates art, culture, growth and identity into the comprehensive plan, while ensuring community engagement is inclusive and open.

03. Community Character

Vision

In 2045, Camas is an inclusive community where residents experience a sense of belonging and connection. The city's unique identity is defined by its small-town feel and the incorporation of the natural landscape into walkable neighborhoods and high-quality development. Camas maintains its distinct sense of place through inclusive community engagement, sustainable development practices, and intentional placemaking that reinforces Camas' beauty, livability, and lasting connection to nature.

Introduction

The community character element establishes a framework for preserving and enhancing the physical, cultural, and social characteristics that make Camas feel like Camas. Community character is shaped not only by the built environment, but also by the natural landscape, cultural identity, historic context, and the ways in which people engage with their surroundings. As Camas plans for continued growth through the 2045 horizon, this element ensures that the qualities residents value—such as the City's small-town atmosphere, its connection to nature, and its strong civic identity—are maintained and reinforced through thoughtful development, design standards, public investment, and public engagement.

Camas' natural and built environment is defined by its integration of the natural features of the land with the development of housing, commercial buildings and its connecting infrastructure. In 2025, the City of Camas is home to 16 parks, 12 miles of scenic trails, and over 1,060 acres of parks and open space. From the forested paths around Lacamas Lake to the many playgrounds throughout the city, the natural beauty of Camas is a defining part of community life.

Camas' diversifying community is comprised of just over 27,000 people and expected to grow to over 37,000 by 2045. While most people who live in Camas commute to nearby cities for employment, in 2025, there are approximately 9,550 jobs within the city with the largest employment sectors being education and

healthcare, followed by professional services. The Georgia Pacific Mill remains a significant part of the city's economic history and a symbol of Camas' working roots.

The majority of housing in Camas is single family detached homes. Most residents own their home, with renters making up 20% of residents. There are approximately 10,000 housing units in Camas in 2025. By 2045, the city needs to add 4,226 new units to support the growing population. Camas also needs a greater variety of housing types at a range of price points to meet residents' diverse needs. By 2045, new multifamily and mixed-use buildings near transit, in Downtown, North Shore, and along NW Parker Street and Pacific Rim Boulevard will expand options for existing and new residents. These future developments will complement the strong sense of place already present in Camas' established neighborhoods like Prune Hill, Crown Park, and Evergreen Terrace.

Access to public art and community events is an important priority to define and enhance the identity of Camas. Beloved local traditions like Camas Days, the Camas Farmers Markets, and seasonal parades and festivals foster a deep sense of connection and pride. New development will include and support inclusive public gathering spaces to host events, ensuring that the community spirit thrives as the city grows.

Key community resources to preserve and enhance include the existing built infrastructure, high quality schools, access to living wage jobs, parks, open space and recreational amenities, and the distinctive Downtown area, where historic storefronts, local restaurants, and venues like the Liberty Theatre draw residents and visitors alike.

The community will connect with city government and processes through accessible engagement and neighborhood leadership. Ongoing collaboration will help ensure that Camas remains a place where people feel heard, welcomed, and at home.

Community Character Goals and Policies

Goal CC-1 Art, Culture, and Heritage

Camas is a city where history, art, and culture are celebrated and accessible to all. Camas events and activities will instill a sense of belonging among residents of all ages, making Camas an ideal place to live and work.

Policy CC-1.1 Encourage and promote a wide range of artistic and cultural activities by reducing barriers and increasing access to hosting and attending community events that define and enhance Camas' community identity.

Policy CC-1.2 Incentivize development sites to create spaces conducive to the provision of art and other cultural activities and amenities. Encourage murals, sculptures, interactive art installations, and

interpretive displays that celebrate the history, culture, and creativity of Camas.

Policy CC-1.3 Develop a process to memorialize historic sites and create and maintain an official inventory of Camas' historic and cultural resources.

Policy CC-1.4 Support the formation of a local arts commission that provides funding and support for local artists and artistic events in Camas.

Policy CC-1.5 Require a percentage of capital project budgets to be allocated for public art and design enhancements.

Policy CC-1.6 Prioritize naming streets, parks, and public facilities after historically significant people, events, geographic features, or native flora and fauna. Consider allowing naming rights in recognition of significant donations.

Goal CC-2 Sustainable Growth and Distinct Identity

Camas' unique identity is enhanced by high-quality urban design that respects the natural landscape, fosters a connection to nature, and integrates sustainable development.

Policy CC-2.1 Establish and enforce clear and objective design standards to ensure that new development respects and enhances Camas' architectural, historical, and natural character.

Policy CC-2.2 Regulate land use and development to protect natural topographic, geologic, vegetative, and hydrologic features, and natural contours of undeveloped properties.

Policy CC-2.3 Promote and provide educational resources for tree-lined streets, rain gardens, and preservation and use of native landscaping to reinforce Camas' connection to nature.

Policy CC-2.4 Align development regulations and design guidelines with dark sky standards to encourage the preservation of the night sky.

Policy CC-2.5 Establish distinctive gateway features at major points of entry into Camas, including attractive signage, landscaping, and public art that reflect Camas' distinct identity.

Policy CC-2.6 Ensure that street signage, lighting, landscaping, and street furniture are designed and maintained with a cohesive aesthetic that enhances community identity.

Policy CC-2.7 Revise the City's sign standards to ensure that all permanent and temporary signage is attractive and well-maintained, with clear regulations and enforcement mechanisms.

Policy CC-2.8 Provide educational and volunteer programs related to climate science, the connections between habitat conditions and native species, and effective ways to mitigate the impacts of climate change.

Goal CC-3 Community Engagement

Camas will have a strong sense of community through open communication, inclusive and meaningful outreach efforts, and enduring partnerships throughout the community.

Policy CC-3.1 Increase access to public engagement by ensuring materials and procedures are accessible for all community members, especially vulnerable groups such as low-income, Limited English Proficiency (LEP) individuals, youth, elderly, and differently abled.

Policy CC-3.2 Utilize outreach strategies such as focus groups and listening posts that accommodate the needs of everyone and account for the broad spectrum of community members.

Policy CC-3.3 Develop and implement strategies to support neighborhood leadership and associations to increase community involvement and provide opportunities to participate in the development processes.

Policy CC-3.4 Regularly inform the community of activities and events through a range of outreach methods including traditional and social media, partnerships with schools, and information at fairs and events.

Policy CC-3.5 Develop a City education program to inform the community on the inner workings of their local government, city functions, and an opportunity to engage with staff.

ourCamas 2045



Land Use

04

Land Use Element

The land use element is designed to support development that adheres to the City's vision to ensure Camas' future is as bright as its past.

04. Land Use

Vision

Camas embraces its small-town feel while responsibly managing growth, ensuring a prosperous and livable future for all. Camas provides a variety of housing options that meet the needs of all residents, while ensuring the town's charm and livability are sustained. Camas is home to a thriving economy and diverse businesses, affording residents ample employment opportunities and access to high wage jobs. Neighborhood commercial hubs connect residents to daily services and amenities through a network of sidewalks and bike lanes, improving access and connectivity.

Land Use Overview

The City of Camas is home to great schools, family-wage jobs, high quality neighborhoods, and an abundance of open space and recreational amenities. Camas has grown into a dynamic, vibrant city with diversified employment opportunities and services that cater to its residents' various needs. In 2025, Camas maintains its small town charm and character, and downtown remains the heart of the City with a mix of restaurants, shops, professional offices, and residential development. The Grass Valley area is home to several national and international technology and manufacturing firms. Newer residential development has occurred recently in the Green Mountain area, and planned transportation improvements in the North Shore area will improve connectivity and provide better transportation options throughout the City.

The land use element is designed to support development that adheres to the City's vision to ensure Camas' future is as bright as its past. The GMA identifies the land use element as the foundation of the comprehensive plan. GMA outlines the framework by which the plan will be implemented and establishes land use designations to accommodate the City's population and employment projections. The development of land in accordance with the goals and policies included in the land use element will ensure the achievement of an appropriate balance of public facilities, housing, employment, services, and recreational uses throughout the City.

Population Projections

GMA requires that each jurisdiction accommodate its share of the region's growth. The City of Camas is expected to have a population of 37,080 by 2045 (based on the County adopted growth rate of 1.2 percent per year), a 7,729-person increase from the 2023 population of 29,352. During the same period, Camas is expected to add 13,658 jobs.

Land Use Designations

In order to ensure the City's vision and land use goals are achieved, land use designations are used to assign a variety of development uses and building densities to land throughout the City. The plan identifies areas for residential, commercial, mixed use, mixed employment and industrial development. The plan also identifies areas for parks and open space to support recreation and enhance natural areas, including habitat and wildlife corridors.

Table 1 Land Use Designations

Comprehensive Plan Designation	Corresponding Zones	Total (Acres)[1]
Residential Low	Residential 15,000 (R-15)	407
	Residential 12,000 (R-12)	27
	Residential 10,000 (R-10)	280
	Residential 7,500 (R-7.5)	151
	Residential 6,000 (R-6)	19
	North Shore Lower Density (LD-NS)	145
	Downtown Residential (R-DT)	68
Residential Medium	Multi-Family 10 (MF-10)	37
Residential High	Multi-Family 18 (MF-18)	41
	Multi-Family 26 (MF-26)	33
	Multi-Family 34 (MF-34)	6
	North Shore Higher Density (HD-NS)	109
Mixed Use	Mixed Use (MX)	141
	North Shore Mixed-Use (MX-NS)	85
	Downtown Mixed-Use Low Rise (MX-LR)	41
	Downtown Mixed-Use Mid Rise (MX-MR)	55
Mixed Employment	Mixed Employment (ME)	235
	North Shore Mixed Employment (ME-NS)	99
Commercial	Neighborhood Commercial (NC)	2
	Community Commercial (CC)	63
	North Shore Commercial (C-NS)	54
	Regional Commercial (RC)	298

	Historic Main Street Core (HMSC)	17
Industrial	Heavy Industrial	545
Parks and Open Space	Neighborhood Park (NP) Special Use Park (SU) Open Space (OS)	1,343

[1]Total acres within each zoning designation are gross acres and inclusive of rights-of-way and infrastructure.

Overlays

In addition to the land use designations listed in Table 1, land use overlays further define appropriate uses and development standards for particular areas within the City. Overlays in Camas include an Airport Overlay and a Design Overlay. Development within all overlay areas must comply with the goals and policies of the underlying land use designation and the specific standards included in the overlay.

The Airport Overlay area applies to land adjacent to Grove Field, an airport owned and operated by the Port of Camas-Washougal and located northeast of Lacamas Lake. Grove Field adjoins the City's UGA and is proposed to be included in the UGA with this update. The Airport Overlay is designated to ensure land uses adjacent to the airport are compatible with air traffic and do not interfere with safe air navigation. For example, the comprehensive plan designation of lands adjacent to the airport is generally Mixed Employment, rather than residential, and the Airport Overlay area restricts uses tending to have higher concentrations of people, such as schools or hospitals.

The Design Overlay is a new overlay with the 2025 update and replaces the Gateways and Corridors Overlay included in the prior plan. The Design Overlay generally applies to the following locations. The specific extents of the overlay are included on the Camas Zoning Map.

- 6th Avenue
- 3rd Avenue
- Everett Street
- 38th Avenue
- Lake Road
- Green Mountain - Goodwin
- Brady Road
- Union Street
- Parker Street

The Design Overlay is intended to enhance the walkability, pedestrian experience, and design of the corridors it covers. Development/redevelopment within a designated Design Overlay must adhere to the Design Overlay goals and policies included in this element. See Goal LU-6 and Policies LU-6.1 – 6.7.

Figure 2 Comprehensive Plan Map

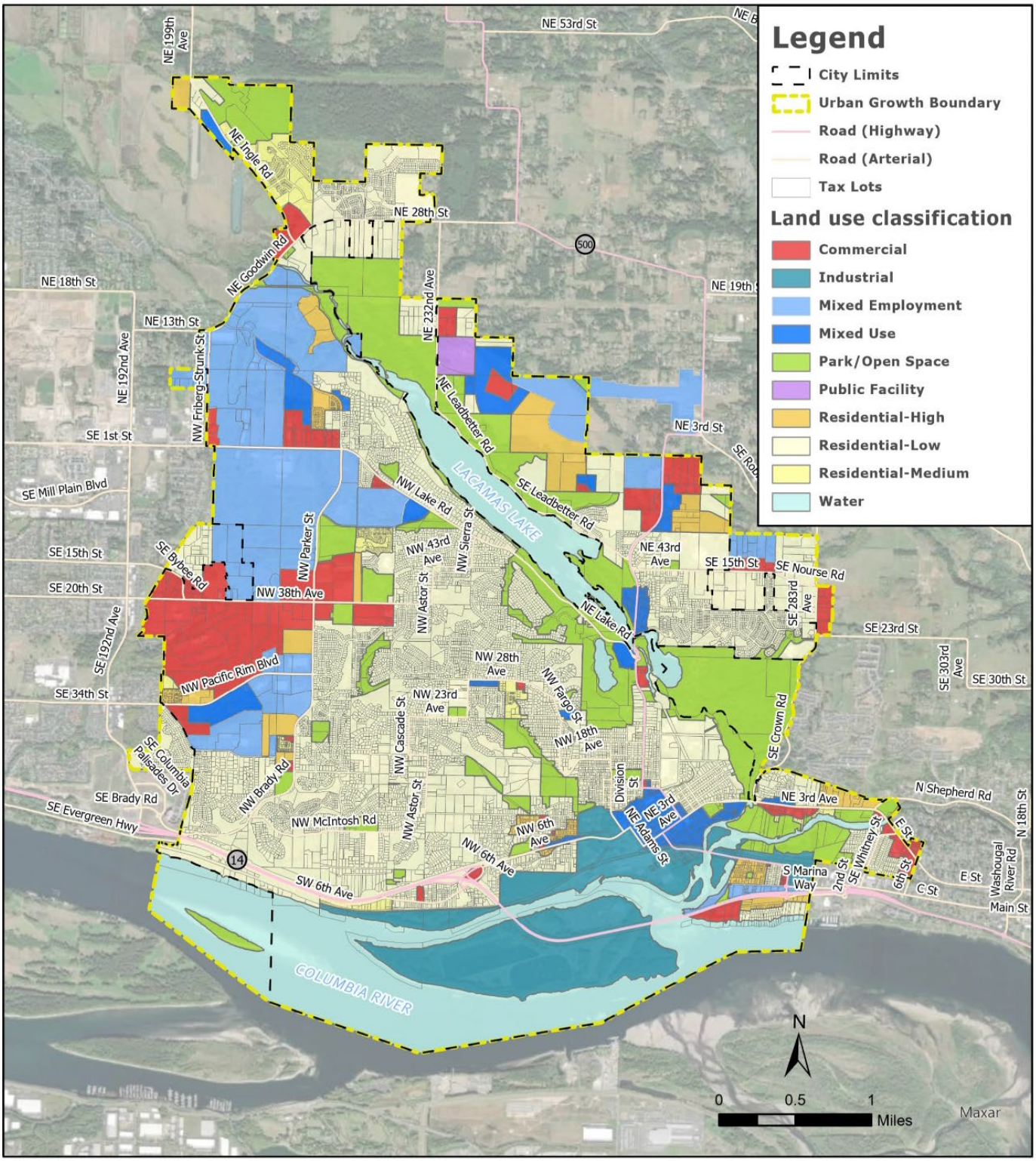
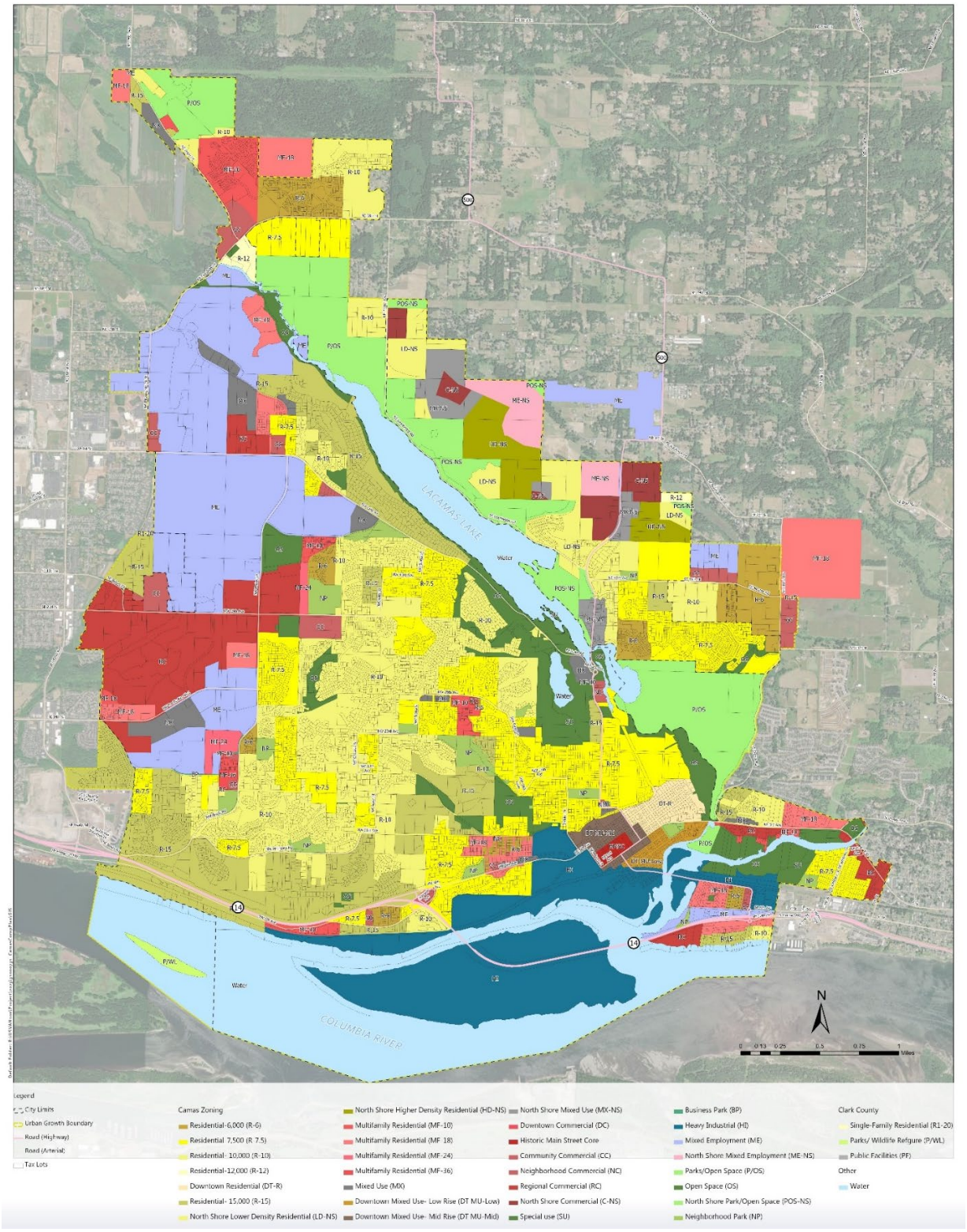


Figure 3 Zoning Map



Land Use Goals and Policies

Goal LU-1 Citywide Land Use

Maintain a land use pattern that respects the natural environment and existing uses while accommodating a mix of housing and employment opportunities to meet the City's growth projections in coordination with the capital improvement plan.

Policy LU-1.1 Ensure the appropriate mix of commercial, residential, and industrial zoned land accommodates the City's share of the regional population and employment projections for the 20-year planning horizon.

Policy LU-1.2 Coordinate with Clark County, the state, and special districts to identify future needs for essential public facilities such as airports, state education facilities, state and regional transportation facilities, state and local correctional facilities, solid waste handling facilities, regional parks and others as identified in RCW 36.70A.200. (See policies ED-3.1, 3.2, and 3.3 regarding Grove Field airport, policy TR-2.1 regarding transportation, and policy PFS-4.27 regarding solid waste.)

Policy LU-1.3 Implement design standards for new development, redevelopment, and infill that consider the surrounding built and natural environments and support a natural transition between uses.

Policy LU-1.4 Ensure that park and recreation land is distributed equitably throughout the City and work to achieve park and continuous trail corridors from Green Mountain to the Columbia River. (See policies PFS-2.1 and 2.4 regarding increasing connectivity to natural areas and continuous trail around Lacamas Lake.)

Policy LU-1.5 Ensure adequate public facilities, including roads, emergency services, utilities, and schools, exist to serve new development, and mitigate potential impacts to current residents. Establish and maintain policies for impact fees for new development.

Policy LU-1.6 Ensure consistency with County-wide planning policies.

Policy LU-1.7 Evaluate and improve design and building standards for new and redeveloped sites in high-risk natural hazard areas.

Policy LU-1.8 Incorporate sustainable and low climate impact design into development codes and standards.

Policy LU-1.9 Encourage high density concentrations of housing, commercial, and other uses needed in daily life along major transportation corridors to support the reduction in vehicle miles traveled and opportunities to increase physical activity.

Policy LU-1.10 Protect the viability of the airport as a significant economic resource to the community by encouraging compatible land uses and densities, and reducing hazards that may endanger the lives and property of the public and aviation users consistent with state laws RCW 36.701A.510 and RCW 36.70547.

Goal LU-2 Employment Land

Create a diversified economy and serve Camas residents, businesses, and tourists by providing sufficient land throughout the City to support a variety of business types and employment opportunities.

Policy LU-2.1 Protect employment land to ensure an adequate supply of commercial and industrial land to meet 20-year employment projections. Encourage a balance of new and existing commercial, light industrial, knowledge-based business, medical, and high-tech uses.

Policy LU-2.2 Encourage mixed-use developments (residential and commercial) that support adjacent uses, reduce vehicle miles traveled, and balance job creation.

Policy LU-2.3 Implement development and landscaping standards to ensure industrial development and other employment lands integrate with the surrounding neighborhoods.

Goal LU-3 Neighborhoods

Create vibrant, stable, and livable neighborhoods with a variety of housing choices that meet all stages in the life cycle and the range of affordability.

Policy LU-3.1 Encourage connectivity between neighborhoods and adjoining natural areas and trails to increase access to recreation amenities. (See policies PFS-2.1 and 2.2)

Policy LU-3.2 Discourage exclusive neighborhoods, privacy walls, and gated communities.

Policy LU-3.3 Provide commercial zoning within a half mile of residential areas for the development of food retailers (grocery stores and farmers' markets) to improve food access.

Goal LU-4 Natural Environment

Develop an interconnected network of parks, trails, and open space to enhance the quality of life for Camas residents and visitors and support and preserve wildlife corridors and natural resources.

Policy LU-4.1 Maintain development regulations that encourage the preservation of trees and natural areas, including the use of density bonuses and other tools to protect sensitive areas and encourage tree replacement. (See policy NE-4.1)

Policy LU-4.2 Support the purchase and preservation of open space by the City and private owners. Encourage careful consideration and integration of the natural environment in planning activities to maintain the park-like setting of Camas.

Policy LU-4.3 Encourage connectivity and increase access to regional trails throughout the City to support multi-modal transportation and physical activity. (See policies PFS-2.1)

Policy LU-4.4 Protect the quality and quantity of groundwater used for public water supplies through conservation of water usage and treatment of runoff.

Goal LU-5 Mixed-Use Areas

Foster economically and socially diverse mixed-use neighborhoods that meet the multi-modal transportation, housing, employment, education, recreation, and health needs of the community.

Policy LU-5.1 Mixed-use developments should be unique to the area in which they are located, encourage small business development, provide a mix of housing types to ensure affordability, increase pedestrian and transit connections, and include design that is sensitive to the natural environment.

Policy LU-5.2 Develop mixed-use areas that are oriented to the public street and scaled and designed to integrate with surrounding land uses.

Policy LU-5.3 Create a mixed-use zone that requires developments to include a minimum percentage of commercial space in both vertical and horizontal mixed-use settings.

Goal LU-6 Design Overlay Areas

Create attractive and welcoming areas in the City and distinguish Camas from adjacent jurisdictions through the development of design overlays.

Policy LU-6.1 Encourage development and redevelopment along the design overlay corridors that respects the historic character of the areas, improves pedestrian mobility/safety, and supports small-scale retail and commercial services.

Policy LU-6.2 Encourage development of commercial uses and multi-family residential within the NE 6th Avenue and NE 3rd Avenue design overlay corridors to support downtown businesses (such as through the Downtown subarea plan). Consider rezoning low-density residential land to support the downtown area. Consider rezoning low-density residential land to support the downtown area.

Policy LU-6.3 Orient building entrances toward the street and provide pedestrian connections from building entrances to the sidewalk. Encourage landscaping, rather than parking, between the building and the street to create a welcoming streetscape.

Policy LU-6.4 Collaborate with partners to support community events, public art, and infrastructure investments that celebrate cultural heritage, provide community amenities, and strengthen community branding. Develop area identities through events, festivals,

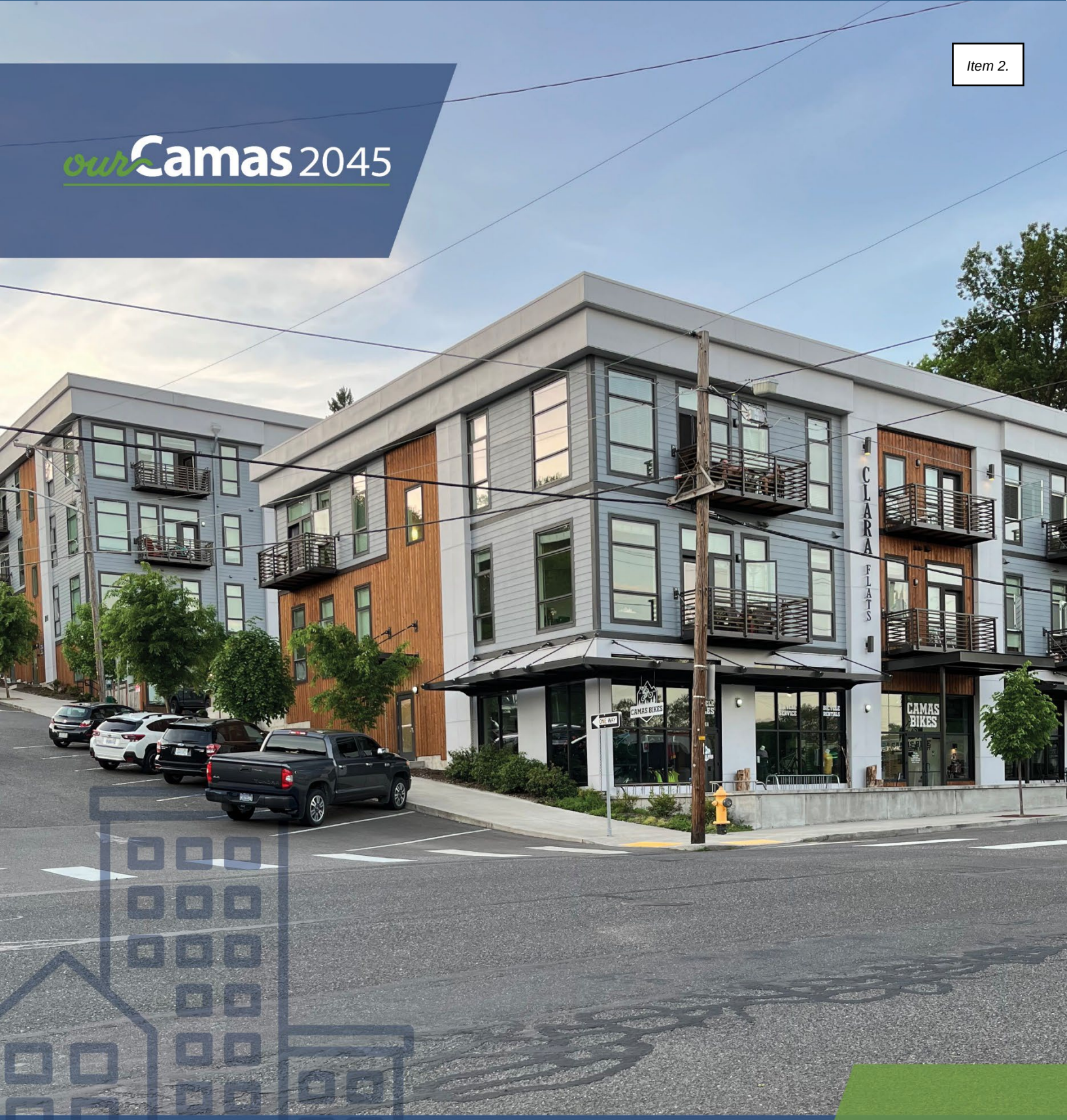
signage, and other improvements that help establish or enhance existing character within the overlay areas.

Policy LU-6.5 Encourage the designation and development of design overlay features in strategic areas to create a distinct pedestrian scale identity and attract visitors.

Policy LU-6.6 Identify streets in the design overlay areas as public places to encourage pedestrian and bicycle mobility and to reinforce the connection between the corridors and the surrounding neighborhoods.

Policy LU-6.7 Improve and increase wayfinding signage in design overlay areas to nearby recreational and other amenities.

ourCamas 2045



Housing

05

05. Housing

Vision

In the year 2045, residents of Camas continue to appreciate their safe, diverse, and welcoming community. Those raised in Camas will return for living-wage jobs and to ultimately retire here. Camas is a well-planned and connected city where residents enjoy pedestrian and bicycle paths between neighborhoods and to downtown. Camas provides a wide variety of housing options that meets the needs of all residents and provides a range of housing for all ages, abilities, needs, preferences, and income levels.

Background

This element of the comprehensive plan sets out the vision, goals, and policies to address current and projected housing needs for the next 20 years (2025 to 2045), inclusive of the diverse needs of the whole community across the income spectrum. Camas is facing housing challenges that could benefit from improved access to more housing options including more housing for seniors and young adults, smaller housing, more rental units, and affordable homeownership opportunities, all of which the City can have a role in supporting.

The housing element is supported by a housing needs assessment (provided below) that quantifies existing housing stock and projected housing needed to accommodate projected growth. Housing analysis is an important exercise as the housing needs in Camas tend to continually evolve based on changes in the broader economy, local demographics, and the regulatory environment. In addition to an assessment of housing needs based on the best available existing data, the housing element goals and policies reflect community input, state legislative requirements, and City of Camas' priorities.

The following section provides background on the planning framework and highlights the analytical findings associated with current and projected housing including details on Camas' community demographics, housing stock, housing market dynamics, expected housing demand, and special housing needs. The insights from this analysis help to build a factual basis for the housing policy updates.

Housing Challenges

Camas is facing housing challenges that could benefit from improved access to more housing options including more housing for seniors and young adults, smaller housing, more rental units, and affordable homeownership opportunities, all of which the City can have a role in supporting.

Planning Framework

In Clark County, RCW 36.70A.040 requires all cities to "fully plan" for the Elements of a Comprehensive Plan, including land use, housing, capital facilities, utilities, transportation, and climate change.[1] The current update process is part of a periodic update also required by the Growth Management Act (GMA), as part of an established schedule by the County.

At the state level, the GMA requires local jurisdictions to adopt Housing Elements that are consistent with statewide goals and objectives. The Housing Element must include an inventory and analysis of existing and projected housing needs that identifies the number of housing units by income level necessary to manage projected growth including permanent supportive and emergency housing.

Recent state legislation calls for cities to expand middle housing allowances in single family residential zones (HB 1110) and support Accessory Dwelling Unit development (HB 1337). These changes require cities to allow up to two Accessory Dwelling Units (ADUs) on all lots zoned to allow single-family homes. Lots with critical areas or their buffers are exempt from the requirements of both HB 1110 and HB 1337. In addition, via HB 1220, the Washington State Department of Commerce instructed local governments to "plan for and accommodate" housing affordable to all income levels.

MIDDLE HOUSING POLICY IN WA

'Middle housing' refers to moderate-density housing types between single-family detached homes and larger multifamily housing. HB 1110 became effective in July 2023 and requires that designated Growth Management Act (GMA) planning cities in Washington must allow certain minimum densities for middle housing within 6 months after their periodic update due date.

Camas is counted as a Tier 2 city under this policy, which must allow for 2 dwelling units per lot or higher in predominantly residential zones, as well as 4 dwelling units per lot within a quarter mile of major transit stops and for affordable housing (ESHB 1110, Sec. 3(1)(c)).

The Clark County Countywide Planning Policies provide helpful guidance on the Comprehensive Plan update. Clark County is currently in the process of updating its Comprehensive Plan and its Countywide Planning Policies. The existing 20-year growth plan spans 2015-2035 and includes a Housing Element with relevant policies for jurisdictions within the County. Please see Appendix X for a summary of the existing relevant Clark County Countywide Planning Policies.

Lastly, the City of Camas completed its Housing Action Plan (HAP) in 2021, including a housing needs assessment and a thorough community engagement process focused on learning about housing experiences and identifying ways to meet housing needs and overcome core challenges. The engagement included two virtual public meetings, seven focus groups and

[1] The GMA includes other optional Elements for economic development, parks and recreation, conservation, energy, sub areas, and ports.

interviews, a housing survey with over 300 responses, a project website, and written public comments. Key findings helped to shape the updates to the Camas Housing Element.

Community Engagement

The project team held interactive open houses and interviewed stakeholders to learn about housing challenges, opportunities, and actions. Engagement activities identified the following themes that could contribute to future decision-making related to housing in Camas.

Housing Insights

- **North Shore:** Need infill development.
- **General:** Are there model cities Camas would strive to look like? (Lake Oswego, Bend, etc.) Compare plans with cities that have experienced similar growth? What did they do well?
- **Housing:** Allow work/live housing along and around UGA/schools and major transportation corridors. Ensure workforce housing is available for current and future workers. Having diverse housing options will lead to a more diverse city.
- **Barriers to development and safety issues for pedestrians:** Height restrictions and fees are challenging, since rents are lower it is harder to make a project pencil, and need for safer crossings on 3rd Ave and difficult to cross 5th in some areas.

Public Engagement Findings Regarding Housing Strategies

- Citywide: Maintain the strength, vitality, and stability of all neighborhoods and promote the development of a variety of housing choices that meet the needs of all members of the community. This goal seems very wide and difficult to achieve. More focused on affordability?
- More moderate density in and near Downtown with good connectivity (Safe, lit, easy).
- Be intentional- positive in messaging about adding middle housing and moderate density so community gets accustomed to why it is so important for our community and culture to include all. Show that it's not scary.
- Consider incentivizing housing developers through zoning, taxes and fees, and partnerships.
- Partnerships: Partner with Vancouver Housing Authority and other organizations to develop affordable housing. Partner with habitat for humanity and housing authority. Proud ground for moderate- and low-income housing.
- Attract a large senior housing project.
- More 4-5 story multi-family units, especially Downtown.
- Builder incentives to focus on mixed use/ apartments.
- Don't forget the bike paths.
- Make it easy to build ADUs in backyards.
- Support yes in my backyard policies.

- Incentivize small developers (housing & economic development combined!).

Housing Action Plan

The City of Camas completed its Housing Action Plan (HAP) in 2021, including a housing needs assessment and a thorough community engagement process focused on learning about housing experiences and identifying ways to meet housing needs and overcome core challenges. The engagement included two virtual public meetings, seven focus groups and interviews, a housing survey with over 300 responses, a project website, and written public comments. Key findings about community priorities and HAP goals and strategies are summarized below.

HAP Goals

- **Develop Housing to Accommodate Growth.** Thoughtful changes to Camas' zoning and development regulations can allow the City to better accommodate projected growth.
- **Diversify the Mix.** A greater variety of housing types can better serve young families, small households, seniors, people with disabilities, and people with diverse incomes.
- **Increase Housing Affordability.** Young families, seniors, and people who work in Camas may have difficulty finding affordable housing in Camas.
- **Preserve Existing Affordable Housing.** Camas should adopt strategies to preserve its existing affordable housing and prevent the displacement of residents. Community members noted concern for preserving existing affordable housing, particularly smaller single-family properties, in older neighborhoods near Downtown.

STRATEGY	GOALS			
	DEVELOP HOUSING	DIVERSIFY HOUSING MIX	INCREASE HOUSING AFFORDABILITY	PRESERVE AFFORDABLE HOUSING
Strategy 1: Expand housing opportunity in mixed use and downtown commercial districts	♦	♦		
Strategy 2: Consider making targeted rezones during Comprehensive Plan updates	♦			
Strategy 3: Diversify allowed housing types and update related lot and dimensional standards	♦	♦	♦	
Strategy 4: Focus on key areas with residential development or redevelopment potential. Expand more mixed-use areas throughout the city.	♦	♦		
Strategy 5: Continue community conversations around housing and housing for all	♦	♦	♦	♦
Strategy 6: Communicate available affordable housing resources			♦	
Strategy 7: Build partnerships to develop and preserve affordable housing for individuals, families, and seniors. Explore expansion of the MFTE program.			♦	♦
Strategy 8: Explore funding source and cost reduction options for affordable housing	♦	♦	♦	♦

Housing Targets

Planning for future housing demand is critical to ensure that the City can meet demand driven by population growth. This section summarizes projected future housing demand for Camas to provide context for the City's housing policies.

Population and Housing Allocations

Table 2 below demonstrates the City of Camas and Clark County's anticipated population forecast between 2023 and 2045. Since 2000, Camas has grown at a faster rate than the County overall with an Average Annual Growth Rate (AAGR) of 5.2% in the City (including annexations), compared to the County's AAGR of 2.4% (Housing Appendix). However, the County's estimates assume a slower growth scenario for the City in the next 22 years. With this assumption, new population growth in Camas is estimated to comprise 4.05% of growth in Clark County overall.

The population growth forecast indicates that the City of Camas will make up 4.05 percent of new growth population in Clark County between 2023 and 2045 with an AAGR of 1.2% in the City. The County's methodology also acknowledges Washington State Department of Commerce's HAPT estimates for current housing supply in Camas and allocates a number of net new units for the Urban Growth Area(s).

Table 2 Population Growth Forecast, Camas and Clark County, 2023 to 2045

Source: Clark County Interim Population Allocations and Clark County Comprehensive Plan 2025 Update, 2025 Population, Housing, and Employment Allocation – Issue Paper 5.

Jurisdiction	2023 Est. Population	Vacant Buildable Land Model Percent Capacity	2023-2045 Growth	2045 Estimate	Change (percent)	AAGR
City of Camas	**29,352**	**4.26%**	**7,729** ***(4.05% of total growth)***	**37,080**	**26%**	**1.2%**
Clark County	527,400	100%	190,754 *(100% of total growth)*	718,154	36%	1.6%

In May 2024, Clark County adopted housing allocations for jurisdictions located within county boundaries. In total, this shows an estimated 4,226 housing units needed by 2045 in the City of Camas and UGA(s).[2] The City would add about 311 new units to meet the new permanent

[2] The Washington State Department of Commerce Housing for All Planning Tool (HAPT) provides two allocation methods for determining the share of a County's housing supply to be met by jurisdictions. Method A assumes all housing needs will be accommodated through new housing production. Method B assumes all jurisdictions will accommodate equivalent shares of the total countywide housing need at each income level, proportional to their size, in the projection year. Clark County elected to use a hybrid method of 75/25 for Camas.

supportive housing target and 1,766 units affordable to low-income households below 80% of AMI by 2045. Camas currently has 143 units of housing affordable for households at or below 30% of AMI that are not Permanently Supportive Housing (PSH)[3] and 14 emergency units[4] according to the HAPT estimate. With this allocation, the City will need to accommodate 172 new units of temporary emergency housing by 2045.[5]

HOUSING ALLOCATIONS

In 2021, HB 1220 created a new way that communities in the state are required to plan for housing needs. This legislation requires that jurisdictions plan for sufficient land capacity for housing needs, including all economic segments of the population (moderate, low, very low and extremely low income, as well as emergency housing and permanent supportive housing).

- **Since 2000, the City of Camas had an average annual growth rate of 221 new housing units per year.**
- **Comparatively, the City will need to add an average of 195 new housing units per year between 2024 and 2045 to reach its allocation of net new units.**

[3] Permanent Supportive Housing is defined as: "subsidized, leased housing with no limit on length of stay that prioritizes people who need comprehensive support services to retain tenancy and utilizes admissions practices designed to use lower barriers to entry than would be typical for other subsidized or unsubsidized rental housing, especially related to rental history, criminal history, and personal behaviors" Washington RCW 36.70A.030(31).

[4] Temporary emergency housing is defined as: "temporary indoor accommodations for individuals or families who are homeless or at imminent risk of becoming homeless that is intended to address the basic health, food, clothing, and personal hygiene needs of individuals or families. Emergency housing may or may not require occupants to enter into a lease or an occupancy agreement." – Washington RCW 36.70A.030(14).

[5] Clark County's interim allocations do not include designated temporary emergency housing units at the City level. Estimates in this section for the City of Camas are derived directly from the Department of Commerce HAPT tool.

Figure 4 Housing Unit Allocations by Income, Camas and its UGA, 2024-2045

Source: Washington State Department of Commerce HAPT, Clark County Interim Housing Allocations, City of Camas
Note: Current supply includes both the estimate from the HAPT with the addition of 599 additional units since its calibration in 2020.



4,226 new homes will be needed over the next 20 years in the City of Camas

In addition, there will also need to be:

172 Emergency housing beds (temporary housing)

	0-30% AMI		>30-50% AMI	>50-80% AMI	>80-100% AMI	>100-120% AMI	>120% AMI	Total	Emergency housing beds
	Non-PSH	PSH							
2024: Current Housing Supply Estimate	143	0	458	1,874	1,182	1,965	4,201	**9,832**	14
2024-2045: New Housing Unit Needed for the Allocation	**564**	**331**	**811**	**955**	**516**	**249**	**799**	**4,226**	172
2045: Total Target Supply	707	331	1,269	2,811	1,627	2,214	4,499	**13,459**	186

Residential Capacity

Residential capacity is generally defined as the amount of existing housing units plus new housing a city can accommodate based on city zoning regulations (e.g., residential density requirements in the zoning code) and land available for new development. Residential capacity relates to residential growth allocations in a number of ways. Evaluating residential growth capacity is necessary to determine whether the housing growth allocation (determined by the

county) can be accommodated within the City of Camas and its UGA. Sufficient capacity is available if residential growth capacity is equal to or greater than the City's allocation. If sufficient capacity is not available, the shortfall must be addressed by rezoning, or revising allowable density, or by modifying or creating a new UGA or annexed area to provide additional area for residential growth capacity. The Vacant Buildable Lands Model (VBLM) for Clark County provided a basis for the available housing capacity in the City of Camas based on available buildable land (including both vacant and underutilized land) and current zoning. The existing zoning and UGA showed insufficient housing capacity.

The City of Camas is proposing zoning modifications that would allow for more residential capacity. Consequently, another analysis was completed to consider future modifications to select zones. According to the housing capacity estimates, Camas would have capacity for 5,329 housing units which would result in a surplus over the 2045 housing target of 4,226 housing units. Results (summarized below) from the updated capacity analysis show sufficient residential growth capacity to meet the 2045 housing target. The estimates depend on the final preferred alternative which could be refined further.

Summary of Housing Analysis Findings

A summary of key findings from the housing data analysis is provided below to help describe key insights to inform Comprehensive Plan policy updates (Technical Appendix provides the full findings).

Community Demographic Trends

- **Since 2000, Camas has grown at a faster rate than Clark County or Washington State overall, more than doubling in size by 2023 from 12,462 to 27,420 persons.** As population increases, the demand for housing also rises and affects planning.
- **In terms of land, Camas has expanded incrementally over time through annexations.** In the 2000's and early 2010's, the City added large new areas on the north side of Lacamas Lake, with a large portion of this area zoned for multifamily housing alongside employment and commercial areas.
- **Camas is becoming a more diverse community.** The share of people of color increased from 13% in 2012 to 24% in 2022 and is slightly more diverse than the county (21% were people of color in 2022).
- **Camas is seeing a larger share of couples and families with children (39%) and has a higher share of both groups than the County or State (24%, 22%, respectively).** The City also had a larger median household size (almost 3 persons) compared to the county (2.65 persons).
- **Median household income in Camas is higher than both Clark County and the state at $133,000 in 2022.** Adjusting for inflation, median income in the City still increased by 31 percentage

points since 2012 which is primarily due to growth in high-income households earning over $100,000 per year.[6]

- **Four out of five households in Camas owned their homes in 2018-2022, at a higher rate than either Clark County or Washington.** The share of renter households stayed the same in Camas since 2012, showing less than a 1% increase over this time period.
- **County-level trends indicate that homeownership disparities exist for some groups by race and ethnicity in Clark County,** with households who are Black or African American, American Indian or Alaska Native, Native Hawaiian or Pacific Islander, Hispanic or Latino, or mixed/other races having lower rates of homeownership.
- **At the County level, income levels also vary by race and ethnicity.** Households who were Black or African American, Native Hawaiian or Pacific Islander, Hispanic or Latino, two or more races, or another race had lower median household incomes than the overall average.
- **Overall levels of housing cost burden are decreasing, but more renters and low-income households experience higher rates.** Around 24% of all Camas households experienced cost burden (2022) with a higher share of renter households experienced cost burden compared to homeowners and with 100% of households earning less than $20,000 experienced severe cost burden (paying at least half of their monthly income towards housing). Although cost burden is generally lower for homeowners, more people of color in Camas who own their homes experience cost burden compared to white, non-Hispanic homeowners.

Existing Housing Inventory

- **Camas has seen growth in their number of housing units in the past two decades,** with a 108% change between 2000 and 2023 (annually this equates with an average of 221 new homes). The City of Camas' growth in housing units was lower than its population change (120%), indicating that the City has not been keeping pace by adding to its supply to meet the rising demand.
- **Camas has steadily low vacancy rates for all housing units in total** (4% in 2022 with little change over the last decade). This level of vacancy is indicative of a healthy housing market with natural rates of turnover; however, the slight decrease could begin to indicate constrained supply of housing.
- **For two-bedroom multifamily units, Camas has seen spikes in vacancy, but these align with new construction trends** which can temporarily raise vacancy rates for newly delivered units but do not indicate long-term vacancy. In 2023, the City saw over 200 new housing units delivered, likely accounting for the fluctuation in vacancies, as well as deliveries in 2017 and 2020.
- **Since 2015, the City has permitted 2,763 new housing units.** Single detached homes have accounted for the largest share (70%) of new permits in the City of Camas, and another 8 percent

[6] The median income in Camas is above the area median income (AMI) for 2023. HUD determined the AMI to be $114,400 for a family of four in the Portland-Vancouver-Hillsboro, OR-WA MSA (including Camas). This is lower than median income in Camas itself which was $133,000 in 2022 (Exhibit 14) and has been consistently lower than the City over time.

were made up of attached townhomes. While apartments, condos, and units in mixed-use buildings made up 20 percent of new permits between 2015-2024, middle housing types like duplexes, triplexes, quadplexes, and accessory dwelling units (ADUs) were only 2 percent of all permits.

- **Median home sale prices in Camas has increased over the last ten years,** with Camas' average prices generally remaining higher than the County. In 2023, the average home sale price in the City was **$704,000,** increasing by 119% since 2013 which is more expensive than the average home in the City of Portland (by $196,000) or Clark County (by $173,000).
- **Prices are also increasing quickly in Camas and Clark County for the average 2-bedroom multifamily rental.** The average 2-bedroom apartment rent was over $1,800 in the City and over $1,700 in Clark County (2024 year-to-date), indicating a 35% increase since 2010. Average 2-bedroom multifamily rents in Portland tracked closely with Camas in the 2010's, while rents in Vancouver remained lower (generally following countywide trends).
- **Compared with home sale price and rent increases in Camas, only households earning over 150% or more of AMI would be able to afford the average home in the City as of 2023.** However, the average 2-bedroom apartment is still affordable to households between 50 and 80% AMI in Camas.
- **The City of Camas had 98 units of regulated affordable housing in 6 buildings** according to data from Oregon Metro and the City. Approximately half of these units are affordable respectively for residents between 30-50% of AMI and 50-80% of AMI. The City also has several long-term care residential facilities for older adults providing 135 units.

Future Housing Demand

- **Since 2000, Camas has grown at a faster rate than Clark County overall but is expected to slow based on County estimates for 2045.** The County's projections assume that new population growth in Camas is estimated to grow at an annual rate of 1.2% to account for 4.05% of county growth.
- **County allocations show the need for 4,226 new housing units in Camas by 2045, adding around 211 new housing units per year.**
- **The City would add about 331 new units to meet the new permanent supportive housing target and 1,766 units affordable to low-income households below 80% of AMI by 2045.**
- **Camas residents with disabilities may require additional housing features for accessibility.** Around 8% of residents in Camas had at least one disability (2022), with the most common being cognitive difficulties, followed by ambulatory and vision difficulties. These disabilities can require housing accommodations such as zero-step entryways, ramps, lifts, or other accessibility features.

Housing Goals and Policies

Goal H-1 Citywide Housing

Promote safe, attractive, and vibrant neighborhoods with access to housing, jobs, services, schools, amenities, and healthy active living that meet the needs of all members of the community.

Policy H-1.1 Provide a range of housing choices and options to support all ages and income levels. Provide an adequate supply of land to accommodate the City's housing growth target.

Policy H-1.2 Support low impact development (LID) in residential development that minimizes both impervious areas and site grading to retain the natural contours of the land. LID strategies include conserving native vegetation, narrower streets, stormwater gardens, and other landscape practices that store and filter runoff.

Policy H-1.3 Promote the use of flexible development options (e.g., planned residential developments and development agreements) to create a variety of accessible housing types within new developments.

Policy H-1.4 Require new residential developments to demonstrate how proposed lot, street, and utility layouts can accommodate development of single-story dwellings, duplexes, and attached or detached accessory dwelling units.

Policy H-1.5 Ensure housing in mixed-use buildings (or developments) will complement the commercial and retail portion of the development and increase local living-wage jobs. Amend the municipal code to support mixed-use and middle housing development in the Downtown Subarea and near other community hubs.

Policy H-1.6 Support in-fill housing development on vacant or underutilized sites, subject to design review guidelines, that have adequate urban services. Ensure development compatibility with the surrounding neighborhood.

Policy H-1.7 Require all new housing developments to provide a range of housing types and sizes that are evaluated through the land use approval process and stipulated on the final plat.

Policy H-1.8 Support the maintenance, repair, and rehabilitation of Camas' existing housing stock by promoting resources that provide financial and other assistance to community members to maintain or repair health and safety features of their home.

Policy H-1.9 Support investment in existing neighborhoods to enhance livability, safety, and accessibility in a way that preserves unique physical character.

Policy H-1.10 Develop objective design standards to ensure new development is compatible in scale, architectural style, and landscape composition with existing and planned neighborhoods.

Policy H-1.11 Provide ongoing education and community engagement regarding Camas' housing needs, including available programs and incentives. Provide permit process support to affordable housing developers.

Policy H-1.12 Achieve and sustain the housing targets by income group allocation for Camas as adopted by the Clark County Council. Monitor and assess the City's progress in meeting housing needs at least every five years.

Policy H-1.13 Support and encourage housing legislation at the county, state, and federal levels that promotes and supports the City's housing goals and policies.

Goal H-2 Housing Choice and Affordability

Create a diversified housing stock that meets the needs of all lifestyles and economic segments of the community through new developments, preservation, and collaborative partnerships.

Policy H-2.1 Support and encourage a wide variety of housing types throughout the City to provide choice, diversity, and affordability and promote homeownership.

Policy H-2.2 Promote the preservation and rehabilitation of the City's existing affordable housing stock of all types, including low-cost rentals and

affordable owner-occupied single-family homes. Support measures that preserve affordable housing, such as home repair programs with partners to rehabilitate existing housing that serve low to moderate-income households.

Policy H-2.3 Create opportunities for ownership housing in a variety of settings, styles, sizes, and affordability levels throughout Camas.

Policy H-2.4 Provide incentives and bonuses for the development of affordable housing and middle housing. Ensure that any affordable housing built with the support of city incentives or bonuses (including, but not limited to, public funds, through development agreements, incentives, or by regulation) remains affordable for the longest possible term.

Policy H-2.5 Participate in collaborative partnerships with local and regional public and non-profit housing groups to ensure that affordable housing and supportive services are provided throughout the City.

Policy H-2.6 Encourage and support collaborations between for-profit and non-profit developers to expand affordable housing options.

Policy H-2.7 Evaluate the existing Multifamily Tax Exemption (MFTE) program provisions and participation. Consider changes and expansions to program options and associated costs and benefits that support housing production and affordable housing targets.

Policy H-2.8 Review and update the Camas Municipal Code to be consistent with State guidelines for housing and residential use.

Policy H-2.9 Plan for and accommodate Camas' allocated share of countywide future housing needs for moderate-, low-, very low-, and extremely low-income households as well as manufactured housing, multifamily housing, group homes, foster care facilities, emergency housing, emergency shelters, and permanent supportive housing.

Goal H-3 Housing Accessibility and Livability

Encourage and support a variety of housing opportunities for those with special needs, particularly those with challenges relating to age, health, or disability.

Policy H-3.1 Encourage and incentivize special needs and senior housing to be dispersed throughout the community and close to public transportation, shopping, medical clinics, and other essential services.

Policy H-3.2 Encourage, support, and work with partners, such as the Clark County Health District, that support social and health service organizations and offer programs and facilities to help persons with special needs remain in the community.

Policy H-3.3 Treat residential structures occupied by persons with disabilities the same as residential structures occupied by a family or by non-disabled unrelated individuals.

Policy H-3.4 Encourage the creation and retrofitting of senior housing and accessible housing types that allow residents to "age in place" to support aging populations and allow residents to continue living in Camas.

Policy H-3.5 Develop and implement a strategy or action plan to work with partners to secure grants and loans by agencies, private developers, and nonprofit organizations that are tied to the provision of permanent supportive housing, emergency shelter beds, transitional housing, and other housing serving at-risk populations.

Policy H-3.6 Work with other jurisdictions and health and social service organizations to develop a coordinated, regional approach to address the impacts of displacement and people at risk of becoming homeless.

Policy H-3.7 Promote the use of universal design principles for new development or redevelopment housing projects to ensure housing is designed for all people and abilities.

Goal H-4 Streamlining Permitting for Housing

Support the development of quality and sustainable housing in Camas with streamlined regulations and permitting processes.

Policy H-4.1 Periodically review and update the City's residential zoning regulations, design standards, and permitting procedures to promote quality development with timely and predictable outcomes.

Policy H-4.2 Create regulations and procedures that balance clarity and objectivity with flexibility for design innovation.

Policy H-4.3 Study the impacts of land use policy decisions and zoning code amendments and minimize the negative impacts to housing supply and affordability.

Policy H-4.4 Classify the development of middle housing and accessory dwelling units as permitted uses in lower density residential zones, consistent with the Growth Management Act.

Policy H-4.5 Review and update policies, codes, and ordinances to allow for a mix of housing types and variable lot and unit sizes in new subdivisions and development projects to promote housing choice diversity and affordability.

Policy H-4.6 Annually review the number and type of housing units built in Camas and permit timelines associated with new housing developments to inform additional changes to permitting, incentives, and housing programs.

ourCamas 2045



Natural Environment

06

06. Natural Environment

Nature in Camas

Camas has an abundance of natural areas that make it an ideal place to live. This element balances Camas' natural environment with the demands of a growing city.

Vision

Camas embraces its connection to nature and enjoys a wealth of outdoor recreational opportunities. Access to forests, clean water, parks, and trails is foundational to Camas' quality of life. The community shares a deep reverence for Camas' beauty, scenery, and tranquility, and is committed to preserving and enhancing its natural resources and tree canopy. Through proactive planning, the City mitigates the effects of changing climate conditions and natural hazards, ensuring a resilient community for generations to come.

Natural Setting

Camas is blessed with an abundance of natural areas and physical features, making it a highly attractive place for people to call home. Residents and businesses who seek an exceptional quality of life are buoyed by the natural surroundings of Camas and enjoy such amenities as Lacamas, Round and Fallen Leaf Lakes, Lacamas Creek, and the Washougal River greenway. Residents also enjoy the beauty and quiet of the open space and greenbelt network throughout the community, stitched together by the City through many decades of planning and implementation.

As envisioned decades ago and to be held in perpetuity as natural, legacy lands along Lacamas Lake, Fallen Leaf Lake, and near Green Mountain are treasured for their mature stands of evergreen and deciduous trees and offer a respite for many in the community. When people think of Camas, they think of a place that values the natural environment on par with other facets of the community. Camas is a place where stewardship of greenbelts, natural areas, and open space is an essential fiber in the fabric of the community.

Overview

The natural environment element of the comprehensive plan provides a policy framework for the identification, protection, and improvement of Camas' natural environment. Goals and policies include those for environmental stewardship, the protection of

environmentally sensitive lands (critical areas), natural areas and open space, shorelines, and landscaping and tree enhancement.

Environmental stewardship refers to the City's role as chief steward of the environment for the Camas community. A chief steward in this context means how the City, on behalf of the residents, establishes a responsible relationship between the people and the land they inhabit.

Stewardship has three prongs for the benefit of all community members. The first prong relates to compliance with the Growth Management Act (GMA) and the identification, designation, and protection of certain environmentally sensitive lands, which, in GMA, are known as critical areas. The second prong relates to the community and its steadfast approach to keeping Camas a place that balances growth with preservation of a natural areas and open space network. Camas has longed placed a premium on its open space network of environmentally sensitive lands, with or without GMA requirements. The third prong is an ethic of volunteerism and stewardship from the community's citizenry, which manifests in many ways including active volunteer groups, active boards and committees, and public involvement on issues related to the environment.

The City of Camas has preserved over 700 acres of open space across 31 sites, including forests, wetlands, riparian corridors, and steep slopes, with nearly half of this land concentrated around Lacamas Lake. These natural areas, distinct from developed parks, are managed to protect ecosystem functions, water quality, native vegetation, and wildlife habitats, while allowing for limited public access through trails and modest amenities. The City prioritizes conservation and restoration of high-value landscapes such as waterfronts, forested hillsides, and sensitive wetlands, balancing environmental stewardship with recreational use. Key efforts include protecting watercourses within three major watersheds, regulating development on steep slopes and wetlands, and maintaining resilient forest lands to support biodiversity and ecological health.

Environmental Stewardship

One of the most demanding roles the City of Camas must fulfill is that of chief steward of the community's environment while also accommodating growth. The City has the duty to implement land use policies via development regulations and the responsibility to comply with federal and state statutes related to the environment.

Facing federal and state mandates, the City strives to ensure that its environment is managed in compliance with applicable laws and does so in a wise manner. While simultaneously accommodating growth, the City encourages the preservation, restoration, and improvement of the natural environment in all development.

Goal NE-1 Environmental Stewardship

Preserve Camas' natural environment citywide by developing a sustainable urban environment and protecting natural areas and open space, including critical areas.

Policy NE-1.1 Support a cleanup of the Camas Mill and other contaminated sites to protect natural resources and the city's water supply.

Policy NE-1.2 Support programs and regulations that monitor, maintain, conserve and protect water quality in Camas, including watersheds, Lacamas Lake Basin, Columbia River Basin, and Washougal River Basin.

Policy NE-1.3 Encourage restoration and protection of natural areas through the removal of invasive species.

Policy NE-1.4 Support and implement actions identified in adopted plans, including adaptive management of natural resources that is consistent with best available science and climate guidance to improve climate resiliency.

Policy NE-1.5 Protect and restore natural resources, valuable historic and cultural areas, climate refugia, habitat areas and corridors to provide biological and hydrological connectivity that fosters resilience to climate impacts.

Policy NE-1.6 Create and support natural resource management plans that consider climate change impacts and guide adaptive management.

Policy NE-1.7 Include immediate and long-term environmental impacts in the policy and regulatory decision-making process. Identify and quantify the ecosystem services benefits of natural systems and include these natural capital assets in cost-benefit assessments for community and development planning.

Policy NE-1.8 Promote and incentivize public and private landowners to restore and create local habitats and corridors to increase the availability throughout the city.

Policy NE-1.9 Regulate land use and development to protect natural topographic, geologic, vegetative, and hydrologic features of undeveloped properties.

Policy NE-1.10 Promote soil stability and minimize and control soil erosion using best management practices, best available science, ecologically sustainable site design, natural drainage systems and protection of existing native vegetation.

Critical Areas

The natural environment includes specific environmentally sensitive areas that the GMA requires the City to identify, designate, and protect. Referred to in statute (RCW 36.70A) as *critical areas.* Under GMA, critical areas include wetlands, critical aquifer recharge areas, frequently flooded areas, geologically hazardous areas, and fish and wildlife habitat conservation areas. Each of these critical areas is present in the City. The law further requires that the City use best available science (BAS) when developing policies and regulations to designate and protect critical areas. GMA also recognizes that salmonids (salmon and trout) play an important role in the ecosystem and are vital cultural and economic resources, which require jurisdictions to give 'special consideration to conservation and protection measures necessary to preserve or enhance anadromous fisheries'.

Functions of Critical Areas

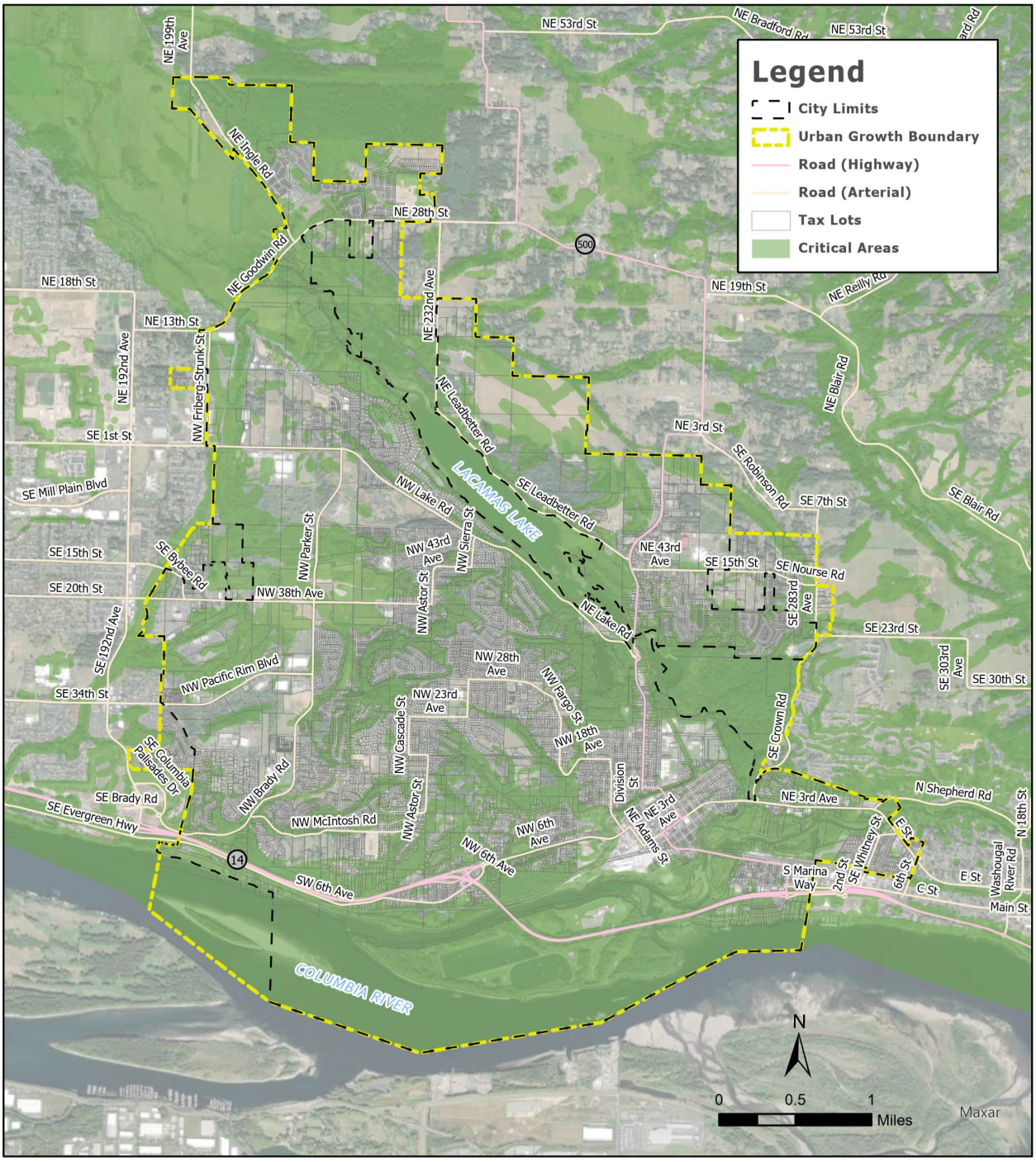
Critical areas perform key functions that enhance the environment and protect us from natural hazards. The beneficial functions and values that critical areas provide include, but are not limited to, water quality protection and enhancement; fish and wildlife habitat; food chain support; flood storage, conveyance, and attenuation of flood waters; groundwater recharge and discharge; drinking water quality and quantity; erosion control; protection from natural hazards; historical, cultural, archaeological, and aesthetic value; and recreation. Identifying the functions and values of local critical areas is essential to defining the purpose of a critical areas protection program.

Each type of critical area performs different functions and each community assesses the values of the critical areas in its environment differently. Therefore, the purpose of protecting critical areas is unique for each community. Critical areas protection is necessary to protect the public's health and safety and is essential to comply with state laws in Washington. It may also provide compliance with federal laws for such things as water quality and endangered species. There are also economic reasons to protect critical areas. For example, protection of drinking water quality and quantity supports sustainable growth, and critical areas support resource industries, such as salmon and other fisheries.

Critical areas are environmentally sensitive and hazardous areas that the State and City have identified for certain development considerations or restrictions to protect their functions and values, while allowing for reasonable use of property. Critical areas protection is regulated through the Camas Municipal Code (CMC) Title 16, which identifies five types of critical areas: wetlands, fish and wildlife habitat conservation areas, geologically hazardous areas (steep

slopes, erosion hazard areas, and seismic hazard areas), critical aquifer recharge areas (CARAs), and frequently flooded areas.

Figure 5 6Critical Areas



Wetlands

Wetlands are defined as those areas, designated in accordance with the approved federal wetland delineation manual and applicable regional supplements, which are inundated or

saturated by surface or ground water at a frequency and duration, and under normal circumstances do support, a prevalence of vegetation adapted for life in saturated soil conditions. Wetlands in the community are generally located in and around the Grass Valley area in west Camas, Lacamas Lake, Lacamas Creek, and the Washougal River greenway. The largest mapped wetland is located around the south end of Lacamas Lake, identified as lake habitat. NWI does not identify mapped wetlands in downtown Camas.

Critical Aquifer Recharge Areas

Critical aquifer recharge areas (CARAs) are those areas with a critical recharging effect on aquifers used for potable water, including areas where an aquifer that is a source of drinking water is vulnerable to contamination that would affect the potability of the water, or is susceptible to reduced recharge. The quality and quantity of groundwater in an aquifer is inextricably linked to its recharge area. To determine the threat to groundwater quality, existing land use activities and their potential to lead to contamination should be evaluated.

The goal of establishing CARAs is to protect the functions and values of the community's drinking water supply by preventing pollution and/or contamination of the supply directly or recharge areas indirectly.

Frequently Flooded Areas

Floodplains and other areas subject to flooding perform important hydrologic functions and may present a risk to persons and property. Classifications of frequently flooded areas should include, at a minimum, the 100-year floodplain designations of the Federal Emergency Management Agency (FEMA) and the National Flood Insurance Program (NFIP), known as the 'special flood hazard area', which is defined further as having a special flood, mudflow, or flood-related erosion hazards and shown on Flood Insurance Rate Maps (FIRM), which also includes the regulatory floodway.

Geologically Hazardous Areas

In the physical context of Camas, geologically hazardous areas include areas susceptible to erosion hazard, seismic hazard, mine hazard, and other geological events. Geologically hazardous areas in Camas include severe erosion hazard areas adjacent to Lacamas Lake, north of the Columbia River, and to the east along the Washougal River.

Fish and Wildlife Habitat Conservation Areas

Fish and Wildlife Habitat Conservation Areas (FWHCAs) are critical ecological zones that support essential habitats and species necessary for maintaining ecosystem integrity and biodiversity. These areas may include rare ecosystems, high-density wildlife zones, breeding and migration corridors, and habitats for endangered or sensitive species. Their designation plays a key role in guiding land use planning, urban growth boundaries, and conservation strategies. FWHCAs must be identified using the best available science, considering factors such as habitat connectivity, human activity levels, riparian and salmonid protection, and the impact of

surrounding land uses. Buffer zones are also recommended to minimize conflicts between development and habitat preservation.

Aquatic and Riparian Habitat

Fish and wildlife habitat conservation areas in Camas include habitats for state or federally listed endangered, threatened, or sensitive species, as well as areas associated with state priority species identified by the Washington Department of Fish and Wildlife. These areas encompass naturally occurring ponds under twenty acres, classified state waters, and water bodies stocked with game fish by governmental or tribal entities. Key aquatic habitats in Camas include the Columbia and Washougal Rivers, Lacamas Creek, Camas Slough, Lacamas Lake, and various streams, ponds, and wetlands, all often bordered by riparian zones. Lacamas Lake is the largest aquatic habitat in the city aside from the Columbia River system.

Terrestrial Habitat

Terrestrial habitats in Camas, like aquatic ones, include areas supporting state or federally listed endangered, threatened, or sensitive species, as well as state priority species identified by the Washington Department of Fish and Wildlife (WDFW), State Natural Area Preserves, and locally important habitats. Locally designated habitats include Oregon white oak trees and stands, and Camas lily fields of specific sizes. While much of the city is mapped as "cave rich" by WDFW, actual cave presence is limited, though caves are considered a priority habitat feature. The Camas biodiversity corridor, which includes mature timber and sightings of Vaux swifts, runs through parts of the city. Oak woodland habitat is primarily found near Lacamas Lake, and the northern part of Camas including the Lacamas Prairie Natural Area Preserve, which protects rare Willamette Valley wet prairie habitat and several endangered plant species, including Bradshaw's lomatium.

Critical Areas Goals & Policies

Preserve, maintain, and restore the City's critical areas to protect their function and value.

Policy NE-2.1 Use best management practices and best available science to preserve, protect, and restore the biological health and diversity of Camas' critical areas.

Policy NE-2.2 Preserve and restore aquatic and riparian habitats consistent with applicable regulations.

Policy NE-2.3 Preserve and avoid development of areas with endangered, threatened, and sensitive species and species of local importance as required by local, state, and federal laws.

Policy NE-2.4 Ensure that development throughout the City meets or exceeds standards and practices for long-term wetland protection and mitigation.

Shorelines

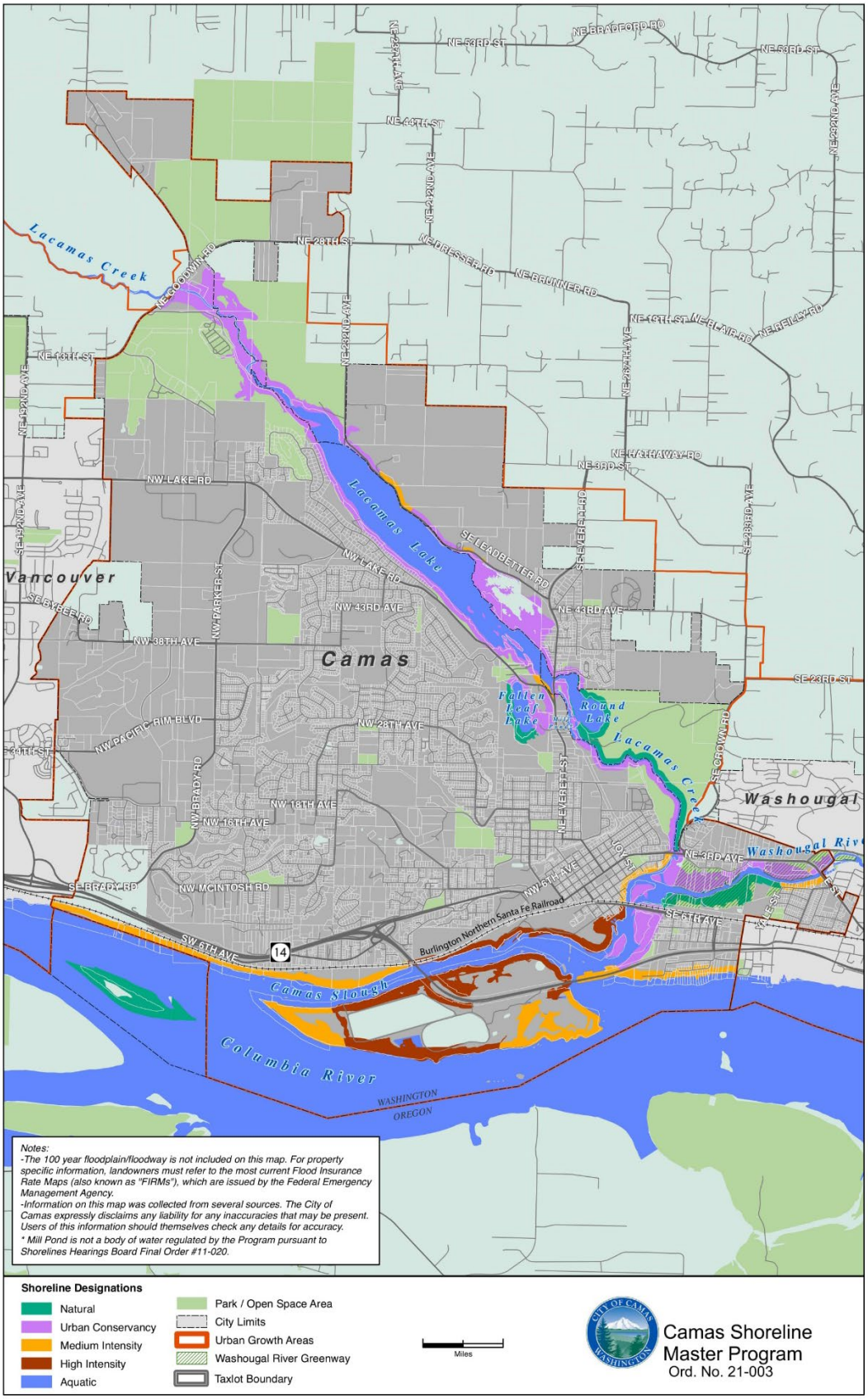
Overview

The Shoreline Management Act, enacted in 1972, created a collaborative framework between Washington State and local governments to manage and protect shorelines. Under this law, local jurisdictions are required to develop Shoreline Master Programs (SMPs) tailored to their specific needs.

Camas encompasses 946 acres of shoreline across 26 miles, including areas along Lacamas Creek, several lakes, and the Columbia and Washougal Rivers. The SMP outlines strategies to minimize flood risks, enhance recreational opportunities, and ensure sustainable shoreline use through voluntary programs and regulatory measures.

To guide development and conservation, Camas assigns specific shoreline designations based on land use, ecological characteristics, and community vision. These designations—Aquatic, Natural, Urban Conservancy, Medium Intensity, and High Intensity—are aligned with state guidelines and the city's comprehensive plan. Each designation comes with tailored policies and development regulations, such as height and setback limits. For example, High Intensity areas support industrial use, while Natural areas prioritize ecological preservation. These designations help ensure that shoreline development aligns with environmental protection and long-term community goals.

Figure 7 Shoreline Map



Shoreline Goals and Policies

Goal NE-3 Shorelines

Use the full potential of shoreline in accordance with the opportunities presented by their relationship to the surrounding area their natural resource values, and their unique aesthetic qualities offered by water, topography, and views. Develop a physical environment that is both ordered and diversified, and which integrates water and shoreline uses while achieving a net gain of ecological function.

Policy NE-3.1 Adopt the goals and policies as outlined in the current Camas Shoreline Master Program.

Landscape Enhancement and Tree Preservation

The natural landscape and existing tree cover are important aspects of Camas' natural environment. Native, mature landscaping and trees contribute to the City's ecological health, supply valuable animal habitat, and enhance the community's natural beauty.

Goal NE-4 Landscape Enhancement and Tree Preservation

Preserve existing natural landscapes and tree canopy. Support opportunities for increasing native and climate resilient landscaping and tree canopy.

Policy NE-4.1 Develop and implement a program to prioritize retention of existing trees and planting of new trees within development sites to maximize cooling and energy savings. Encourage planting of hardy and climate resilient native trees.

Policy NE-4.2 Develop an urban forestry program that articulates a long-term strategy for future-proofing the City's tree canopy, including actions for tree protection, management, education, and collecting and maintaining data on citywide tree canopy.

Policy NE-4.3 Require the use of native and climate resilient plants in residential, commercial, and industrial landscapes to support the implementation of low impact development.

Policy NE-4.4 Develop and implement a program to mitigate and compensate for tree canopy loss when retention of mature trees within development sites is impractical.

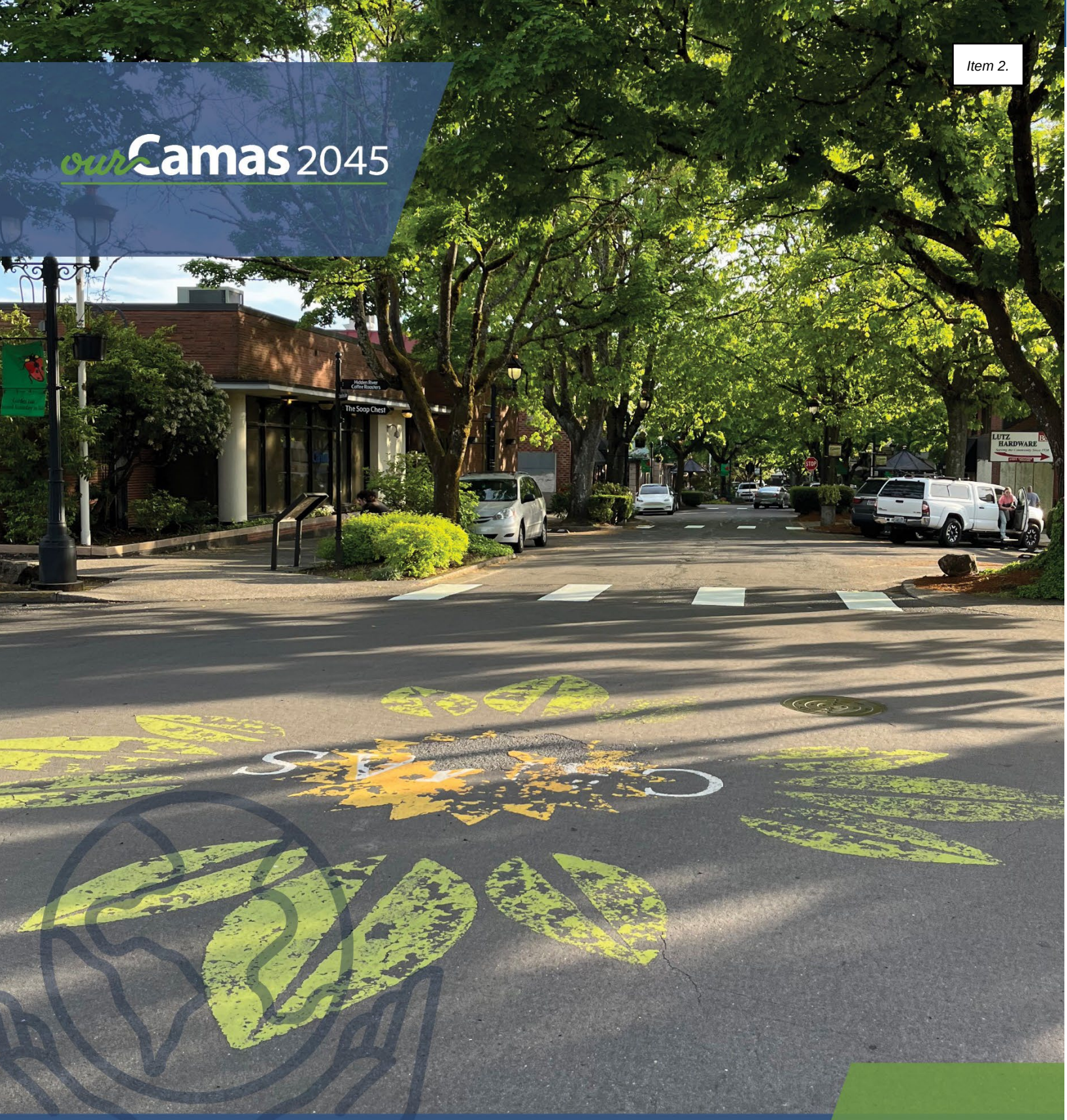
Policy NE-4.5 Develop and implement a program to prioritize retention of existing trees and planting of new trees within development sites to maximize cooling and energy savings. Encourage planting of hardy and climate resilient native trees.

Policy NE-4.6 Develop an urban forestry program that articulates a long-term strategy for future-proofing the City's tree canopy, including actions for tree protection, management, education, and collection and maintaining data on citywide tree canopy.

Policy NE-4.7 Require the use of native and climate resilient plants in residential, commercial, and industrial landscapes to support the implementation of low impact development.

Policy NE-4.8 Develop and implement a program to mitigate and compensate for tree canopy loss when retention of mature trees within development sites is impractical.

ourCamas 2045



Climate Change & Resliency

07

07. Climate Change & Resiliency

Community Impacts from Climate Change

Climate hazards (i.e., natural hazards exacerbated by climate change) of the highest concern and priority are extreme heat and precipitation. Camas can address anticipated impacts by reducing GHG emissions and building community resiliency.

Vision

In 2045, Camas has proactive plans to reduce greenhouse gas (GHG) emissions and mitigate the effects of changing climate conditions and natural hazards, ensuring a resilient community for generations to come. The most vulnerable communities are protected, and climate planning contributes to improvements in community health and well-being.

Introduction

The City developed this climate change and resiliency element consistent with House Bill 1181, signed into law in 2023. This new state law integrates climate planning into Washington's GMA and requires cities and counties to include a climate element in their comprehensive plans.

Climate change refers to long-term shifts in temperatures and weather patterns. The burning of fossil fuels and other human activities are increasing emissions of greenhouse gases (GHGs) that trap heat in the atmosphere and contribute to global and local climate change. Negative effects include impacts on the community caused by natural hazards that are exacerbated by climate change (e.g., the increased frequency and severity of drought conditions). Natural hazards are also referred to as "climate hazards" in this element as climate change is anticipated to affect the frequency and intensity of natural hazards.

The purpose of this climate element is twofold: to reduce contributions to climate change (i.e., GHG emissions) and to build community resilience to climate change.

To support these two overarching goals, the City formed a Climate Policy Advisory Group (CPAT) to advise on the creation of this new element. The 17 CPAT members included community members, City staff, City Council and Planning Commission liaisons, and representatives from the Port of Camas-Washougal, Clark Public Utilities, NW Natural, and the Camas School District. CPAT members held five meetings between early 2024 and early 2025.

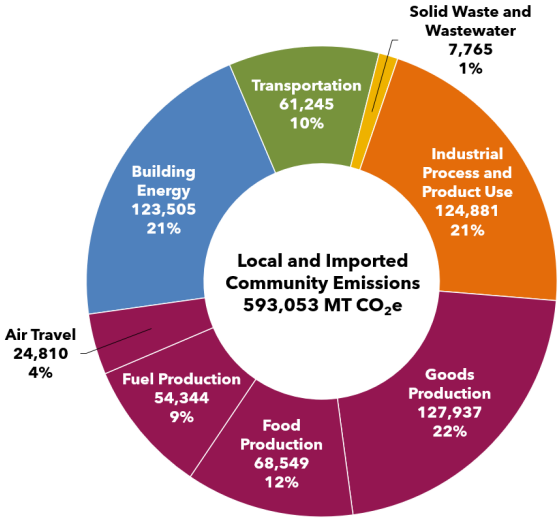
The CPAT was instrumental in the identification and development of climate goals and policies.

Climate Overview

Greenhouse Gas Emissions

The GHG reduction subelement identifies actions to reduce GHG emissions and decrease per capita vehicle miles traveled (VMT). One of the requirements of the GHG reduction subelement is to meet the GHG reduction requirements in RCW 36.70a.070(9)(d), including reducing per capita VMT within Camas but without increasing GHG emissions elsewhere in the state. To identify actions for VMT reduction, Clark County worked with local cities to prepare a VMT study and travel market assessment to understand baseline travel patterns and strategies for VMT reduction. According to the VMT study, data from the Highway Performance Monitoring System shows that the city's estimated per capita VMT, which represents the average weekday VMT within Camas divided by the city's population, is 11.1. The travel market assessment identified key travel destinations in the city for short trips (i.e., trips 3 miles or less), showing that areas near Lacamas Lake, Camas high school, and Downtown Camas are popular destinations. Both assessments will help inform a regional target for VMT, which will be established outside the climate element/comprehensive plan framework. In addition to VMT reduction, Clark County's Countywide Planning Policies establish requirements for cities to reach net-zero emissions by 2050 (14.1.2) in alignment with statewide GHG emission reductions (RCW 70A.45.020(1)) and set interim (5-year) objectives or targets (14.1.4). A GHG inventory for Camas was also prepared to inform GHG reduction strategies. The inventory provides an estimate of the city's carbon footprint from local emissions (building energy, transportation, solid waste and wastewater, and industrial process and product use) and imported emissions (consumption of goods). Figure 8 Camas Emissions, 2022 shows the combined and per capita emissions for the city.

Figure 8 Camas Emissions, 2022



With a population of 27,250, all 2022 GHG emissions combined (local and imported) for City of Camas totaled

593,035 MT CO_2e

21.8 MT CO_2e Per Capita

Local emissions include sector-based emissions that are generated within Camas. Imported emissions are generated outside of Camas to produce and provide the goods, food, services, air travel, and production of transport of fuels consumed by households. Additionally, wildfires have become one of the largest sources of carbon emissions in Washington state. From 2014 to 2018, wildfires in the state generated 39,200,000 MT CO_2e.

Figure 9 Local and Imported Emissions in Camas

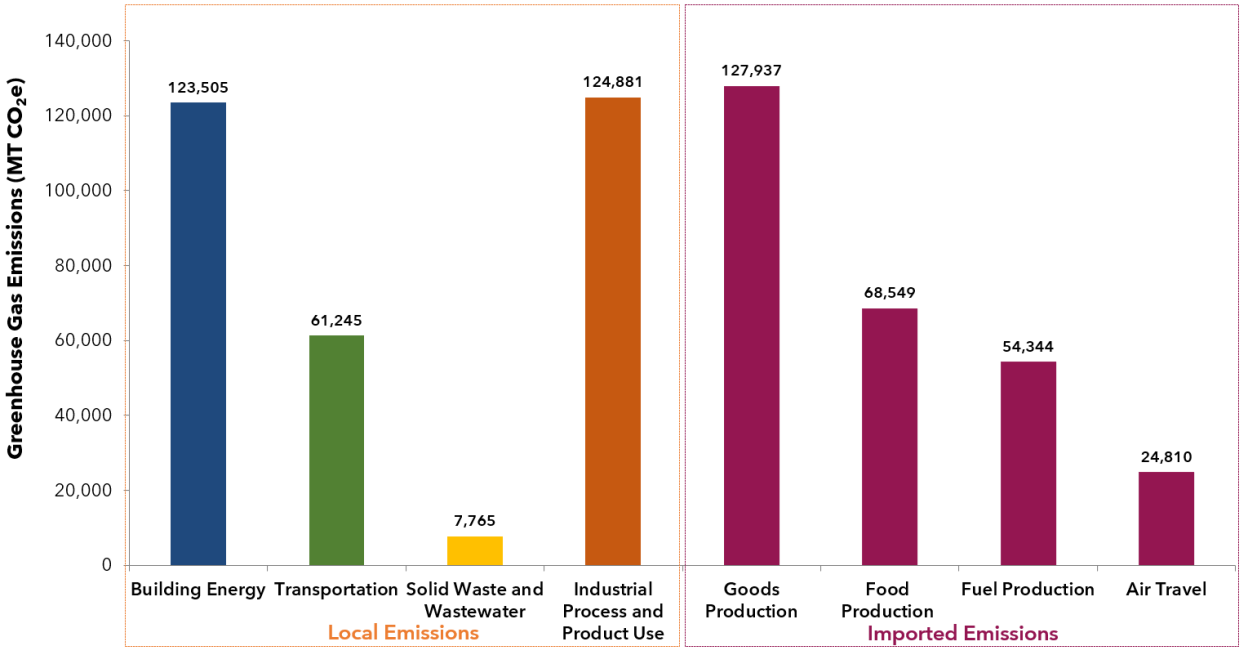


Figure 9 shows a breakdown of the sources of local and imported emissions in Camas. Most sources of local emissions include **industrial process and product use** and **building energy**, which accounts for **78%** of local emissions. Emissions from the industrial process and product use sector generally involve facilities with silicon semiconductor manufacturing. While emissions from these facilities contribute to a large share of local emissions, demand for these goods is global and not specific to Camas. Therefore, goals and policies target reducing local emissions and support existing GHG reduction strategies or targets that are being implemented by businesses and industries in Camas.

Climate Resiliency

Community resiliency is the ongoing process of preparing for, anticipating, and responding to natural hazards created or aggravated by climate change.

Natural hazards relevant to Camas are identified in the 2023 Clark County Natural Hazard Mitigation Plan (NHMP) (CRESA 2023). Table 3 Natural Hazards in Camas lists hazards of concern in order of ranking and their priority, which were evaluated as part of the risk assessment in the NHMP. The risk rating reflects the probability of a hazard weighted against its potential impact on people, property, and the economy. The table also shows the projected climate impacts for each hazard and how hazards have affected the community in the past.

Table 3 Natural Hazards in Camas

Natural Hazard (NHMP Rating[7])	Projected Changes by 2050[8]	Effects on the Community[9]
Extreme Heat (High)	40+ days per year that feel hotter than 90 degrees.	Increased demand for air conditioning, higher utility bills, heat-related illness for sensitive populations and youth at school playgrounds and sports fields, disruption of outdoor activities.
Extreme Precipitation (High)	12% increase in total annual precipitation	Overflowing of streams or rivers, unsafe driving and walking conditions.
Landslide (Medium)	13% increase in heavy rain events	Physical damage to residential and commercial property, energy infrastructure, communication infrastructure, and transportation infrastructure.
Flood (Medium)	17% increase in peak streamflow in Washougal River	Property damage, particularly for older buildings and low-income housing near the floodplain, and temporary or permanent displacement. Temporary closures of businesses and other services.
Wildfire (Medium)	9+ days per year that have high fire danger	Wildfire smoke can impact human health, particularly people with respiratory illnesses or diseases. Increased health risks and property damage for communities near the wildland-urban interface[10].

[7] 2023 CRESA Regional Natural Hazard Mitigation Plan Volume 2 – Planning Partner Annexes
[8] University of Washington's Climate Mapping for a Resilient Washington webtool. Projections are based on a "business as usual" emissions scenario.
[9] Includes effects identified by the Camas community in a 2025 survey.
[10] Clark County Code (15.13.030) defines the wildland-urban interface as areas with elevation in excess of 500 feet and one or more of the following conditions: (a) slope equal to or greater than 25%, (b) forest type vegetation, and (c) outside of an organized fire protection district.

Drought (Low)	14% decrease in summer rains	Impacts to water quality and quantity, decrease in habitat quality and quantity for salmon and other aquatic species.

Vulnerability

Vulnerable Communities

Climate change can impact certain groups of people (vulnerable populations) and areas of the city (overburdened communities) differently. Vulnerable populations are groups of people who are more vulnerable to environmental harms due to socioeconomic factors and other health risk factors (RCW 70A.02.010(14)). Overburdened communities are areas where vulnerable populations experience environmental harms and health impacts (RCW 70A.02.010(11)). Together, vulnerable and overburdened communities are disproportionately impacted by climate change due to the concentration of environmental harms (e.g., air pollution near major roadways) and socioeconomic characteristics (e.g., low income, youth and children). People and communities in Camas who are vulnerable to climate hazards are generally described in the *Our Camas 2045* Equity Framework (see **Introduction** for a description of Equity Communities in Camas).

In addition to communities described in the Equity Framework, CPAT members identified additional communities that could be more vulnerable to climate hazards. These communities include areas that are located near floodplains (such as Lacamas Lake and the Columbia River), near mobile sources of air pollution (such as major roadways), near steep slopes and steep road grades, and/or near the wildland urban interface (e.g., homes adjacent to forested areas).

Vulnerable Assets

In Camas, the impact of climate hazards can depend on the proximity of people and buildings to each hazard. The approximate location of these hazards is shown in Figure 10 Wildfire Hazard Areas and Figure 11 Flood and Landslide Hazard Areas. Climate hazard locations are based on data from publicly available sources such as Clark County's Open Data Hub and include approximate areas of increased risk. While this information provides a visualization of higher risk areas, data may not include all potential risks and data gaps may exist depending on when data was published. Therefore, these figures provide a conceptual understanding of the location of climate hazards and potential effects on the community.

Figure 10 Wildfire Hazard Areas

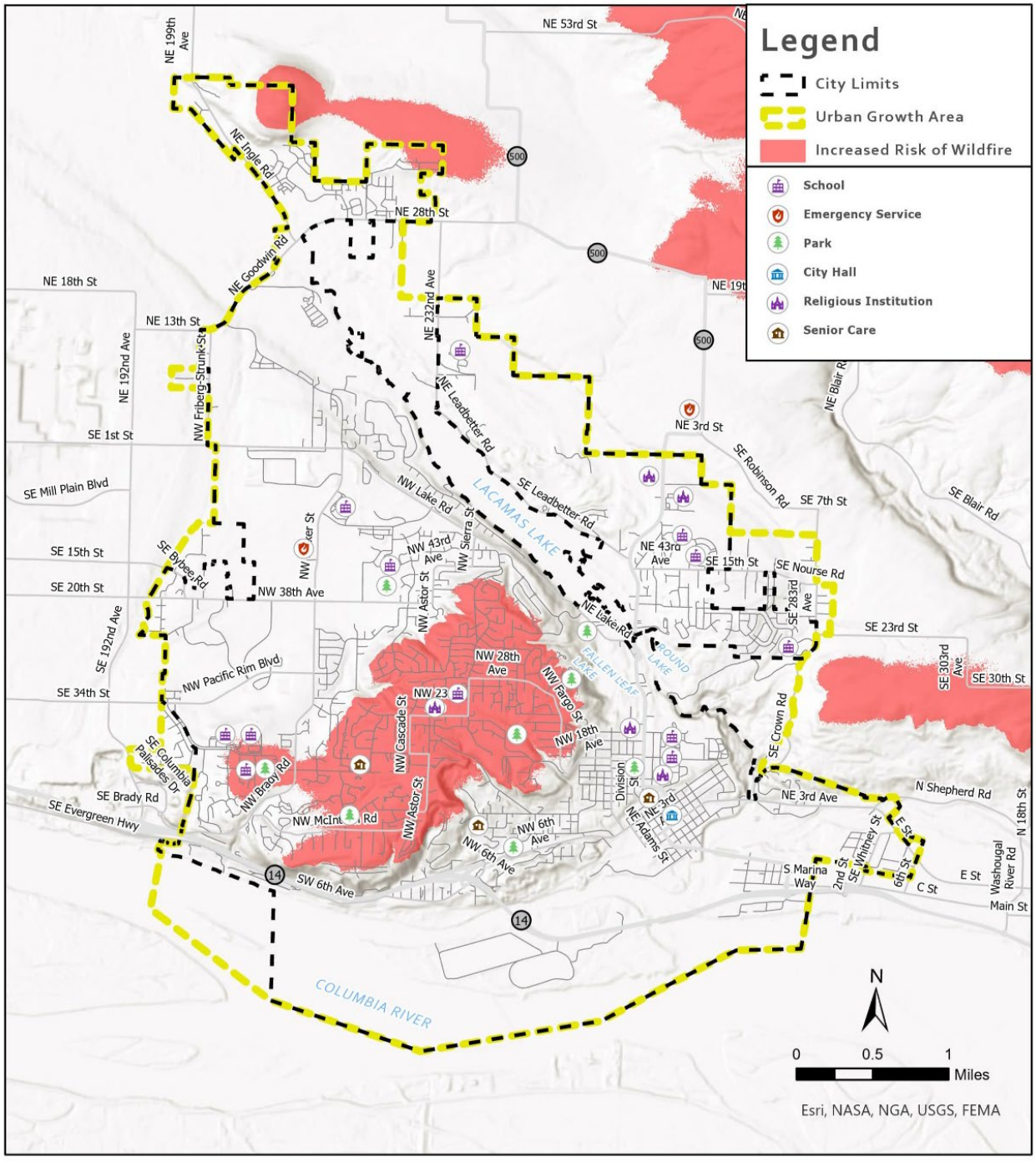
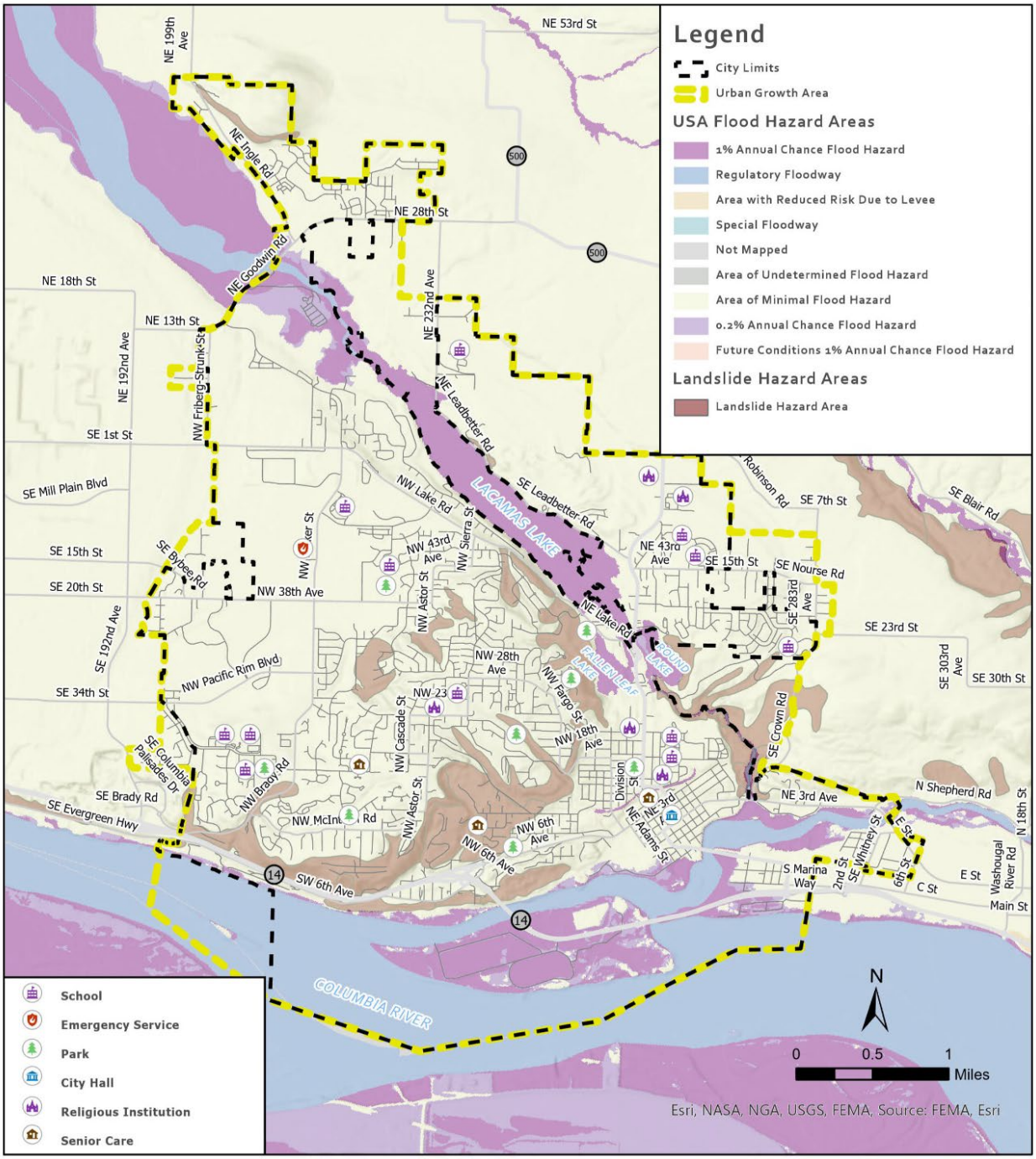


Figure 11 Flood and Landslide Hazard Areas



In Camas, buildings and infrastructure that could be vulnerable to climate hazards include aging water and sewer lines, buildings constructed before adopted seismic codes (e.g., city hall, public works operations center), and high-pressure natural gas lines. High tension power lines may also be vulnerable to severe storms (i.e., wind and ice), homes along the Washougal and Columbia Rivers, including the Georgia Pacific paper mill, may be susceptible to flooding, and the dam at Lacamas Lake could be impacted by an earthquake or flooding.

Extreme heat is one of the highest rated hazards for Camas. Buildings and impervious surfaces such as streets are factors in the urban heat island effect, where urban areas are warmer than surrounding rural or less developed areas. The County's department of public health collected heat data on one day in July 2024 and prepared a heat watch summary report describing how urban heat varies across neighborhoods in the county and how landscape features affect temperature and humidity. Across the county, areas with more buildings and paved surfaces tend to be hotter during the afternoon and evening. In Camas, the hottest areas of the city during the afternoon and evening are near Downtown Camas while cooler areas with more vegetation and shade are in west Camas, northeast of downtown, and near Lacamas Lake.

Vulnerability Assessment

A vulnerability and risk assessment prepared for Camas evaluated the risk of extreme heat on outdoor recreation sites, including (1) Lakes, (2) Parks & Trails, (3) School Playgrounds & Sport Fields, and (4) Downtown Camas. Both vulnerability (sensitivity and adaptive capacity) and risk (probability and magnitude) were evaluated.

The assessment produced composite scores for vulnerability and risk. For the lakes, Lacamas Lake and Round Lake scored high and Fallen Leaf Lake scored low. Under parks and trails, seven scored low, two scored medium, and 11 scored high. School playgrounds and sports fields scored medium (6) and high (6). Lastly, Downtown Camas scored high as it features the hottest area of the city.

To reduce vulnerability and risk, this element includes policies to mitigate the impacts of extreme heat.

Climate Change and Resiliency Goals and Policies

Climate goals and policies are established to meet the State's vision to reduce greenhouse gas emissions, plan for resilience, and support environmental justice. While these goals and policies directly focus on emissions and resiliency, additional policies in other elements of the plan tangentially support these goals. Those policies are noted with a leaf symbol.

Goal CL-1 Energy

Ensure that development and redevelopment projects, including buildings and energy infrastructure (generation, storage, and transmission) are designed to accommodate and use renewable energy, conservation, and efficiency technologies and practices to reduce GHG emissions and increase resiliency to natural hazards.

Policy CL-1.1 Support residents' efforts to improve energy efficiency and resiliency in existing and new residences.

Policy CL-1.2 Encourage renewable energy sources for new and existing buildings.

Policy CL-1.3 Provide commercial buildings, particularly restaurants and food services, with incentives to retrofit buildings for energy efficiency (e.g., grant programs, reduce permit fees, etc.).

Policy CL-1.4 Incentivize and streamline the review process for renewable resource projects.

Goal CL-2 Transportation

Improve the efficiency and resiliency of the transportation system to achieve GHG reduction goals and better withstand natural hazards.

Policy CL-2.1 Promote and complement state and utility incentives to provide electric vehicle charging infrastructure throughout the city, particularly at existing and new multi-family buildings and large employers.

Policy CL-2.2 Provide homeowners and renters information on state and federal tax credits/rebates for electric vehicles, renewable resources and energy efficiency.

Policy CL-2.3 Incorporate projected hydrologic climate impacts into the design and maintenance of water-crossing structures (e.g., climate-smart culverts and bridges).

Goal CL-3 Local Agency Sustainability and Preparedness

Support agencies, districts, and businesses in establishing and achieving their own sustainability goals, initiatives, and programs.

Policy CL-3.1 Support the sustainability initiatives of local agencies, districts, and businesses.

Policy CL-3.2 Support local businesses efforts to bolster climate preparedness and continuity of operations (e.g., develop on-site electricity storage to reduce energy demand during peak hours, incentives to install backup power, building retrofits).

Policy CL-3.3 Support the local economy's resilience to climate disruptions by providing information and resources on how to prepare for extreme heat, flooding, and wildfire.

Policy CL-3.4 Support economic opportunities for green jobs in Camas, including businesses that produce goods or services that benefit the environment and jobs that support business production processes to be more environmentally friendly or use fewer natural resources.

Policy CL-3.5 Develop a sustainable purchasing policy and sustainable construction standards for the City of Camas.

Goal CL-4 Community Health

Protect community health and well-being from the impacts of climate-exacerbated hazards and ensure that the most vulnerable residents do not bear disproportionate health impacts.

Policy CL-4.1 Promote the use of health impact assessments and other tools to identify and address the impacts on health and equity from climate change.

Policy CL-4.2 Develop and implement an urban heat resilience strategy that addresses land use, urban design, urban greening, and waste heat reduction actions.

Goal CL-5 Emergency Preparedness

Enhance emergency preparedness, response, and recovery efforts to mitigate risks and impacts associated with natural hazards.

Policy CL-5.1 Create accessible evacuation plans and outreach materials to help residents plan and practice actions that make evacuation and reunification quicker and safer during a natural hazard event (e.g., notification alerts).

Policy CL-5.2 Develop a comprehensive, communitywide wildfire resilience strategy to improve emergency response capabilities, create fire-resilient landscapes, promote fire-adapted communities, and support the development of community wildfire protection plans.

Policy CL-5.3 Support enhanced data collection for hazard events of all magnitudes to provide a fuller understanding of the community's hazard characteristics.

Policy CL-5.4 Develop resiliency hubs, such as community-serving facilities that support residents, coordinate communication, distribute resources, and enhance quality of life.

Policy CL-5.5 Prepare, plan, and provide ongoing training for those responding to adverse environmental events.

Goal CL-6 Water Resources

Protect and preserve the long-term quality and quantity of Camas' water, and natural and cultural resources from climate change hazards such asdrought and extreme participation.

Policy CL-6.1 Develop and implement a comprehensive drought resilience strategy that factors in projected climate impacts and sets action levels for different drought stages.

Policy CL-6.2 Evaluate the long-term adequacy of water delivery and storage infrastructure to ensure projected changes in hydrological conditions can be anticipated and managed effectively.

Policy CL-6.3 Implement actions recommended by the Lacamas, Round, and Fallen Leaf Lakes Management Plan to reduce the frequency of harmful algae blooms in lakes due to water pollution and projected changes in climate conditions, including higher temperatures.

Policy CL-6.4 Identify funding mechanisms for mitigation measures recommended by the Lake Management Plan to address the impacts of climate hazards on Lacamas, Round, and Fallen Leaf Lakes.

Policy CL-6.5 Introduce adaptive cooling features at local parks and school playgrounds and sports fields to help mitigate the effects of extreme heat on vulnerable park users and young children.

ourCamas 2045



Transportation

08

08. Transportation

GMA Planning Goal

Encourage efficient multimodal transportation systems that will reduce greenhouse gas emissions and per capita vehicle miles traveled, and are based on regional priorities and coordinated with county and city comprehensive plans.

Vision

In 2045, residents of Camas continue to appreciate their safe transportation infrastructure that equitably serves all users.

Introduction

As part of the comprehensive plan periodic update, the City of Camas reviewed and updated its Transportation System Plan (TSP). The TSP is adopted by reference and included as Appendix X. The TSP is a long-range plan to guide transportation investments for Camas and its UGA for the planning horizon to 2045. The TSP provides the following:

- Inventory of the current transportation system for all modes of travel
- Summary of land use assumptions used for estimating travel demands
- Summary of level of service (LOS) standards
- List of actions to address deficiencies
- Forecast of traffic demand for twenty years
- System needs to meet the current and forecasted demand
- Six-year Transportation Improvement Plan (TIP)

These items are foundational to a comprehensive plan and integral to implementing the Land Use plan.

The transportation element is one of the main parts of the comprehensive plan and is an effective tool for shaping the city's future development patterns. Growth and development patterns have a major influence on the fiscal health of local governments and on the economic performance of the community. The nature of public streets can shape the level of traffic congestion, the use of multiple modes, and the character of neighborhoods. Related requirements, such as parking and loading, will influence the cost to develop in a community and can present both opportunities and barriers to how people can access homes, schools, recreational opportunities, and businesses within the community and in the region.

Ownership, control, development, and the operation and maintenance of streets and public rights-of-way are primary functions of local governments. A transportation system is one of the most expensive facilities a community will construct, operate and maintain. Each new facility adds an asset to the city's portfolio, but it also must be managed, resulting in an incremental increase in operating costs and a new set of maintenance, preservation, and rehabilitation obligations.

Decisions about transportation facilities greatly influence the safety and security of the community. How the streets, roads and other transportation facilities are designed, built and maintained will influence safety in multiple ways for all users.

Federal, state, county and city transportation systems are interrelated, so coordination with other units of government is essential. Responsibility for transportation systems spans all levels of government. The Camas transportation network connects to state highways, neighboring city streets and adjacent county roads and indirectly to federal and interstate highways. It also interacts with transportation facilities operated by other special purpose districts like C-TRAN and for-profit businesses. Moreover, the public does not experience the transportation system as a series of separate systems, but as a single, unified system, and it expects all the parts to function in an integrated fashion.

The GMA requires the transportation element to implement and be consistent with the land use element. Counties and cities should use consistent land use assumptions, population forecasts, and planning periods for both elements. Coordination of the land use and transportation elements must be dynamic and iterative with an ongoing feedback loop coordinating land use and transportation in the plan development and in local implementation. The transportation element is also required to be consistent with state and regional plans. The transportation element is certified by the regional transportation organization, which is the Southwest Washington Regional Transportation Council (RTC), to ensure consistency with the regional transportation plan (RTP).

Performance Standards

Level of Service (LOS)

The TSP includes level of service as a measure of performance standards for motor vehicles. A LOS "D" and a vehicle to capacity (v/c) ratio not higher than 0.85 is the minimum performance standard during the highest one-hour period of the day for signalized, all-way stop and roundabout controlled intersections under City jurisdiction. These standards shall be applied to the intersection as a whole.

A LOS "E" and a v/c ratio not higher than 0.90 is the minimum performance standard during the highest one-hour period of the day for two-way stop and yield controlled intersections under City jurisdiction. These standards shall be applied to all intersection approaches serving more than 20 vehicles. Mobility standards do not apply to approaches at intersections serving 20 vehicles or fewer during the highest one-hour period of the day8. This mobility standard allows

more flexibility in the tension between larger intersection and street designs that are sometimes needed to accommodate peak vehicle demands, and the desire to maintain smaller designs that encourage slower vehicle speeds and tend to be more accommodating to pedestrian and bicycle users.

Level of Service for Highways of Statewide Significance is set by the State. In Clark County, the standard is set as LOS "D" for urban areas, including SR 14. Level of Service for regional state highway facilities (not part of the HSS), including SR 500 in Camas, is set through the Southwest Washington RTC. The Southwest Washington RTC Board adopted LOS 'E' or better for non-HSS urban state highway facilities.

As part of the City's TSP update, forecasted 2045 motor vehicle volumes for peak hour conditions were utilized to determine areas on the baseline roadway network that will be congested and may require future investments to accommodate forecasted growth. The corridors recommended to prioritize for improvements include:

- SR 500-NE Everett Street between NE 23rd Avenue and SE Leadbetter Road
- NW 6th Avenue between Norwood Street and Adams Street
- NE 3rd Avenue between NE Dallas Street and SE Lechner Street

Level of Traffic Stress (LTS)

The TSP includes Level of Traffic Stress (LTS) to measure the comfort of those who are walking, biking or rolling on streets shared with vehicles. The best way to make these facilities comfortable to use while walking, biking and rolling is with space, separation, and visibility. The specific application depends on the conditions of each street. LTS is measured on a scale of one to four. A road with an LTS of 1 is best and is suitable for all users. A road with an LTS of 4 has the highest level of stress for a user and is typically used by those with a high level of confidence or those who don't have an alternative option. The TSP indicates LTS 2 is the standard, meaning streets should be comfortable for most adults, including most adults experiencing disabilities. There may be some separation between pedestrians and vehicles, though no physical barrier.

Travel Demands and Characteristics

The number of people who choose to walk, bike, ride transit, or drive alone with the distances they travel is important for assessing how well existing transportation facilities serve the needs of users. Available data on travel demand, travel mode choice, and trip length are used to better understand travel behavior in the community and inform the needs analysis for the transportation system. This data is largely derived from the US Census Bureau on employment-based trips; however, no other travel data is available from this source. The following sections provide a summary of travel demands and characteristics in the City's planning area.

Commuter Trips

Much of the traffic in the Camas planning area, especially during the more congested weekday peak periods, is related to employment. In other words, how do people get to and from work

from their place of residence. People who live in Camas and who are employed overwhelmingly commute to work outside of the planning area (87 percent), while jobs in the planning area are overwhelmingly filled by people who live outside of the planning area (83 percent).[11]

In terms of the predominant travel mode, on average, almost 75 percent of employed residents in the Camas planning area commute to work using single-occupant motor vehicles. About 8 percent of residents carpool to work and the remaining 17 percent work from home, walk, bike, take transit, or use some other means of travel[12].

About 11 percent of employed residents in the Camas planning area worked from home pre-COVID, and that figure likely increased due to COVID-19. It seems likely that a higher percentage of workers will continue a hybrid work schedule that includes teleworking, at least part time. Any increase in the hybrid work week (e.g. 2-3 days in an office with the balance at home or some other remote location) will change the demand on the transportation network, including when and how people travel.

Transportation Demand by Mode

Pedestrian, bicycle, and motor vehicle traffic counts were conducted at key intersections throughout Camas on typical weekdays[13]. This information indicates where and when travel demand is highest for each mode of travel. It also provides a basis for assessing how well existing transportation facilities are able to meet the needs of users during peak demand periods.

- Pedestrian volumes during the PM peak hour are generally highest near downtown Camas, including along NE 3rd Avenue and NE Adams Street (the traffic count summary is included in the appendix). The highest hourly pedestrian activity during the evening peak occurred at the NW Sierra Drive intersection with NW 28th Avenue, near Dorothy Fox Elementary school, with 30 pedestrian crossings in the one-hour period. Other study intersections with more than 15 pedestrian crossings during the one-hour period included many downtown locations such as NE 6th Avenue at NE Adams Street, NE 3rd Avenue at NE Dallas Street, NE 3rd Avenue at NE 4th Street, and Weir Road at NE 3rd Avenue, near the border of Camas and Washougal.
- Bicycle volumes indicate limited biking, with the highest volumes along NW Lake Road, and NW Sierra Street (the traffic count summary is included in the appendix). During the evening peak hour, 20 of the 50 study intersections had no observed bicyclists during the one-hour period. The NE Lake Road at SR 500, NW Lake Road at NW Sierra Street, NW Lake Road at NW Leadbetter Drive, NW Sierra Street at NW 45th Avenue, and NE 6th Avenue at NE Garfield Street intersections had the highest observed bicycle volumes, with 4 or more bicyclists counted during the single hour at each of the intersections.

[11] US Census Bureau, OnTheMap. Home/Work Distance/Direction Analysis, 2015.
[12] US Census Bureau, 2012-2016 American Community Survey
[13] Based on counts conducted in April of 2018.

- Motor vehicle volumes on the roadways in Camas (the traffic count summary is included in the appendix) most commonly peak during weekday evenings between 4:50 and 5:50 p.m. The highest hourly motor vehicle volumes during the evening peak occurred along the NW 6th Avenue corridor between the SR 14 ramps and NE Adams Street, with more than 1,300 trips during the one-hour period. This corridor is the primary entrance into Camas from eastbound travel. The NE Lake Road at NE Everett Street, and NW 6th Avenue at SR 14 Ramps intersections had the highest observed volumes, with more than 1,800 entering vehicle trips during the single hour at each of the intersections.

Active Transportation Networks

Camas is a community with an active citizenry and, therefore, requires a fairly robust active transportation system that includes pedestrian and biking facilities. The TSP inventoried the pedestrian and biking facilities, listed gaps in the systems, and assessed the facilities for how a pedestrian and bicyclist experiences them.

Multimodal Network Design

The design of the streets in the City's planning area is based on the network classifications and area designation. All streets in the planning area are multimodal and include travel lanes and on-street parking for vehicles, sidewalks for pedestrians, and on-street or separated facilities for bicyclists. Accommodating these modes varies by the functional classification and area designations. For a typical street cross-section, the functional classification determines the minimum design requirements for the number of vehicle travel way lanes and on-street parking, and the minimum acceptable bike facility, and the area designation is used to determine the minimum acceptable design for pedestrian facilities, and the minimum travel lane and median/turn lane width. Together, these cross-section standards identify the design characteristics needed to meet the function and demand for each facility type for streets in the City's planning area. Since the actual design of a roadway can vary from segment to segment due to adjacent land uses and demands, this system allows standardization of key characteristics to provide consistency.

The typical designs are intended to be implemented in newly developing or redeveloping areas of the City's planning area, where constrained conditions do not limit the ability to construct the typical cross-section. A variety of physical and natural constraints may prevent adherence to the multimodal network design requirements. A deviation to the street standards may be requested from the City Engineer or City Engineer's designee with justification of constraints to consider a constrained cross-section or other adjustments.

Pedestrian Network

Walking supports healthy lifestyles, is an easy and economical way to travel, and is well-suited for people of all ages and abilities. In this plan, "walking" and "pedestrian" are terms that include people who walk independently or use canes, wheelchairs, or other walking aids, or strollers. Approximately two percent of commuters in the city walk to work, with three percent

utilizing public transportation, which often includes walking at the beginning or end of the trip.[14] In addition to the work commute trips, walking trips are made to and from recreational areas, shopping areas, schools, and other key destinations in the community. Continuous and direct sidewalk connections to all key destinations and along all streets, in addition to safe crossing opportunities along major roadways, are essential to encourage walking and transit use.

A pedestrian network assessment of streets, showing the extent to which the walking network on collector and arterial streets provides a level of comfort and safety for users, was completed throughout the city. About 30 percent of the collector and arterial street miles in Camas were rated "good (i.e., level of traffic stress (LTS) 2)" or "excellent (i.e., LTS 1)" for pedestrians. However, over 35 percent of the collector and arterial street miles rate poorly (i.e., LTS 4). Most of the street miles rated "poor" are located in high growth areas, be that housing or business growth. The pedestrian network in these areas is largely unimproved due to the once rural nature of the surrounding land use. As future urban development occurs, pedestrian facilities will improve in those areas. Overall, the pedestrian network rates relatively high near downtown, and generally poorer towards the edges of the city. See Figure 13 for an inventory of the pedestrian network.

Bicycle Network

Cycling is important for both transportation and recreation in the Camas planning area. This includes people who bike to work and school, bike for recreation or running errands. Approximately one percent of commuters in the city bicycle to work[15]. Riding bicycles also plays a key role in the transportation system's ability to support healthy and active lifestyles and provide a viable alternative to the automobile. Continuous bicycle connections between all activity generators and arterial/collector roadways are desirable to allow for safe and attractive non-motorized travel options.

The bicycle network in the City's planning area, shown in

Figure 12, is composed of bike lanes, roadway shoulders, shared roadways, and shared-use paths.

- Bike lanes are portions of the roadway designated specifically for bicycle travel via a striped lane and pavement stencils. Bike lanes are most appropriate for arterials and collectors, where high traffic volumes and speeds warrant greater separation of the travel modes. Significant segments of continuous bicycle lanes exist along portions of NW Lake Road, NW 38th Avenue, NW Parker Street, NW Friberg-Strunk Street, and SR 500.
- Shoulder bikeways are paved with striped shoulders wide enough for bicycle travel. A six-foot paved shoulder is desired to adequately provide for bicyclists, with a four-foot minimum width in constrained areas. Roadways with shoulders less than four feet are

[14] US Census Bureau, 2012-2016 American Community Survey
[15] US Census Bureau, 2012-2016 American Community Survey

considered shared roadways. Some shoulder bikeways are signed to alert motorists to expect bicycle travel along the roadway

- Shared roadways include those on which bicyclists and motorists share the same travel lane. The most suitable roadways for shared bicycle use are those with low speeds (25 mph or less) and low traffic volumes (3,000 vehicles or fewer per day). Shared roadways, often signed as bicycle routes, serve to provide continuity to other bicycle facilities (e.g., bicycle lanes) or can be designated as a preferred route through the community. Shared roadways can have signs that highlight a special route or provide directional information in bicycling minutes or distance. Most local roadways in the city are considered shared roadways, but do not have signs or pavement markings, although some are planned to be improved in the TSP.
- Shared-use paths provide off-street travel for bicyclists and pedestrians, and are wider than an average sidewalk (e.g., 10 – 14 feet). Shared-use paths are typically paved (asphalt or concrete) but may also consist of an unpaved smooth surface, such as compacted gravel, as long as it meets Americans with Disabilities Act (ADA) standards. Paved shared-use paths exist along portions of NW Parker Street, NW 18th Avenue, Lacamas Lake, Washougal River, and scattered throughout the residential neighborhoods.

A bicycle network assessment of streets in Camas shows the extent to which the bicycle network on collector and arterial streets provides a level of comfort and safety for users. About 20 percent of the collector and arterial street miles' in Camas rate "good (i.e., LTS 2)" or "excellent (i.e., LTS1)" for bicyclists. However, about 65 percent of the collector and arterial street miles' rate poorly (i.e., LTS 4) for bicyclists.

Overall, the bicycle network rates relatively high on the northwest side of the city and poor on the south and east side. The streets with the lowest ratings are the streets important for local and regional through travel (e.g. portions of NW 6th Avenue, NE 3rd Avenue, and SR 500), where many businesses and services are located. These streets rate low due to the relatively high motor vehicle traffic volumes and speeds and lack of separated bicycle facilities.

Transition Plan for Transportation

Title II of the Americans with Disabilities Act requires cities to establish a transition plan for transportation. The plan shall, at a minimum:

1. Identify physical obstacles in Camas' facilities that limit the accessibility of its programs or activities to individuals with disabilities;
2. Describe in detail the methods that will be used to make the facilities accessible;
3. Specify the schedule for taking the steps necessary to achieve compliance and, if the time period of the transition plan is longer than one year, identify steps that will be taken during each year of the transition period; and
4. Indicate the official responsible for implementation of the plan.

Camas has a relatively well-developed pedestrian network that is also potentially suitable for those who use mobility devices. The network is composed of sidewalks, shared-use paths and pedestrian trails, and other accessways. A large part of downtown Camas was developed prior to 1950, a time in which sidewalks were incorporated into the design of neighborhoods and streets. Although most areas incorporated into Camas over the following decades have sidewalk coverage, a few areas have noticeable gaps that do not make for a complete sidewalk network. These gaps are most significant in southwest, southeast, and northeast Camas, and on roadway segments outside city limits. Paved shared-use paths exist along portions of NW Parker Street, NW 18th Avenue, Lacamas Lake, Washougal River, and scattered throughout residential neighborhoods. Unpaved pedestrian only trails are scattered throughout the city.

Many intersections in older parts of the city lack ADA-compliant ramps, which provide important connections between sidewalks, making it easier to cross streets and handle the vertical drop at curbs. Knowing these conditions, the city has been recently installing new curb ramps in many of these locations. The presence of curb ramps is fairly consistent along streets in downtown Camas, and in the newer neighborhoods in the city. Additional work is required by the City to ensure all existing and future sidewalks have curb ramps.

About 38 percent of street miles (including City arterial, collector and local streets) lack sidewalk coverage along one or both sides (see Figure 13). These gaps are more common along arterial streets than collector streets, at 40 and 23 percent, respectively, of the street miles with no sidewalk on either side. These numbers do not incorporate off-street shared-use paths that may run alongside some roadways. Any future streets constructed in association with development projects will be required to construct sidewalks with curb ramps, increasing the overall sidewalk supply.

Transportation Projects and Priorities

This section describes the transportation system improvement projects- multimodal street improvement, intersection improvement, pedestrian/bike improvement, transit enhancement, and demand/system management – to address the system needs identified in earlier text.

The list of projects was developed through three main sources including stakeholders, relying on previous plans (such as the North Shore Subarea Plan), and independent project team evaluation.

The full list of projects is identified to improve the transportation network along major streets in the City's planning area, regardless of their priority or their likelihood of being funded. The TSP focuses on streets in the planning area with a functional classification of Collector or higher. Additional improvements will occur with private development in the planning area, including the build-out of the local street network consistent with the applicable standards.

The planning process from the TSP screens candidate projects to set aside those that may not be feasible due to environmental or existing development limitations. The remaining projects

are a combination of new and previous ideas for the transportation system that seek to address the gaps and deficiencies in the city.

The full project list, included as Appendix X, includes 99 projects totaling over $180 million in total investments. For the purposes of cost estimates, project design elements are identified, however, the actual design elements for any project are subject to change and will ultimately be determined through a preliminary and final design process and are subject to City, WSDOT, Clark County, and/or other partner agency approval. The projects were assigned to one of several categories:

- Multimodal Street Improvement - these projects will improve or construct new multimodal streets throughout the planning area, each with facilities for motorists, pedestrians, and bicyclists. A total of 29 projects have been identified that, as of 2024, will cost an estimated $72 million to complete.
- Intersection Improvement – these projects will improve safety and mobility at intersections throughout the planning area. A total of 19 projects were identified to construct new or improve existing intersections that, as of 2024, will cost an estimated $64 million to complete.
- Pedestrian/Bike Improvement – these projects include stand-alone sidewalk, path and roadway crossing improvements, and an integrated network of bicycle lanes, marked on-street routes and shared-use paths to facilitate safe and convenient travel citywide. A total of 39 pedestrian and bicycle projects were identified that, as of 2024, will cost an estimated $38 million to complete.
- Transit Enhancement – these projects will enhance the quality and convenience for transit passengers. One transit project was identified that, as of 2024, will cost an estimated $1 million.
- Demand/System Management – this will encourage more efficient usage of the transportation system. Two projects were identified that, as of 2024, will cost an estimated $450,000.

Transportation Facility Maps

Figure 12 Bicycle Facilities

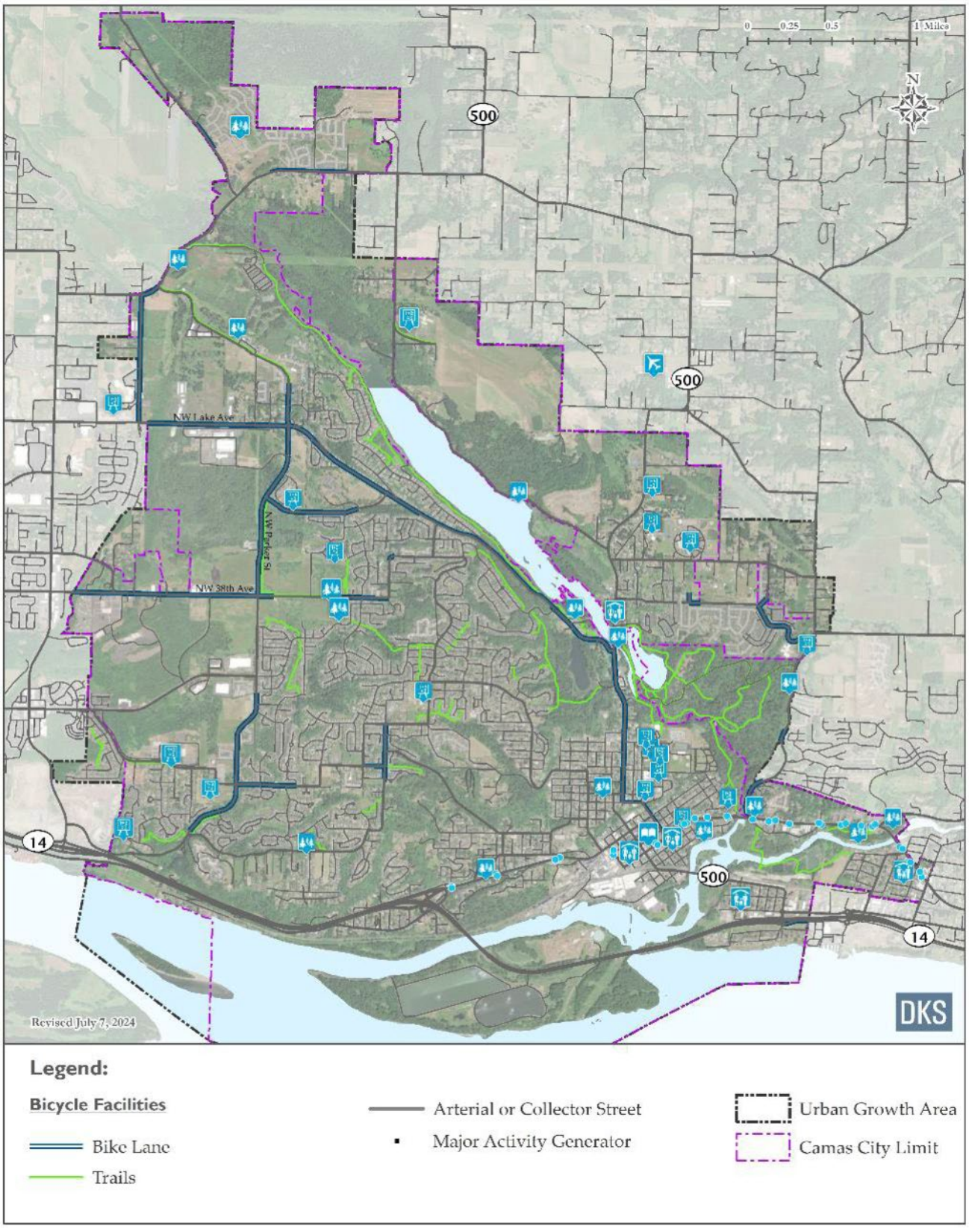


Figure 13 Pedestrian Facilities

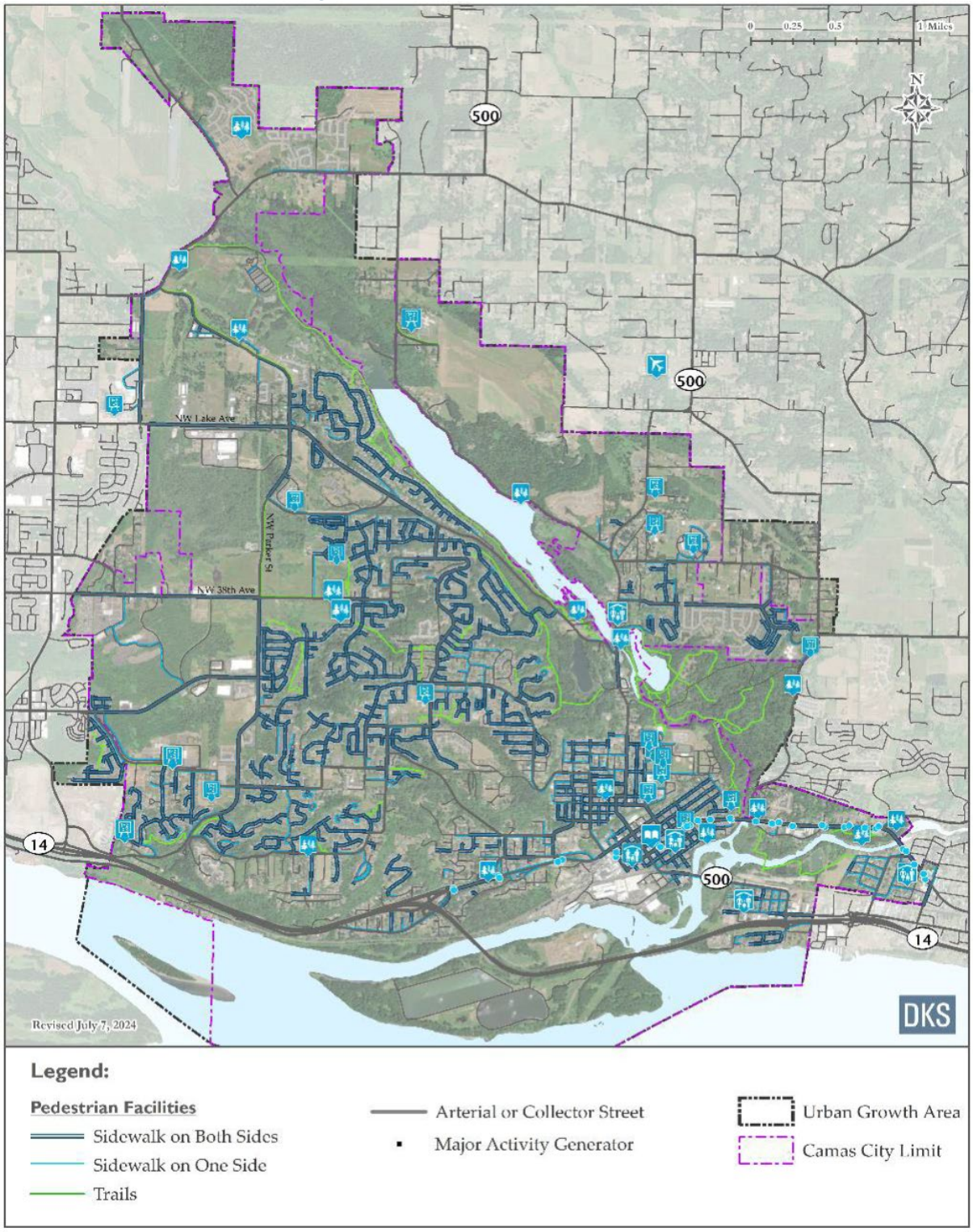


Figure 14 Street Network

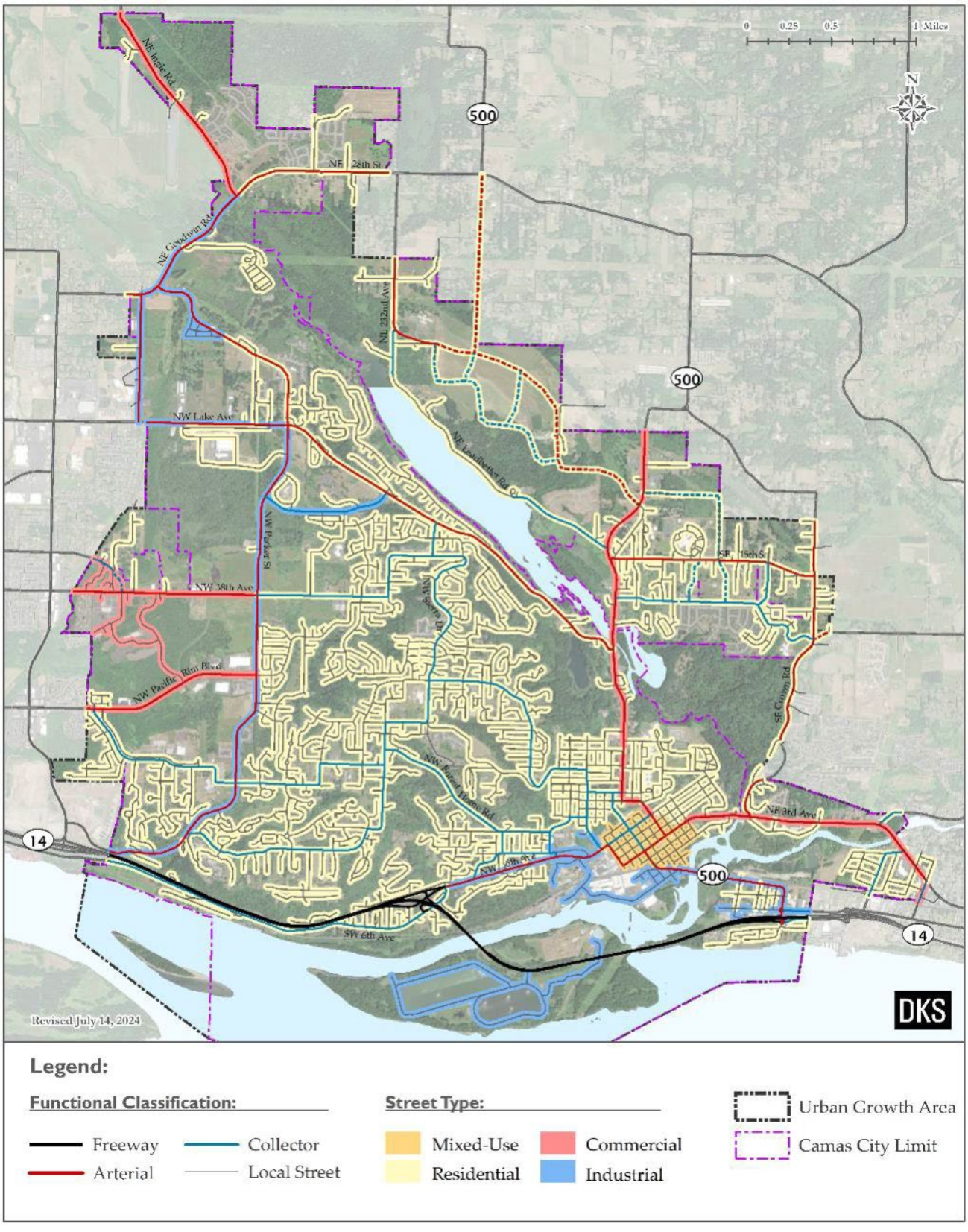
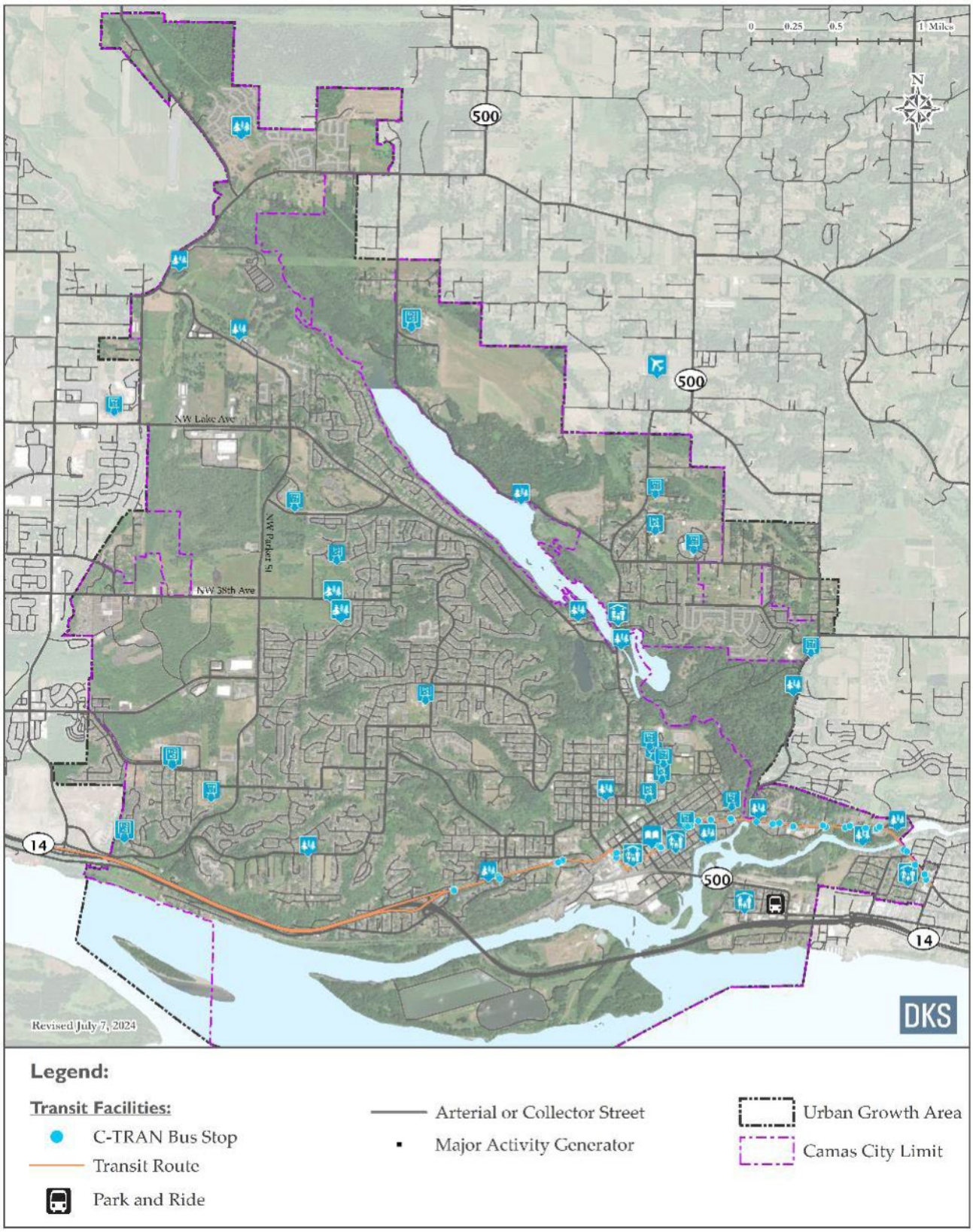


Figure 15 Transit Facilities



Transportation Goals and Policies

Goal TR-1 Complete Streets

Streets will function for all users of all abilities including bicyclists, pedestrians, transit users, and motorists.

Policy TR-1.1 Implement the Transportation System Plan (TSP) to maintain the livability of Camas and guide decision-making for transportation-related projects, policies, and design. Ensure consistency between the TSP, the Parks, Recreation and Open Space Plan and the 6-year street plan.

Policy TR-1.2 Maintain the transportation system to enhance safety and efficiency for all users, facility aesthetics, access management measures and the overall integrity of the system.

Policy TR-1.3 Construct streets that are interconnected and avoid long cul-de-sacs or dead ends. Block lengths should be less than 1,000 feet. Include pedestrian and bicycle linkages in the construction of cul-de-sacs and other forms of dead-end streets. Existing dead-end streets should be retrofitted to provide bicycle and pedestrian linkages as practicable.

Policy TR-1.4 Develop and implement design standards that provide attractive streetscapes, encourage appropriate traffic volumes and speeds, and support multi-modal safety. Include enhanced roadway features such as roundabouts, decorative lighting, and landscaping in gateways and design overlay areas.

Policy TR-1.5 Minimize access to new development and redevelopment along City arterials and consolidate access points when spacing is insufficient.

Policy TR-1.6 Provide routes designed for active transportation to encourage mode shift for short trips. Route planning should seek shortcuts and other opportunities that provide advantages to active transportation users. Public investments should support active transportation routes such as street lighting, safe crosswalks, and protected bike lanes.

Policy TR-1.7 Coordinate with Camas School District to implement a safe routes to school program to encourage the use of alternative and active transportation.

Policy TR-1.8 Develop and implement Complete Streets design in all new and retrofit street projects to support the use of alternative travel modes. Adopt engineering design standards consistent with Complete Streets goals.

Policy TR-1.9 Increase wayfinding signage for outdoor destinations throughout the City.

Policy TR-1.10 Inventory current bicycle and pedestrian networks to identify gaps in route coverage. Support filling in network gaps as new development and redevelopment occurs to create a bicycle and pedestrian network that is safe, comfortable, and accessible to people of all ages and abilities.

Policy TR-1.11 Minimize cut and fill roadway design and, where feasible, minimize restructuring the natural contours of the land.

Policy TR-1.12 Encourage the inclusion of low impact development (LID) design features (e.g. rain gardens, grass pavers, pervious pavement) in the design of road surfaces.

Policy TR-1.13 Require LED lights in new development and replace existing inventory that lack LED features.

Goal TR-2 Local and Regional Transit

Regional transit will provide safe, efficient, and dependable service to the Camas community for a variety of trips within and outside of the city.

Policy TR-2.1 Coordinate with local municipalities, Washington Department of Transportation, adjacent counties, and C-TRAN to ensure that minimum roadway and multi-modal design standards are consistent.

Policy TR-2.2 Partner with C-Tran to advocate for and develop transit options that are safe, convenient, frequent, and accessible for Camas residents.

Goal TR-3 Traffic Safety

Design and construct safe transportation facilities that meet applicable requirements.

Policy TR-3.1 Encourage traffic safety through education, enforcement, and engineering. Use traffic calming, traffic diversion, and other available tools such as landscaping, trees, and art to ensure a comfortable and safe environment for all users.

Policy TR-3.2 Provide adequate access for emergency vehicles throughout the city.

Policy TR-3.3 Develop safe pedestrian and bicycle routes between residential areas, schools, and public facilities.

Policy TR-3.4 Require new development to implement designs standards using the Neighborhood Traffic Management Plan.

Policy TR-3.5 Identify high accident areas and implement specific measures to reduce accident occurrences.

Goal TR-4 Transportation Demand Management

Transportation planning will achieve the efficient use of transportation infrastructure, increase its person carrying capacity, and accommodate and facilitate future growth consistent with land use objectives.

Policy TR-4.1 Require large employers to implement a commute trip reduction program for employees, as mandated by state law.

Policy TR-4.2 Support intergovernmental development review.

Policy TR-4.3 Support the Regional Transportation Council (RTC) with funding and staff participation to the extent possible.

Goal TR-5 Concurrency and Level of Service

The City will maintain the adopted LOS standards for all arterial streets and transit routes.

Policy TR-5.1 Encourage growth in areas with existing or planned infrastructure capacity.

Policy TR-5.2 Require new development to demonstrate that adequate person trips are available, or that multi-modal improvements to the transportation system will be made to accommodate the impacts concurrent with the development.

Policy TR-5.3 Utilize traffic impact fee studies, development traffic impact analyses, and corridor studies to identify deficiencies and plan improvements to maintain or improve LOS standards.

Policy TR-5.4 Take the following actions (in no priority order) if the probable funding falls short of meeting identified needs: 1) delay development until programs, facilities, or services can be funded; 2) obtain the revenue needed or revise the transportation plan to reflect known financial resources; or 3) change the transportation LOS standard, which is a last resort measure.

Goal TR-6 Transportation Revenue

Maximize the use of state and federal funds for transportation capital, operating, service, and demand improvements.

Policy TR-6.1 Maintain a capital improvement plan (CIP) that identifies construction and improvement priorities and funding.

Policy TR-6.2 Ensure that the transportation impact fee program responds to land use changes, supports connectivity, and requires new development to pay its proportionate share of needed capacity.

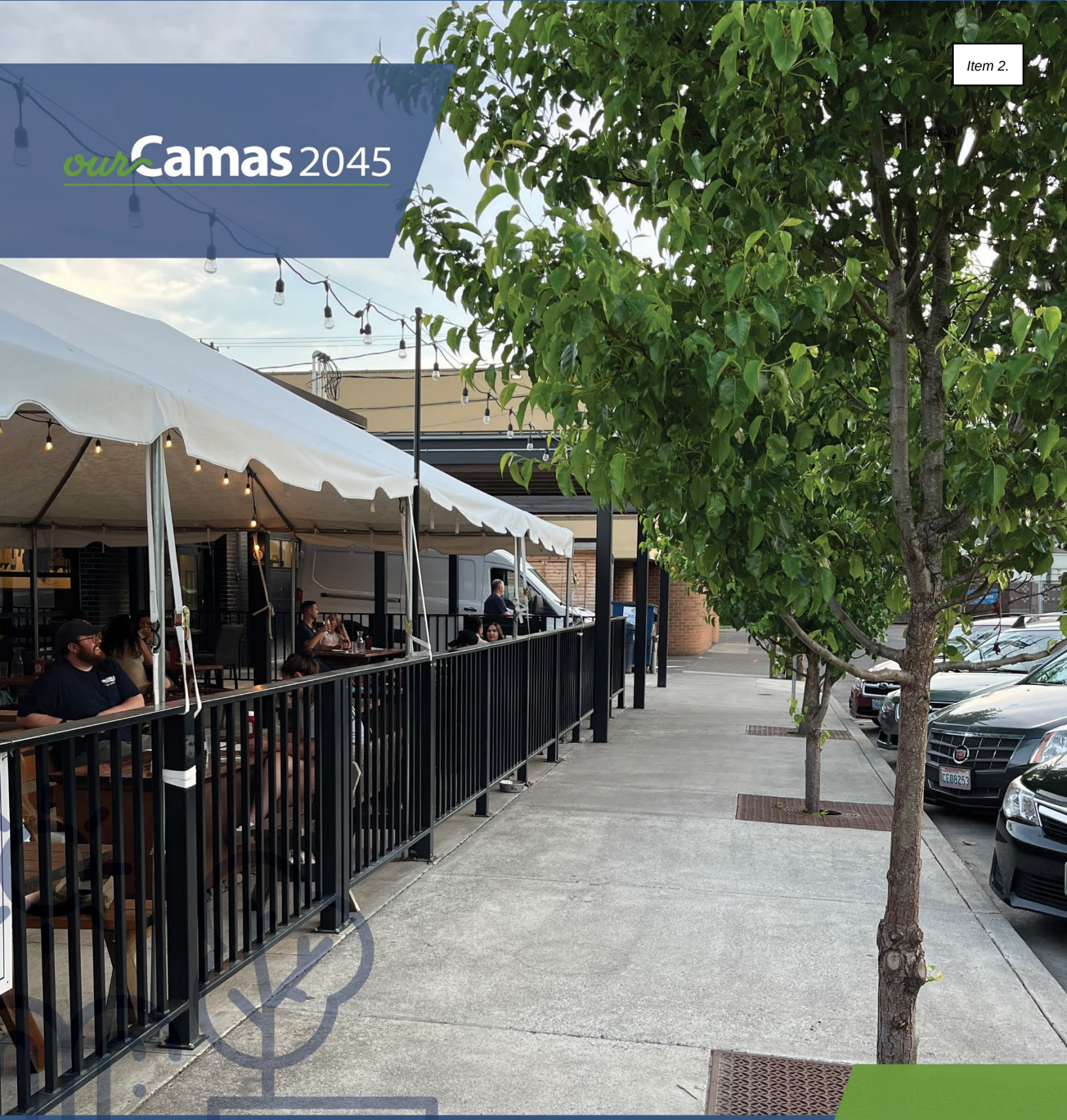
Policy TR-6.3 Support the Pavement Asset Management System and other maintenance programs to ensure cost-effective maintenance of transportation facilities and efficient use of public funds.

Policy TR-6.4 Develop equitable transportation impact fees to assess developers a fair-share contributions for any transportation improvements.

Policy TR-6.5 Prioritize transportation funding for multi-modal improvements that will enhance safety and access between infill areas, schools, and employment centers.

Policy TR-6.6 Focus transportation projects in economic development areas to act as catalysts for job growth.

ourCamas 2045



Public Facilities & Services

09

09. Public Facilities & Services

Purpose

Plan for adequate facilities that are consistent with the other elements, goals and policies of Our Camas 2045, can accommodate the projected population and employment growth and land use plan, and based on sound fiscal policies for the City.

Vision

In 2045, Camas residents enjoy the city's parks, trails, community centers, and other recreational opportunities. The school district draws families to the community and the library continues its vital role as a place of learning. Residents value accessible police, fire, and emergency response services. Proficient government agencies maintain existing City assets and coordinate future development.

Introduction

The City of Camas is a full-service community that offers a breadth of public facilities, services, and utilities. Public facilities include such things as City Hall, the Camas Public Library, the Public Works Operation Center, Lacamas Lodge, the Community Center, the Camas Police Department headquarters, and Fire Stations 41 and 42. The majority of the City's functions and services are carried out from these facilities.

General government services include such departments as Administration and Human Resources, Community Development, Finance, Information Technology, and the Camas Public Library. General services include but are not limited to utility billing, human resources, city clerk functions, building and engineering permits and inspection, and activities of the City Council and city boards and commissions.

Other city services include Fire and Emergency Medical Services (EMS), Police, and Parks and Recreation. Fire and EMS services are provided in Camas and, via intergovernmental agreements, beyond Camas city limits. The Camas Police Station dispatches law enforcement services throughout the community. Parks and Recreation services are housed in several facilities including Lacamas Lodge, the Community Center, and through a myriad of parks, trails, open spaces, and special use buildings.

Public utilities, administered by the Public Works Department, includes the city's sewer system, water system, and municipal stormwater system. These systems have a variety of assets that support them and are scattered throughout the city.

Public Works also operates solid waste service. Garbage trucks are dispatched from the Operations Center, the hub of Public Works' activities, and the solid waste is transported to an off-site transfer station and then to a landfill in eastern Washington. The City budgets money for capital equipment, however, the solid waste system does not require the same kinds of investments that the sewer, water, and stormwater systems require.

The public facilities and services element is divided into four sections:

- Public Facilities and Services including fire, emergency medical and police services, parks and open space, and City owned facilities
- Public and Franchise Utilities including water, sewer, stormwater, solid waste, electricity, natural gas, and telecommunications
- Capital Improvement Plan
- School Districts

Related to this element is the City's Capital Facilities Plan (CFP) (Appendix X), which provides a comprehensive project list and schedule guiding the investment of city resources in facilities and infrastructure. These resources are made up of local revenues as well as State, Federal and other sources. The CFP identifies those projects which have secured funding as well as a list of projects which have not yet been funded. The projects included in the overall CFP have largely been identified through other planning documents and efforts which are all incorporated into the City's comprehensive plan.

Level of Service (LOS) Standards

Under the GMA, adequate provisions for urban governmental services must be provided in the UGA. The goals and policies in this element are provided to address anticipated growth and maintain adopted LOS standards.

Public Facilities and Services

Many of the public facilities and services listed in this element have strategic plans and actions that guide maintenance and service improvements. The identified goals and policies were given consideration based on a framework of budgetary and operational guidelines as well as these strategic plans.

Fire Protection, Emergency Medical Services, and Police Protection

The city is served by the Camas-Washougal Fire Department (CWFD), which covers 20 square miles and 33,000 residents for fire protection and 80 square miles and 65,000 residents for emergency medical services. The Camas and Washougal fire departments consolidated in 2011 through a joint contract for service to improve efficiency and lower costs. CWFD averages approximately 5,000 fire and medical calls annually. The CWFD is the only fire department in

Clark County to provide ambulance transport services, which requires additional training for the firefighters in addition to fire suppression techniques.

Camas Fire and EMS operates out of two stations – Station 41 located in City Hall on NE Fourth Avenue and Station 42 located off NW Parker Street. Station 42 is relatively new, while Station 41 is many decades old.

Voters approved a capital construction bond in August of 2024 for a new downtown station and headquarters to replace Station 41. It will be located on the property occupied by the City Hall Annex building just west of City Hall on NE Fourth Avenue. When the new Station 41 is completed, there will be vacated space in the City Hall building. Future uses for the vacated space have not been determined.

A Facility Conditions Assessment (Appendix X) was completed in 2021 and lists some deficiencies in Station 42 in the form of HVAC, plumbing, electrical, and interior finishes that will be addressed with funding from a general obligation bond.

The Camas Police Department operates a full-service police department from one location near the downtown core. This 15,000 square-foot facility was built in 1998 and includes a 1,500 square-foot community/training room. Services include police response, community engagement, school resource officers, investigative follow-up, parking enforcement, code enforcement, and records services.

The City is currently investing over $400,000 in upgrades to the Camas Police Station by replacing end-of-life mechanical equipment. This investment will make it more cost-effective and environmentally resilient.

Parks, Trails, and Open Space

Camas' Comprehensive Parks, Recreation, and Open Space (PROS) plan , updated in March 2022, outlines a community vision for Camas that includes a high-quality park and recreation system, with a comprehensive open space and trail system linking all recreational sites to the regional trail network. The PROS plan is adopted by reference and included as Appendix X.

Parks and recreational opportunities in Camas include neighborhood parks that serve individual neighborhoods, natural open space areas that preserve resources throughout the community, and special use areas for specific recreation needs. Supplementing these are public and private sites and facilities, such as school sites, regional parks, and privately-owned recreation facilities.

In response to the community's feedback on the PROS plan, the City is currently working on a Parks and Open Space Management Plan (POSMP). The purpose of the POSMP is to maintain the existing facilities, fill gaps and improve trail connections, and develop and improve existing parks. The POSMP will outline a strategic vision for the thoughtful management of parks and open spaces within the city, ensuring that they continue to serve as resources for all users. The City will need to coordinate the POSMP with the comprehensive plan to ensure consistency.

During the City's review of land use designations, the PROS plan was reviewed to ensure that sufficient land is designated as Park, Open Space/Green Space, and NS-Parks/Open Space. Because the North Shore Subarea Plan was adopted after the last comprehensive plan update, this update includes revisions that incorporate the new NS-Parks/Open Space designation.

Camas receives impact fees paid by new development for park, trail, and open space improvements that increase the capacity of the system. The expenditure of the collected fees will be applied to the total costs of implementing projects that are identified in the PROS Plan project list, and as further refined by the City's Capital Improvements Plan.

City Facilities

The comprehensive FCA reviewed 17 publicly owned buildings located at 11 different sites. The total square footage of the surveyed buildings is just under 276,000 square feet.

The FCA report notes the total replacement value of all facilities at $61 million in 2022 dollars. The reported deficiencies for the years 2022-2027 total $17 million with the priority needs (life safety and code issue deficiencies) at $6.3 million. Long-term needs would require $18 million for major maintenance projects.

Recently, the City appropriated funding, through limited general obligation bonds, to pay for many of the items listed as priority needs in the FCA. This approximately $7 million has allowed the City to attend to some of the high priority deficiencies.

Noteworthy on the list is Station 41 and the City Hall Annex. With passage of a voter approved bond in 2024 specifically to replace Station 41, the City Hall Annex building will be demolished, and the site will house the new Station 41, which will also serve as the Fire Department's headquarters.

The Camas Public Library, located across the street from City Hall on NE Fourth Avenue, provides library services to the community at-large. According to the FCA, the library is in need of priority improvements to address immediate deficiencies. Since the date of the report, the City is funding a number of deficiencies through a general obligation bond.

City and Franchise Utilities

Water

The City owns and operates a multi-source municipal water system which includes supply, treatment, storage, and distribution of potable water to residential and commercial customers. The City currently obtains its water from ten groundwater wells and two surface water sources that are treated to provide high quality water to customers. The City owns over 143 miles of pipelines in its water transmission and distribution system. Service is provided to customers across five major pressure zones and 18 subzones. Eight booster pumping stations are used to move water between pressure zones. Seven storage facilities, with a combined total of 8.45 million gallons (MG), provide storage for normal and emergency conditions, such as fire

suppression. Additionally, distribution system includes numerous meters, isolation valves, and hydrants. Additional information regarding Camas Water Service, including capacity analysis, is available in Appendix X, Water System Plan (2019).

Sewer

The majority of the 7,700-acre UGA and the sewage collecting infrastructure inside the city limits is owned and operated by the City of Camas. The collecting system consists of traditional gravity sewers, pump stations, force mains, and septic tank effluent systems. The system includes 38,260 linear feet of force main, 29 lift stations, and 236,200 linear feet of gravity mains. Approximately half of the city is served by septic tank effluent systems and the other half by a traditional collection system. The City gathers, treats, and discharges wastewater into the Columbia River at the Camas Wastewater Treatment Plant (WWTP).

The City of Camas Sewer Division serves residences and commercial buildings, with approximately 8,500 customers, comprised of industrial, commercial, and residential users.

A collection system flow metering and projection was conducted in 2018/2019 to evaluate the collection system using the City's hydraulic model. The results of this analysis are available in Appendix X, General Sewer Plan (2022), which develops a management plan for the system over the next 20 years.

Stormwater

The stormwater runoff generated from approximately 7,500 acres across the city of Camas is managed through 75 miles of stormwater conveyance pipe and 1,800 stormwater inlets and catch basins. The stormwater conveyance system is owned and maintained by the City. The City also owns and maintains stormwater facilities, including underground treatment vaults, detention ponds, biofiltration swales, wet ponds, drainage ditches, and culverts. These have been geolocated on the City's Stormwater Management Action Plan (SMAP) Public Input Map. The SMAP identifies actions to protect and improve receiving waters' water quality. Commercial and residential stormwater facilities are privately owned and maintained per stormwater code CMC 14.02.200 Ownership and Maintenance. These privately owned facilities within the city are geolocated on the SMAP Public Input Map. Additional details on stormwater management in Camas can be found in Appendix X, Stormwater Management Program (2024).

Solid Waste

The City owns and operates its own solid waste utility which provides for the collection and transfer of solid waste refuse to the Clark County-owned Washougal Transfer Station. The City is responsible for managing garbage collection within the Camas boundaries. The City has established universal compulsory solid waste collection, requiring all residents and businesses to maintain solid waste service. The City contracts with Waste Connections of Washington to provide recycling and yard debris management, collection, and disposal. The City also contracts with Waste Connections to provide large container service (larger than 2 cubic yards) to those with greater solid waste handling needs.

All cities and towns in Clark County have delegated responsibility for solid waste transfer and disposal planning to the County, including Camas. The currently adopted Clark County Solid Waste Management Plan (CSWMP) of 2015 is undergoing updates and anticipated to be adopted by the end of 2025. Agreements between Clark County and its cities commit each to the plan and to the plan's waste disposal system.

Franchise Utilities

There are several other utilities, some of which are provided by public entities and others by private entities, that contribute to the functionality and prosperity of the community. The main utilities include electricity, natural gas, and telecommunications. Electricity is provided by Clark Public Utilities (CPU), a customer-owned public utility; natural gas is provided by Northwest Natural; and telecommunications, including high-speed internet, are provided by a variety of companies (e.g. Comcast, Verizon, Frontier, etc.). No detailed inventory regarding the capacity of these utilities is available.

Electrical

Clark Public Utilities (CPU) (https://www.clarkpublicutilities.com/) provides electricity to Camas and throughout Clark County. CPU balances strategic planning for the future with present rate and service stability in compliance with changing requirements at the local, state, and federal levels. CPU is led by an elected board to plan for integration of new technologies and has indicated there is ample capacity to meet existing demand for areas within both the incorporated City limits and the UGA. Power supplies are provided through a combination of power supply contracts and purchases from the generating system.

Natural Gas

Delivery of natural gas to Camas and its UGA is provided by Northwest Natural (https://www.nwnatural.com/). The delivery of natural gas is governed by the Federal Energy Regulatory Commission, the National Office of Pipeline Safety, and the Washington Utilities and Transportation Commission (WUTC). The City's regulations include safety and emergency provisions, LOS standards, and rate limitations. Northwest Natural provides natural gas service to all of Clark County. The alignment of the main pipeline crosses the Columbia River at the area of the Port of Camas-Washougal. Additionally, Northwest Natural is improving its backbone through the City with the installation of a large-diameter high-pressure gas main connecting Lake Road and Pacific Rim Boulevard.

Telecommunications

Verizon provides local telephone service to the City and its UGA. Many of the telecommunication facilities, including aerial and underground, are co-located with those of the electrical power provider. Frontier Communications also provides telecommunications to a large number of customers in the Camas area. Contact information for telecommunication utility providers is available on the City of Camas website (https://www.cityofcamas.us/utilities/page/new-resident-information).

Capital Improvement Plan

The 6-year Capital Improvement Plan (CIP) is a significant component of the financing plan and is adopted as part of the biennial budget. It includes a list of projects, project start dates, estimated cost, and funding. The CIP is a shorter term funding plan that directs available resources to specific projects including street preservation and improvements, fire and EMS, parks and recreation, stormwater, water, and sewer projects. The 2025-2026 CIP is included as Appendix X.

The first two years of the capital facilities plan are typically consistent with the adopted City budget. However, since capital expenditures often impact multiple years after funding has been committed, it is prudent to plan ahead for the expenditure of funds for at least four years or longer. Additionally, some of the City's adopted plans include longer term expenditure plans in which resources are actively being pursued when opportunities arise.

School Districts

Public schools are recognized as one of the largest public services within the community. Education serves one of the most important roles in community health as the quality of education today impacts the skill levels, employment rates, labor supply, and wages of tomorrow.

The Camas School District has the most, and some of largest, public facilities in the Camas Urban Growth Area. The UGA spans two school districts. Camas and Evergreen School Districts are responsible for facility planning and service levels of the districts and coordination with the city's overall development. Both school districts are currently evaluating school facilities and overall needs to serve the community.

The Camas School District has prepared a 2022 Capital Facilities Plan (CFP) to provide the County and the Cities with a schedule and financing program for capital improvement needs over a six year period (2022-2028) to ensure that adequate facilities are available to serve new growth and development.

The collection of school impact fees generates partial funding for construction of public facilities needed to accommodate new development. School impact fees are collected by the cities and County on behalf of the District at the time plats are approved or building permits are issued. Impact fees are calculated based on a formula, which includes the portion of District construction resulting in increased capacity in schools. The districts submit their capital facilities plans every other year, accompanied by impact fee calculations. The plans describe the existing and planned school facilities and services.

Anticipated property acquisition and new construction is based on the enrollment forecast, capacity, the District's educational standards and the community's support of finance tools to fund improvements.

Public Facilities and Services Goals and Policies

Goal PFS-1 Fire Protection, Emergency Medical Services, Police Protection

Provide fire protection, emergency medical services, and police protection to Camas and accommodate growth in the community.

Policy PFS-1.1 Plan for fire and emergency medical services to include adequate land, building, and equipment to effectively serve the geographic area of the city north of Lacamas Lake (North Shore).

Policy PFS-1.2 Assess the level of service needs and provide fire, advanced life support emergency medical, and police services that meet the community demand. Maintain service levels as growth occurs.Ensure

Policy PFS-1.3 Ensure the installation of commercial fire sprinklers where required by code and strongly encourage their use when installation is optional.Require

Policy PFS-1.4 Pursue funding to maintain fire facilities, including all fire apparatus at levels that best serve the community. Fire apparatus includes fire suppression equipment such as engine, water tenders, brush trucks and command officer vehicles.

Policy PFS-1.5 Require all new residences to install fire sprinkler systems.

Policy PFS-1.6 Plan police annex facilities at strategic locations throughout the City.

Goal PFS-2 Parks, Trails and Open Space

A network of parks, trails, and open space will connect neighborhoods, wildlife corridors, and natural resources and enhance the quality of life for residents and visitors. Refer to the Camas PROS plan for additional goals and policies.

Policy PFS-2.1 Provide and maintain an active transportation network to increase connectivity to natural areas, wildlife corridors, and other natural resources in Camas.

Policy PFS-2.2 Ensure every neighborhood has access to a park within a 15-minute walk or roll.

Policy PFS-2.3 Provide safe and maintained parks, natural areas, and other recreational spaces that are accessible for all ages and abilities.

Policy PFS-2.4 Provide a continuous trail network around Lacamas Lake with ample access points, prioritizing active transportation users. Consider new public access points through dedications, easements, and acquisitions. Partner with transit agencies to plan and implement transit service to Lacamas and Round Lake.X

Policy PFS-2.5 Explore the development of dog parks within special use park areas to balance the needs of pet owners and other park users.

Policy PFS-2.6 Encourage the development of parks and playgrounds that have ample facilities for all users.

Policy PFS-2.7 Work with the Camas Parks & Recreation Department to acquire land for parks, trails, recreational uses, and habitat conservation.

Policy PFS-2.8 Enhance water conservation methods and technologies in development of irrigation infrastructure within parks and recreation areas.

Goal PFS-3 City Facilities and Services

Provide facilities and services to support the functions of City government and the community, including cemetery, animal control, and the public library.

Policy PFS-3.1 Develop an expansion plan (e.g., new municipal facility, meeting space) to accommodate additional personnel.

Policy PFS-3.2 Ensure that the municipal building and primary services remain downtown.

Policy PFS-3.3 Incorporate sustainable and low climate impact design into city buildings. Promote LEED certification (or similar) for all publicly owned facilities.

Policy PFS-3.4 Utilize the City's capital improvement program to develop alternative transportation facilities and electric vehicle charging infrastructure for public facilities.

Policy PFS-3.5 Maximize the developed and undeveloped property for cemetery use to meet future burial needs and trends and meet residents' service expectations.

Policy PFS-3.6 Provide economic stability to the cemetery fund by reducing dependency on the general fund.

Policy PFS-3.7 Develop a strong volunteer and donation program for the cemetery.

Policy PFS-3.8 Continue animal control partnership with the City of Washougal.

Policy PFS-3.9 Maintain funding and support for library services that meet the demands of current and future residents.

Policy PFS-3.10 Assess need and solutions for additional library services throughout the growing City.

Goal PFS-4 City and Franchise Utilities

Provide utility services, including energy and communication facilities and their services, to all businesses, residents, and properties in the City limits.

General Utilities Policy

Policy PFS-4.1 Maintain and improve City utility systems through preventative maintenance and regular assessments and improvements to meet regulatory standards.

Policy PFS-4.2 Where service is available, require connection to public water for domestic and irrigation needs and connection to sewer systems. Promote connection to sewer and water before system failure of private well or septic.

Policy PFS-4.3 The City should be the sole provider of urban services, including water and sewer, within the UGA for sewer service and the Water Service Area for water. Require all new construction connect to city systems. Prohibit construction of new private wells and subsurface sewage disposal systems in new developments.

Policy PFS-4.4 Do not extend utilities without annexation or commitments for annexation. Exceptions may be made in cases where human

health is threatened. In areas where utilities presently extend beyond City limits, but are within UGAs, plan development jointly with the County. A joint development must be consistent with City standards.

Policy PFS-4.5 Coordinate plans for providing public utility services in UGAs and rural areas with plans for transitioning undeveloped land to urban uses.

Policy PFS-4.6 Plan public utility services so that service provision maximizes efficiency and cost effectiveness and ensures concurrency. Coordinate with other entities to provide services within the urban area.

Water Service Policy

Policy PFS-4.7 Extend adequate public water service throughout the City's urban areas that meets state requirements and provides minimum fire flow as required by the Fire Marshal.

Policy PFS-4.8 Conserve and protect groundwater resources to provide safe, clean, high quality drinking water to residents.

Policy PFS-4.9 Ensure water infrastructure is designed to City standards and is in place prior to land development.

Policy PFS-4.10 Coordinate with Clark County and other purveyors to eliminate private systems in accordance with the Clark County Coordinated Water System Plan.

Policy PFS-4.11 Coordinate with the County and the cities of Vancouver and Washougal to protect groundwater from contamination.

Policy PFS-4.12 Expand municipal reclaimed water systems and allow onsite non-potable water systems to reduce water demand in private-sector commercial and residential buildings.

Policy PFS-4.13 Eliminate the introduction of groundwater and surface water into the sewer system.

Sewer Services Policy

Policy PFS-4.14 Extend public sanitary sewer service, as required, throughout urban areas. Service may be provided outside urban areas to serve areas where imminent health hazards exist.

Policy PFS-4.15 Use traditional gravity sewer systems (in lieu of STEP systems) to serve future customers and reduce maintenance and power costs.

Policy PFS-4.16 Coordinate with Clark County to eliminate septic systems.

Stormwater Policy

Policy PFS-4.17 Provide a stable funding source to meet National Pollutant Discharge Elimination Systems (NPDES) Phase II requirements to manage and control stormwater runoff.

Policy PFS-4.18 Inspect homeowner association and other private facilities and provide directions and standards for repair.

Policy PFS-4.19 Meet water quality standards by providing best management practices for development activities.

Policy PFS-4.20 Establish baseline flows on each drainage basin or sub-basin for the analysis of deficiencies.

Policy PFS-4.21 Consider stormwater impacts during land use review processes and develop standards that would reduce the amount of impervious surface on existing and new development, including the creation and adoption of low-impact development standards and the use of green infrastructure, to address increased storm intensities and stormwater runoff.

Policy PFS-4.22 Require new development or redevelopment to comply with the Camas Stormwater Design Standards Manual and design criteria.

Policy PFS-4.23 Protect natural stream courses for water quality.

Policy PFS-4.24 Manage stormwater to safely pass surface water and maintain water quality of lakes, streams, and rivers.

Solid Waste Policy

Policy PFS-4.25 Provide for solid waste service throughout the City through continuance of self-collection of solid waste and contracting with private waste management companies to provide recycling and yard debris collection options.

Policy PFS-4.26 Continue a system of universal compulsory solid waste collection.

Policy PFS-4.27 Coordinate with the County to implement the Clark County Solid Waste Management Plan (CSWMP). Reduce the total production of waste, increase the recycling rate of waste that is produced, and properly manage and dispose of waste that is not recycled. Provide education and outreach to businesses and the public on benefits and opportunities for waste reduction and recycling. Focus on residential recycling rates to improve participation rates similar to the rest of the County.

Policy PFS-4.28 Work with solid waste utility companies to determine if household food waste/compost can be accommodated in yard waste bins.

Franchise Utility Policy

Policy PFS-4.29 Minimize the effects on adjacent properties, the environment, and the visual quality of the community of siting, developing, operating, and maintaining facilities.

Policy PFS-4.30 Coordinate to provide reliable service through partnerships and agreements with utility companies.

Policy PFS-4.31 Promote the conservation of energy resources through the adoption of appropriate energy codes and efficient land use and transportation systems.

Policy PFS-4.32 Work with energy utilities to improve the safety and reliability of infrastructure vulnerable to climate change (e.g., undergrounding transmission lines).

Goal PFS-5 Capital Improvement Plan

Maintain and implement the Capital Improvement Plan in coordination with the biennial budget.

Policy PFS-5.1 Update the capital improvement plan biannually and include a statement of projected costs and sources of revenue.

Policy PFS-5.2 Ensure capital improvements enhance the community and add physical value to the City.

Policy PFS-5.3 Apply earnings from bond proceeds toward the debt service fund reserved for the future repayment of debt directly for enhancement of the project.

Policy PFS-5.4 Dedicate all or a portion of the first year of property taxes generated from newly incorporated areas to the Capital Fund.

Policy PFS-5.5 Dedicated funds and bonds may be used to fund essential capital improvement projects such as police, fire, and general municipal structures.

Policy PFS-5.6 Use voted, general obligation debt for discretionary projects such as recreation and library facilities.

Policy PFS-5.7 Prioritize projects that support the core services provided by the City.

Policy PFS-5.8 Ensure consistency of capital improvement plans with the adopted comprehensive plan map and evaluate if funding is adequate to provide necessary public facilities and services to implement the plan.

Goal PFS-6 School Districts

Support access to quality education and public schools through partnerships and investments.

Policy PFS-6.1 Encourage the Camas School District, Clark County, and the City of Camas to invest in mutual use facilities that support intergenerational and intercultural use.

Policy PFS-6.2 Coordinate planning between the Camas School District and the City of Camas to reflect school facility needs in response to growth forecasts.

Policy PFS-6.3 Ensure equitable access to schools and educational programs, specifically considering those in underserved areas, where needs and abilities may differ.

ourCamas 2045



Economic Development

10

10. Economic Development

Boosting the Local Economy

The economic health and well-being of the City of Camas is supported by providing a wide range of employment opportunities throughout the community and a setting and quality of life that is attractive to businesses and residents.

Vision

In 2045, Camas has cultivated a diverse and thriving economy with stable employment opportunities and living-wage jobs across various sectors, including technology, healthcare, manufacturing, retail, recreation, and professional services. Camas residents have access to a wide range of services and amenities in their community, while benefiting from excellent regional connectivity and the city's proximity to Portland International Airport. Camas is a gateway to nature and recreational opportunities, supporting regional tourism in the area. Camas is home to a thriving economy and diverse businesses, affording residents ample employment opportunities. Neighborhood commercial hubs connect residents to daily services and amenities through a network of sidewalks and bike lanes, improving access and connectivity. Professional office, medical, and industrial uses typify western Camas, with retail businesses supporting these firms and nearby residents. The North Shore area will fulfill the employment and retail needs of the growing population on the northeast side, and reduce trips outside the city. Downtown Camas anchors the community with a dynamic economic landscape and retains its historic atmosphere as a walkable, attractive place to shop, dine, and gather. Inclusive housing options within the city's core contributes to a town center that supports local businesses.

Approach for Updating this Element

The approach for updating the economic development element for the 2025 to 2045 planning horizon was informed by community input (outlined below), state legislation requirements, priorities, and a comprehensive economic profile. This profile integrated the best available information from public and private data sources to assess the city's economic trajectory, opportunities, challenges, and economic conditions and competitiveness. These insights help build a factual basis for the updates.

Community Engagement Insights

Interactive open houses and interviews with stakeholders provided information about economic development strengths,

challenges, opportunities, and actions in Downtown Camas and other areas in the City. Engagement activities identified the following themes that could contribute to future decision-making related to economic development in Camas.

Economic Development

- **North Shore:** Need infill development.
- **Grass Valley:** Needs mixed/light industrial park with athlete fields/parks. Why no Grass Valley Subarea Plan? Be clear on what kinds of businesses would be most beneficial to Camas in Grass Valley to build awareness when talking with prospective businesses.
- **General:** Need more commercial space, more manufacturing jobs, and a dedicated economic development director or staff person (apply for grant), and plan. Focus on tourism and bring in money. Are there model cities Camas would strive to look like? (Lake Oswego, Bend, etc.) Compare plans with cities that have experienced similar growth? What did they do well?
- **Housing:** Allow work/live housing along and around UGA/schools and major transportation corridors. Ensure workforce housing is available for current and future workers. Having diverse housing options will lead to a more diverse city.

Downtown Strengths

- **Strong sense of place:** Downtown stakeholders feel supported by Camas community. They discussed the quaint, small-town character, with unique features attracting visitors and services and how the mix of new and old/established businesses contributes to vitality of Downtown.
- **Positive support for businesses**: Good interactions with the DCA, overall good experience working with the City and business owners cultivate a collaborative environment.
- **Increases in housing density seen as a positive direction:** New housing is opportunity for more amenities to support the growth and expansion of amenities can make Downtown more walkable.

Downtown Opportunities

- **Improvements to public realm** to increase / improve street lighting, address issues with street trees (some interfere with sidewalks, other infrastructure), improve the civic area of Fire Dept. plan, add connectivity to adjacent residential neighborhoods, and open spaces, and provide outdoor dining spilling out onto sidewalk.
- **Community gathering spaces**: Need more meeting places indoor/outdoor and outdoor spaces for children/families, should expand Downtown Core beyond 4th Ave, support redevelopment of underutilized land on 3rd and 5th Ave, and should create more spaces for retail that extends walkability of Downtown, cohesiveness.
- **Development potential:** Explore more ways to activate ground floors and embrace walkability / modern parking standards.

Downtown Challenges

- **Parking is a concern for some:** Two-hour duration (especially difficult for employees) and Mill property / parking lot.
- **Pace of development:** Concern over what new development will mean for current businesses and need for balance between new development and preserving historic structures in Downtown.
- **Growth opportunities are limited:** Need to expand the definition of Downtown (beyond just 4th Ave) to expand and provide more amenities. There is limited space on 4th Ave where businesses would like to locate.
- **Barriers to development and safety issues for pedestrians:** Height restrictions and fees are challenging, since rents are lower it is harder to make a project pencil, and need for safer crossings on 3rd Ave and difficult to cross 5th in some areas.

Public Engagement Findings Regarding Strategies

- **Need more responsive permitting and ongoing maintenance to the public realm** since this supports the success of Downtown.
- **More partnerships between City and Downtown businesses:** City can increase interaction and build relationships with business / property owners.
- **Identify ways to keep local presence and restore historic structures:** Some expressed concern over losing historic structures and asked for ways to balance preservation with new development. The City could provide incentives for existing business owners who would like to expand or stay in Downtown Camas as new development continues.
- **Explore ways to address underutilized property**: For example, opportunities at GP parking lot.
- **Pedestrian Safety and Connectivity:** Address 3rd and 5th Avenue pedestrian safety and improve connections to and from Downtown. Focus on pedestrian activation through plazas and public spaces. Address accessibility needs both with ADA and beyond.
- **Improvements:** Expand character of Downtown to the broader boundary defined in the plan. Accommodate a flexibility of spaces and variety of uses through use of public space (sidewalks, parking, etc.). Define the historic character of 4th Avenue through specific streetscape elements.

City of Camas Competitive Position

The city's competitive position can be summarized in terms of strengths, weaknesses, opportunities, and threats. These represent internal and external factors that can have positive or negative impacts on economic outcomes in Camas. Several ideas added to the summary below are based on feedback received through community engagement activities. Table 4 below outlines key findings associated with economic growth and development.

Table 4 Strengths, Weaknesses, Opportunities, and Threats Summary Analysis

STRENGTHS

- High quality of life amenities like parks and recreation opportunities including new City investments in capital projects.
- Downtown experiencing high visitation and high demand for retail spaces (increasing rents, low vacancy).
- Responsive permitting, ongoing maintenance of the public realm.
- No Washington State income tax.
- Proximity to Portland International Airport.
- Well regarded public schools.
- The Downtown Camas Association is completing a comprehensive Downtown lighting plan with a state grant to support safety.

WEAKNESSES

- Rising housing costs, purchasing a home is unaffordable for those under 120% AMI.
- High industrial rents and very low industrial real estate vacancies.
- Development standards related to height was cited as a barrier by stakeholders.
- Need Downtown development to be feasible to build (pencil).
- Highly constrained lands may be difficult to develop for commercial or industrial land uses (such as in Washougal).

OPPORTUNITIES

- Attract highly skilled workers with locational flexibility.
- Develop pathways for youth to gain skills and seek jobs in Camas.
- Identify target industries for managing land capacity and expected growth.
- Incentives for existing business owners, wishing to expand their operations.
- Opportunities for Downtown redevelopment and partnerships with Downtown businesses and nonprofits (such as Downtown Camas Association, the Port, Chamber, Farmers Market, and more).
- Develop mill ditch into a compelling, easy, and beautiful trail system that is clear to connect with from Downtown and improve the trails to encourage local resident activity and to attract visitors.
- Need more hotels and conference space.
- City should partner more with the Downtown Camas Association on incentive programs.
- Improve pedestrian safety throughout downtown.

THREATS

- Unequal rates of homeownership by race and ethnicity indicating unequal economic opportunities.
- Disparities between remote and non-remote workers.
- Anchor employer changes.
- Safety threats that could be supported by better lighting, street tree improvements, safer crossings for pedestrians in the Downtown.
- Need to balance preserving historic features with new development in Downtown.

Broad Planning Context

Comprehensive planning in Washington is guided by the Growth Management Act (GMA), a series of statutes first adopted in 1990 which requires cities and towns within the state's most populous counties to fully plan for future growth (RCW 36.70A) and develop mandatory comprehensive plan elements. State provisions set limits on what actions cities and counties can take to support economic development. Article 8, Section 7 of the state constitution specifies that "No county, city, town or other municipal corporation shall hereafter give any money, property, or loan its money, or credit to or in aid of any individual, association, company or corporation, except for the necessary support of the poor and infirm."[16] Given this limitation, cities generally cannot directly use public funds to attract private development and instead target policies that facilitate economic growth through land use, infrastructure, tourism, marketing, and partnerships with nonprofit community-based organizations.

Cities in Washington also coordinate with county-level Associate Development Organizations (ADOs) that represent each of Washington's counties, funded in part by the state Department of Commerce. The Columbia River Economic Development Council (CREDC) represents Clark County and presents a baseline of goals and objectives for the region. Their former 2018-2023 Comprehensive Economic Development Plan outlined goals and actions based on a vision and set of values and guiding principles identified through extensive engagement with local partners, which have carried through and expanded with the more recent 2024 Comprehensive Economic Development Plan with new supplemental actions to encourage economic development for communities within Clark County.

New objectives in CREDC's regional economic development plan expand on support for entrepreneurship, placemaking investments, fostering development and redevelopment projects, and expanding equitable employment opportunities. The Plan also recognizes the growing role of smaller cities like Camas outside of Vancouver which are seeing fast population growth and opportunities to develop their own employment bases.

[16] RCW 35.21.703 does allow cities to contract with nonprofit corporations to advance economic development.

Table 5 Goals and Objectives from 2018-2023 CREDC Comprehensive Economic Development Plan

Source: CREDC

	2018 Plan Objectives	2024 Update Objectives
Expand the Existing Base	• Become Industry Experts • Strategically Market Industry Clusters • Build a Start-Up Ecosystem	• Reduce Site Infrastructure Hurdles • Grow Start-Up Ecosystem • Support Permitting Consistency • Explore Commercial Code Flexibility • Foster Small Business Networking
Support People	• Foster Skills Development • Prepare Youth for Economic Opportunity • Launch a Brain Gain Initiative	• Align Workforce with Employer Needs • Enhance Access to Career Pathways • Support Talent Retention
Create Place	• Each Community Creates a Placemaking Strategy • Embrace Economic Opportunity in Urban Center • CREDC Tells the Story of Place • Make Areas Desired by Industry Clusters Shovel-Ready • Determine All Transportation Needs on a Regional Level	• Leverage Placemaking Investments • Encourage Infrastructure Investments That Cross Municipal Boundaries

The Clark Countywide Planning Policies provide guidance on economic development across incorporated and unincorporated areas of the County (the County also distinguishes policies specifically for unincorporated areas, but not for jurisdictions and their UGAs). These policies (adopted in 2015) are currently being updated. The updated version will be reviewed as a part of the policy and goal development stage of the Comprehensive Plan update.

Buildable Land Capacity and Employment Capacity

Cities fully planning for adequate land capacity to meet the needs of the community must understand their current employment base, development trends, workforce housing availability, income segments of the population, and future projections. To fully plan for growth and meet community needs in compliance with state provisions, more suburban cities like Camas that are

growing in terms of employment must understand the dynamics of the local and regional economy, consider where employment is concentrated and how residents and workers access employment opportunities, what industries are growing or declining, and whether there is sufficient space to fulfill anticipated employment land needs alongside other uses.

Washington's Review and Evaluation Program (the Buildable Lands Program, RCW 36.70A.215) requires certain counties, including Clark County, to establish their own buildable lands programs and review past development and density patterns to see if local policies are effective and prepare to plan for the next 20 years of growth, through a "Buildable Lands Report" released before a Comprehensive Plan update.

Clark County has updated its Vacant Buildable Lands Model (VBLM) as a part of their 2025 periodic update of their Comprehensive Plan. This VBLM provides a basis for the available employment capacity in the City of Camas based on available buildable land (including both vacant and underutilized land), current zoning, and market and employment density assumptions. Table 6 below shows the County's current allocation of jobs for the City of Camas and the Camas Urban Growth Area (UGA) and the 2023 Vacant Buildable Lands Model (VBLM) capacity and yield calculations.[17]

This analysis shows that the City of Camas has a job target of 13,658 jobs, with a preliminary estimated capacity showing availability for 11,363 jobs, as well as additional assumptions for work from home, construction, and government jobs which have specific land need considerations documented in Clark County's 2025 Population, Housing and Employment Allocation memorandum.[18]

Evaluating employment capacity is necessary to determine whether the job growth allocation (determined by the county) can be accommodated within the City of Camas and Camas UGA(s). Sufficient capacity is available if employment growth capacity is equal to or greater than the City's allocation. If sufficient capacity is not available, the shortfall must be addressed by rezoning, or revising allowable density, or by modifying or creating a new UGA or annexed area to provide additional area for employment growth capacity. To help provide geographic context for this analysis, a map of the City of Camas and its existing and proposed Urban Growth Areas was created see Figure 16.

[17] This has been modified since the County's 2020 Buildable Lands Report, which identified 963 net buildable acres (296 on commercial land, 667 on industrial land) in the Camas UGA (Clark County Buildable Lands Report, 2023).

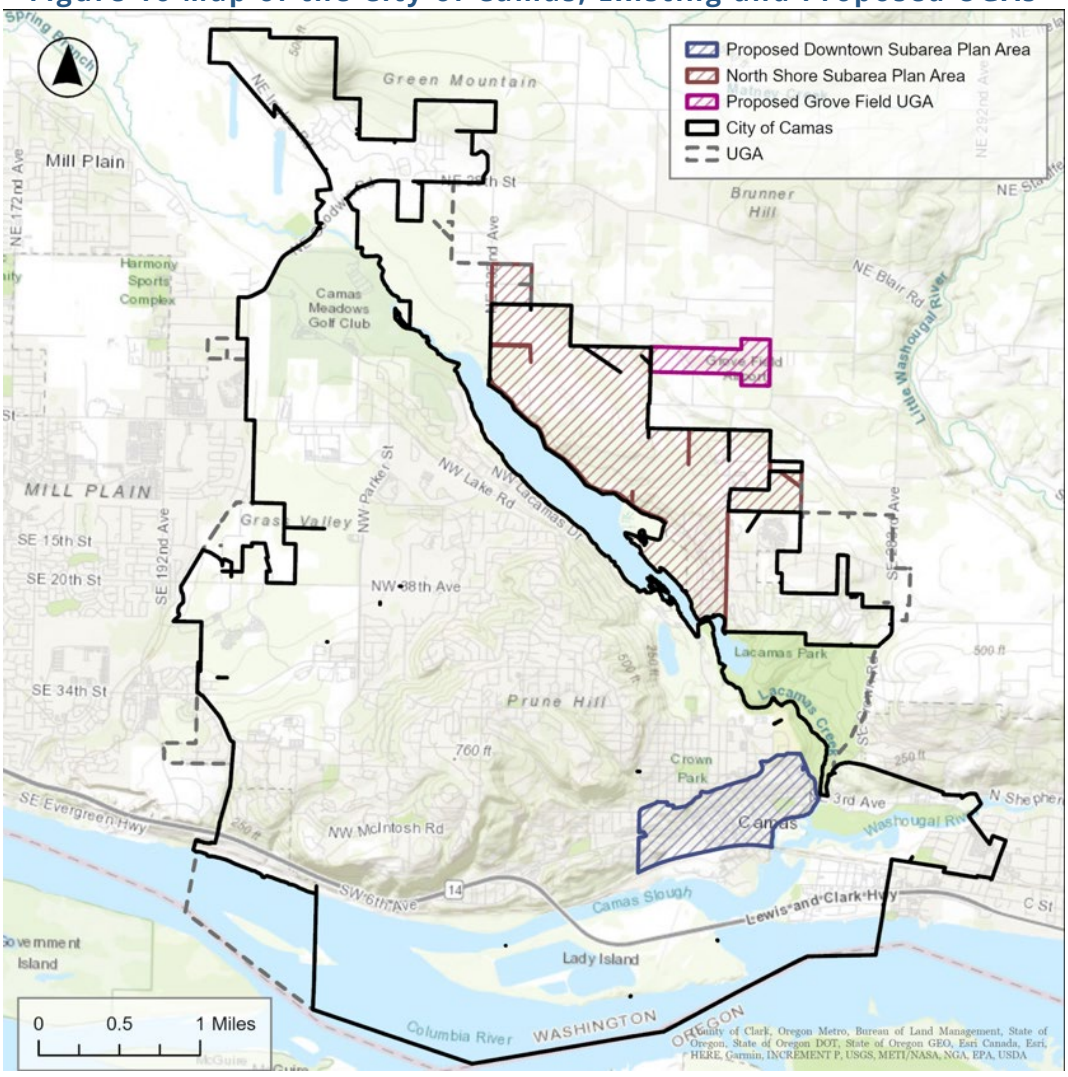
[18] Clark County Community Planning, 'Clark County Comprehensive Plan 2025 Update 2025 Population, Housing and Employment Allocation – Issue Paper 5,' April 2024, https://clark.wa.gov/sites/default/files/media/document/2024-04/issue_paper_5_pop-emp_alloc_4_17_24.pdf.

Table 6 Employment Capacity and Allocation by UGA, Clark County

Source: VBLM 2023, Capacity and Yield by Jurisdiction. Note: The County total estimate is 88,100 jobs accounting for government, construction, rural, and work from home jobs.

Jurisdiction	2023-2045 Employment Allocation	2023 VBLM Capacity	Assumptions		
			Work from Home	Construction	Government
City of Camas and Camas UGA	**13,658 jobs**	**11,363 jobs**	615 jobs	879 jobs	549 jobs
Total Clark County UGAs and Cities	**83,695 jobs**	65,091 jobs	3,524 jobs	5,038 jobs	8,600 jobs

Figure 16 Map of the City of Camas, Existing and Proposed UGAs



Additional analysis refining the employment capacity is underway that is based on key City of Camas zoning and UGA modifications. The City of Camas is proposing zoning modifications and the addition of a new UGA that would allow for additional employment capacity. According to these refined employment capacity estimates, Camas would have capacity for 12,273 jobs which would almost meet the 2045 employment target of 13,658 jobs. The finalized estimates will depend on the final preferred alternative.

CLARK COUNTY'S BUILDABLE LANDS REPORT, 2023, KEY FINDINGS

Clark County's Buildable Lands Report was adopted in June 2022 to update the methodology and Vacant Buildable Lands Model (VBLM) and updated with 2023 data.

- The Clark County Buildable Lands Report and employment allocations and City of Camas estimates indicate that there is sufficient employment capacity for employment growth in the county through 2045.
- Camas has the second largest share of total projected jobs in Clark County (17.5%) after the City of Vancouver and the Vancouver Unincorporated Urban Area (U). The City of Camas is expected to have capacity to accommodate 11,363 jobs, with about half (55%) of new employment on commercial land and half on industrial (45%).

City of Camas Profile

More than 10,000 years ago, Native Americans occupied the Columbia River Valley in the area where Camas is now situated. Before Camas was incorporated, a paper mill owned by the LaCamas Colony Company was established in 1883 to help supply newsprint for The Oregonian. Shortly thereafter, the City of Camas became an incorporated city in 1906. The City is named after the camas lily, a deep blue flowered plant with edible onion-like bulbs valued by various Columbia river Native American Tribes.[19] The paper mill expanded in the early 20th Century playing an important role in the local economy and grew to become Clark County's largest manufacturing company with 2,700 employees by 1971.[20] Located in the western edge of Downtown Camas along the Columbia River, the mill then experienced a downturn beginning in the 1980s that continued into the 21st Century, resulting in a reduced workforce. More recently, in 2018, the mill now owned by Georgia-Pacific, shut down several facilities and all but one of its paper machines and downsized its workforce to roughly 150 workers. In 2024, the mill continues to operate with a reduced workforce.

[19] City of Camas history: https://www.cityofcamas.us/community/page/camas-history
[20] Source: https://www.camaspostrecord.com/news/2023/sep/07/camas-mill-celebrates-its-140th-birthday/#:~:text=An%20entire%20wall%20of%20photos,built%20the%20mill%20to%20produce

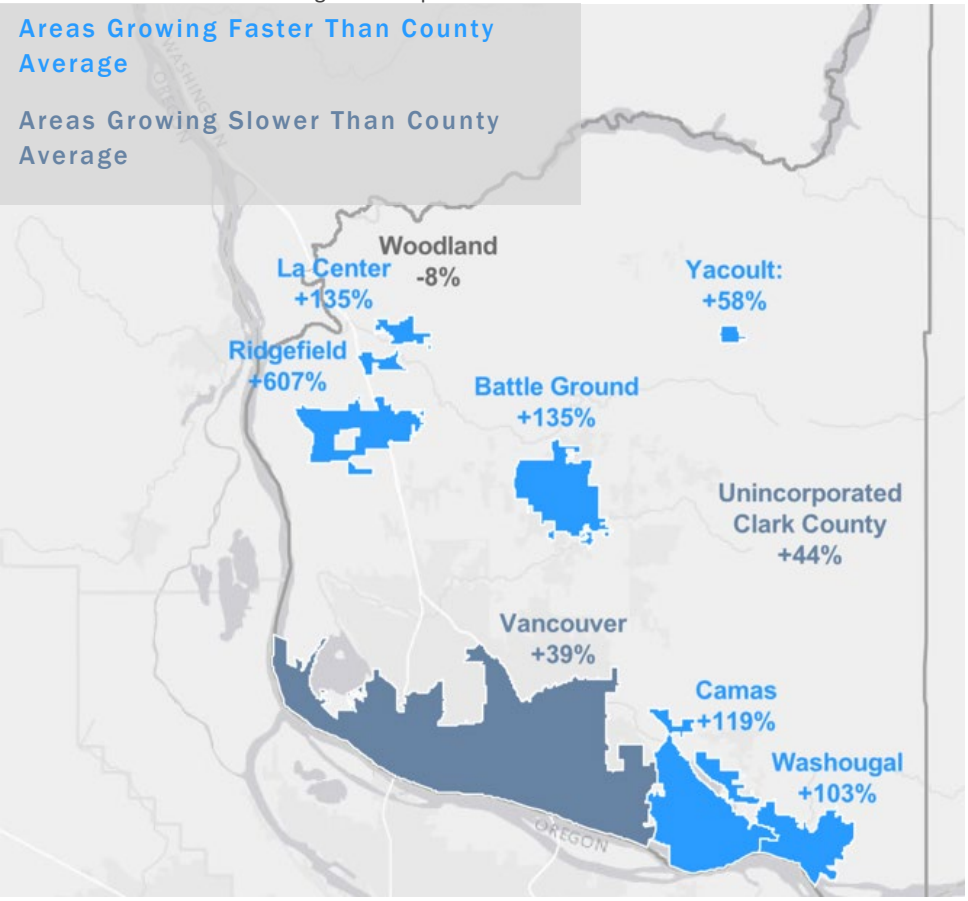
The early economy in Camas was at first dominated by manufacturing but has shifted and diversified over time. The 2015 Comp Plan describes a transition where the City's past economic health was closely tied to the paper mill and then shifted to become more diversified supporting many technology and manufacturing firms, as well as a growing school system and professional offices. In the last four decades, the family-friendly City with close ties to the Portland Metropolitan Region has continued to attract more residents especially from 1990 to 2000 by almost doubling in size to almost 13,000 people, increasing to a little over 19,000 people in 2010, and then reaching 27,420 people by 2023. Similar to the City of Vancouver, Camas has experienced high population growth over the last two decades, with an average annual growth rate of 5.2% which is double the rate in Clark County and Washington State.

Today, the City of Camas is a highly desirable place to live, offering a prime location nearby the growing cities and employment centers of Vancouver and Portland, and the smaller cities of Washougal and Battle Ground in south Clark County. The City of Camas is sandwiched between the City of Vancouver (sharing a border on the west side of Camas) to the west and the City of Washougal to the east. At a regional level, the City is interconnected to the Portland Metropolitan region, located northeast of Portland (see map below).

Camas has been working to advance its economic development goals in recent years while investing in quality-of-life amenities that make it as competitive location for attracting workers and residents. Recently, the City adopted a North Shore subarea plan (2022) to support community vibrancy and economic development strategies and the City is working to adopt a new Downtown subarea plan as a part of the 2025 Comprehensive Plan periodic update project. The City has also been expanding its inventory of parks space by leveraging the County's Legacy Lands program to expand its offerings of natural areas and recreation facilities. As larger economic trends increase locational flexibility (especially for professional services and traditionally office-based jobs), these types of investments will be critical for cities in the region to continue drawing in and retaining a residential base and workforce. The Port of Camas-Washougal manages an airport that is outside City limits, but most of the developable land in the North Shore area is within the airport influence area.

Figure 17 Camas Compared to Clark County Cities

Source: Office of Financial Management Population Estimates



Economic Development Overview

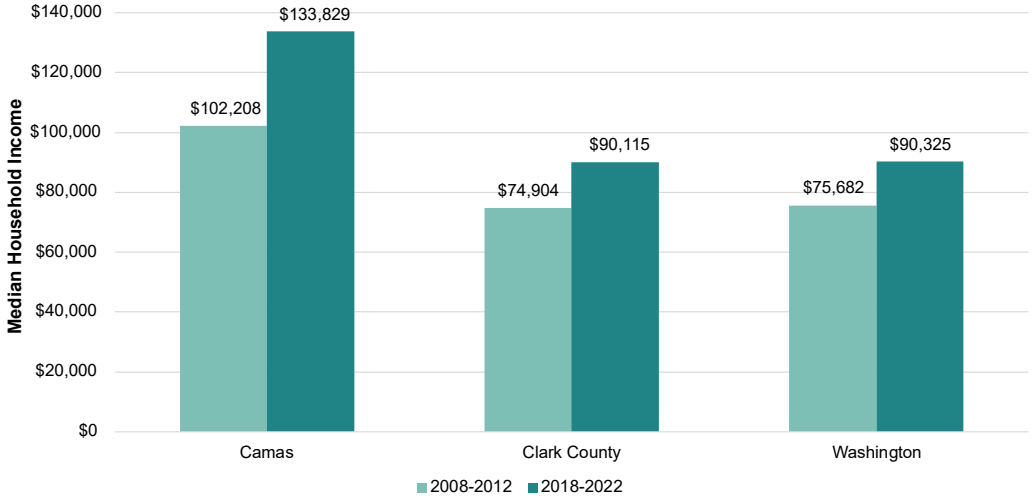
Economic development for the City of Camas is the creation and sustenance of a diverse array of employment opportunities, ensuring the tax base currently enjoyed by the City endures and is strengthened. The economic health and well-being of the City are tied to commitments to promote a wide range of employment opportunities for the citizens of the community and to provide a setting and quality of life that attract businesses and residents.

Planning a diverse and vibrant economy must start by understanding current economic conditions in the City and Clark County. While the City's past economic health was closely tied to the paper mill, in more recent years, the City's economy has diversified and now supports many technology and manufacturing firms, as well as a growing school system and professional offices. The figures below compare the median household income for Camas, Clark County, and Washington as well as employment and related trends over time.

As illustrated in Figure 18 when compared with Clark County, wages in Camas are higher and have grown over the last decade. Higher wages can have positive impacts on other aspects of the economy, and community members have expressed their desire to support living-wage jobs, particularly in healthcare and high technology.

Figure 18 Median Household Income, Camas, Clark County, and Washington

Source: U.S. Census Bureau, 2008-2012 and 2018-2022 ACS 5-Year Estimates
Note: 2008-2012 values are adjusted for inflation. Median household incomes are shown in 2022 $.



Growth in employment, population, and housing are interconnected. In general, communities with a high ratio of population to jobs can be characterized as "bedroom" or commuter communities, where there are fewer jobs than residents in the city. In Camas, there are roughly three residents for every one employee, indicating a continued trend from the past decade.

The ratio of jobs to housing has slightly increased from 0.9 to 1.0, indicating a healthy balance of housing units in comparison with employment and meeting the jobs-to-housing ratio of 1:1 adopted by Clark County (Resolution 2016-03-01). As the City grows, maintaining this trend can help to ensure there is adequate housing for those who work in Camas.

Table 7 Population, Employment, and Jobs Comparison Ratios, Camas, 2010-2021

Source: OFM, LEHD-LODES. Note: Employment data is currently only available at the City level through 2021.

	Trends			Ratios	
	Population	Employment	Housing Units	Population : Jobs	Jobs : Housing
2010	19,355	6,508	7,072	3.0	0.9
2021	26,870	9,558	9,586	2.8	**1.0**

Overall, Clark County has seen fluctuations in employment since 2000, with the most notable decline in employment in the wake of the 2008 recession and at the onset of the COVID-19 in 2020. However, the County has also seen a rapid rebound from pandemic trends, with sharp employment growth after 2020. The City has generally seen positive growth in employment over the last two decades. The City saw less of a decrease during 2020 compared to Clark County overall, which may reflect Camas' growth in remote workers during this period (Figure 19).

Figure 19 Total Covered Employment Change YOY, Clark County (2001-2022)

Source: Washington Employment Security Department

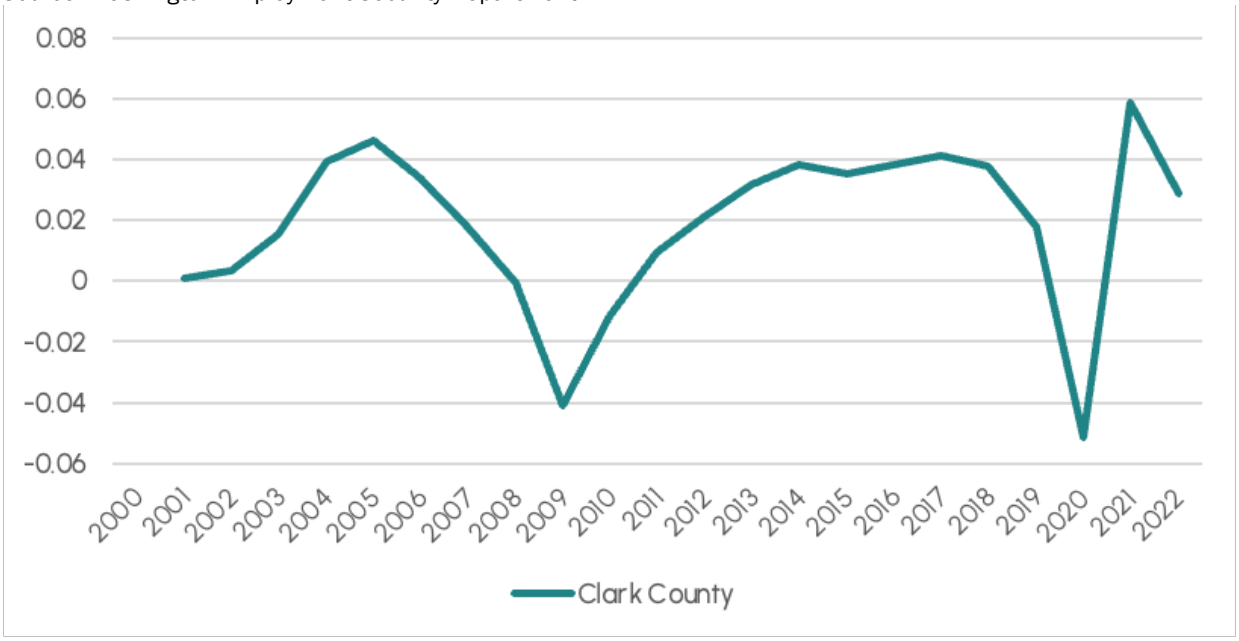
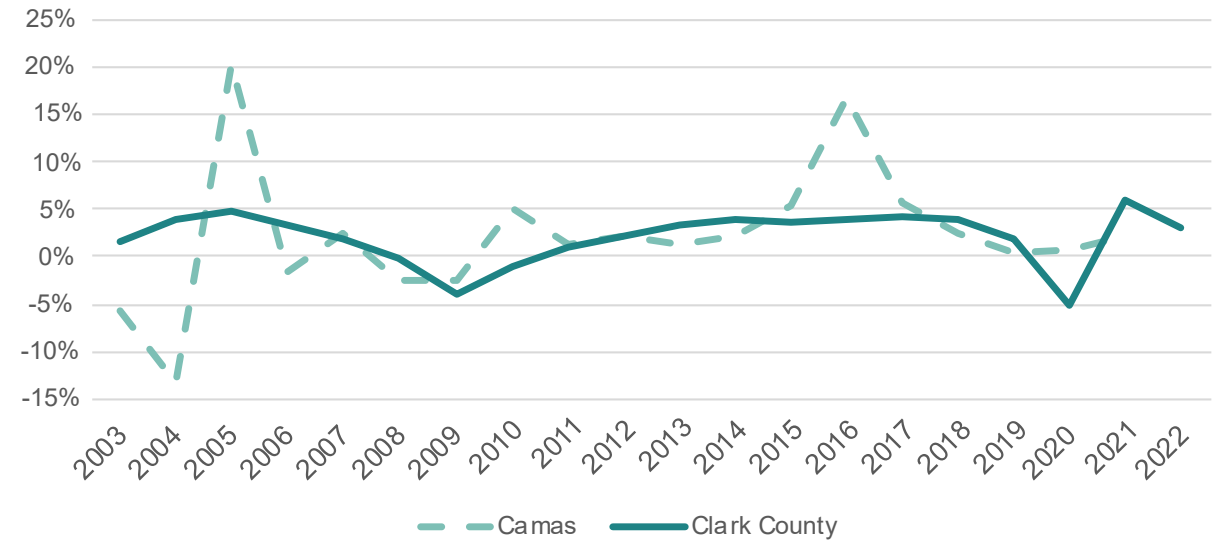


Figure 20 Total Employment Change YOY (Primary Jobs), Camas and Clark County

Source: Washington Employment Security Department, LEHD-LODES. Note: LEHD-LODES data for the City of Camas only available through 2021



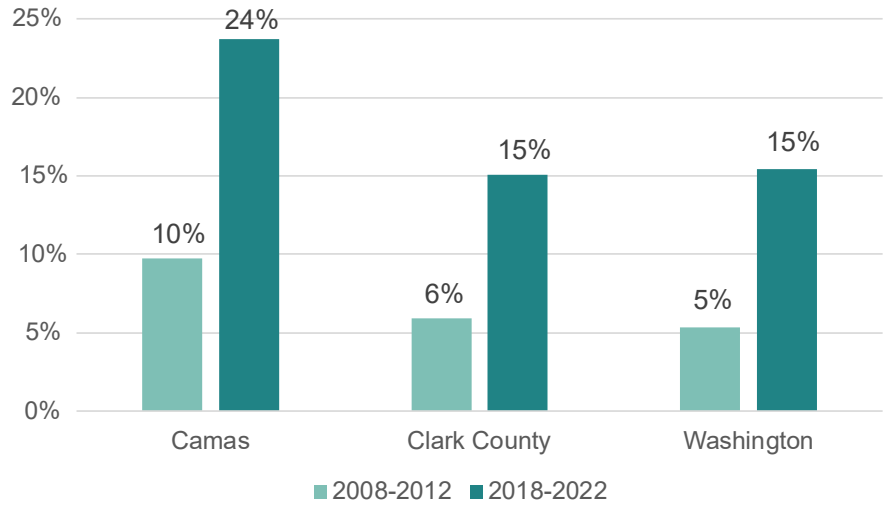
The Economic Development Element establishes goals and policies that seek to maintain the diversification of employment opportunities and support the continued growth of the Camas economy and attainment of the jobs target by 2045.

The City is targeting businesses that provide a greater proportion of living-wage jobs. Increasing retail services in support of residential, industrial, and professional business growth

is highly desirable. Camas is also seeing an increasing share of remote workers at a higher rate than the County or State, with nearly a quarter of workers falling into this category in 2022.

Figure 21 Share of Remote Workers, Camas, Clark County, and Washington, 2012-2022

Source: ACS, 2008-2012, 2018-2022



Summary of Demographic and Economic Trends

A summary of key findings from this Economic Development Element analysis is provided below to help describe key insights regarding the economic context, economic opportunities and challenges informing plan updates (Technical Appendix provides the full findings).

- **Camas has an aging population with a median age of 40 years in 2022 and a growing share of residents aged 60 years and over.** This group typically represents late-career workers or retirees. Median age in Camas is higher than Clark County overall and quickly growing since 2012, likely indicating a combination of natural growth and in-migration of older adults.
- **Camas has a higher share of residents 25 or older with at least a college level bachelor degree compared to Clark County or Washington State**, with 79% of residents holding these degrees in 2022. This share of residents rose quickly from only 37% in 2012.
- **Median household income for all households in Camas was nearly $134,000 in 2022, higher than Clark County or Washington State.** Since 2012, median income for residents of Camas increased by about 30% (in nominal dollars, not adjusted for inflation), more than either the County or State.
- **The City of Camas has seen generally positive trends in employment growth over the last two decades,** with notable increases in the number of workers in 2005, 2010, and 2016. The City of Camas employment grew from approximately 6,584 to 9,558 between 2011 and 2021.

- **The current employment to housing ratio in Camas was 1.0 in 2021, meaning that there is about one employee working in the City for every housing unit.** This ratio indicates that Camas has a well-balanced housing stock to accommodate workers in the City.
- **In 2021, the top five industries by employment in Camas were Finance and Insurance; Manufacturing; Educational Services; Professional, Scientific, and Technical Services; and Wholesale Trade.** Four of these five top industries paid above average wages (all except Educational Services paid below average wages). Finance and Insurance was the City's fastest growing industry (with an average annual growth rate of about 33%).
- **Top employers also reflect many of the County's largest industries, including professional services like finance and insurance, technology, manufacturing, and health care. Four of the City's top ten employers were in the manufacturing industry as of 2020.** Within Camas, employment has concentrated at two nodes, including the Downtown area to the southeast and corporate campuses in the Grass Valley near the border with the City of Vancouver.
- **Camas is part of an interconnected region, with more residents commuting out of Camas for work (8,159) than employees commuting in (6,982) as of 2021. Approximately 9,102 people are employed in Camas and among this total nearly 90% live in Camas (8,159) but work outside of the city and the remaining 10% live and work in Camas (943 people).** Top commuting destinations for Camas residents are primarily nearby, larger cities with employment hubs like Vancouver and Portland, while only 10% remained in the City. Nearly 59% commute less than 10 miles. The fourth most common destination for residents was Seattle, likely indicating remote workers at companies based in the Puget Sound area. Workers commuting to Camas originated from similar destinations, with one quarter coming from Vancouver.
- **Washington State Employment Security Department projections for future employment growth estimated that the Southwest Washington region will grow by about 19% overall by 2031.** The sectors expected to see the greatest increase in their share of employment are Professional/ Business Services, Leisure/ Hospitality, Education/ Health Services, Information, and Other Services.
- **Camas has a larger share of remote workers compared with Clark County and Washington State.** In 2022 one in four workers in Camas was a remote employee, compared to 15% in both the County and State overall. The share of remote workers in Camas has grown since 2012.
- **Since 2020, the City has issued 8,652 new business permits, with the largest volume of new permits in 2020 and a decreasing amount annually after 2020.** General business establishments accounted for the largest portion of these permits (74%), followed by home occupations (25%), and nonprofits (1%).
- **Camas' taxable retail sales were higher than those in most comparable jurisdictions in Clark County over the past decade**, competing primarily with the City of Battle

Ground for the highest annual sales. In 2022, total taxable retail sales reached an all-time high of over $600 million.

- **Retail rents in Camas had slight upward growth since 2014 while vacancies trended downward, indicating increasing demand for retail. Industrial real estate in the City of Camas is also performing well compared to Clark County in 2024.** The City is home to only about 3.9% of Clark County's industrial real estate in square footage but saw a sharp increase of industrial rents PSF in 2022, growing by over 200% year-over-year (YOY) to $23. Vacancy rates for industrial real estate were also extremely low in Camas in 2024 YTD at 1.7%, indicating high demand in the industrial market.

Implementation Tools and Strategies

Realizing the City of Camas economic development goals requires building on the City's potential while overcoming existing constraints. The following implementation strategies will generate positive momentum toward creating a more balanced and healthy economy.

Programmatic Strategies

- **Economic Development Committee:** Establish a mayor-appointed committee to help refine and implement Camas' economic development goals and strategies. The committee will:
  - Convene government, private sector, and nonprofit partners to leverage resources or secure financial support for economic development initiatives that benefit Camas and the broader region. In addition, this committee would help provide input on the Economic Development Strategy.
- **Economic Development Strategy**: Create an Economic Development Strategic Plan involving the Economic Development Committee, local businesses, community groups, school districts, and city leadership that further identifies priorities for job creation in targeted industries, infrastructure needs, reducing regulatory barriers, and incentives to attract needed and desired businesses.
  - Promote the development of an economic development strategy that will capitalize on the creation and retention of industries that provide living-wage jobs.
  - Future economic development strategy planning should capitalize on existing facilities and infrastructure and include a mix of uses that are trail- and transit-oriented and designed with high-quality streetscape appeal.
  - Lead an economic development strategy update every 1 to 3 years.

Financial Strategies

- **Leverage Grant Dollars**: Utilize federal, state, and county grants to support the establishment and expansion of small local businesses and infrastructure improvements benefiting economic development areas.
- **Incentives**: Explore incentives to encourage mixed-use development and provide affordable housing options (such as TIF, LID, MFTE changes).

- **Partnership**: Coordinate with the Columbia River Economic Development Council (CREDC) or other relevant organizations, to explore collaborative opportunities in promoting regional workforce development.
- **Opportunity Site Inventory**: Identify sites where the city can participate in cost-sharing mechanisms for infrastructure development.
    - Establish a policy that prioritizes capital investments to or on opportunities sites or other capital projects that better connect commercial nodes. This could include sidewalks, trails, bike paths, etc.

Regulatory Strategies

- **Code Audit**: Ensure the zoning code supports/incentivizes a broad range of needed and desired businesses in various zones.
    - **Study Allowed Uses:** Ensure needed and desired businesses are allowed in certain zones, including accessory uses which can support home-based businesses.
    - **Design standards**: Consider revisiting existing design standards to ensure they adequately support efforts to maintain and enhance existing character without compromising development feasibility.
    - **Flexible parking standards:** Develop flexible parking standards that can respond to site conditions.
    - **Revised Gateway Corridor Design Standards:** Update the design standards and allowed uses for gateway corridors to enhance its natural beauty but deemphasize its auto-oriented environment.

Procedural Strategies

- **Capacity Building**: Leverage increased tax revenue from population growth to support Camas' economic development strategy.
- **Clear and Objective Development Standards**: Establish clear and objective development standards for all development types, reducing the need for conditional use processes or other discretionary review processes.
- **Monitoring**: Monitor the performance of economic development such as with business retention and attrition, changes in tax revenues, and permitting of employment facilities. Monitor the financial impact of new programs, policies, and regulatory requirements on development feasibility by providing a report update every 1-3 years describing key metrics such as development changes and infrastructure projects.

Economic Development Goals and Policies

Goal ED-1 Citywide Economic Development

Maintain a diverse range of employment opportunities to support all residents, provide sufficient land supporting employment needs, and provide a setting and quality of life that attract and retain living-wage jobs[21] throughout the community.

Policy ED-1.1 Work with partners to identify strategies to proactively recruit businesses and ensure that tools and incentives are in place to attract sustainable and innovative industries to expand and provide stable living-wage employment.

Policy ED-1.2 Work with partners (such as the Chamber of Commerce, education programs, Workforce SW WA, CREDC) to provide apprenticeships, internships, vocational training schools, entrepreneurship programs, equitable opportunities, and on-the-job training in targeted industry sectors.

Policy ED-1.3 Encourage appropriate reuse, environmental cleanup, and redevelopment of older and deteriorating commercial areas and industrial brownfield sites. Identify opportunities to support place-based economic development, provide connections to the waterfront, diversify the economy, and support mixed-use development.

Policy ED-1.4 Foster and expand year-round recreational services, lodging, conference spaces, dining, and retail options to support tourism, benefit residents and employers, leverage Camas' strong parks and open space assets, and connect to the waterfront.

Policy ED-1.5 Participate in regional recruitment organizations to ensure the availability of an adequate supply of commercial and industrial employment land to support the City's economic development goals. Evaluate city resources to support economic development

[21] A living-wage job is one that pays an income sufficient to cover basic living expenses without financial hardship, allowing an individual or family to afford essential needs such as housing, food, healthcare, transportation, childcare, and other necessities without relying on public assistance. MIT Living wage calculation (2024): https://livingwage.mit.edu/counties/53053.

planning and implementation by designating a point-of-contact for economic development programs and serving as a liaison to the business community.

Policy ED-1.6 Support and encourage employees to use the Commute Trip Reduction Program. Encourage businesses to support remote work to reduce trips and implement a trip reduction program with incentives for carpooling, transit ridership, and other options beyond single-occupancy vehicles.

Policy ED-1.7 Encourage mixed-use development and complementary businesses throughout the City to support industry clusters and leverage resources.

Policy ED-1.8 Review regulatory design standards and planning procedures for industrial and commercial facilities and provide economic incentives to promote private investment in start-ups, incubator businesses, and businesses relocating to Camas.

Policy ED-1.9 Coordinate with Clark County and evaluate adding a Grove Field Urban Growth Area (UGA) for employment purposes to support employment targets.

Policy ED-1.10 Explore ways to support remote workers such as community hubs and third places and code revisions for co-working spaces.

Policy ED-1.11 Implement the Downtown Camas subarea plan and the associated goals and actions (see downtown subarea element).

Policy ED-1.12 Promote the growth of residential development in the North Shore as described in the Camas North Shore Subarea Plan.

Goal ED-2 Local Business Development

Promote business creation, expansion, retention, and diversification throughout the community to create a consistent and reliable tax base and a healthy, diversified local economy.

Policy ED-2.1 Identify and plan for infrastructure (such as the capital facilities plan) to nurture and incubate new businesses. Explore financing tools such as tax increment financing to fund infrastructure to support development and investment in targeted areas.

Policy ED-2.2 Support retention, expansion, and recruitment of local businesses in Camas.

Policy ED-2.3 Support development standards that promote high-quality building and site design, encourage businesses to operate in a sustainable and environmentally responsible manner and integrate energy efficient design features.

Policy ED-2.4 Collaborate with partners and agencies (such as CREDC and the Port of Camas Washougal) to develop economic strategies that promote diversification of business and industry in the city and facilitate opportunities for entrepreneurship.

Policy ED-2.5 Work with partners to proactively recruit and promote the growth of businesses and industries that provide, at a minimum, cost-of-living wages and economic diversity in alignment with the CREDC regional economic development plan.

Policy ED-2.6 Explore the creation of an economic development grant program for local businesses in connection with local partners.

Policy ED-2.7 Facilitate an environment for the success and growth of small businesses to maintain a strong, diverse, and resilient local economy.

Policy ED-2.8 Encourage investments and programs that provide resources and support to minority-owned and woman-owned businesses.

Policy ED-2.9 Increase the number of neighborhood business districts to expand local access to goods and services. Consider expanding mixed-use zoning options with ground floor commercial uses that allow residents to walk or roll from home.

Policy ED-2.10 Encourage shopping local to support Camas businesses.

Goal ED-3 Mixed Use and Commercial Areas

Encourage efficient and innovative development that thoughtfully mixes commercial and residential land uses that are pedestrian-friendly and consider the context of the surrounding area.

Policy ED-3.1 Develop commercial and mixed-use areas that are safe, comfortable, and attractive to pedestrians.

Policy ED-3.2 Encourage efficient land use in the mixed-use land use designation by facilitating compact, high-density development and minimizing the amount of land that is needed for surface parking.

Policy ED-3.3 Promote the growth of businesses such as grocery stores, medical offices, and restaurants that meet the retail and service needs of the community.

Policy ED-3.4 Encourage new developments to provide neighborhood parks and shared use paths to encourage greater physical activity and connect residential areas to commercial centers, public transit, and community facilities.

Goal ED-4 Mixed Employment and Industrial Areas

Providing a mix of traditional industrial and non-industrial land uses to maximize opportunities and partnerships and facilitate employers to remain, expand, or locate in Camas.

Policy ED-4.1 Evaluate the costs and benefits associated with adding the Grove Field Urban Growth Area to the North Shore Subarea Plan.

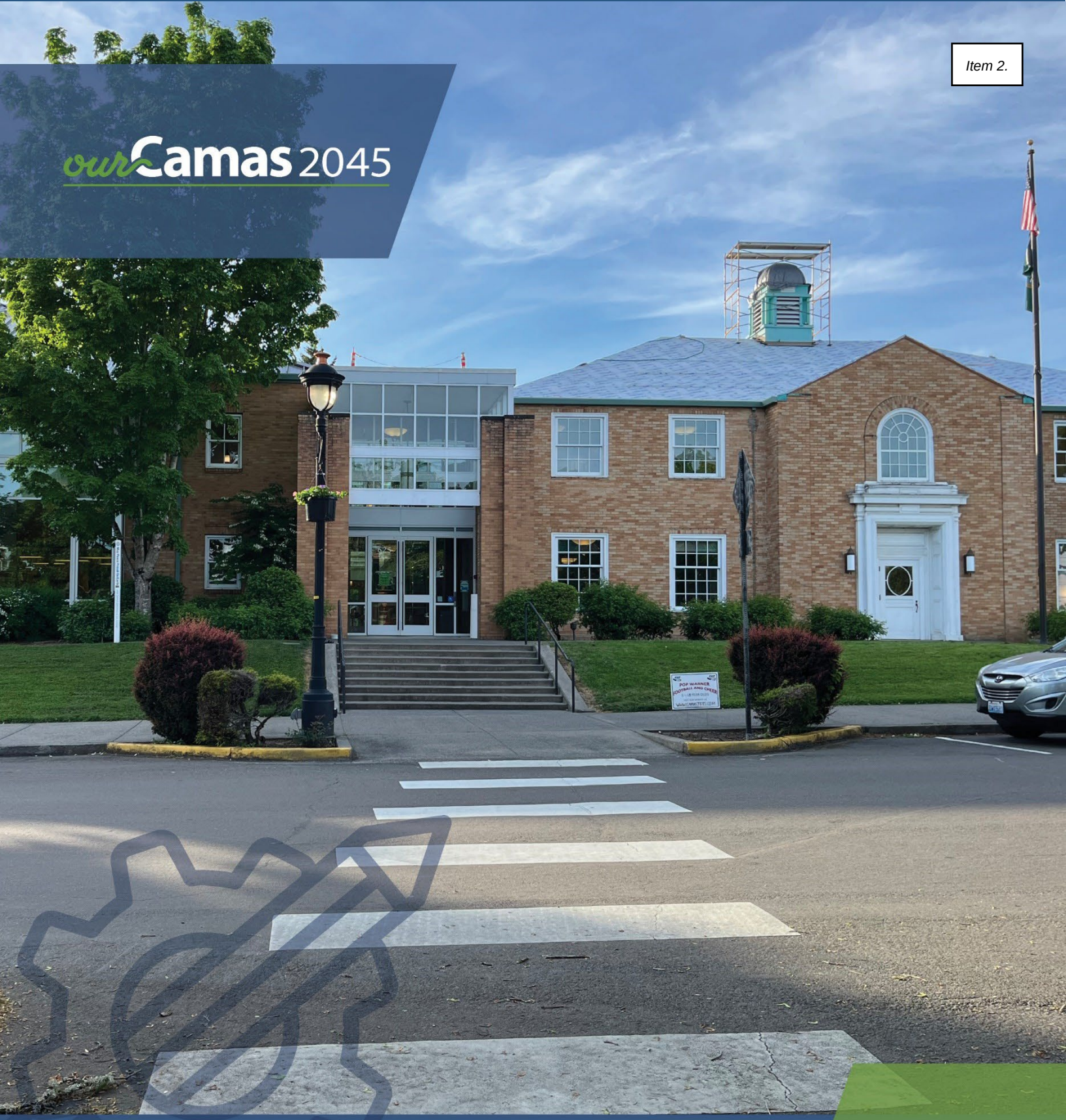
Policy ED-4.2 Preserve large tracts of land for large industry and master-planned commercial development within mixed employment land use areas.

Policy ED-4.3 Support a mix of light industrial, research and development, manufacturing, and office spaces through flexible zoning that allows for evolving business needs.

Policy ED-4.4 Support the development of business parks, incubators, and innovation hubs that integrate industrial and high-tech employment uses.

Policy ED-4.5 Ensure zoning and development regulations support both large-scale employers and small businesses, including start-ups and maker spaces.

ourCamas 2045



Technical Appendices

11

11. Technical Appendices

[Appendices to be included in future draft]

2025-2026 Capital Improvement Project List

6-Year Street Plan

Camas General Sewer Plan (2022)

Camas School District Capital Facilities Plan (2022)

Camas Stormwater Management Plan (2024)

Camas Water System Plan (2019)

Capital Facilities Plan

Clark County Comprehensive Plan (2025)

Economic Opportunity Analysis (2024)

Engagement Summary

Facility Conditions Assessment, Volumes 1 and 2

Housing Action Plan (2021)

Housing Needs Assessment (2024)

Parks and Open Space Management Plan (POSMP) (2025)

Parks, Recreation & Open Space Plan (2022)

Transportation System Plan (2025)

ATTACHMENT D

RDII PARAMETERS

RDII PARAMETERS

Table D.1 Connected Basin Area

Basin	Area (acres)	Connected Impervious (acres)	Connected Pervious (acres)	Total Connected (acres)	Total Connected (%)
4-1-3	92.8	82.4	9.1	82.4	88.8%
5-1-2	1,898.2	1,067.4	18.7	1,067.4	56.2%
5-2-1	958.8	199.6	17.6	199.6	20.8%
8-1-2	220.7	120.7	5.2	120.7	54.7%
STEP/WWTF	3,868.3	2,011.1	99.3	2,011.1	52.0%
Goodwin Road	637.8	89.3	0.0	89.3	14.0%
Leadbetter Road	1,076.9	85.1	15.8	85.1	7.9%

Table D.2 Model A Parameters

Basin	Impervious (%)	Time of Concentration (min)	Reduction Factor	Initial Loss (ft)
4-1-3	5	7	0.9	0.00196
5-1-2	0.25	7	0.9	0.00196
5-2-1	0.6	7	0.9	0.00196
8-1-2	0.6	7	0.9	0.00196
STEP/WWTF	0.1	7	0.9	0.00196
Goodwin Road	1	7	0.9	0.00196
Leadbetter Road	2	7	0.9	0.00196

Table D.3 RDI Parameters

Basin	Percent RDI Area (%)	Surface Storage (Umax)	Root Zone Storage (Lmax)	Overland Coefficient (Cqof)	Groundwater Coefficient (Carea)	TC Overland Flow (CKof)	TC Interflow (CKif)	TC Baseflow (CKbf)	Overland Flow Threshold (Tof)	Interflow Threshold (Tif)	Groundwater Threshold (Tg)	Initial Surface Storage (U)	Initial Root Zone Moisture (L)	Initial Groundwater Depth (GWL)	Initial Overland Flow (OF)	Initial Interflow (IF)	Specific Yield (Sy)	Minimum Groundwater Depth (GWLmin)	Max GW depth causing Baseflow (GWLbf0)	GW Depth for Unit Capillary flux (GWLfl1)
8-1-2	0.5	0.0328	0.328	0.30	1	20	500	2000	0	0	0	0	0	32.8084	0	0	0.1	0	32.808399	0
5-1-2	8.0	0.0328	0.50	0.53	1	5	55	500	0	0	0	0	0.16	32.8084	0	0	0.1	0	32.808399	0
5-2-1	8.0	0.0328	0.328	0.30	1	20	500	2000	0	0	0	0	0	32.8084	0	0	0.1	0	32.808399	0
4-1-3	62.0	0.0328	0.50	0.75	1	4.5	10	100	0	0	0	0	0.28	32.8084	0	0	0.1	0	32.808399	0
STEP/WWTF	18.0	0.0328	0.328	0.20	1	20	500	2000	0	0	0	0	0.20	32.8084	0	0	0.1	0	32.808399	0
Goodwin Road	4.0	0.0328	0.328	0.30	1	20	500	2000	0	0	0	0	0	32.8084	0	0	0.1	0	32.808399	0
Leadbetter Road	7.0	0.0328	0.328	0.90	1	20	500	2000	0	0	0	0	0	32.8084	0	0	0.1	0	32.808399	0

ATTACHMENT E

DRY WEATHER CALIBRATION RESULTS

DRY WEATHER CALIBRATION RESULTS

Table E.1 Dry Weather Flow Calibration Results

Meter Number	Pipe Diameter (inches)	Weekday Dry Weather Flow			Weekend Dry Weather Flow			Average Dry Weather Flow(4)		
		Percent Error(3)			Percent Error(3)			Measured ADWF (mgd)	Modeled ADWF (mgd)	Percent Difference (%)
		Average Flow (%)	Peak Flow (%)	Max Level Difference (inches)	Average Flow (%)	Peak Flow (%)	Max Level Difference (inches)			
Meter 4-1-3	12	-2.6%	0.7%	2.07	-1.1%	-0.4%	2.01	0.24	0.24	-2.2%
Meter 5-1-2	21	1.3%	-1.9%	1.35	0.9%	0.9%	1.32	0.85	0.86	1.2%
Meter 5-2-1	18	0.4%	-7.8%	0.21	-3.9%	3.0%	0.32	0.20	0.20	-0.9%
Meter 8-1-2	12	0.4%	-1.7%	0.37	4.1%	2.0%	0.30	0.12	0.12	1.4%
WWTF/STEP		2.2%	-0.4%		1.0%	-1.2%		2.80	2.86	1.8%
Leadbetter Rd	18	10.0%	0.7%		-1.3%	-5.6%		0.13	0.14	6.5%
Goodwin Rd	18	4.0%	2.8%		-3.3%	-4.2%		0.09	0.10	1.8%

Notes:
(1) Source: City of Camas Temporary Flow Monitoring Program dated May 28, 2025, ADS.
(2) Average flow, level, and velocity are calculated from weekday/weekend dry weather flow monitoring data. Maximum flow values are hourly peaks corresponding to either weekend or weekday conditions, as appropriate.
(3) Percent Difference = (Modeled - Measured)/Measured*100.
(4) Average Dry Weather Flow = (5*Weekday Dry Weather Flow + 2*Weekend Dry Weather Flow)/7.

Table E.2 Meter 4-1-3

Hour		Measured Data			Modeled Data			Diurnal	
		Flow	Level	Velocity	Flow	Level	Velocity	Initial	Calibrated
		(mgd)	(inches)	(ft/s)	(mgd)	(inches)	(ft/s)	Curve	Diurnal
Weekday	0	0.20	2.47	1.79	0.23	4.46	1.42	0.82	0.46
	1	0.18	2.36	1.74	0.16	4.04	1.33	0.76	0.53
	2	0.15	2.12	1.64	0.14	3.38	1.21	0.61	0.46
	3	0.15	2.10	1.62	0.13	3.14	1.15	0.60	0.50
	4	0.14	2.07	1.64	0.13	3.04	1.13	0.58	0.57
	5	0.14	2.09	1.66	0.13	3.02	1.15	0.59	0.71
	6	0.19	2.41	1.79	0.15	3.11	1.14	0.79	0.79
	7	0.26	2.84	1.94	0.23	3.24	1.16	1.06	1.09
	8	0.30	3.10	2.01	0.28	4.06	1.33	1.22	1.28
	9	0.29	3.06	2.01	0.29	4.46	1.42	1.19	1.33
	10	0.28	3.01	1.99	0.28	4.59	1.44	1.15	1.31
	11	0.28	3.04	1.98	0.28	4.50	1.42	1.17	1.28
	12	0.26	2.91	1.95	0.27	4.46	1.42	1.09	1.23
	13	0.26	2.89	1.97	0.26	4.43	1.41	1.09	1.14
	14	0.25	2.83	1.94	0.24	4.32	1.39	1.04	1.09
	15	0.25	2.82	1.93	0.24	4.19	1.36	1.04	1.09
	16	0.24	2.77	1.92	0.25	4.19	1.36	1.00	1.12
	17	0.27	2.96	1.96	0.26	4.22	1.36	1.13	1.18
	18	0.29	3.06	1.99	0.27	4.35	1.39	1.19	1.33
	19	0.31	3.19	2.03	0.28	4.40	1.41	1.28	1.38
	20	0.31	3.21	2.04	0.29	4.52	1.43	1.30	1.28
	21	0.31	3.20	2.03	0.31	4.57	1.44	1.29	1.13
	22	0.28	3.02	1.99	0.32	4.73	1.47	1.17	0.94
	23	0.23	2.69	1.89	0.28	4.76	1.47	0.96	0.79
Weekend	24	0.19	2.44	1.78	0.23	4.45	1.41	0.81	0.51
	25	0.18	2.37	1.74	0.16	4.04	1.34	0.77	0.53
	26	0.16	2.20	1.65	0.14	3.40	1.21	0.67	0.46
	27	0.13	2.03	1.59	0.13	3.18	1.16	0.56	0.54
	28	0.14	2.03	1.56	0.13	3.07	1.14	0.58	0.71
	29	0.12	1.96	1.55	0.12	3.03	1.12	0.51	0.71
	30	0.14	2.09	1.64	0.11	2.97	1.12	0.60	1.22
	31	0.18	2.33	1.74	0.14	2.79	1.07	0.75	1.31
	32	0.23	2.67	1.87	0.22	3.29	1.18	0.96	1.25
	33	0.30	3.11	2.01	0.26	3.94	1.31	1.25	1.14
	34	0.33	3.29	2.06	0.31	4.34	1.39	1.37	1.17
	35	0.33	3.31	2.05	0.33	4.69	1.46	1.38	1.16
	36	0.30	3.16	1.99	0.32	4.84	1.49	1.27	1.12
	37	0.29	3.09	1.98	0.32	4.81	1.48	1.22	0.97
	38	0.28	3.03	1.97	0.29	4.76	1.47	1.19	1.04
	39	0.27	2.92	1.93	0.28	4.60	1.45	1.12	1.09
	40	0.25	2.85	1.91	0.26	4.50	1.43	1.07	1.14
	41	0.27	2.98	1.94	0.26	4.30	1.39	1.15	1.19
	42	0.28	2.99	1.94	0.27	4.29	1.39	1.16	1.19
	43	0.30	3.13	1.99	0.28	4.39	1.40	1.26	1.01
	44	0.30	3.13	1.99	0.30	4.46	1.42	1.25	1.05
	45	0.28	3.04	1.97	0.30	4.62	1.45	1.19	1.12
	46	0.27	2.94	1.93	0.27	4.64	1.46	1.14	1.16
	47	0.22	2.59	1.83	0.25	4.43	1.42	0.91	1.08
Average									
Weekday		**0.24**	**2.76**	**1.89**	**0.24**	**4.09**	**1.34**	**1.0**	**0.98**
Weekend		**0.24**	**2.74**	**1.86**	**0.24**	**4.08**	**1.34**	**1.0**	**1.05**
ADWF(1)		**0.24**	**2.75**	**1.88**	**0.24**	**4.08**	**1.34**	**1.0**	**1.00**
% Error									
Weekday					**-2.6%**	**48.2%**	**-29.1%**		
Weekend					**-1.1%**	**48.9%**	**-28.0%**		

Notes:
(1) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Table E.3 Meter 5-1-2

Hour		Measured Data			Modeled Data			Diurnal	
		Flow	Level	Velocity	Flow	Level	Velocity	Initial	Calibrated
		(mgd)	(inches)	(ft/s)	(mgd)	(inches)	(ft/s)	Curve	Curve
Weekday	0	0.65	5.52	1.95	0.75	6.87	1.98	-8.3%	0.65
	1	0.55	5.17	1.82	0.58	6.28	1.90	-8.8%	0.55
	2	0.49	4.89	1.72	0.50	5.40	1.83	-8.3%	0.53
	3	0.47	4.81	1.69	0.42	4.89	1.70	-8.8%	0.50
	4	0.48	4.83	1.71	0.46	4.50	1.69	-8.3%	0.50
	5	0.50	4.95	1.74	0.53	4.70	1.65	-8.8%	0.56
	6	0.66	5.58	1.96	0.70	5.12	1.75	-8.3%	0.69
	7	0.88	6.39	2.20	0.88	5.95	1.89	-8.8%	1.15
	8	1.04	6.92	2.35	1.08	6.87	2.03	-8.3%	1.21
	9	1.06	6.97	2.37	1.05	7.72	2.11	-8.8%	1.39
	10	1.02	6.86	2.35	1.04	7.62	2.11	-8.3%	1.39
	11	1.01	6.82	2.34	1.09	7.59	2.10	-8.8%	1.39
	12	0.97	6.68	2.30	1.01	7.76	2.10	-8.3%	1.39
	13	0.94	6.57	2.28	1.02	7.42	2.10	-8.8%	1.34
	14	0.92	6.52	2.26	0.97	7.49	2.08	-8.3%	1.26
	15	0.90	6.46	2.24	0.95	7.27	2.05	-8.8%	1.14
	16	0.92	6.50	2.26	0.92	7.16	2.06	-8.3%	1.11
	17	0.95	6.62	2.29	0.96	7.05	2.03	-8.8%	1.14
	18	1.01	6.81	2.34	0.92	7.20	2.04	-8.3%	1.19
	19	1.07	7.02	2.39	1.00	7.02	2.05	-8.8%	1.22
	20	1.11	7.13	2.42	0.98	7.43	2.05	-8.3%	1.10
	21	1.06	6.98	2.38	1.04	7.28	2.08	-8.8%	0.99
	22	0.94	6.59	2.28	0.91	7.59	2.09	-8.3%	0.83
	23	0.82	6.16	2.16	0.91	7.01	2.04	-8.8%	0.81
Weekend	24	0.69	5.71	2.02	0.75	6.99	2.00	-8.3%	0.53
	25	0.59	5.34	1.89	0.64	6.26	1.91	-8.8%	0.50
	26	0.50	4.98	1.77	0.55	5.73	1.83	-8.3%	0.50
	27	0.48	4.89	1.73	0.44	5.23	1.76	-8.8%	0.56
	28	0.45	4.74	1.67	0.49	4.59	1.67	-8.3%	0.69
	29	0.45	4.76	1.69	0.40	4.87	1.70	-8.8%	1.03
	30	0.51	5.02	1.79	0.51	4.34	1.65	-8.3%	1.26
	31	0.63	5.47	1.94	0.51	4.99	1.71	-8.8%	1.26
	32	0.85	6.28	2.18	0.80	4.96	1.77	-8.3%	1.26
	33	1.05	6.97	2.36	0.97	6.44	1.95	-8.8%	1.26
	34	1.17	7.35	2.46	1.15	7.24	2.06	-8.3%	1.23
	35	1.19	7.39	2.49	1.16	8.00	2.14	-8.8%	1.22
	36	1.12	7.15	2.44	1.20	8.09	2.17	-8.3%	1.20
	37	1.08	7.03	2.40	1.19	8.24	2.17	-8.8%	1.17
	38	1.03	6.87	2.37	1.14	8.17	2.17	-8.3%	1.10
	39	0.98	6.71	2.33	1.05	7.97	2.15	-8.8%	1.08
	40	0.98	6.70	2.32	1.02	7.64	2.11	-8.3%	1.06
	41	0.97	6.68	2.32	0.92	7.47	2.06	-8.8%	1.09
	42	1.00	6.77	2.34	0.98	7.07	2.04	-8.3%	1.15
	43	1.04	6.92	2.37	0.98	7.30	2.05	-8.8%	1.18
	44	1.07	7.03	2.39	1.06	7.30	2.08	-8.3%	1.08
	45	0.99	6.73	2.34	0.99	7.65	2.10	-8.8%	0.99
	46	0.90	6.43	2.25	0.94	7.36	2.06	-8.3%	0.82
	47	0.75	5.93	2.10	0.79	7.16	2.06	-8.8%	0.80
Average									
Weekday		**0.85**	**6.24**	**2.16**	**0.86**	**6.72**	**1.98**	1.98	**1.00**
Weekend		**0.85**	**6.24**	**2.17**	**0.86**	**6.71**	**1.97**	1.97	**1.00**
ADWF(1)		**0.85**	**6.24**	**2.16**	**0.86**	**6.71**	**1.98**	1.98	**1.00**
% Error									
Weekday					**1.3%**	7.6%	-8.3%		
Weekend					**0.9%**	7.5%	-8.8%		

Notes:
(1) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Table E.4 Meter 5-2-1

Hour		Measured Data			Modeled Data			Diurnal	
		Flow	Level	Velocity	Flow	Level	Velocity	Initial	Calibrated
		(mgd)	(inches)	(ft/s)	(mgd)	(inches)	(ft/s)	Curve	Diurnal
Weekday	0	0.15	1.37	2.75	0.12	1.50	3.41	0.74	0.51
	1	0.11	1.23	2.30	0.13	1.22	3.13	0.57	0.45
	2	0.09	1.12	1.98	0.09	1.25	3.27	0.44	0.51
	3	0.08	1.09	1.83	0.10	1.09	2.56	0.41	0.53
	4	0.10	1.14	2.01	0.08	1.18	2.96	0.48	0.61
	5	0.10	1.18	2.10	0.16	1.04	2.75	0.52	0.71
	6	0.14	1.30	2.35	0.17	1.38	3.28	0.70	1.07
	7	0.22	1.61	3.23	0.23	1.47	3.43	1.08	1.12
	8	0.25	1.76	3.62	0.20	1.69	3.73	1.27	1.12
	9	0.25	1.74	3.63	0.26	1.66	3.73	1.23	1.28
	10	0.24	1.72	3.61	0.22	1.82	3.96	1.22	1.31
	11	0.23	1.69	3.57	0.23	1.70	3.80	1.17	1.31
	12	0.23	1.65	3.53	0.22	1.74	3.82	1.13	1.28
	13	0.22	1.64	3.48	0.21	1.65	3.72	1.10	1.07
	14	0.21	1.59	3.42	0.20	1.66	3.75	1.04	1.12
	15	0.20	1.57	3.34	0.24	1.58	3.61	1.01	1.17
	16	0.21	1.60	3.38	0.21	1.81	3.95	1.05	1.30
	17	0.23	1.67	3.52	0.25	1.64	3.68	1.15	1.29
	18	0.25	1.76	3.69	0.26	1.84	3.99	1.28	1.45
	19	0.25	1.76	3.75	0.25	1.81	3.94	1.27	1.36
	20	0.28	1.86	3.83	0.26	1.80	3.92	1.42	1.20
	21	0.27	1.81	3.73	0.26	1.84	3.97	1.34	0.97
	22	0.24	1.70	3.50	0.19	1.82	3.97	1.18	0.75
	23	0.19	1.53	3.14	0.23	1.56	3.56	0.95	0.58
Weekend	24	0.16	1.41	2.93	0.15	1.74	3.84	0.76	0.45
	25	0.13	1.28	2.46	0.07	1.32	3.19	0.61	0.42
	26	0.12	1.27	2.43	0.10	0.98	2.67	0.60	0.53
	27	0.06	1.02	1.68	0.13	1.12	2.86	0.31	0.52
	28	0.08	1.08	1.85	0.07	1.30	3.21	0.40	0.65
	29	0.08	1.08	1.84	0.14	0.87	2.42	0.38	1.09
	30	0.10	1.17	2.13	0.12	1.36	3.29	0.48	1.09
	31	0.15	1.35	2.62	0.19	1.26	3.11	0.70	1.19
	32	0.20	1.53	3.19	0.21	1.54	3.53	0.95	1.23
	33	0.24	1.72	3.62	0.23	1.67	3.78	1.17	1.19
	34	0.27	1.83	3.87	0.23	1.70	3.78	1.33	1.14
	35	0.29	1.88	3.85	0.27	1.75	3.87	1.39	1.12
	36	0.28	1.88	4.02	0.27	1.88	4.02	1.37	1.09
	37	0.26	1.79	3.77	0.23	1.85	3.96	1.26	1.02
	38	0.27	1.82	3.75	0.23	1.75	3.85	1.30	1.06
	39	0.25	1.76	3.65	0.19	1.74	3.85	1.21	1.16
	40	0.25	1.75	3.62	0.25	1.59	3.63	1.19	1.29
	41	0.26	1.78	3.62	0.25	1.81	3.98	1.25	1.28
	42	0.26	1.80	3.64	0.25	1.79	3.86	1.25	1.43
	43	0.26	1.80	3.69	0.30	1.81	3.93	1.27	1.35
	44	0.28	1.86	3.86	0.28	1.98	4.18	1.34	1.19
	45	0.27	1.83	3.63	0.24	1.91	4.05	1.32	1.06
	46	0.22	1.67	3.45	0.19	1.79	3.94	1.08	0.87
	47	0.17	1.48	2.98	0.14	1.56	3.53	0.87	0.61
Average									
Weekday		**0.20**	**1.55**	**3.14**	**0.20**	**1.57**	**3.58**	**1.00**	**1.00**
Weekend		**0.21**	**1.58**	**3.17**	**0.20**	**1.59**	**3.60**	**1.00**	**1.00**
ADWF(1)		**0.20**	**1.55**	**3.15**	**0.20**	**1.58**	**3.58**	**1.00**	**1.00**
% Error									
Weekday					**0.4%**	**1.8%**	**14.1%**		
Weekend					**-3.9%**	**0.7%**	**13.5%**		

Notes:
(1) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Table E.5 Meter 8-1-2

Hour		Measured Data			Modeled Data			Diurnal	
		Flow	Level	Velocity	Flow	Level	Velocity	Initial	Calibrated
		(mgd)	(inches)	(ft/s)	(mgd)	(inches)	(ft/s)	Curve	Diurnal
Weekday	0	0.08	1.80	1.65	0.09	1.99	1.60	0.69	0.47
	1	0.07	1.69	1.47	0.06	1.78	1.50	0.58	0.45
	2	0.05	1.56	1.32	0.06	1.53	1.38	0.46	0.45
	3	0.05	1.52	1.30	0.05	1.46	1.33	0.44	0.47
	4	0.06	1.55	1.36	0.06	1.33	1.28	0.48	0.49
	5	0.06	1.63	1.47	0.05	1.44	1.32	0.54	0.55
	6	0.08	1.78	1.65	0.08	1.40	1.32	0.68	0.69
	7	0.11	2.07	1.93	0.12	1.71	1.46	0.99	1.23
	8	0.14	2.25	2.11	0.15	2.15	1.68	1.21	1.30
	9	0.15	2.34	2.13	0.15	2.34	1.77	1.28	1.27
	10	0.15	2.34	2.09	0.15	2.37	1.78	1.25	1.33
	11	0.15	2.36	2.15	0.15	2.39	1.79	1.31	1.37
	12	0.16	2.40	2.15	0.15	2.39	1.79	1.35	1.34
	13	0.15	2.40	2.11	0.15	2.40	1.79	1.32	1.33
	14	0.15	2.46	2.04	0.15	2.40	1.79	1.31	1.26
	15	0.14	2.38	2.00	0.14	2.37	1.78	1.24	1.18
	16	0.13	2.26	2.01	0.14	2.32	1.75	1.16	1.19
	17	0.14	2.25	2.06	0.14	2.25	1.73	1.17	1.27
	18	0.14	2.31	2.11	0.14	2.26	1.73	1.25	1.27
	19	0.15	2.31	2.12	0.14	2.29	1.74	1.25	1.22
	20	0.14	2.28	2.07	0.14	2.31	1.75	1.20	1.18
	21	0.13	2.25	2.05	0.13	2.28	1.74	1.16	1.08
	22	0.12	2.15	1.99	0.12	2.22	1.71	1.06	0.88
	23	0.10	1.97	1.84	0.10	2.14	1.67	0.87	0.74
Weekend	24	0.08	1.76	1.73	0.09	1.98	1.59	0.73	0.47
	25	0.07	1.66	1.59	0.07	1.81	1.52	0.62	0.45
	26	0.06	1.58	1.48	0.05	1.56	1.39	0.54	0.45
	27	0.06	1.54	1.41	0.06	1.41	1.30	0.50	0.47
	28	0.05	1.50	1.39	0.05	1.43	1.33	0.48	0.49
	29	0.05	1.46	1.37	0.06	1.38	1.28	0.46	0.55
	30	0.06	1.55	1.52	0.06	1.48	1.35	0.54	0.69
	31	0.09	1.75	1.80	0.08	1.50	1.36	0.77	1.26
	32	0.12	1.99	2.08	0.13	1.76	1.49	1.05	1.30
	33	0.14	2.13	2.20	0.15	2.17	1.69	1.22	1.33
	34	0.15	2.22	2.28	0.15	2.36	1.77	1.33	1.33
	35	0.16	2.26	2.33	0.15	2.38	1.78	1.39	1.37
	36	0.16	2.27	2.32	0.16	2.41	1.80	1.40	1.34
	37	0.15	2.24	2.29	0.16	2.45	1.81	1.35	1.33
	38	0.14	2.17	2.26	0.16	2.44	1.81	1.28	1.25
	39	0.14	2.15	2.18	0.15	2.42	1.80	1.22	1.17
	40	0.13	2.10	2.17	0.14	2.36	1.77	1.17	1.18
	41	0.14	2.13	2.19	0.14	2.31	1.75	1.21	1.26
	42	0.14	2.15	2.19	0.15	2.30	1.75	1.22	1.26
	43	0.14	2.20	2.24	0.15	2.35	1.77	1.29	1.21
	44	0.14	2.19	2.21	0.15	2.35	1.77	1.27	1.17
	45	0.13	2.13	2.19	0.14	2.33	1.76	1.20	1.07
	46	0.12	2.06	2.11	0.13	2.27	1.73	1.11	0.88
	47	0.10	1.88	1.93	0.11	2.18	1.69	0.89	0.74
Average									
Weekday		**0.117**	**2.10**	**1.88**	**0.118**	**2.06**	**1.63**	**1.00**	**1.00**
Weekend		**0.113**	**1.96**	**1.98**	**0.118**	**2.06**	**1.63**	**1.00**	**1.00**
ADWF(1)		**0.116**	**2.06**	**1.91**	**0.118**	**2.06**	**1.63**	**1.00**	**1.00**
% Error									
Weekday					**0.4%**	**-1.5%**	**-13.2%**		
Weekend					**4.1%**	**4.9%**	**-17.6%**		

Notes:
(1) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Table E.6 Meter WWTF/STEP

Hour		Measured Data			Modeled Data			Diurnal	
		Flow	Level	Velocity	Flow	Level	Velocity	Initial	Calibrated
		(mgd)	(inches)	(ft/s)	(mgd)	(inches)	(ft/s)	Curve	Diurnal
Weekday	0	3.18	-	-	3.06	-	-	1.13	1.13
	1	2.84	-	-	2.67	-	-	1.01	1.01
	2	2.46	-	-	2.43	-	-	0.88	0.88
	3	2.16	-	-	2.02	-	-	0.77	0.77
	4	2.01	-	-	2.16	-	-	0.72	0.72
	5	1.84	-	-	2.09	-	-	0.66	0.66
	6	1.85	-	-	2.22	-	-	0.66	0.66
	7	1.93	-	-	2.31	-	-	0.69	0.69
	8	2.21	-	-	2.36	-	-	0.79	0.79
	9	2.92	-	-	2.99	-	-	1.04	1.04
	10	3.33	-	-	2.97	-	-	1.19	1.19
	11	3.22	-	-	3.01	-	-	1.15	1.15
	12	3.08	-	-	3.19	-	-	1.10	1.10
	13	3.06	-	-	3.33	-	-	1.09	1.09
	14	3.06	-	-	3.32	-	-	1.09	1.09
	15	3.12	-	-	3.34	-	-	1.11	1.11
	16	2.97	-	-	3.10	-	-	1.06	1.06
	17	2.91	-	-	2.95	-	-	1.04	1.04
	18	2.91	-	-	3.38	-	-	1.04	1.04
	19	3.06	-	-	2.68	-	-	1.09	1.09
	20	3.12	-	-	3.39	-	-	1.11	1.11
	21	3.33	-	-	3.26	-	-	1.19	1.19
	22	3.43	-	-	3.42	-	-	1.23	1.23
	23	3.41	-	-	3.24	-	-	1.22	1.22
Weekend	24	3.08	-	-	2.93	-	-	1.10	1.13
	25	2.75	-	-	2.72	-	-	0.98	1.01
	26	2.46	-	-	2.42	-	-	0.88	0.88
	27	2.19	-	-	2.19	-	-	0.78	0.77
	28	2.09	-	-	2.09	-	-	0.74	0.72
	29	1.98	-	-	1.93	-	-	0.71	0.66
	30	1.78	-	-	1.84	-	-	0.63	0.66
	31	1.79	-	-	1.99	-	-	0.64	0.69
	32	1.96	-	-	2.05	-	-	0.70	0.79
	33	2.19	-	-	2.22	-	-	0.78	1.04
	34	2.65	-	-	2.90	-	-	0.94	1.19
	35	3.21	-	-	3.35	-	-	1.14	1.15
	36	3.45	-	-	3.47	-	-	1.23	1.10
	37	3.54	-	-	3.50	-	-	1.26	1.09
	38	3.55	-	-	3.20	-	-	1.27	1.09
	39	3.29	-	-	2.99	-	-	1.18	1.11
	40	3.12	-	-	3.03	-	-	1.11	1.06
	41	3.05	-	-	3.51	-	-	1.09	1.04
	42	3.05	-	-	3.23	-	-	1.09	1.04
	43	3.00	-	-	2.94	-	-	1.07	1.09
	44	3.23	-	-	3.30	-	-	1.15	1.11
	45	3.11	-	-	3.23	-	-	1.11	1.19
	46	3.21	-	-	3.30	-	-	1.15	1.23
	47	3.16	-	-	3.28	-	-	1.13	1.22
Average									
Weekday		**2.81**	**-**	**-**	**2.87**	**-**	**-**	**1.00**	**1.00**
Weekend		**2.79**	**-**	**-**	**2.82**	**-**	**-**	**0.99**	**1.00**
ADWF(1)		**2.80**	**-**	**-**	**2.86**	**-**	**-**	**1.00**	**1.00**
% Error									
Weekday					**2.2%**				
Weekend					**1.0%**				

Notes:
(1) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Table E.7 Meter Goodwin Road LS

Hour		Measured Data			Modeled Data			Diurnal	
		Flow	Level	Velocity	Flow	Level	Velocity	Initial	Calibrated
		(mgd)	(inches)	(ft/s)	(mgd)	(inches)	(ft/s)	Curve	Diurnal
Weekday	0	0.08	-	-	0.08	-	-	0.80	0.61
	1	0.06	-	-	0.06	-	-	0.61	0.49
	2	0.05	-	-	0.05	-	-	0.49	0.41
	3	0.04	-	-	0.04	-	-	0.41	0.38
	4	0.04	-	-	0.04	-	-	0.38	0.43
	5	0.04	-	-	0.04	-	-	0.43	0.66
	6	0.06	-	-	0.07	-	-	0.66	1.12
	7	0.11	-	-	0.11	-	-	1.12	1.37
	8	0.13	-	-	0.13	-	-	1.37	1.24
	9	0.12	-	-	0.12	-	-	1.24	1.15
	10	0.11	-	-	0.11	-	-	1.15	1.10
	11	0.10	-	-	0.11	-	-	1.10	1.03
	12	0.10	-	-	0.10	-	-	1.03	0.99
	13	0.09	-	-	0.10	-	-	0.99	0.96
	14	0.09	-	-	0.09	-	-	0.96	0.95
	15	0.09	-	-	0.09	-	-	0.95	0.95
	16	0.09	-	-	0.10	-	-	0.95	1.04
	17	0.10	-	-	0.10	-	-	1.04	1.17
	18	0.11	-	-	0.12	-	-	1.17	1.32
	19	0.13	-	-	0.13	-	-	1.32	1.42
	20	0.13	-	-	0.14	-	-	1.42	1.44
	21	0.14	-	-	0.14	-	-	1.44	1.38
	22	0.13	-	-	0.13	-	-	1.38	1.08
	23	0.10	-	-	0.10	-	-	1.08	0.78
Weekend	24	0.07	-	-	0.08	-	-	0.78	0.75
	25	0.07	-	-	0.07	-	-	0.75	0.48
	26	0.05	-	-	0.05	-	-	0.48	0.46
	27	0.04	-	-	0.04	-	-	0.46	0.33
	28	0.03	-	-	0.03	-	-	0.33	0.30
	29	0.03	-	-	0.03	-	-	0.30	0.35
	30	0.03	-	-	0.03	-	-	0.35	0.51
	31	0.05	-	-	0.05	-	-	0.51	1.02
	32	0.10	-	-	0.09	-	-	1.02	1.39
	33	0.13	-	-	0.13	-	-	1.39	1.51
	34	0.14	-	-	0.14	-	-	1.51	1.52
	35	0.14	-	-	0.14	-	-	1.52	1.49
	36	0.14	-	-	0.13	-	-	1.49	1.31
	37	0.12	-	-	0.12	-	-	1.31	1.37
	38	0.13	-	-	0.12	-	-	1.37	1.22
	39	0.12	-	-	0.11	-	-	1.22	1.28
	40	0.12	-	-	0.12	-	-	1.28	1.28
	41	0.12	-	-	0.12	-	-	1.28	1.20
	42	0.11	-	-	0.11	-	-	1.20	1.43
	43	0.14	-	-	0.13	-	-	1.43	1.45
	44	0.14	-	-	0.13	-	-	1.45	1.44
	45	0.14	-	-	0.13	-	-	1.44	1.33
	46	0.13	-	-	0.12	-	-	1.33	1.11
	47	0.10	-	-	0.10	-	-	1.11	0.80
Average									
Weekday		**0.093**	**-**	**-**	**0.096**	**-**	**-**	**0.98**	**1.00**
Weekend		**0.100**	**-**	**-**	**0.096**	**-**	**-**	**0.98**	**1.00**
ADWF(1)		**0.095**	**-**	**-**	**0.096**	**-**	**-**	**0.98**	**1.00**
% Error									
Weekday					**4.0%**				
Weekend					**-3.3%**				

Notes:
(1) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Table E.8 Meter Leadbetter Road LS

Hour		Measured Data			Modeled Data			Diurnal	
		Flow	Level	Velocity	Flow	Level	Velocity	Initial	Calibrated
		(mgd)	(inches)	(ft/s)	(mgd)	(inches)	(ft/s)	Curve	Diurnal
Weekday	0	0.10	-	-	0.13	-	-	0.79	0.40
	1	0.07	-	-	0.09	-	-	0.57	0.19
	2	0.06	-	-	0.07	-	-	0.48	0.35
	3	0.05	-	-	0.06	-	-	0.36	0.08
	4	0.05	-	-	0.05	-	-	0.40	0.15
	5	0.04	-	-	0.06	-	-	0.32	0.48
	6	0.07	-	-	0.09	-	-	0.51	0.45
	7	0.12	-	-	0.13	-	-	0.92	0.91
	8	0.17	-	-	0.16	-	-	1.30	1.28
	9	0.17	-	-	0.18	-	-	1.30	1.28
	10	0.15	-	-	0.16	-	-	1.19	1.57
	11	0.14	-	-	0.16	-	-	1.06	1.47
	12	0.14	-	-	0.15	-	-	1.09	1.36
	13	0.13	-	-	0.14	-	-	1.00	1.25
	14	0.14	-	-	0.14	-	-	1.09	1.24
	15	0.13	-	-	0.14	-	-	0.98	1.11
	16	0.12	-	-	0.15	-	-	0.94	1.23
	17	0.14	-	-	0.15	-	-	1.09	1.12
	18	0.15	-	-	0.16	-	-	1.12	1.42
	19	0.18	-	-	0.19	-	-	1.35	1.32
	20	0.20	-	-	0.20	-	-	1.52	1.50
	21	0.19	-	-	0.20	-	-	1.44	1.46
	22	0.18	-	-	0.19	-	-	1.37	1.24
	23	0.14	-	-	0.17	-	-	1.11	1.18
Weekend	24	0.11	-	-	0.13	-	-	0.80	0.34
	25	0.07	-	-	0.10	-	-	0.49	0.22
	26	0.08	-	-	0.07	-	-	0.56	0.26
	27	0.05	-	-	0.06	-	-	0.31	0.18
	28	0.07	-	-	0.05	-	-	0.50	0.36
	29	0.03	-	-	0.04	-	-	0.19	0.73
	30	0.04	-	-	0.05	-	-	0.28	1.18
	31	0.09	-	-	0.07	-	-	0.64	1.40
	32	0.09	-	-	0.10	-	-	0.62	1.26
	33	0.16	-	-	0.15	-	-	1.13	1.13
	34	0.21	-	-	0.18	-	-	1.43	1.16
	35	0.19	-	-	0.19	-	-	1.35	1.07
	36	0.19	-	-	0.19	-	-	1.34	1.01
	37	0.19	-	-	0.18	-	-	1.30	1.05
	38	0.18	-	-	0.17	-	-	1.25	1.01
	39	0.16	-	-	0.17	-	-	1.14	1.01
	40	0.17	-	-	0.16	-	-	1.19	1.16
	41	0.16	-	-	0.17	-	-	1.14	1.19
	42	0.18	-	-	0.16	-	-	1.28	1.62
	43	0.18	-	-	0.17	-	-	1.25	1.54
	44	0.20	-	-	0.19	-	-	1.39	1.54
	45	0.20	-	-	0.19	-	-	1.36	1.47
	46	0.18	-	-	0.18	-	-	1.23	1.18
	47	0.16	-	-	0.17	-	-	1.11	0.93
Average									
Weekday		**0.126**	**-**	**-**	**0.139**	**-**	**-**	**0.97**	**1.00**
Weekend		**0.140**	**-**	**-**	**0.138**	**-**	**-**	**0.97**	**1.00**
ADWF(1)		**0.130**	**-**	**-**	**0.139**	**-**	**-**	**0.97**	**1.00**
% Error									
Weekday					**10.0%**				
Weekend					**-1.3%**				

Notes:
(1) ADWF = (5xWeekday Average + 2xWeekend Average)/7

ATTACHMENT F

WET WEATHER CALIBRATION RESULTS

WET WEATHER CALIBRATION RESULTS

Table F.1 Wet Weather Flow Calibration

Meter Number	Pipe Diameter (inches)	Storm 1 (03/12/2025-03/18/2025)			Storm 2 (03/20/2025-04/01/2025)			Storm 3 (04/05/2025-04/09/2025)		
		Percent Error[3]			Percent Error[3]			Percent Error[3]		
		Total Volume Flow (%)	Peak Flow (%)	Max Level Difference (inches)	Total Volume Flow (%)	Peak Flow (%)	Max Level Difference (inches)	Total Volume Flow (%)	Peak Flow (%)	Max Level Difference (inches)
4-1-3	12	8.0%	13.0%	2.5	6.1%	12.0%	2.5	28.2%	81.1%	3.7
5-1-2	20	-4.2%	-4.6%	2.4	6.0%	12.8%	4.0	33.7%	74.8%	6.1
5-2-1	18	-18.9%	-49.3%	-0.3	-9.4%	-11.7%	1.3	1.9%	3.1%	1.1
8-1-2	12	6.5%	-1.8%	0.2	6.8%	3.3%	0.1	11.5%	13.4%	0.1
WWTP/STEP[4][5]	-	5.2%	0.8%		19.6%	13.0%		39.8%	53.5%	
Leadbetter Rd[4]	18	-8.2%	-28.3%		4.1%	-10.1%		6.2%	-4.6%	
Goodwin Rd[4]	18	-6.4%	-9.1%		3.2%	20.8%		7.1%	38.3%	

Notes:
(1) Source: City of Camas Flow Monitoring Report 2025 dated May 28, 2025 by ADS
(2) Average flows are computed from hydraulic modeling results. Maximum flow values are hourly peaks
(3) Percent Difference = (Modeled – Measured)/Measured*100.
(4) Flow meter information was provided by the City
(5) No upstream pipe ID information was available for the STEP basin. Flow for this area was therefore estimated using GIS-derived upstream drainage data and a mass balance approach to represent inflows to the WWTF.

Location: 1724 NE Franklin
Site Name: CAM_100290
Pipeline diameter: 18"
City Manhole ID: MH100290

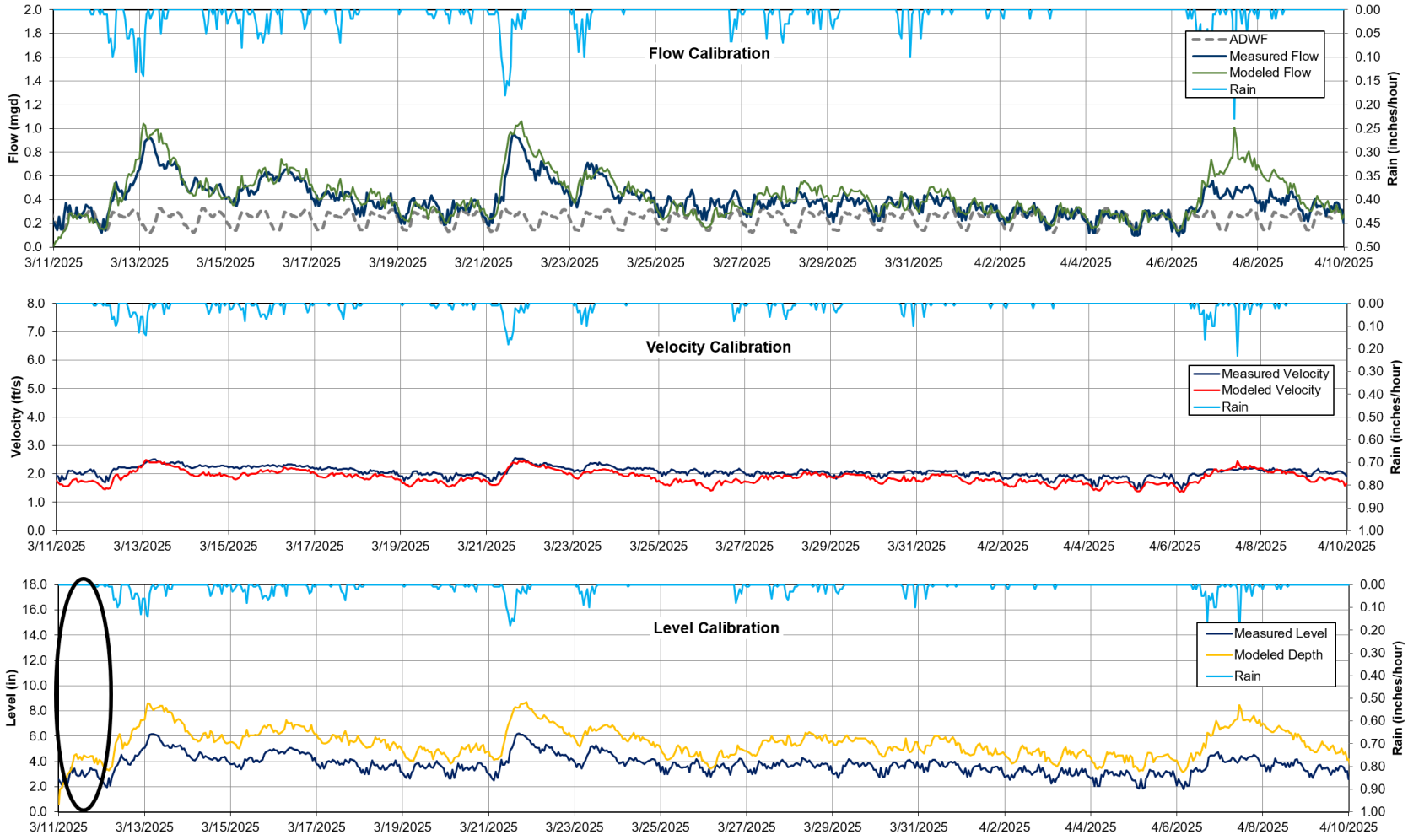


Figure F.1 Flow Monitoring Meter 4-1-3 Wet Weather Flow Calibration

Location: SE Cedar St and SE 3rd Ave
Site Name: CAM_51123
Pipeline diameter: 20"
City Manhole ID: MH100271

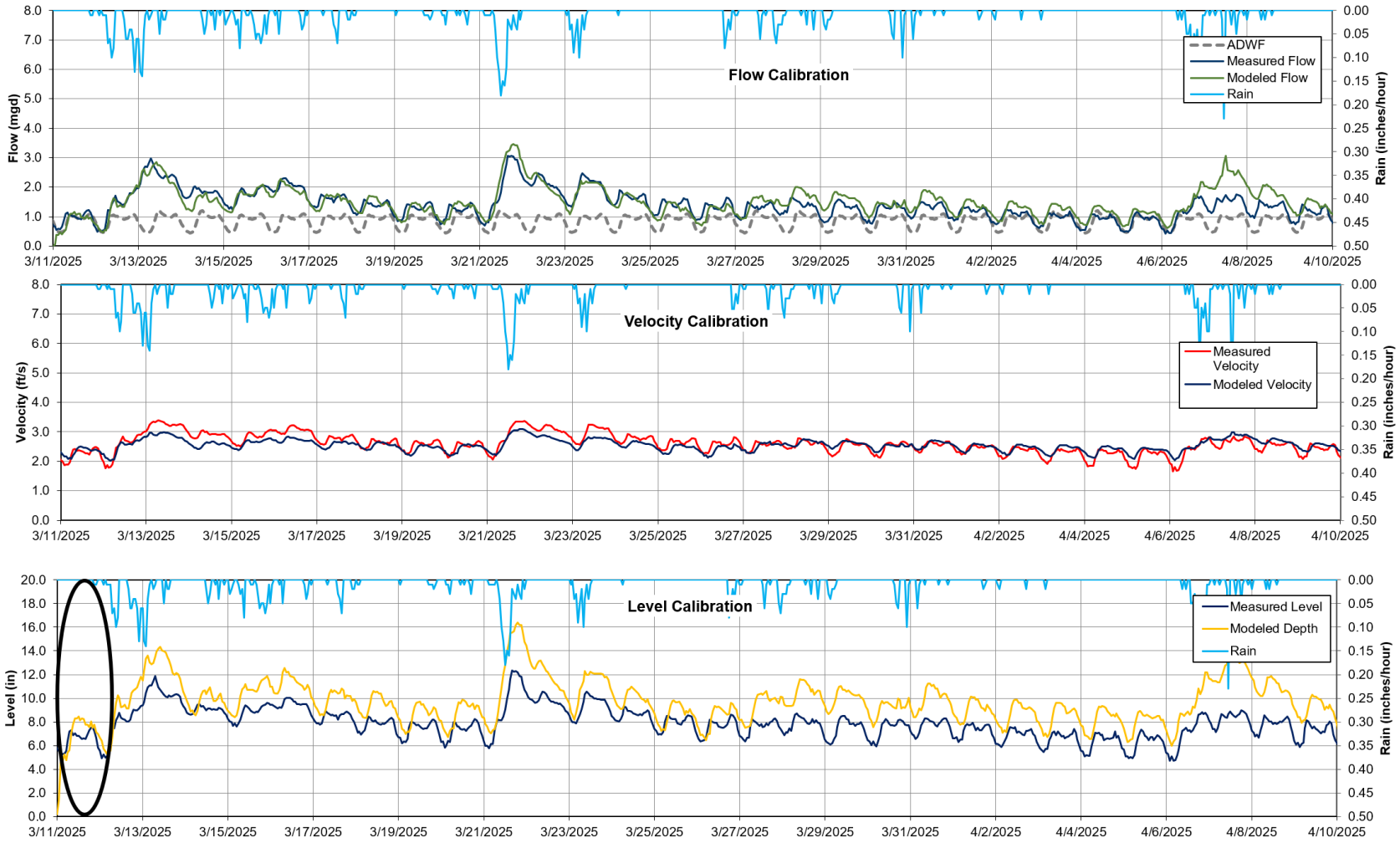


Figure F.2 Flow Monitoring Meter 5-1-2 Wet Weather Flow Calibration

Location: SE Dallas St and SE 3rd Av
Site Name: CAM_52167
Pipeline diameter: 18"
City Manhole ID: MH100270

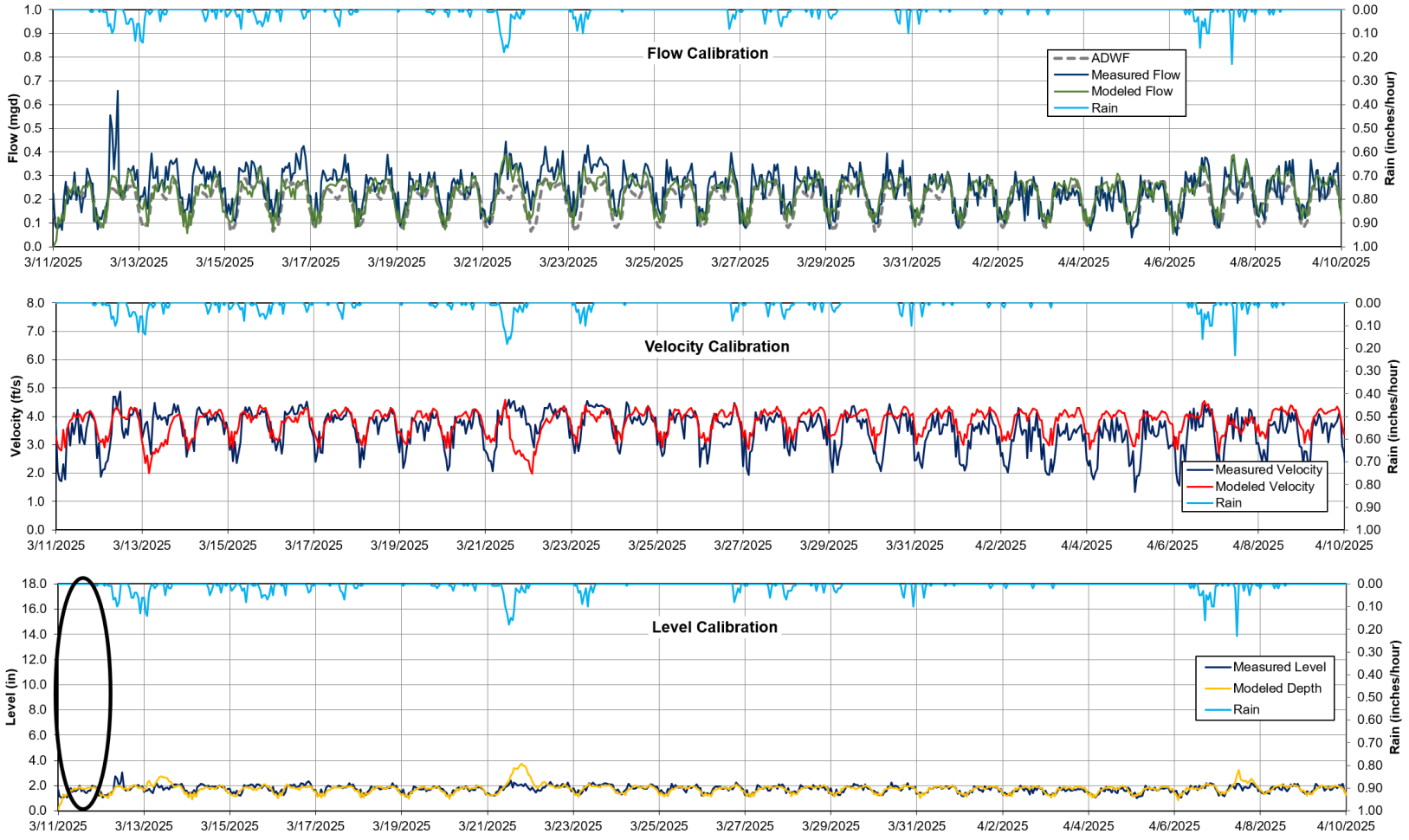


Figure F.3 Flow Monitoring Meter 5-2-1 Wet Weather Flow Calibration

Location: 820 SE Polk St
Site Name: CAM_81189
Pipeline diameter: 12"
City Manhole ID: MH100081

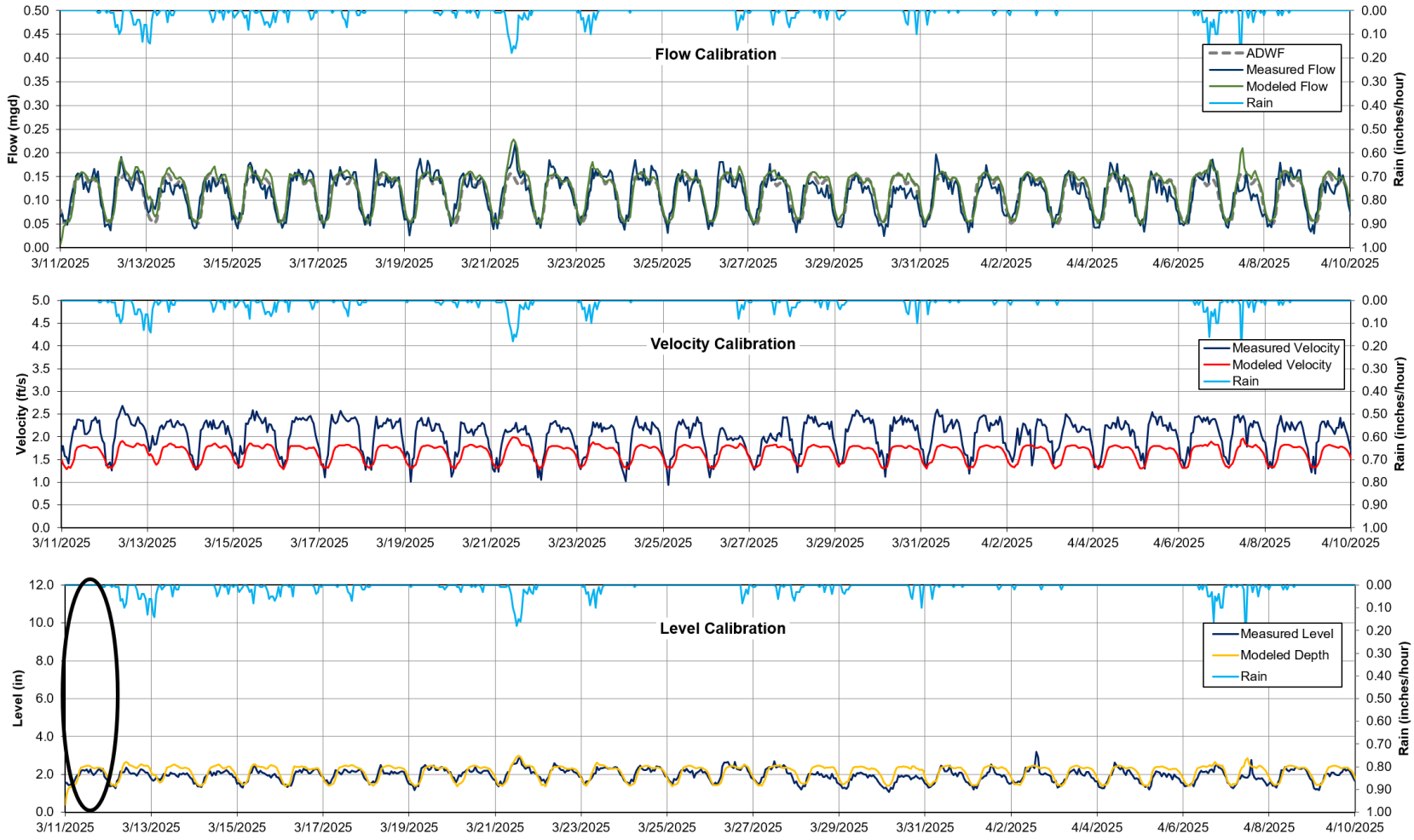


Figure F.4 Flow Monitoring Meter 8-1-2 Wet Weather Flow Calibration

Location: WWTF	
Site Name: -	
Pipeline diameter: "	
City Manhole ID: -	

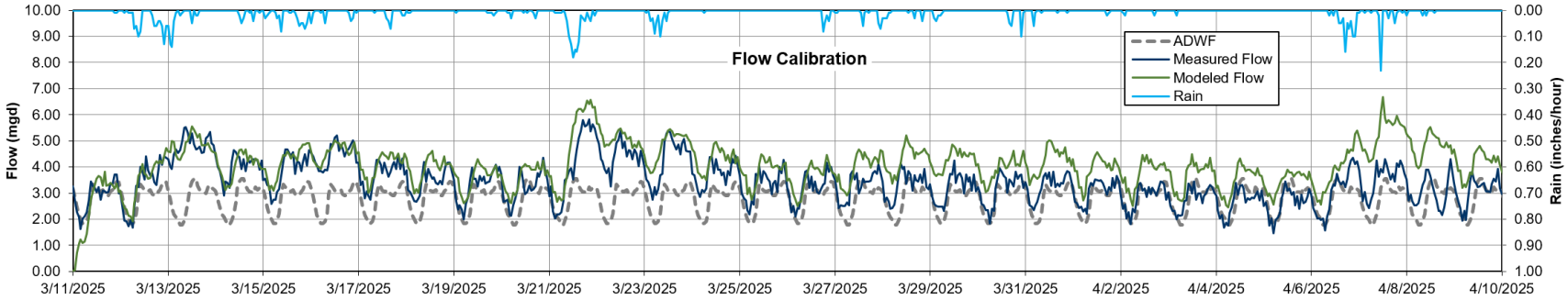


Figure F.5 Flow Monitoring Meter WWTF/STEP Wet Weather Flow Calibration

Location: Leadbetter Rd LS		
Site Name: -		
Pipeline diameter: 18"		
City Manhole ID: -		

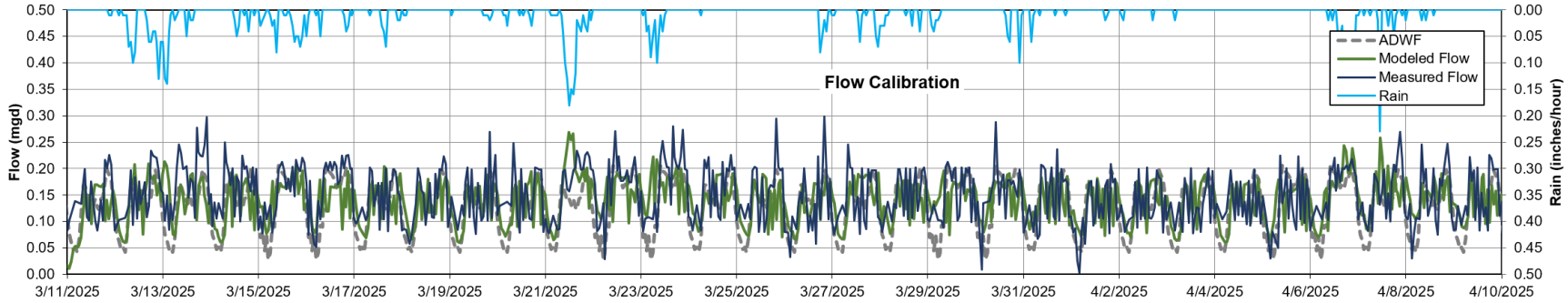


Figure F.6 Flow Monitoring Meter Leadbetter Rd LS Wet Weather Flow Calibration

Location: Goodwin Rd LS	
Site Name: -	
Pipeline diameter: 18"	
City Manhole ID: -	

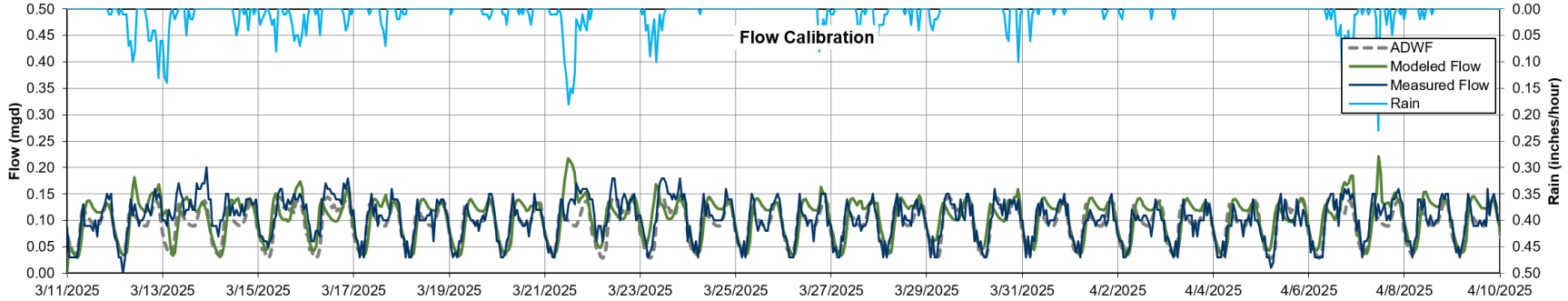


Figure F.7 Flow Monitoring Meter Goodwin Rd LS Wet Weather Flow Calibration

APPENDIX F

I/I PROGRAM REPORTS

City of Camas Washington
Public Works Department
616 NE 4th Avenue
Camas, WA 98607

July 15, 2019

Carey Cholski
Washington State Department of Ecology
PO Box 47775
Olympia, WA 98504-7775

Subject: **May 2018 – April 2019 Annual Inflow and Infiltration Report**
City of Camas, WA Wastewater Treatment Facility (Permit No. WA0020249)

Ms. Cholski,

Pursuant to Section S4.E of our current NPDES Permit, enclosed is our annual Inflow and Infiltration (I/I) report. Section S4.E.3 of our permit states:

> *The Permittee must conduct an annual analysis of infiltration and inflow according to Ecology's guidance manual for treatment plant operators. This report shall consider the 12-month period May 1st through the following April 30th as the annual period and shall be submitted by July 15, 2017 and annually thereafter. This report shall include an update on the status of each inflow reduction project completed in fulfillment of S4.E.2 (above) including the funds expended or contractually obligated, and the proportion of the project completed as of the end of the reporting period. For each basin or sub-basin in which work has been done within the reporting period, the report shall include the estimated inflow rates before and after the project and the estimated effect on the overall Publicly Owned Treatment Works (POTW) inflow rate.*

According to Ecology's Information Manual for Treatment Plant Operators (Feb. 2004), an Annual I/I Report should include each of the following elements:

1. *The average monthly flow and total precipitation for each month for the past year together with a graph … plotting a comparison of precipitation versus influent flow.*
2. *The maximum monthly and peak hourly hydraulic design capacity for the plant.*
3. *The design population equivalent for the treatment plant and the population served by the facility, per month, for the past year.*

4. *The amount of I/I for each year since the base year and the percent of maximum monthly design capacity each year's I/I represents.*
5. *The percent increase or reduction in I/I for each year subsequent to the base year I/I.*
6. *The additional lengths of sewer lines added to the collection system, per month, for the past year. Also include a brief summary of any major sewer rehabilitation or I/I reduction projects.*

The following information and attachments are now being submitted to satisfy these requirements and to provide documentation of the City of Camas' ongoing inflow reduction effort, as detailed in Gray & Osborne's June 2016 Infiltration and Inflow Study (indicated hereafter as the "2016 I/I Study").

I. REPORTING PERIOD AND BASE YEAR

As described in Section S4.E.3 of our current NPDES permit, the annual period for our I/I report is May 1st through April 30th. Accordingly, please note that when this report refers to the "reporting period" or "year", it is referring to the 12-month period from May 1st through April 30th. For any particular year that is referenced in the report, it is denoting the May through April reporting year and the calendar year in which May falls.

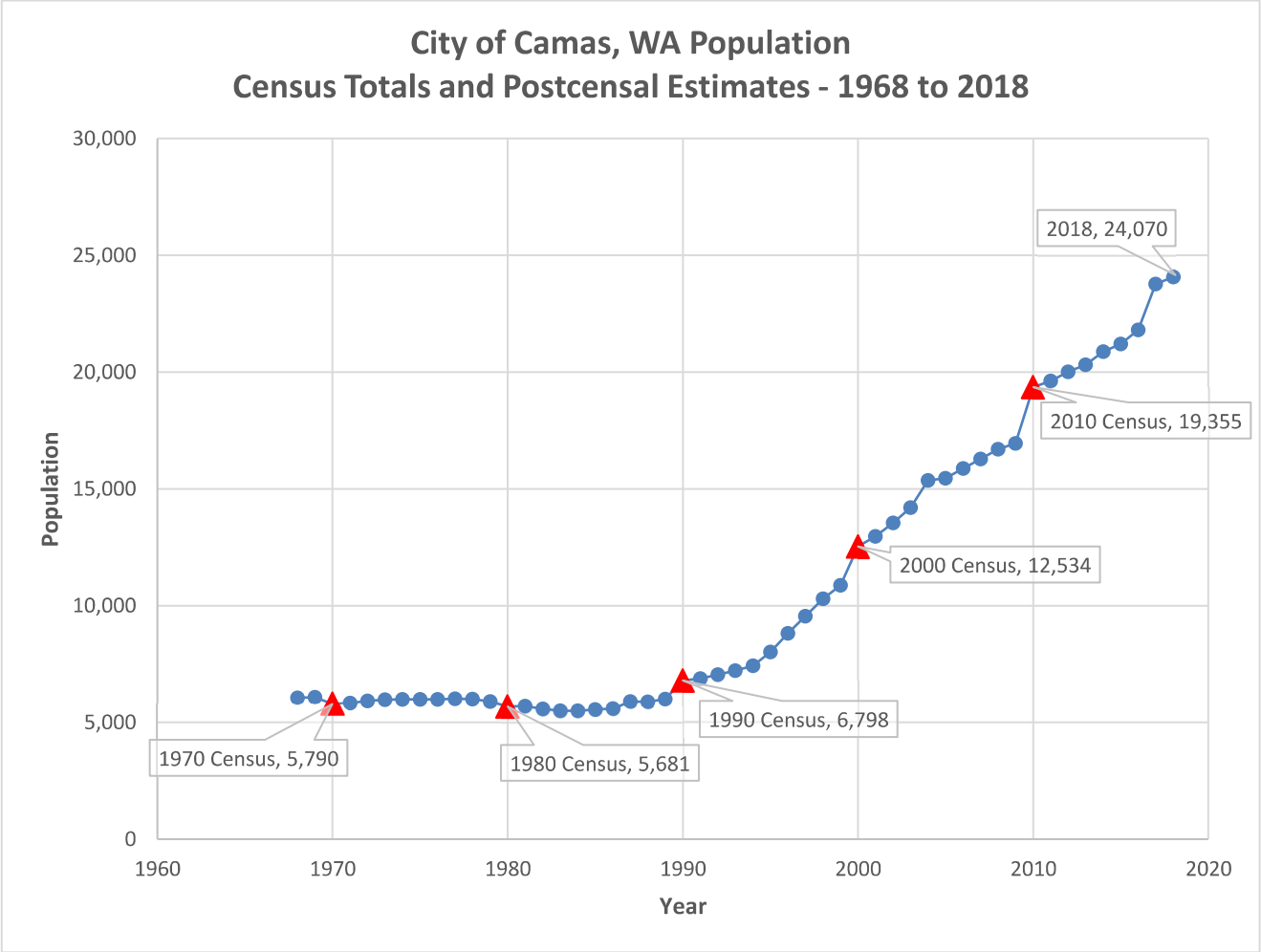
For the purposes of selecting an appropriate Base Year, the past twenty years of historical precipitation and plant influent flow data are reviewed annually. A summary of the monthly precipitation totals and influent flow averages for the past twenty years are included in Attachment A.

From analysis of the historical data, May 2011-April 2012 continues to best represent an average, annual rainfall in Camas and therefore continues to serve as the Base Year for the purposes of this report. For the twenty-year period of May 1, 1999 to April 30, 2019, the average 12-month rainfall in Camas was 45.18 inches. From May 1, 2011 to April 30th 2012, the rainfall was 47.60, which is approximately the 50th percentile of all twenty 12-month totals and only 2.42 inches more than the twenty-year average.

TABLE 1 - 12-Month May Through April Rainfall Totals, 1999-2018

	Average	Minimum	50th Percentile	Maximum
Annual Total Rainfall (in.)	45.18	31.44 (May 2018 – April 2019)	47.60 (May 2011-April 2012)	73.36 (May 2010-April 2011)

In addition to representing the 20-year median rainfall, using 2011-2012 as the "Base Year" incorporates the City's rapid growth that has occurred in the last 20 years. In I/I annual reports prior to 2016, the City of Camas had been using 1989 as the Base Year. Since 1989, the City of Camas has seen rapid growth in population and significant additions to its wastewater collection system. The May 2011-April 2012 period captures that growth, which has taken place primarily after 1990. The chart below illustrates the City's annual, calendar year, population growth since 1968:



Historical Population Estimates for Camas, WA by Washington State Office of Financial Management
(http://www.ofm.wa.gov/pop/april1/hseries/default.asp)

II. INFLOW AND INFILTRATION ANALYSIS

Facility Design Parameters

The maximum monthly hydraulic design capacity for the Camas Wastewater Treatment Plant (WWTP) is 6.10 million gallons per day (MGD) and has a peak hourly hydraulic design capacity of 13.44 MGD. The Design Population Equivalent for the Camas WWTP is 28,075.

Calculated I/I and Annual Rainfall 20-Year History

The following chart is a summary of the calculated I/I, the percent of maximum monthly design capacity the calculated I/I represents, the percentage increase or decrease of I/I from the previous year and the total rainfall for each reporting year from May 1999 to April 2019:

TABLE 2 – Camas Calculated I/I & Rainfall

Year	Calculated I/I (MGD)	I/I as % of Design Capacity	I/I % Increase/Decrease from Prior Year	Total 12-Month Rainfall (in.)
1999	1.047	17%	-30%	37.30
2000	1.587	26%	+52%	31.46
2001	1.260	21%	-21%	42.63
2002	1.069	18%	-15%	41.48
2003	1.258	21%	+18%	37.74
2004	0.661	11%	-47%	36.81
2005	2.093	34%	+217%	53.16
2006	1.400	23%	-33%	47.80
2007	2.145	35%	+53%	48.05
2008	0.911	15%	-58%	49.72
2009	1.242	20%	+36%	49.92
2010	1.615	26%	+30%	73.36
2011	1.511	25%	-6%	47.60
2012	2.340	38%	+55%	51.79
2013	0.591	10%	-75%	39.19
2014	0.985	16%	+67%	38.15
2015	2.277	37%	+131%	48.17
2016	1.920	31%	-16%	57.06
2017	1.021	17%	-47%	40.74
2018	1.052	17%	+3%	31.44
Average	**1.399**	**23%**	**18%**	**45.18**

Yellow Highlight = Base Year

Annual Report Form

Please see Attachment B for the Annual I/I Report form which summarizes the following data:

- The average monthly flow and total precipitation for each month, for the past three years.
- The calculated amount of I/I for each year.
- The percent of maximum monthly design capacity that each period's I/I represents.
- The population served by the facility, per month, for the past three years.
- The additional lengths of sewer lines added to the collection system, per month and per year, for the past three years.
- A summary of the I/I from the past three years, including a comparison with the selected Base Year (2011)

Charts

Please see Attachment C for several charts which plot I/I data to illustrate the following:

- Chart I: Comparison of precipitation versus influent flow for each month of the current reporting period.
- Chart II: Comparison of 12-month total precipitation and calculated I/I, for each year since the Base Year.
- Chart III: Monthly Average Influent Flow at the WWTP since the Base Year.
- Chart IV: Monthly Total Rainfall since the Base Year.

III. COLLECTION SYSTEM AND I/I REDUCTION PROJECTS AND MEASURES

Collection System Details

According the City of Camas' General Sewer/Wastewater Facility Plan, last updated in November 2009, the city sanitary collection system was comprised of approximately 462,000 linear feet (87.5 miles) of pipe. Since 2009, approximately 133,000 linear feet of sewer line has been added, giving Camas approximately 595,000 linear feet (113 miles) of sewer line, as of the end of 2018.

In 2018, the nearly twelve miles of new sanitary sewer line and three, new sanitary lift stations were added to the City of Camas sanitary collection system. The three new lift stations and the majority of the new sewer line were related to the City's North Shore Sewer Transmission System (NSSTS) project. The NSSTS project provided HDPE gravity sewer mains to support current and future development in the City's northern urban growth boundary, located East of Lacamas Lake.

Camas' collection system is comprised of a combination of both traditional gravity sewer, force mains, pressure sewer lines, and 27 lift stations. Please see Attachment B for the lengths of sewer lines added to the collection system, per month and per year, for the past three years.

Summary of I/I Reduction Projects

Please see Attachment D for a copy of "Table 7-6, Project Schedule" from the 2016 I/I Study. This table is the full list of I/I reduction projects that were proposed by the study, scheduled by year. Projects that are underway or have been competed are highlighted as indicated. Project completion date(s) are noted.

Mill Ditch Sewer Main Replacement

In the previous reporting period, the City completed the "Mill Ditch Sewer Main Replacement" project, which took place between the intersections of NE 1th & Adams St. to the intersection of NE 1th Ave. and Everett St., along the Georgia-Pacific Mill Ditch. The project replaced approximately 900 linear feet of deteriorated 15" concrete sewer pipe and 5 manhole structures. The 15" concrete main was replaced with 21" HDPE pipe.

The following is a summary of the work:

Project Name: Mill Ditch Sewer Main Replacement
Collection System Basin: 3s
Project Started: 10/16/2017
Project Competed: 04/16/2018
Total Funds Expended: $417,105.25
Total Sewer Line Replaced: 900
Total Manholes Replaced: 5

Due to the timing of the project's completion and the unseasonably dry spring our area experienced last year, flow monitoring to document I/I removal could not be conducted until after last year's I/I report was submitted. Therefore, we are providing those results and the I/I removal evaluation now.

Table 3 below summarizes the Basin 3s flows measured at Manhole 5-8-1, prior to and after the Mill Ditch sewer replacement project. Calculations for flows prior to the project were documented in our 2016 I/I Study, and were based on flow measurements from February 5, 2016 to February 23, 2016. Calculations for flows after the project are based on data collected by a flow meter placed in manhole 5-8-1 from March 19, 2019 to June 4, 2019.

As established in the 2016 I/I Study, inflow calculations assume a Winter Dry Weather Flow of 0.21521 MGD for combined Basins 3n, 3s and 4 measured at manhole 5-8-1, and 2.20 MGD for the entire city. Also, only measurements on peak influent flow days for the WWTP (those exceeding 3.6 MGD) were considered for inflow calculations. Table 4 summarizes the WWTP influent flow and rainfall for the two measurement periods.

TABLE 3 – Estimated Inflow Rates Before and After the Mill Ditch Sewer Replacement Work

Manhole	Basin Measured	Flow Meter Installed	Flow Meter Removed	Parameter	Daily Flows (MGD)		
					Min.	Ave.	Max.
MH 5-8-1 Before Project	3n, 3s, 4	2/5/2016	2/23/2016	Flow (MGD)	0.352	0.909	1.969
				Inflow (MGD)	0.680	1.114	1.617
				% of Total Camas Inflow	43.7%	**67.2%**	100%
MH 5-8-1 After Project	3n, 3s, 4	3/19/2019	6/4/2019	Flow (MGD)	0.460	0.795	2.496
				Inflow (MGD)	0.245	0.580	2.280
				% of Total Camas Inflow	79.2%	**85.1%**	91.6%

TABLE 4 – WWTP Influent Flow and Rainfall During Flow Measurement at Manhole 5-8-1

	Measurement Period	Daily Average WWTP Influent Flow (MGD)	Highest Daily WWTP Influent Flow (MGD)	Total Rainfall (in.)	Average Daily Rainfall (in.)
Before Project	2/5/16 – 2/23/16	3.370	4.882	3.74	0.197
After Project	3/19/19 - 6/4/19	2.277	5.008	6.38	0.082

Based upon the above inflow calculations, it appears that the I/I contribution from basins, 3n, 3s and 4 has actually increased since the Mill Ditch Sewer Replacement Project.

During flow monitoring in 2016, prior to the Mill Ditch project, Basins 3n, 3s and 4 contributed an average of 67.2% of the city's total inflow. Though the City's overall, calculated I/I has decreased since 2016, this year's flow monitoring conducted at manhole 5-8-1 indicates that the inflow contribution from basins 3n, 3s and 4 has increased to 85.1%. Therefore, the repairs to the Mill Ditch Sewer line do not appear to have resulted in a measurable reduction in the total I/I from sewer basins 3n, 3s and 4.

Though the reason for the increase is not immediately apparent, it seems it may be related to the size of the rain events captured in each monitoring period. We hope that this result will be clarified during our upcoming follow-up to the 2016 I/I Study, which will be submitted to Ecology in 2020.

View Ridge Court Sewer Replacement

On June 18, 2019, the City of Camas awarded a project to replace approximately 800 linear feet of existing 8" diameter concrete sewer pipe with new 8" PVC and 10" HDPE sewer pipe, between NW View Ridge Court and NW View Ridge Street. The work is also to include the replacement of four existing manholes and the replacement of all affected sewer laterals.

The following is a summary of the work:

Project Name: View Ridge Court Sewer Replacement
Collection System Basin: 10
Scheduled Project Start Date: 8/5/2019
Estimated Project Completion Date: 10/7/2019
Project Bid Amount: $369,709.04
Total Sewer Line to be Replaced (feet): 800
Total Manholes to be Replaced: 4

Though it was not mentioned in the 2016 I/I Study, this section of sewer pipe has since been identified as being badly deteriorated and is likely a major contributor of I&I into the City's sewer Basin 10. In the 2016 study, our South Prune Hill and West Camas pump stations were both identified as exceeding the 3.4:1 peaking factor criterion. Both of these pump stations are downstream of the sewer segment being repaired.

Flow monitoring of the View Ridge Court Sewer repair project will be conducted before and after the piping replacement occurs, and the results of which will be included in the 2019 I/I report that will be submitted in July of 2020.

If you have any questions regarding this report or require any additional information, please do not hesitate to contact me at (360) 834-3263 or via email at bbusch@cityofcamas.us.

Best Regards

Bob Busch
Wastewater Operations Supervisor

Cc: Sam Adams
Steve Wall

ATTACHMENT A - Camas 20-Year WWTP Influent Flow and Rainfall

WWTP Design Capacity	
Peak Day Design Flow (MGD):	10.04
Max. Monthly Average Design (MMAD) Flow (MGD):	6.10
Design Population Equivalent:	28,075

Monthly Average Influent Flow (MGD) - MAY 1, 1999 to APRIL 30, 2019

Month	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	AVG
May	1.694	1.490	1.413	1.542	1.622	1.953	2.607	2.177	2.064	2.056	2.255	2.370	2.563	2.446	2.576	2.299	2.155	2.259	2.263	1.946	**2.087**
June	1.678	1.410	1.423	1.547	1.520	1.996	2.083	2.095	1.997	2.092	1.918	2.833	2.190	2.480	2.149	2.623	2.118	2.244	2.019	1.983	**2.020**
July	1.619	1.471	1.358	1.458	1.483	1.832	1.925	2.023	1.954	1.903	1.904	1.973	1.994	2.129	2.015	2.915	2.028	2.135	1.831	1.828	**1.889**
August	1.618	1.364	1.334	1.420	1.450	2.011	1.981	2.050	1.948	2.015	1.921	1.955	2.029	2.093	2.033	3.284	2.088	2.112	1.881	1.890	**1.924**
September	1.598	1.449	1.336	1.434	1.549	1.948	2.031	2.087	2.035	1.971	1.963	2.055	2.062	2.079	2.454	2.935	2.187	2.169	1.985	1.884	**1.961**
October	1.588	1.930	1.486	1.447	1.619	2.089	2.212	2.101	2.252	2.013	2.078	2.226	2.148	2.518	2.324	2.961	2.292	3.185	2.262	2.035	**2.138**
November	2.396	2.951	2.014	1.500	1.903	2.202	2.700	3.423	2.484	2.391	2.510	3.057	2.653	3.312	2.528	2.849	2.867	3.312	2.764	2.178	**2.600**
December	2.008	1.972	2.594	2.066	2.573	2.494	3.086	3.148	3.465	2.433	2.580	3.364	2.396	3.540	2.556	2.560	4.305	3.191	2.465	2.648	**2.772**
January	2.273	1.653	2.399	2.431	2.708	2.262	4.018	2.798	4.094	2.814	3.146	3.042	3.222	2.995	2.606	2.810	3.548	2.988	2.852	2.480	**2.857**
February	2.162	1.673	2.128	2.220	2.414	2.165	2.584	2.754	2.643	2.061	2.567	2.648	2.748	2.522	2.422	2.863	3.251	4.031	2.405	2.880	**2.557**
March	1.831	1.751	2.199	2.488	1.887	2.345	2.576	2.819	2.442	2.504	2.388	3.570	3.505	4.419	2.314	2.784	3.099	3.442	2.552	2.156	**2.654**
April	1.349	1.689	1.770	2.052	1.627	2.156	2.377	2.327	2.302	2.327	2.308	2.904	2.898	2.428	2.191	2.425	2.321	2.643	2.710	2.639	**2.272**
AVG	**1.818**	**1.734**	**1.788**	**1.800**	**1.863**	**2.121**	**2.515**	**2.483**	**2.473**	**2.215**	**2.295**	**2.666**	**2.534**	**2.747**	**2.347**	**2.776**	**2.688**	**2.809**	**2.332**	**2.212**	**2.311**
MAX	**2.396**	**2.951**	**2.594**	**2.488**	**2.708**	**2.494**	**4.018**	**3.423**	**4.094**	**2.814**	**3.146**	**3.570**	**3.505**	**4.419**	**2.606**	**3.284**	**4.305**	**4.031**	**2.852**	**2.880**	**3.229**
MIN	**1.349**	**1.364**	**1.334**	**1.420**	**1.450**	**1.832**	**1.925**	**2.023**	**1.948**	**1.903**	**1.904**	**1.955**	**1.994**	**2.079**	**2.015**	**2.299**	**2.028**	**2.112**	**1.831**	**1.828**	**1.830**
Annual I/I	**1.047**	**1.587**	**1.260**	**1.069**	**1.258**	**0.661**	**2.093**	**1.400**	**2.145**	**0.911**	**1.242**	**1.615**	**1.511**	**2.340**	**0.591**	**0.985**	**2.277**	**1.920**	**1.021**	**1.052**	**1.399**
% of MMAD Flow	17%	26%	21%	18%	21%	11%	34%	23%	35%	15%	20%	26%	25%	38%	10%	16%	37%	31%	17%	17%	23%
% +/- vs Prior Year	11%	52%	-21%	-15%	18%	-47%	217%	-33%	53%	-58%	36%	30%	-6%	55%	-75%	67%	131%	-16%	-47%	3%	18%

YELLOW = BASE YEAR

Monthly Total Rainfall (in.) - MAY 1, 1999 to APRIL 30, 2019

Month	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	AVG
May	2.61	3.65	1.58	1.65	2.00	1.65	6.14	2.94	2.11	2.11	4.44	3.93	4.94	4.58	4.64	2.35	0.50	2.10	3.13	0.46	**2.88**
June	3.09	1.27	2.97	1.75	0.52	1.52	3.22	1.24	2.01	2.19	1.18	7.03	1.16	4.83	1.88	2.05	0.52	2.06	1.74	1.87	**2.21**
July	1.05	0.06	0.66	0.25	0.00	0.24	0.71	0.67	0.74	0.04	0.09	0.35	0.85	0.41	0.00	1.07	0.57	1.17	0.00	0.06	**0.45**
August	1.24	0.17	1.23	0.02	0.09	3.91	0.74	0.02	0.99	1.98	0.60	0.90	0.09	0.01	0.26	0.13	0.90	0.15	0.27	0.47	**0.71**
September	0.12	3.71	0.80	1.41	1.36	2.45	2.37	2.35	3.46	0.81	1.18	3.64	1.00	0.05	5.98	1.02	1.25	1.76	2.66	1.03	**1.92**
October	2.66	4.12	2.40	1.09	3.09	5.32	5.02	2.44	5.15	4.43	4.11	6.39	2.78	9.52	1.47	6.26	4.80	10.43	5.13	4.39	**4.55**
November	6.96	3.51	7.51	2.90	5.57	3.19	5.10	12.77	6.29	11.17	7.59	10.76	8.39	11.62	3.33	3.56	5.31	6.39	7.21	3.62	**6.64**
December	4.77	3.34	6.34	9.30	8.99	4.87	8.88	6.57	10.54	7.27	5.98	10.26	3.77	10.58	2.73	6.58	13.84	4.24	3.21	6.33	**6.92**
January	6.99	2.27	6.94	8.83	6.73	2.28	11.35	2.69	4.82	6.30	8.87	6.87	7.69	4.52	3.68	3.56	7.17	3.64	6.15	3.19	**5.73**
February	4.15	1.60	3.65	2.75	5.68	1.81	2.92	5.54	2.59	2.19	4.97	6.05	3.95	2.01	5.83	4.17	5.49	9.68	3.05	4.67	**4.14**
March	0.88	4.73	4.93	7.49	2.28	4.65	3.86	6.79	3.71	6.97	6.17	9.75	9.98	0.74	5.35	4.89	5.31	9.85	3.49	1.66	**5.17**
April	2.78	3.03	3.62	4.04	1.43	4.92	2.85	3.78	5.64	4.26	4.74	7.43	3.00	2.92	4.04	2.51	2.51	5.59	4.70	3.69	**3.87**
TOTAL	**37.30**	**31.46**	**42.63**	**41.48**	**37.74**	**36.81**	**53.16**	**47.80**	**48.05**	**49.72**	**49.92**	**73.36**	**47.60**	**51.79**	**39.19**	**38.15**	**48.17**	**57.06**	**40.74**	**31.44**	**45.18**
AVG	**3.11**	**2.62**	**3.55**	**3.46**	**3.15**	**3.07**	**4.43**	**3.98**	**4.00**	**4.14**	**4.16**	**6.11**	**3.97**	**4.32**	**3.27**	**3.18**	**4.01**	**4.76**	**3.40**	**2.62**	**3.76**
MAX	**6.99**	**4.73**	**7.51**	**9.30**	**8.99**	**5.32**	**11.35**	**12.77**	**10.54**	**11.17**	**8.87**	**10.76**	**9.98**	**11.62**	**5.98**	**6.58**	**13.84**	**10.43**	**7.21**	**6.33**	**9.01**
MIN	**0.12**	**0.06**	**0.66**	**0.02**	**0.00**	**0.24**	**0.71**	**0.02**	**0.74**	**0.04**	**0.09**	**0.35**	**0.09**	**0.01**	**0.00**	**0.13**	**0.50**	**0.15**	**0.00**	**0.06**	**0.20**

20-Year Rainfall Summary	
20-Year Average Annual Rainfall (in.):	**45.18**
20-Year Maximum Annual Rainfal (in.):	**73.36** (2010)
20-Year Minimum Annual Rainfall (in.):	**31.44** (2018)

City of Camas WWTP (WA0020249) - Annual Infiltration and Inflow Report

May 2016 to April 2019

WWTP Design Capacity

Peak Hourly Hydraulic Design Flow (MGD):	**13.44**
Maximum Monthly Average Design Flow (MGD):	**6.10**
Design Population Equivalent:	**28,075**

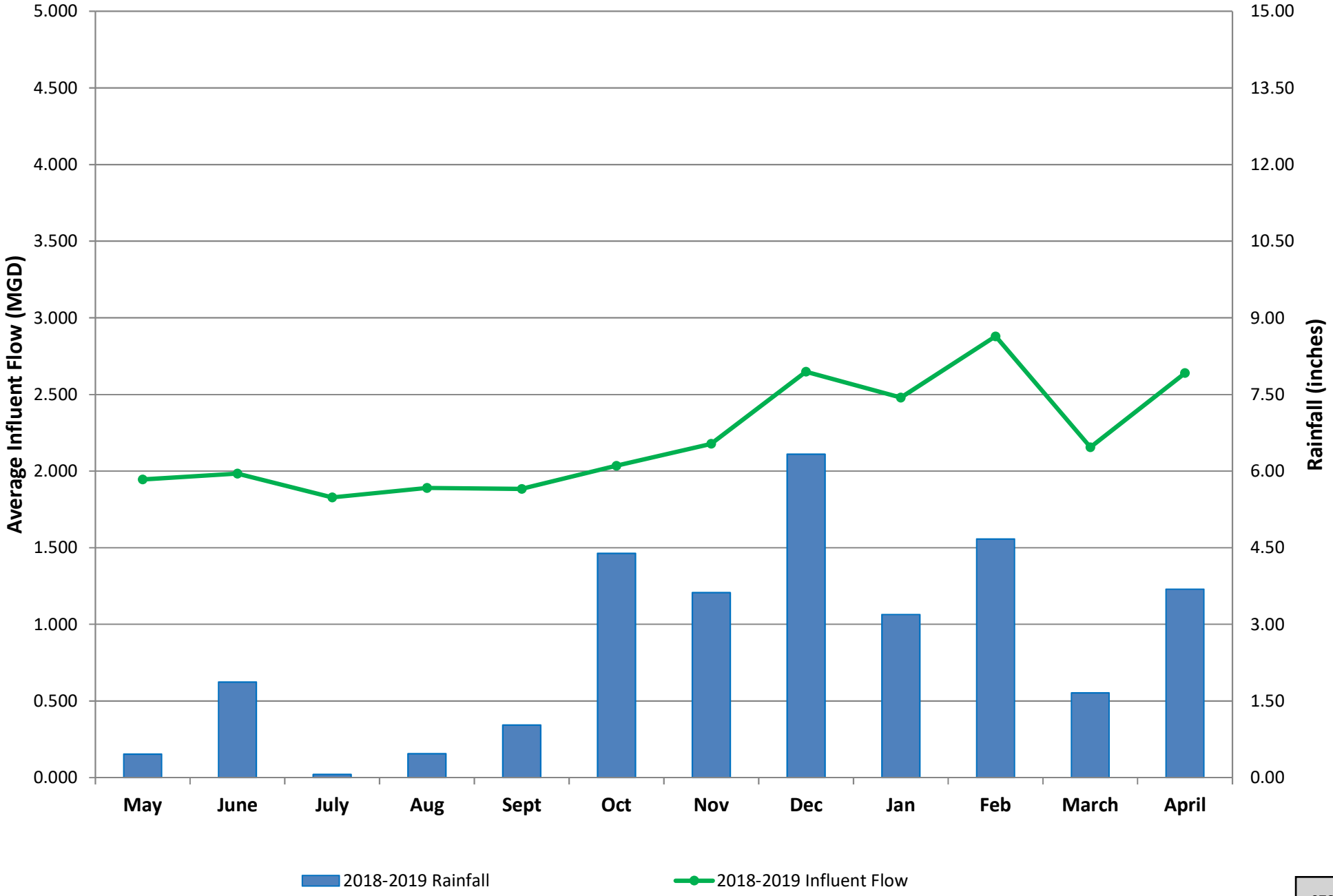
	Monthly Average WWTP Influent Flow (MGD)			Total Monthly Rainfall (inches)			Population Served			Additional Sewer Lines Added (ft.)		
Month	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**
May	2.259	2.263	1.946	2.10	3.13	0.46	21,810	23,080	23,770	3,609	0	1,871
June	2.244	2.019	1.983	2.06	1.74	1.87	21,810	23,080	23,770	5,307	0	45,563
July	2.135	1.831	1.828	1.17	0.00	0.06	21,810	23,080	23,770	2,576	11,060	1,311
Aug	2.112	1.881	1.890	0.15	0.27	0.47	21,810	23,080	23,770	0	0	0
Sept	2.169	1.985	1.884	1.76	2.66	1.03	21,810	23,080	23,770	837	0	2,395
Oct	3.185	2.262	2.035	**10.43**	5.13	4.39	21,810	23,080	23,770	0	0	0
Nov	3.312	2.764	2.178	6.39	**7.21**	3.62	21,810	23,080	23,770	0	0	8,728
Dec	3.191	2.465	2.648	4.24	3.21	**6.33**	21,810	23,080	23,770	622	0	1,679
Jan	2.988	**2.852**	2.480	3.64	6.15	3.19	22,085	23,770	24,070	0	0	0
Feb	**4.031**	2.405	**2.880**	9.68	3.05	4.67	22,085	23,770	24,070	819	0	0
March	3.442	2.552	2.156	9.85	3.49	1.66	22,085	23,770	24,070	0	4,663	0
April	2.643	2.710	2.639	5.59	4.70	3.69	22,085	23,770	24,070	0	0	0
Period Total:	33.710	27.989	26.546	57.06	40.74	31.44				**Total Added (feet):**	13,770	15,723	61,547
Low Month:	2.112	1.831	1.828	0.15	0.00	0.06				**Total Added (miles):**	2.61	2.98	11.66
High Month:	**4.031**	**2.852**	**2.880**	**10.43**	**7.21**	**6.33**							
Annual Average:	2.809	2.332	2.212	4.76	3.40	2.62							
Period I/I:	1.920	1.021	1.052										

INFILTRATION/INFLOW SUMMARY

Year	I/I	% Increase/Decrease From Base I/I	% Increase/Decrease from Prior Year	% of Max Month. Design Flow	Total Rainfall
Base Year: 2011	***1.511***	***n/a***	***-6%***	***25%***	***47.60***
2016-2017	1.920	27%	131%	31%	48.17
2017-2018	1.021	-32%	-47%	17%	57.06
2018-2019	1.052	-30%	3%	17%	40.74

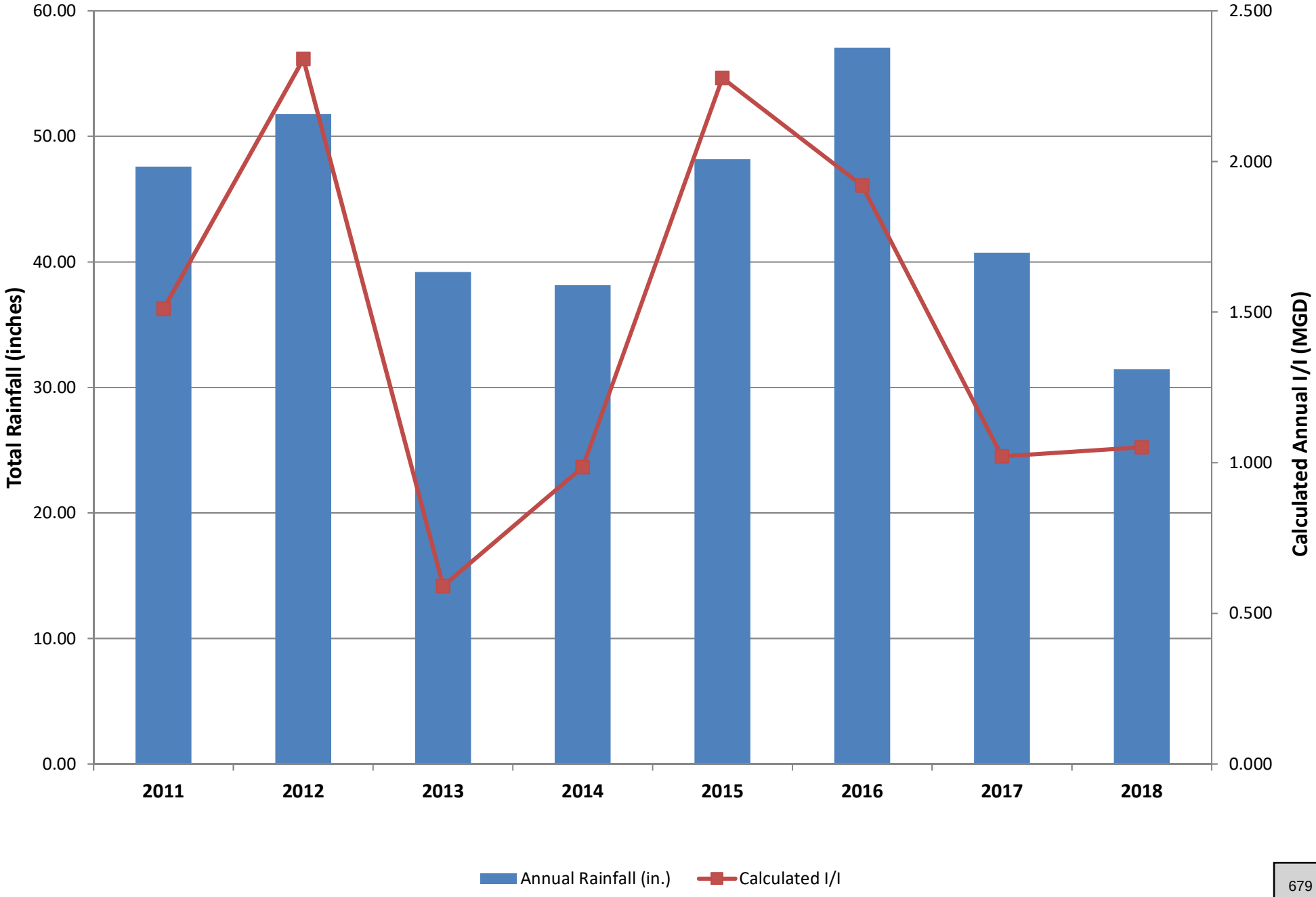
ATTACHMENT C, CHART I

May 2018 - April 2019 Monthly Average Influent Flow and Monthly Total Rainfall



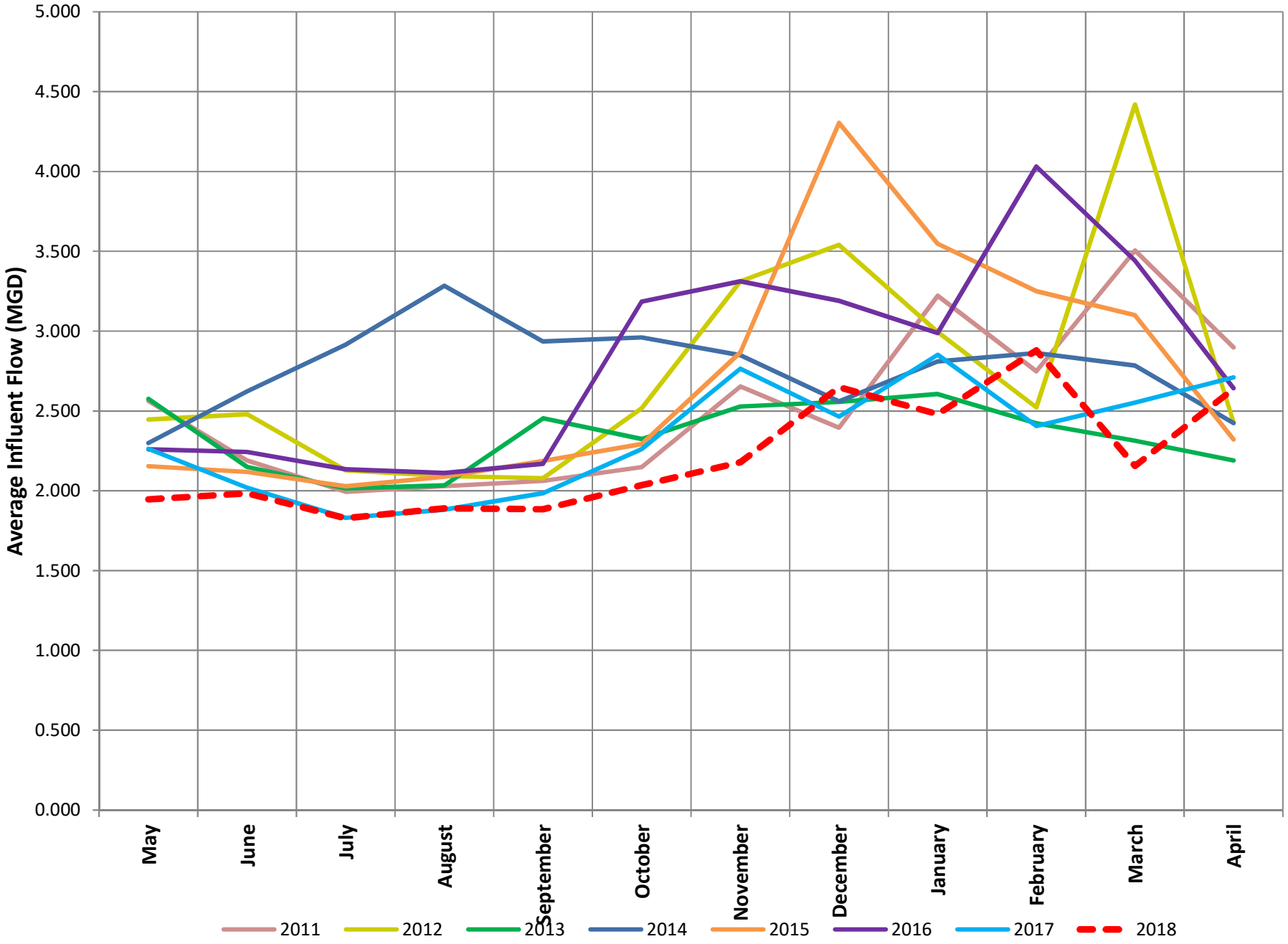
ATTACHMENT C, CHART II

Annual Rainfall & Calculated I/I Since Base Year (2011)



ATTACHMENT C, CHART III

WWTP Monthly Average Influent Flow Since Base Year (2011)



ATTACHMENT C, CHART IV

Monthly Total Rainfall Since Base Year (2011)

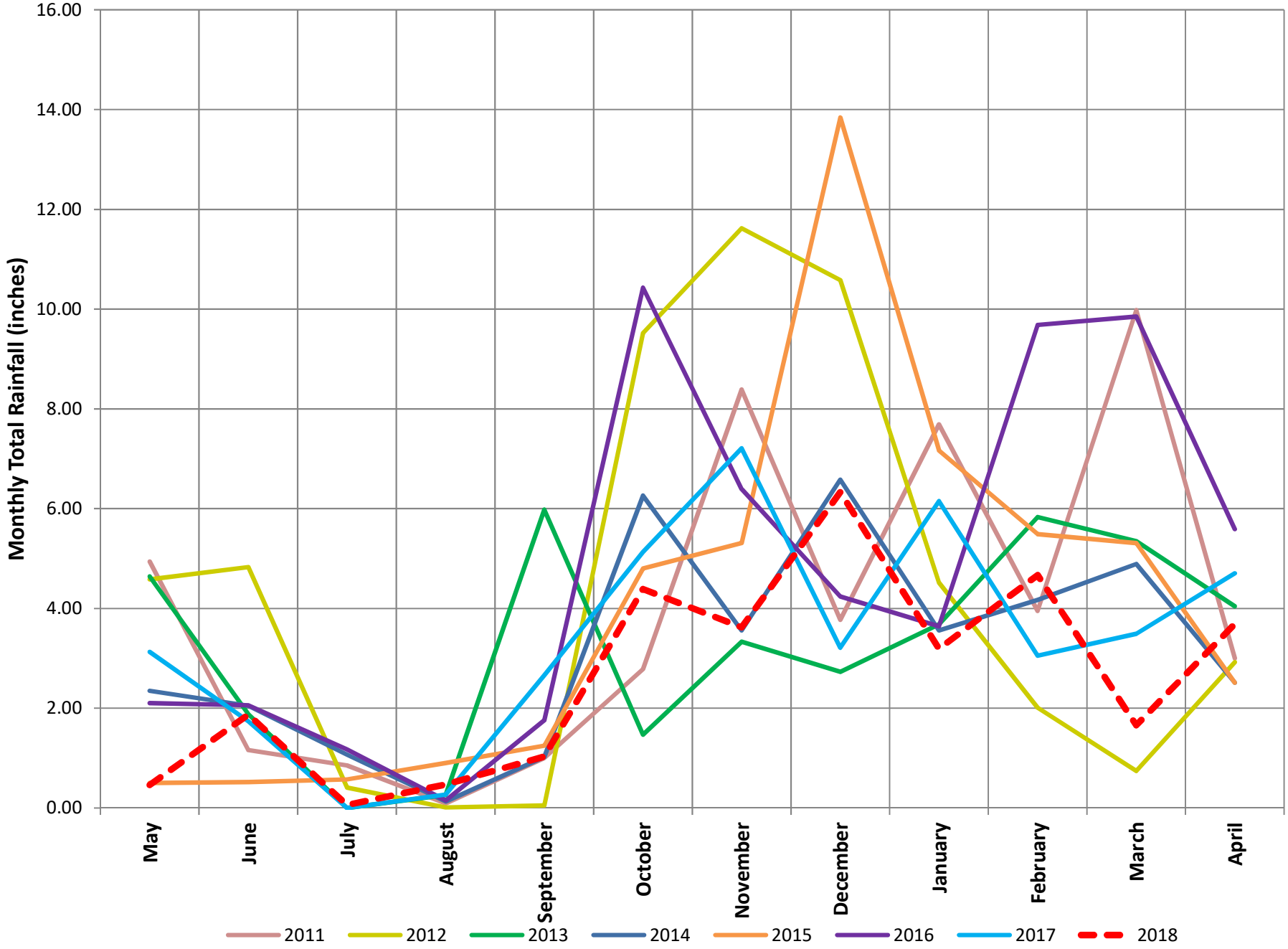


TABLE 7-6

Project Schedule[1]

COMPLETED	Year	Basin(s)	Location	Description	Cost
10/2016	2016	4	NE Franklin Street	Replace sewer line between MH 4-1-1 and MH 4-1-4	$250,000
03/2014	2016	3n	Basin 3n	Clean and Video All Sewer Lines in Basin 3n, begin Basin 3s (Note: Crown View Lift Station subbasin, 13,500 feet, was video inspected for the I/I study in the Spring, the remainder of Basin 3n will be cleaned/videoed in the fall of 2016)	$50,000
02/2018	2016	3s	Mill Ditch	Replaced section of sewer line between Dallas Street and Birch Street	$78,000
	2016	**Total Inflow Removal Projects (does not include cleaning and video inspection work)**			**$328,000**
02/2018	2017	3s	Mill Ditch	Rehabilitate or replace 15-inch CONC from MH 3-2-6 to 3-1-1 (1,370 ft).	$180,000
	2017	4	NE 23rd Avenue	Replace existing sewerline between Everett and Birch	$110,000
	2017	1, 2, 3n	Various (see Table 7-2)	Repair cleanouts /or replace missing/broken caps as needed at 13 locations.	$13,500
	2017	3n, 3s, 4, 5, 6	Various (see Table 7-2)	Disconnect Roof Drains at five residences.	$2,500
	2017	4, 5, 6, 10	Various (see Table 7-3)	Disconnect Stormwater Catch Basins from Sanitary Sewer at five locations.	$74,000
03/2014	2017	4, 3s	Basins 4 and 3s	Clean and Video Remaining Sewer Lines in Basin 3s and All Lines in Basin 4, begin video inspection of Basin 5.	$50,000
	2017	**Total Inflow Removal Projects (does not include cleaning and video inspection work)**			**$380,000**
	2018	4	Everett and 19th Avenue	Replace 1,140 feet of existing sewer line and manholes	$240,000
	2018	5	SE Adams Street	Slipline 18-inch CONC from MH 3-1-1 to 5-8-1 (446 ft).	$60,000
	2018	5	Various (see Table 7-3)	Replace three manholes (MHs 5-1-13, 5-1-15, 5-7-3).	$75,000
	2018	4, 5, 7	Various (see Table 7-3)	Modify below grade manhole lids (MHs 4-1-1, 4-1-12, 5-7-3, 7-3A-1).	$16,000
	2018	3s, 3n, 5	Various (see Table 7-4)	Seal leaks around pipes and regrout joints (MH 3-1-6, 3-6-4, 3-22-9, 3-1-44, 3-22-8, 3-221-3, 3-22B-2, 3-22C-2, 5-6-1).	$24,000
	2018	2	NW Drake Street	Fix sag in 8-inch HDPE between MH 2-3-5 and 2-3-3.	$20,000
	2018	3n	NW Kent Street	Repair broken 8-inch CONC pipe between MH3-21A-1 and 3-21-4.	$15,000
	2018	3s	NE Adams Street	Repair cracks, debris, holes in the 8-inch CONC pipe and laterals between MH 3-3-2 and 3-3-1.	$15,000
	2018	3s	NE Adams Street	Repair separated and offset joints, and broken pipe and check for return of roots in the 8-inch CONC pipe between MH 3-3-1 and 3-1-1.	$15,000

TABLE 7-6 – (continued)

Project Schedule[1]

Year	Basin(s)	Location	Description	Cost
2018	5	NE 5th Avenue	Repair cracks and separated and offset joints in the 8-inch VCP pipe between MH 5-7-3 and 5-7-2.	$20,000
2018	5, 6	Basins 5 and 6	Video and Clean Remainder of Basin 5, video inspection all of Basin 6 and begin video inspection of Basin 7.	$50,000
2018	**Total Inflow Removal Projects (completes all High Priority projects does not include I/I Report or Video Work)**			**$500,000**
2019	5	NE 6th Avenue	Repair cracks and offset joints in the 8-inch VCP pipe between MH 5-1-15 and 5-1-14	$20,000
2019	5	NE 6th Avenue	Repair broken lateral in the 8-inch VCP pipe between MH 5-1-13 and 5-1-12.	$15,000
2019	5	NE 6th Avenue	Repair broken pipe and voids in the 8-inch PVC pipe between MH 5-1-20 and 5-1-19. (265')	$15,000
2019	8	SE Russell Street	Fix lateral connection problems, and check for grease sags in 8-inch CONC pipe between MH 8-4-1 and 8-1-4.	$20,000
2019	10	NW 6th Avenue	Repair void and collapsed section of pipe in the 10-inch CONC pipe between MH 10-1-3 and 10-1-2.	$30,000
2019	10	NW 11th Avenue	Repair broken 8-inch CONC pipe between MH 10-1-31 and 10-1-30.	$15,000
2019	10	NW McIntosh Road	Slip line the 8-inch CONC pipe between MH 10-1-27 and 10-1-26.	$15,000
2019	N/A	N/A	I/I Report	$100,000
2019	7, 8, 9	Basins 7, 8, 9	Clean and Video Remainder of Basin 7 and All of Basins 8, 9 and 10.	$50,000
2019	**Total Inflow Removal Projects (completes all Medium High Priority projects does not include I/I Report or Video Work)**			**$130,000**
2020	3n	NW 29th Avenue	Repair broken 8-inch CONC pipe between MH 3-20B-1 and 3-20-6.	$15,000
2020	3n	NW 29th Circle	Repair cracked 8-inch CONC pipe between MH 3-1-60 and 3-1-59.	$15,000
2020	3n	NW 30th Avenue	Repair broken 8-inch CONC pipe between MH 3-21-7 and 3-21-4.	$15,000
2020	3n	NW 30th Avenue	Repair broken 8-inch CONC pipe between MH 3-21-4 and 3-21-3.	$15,000
2020	3n	NW 32nd Avenue	Repair separated and offset joints in the 8-inch CONC pipe between MH 3-1-43 and 3-1-42.	$15,000
2020	3n	NW 32nd Avenue	Repair cracked 8-inch CONC pipe between MH 3-1-41 and 3-1-39.	$15,000
2020	3n	NW Logan Street	Repair broken pipe in the 8-inch CONC pipe between MH 3-21-5 and 3-21-4.	$15,000

TABLE 7-6 – (continued)

Project Schedule[(1)]

Year	Basin(s)	Location	Description	Cost
2020	3n	NW Norwood Circle	Repair cracks in the 8-inch CONC pipe between CO – Norwood Cir A and CO – Norwood Cir B. (508')	$15,000
2020	3n	NW Sierra Drive	Repair cracks in the 8-inch CONC pipe between MH 3-22-7 and 3-22-6.	$15,000
2020	3n	NW Quartz Place	Repair cracks in the 8-inch CONC pipe between MH 3-22A-1 and 3-22-6.	$15,000
2020	**Total Inflow Removal Projects**			**$150,000**
2021	3n	NW Quartz Place	Remove roots in the 8-inch PVC pipe between MH 3-22-6 and 3-22-4 and repair pipe as needed.	$15,000
2021	3n	NW Norwood Circle	Repair cracks in the 8-inch CONC pipe between CO – Norwood Cir A and CO – Norwood Cir B.	$15,000
2021	3n	NW Sierra Drive	Repair cracks in the 8-inch CONC pipe between MH 3-22-7 and 3-22-6.	$15,000
2021	3n	NW Quartz Place	Repair cracks in the 8-inch CONC pipe between MH 3-22A-1 and 3-22-6.	$15,000
2021	3n	NW Quartz Place	Remove roots in the 8-inch PVC pipe between MH 3-22-6 and 3-22-4 and repair pipe as needed.	$15,000
2021	3s	NW 15th Avenue	Repair broken pipe, cracks and check for regrown roots in 8-inch CONC pipe between MH 3-4-8 and MH 3-4-7.	$15,000
2021	3s	NW 15th Avenue	Repair cracks and check for regrown roots in 8-inch CONC pipe between MH 3-4-7 and MH 3-4-6.	$15,000
2021	3s	NW 16th Avenue	Fix sag in 8-inch HDPE pipe between MH 3-6-2 and 3-6-1.	$20,000
2021	**Total Inflow Removal Projects**			**$135,000**
2022	3s	NW Ash Street	Fix sags in the 8-inch CONC pipe between MH 3-4A-4 and 3-4A-2.	$20,000
2022	3s	NW Ash Street	Fix sags in 8-inch HDPE pipe between MH 3-4A-4 and 3-4A-2.	$20,000
2022	3s	NW Ash Street	Repair broken pipe in the 8-inch HDPE pipe between MH 3-4A-2 and 3-4A-1.	$15,000
2022	3s	NW Benton Street	Repair broken pipe, cracks, and check for roots in 8-inch CONC pipe between MH 3-4-3 and MH 3-4-2.	$15,000
2022	3s	NE Birch Street	Repair separated and offset joints in the 8-inch CONC pipe between MH 3-2A-4 and 3-2A-3.	$20,000
2022	3s	NE Birch Street	Repair cracks and check for roots in the 8-inch CONC pipe between MH 3-2A-3 and 3-2A-2.	$15,000

TABLE 7-6 – (continued)

Project Schedule[(1)]

Year	Basin(s)	Location	Description	Cost
2022	3s	NE Birch Street	Repair broken pipe, fix sag and check for roots and in the 8-inch CONC pipe between MH 3-2A-2 and 3-2A-1.	$20,000
2022	3s	NE Birch Street	Repair separated and offset joints, and cracks and check for roots in the 8-inch CONC pipe between MH 3-2A-1 and 3-2-1.	$15,000
2022	**Total Inflow Removal Projects**			**$150,000**
2023	3s	NE Birch Street	Repair broken pipe, fix sag and check for roots and in the 8-inch CONC pipe between MH 3-2A-2 and 3-2A-1.	$15,000
2023	3s	NE Birch Street	Repair separated and offset joints, and cracks and check for roots in the 8-inch CONC pipe between MH 3-2A-1 and 3-2-1.	$15,000
2023	3s	NW Drake Way	Repair cracks in the 8-inch CONC pipe between MH 3-4B-4 and 3-4B-3.	$15,000
2023	3s	NW Drake Way	Repair broken pipe, cracks in the 8-inch CONC pipe between MH 3-4B-3 and 3-4B-2.	$15,000
2023	4	NW 19th Avenue	Repair cracks in the 8-inch VCP pipe between MH 4-7-8 and 4-7-7.	$15,000
2023	4	NW 19th Avenue	Repair cracks in the 8-inch PVC pipe between MH 4-7-7 and 4-7-6.	$15,000
2023	4	NW 19th Avenue	Repair cracks in the 8-inch VCP pipe between MH 4-7-6 and 4-7-5.	$15,000
2023	4	NE 19th Avenue	Repair broken pipe and cracks in the 8-inch VCP pipe between MH 4-7-3 and 4-7-2.	$15,000
2023	4	NE 19th Avenue	Repair cracks, check for roots, fix sag in the 8-inch VCP pipe between MH 4-7-2 and 4-7-1.	$15,000
2023	4	NW 21st Avenue	Repair broken 8-inch CONC pipe between MH 4-9-6 and 4-9-5.	$15,000
2023	**Total Inflow Removal Projects**			**$150,000**
2024	4	NW 21st Avenue	Repair broken 8-inch CONC pip and check for return of roots between MH 4-9-4 and 4-9-3.	$15,000
2024	4	NW 21st Avenue	Repair broken 8-inch CONC pipe between MH 4-9-3 and 4-9-2.	$15,000
2024	5	NE 4th Avenue	Fix sag and check for regrown roots in joints and laterals in the 8-inch VCP pipe between MH 5-6-3 and 5-6-2.	$20,000
2024	8	SE 7th Avenue	Fix lateral connection problems and sags and investigate signs of debris, in the 8 inch CONC pipe between MH 8-3A-1 and 8-3-1.	$20,000

TABLE 7-6 – (continued)

Project Schedule[1]

Year	Basin(s)	Location	Description	Cost
2024	8	SE 7th Avenue	Fix sags and check for debris and in the 8-inch CONC pipe between MH 8-3B-1 and 8-3-1.	$20,000
2024	8	SE 9th Avenue	Fix sags and check for debris in 12" CONC pipe between MH 8-1-4 and 8-1-3.	$20,000
2024	9	SE James Street	Repair cracks, check for debris and regrown roots in laterals, and fix sag in the 8 inch CONC pipe between MH 9-1-8 and 9-1-7. (440')	$20,000
2024	9	SE Whitney Street	Fix sag in the 8-inch CONC pipe between MH 9-4-3 and 9-4-2.	$20,000
2024	**Total Inflow Removal Projects**			**$150,000**
2025	9	SE Whitney Street	Fix sag in the 8-inch CONC pipe between MH 9-4-3 and 9-4-2.	$20,000
2025	10	NW 6th Avenue	Repair cracks and separated joints in the 10-inch PVC pipe between MH 10-1-2 and 10-1-1. (304')	$15,000
2025	10	NW Fremont Street	Repair cracks in the 8-inch CONC pipe between MH 10-8-1 and 10-1-22.	$15,000
2025	**Total Inflow Removal Projects (completes Medium Priority projects)**			**$50,000**
2026-2028	1	NW 8th Avenue	Repair crack in 8-inch PVC pipe between the cleanout and MH 1-3A-9. (350')	$15,000
2026-2028	2	NW 10th Avenue	Repair offset joint and sag in the 8-inch HDPE pipe between MH 2-3-7 and 2-3-6. (265')	$15,000
2026-2028	5	NE 4th Avenue	Repair cracks and check for return of roots in joints in the 8-inch VCP pipe between MH 5-6-1 and 5-1-10. (289')	$15,000
2026-2028	5	NE 6th Avenue	Repair broken pipe, offset joints, and check for regrown roots in the 6-inch VCP pipe and 6-inch DI pipe between MH 5-13-1 and 5-1-20. (369')	$20,000
2026-2028	6	SE 1st Avenue	Repair offset joint in the 8-inch pipe between MH 6-5-3 and 6-5-2.	$15,000
2026-2028	6	NE 4th Avenue	Repair offset joints in the 8-inch VCP pipe between MH 6-8-3 and 6-8-2.	$15,000
2026-2028	6	NE 4th Avenue	Repair cracks and offset joints in the 8-inch VCP pipe between MH 6-8-2 and 6-8-1. (314')	$15,000
2026-2028	6	NE 5th Avenue	Repair separated/offset joints and fix sag in the 8-inch VCP pipe between MH 6-7B-1 and 6-7B-2. (336')	$25,000

TABLE 7-6 – (continued)

Project Schedule(1)

Year	Basin(s)	Location	Description	Cost
2026-2028	7	NE 3rd Avenue	Repair cracks in the 8-inch CONC pipe between MH 7-8-2 and 7-8-1. (255')	$15,000
2026-2028	7	NE 3rd Avenue	Repair cracks and check for regrown roots in 8-inch CONC pipe between MH LH and 7-5-1A.	$15,000
2026-2028	7	NE 3rd Loop	Repair cracks and check for regrown roots in laterals and 8-inch CONC pipe between MH 7-1-8 and 7-1-7.	$15,000
2026-2028	8	SE Russell Street	Fix lateral connection problems in the 8-inch CONC pipe between MH 8-4-2 and 8-4-1.	$20,000
2026-2028	9	SE 1st Avenue	Repair cracks in the 8-inch CONC pipe between MH 9-3A-2 and 9-3A-1. (418')	$15,000
2026-2028	9	SE 1st Avenue	Fix sags in the 8-inch CONC pipe between MH 9-3A-1 and 9-3-1. (420')	$15,000
2026-2028	9	NE 2nd Avenue	Repair broken 8-inch CONC pipe between MH 9-1-5 and 9-1-4. (224')	$15,000
2026-2028	9	NE 3rd Avenue	Fix lateral connection problems, check for grease and roots in laterals in 8-inch CONC pipe between MH 9-5-6 and 9-5-5.	$15,000
2026-2028	9	NE 3rd Avenue	Repair cracks and check for grease in 8-inch CONC pipe between MH 9-5-5 and 9-5-4. (111')	$15,000
2026-2028	9	SE 3rd Avenue	Fix sags in the 8-inch CONC pipe between MH 9-6-2 and 9-6-1.	$20,000
2026-2028	9	SE James Street	Repair cracks, check for grease, and investigate sag in the 8-inch CONC pipe between MH 9-6-1 and 9-1-11. (337')	$15,000
2026-2028	9	SE James Street	Repair cracks and check for regrown roots in the 8-inch CONC pipe between MH 9-1-9 and 9-1-8. (380')	$15,000
2026-2028	**Total Inflow Removal projects (completes Low Priority projects)**			**$325,000**

(1) Project list will be reassessed and potentially modified each year to meet objectives.

City of Camas Washington
Public Works Department
616 NE 4th Avenue
Camas, WA 98607

July 14, 2021

Carey Cholski
Washington State Department of Ecology
PO Box 47775
Olympia, WA 98504-7775

Subject: **May 2020 – April 2021 Annual Inflow and Infiltration Report**
City of Camas, WA Wastewater Treatment Facility (Permit No. WA0020249)

Ms. Cholski,

Pursuant to Section S4.E of our current NPDES Permit, enclosed is our annual Inflow and Infiltration (I/I) report. Section S4.E.3 of our permit states:

> *The Permittee must conduct an annual analysis of infiltration and inflow according to Ecology's guidance manual for treatment plant operators. This report shall consider the 12-month period May 1st through the following April 30th as the annual period and shall be submitted by July 15, 2017 and annually thereafter. This report shall include an update on the status of each inflow reduction project completed in fulfillment of S4.E.2 (above) including the funds expended or contractually obligated, and the proportion of the project completed as of the end of the reporting period. For each basin or sub-basin in which work has been done within the reporting period, the report shall include the estimated inflow rates before and after the project and the estimated effect on the overall Publicly Owned Treatment Works (POTW) inflow rate.*

According to Ecology's Information Manual for Treatment Plant Operators (Feb. 2004), an Annual I/I Report should include each of the following elements:

1. *The average monthly flow and total precipitation for each month for the past year together with a graph … plotting a comparison of precipitation versus influent flow.*
2. *The maximum monthly and peak hourly hydraulic design capacity for the plant.*
3. *The design population equivalent for the treatment plant and the population served by the facility, per month, for the past year.*

4. *The amount of I/I for each year since the base year and the percent of maximum monthly design capacity each year's I/I represents.*
5. *The percent increase or reduction in I/I for each year subsequent to the base year I/I.*
6. *The additional lengths of sewer lines added to the collection system, per month, for the past year. Also include a brief summary of any major sewer rehabilitation or I/I reduction projects.*

The following information and attachments are now being submitted to satisfy these requirements.

I. REPORTING PERIOD AND BASE YEAR

As described in Section S4.E.3 of our current NPDES permit, the annual period for our I/I report is May 1st through April 30th. Accordingly, please note that when this report refers to the "reporting period" or "year", it is referring to the 12-month period from May 1st through April 30th. For any particular year that is referenced in the report, it is denoting the May through April reporting year and the calendar year in which May falls.

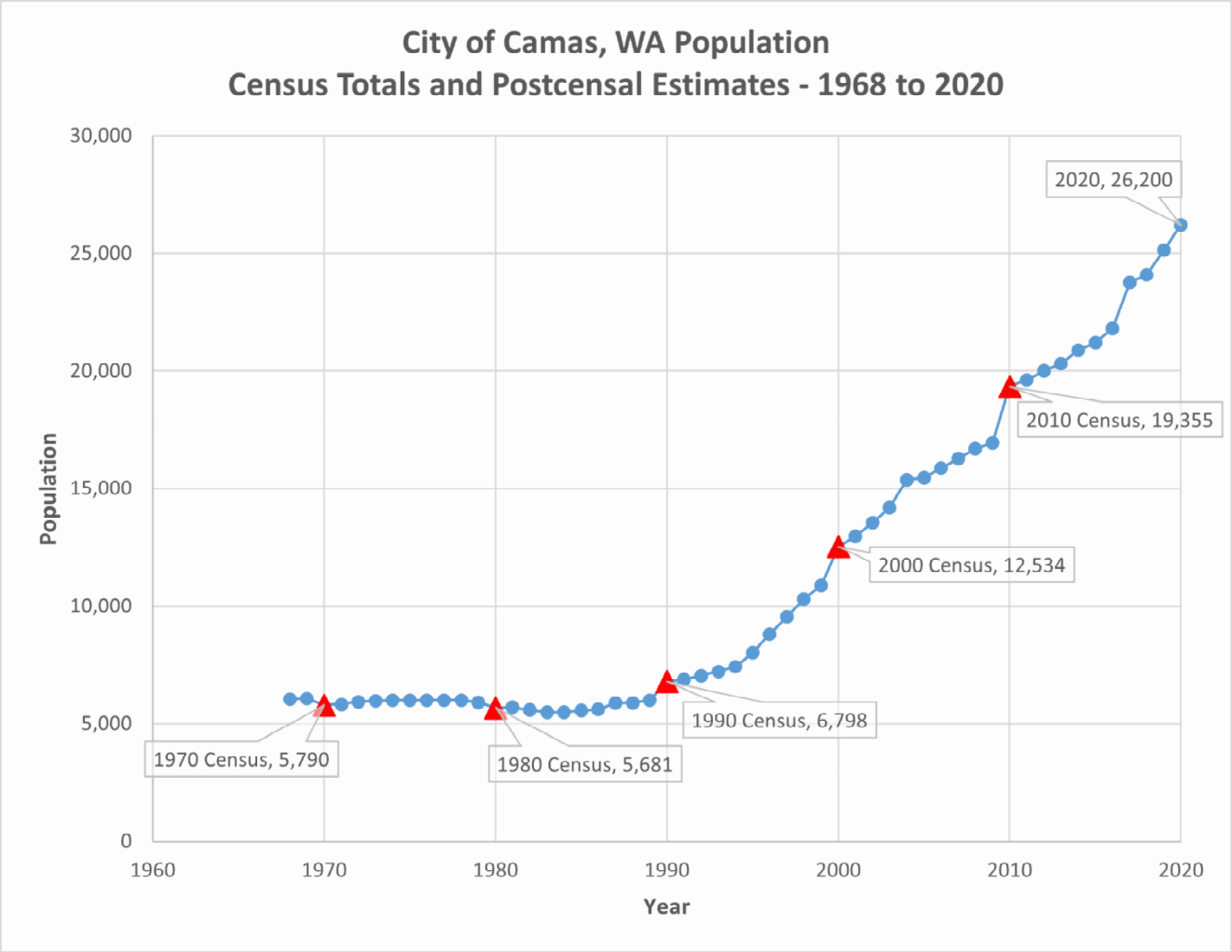
For the purposes of selecting an appropriate Base Year, the past twenty years of historical precipitation and plant influent flow data are reviewed annually. A summary of the monthly precipitation totals and influent flow averages for the past twenty years are included in Attachment A.

From analysis of the historical data, May 2011-April 2012 continues to best represent an average, annual rainfall in Camas and therefore continues to serve as the Base Year for the purposes of this report. For the twenty-year period of May 1, 2001 to April 30, 2021, the average 12-month rainfall in Camas was 45.57 inches. From May 1, 2011 to April 30th 2012, the rainfall was 47.60, which is approximately the 50th percentile of all twenty 12-month totals and only 2.03 inches more than the twenty-year average.

TABLE 1 - 12-Month May Through April Rainfall Totals, 2001-2020

	Average	Minimum	50th Percentile	Maximum
Annual Total Rainfall (in.)	45.57	28.35 (May 2019 – April 2020)	47.60 (May 2011-April 2012)	73.36 (May 2010-April 2011)

In addition to representing the 20-year median rainfall, using 2011-2012 as the "Base Year" incorporates the City's rapid growth that has occurred in the last 20 years. In I/I annual reports prior to 2016, the City of Camas had been using 1989 as the Base Year. Since 1989, the City of Camas has seen rapid growth in population and significant additions to its wastewater collection system. The May 2011-April 2012 period captures that growth, which has taken place primarily after 1990. The chart below illustrates the City's annual, calendar year, population growth since 1968:



Historical Population Estimates for Camas, WA by Washington State Office of Financial Management
(https://ofm.wa.gov/washington-data-research/population-demographics/population-estimates/april-1-official-population-estimates)

II. INFLOW AND INFILTRATION ANALYSIS

Facility Design Parameters

The maximum monthly hydraulic design capacity for the Camas Wastewater Treatment Plant (WWTP) is 6.10 million gallons per day (MGD) and has a peak hourly hydraulic design capacity of 13.44 MGD. The Design Population Equivalent for the Camas WWTP is 28,075.

Calculated I/I and Annual Rainfall 20-Year History

The following chart is a summary of the calculated I/I, the percent of maximum monthly design capacity the calculated I/I represents, the percentage increase or decrease of I/I from the previous year and the total rainfall for each reporting year from May 2001 to April 2021:

TABLE 2 – Camas Calculated I/I & Rainfall

Year	Calculated I/I (MGD)	I/I as % of Design Capacity	I/I % Increase/Decrease from Prior Year	Total 12-Month Rainfall (in.)
2001	1.260	21%	-21%	42.63
2002	1.069	18%	-15%	41.48
2003	1.258	21%	+18%	37.74
2004	0.661	11%	-47%	36.81
2005	2.093	34%	+217%	53.16
2006	1.400	23%	-33%	47.80
2007	2.145	35%	+53%	48.05
2008	0.911	15%	-58%	49.72
2009	1.242	20%	+36%	49.92
2010	1.615	26%	+30%	73.36
2011	1.511	25%	-6%	47.60
2012	2.340	38%	+55%	51.79
2013	0.591	10%	-75%	39.19
2014	0.985	16%	+67%	38.15
2015	2.277	37%	+131%	48.17
2016	1.920	31%	-16%	57.06
2017	1.021	17%	-47%	40.74
2018	1.052	17%	+3%	31.44
2019	1.541	25%	+47%	28.35
2020	1.334	22%	-13%	48.24
Average	**1.411**	**23%**	**18%**	**45.57**

Yellow Highlight = Base Year

Annual Report Form

Please see Attachment B for the Annual I/I Report form which summarizes the following data:

- The average monthly flow and total precipitation for each month, for the past three years.
- The calculated amount of I/I for each year.
- The percent of maximum monthly design capacity that each period's I/I represents.
- The population served by the facility, per month, for the past three years.
- The additional lengths of sewer lines added to the collection system, per month and per year, for the past three years.
- A summary of the I/I from the past three years, including a comparison with the selected Base Year (2011)

Charts

Please see Attachment C for several charts which plot I/I data to illustrate the following:

- Chart I: Comparison of precipitation versus influent flow for each month of the current reporting period.
- Chart II: Comparison of 12-month total precipitation and calculated I/I, for each year since the Base Year.
- Chart III: Monthly Average Influent Flow at the WWTP since the Base Year.
- Chart IV: Monthly Total Rainfall since the Base Year.

III. COLLECTION SYSTEM AND I/I REDUCTION PROJECTS AND MEASURES

Collection System Details

According to the City of Camas' General Sewer/Wastewater Facility Plan, last updated in November 2009, the city sanitary collection system was comprised of approximately 462,000 linear feet (87.5 miles) of pipe. Since 2009, approximately 152,000 linear feet of sewer line has been added, giving Camas approximately 614,000 linear feet (116 miles) of sewer line, as of the end of 2020.

In 2020, approximately 12,000 linear feet of new sanitary sewer line were added to the City's system. The majority of that total (approximately 9,000 linear feet) was connected to several residential developments added during the year. Approximately 3,000 linear feet of sewer were added as a part of our Lacamas Creek Lift Station Improvement project, which saw the construction of two new sanitary lift stations.

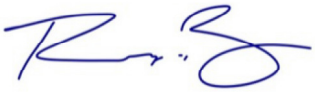
Camas' collection system is comprised of a combination of both traditional gravity sewer, force mains, pressure sewer lines, and 27 lift stations. Please see Attachment B for the lengths of sewer lines added to the collection system, per month and per year, for the past three years.

Sewer Improvement and I/I Reduction Projects

The Lacamas Creek Lift Station Improvements project mentioned above, included the removal and/or abandonment of approximately 1,500 linear feet of aging sewer line, and the complete replacement of lift station that was originally built in 1958. The project saw the removal of a 300-linear-foot, 10 inch, steel gravity which traversed the creek; the abandonment of a 1,600-linear-foot, 6 inch, asbestos-cement forcemain; and the removal of the 62 year old pump station-all of which were within Lacamas Creek's 100-year floodplain. Though there were no projects that took place in the reporting year (May 2020 – April 2021) which were specifically targeted at I/I reduction, the Lacamas Creek Lift Station Improvements project arguably helped to decrease existing sources of inflow and/or infiltration and mitigate the potential for future I/I within its basin.

If you have any questions regarding this report or require any additional information, please do not hesitate to contact me at (360) 834-3263 or via email at bbusch@cityofcamas.us.

Best Regards,



Bob Busch
Wastewater Operations Supervisor

Cc: Sam Adams
Steve Wall

ATTACHMENT A - Camas 20-Year WWTP Influent Flow and Rainfall

WWTP Design Capacity	
Peak Day Design Flow (MGD):	10.04
Max. Monthly Average Design (MMAD) Flow (MGD):	6.10
Design Population Equivalent:	28,075

Monthly Average Influent Flow (MGD) - MAY 1, 2001 to APRIL 30, 2021

Month	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	AVG
May	1.413	1.542	1.622	1.953	2.607	2.177	2.064	2.056	2.255	2.370	2.563	2.446	2.576	2.299	2.155	2.259	2.263	1.946	2.050	2.319	**2.147**
June	1.423	1.547	1.520	1.996	2.083	2.095	1.997	2.092	1.918	2.833	2.190	2.480	2.149	2.623	2.118	2.244	2.019	1.983	1.992	2.409	**2.085**
July	1.358	1.458	1.483	1.832	1.925	2.023	1.954	1.903	1.904	1.973	1.994	2.129	2.015	2.915	2.028	2.135	1.831	1.828	1.961	1.972	**1.931**
August	1.334	1.420	1.450	2.011	1.981	2.050	1.948	2.015	1.921	1.955	2.029	2.093	2.033	3.284	2.088	2.112	1.881	1.890	1.943	2.043	**1.974**
September	1.336	1.434	1.549	1.948	2.031	2.087	2.035	1.971	1.963	2.055	2.062	2.079	2.454	2.935	2.187	2.169	1.985	1.884	2.151	2.192	**2.025**
October	1.486	1.447	1.619	2.089	2.212	2.101	2.252	2.013	2.078	2.226	2.148	2.518	2.324	2.961	2.292	3.185	2.262	2.035	2.199	2.231	**2.184**
November	2.014	1.500	1.903	2.202	2.700	3.423	2.484	2.391	2.510	3.057	2.653	3.312	2.528	2.849	2.867	3.312	2.764	2.178	2.143	2.691	**2.574**
December	2.594	2.066	2.573	2.494	3.086	3.148	3.465	2.433	2.580	3.364	2.396	3.540	2.556	2.560	4.305	3.191	2.465	2.648	2.461	2.991	**2.846**
January	2.399	2.431	2.708	2.262	4.018	2.798	4.094	2.814	3.146	3.042	3.222	2.995	2.606	2.810	3.548	2.988	2.852	2.480	3.484	3.306	**3.000**
February	2.128	2.220	2.414	2.165	2.584	2.754	2.643	2.061	2.567	2.648	2.748	2.522	2.422	2.863	3.251	4.031	2.405	2.880	2.644	3.222	**2.659**
March	2.199	2.488	1.887	2.345	2.576	2.819	2.442	2.504	2.388	3.570	3.505	4.419	2.314	2.784	3.099	3.442	2.552	2.156	2.476	2.470	**2.722**
April	1.770	2.052	1.627	2.156	2.377	2.327	2.302	2.327	2.308	2.904	2.898	2.428	2.191	2.425	2.321	2.643	2.710	2.639	2.330	2.139	**2.344**
AVG	**1.788**	**1.800**	**1.863**	**2.121**	**2.515**	**2.483**	**2.473**	**2.215**	**2.295**	**2.666**	**2.534**	**2.747**	**2.347**	**2.776**	**2.688**	**2.809**	**2.332**	**2.212**	**2.320**	**2.499**	**2.374**
MAX	**2.594**	**2.488**	**2.708**	**2.494**	**4.018**	**3.423**	**4.094**	**2.814**	**3.146**	**3.570**	**3.505**	**4.419**	**2.606**	**3.284**	**4.305**	**4.031**	**2.852**	**2.880**	**3.484**	**3.306**	**3.301**
MIN	**1.334**	**1.420**	**1.450**	**1.832**	**1.925**	**2.023**	**1.948**	**1.903**	**1.904**	**1.955**	**1.994**	**2.079**	**2.015**	**2.299**	**2.028**	**2.112**	**1.831**	**1.828**	**1.943**	**1.972**	**1.890**
Annual I/I	**1.260**	**1.069**	**1.258**	**0.661**	**2.093**	**1.400**	**2.145**	**0.911**	**1.242**	**1.615**	**1.511**	**2.340**	**0.591**	**0.985**	**2.277**	**1.920**	**1.021**	**1.052**	**1.541**	**1.334**	**1.411**
% of MMAD Flow	21%	18%	21%	11%	34%	23%	35%	15%	20%	26%	25%	38%	10%	16%	37%	31%	17%	17%	25%	22%	23%
% +/- vs Prior Year	11%	-15%	18%	-47%	217%	-33%	53%	-58%	36%	30%	-6%	55%	-75%	67%	131%	-16%	-47%	3%	47%	-13%	18%

YELLOW = BASE YEAR

Monthly Total Rainfall (in.) - MAY 1, 2001 to APRIL 30, 2021

Month	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	AVG
May	1.58	1.65	2.00	1.65	6.14	2.94	2.11	2.11	4.44	3.93	4.94	4.58	4.64	2.35	0.50	2.10	3.13	0.46	2.10	3.37	**2.84**
June	2.97	1.75	0.52	1.52	3.22	1.24	2.01	2.19	1.18	7.03	1.16	4.83	1.88	2.05	0.52	2.06	1.74	1.87	0.80	5.54	**2.30**
July	0.66	0.25	0.00	0.24	0.71	0.67	0.74	0.04	0.09	0.35	0.85	0.41	0.00	1.07	0.57	1.17	0.00	0.06	0.70	0.09	**0.43**
August	1.23	0.02	0.09	3.91	0.74	0.02	0.99	1.98	0.60	0.90	0.09	0.01	0.26	0.13	0.90	0.15	0.27	0.47	0.75	0.33	**0.69**
September	0.80	1.41	1.36	2.45	2.37	2.35	3.46	0.81	1.18	3.64	1.00	0.05	5.98	1.02	1.25	1.76	2.66	1.03	3.42	4.77	**2.14**
October	2.40	1.09	3.09	5.32	5.02	2.44	5.15	4.43	4.11	6.39	2.78	9.52	1.47	6.26	4.80	10.43	5.13	4.39	3.95	2.45	**4.53**
November	7.51	2.90	5.57	3.19	5.10	12.77	6.29	11.17	7.59	10.76	8.39	11.62	3.33	3.56	5.31	6.39	7.21	3.62	1.65	7.13	**6.55**
December	6.34	9.30	8.99	4.87	8.88	6.57	10.54	7.27	5.98	10.26	3.77	10.58	2.73	6.58	13.84	4.24	3.21	6.33	3.08	7.96	**7.07**
January	6.94	8.83	6.73	2.28	11.35	2.69	4.82	6.30	8.87	6.87	7.69	4.52	3.68	3.56	7.17	3.64	6.15	3.19	6.71	8.64	**6.03**
February	3.65	2.75	5.68	1.81	2.92	5.54	2.59	2.19	4.97	6.05	3.95	2.01	5.83	4.17	5.49	9.68	3.05	4.67	1.44	4.62	**4.15**
March	4.93	7.49	2.28	4.65	3.86	6.79	3.71	6.97	6.17	9.75	9.98	0.74	5.35	4.89	5.31	9.85	3.49	1.66	2.97	2.63	**5.17**
April	3.62	4.04	1.43	4.92	2.85	3.78	5.64	4.26	4.74	7.43	3.00	2.92	4.04	2.51	2.51	5.59	4.70	3.69	0.78	0.71	**3.66**
TOTAL	**42.63**	**41.48**	**37.74**	**36.81**	**53.16**	**47.80**	**48.05**	**49.72**	**49.92**	**73.36**	**47.60**	**51.79**	**39.19**	**38.15**	**48.17**	**57.06**	**40.74**	**31.44**	**28.35**	**48.24**	**45.57**
AVG	**3.55**	**3.46**	**3.15**	**3.07**	**4.43**	**3.98**	**4.00**	**4.14**	**4.16**	**6.11**	**3.97**	**4.32**	**3.27**	**3.18**	**4.01**	**4.76**	**3.40**	**2.62**	**2.36**	**4.02**	**3.80**
MAX	**7.51**	**9.30**	**8.99**	**5.32**	**11.35**	**12.77**	**10.54**	**11.17**	**8.87**	**10.76**	**9.98**	**11.62**	**5.98**	**6.58**	**13.84**	**10.43**	**7.21**	**6.33**	**6.71**	**8.64**	**9.20**
MIN	**0.66**	**0.02**	**0.00**	**0.24**	**0.71**	**0.02**	**0.74**	**0.04**	**0.09**	**0.35**	**0.09**	**0.01**	**0.00**	**0.13**	**0.50**	**0.15**	**0.00**	**0.06**	**0.70**	**0.09**	**0.23**

20-Year Rainfall Summary	
20-Year Average Annual Rainfall (in.):	**45.57**
20-Year Maximum Annual Rainfal (in.):	**73.36** (2010)
20-Year Minimum Annual Rainfall (in.):	**28.35** (2019)

City of Camas WWTP (WA0020249) - Annual Infiltration and Inflow Report

May 2018 to April 2021

WWTP Design Capacity

Peak Hourly Hydraulic Design Flow (MGD):	**13.44**
Maximum Monthly Average Design Flow (MGD):	**6.10**
Design Population Equivalent:	**28,075**

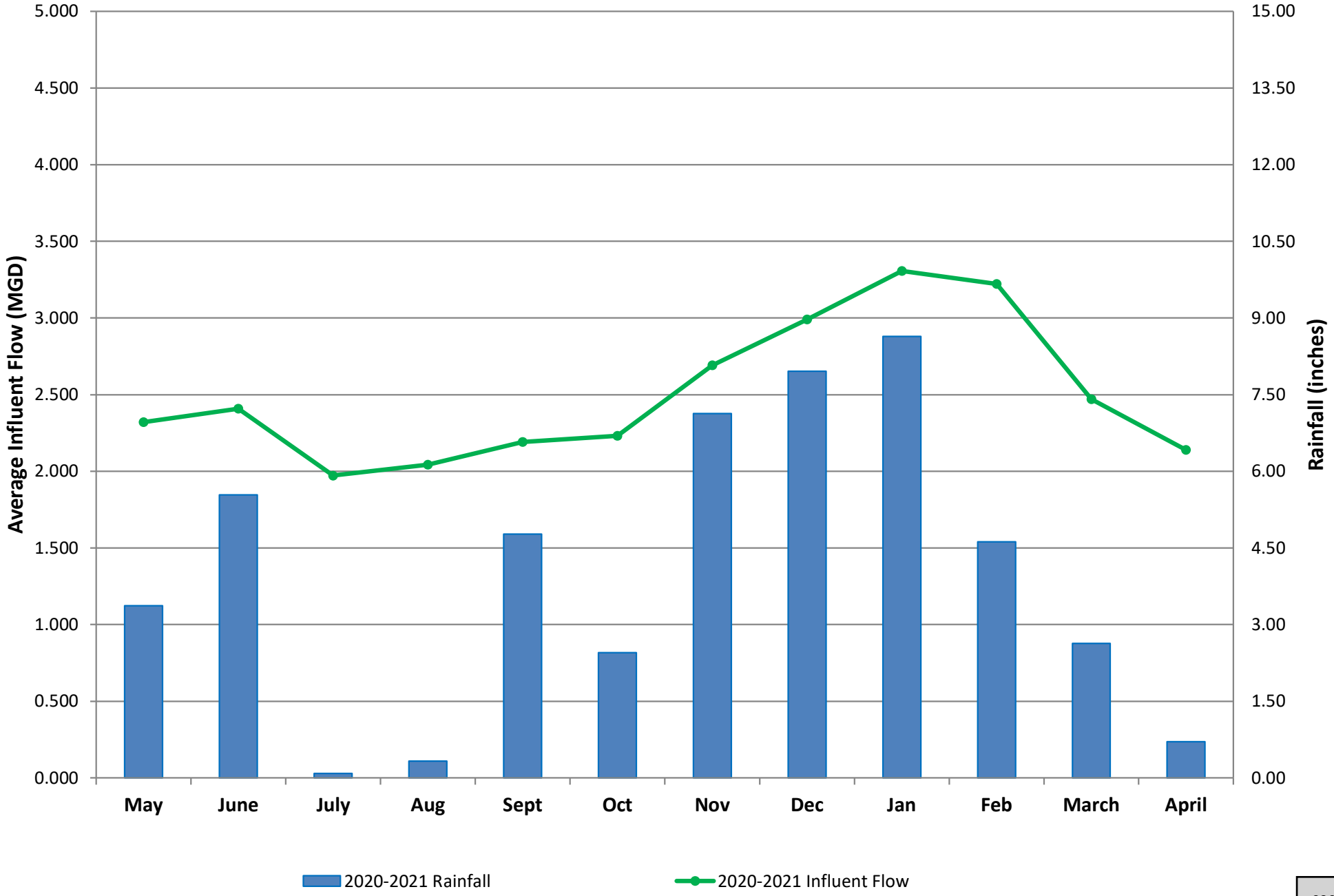
	Monthly Average WWTP Influent Flow (MGD)			Total Monthly Rainfall (inches)			Population Served			Additional Sewer Lines Added (ft.)		
Month	**2018**	**2019**	**2020**	**2018**	**2019**	**2020**	**2018**	**2019**	**2020**	**2018**	**2019**	**2020**
May	1.946	2.050	2.319	0.46	2.10	3.37	23,770	24,090	25,140	1,871	0	0
June	1.983	1.992	2.409	1.87	0.80	5.54	23,770	24,090	25,140	45,563	0	0
July	1.828	1.961	1.972	0.06	0.70	0.09	23,770	24,090	25,140	1,311	2,060	3,130
Aug	1.890	1.943	2.043	0.47	0.75	0.33	23,770	24,090	25,140	0	0	1,910
Sept	1.884	2.151	2.192	1.03	3.42	4.77	23,770	24,090	25,140	2,395	0	4,171
Oct	2.035	2.199	2.231	4.39	3.95	2.45	23,770	24,090	25,140	0	0	3,076
Nov	2.178	2.143	2.691	3.62	1.65	7.13	23,770	24,090	25,140	8,728	0	0
Dec	2.648	2.461	2.991	**6.33**	3.08	7.96	23,770	24,090	25,140	1,323	722	0
Jan	2.480	**3.484**	**3.306**	3.19	**6.71**	**8.64**	24,090	25,140	26,200	356	3,026	0
Feb	**2.880**	2.644	3.222	4.67	1.44	4.62	24,090	25,140	26,200	12,100	0	0
March	2.156	2.476	2.470	1.66	2.97	2.63	24,090	25,140	26,200	0	225	0
April	2.639	2.330	2.139	3.69	0.78	0.71	24,090	25,140	26,200	0	0	0
Period Total:	26.546	27.834	29.984	31.44	28.35	48.24			**Total Added (feet):**	73,647	6,033	12,287
Low Month:	1.828	1.943	1.972	0.06	0.70	0.09			**Total Added (miles):**	13.95	1.14	2.33
High Month:	**2.880**	**3.484**	**3.306**	**6.33**	**6.71**	**8.64**						
Annual Average:	2.212	2.320	2.499	2.62	2.36	4.02						
Period I/I:	1.052	1.541	1.334									

INFILTRATION/INFLOW SUMMARY

Year	I/I	% Increase/Decrease From Base I/I	% Increase/Decrease from Prior Year	% of Max Month. Design Flow	Total Rainfall
Base Year: 2011	***1.511***	***n/a***	***-6%***	***25%***	***47.60***
2018-2019	1.052	-30%	131%	17%	31.44
2019-2020	1.541	2%	47%	25%	28.35
2020-2021	1.334	-12%	-13%	22%	48.24

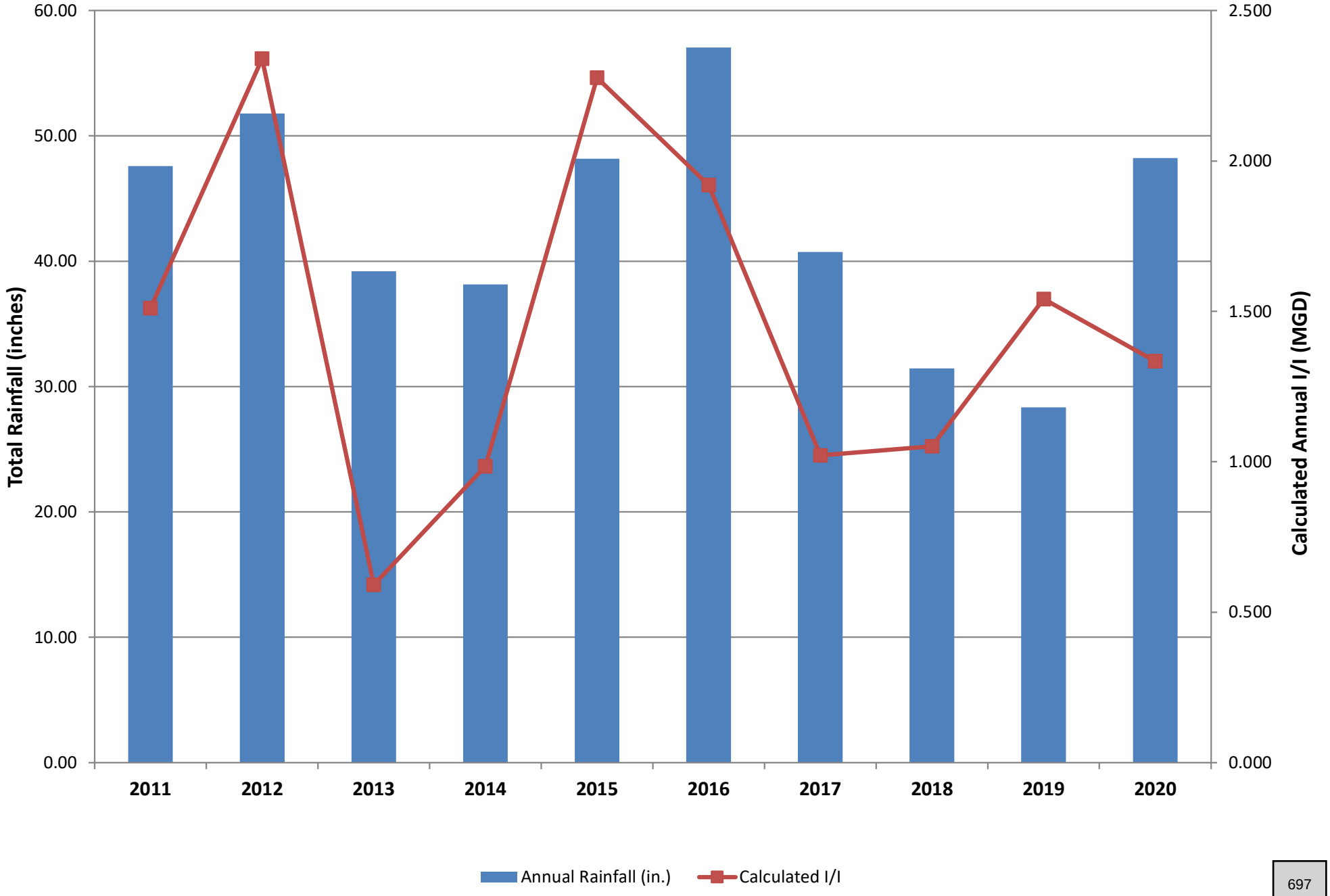
ATTACHMENT C, CHART I

May 2020 - April 2021 Monthly Average Influent Flow and Monthly Total Rainfall



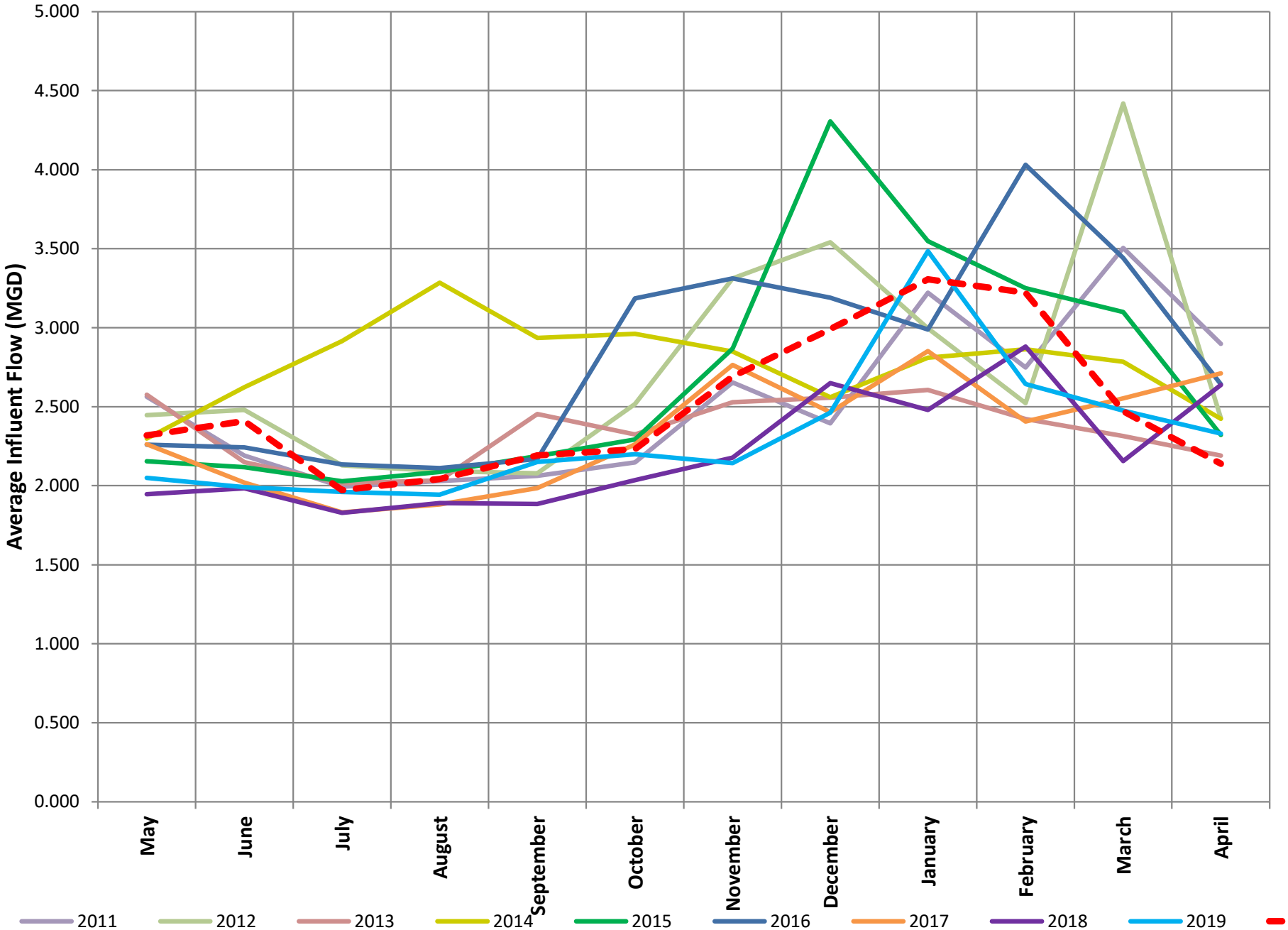
ATTACHMENT C, CHART II

Annual Rainfall & Calculated I/I Since Base Year (2011)



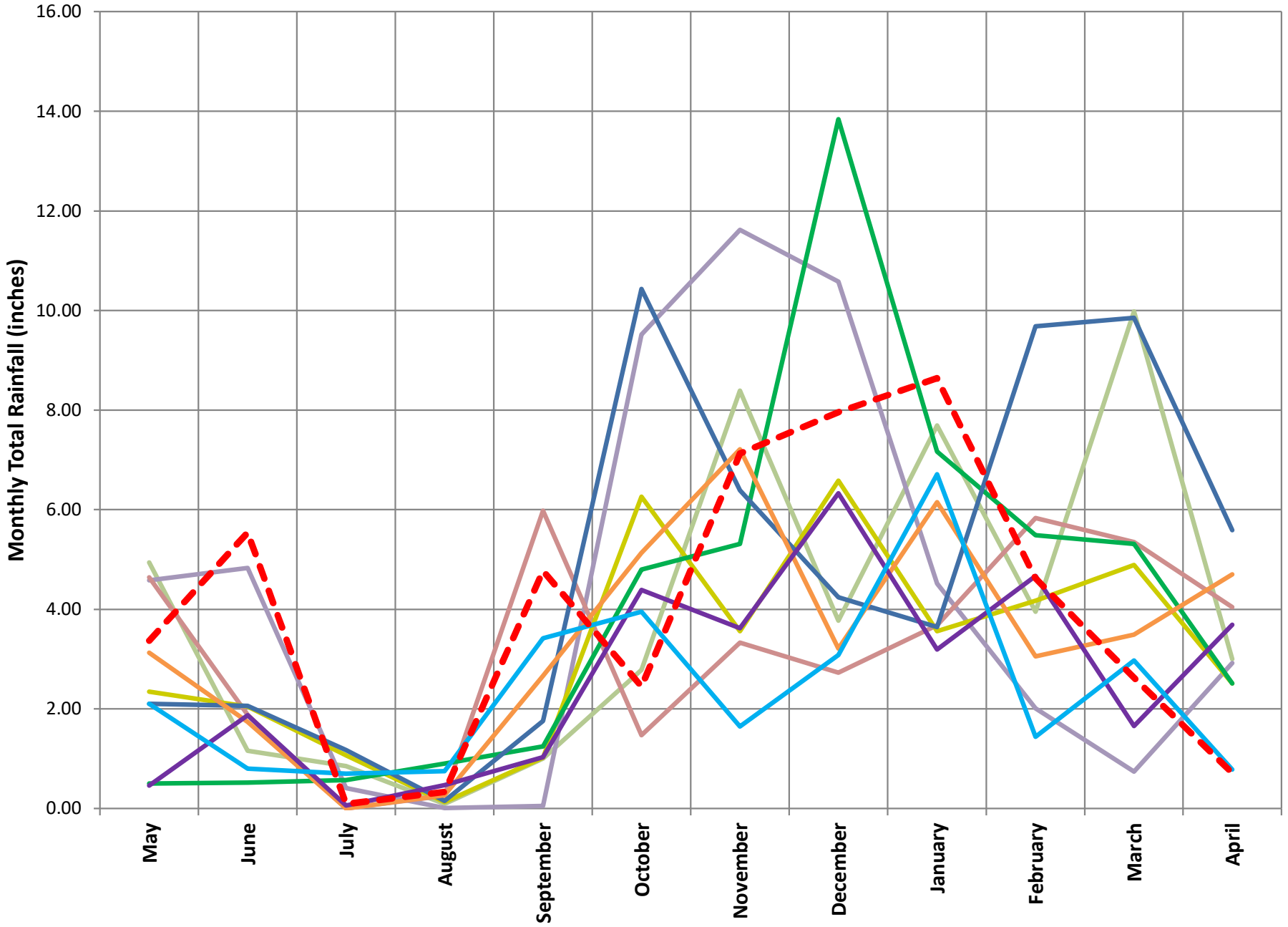
ATTACHMENT C, CHART III

WWTP Monthly Average Influent Flow Since Base Year (2011)



ATTACHMENT C, CHART IV

Monthly Total Rainfall Since Base Year (2011)



City of Camas Washington
Public Works Department
616 NE 4th Avenue
Camas, WA 98607

June 1, 2022

Carey Cholski
Washington State Department of Ecology
PO Box 47775
Olympia, WA 98504-7775

Subject: **May 2021 – April 2022 Annual Inflow and Infiltration Report**
City of Camas, WA Wastewater Treatment Facility (Permit No. WA0020249)

Ms. Cholski,

Pursuant to Section S4.E of our current NPDES Permit, enclosed is our annual Inflow and Infiltration (I/I) report. Section S4.E.3 of our permit states:

> *The Permittee must conduct an annual analysis of infiltration and inflow according to Ecology's guidance manual for treatment plant operators. This report shall consider the 12-month period May 1st through the following April 30th as the annual period and shall be submitted by July 15, 2017 and annually thereafter. This report shall include an update on the status of each inflow reduction project completed in fulfillment of S4.E.2 (above) including the funds expended or contractually obligated, and the proportion of the project completed as of the end of the reporting period. For each basin or sub-basin in which work has been done within the reporting period, the report shall include the estimated inflow rates before and after the project and the estimated effect on the overall Publicly Owned Treatment Works (POTW) inflow rate.*

According to Ecology's Information Manual for Treatment Plant Operators (Feb. 2004), an Annual I/I Report should include each of the following elements:

1. *The average monthly flow and total precipitation for each month for the past year together with a graph … plotting a comparison of precipitation versus influent flow.*
2. *The maximum monthly and peak hourly hydraulic design capacity for the plant.*
3. *The design population equivalent for the treatment plant and the population served by the facility, per month, for the past year.*

4. *The amount of I/I for each year since the base year and the percent of maximum monthly design capacity each year's I/I represents.*
5. *The percent increase or reduction in I/I for each year subsequent to the base year I/I.*
6. *The additional lengths of sewer lines added to the collection system, per month, for the past year. Also include a brief summary of any major sewer rehabilitation or I/I reduction projects.*

The following information and attachments are now being submitted to satisfy these requirements.

I. REPORTING PERIOD AND BASE YEAR

As described in Section S4.E.3 of our current NPDES permit, the annual period for our I/I report is May 1st through April 30th. Accordingly, please note that when this report refers to the "reporting period" or "year", it is referring to the 12-month period from May 1st through April 30th. For any particular year that is referenced in the report, it is denoting the May through April reporting year and the calendar year in which May falls.

For the purposes of selecting an appropriate Base Year, the past twenty years of historical precipitation and plant influent flow data are reviewed annually. A summary of the monthly precipitation totals and influent flow averages for the past twenty years are included in Attachment A.

Since our facility's 2016 I&I report, the May 2011-April 2012 reporting year has been used as the Base Year, as it has reflected Camas' average rainfall, population growth and disposition of the City's sanitary sewer collection system.

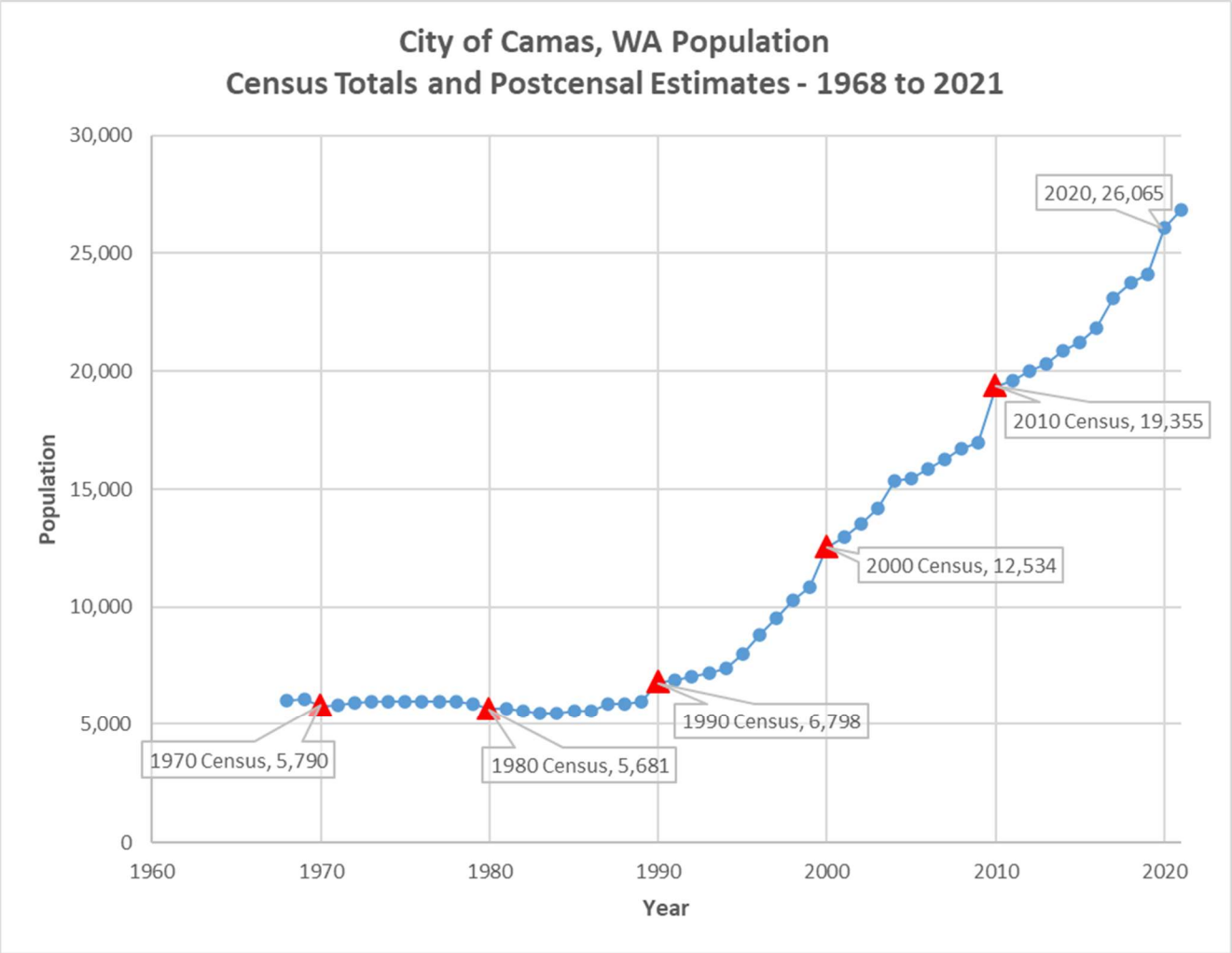
From analysis of the historical data, May 2011-April 2012 continues to best an average, annual rainfall in Camas and therefore continues to serve as the Base Year for the purposes of this report.

For the twenty-year period of May 1, 2002 to April 30, 2021, the average 12-month rainfall in Camas was 46.33 inches. From May 1, 2011 to April 30th 2012, the rainfall was 47.60, only 1.27 inches more than the twenty-year average. This represented the closest annual total to the twenty-year average, of all twenty years of data reviewed.

TABLE 1 - 12-Month May Through April Rainfall Totals, 2002-2021

	Average	Minimum	Base Year	Maximum
Annual Total Rainfall (in.)	46.33	28.35 (May 2019 – April 2020)	47.93 (May 2011-April 2012)	73.36 (May 2010-April 2011)

In addition to representing the 20-year median rainfall, using 2011-2012 as the "Base Year" incorporates the City's rapid growth that has occurred in the last 20 years. In I/I annual reports prior to 2016, the City of Camas had been using 1989 as the Base Year. Since 1989, the City of Camas has seen rapid growth in population and significant additions to its wastewater collection system. The May 2011-April 2012 period captures that growth, which has taken place primarily after 1990. The chart below illustrates the City's annual, calendar year, population growth since 1968:



Historical Population Estimates for Camas, WA by Washington State Office of Financial Management
(https://ofm.wa.gov/washington-data-research/population-demographics/population-estimates/april-1-official-population-estimates)

II. INFLOW AND INFILTRATION ANALYSIS

Facility Design Parameters

The maximum monthly hydraulic design capacity for the Camas Wastewater Treatment Plant (WWTP) is 6.10 million gallons per day (MGD) and has a peak hourly hydraulic design capacity of 13.44 MGD. The Design Population Equivalent for the Camas WWTP is 28,075.

Calculated I/I and Annual Rainfall 20-Year History

The following chart is a summary of the calculated I/I, the percent of maximum monthly design capacity the calculated I/I represents, the percentage increase or decrease of I/I from the previous year and the total rainfall for each reporting year from May 2002 to April 2021:

TABLE 2 – Camas Calculated I/I & Rainfall

Year	Calculated I/I (MGD)	I/I as % of Design Capacity	I/I % Increase/Decrease from Prior Year	Total 12-Month Rainfall (in.)
2002	1.069	18%	-15%	41.48
2003	1.258	21%	+18%	37.74
2004	0.661	11%	-47%	36.81
2005	2.093	34%	+217%	53.16
2006	1.400	23%	-33%	47.80
2007	2.145	35%	+53%	48.05
2008	0.911	15%	-58%	49.72
2009	1.242	20%	+36%	49.92
2010	1.615	26%	+30%	73.36
2011	1.511	25%	-6%	47.60
2012	2.340	38%	+55%	51.79
2013	0.591	10%	-75%	39.19
2014	0.985	16%	+67%	38.15
2015	2.277	37%	+131%	48.17
2016	1.920	31%	-16%	57.06
2017	1.021	17%	-47%	40.74
2018	1.052	17%	+3%	31.44
2019	1.541	25%	+47%	28.35
2020	1.334	22%	-13%	48.24
2021	1.400	23%	5%	57.77
Average				

Yellow Highlight = Base Year

Annual Report Form

Please see Attachment B for the Annual I/I Report form which summarizes the following data:

- The average monthly flow and total precipitation for each month, for the past three years.
- The calculated amount of I/I for each year.
- The percent of maximum monthly design capacity that each period's I/I represents.
- The population served by the facility, per month, for the past three years.
- The additional lengths of sewer lines added to the collection system, per month and per year, for the past three years.
- A summary of the I/I from the past three years, including a comparison with the selected Base Year (2011)

Charts

Please see Attachment C for several charts which plot I/I data to illustrate the following:

- Chart I: Comparison of precipitation versus influent flow for each month of the current reporting period.
- Chart II: Comparison of 12-month total precipitation and calculated I/I, for each year since the Base Year.
- Chart III: Monthly Average Influent Flow at the WWTP since the Base Year.
- Chart IV: Monthly Total Rainfall since the Base Year.

III. COLLECTION SYSTEM AND I/I REDUCTION PROJECTS AND MEASURES

Collection System Details

According to the City of Camas' General Sewer/Wastewater Facility Plan, last updated in November 2009, the city sanitary collection system was comprised of approximately 462,000 linear feet (87.5 miles) of pipe. Since 2009, approximately 156,000 linear feet of sewer line has been added, giving Camas approximately 618,000 linear feet (117 miles) of sewer line, as of the end of 2021.

In 2021, approximately 4,000 linear feet of new sanitary sewer line were added to the City's system. All of which were installed in connection with residential developments projects occurring throughout the year.

Camas' collection system is comprised of a combination of both traditional gravity sewer, force mains, pressure sewer lines, and 27 lift stations. Please see Attachment B for the lengths of sewer lines added to the collection system, per month and per year, for the past three years.

If you have any questions regarding this report or require any additional information, please do not hesitate to contact the Camas Wastewater Treatment Facility at (360) 834-3263.

Best Regards,



Bob Busch
Wastewater Treatment Plant Operations Supervisor

Cc: Steve Wall

ATTACHMENT A - Camas 20-Year WWTP Influent Flow and Rainfall

WWTP Design Capacity	
Peak Day Design Flow (MGD):	10.04
Max. Monthly Average Design (MMAD) Flow (MGD):	6.10
Design Population Equivalent:	28,075

Monthly Average Influent Flow (MGD) - MAY 1, 2002 to APRIL 30, 2022

Month	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	AVG
May	1.542	1.622	1.953	2.607	2.177	2.064	2.056	2.255	2.370	2.563	2.446	2.576	2.299	2.155	2.259	2.263	1.946	2.050	2.319	2.138	**2.183**
June	1.547	1.520	1.996	2.083	2.095	1.997	2.092	1.918	2.833	2.190	2.480	2.149	2.623	2.118	2.244	2.019	1.983	1.992	2.409	2.156	**2.122**
July	1.458	1.483	1.832	1.925	2.023	1.954	1.903	1.904	1.973	1.994	2.129	2.015	2.915	2.028	2.135	1.831	1.828	1.961	1.972	2.084	**1.967**
August	1.420	1.450	2.011	1.981	2.050	1.948	2.015	1.921	1.955	2.029	2.093	2.033	3.284	2.088	2.112	1.881	1.890	1.943	2.043	2.146	**2.015**
September	1.434	1.549	1.948	2.031	2.087	2.035	1.971	1.963	2.055	2.062	2.079	2.454	2.935	2.187	2.169	1.985	1.884	2.151	2.192	2.284	**2.073**
October	1.447	1.619	2.089	2.212	2.101	2.252	2.013	2.078	2.226	2.148	2.518	2.324	2.961	2.292	3.185	2.262	2.035	2.199	2.231	2.493	**2.234**
November	1.500	1.903	2.202	2.700	3.423	2.484	2.391	2.510	3.057	2.653	3.312	2.528	2.849	2.867	3.312	2.764	2.178	2.143	2.691	3.187	**2.633**
December	2.066	2.573	2.494	3.086	3.148	3.465	2.433	2.580	3.364	2.396	3.540	2.556	2.560	4.305	3.191	2.465	2.648	2.461	2.991	3.401	**2.886**
January	2.431	2.708	2.262	4.018	2.798	4.094	2.814	3.146	3.042	3.222	2.995	2.606	2.810	3.548	2.988	2.852	2.480	3.484	3.306	3.484	**3.054**
February	2.220	2.414	2.165	2.584	2.754	2.643	2.061	2.567	2.648	2.748	2.522	2.422	2.863	3.251	4.031	2.405	2.880	2.644	3.222	2.570	**2.681**
March	2.488	1.887	2.345	2.576	2.819	2.442	2.504	2.388	3.570	3.505	4.419	2.314	2.784	3.099	3.442	2.552	2.156	2.476	2.470	2.949	**2.759**
April	2.052	1.627	2.156	2.377	2.327	2.302	2.327	2.308	2.904	2.898	2.428	2.191	2.425	2.321	2.643	2.710	2.639	2.330	2.139	2.952	**2.403**
AVG	**1.800**	**1.863**	**2.121**	**2.515**	**2.483**	**2.473**	**2.215**	**2.295**	**2.666**	**2.534**	**2.747**	**2.347**	**2.776**	**2.688**	**2.809**	**2.332**	**2.212**	**2.320**	**2.499**	**2.654**	**2.417**
MAX	**2.488**	**2.708**	**2.494**	**4.018**	**3.423**	**4.094**	**2.814**	**3.146**	**3.570**	**3.505**	**4.419**	**2.606**	**3.284**	**4.305**	**4.031**	**2.852**	**2.880**	**3.484**	**3.306**	**3.484**	**3.346**
MIN	**1.420**	**1.450**	**1.832**	**1.925**	**2.023**	**1.948**	**1.903**	**1.904**	**1.955**	**1.994**	**2.079**	**2.015**	**2.299**	**2.028**	**2.112**	**1.831**	**1.828**	**1.943**	**1.972**	**2.084**	**1.927**
Annual I/I	**1.069**	**1.258**	**0.661**	**2.093**	**1.400**	**2.145**	**0.911**	**1.242**	**1.615**	**1.511**	**2.340**	**0.591**	**0.985**	**2.277**	**1.920**	**1.021**	**1.052**	**1.541**	**1.334**	**1.400**	**1.418**
% of MMAD Flow	18%	21%	11%	34%	23%	35%	15%	20%	26%	25%	38%	10%	16%	37%	31%	17%	17%	25%	22%	23%	23%
% +/- vs Prior Year	-15%	18%	-47%	217%	-33%	53%	-58%	36%	30%	-6%	55%	-75%	67%	131%	-16%	-47%	3%	47%	-13%	5%	18%

YELLOW = BASE YEAR

Monthly Total Rainfall (in.) - MAY 1, 2002 to APRIL 30, 2022

Month	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	AVG
May	1.65	2.00	1.65	6.14	2.94	2.11	2.11	4.44	3.93	4.94	4.58	4.64	2.35	0.50	2.10	3.13	0.46	2.10	3.37	2.46	**2.88**
June	1.75	0.52	1.52	3.22	1.24	2.01	2.19	1.18	7.03	1.16	4.83	1.88	2.05	0.52	2.06	1.74	1.87	0.80	5.54	2.40	**2.28**
July	0.25	0.00	0.24	0.71	0.67	0.74	0.04	0.09	0.35	0.85	0.41	0.00	1.07	0.57	1.17	0.00	0.06	0.70	0.09	0.00	**0.40**
August	0.02	0.09	3.91	0.74	0.02	0.99	1.98	0.60	0.90	0.09	0.01	0.26	0.13	0.90	0.15	0.27	0.47	0.75	0.33	0.16	**0.64**
September	1.41	1.36	2.45	2.37	2.35	3.46	0.81	1.18	3.64	1.00	0.05	5.98	1.02	1.25	1.76	2.66	1.03	3.42	4.77	4.64	**2.33**
October	1.09	3.09	5.32	5.02	2.44	5.15	4.43	4.11	6.39	2.78	9.52	1.47	6.26	4.80	10.43	5.13	4.39	3.95	2.45	4.89	**4.66**
November	2.90	5.57	3.19	5.10	12.77	6.29	11.17	7.59	10.76	8.39	11.62	3.33	3.56	5.31	6.39	7.21	3.62	1.65	7.13	10.43	**6.70**
December	9.30	8.99	4.87	8.88	6.57	10.54	7.27	5.98	10.26	3.77	10.58	2.73	6.58	13.84	4.24	3.21	6.33	3.08	7.96	8.06	**7.15**
January	8.83	6.73	2.28	11.35	2.69	4.82	6.30	8.87	6.87	7.69	4.52	3.68	3.56	7.17	3.64	6.15	3.19	6.71	8.64	7.88	**6.08**
February	2.75	5.68	1.81	2.92	5.54	2.59	2.19	4.97	6.05	3.95	2.01	5.83	4.17	5.49	9.68	3.05	4.67	1.44	4.62	3.36	**4.14**
March	7.49	2.28	4.65	3.86	6.79	3.71	6.97	6.17	9.75	9.98	0.74	5.35	4.89	5.31	9.85	3.49	1.66	2.97	2.63	5.37	**5.19**
April	4.04	1.43	4.92	2.85	3.78	5.64	4.26	4.74	7.43	3.00	2.92	4.04	2.51	2.51	5.59	4.70	3.69	0.78	0.71	8.12	**3.66**
TOTAL	**41.48**	**37.74**	**36.81**	**53.16**	**47.80**	**48.05**	**49.72**	**49.92**	**73.36**	**47.60**	**51.79**	**39.19**	**38.15**	**48.17**	**57.06**	**40.74**	**31.44**	**28.35**	**48.24**	**57.77**	**46.33**
AVG	**3.46**	**3.15**	**3.07**	**4.43**	**3.98**	**4.00**	**4.14**	**4.16**	**6.11**	**3.97**	**4.32**	**3.27**	**3.18**	**4.01**	**4.76**	**3.40**	**2.62**	**2.36**	**4.02**	**4.81**	**3.86**
MAX	**9.30**	**8.99**	**5.32**	**11.35**	**12.77**	**10.54**	**11.17**	**8.87**	**10.76**	**9.98**	**11.62**	**5.98**	**6.58**	**13.84**	**10.43**	**7.21**	**6.33**	**6.71**	**8.64**	**10.43**	**9.34**
MIN	**0.02**	**0.00**	**0.24**	**0.71**	**0.02**	**0.74**	**0.04**	**0.09**	**0.35**	**0.09**	**0.01**	**0.00**	**0.13**	**0.50**	**0.15**	**0.00**	**0.06**	**0.70**	**0.09**	**0.00**	**0.20**

20-Year Rainfall Summary		
20-Year Average Annual Rainfall (in.):	46.33	
20-Year Maximum Annual Rainfal (in.):	73.36	(2010)
20-Year Minimum Annual Rainfall (in.):	28.35	(2019)

ATTACHMENT B

City of Camas WWTP (WA0020249) - Annual Infiltration and Inflow Report

May 2021 to April 2022

WWTP Design Capacity

Peak Hourly Hydraulic Design Flow (MGD): **13.44**

Maximum Monthly Average Design Flow (MGD): **6.10**

Design Population Equivalent: **28,075**

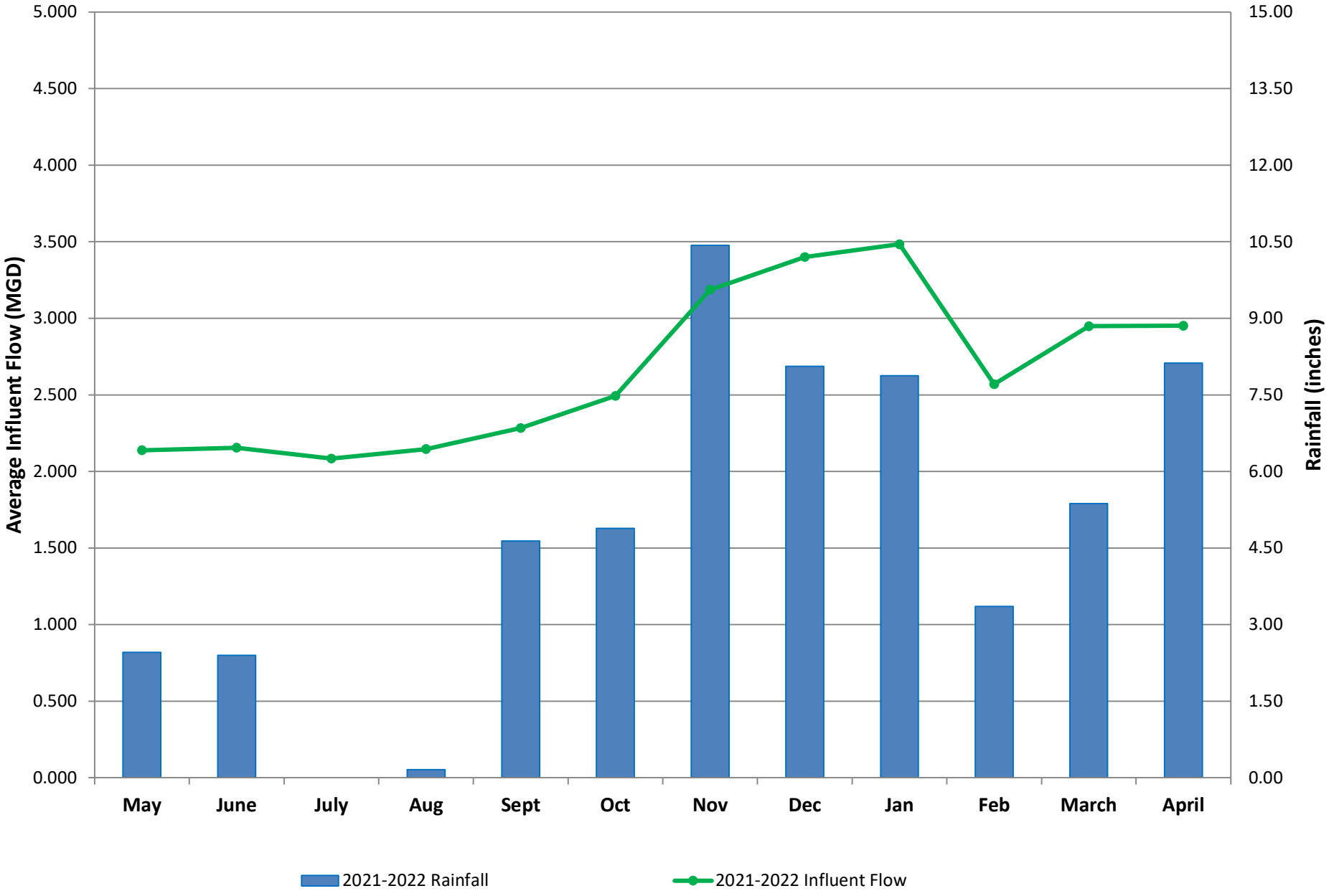
	Monthly Average WWTP Influent Flow (MGD)			Total Monthly Rainfall (inches)			Population Served			Additional Sewer Lines Added (ft.)		
Month	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**
May	2.050	2.319	2.138	2.10	3.37	2.46	24,090	26,065	26,870	0	0	1,714
June	1.992	2.409	2.156	0.80	5.54	2.40	24,090	26,065	26,870	0	0	1,114
July	1.961	1.972	2.084	0.70	0.09	0.00	24,090	26,065	26,870	2,060	3,130	0
Aug	1.943	2.043	2.146	0.75	0.33	0.16	24,090	26,065	26,870	0	1,910	0
Sept	2.151	2.192	2.284	3.42	4.77	4.64	24,090	26,065	26,870	0	4,171	0
Oct	2.199	2.231	2.493	3.95	2.45	4.89	24,090	26,065	26,870	0	3,076	0
Nov	2.143	2.691	3.187	1.65	7.13	**10.43**	24,090	26,065	26,870	0	0	0
Dec	2.461	2.991	3.401	3.08	7.96	8.06	24,090	26,065	26,870	722	0	0
Jan	**3.484**	**3.306**	**3.484**	**6.71**	**8.64**	7.88	26,065	26,870	*26,870*	3,026	0	0
Feb	2.644	3.222	2.570	1.44	4.62	3.36	26,065	26,870	*26,870*	0	0	0
March	2.476	2.470	2.949	2.97	2.63	5.37	26,065	26,870	*26,870*	225	525	0
April	2.330	2.139	2.952	0.78	0.71	8.12	26,065	26,870	*26,870*	0	580	0
Period Total:	27.834	29.984	31.842	28.35	48.24	57.77				**Total Added (feet):**	6,033	13,392	2,828
Low Month:	1.943	1.972	2.084	0.70	0.09	0.00				**Total Added (miles):**	1.14	2.54	0.54
High Month:	**3.484**	**3.306**	**3.484**	**6.71**	**8.64**	**10.43**							
Annual Average:	2.320	2.499	2.654	2.36	4.02	4.81							
Period I/I:	1.541	1.334	1.400										

INFILTRATION/INFLOW SUMMARY

Year	I/I	% Increase/Decrease From Base I/I	% Increase/Decrease from Prior Year	% of Max Month. Design Flow	Total Rainfall
Base Year: 2011	***1.511***	***n/a***	***-6%***	***25%***	***47.60***
2019-2020	1.541	2%	131%	25%	28.35
2020-2021	1.334	-12%	-13%	22%	48.24
2021-2022	1.400	-7%	5%	23%	57.77

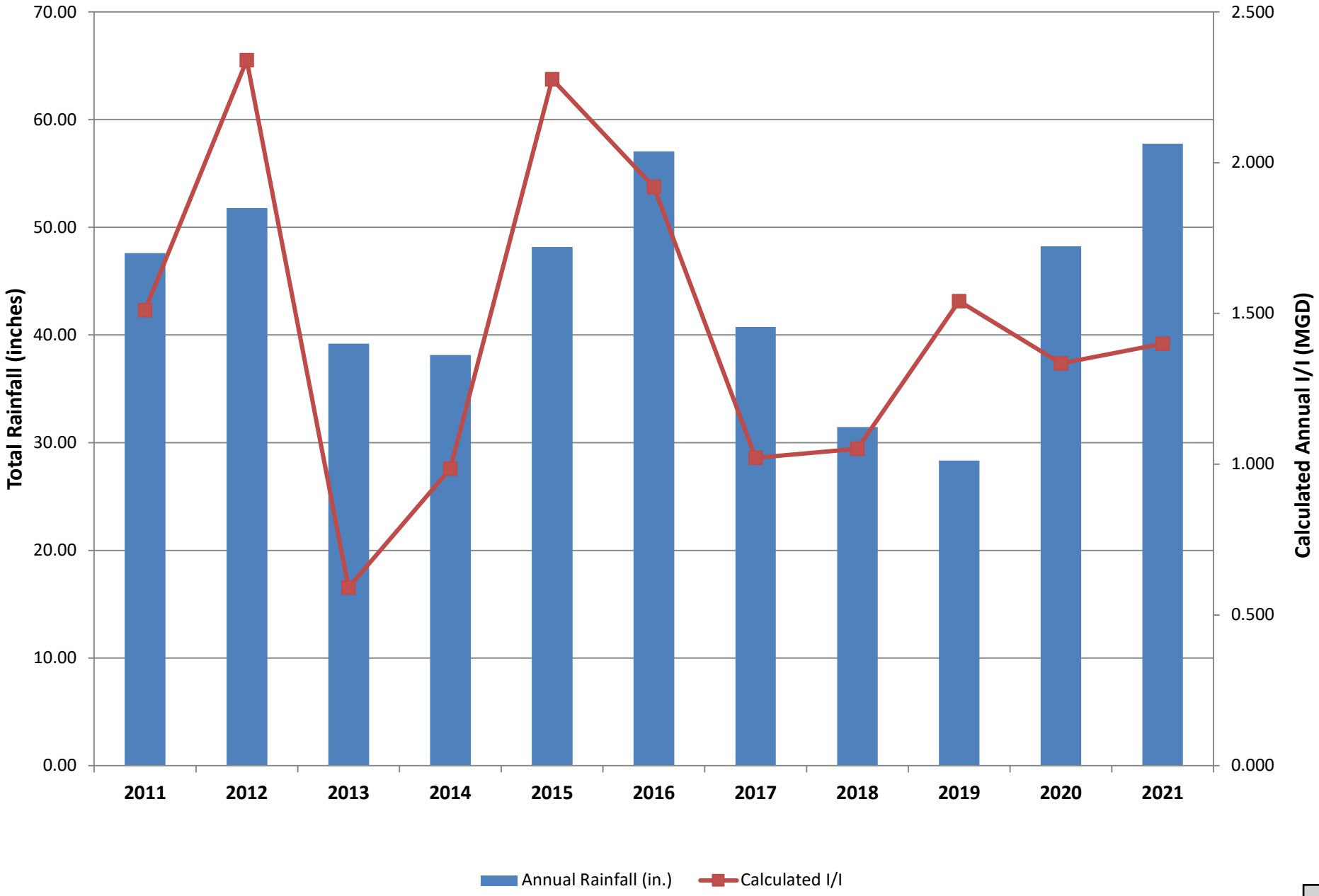
ATTACHMENT C, CHART I

May 2021 - April 2022 Monthly Average Influent Flow and Monthly Total Rainfall



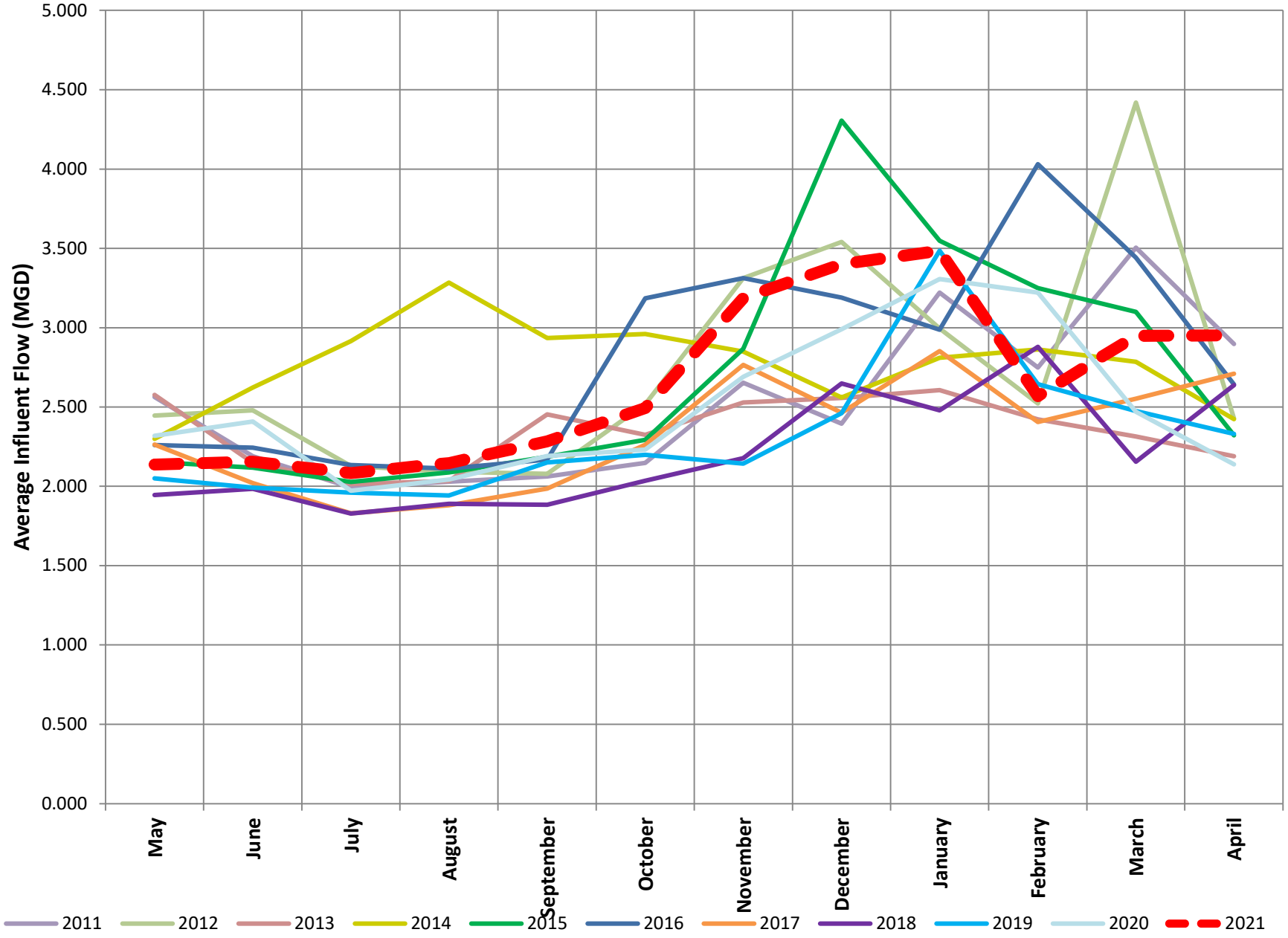
ATTACHMENT C, CHART II

Annual Rainfall & Calculated I/I Since Base Year (2011)



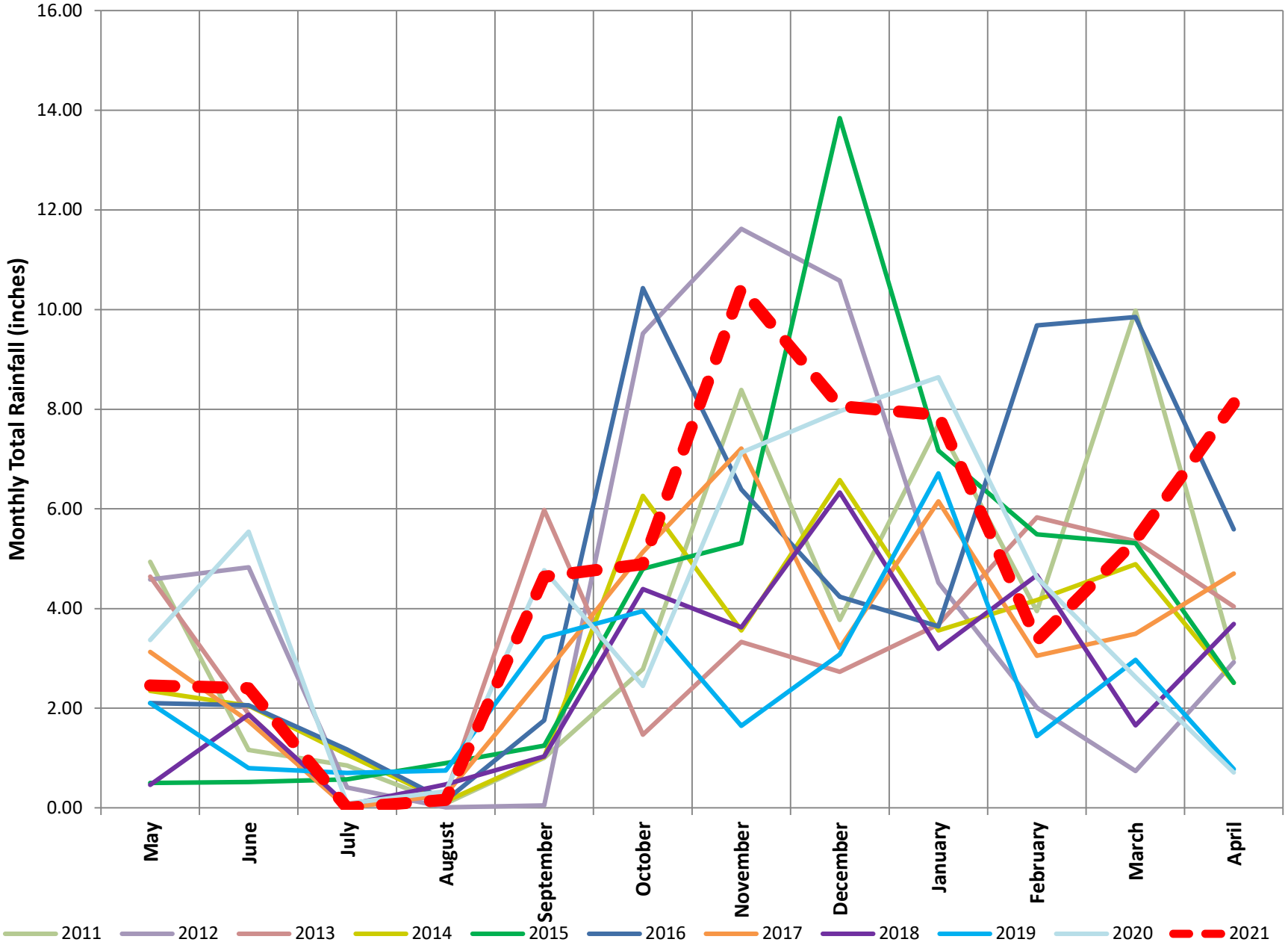
ATTACHMENT C, CHART III

WWTP Monthly Average Influent Flow Since Base Year (2011)



ATTACHMENT C, CHART IV

Monthly Total Rainfall Since Base Year (2011)



City of Camas Washington
Public Works Department
616 NE 4th Avenue
Camas, WA 98607

June 1, 2023

Carey Cholski
Washington State Department of Ecology
PO Box 47775
Olympia, WA 98504-7775

Subject: **May 2022 – April 2023 Annual Inflow and Infiltration Report**
City of Camas, WA Wastewater Treatment Facility (Permit No. WA0020249)

Ms. Cholski,

Pursuant to Section S4.E of our current NPDES Permit, enclosed is our annual Inflow and Infiltration (I/I) report. Section S4.E.3 of our permit states:

> *The Permittee must conduct an annual analysis of infiltration and inflow according to Ecology's guidance manual for treatment plant operators. This report shall consider the 12-month period May 1st through the following April 30th as the annual period and shall be submitted by July 15, 2017 and annually thereafter. This report shall include an update on the status of each inflow reduction project completed in fulfillment of S4.E.2 (above) including the funds expended or contractually obligated, and the proportion of the project completed as of the end of the reporting period. For each basin or sub-basin in which work has been done within the reporting period, the report shall include the estimated inflow rates before and after the project and the estimated effect on the overall Publicly Owned Treatment Works (POTW) inflow rate.*

According to Ecology's Information Manual for Treatment Plant Operators (Feb. 2004), an Annual I/I Report should include each of the following elements:

1. *The average monthly flow and total precipitation for each month for the past year together with a graph … plotting a comparison of precipitation versus influent flow.*
2. *The maximum monthly and peak hourly hydraulic design capacity for the plant.*
3. *The design population equivalent for the treatment plant and the population served by the facility, per month, for the past year.*

4. *The amount of I/I for each year since the base year and the percent of maximum monthly design capacity each year's I/I represents.*
5. *The percent increase or reduction in I/I for each year subsequent to the base year I/I.*
6. *The additional lengths of sewer lines added to the collection system, per month, for the past year. Also include a brief summary of any major sewer rehabilitation or I/I reduction projects.*

The following information and attachments are now being submitted to satisfy these requirements.

I. REPORTING PERIOD AND BASE YEAR

As described in Section S4.E.3 of our current NPDES permit, the annual period for our I/I report is May 1st through April 30th. Accordingly, please note that when this report refers to the "reporting period" or "year", it is referring to the 12-month period from May 1st through April 30th. For any particular year that is referenced in the report, it is denoting the May through April reporting year and the calendar year in which May falls.

For the purposes of selecting an appropriate Base Year, the past twenty years of historical precipitation and plant influent flow data are reviewed annually. A summary of the monthly precipitation totals and influent flow averages for the past twenty years are included in Attachment A.

Since our facility's 2016 I&I report, the May 2011-April 2012 reporting year has been used as the Base Year, as it has reflected Camas' average rainfall, population growth and disposition of the City's sanitary sewer collection system.

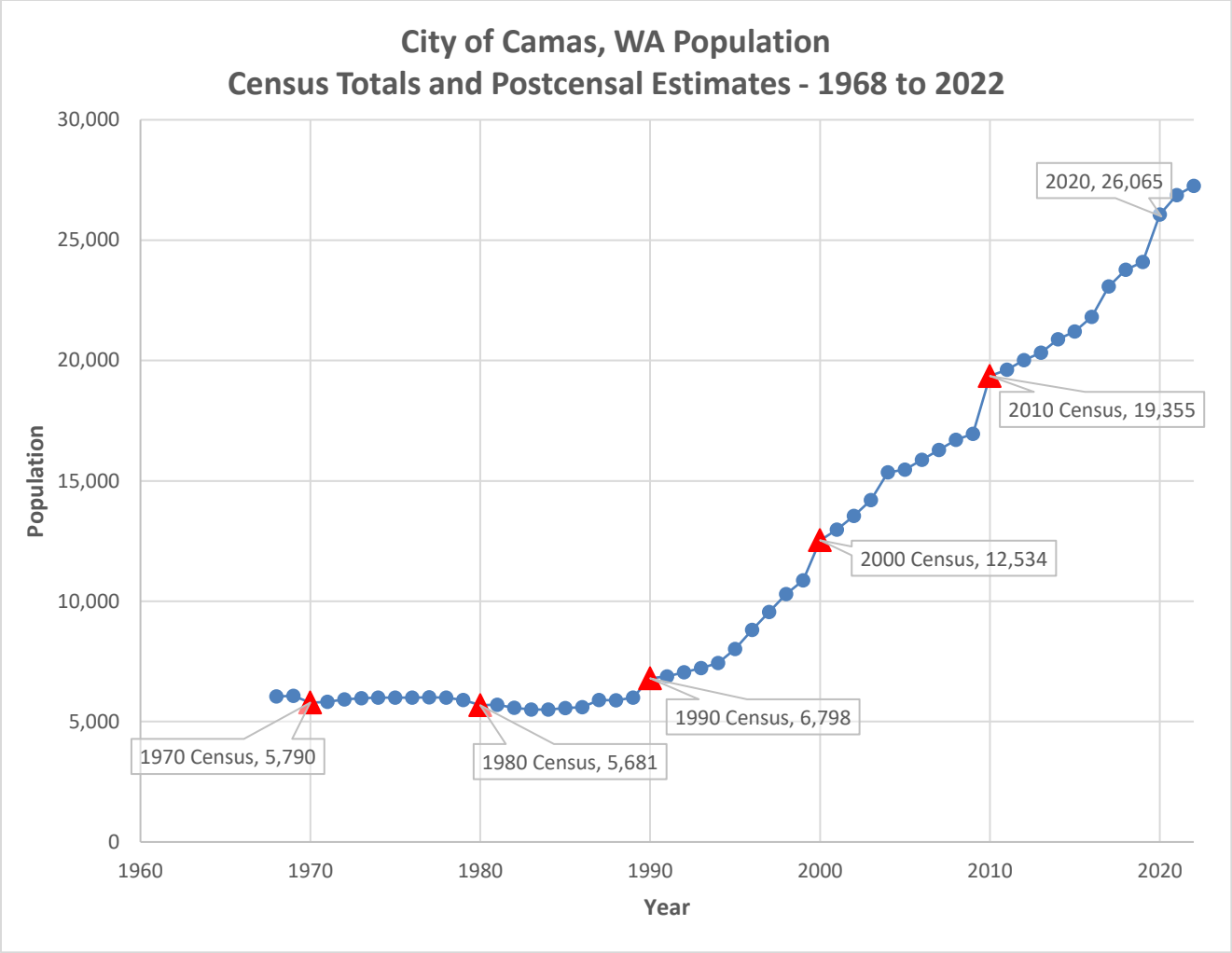
From analysis of the historical data, May 2011-April 2012 continues to best an average, annual rainfall in Camas and therefore continues to serve as the Base Year for the purposes of this report.

For the twenty-year period of May 1, 2003 to April 30, 2023, the average 12-month rainfall in Camas was 46.73 inches. From May 1, 2011 to April 30th 2012, the rainfall was 47.60, only .87 inches more than the twenty-year average. This represented the closest annual total to the twenty-year average, of all twenty years of data reviewed.

TABLE 1 - 12-Month May Through April Rainfall Totals, 2002-2022

	Average	Minimum	Base Year	Maximum
Annual Total Rainfall (in.)	46.73	28.35 (May 2019 – April 2020)	47.93 (May 2011-April 2012)	73.36 (May 2010-April 2011)

In addition to representing the 20-year median rainfall, using 2011-2012 as the "Base Year" incorporates the City's rapid growth that has occurred in the last 20 years. In I/I annual reports prior to 2016, the City of Camas had been using 1989 as the Base Year. Since 1989, the City of Camas has seen rapid growth in population and significant additions to its wastewater collection system. The May 2011-April 2012 period captures that growth, which has taken place primarily after 1990. The chart below illustrates the City's annual, calendar year, population growth since 1968:



Historical Population Estimates for Camas, WA by Washington State Office of Financial Management
(https://ofm.wa.gov/washington-data-research/population-demographics/population-estimates/april-1-official-population-estimates)

II. INFLOW AND INFILTRATION ANALYSIS

Facility Design Parameters

The maximum monthly hydraulic design capacity for the Camas Wastewater Treatment Plant (WWTP) is 6.10 million gallons per day (MGD) and has a peak hourly hydraulic design capacity of 13.44 MGD. The Design Population Equivalent for the Camas WWTP is 28,075.

Calculated I/I and Annual Rainfall 20-Year History

The following chart is a summary of the calculated I/I, the percent of maximum monthly design capacity the calculated I/I represents, the percentage increase or decrease of I/I from the previous year and the total rainfall for each reporting year from May 2002 to April 2023:

TABLE 2 – Camas Calculated I/I & Rainfall

Year	Calculated I/I (MGD)	I/I as % of Design Capacity	I/I % Increase/Decrease from Prior Year	Total 12-Month Rainfall (in.)
2002	1.069	18%	-15%	41.48
2003	1.258	21%	+18%	37.74
2004	0.661	11%	-47%	36.81
2005	2.093	34%	+217%	53.16
2006	1.400	23%	-33%	47.80
2007	2.145	35%	+53%	48.05
2008	0.911	15%	-58%	49.72
2009	1.242	20%	+36%	49.92
2010	1.615	26%	+30%	73.36
2011	1.511	25%	-6%	47.60
2012	2.340	38%	+55%	51.79
2013	0.591	10%	-75%	39.19
2014	0.985	16%	+67%	38.15
2015	2.277	37%	+131%	48.17
2016	1.920	31%	-16%	57.06
2017	1.021	17%	-47%	40.74
2018	1.052	17%	+3%	31.44
2019	1.541	25%	+47%	28.35
2020	1.334	22%	-13%	48.24
2021	1.400	23%	5%	57.77
2022	1.264	21%	-10%	47.68
Average				

Yellow Highlight = Base Year

Annual Report Form

Please see Attachment B for the Annual I/I Report form which summarizes the following data:

- The average monthly flow and total precipitation for each month, for the past three years.
- The calculated amount of I/I for each year.
- The percent of maximum monthly design capacity that each period's I/I represents.
- The population served by the facility, per month, for the past three years.
- The additional lengths of sewer lines added to the collection system, per month and per year, for the past three years.
- A summary of the I/I from the past three years, including a comparison with the selected Base Year (2011)

Charts

Please see Attachment C for several charts which plot I/I data to illustrate the following:

- Chart I: Comparison of precipitation versus influent flow for each month of the current reporting period.
- Chart II: Comparison of 12-month total precipitation and calculated I/I, for each year since the Base Year.
- Chart III: Monthly Average Influent Flow at the WWTP since the Base Year.
- Chart IV: Monthly Total Rainfall since the Base Year.

III. COLLECTION SYSTEM AND I/I REDUCTION PROJECTS AND MEASURES

Collection System Details

According to the City of Camas' General Sewer Plan, last updated in November of 2009, the city sanitary collection system was comprised of approximately 462,000 linear feet (87.5 miles) of pipe. Since 2009, approximately 156,800 linear feet of sewer line has been added, giving Camas approximately 619,000 linear feet (117 miles) of sewer line, as of the end of 2022.

In 2022, approximately 800 linear feet of new sanitary sewer line were added to the City's system. All of which were installed in connection with residential development projects occurring throughout the year.

Camas' collection system is comprised of a combination of both traditional gravity sewer, force mains, pressure sewer lines, and 28 lift stations. Please see Attachment B for the lengths of sewer lines added to the collection system, per month and per year, for the past three years.

If you have any questions regarding this report or require any additional information, please do not hesitate to contact the Camas Wastewater Treatment Facility at (360) 817-7164.

Best Regards,

Darren Eki

Darren Eki
Wastewater Treatment Plant Operations Supervisor

Cc: Steve Wall

ATTACHMENT A - Camas 20-Year WWTP Influent Flow and Rainfall

WWTP Design Capacity	
Peak Day Design Flow (MGD):	10.04
Max. Monthly Average Design (MMAD) Flow (MGD):	6.10
Design Population Equivalent:	28,075

Monthly Average Influent Flow (MGD) - MAY 1, 2002 to APRIL 30, 2022

Month	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	AVG
May	1.542	1.622	1.953	2.607	2.177	2.064	2.056	2.255	2.370	2.563	2.446	2.576	2.299	2.155	2.259	2.263	1.946	2.050	2.319	2.138	2.886	**2.217**
June	1.547	1.520	1.996	2.083	2.095	1.997	2.092	1.918	2.833	2.190	2.480	2.149	2.623	2.118	2.244	2.019	1.983	1.992	2.409	2.156	2.838	**2.156**
July	1.458	1.483	1.832	1.925	2.023	1.954	1.903	1.904	1.973	1.994	2.129	2.015	2.915	2.028	2.135	1.831	1.828	1.961	1.972	2.084	2.098	**1.974**
August	1.420	1.450	2.011	1.981	2.050	1.948	2.015	1.921	1.955	2.029	2.093	2.033	3.284	2.088	2.112	1.881	1.890	1.943	2.043	2.146	2.109	**2.019**
September	1.434	1.549	1.948	2.031	2.087	2.035	1.971	1.963	2.055	2.062	2.079	2.454	2.935	2.187	2.169	1.985	1.884	2.151	2.192	2.284	2.140	**2.076**
October	1.447	1.619	2.089	2.212	2.101	2.252	2.013	2.078	2.226	2.148	2.518	2.324	2.961	2.292	3.185	2.262	2.035	2.199	2.231	2.493	2.294	**2.237**
November	1.500	1.903	2.202	2.700	3.423	2.484	2.391	2.510	3.057	2.653	3.312	2.528	2.849	2.867	3.312	2.764	2.178	2.143	2.691	3.187	2.842	**2.643**
December	2.066	2.573	2.494	3.086	3.148	3.465	2.433	2.580	3.364	2.396	3.540	2.556	2.560	4.305	3.191	2.465	2.648	2.461	2.991	3.401	3.362	**2.909**
January	2.431	2.708	2.262	4.018	2.798	4.094	2.814	3.146	3.042	3.222	2.995	2.606	2.810	3.548	2.988	2.852	2.480	3.484	3.306	3.484	3.044	**3.054**
February	2.220	2.414	2.165	2.584	2.754	2.643	2.061	2.567	2.648	2.748	2.522	2.422	2.863	3.251	4.031	2.405	2.880	2.644	3.222	2.570	2.710	**2.682**
March	2.488	1.887	2.345	2.576	2.819	2.442	2.504	2.388	3.570	3.505	4.419	2.314	2.784	3.099	3.442	2.552	2.156	2.476	2.470	2.949	3.141	**2.777**
April	2.052	1.627	2.156	2.377	2.327	2.302	2.327	2.308	2.904	2.898	2.428	2.191	2.425	2.321	2.643	2.710	2.639	2.330	2.139	2.952	3.320	**2.446**
AVG	**1.800**	**1.863**	**2.121**	**2.515**	**2.483**	**2.473**	**2.215**	**2.295**	**2.666**	**2.534**	**2.747**	**2.347**	**2.776**	**2.688**	**2.809**	**2.332**	**2.212**	**2.320**	**2.499**	**2.654**	**2.732**	2.417
MAX	**2.488**	**2.708**	**2.494**	**4.018**	**3.423**	**4.094**	**2.814**	**3.146**	**3.570**	**3.505**	**4.419**	**2.606**	**3.284**	**4.305**	**4.031**	**2.852**	**2.880**	**3.484**	**3.306**	**3.484**	**3.362**	3.346
MIN	**1.420**	**1.450**	**1.832**	**1.925**	**2.023**	**1.948**	**1.903**	**1.904**	**1.955**	**1.994**	**2.079**	**2.015**	**2.299**	**2.028**	**2.112**	**1.831**	**1.828**	**1.943**	**1.972**	**2.084**	**2.098**	1.927
Annual I/I	**1.069**	**1.258**	**0.661**	**2.093**	**1.400**	**2.145**	**0.911**	**1.242**	**1.615**	**1.511**	**2.340**	**0.591**	**0.985**	**2.277**	**1.920**	**1.021**	**1.052**	**1.541**	**1.334**	**1.400**	**1.264**	1.418
% of MMAD Flow	18%	21%	11%	34%	23%	35%	15%	20%	26%	25%	38%	10%	16%	37%	31%	17%	17%	25%	22%	23%	21%	23%
% +/- vs Prior Year	-15%	18%	-47%	217%	-33%	53%	-58%	36%	30%	-6%	55%	-75%	67%	131%	-16%	-47%	3%	47%	-13%	5%	-10%	18%

YELLOW = BASE YEAR

Monthly Total Rainfall (in.) - MAY 1, 2002 to APRIL 30, 2022

Month	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	AVG
May	1.65	2.00	1.65	6.14	2.94	2.11	2.11	4.44	3.93	4.94	4.58	4.64	2.35	0.50	2.10	3.13	0.46	2.10	3.37	2.46	6.63	**3.06**
June	1.75	0.52	1.52	3.22	1.24	2.01	2.19	1.18	7.03	1.16	4.83	1.88	2.05	0.52	2.06	1.74	1.87	0.80	5.54	2.40	6.73	**2.49**
July	0.25	0.00	0.24	0.71	0.67	0.74	0.04	0.09	0.35	0.85	0.41	0.00	1.07	0.57	1.17	0.00	0.06	0.70	0.09	0.00	0.43	**0.40**
August	0.02	0.09	3.91	0.74	0.02	0.99	1.98	0.60	0.90	0.09	0.01	0.26	0.13	0.90	0.15	0.27	0.47	0.75	0.33	0.16	0.00	**0.61**
September	1.41	1.36	2.45	2.37	2.35	3.46	0.81	1.18	3.64	1.00	0.05	5.98	1.02	1.25	1.76	2.66	1.03	3.42	4.77	4.64	0.01	**2.22**
October	1.09	3.09	5.32	5.02	2.44	5.15	4.43	4.11	6.39	2.78	9.52	1.47	6.26	4.80	10.43	5.13	4.39	3.95	2.45	4.89	5.16	**4.68**
November	2.90	5.57	3.19	5.10	12.77	6.29	11.17	7.59	10.76	8.39	11.62	3.33	3.56	5.31	6.39	7.21	3.62	1.65	7.13	10.43	7.49	**6.74**
December	9.30	8.99	4.87	8.88	6.57	10.54	7.27	5.98	10.26	3.77	10.58	2.73	6.58	13.84	4.24	3.21	6.33	3.08	7.96	8.06	6.01	**7.10**
January	8.83	6.73	2.28	11.35	2.69	4.82	6.30	8.87	6.87	7.69	4.52	3.68	3.56	7.17	3.64	6.15	3.19	6.71	8.64	7.88	5.83	**6.07**
February	2.75	5.68	1.81	2.92	5.54	2.59	2.19	4.97	6.05	3.95	2.01	5.83	4.17	5.49	9.68	3.05	4.67	1.44	4.62	3.36	3.54	**4.11**
March	7.49	2.28	4.65	3.86	6.79	3.71	6.97	6.17	9.75	9.98	0.74	5.35	4.89	5.31	9.85	3.49	1.66	2.97	2.63	5.37	5.85	**5.19**
April	4.04	1.43	4.92	2.85	3.78	5.64	4.26	4.74	7.43	3.00	2.92	4.04	2.51	2.51	5.59	4.70	3.69	0.78	0.71	8.12	7.13	**3.66**
TOTAL	**41.48**	**37.74**	**36.81**	**53.16**	**47.80**	**48.05**	**49.72**	**49.92**	**73.36**	**47.60**	**51.79**	**39.19**	**38.15**	**48.17**	**57.06**	**40.74**	**31.44**	**28.35**	**48.24**	**57.77**	**54.81**	46.73
AVG	**3.46**	**3.15**	**3.07**	**4.43**	**3.98**	**4.00**	**4.14**	**4.16**	**6.11**	**3.97**	**4.32**	**3.27**	**3.18**	**4.01**	**4.76**	**3.40**	**2.62**	**2.36**	**4.02**	**4.81**	**4.57**	3.86
MAX	**9.30**	**8.99**	**5.32**	**11.35**	**12.77**	**10.54**	**11.17**	**8.87**	**10.76**	**9.98**	**11.62**	**5.98**	**6.58**	**13.84**	**10.43**	**7.21**	**6.33**	**6.71**	**8.64**	**10.43**	**7.49**	9.34
MIN	**0.02**	**0.00**	**0.24**	**0.71**	**0.02**	**0.74**	**0.04**	**0.09**	**0.35**	**0.09**	**0.01**	**0.00**	**0.13**	**0.50**	**0.15**	**0.00**	**0.06**	**0.70**	**0.09**	**0.00**	**0.00**	0.20

20-Year Rainfall Summary		
20-Year Average Annual Rainfall (in.):	46.33	
20-Year Maximum Annual Rainfal (in.):	73.36	(2010)
20-Year Minimum Annual Rainfall (in.):	28.35	(2019)

ATTACHMENT B

City of Camas WWTP (WA0020249) - Annual Infiltration and Inflow Report

May 2022 to April 2023

WWTP Design Capacity

Peak Hourly Hydraulic Design Flow (MGD):	13.44
Maximum Monthly Average Design Flow (MGD):	6.10
Design Population Equivalent:	28,075

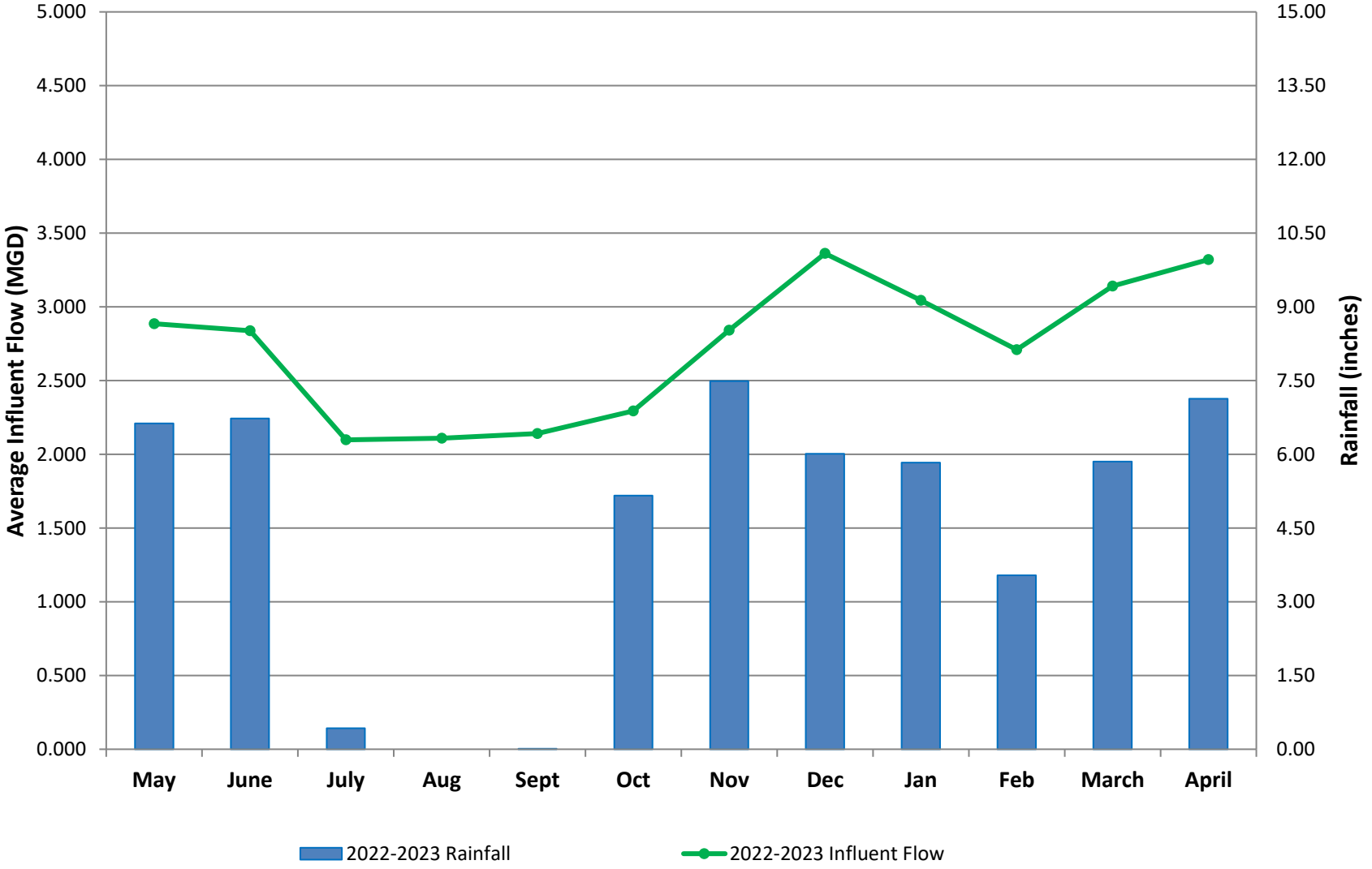
	Monthly Average WWTP Influent Flow (MGD)			Total Monthly Rainfall (inches)			Population Served			Additional Sewer Lines Added (ft.)		
Month	**2020**	**2021**	**2022**	**2020**	**2021**	**2022**	**2020**	**2021**	**2022**	**2020**	**2021**	**2022**
May	2.319	2.138	2.886	3.37	2.46	6.63	26,065	26,870	27,250	0	1,714	0
June	2.409	2.156	2.838	5.54	2.40	6.73	26,065	26,870	27,250	0	1,114	0
July	1.972	2.084	2.098	0.09	0.00	0.43	26,065	26,870	27,250	3,130	0	0
Aug	2.043	2.146	2.109	0.33	0.16	0.00	26,065	26,870	27,250	1,910	0	0
Sept	2.192	2.284	2.140	4.77	4.64	0.01	26,065	26,870	27,250	4,171	0	0
Oct	2.231	2.493	2.294	2.45	4.89	5.16	26,065	26,870	27,250	3,076	0	0
Nov	2.691	3.187	2.842	7.13	**10.43**	**7.49**	26,065	26,870	27,250	0	0	0
Dec	2.991	3.401	**3.362**	7.96	8.06	6.01	26,065	26,870	27,250	0	0	0
Jan	**3.306**	**3.484**	3.044	**8.64**	7.88	5.83	26,870	27,250	27,598	0	0	0
Feb	3.222	2.570	2.710	4.62	3.36	3.54	26,870	27,250	27,598	0	0	0
March	2.470	2.949	3.141	2.63	5.37	5.85	26,870	27,250	27,598	525	795	0
April	2.139	2.952	3.320	0.71	8.12	7.13	26,870	27,250	27,598	580	0	0
Period Total:	29.984	31.842	32.784	48.24	57.77	54.81			**Total Added (feet):**	13,392	3,623	0
Low Month:	1.972	2.084	2.098	0.09	0.00	0.00			**Total Added (miles):**	2.54	0.69	0.00
High Month:	**3.306**	**3.484**	**3.362**	**8.64**	**10.43**	**7.49**						
Annual Average:	2.499	2.654	2.732	4.02	4.81	4.57						
Period I/I:	1.334	1.400	1.264									

INFILTRATION/INFLOW SUMMARY

Year	I/I	% Increase/Decrease From Base I/I	% Increase/Decrease from Prior Year	% of Max Month. Design Flow	Total Rainfall
Base Year: 2011	***1.511***	***n/a***	***-6%***	***25%***	***47.60***
2020-2021	1.334	-12%	131%	22%	48.24
2021-2022	1.400	-7%	5%	23%	57.77
2022-2023	1.264	-16%	-10%	21%	54.81

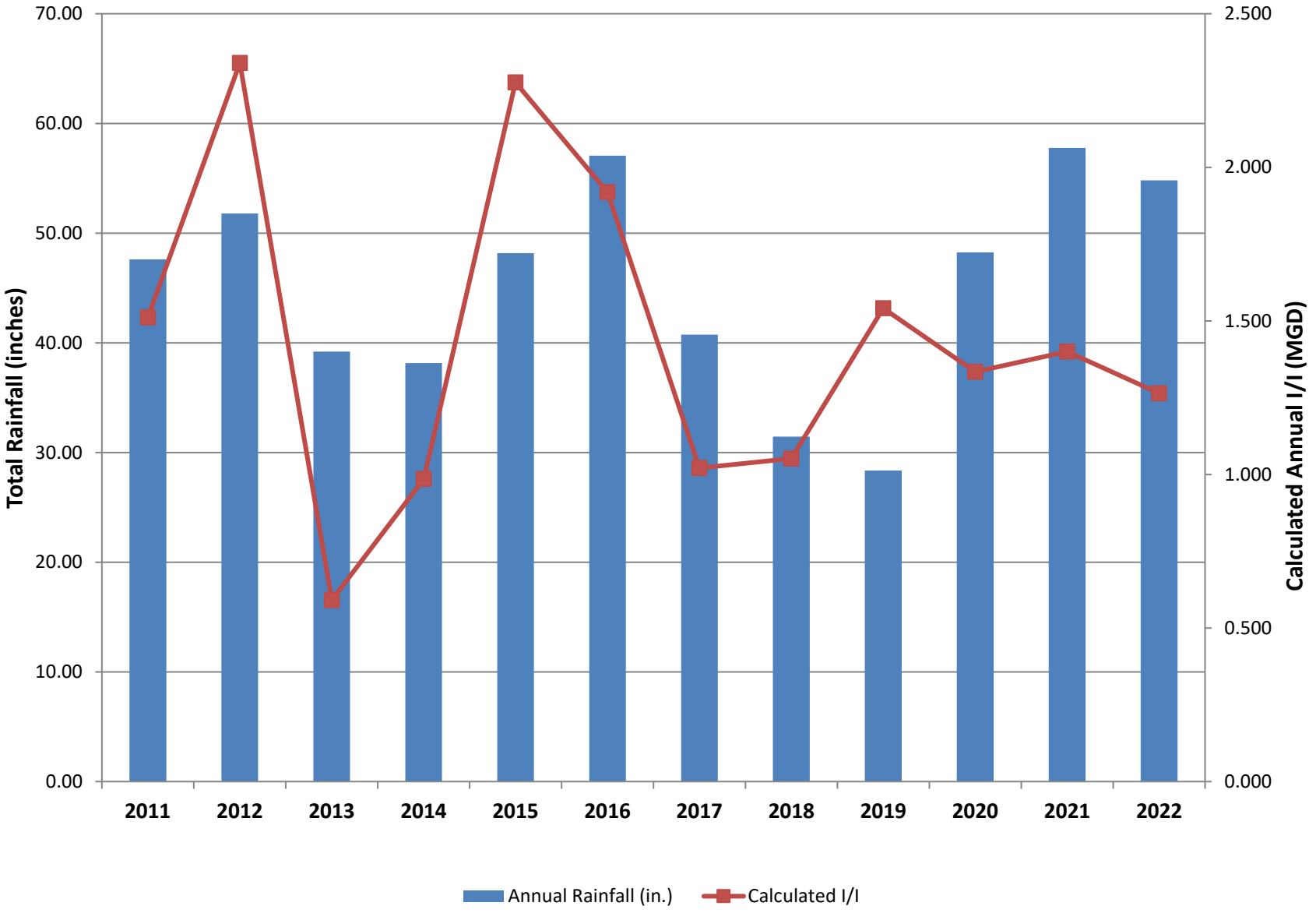
ATTACHMENT C, CHART I

May 2022 - April 2023 Monthly Average Influent Flow and Monthly Total Rainfall



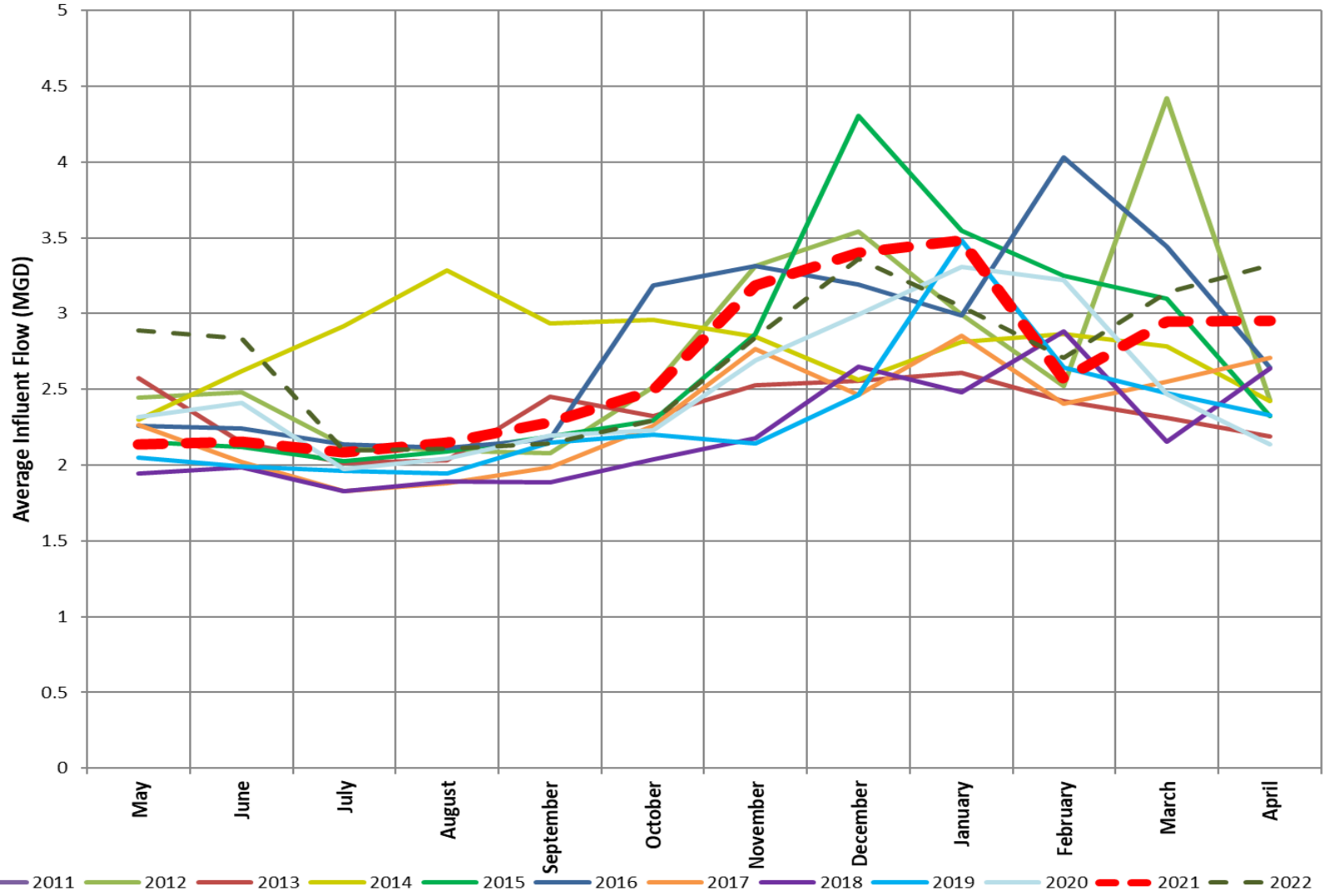
ATTACHMENT C, CHART II

Annual Rainfall & Calculated I/I Since Base Year (2011)



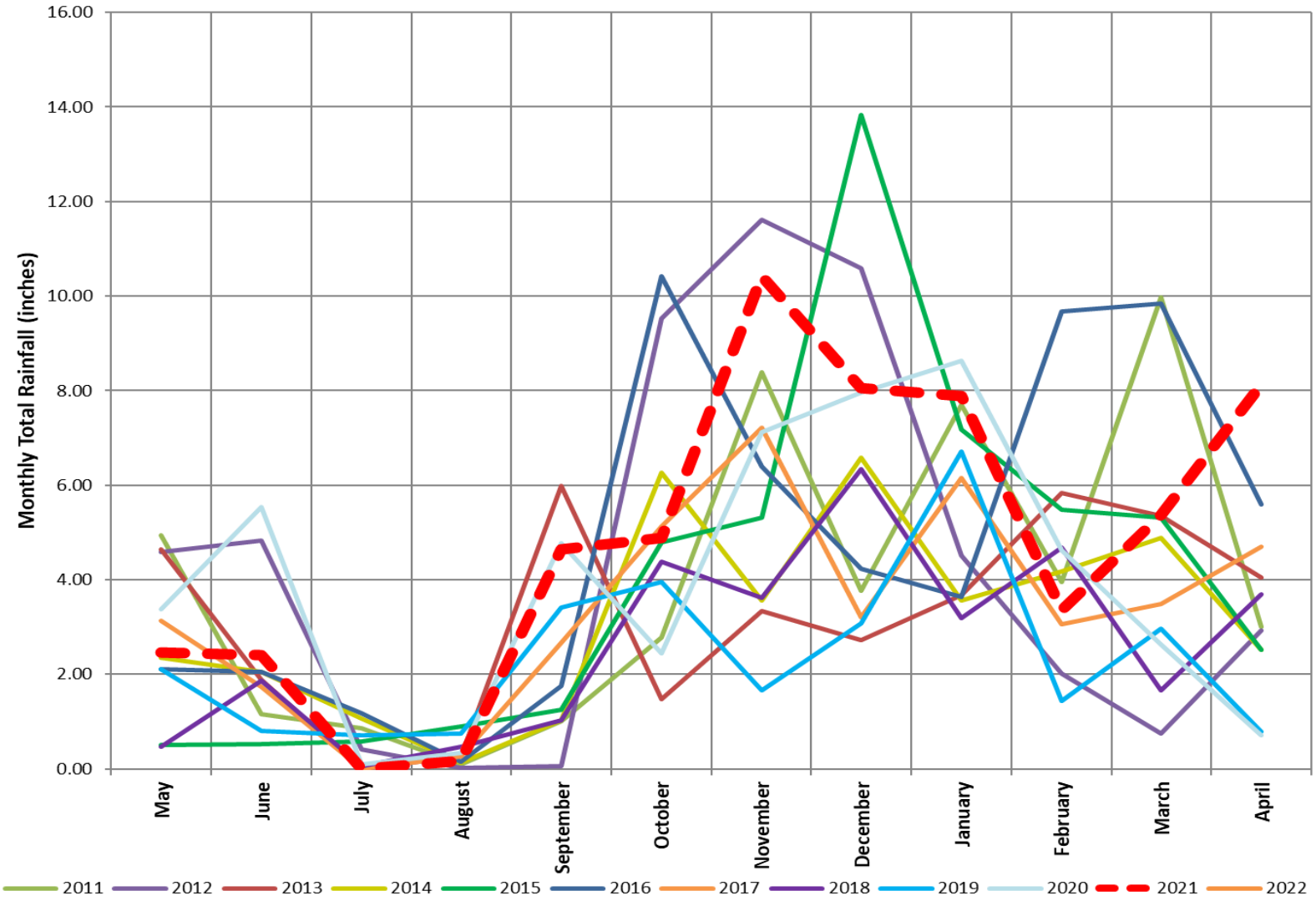
ATTACHMENT C, CHART III

WWTP Monthly Average Influent Flow Since Base Year (2011)



ATTACHMENT C, CHART IV

Monthly Total Rainfall Since Base Year (2011)



City of Camas Washington
Public Works Department
616 NE 4th Avenue
Camas, WA 98607

July 9, 2024

Carey Cholski
Washington State Department of Ecology
PO Box 47775
Olympia, WA 98504-7775

Subject: **May 2023 – April 2024 Annual Inflow and Infiltration Report**
City of Camas, WA Wastewater Treatment Facility (Permit No. WA0020249)

Ms. Cholski,

Pursuant to Section S4.E of our current NPDES Permit, enclosed is our annual Inflow and Infiltration (I/I) report. Section S4.E.3 of our permit states:

> *The Permittee must conduct an annual analysis of infiltration and inflow according to Ecology's guidance manual for treatment plant operators. This report shall consider the 12-month period May 1st through the following April 30th as the annual period and shall be submitted by July 15, 2017 and annually thereafter. This report shall include an update on the status of each inflow reduction project completed in fulfillment of S4.E.2 (above) including the funds expended or contractually obligated, and the proportion of the project completed as of the end of the reporting period. For each basin or sub-basin in which work has been done within the reporting period, the report shall include the estimated inflow rates before and after the project and the estimated effect on the overall Publicly Owned Treatment Works (POTW) inflow rate.*

According to Ecology's Information Manual for Treatment Plant Operators (Feb. 2004), an Annual I/I Report should include each of the following elements:

1. *The average monthly flow and total precipitation for each month for the past year together with a graph … plotting a comparison of precipitation versus influent flow.*
2. *The maximum monthly and peak hourly hydraulic design capacity for the plant.*

3. *The design population equivalent for the treatment plant and the population served by the facility, per month, for the past year.*
4. *The amount of I/I for each year since the base year and the percent of maximum monthly design capacity each year's I/I represents.*
5. *The percent increase or reduction in I/I for each year subsequent to the base year I/I.*
6. *The additional lengths of sewer lines added to the collection system, per month, for the past year. Also include a brief summary of any major sewer rehabilitation or I/I reduction projects.*

The following information and attachments are now being submitted to satisfy these requirements.

I. REPORTING PERIOD AND BASE YEAR

As described in Section S4.E.3 of our current NPDES permit, the annual period for our I/I report is May 1st through April 30th. Accordingly, please note that when this report refers to the "reporting period" or "year", it is referring to the 12-month period from May 1st through April 30th. For any particular year that is referenced in the report, it is denoting the May through April reporting year and the calendar year in which May falls.

For the purposes of selecting an appropriate Base Year, the past twenty years of historical precipitation and plant influent flow data are reviewed annually. A summary of the monthly precipitation totals and influent flow averages for the past twenty years are included in Attachment A.

Since our facility's 2016 I&I report, the May 2011-April 2012 reporting year has been used as the Base Year, as it has reflected Camas' average rainfall, population growth and disposition of the City's sanitary sewer collection system.

From analysis of the historical data, May 2011-April 2012 continues to best an average, annual rainfall in Camas and therefore continues to serve as the Base Year for the purposes of this report.

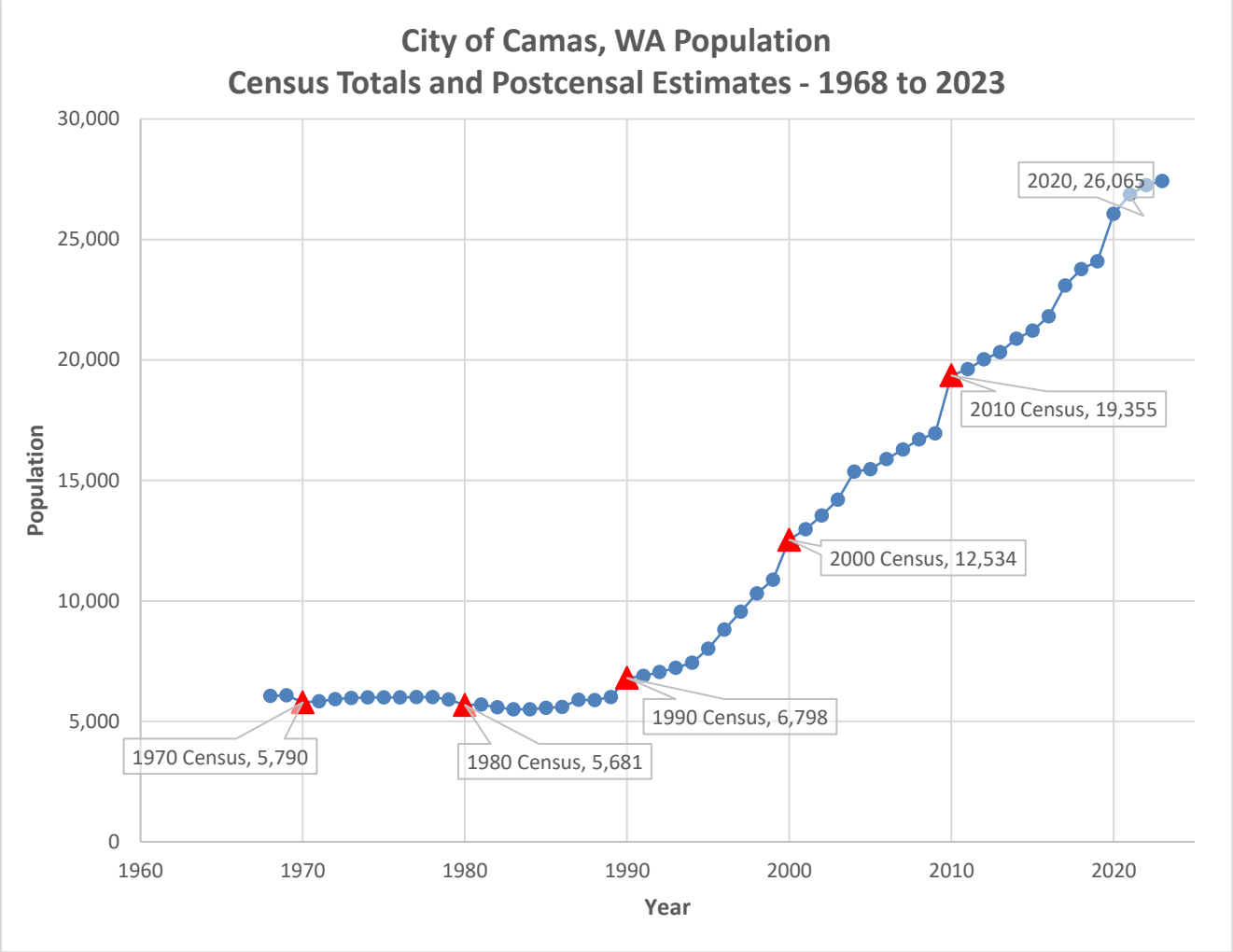
For the twenty-year period of May 1, 2003 to April 30, 2023, the average 12-month rainfall in Camas was 47.56 inches. From May 1, 2011 to April 30th 2012, the rainfall was 47.60, only 1.27 inches more than the twenty-year average. This represented the closest annual total to the twenty-year average, of all twenty years of data reviewed.

TABLE 1 - 12-Month May Through April Rainfall Totals, 2003-2023

	Average	Minimum	Base Year	Maximum
Annual Total Rainfall (in.)	47.56	28.35 (May 2019 – April 2020)	47.60 (May 2011-April 2012)	73.36 (May 2010-April 2011)

In addition to representing the 20-year median rainfall, using 2011-2012 as the "Base Year" incorporates the City's rapid growth that has occurred in the last 20 years. In I/I annual reports prior to 2016, the City of Camas had been using 1989 as the Base Year. Since 1989, the City of Camas has seen rapid growth in population and significant additions to its wastewater collection system. The May 2011-April 2012 period captures that growth,

which has taken place primarily after 1990. The chart below illustrates the City's annual, calendar year, population growth since 1968:



Historical Population Estimates for Camas, WA by Washington State Office of Financial Management
(https://ofm.wa.gov/washington-data-research/population-demographics/population-estimates/april-1-official-population-estimates)

II. INFLOW AND INFILTRATION ANALYSIS

Facility Design Parameters

The maximum monthly hydraulic design capacity for the Camas Wastewater Treatment Plant (WWTP) is 6.10 million gallons per day (MGD) and has a peak hourly hydraulic design capacity of 13.44 MGD. The Design Population Equivalent for the Camas WWTP is 28,075.

Calculated I/I and Annual Rainfall 20-Year History

The following chart is a summary of the calculated I/I, the percent of maximum monthly design capacity the calculated I/I represents, the percentage increase or decrease of I/I from the previous year and the total rainfall for each reporting year from May 2002 to April 2023:

TABLE 2 – Camas Calculated I/I & Rainfall

Year	Calculated I/I (MGD)	I/I as % of Design Capacity	I/I % Increase/Decrease from Prior Year	Total 12-Month Rainfall (in.)
2002	1.069	18%	-15%	41.48
2003	1.258	21%	+18%	37.74
2004	0.661	11%	-47%	36.81
2005	2.093	34%	+217%	53.16
2006	1.400	23%	-33%	47.80
2007	2.145	35%	+53%	48.05
2008	0.911	15%	-58%	49.72
2009	1.242	20%	+36%	49.92
2010	1.615	26%	+30%	73.36
2011	1.511	25%	-6%	47.60
2012	2.340	38%	+55%	51.79
2013	0.591	10%	-75%	39.19
2014	0.985	16%	+67%	38.15
2015	2.277	37%	+131%	48.17
2016	1.920	31%	-16%	57.06
2017	1.021	17%	-47%	40.74
2018	1.052	17%	+3%	31.44
2019	1.541	25%	+47%	28.35
2020	1.334	22%	-13%	48.24
2021	1.400	23%	+5%	57.77
2022	1.264	21%	-10%	54.81
2023	2.266	37%	+79%	58.80
Average				

Yellow Highlight = Base Year

Annual Report Form

Please see Attachment B for the Annual I/I Report form which summarizes the following data:

- The average monthly flow and total precipitation for each month, for the past three years.
- The calculated amount of I/I for each year.
- The percent of maximum monthly design capacity that each period's I/I represents.
- The population served by the facility, per month, for the past three years.
- The additional lengths of sewer lines added to the collection system, per month and per year, for the past three years.
- A summary of the I/I from the past three years, including a comparison with the selected Base Year (2011)

Charts

Please see Attachment C for several charts which plot I/I data to illustrate the following:

- Chart I: Comparison of precipitation versus influent flow for each month of the current reporting period.
- Chart II: Comparison of 12-month total precipitation and calculated I/I, for each year since the Base Year.
- Chart III: Monthly Average Influent Flow at the WWTP since the Base Year.
- Chart IV: Monthly Total Rainfall since the Base Year.

III. COLLECTION SYSTEM AND I/I REDUCTION PROJECTS AND MEASURES

Collection System Details

According to the City of Camas' General Sewer Plan, last updated in November of 2009, the city sanitary collection system was comprised of approximately 462,000 linear feet (87.5 miles) of pipe. Since 2009, approximately 156,800 linear feet of sewer line has been added, giving Camas approximately 619,637 linear feet (117 miles) of sewer line, as of the end of 2023.

In 2023/24, approximately 7878 linear feet of new sanitary sewer line were added to the City's system. All of which were installed in connection with residential development projects occurring throughout the year.

Camas' collection system is comprised of a combination of both traditional gravity sewer, force mains, pressure sewer lines, and 28 lift stations. Please see Attachment B for the lengths of sewer lines added to the collection system, per month and per year, for the past three years.

If you have any questions regarding this report or require any additional information, please do not hesitate to contact the Camas Wastewater Treatment Facility at (360) 834-3263.

Best Regards,

Darren Eki

Darren Eki
Wastewater Treatment Plant Operations Supervisor

Cc: Steve Wall

ATTACHMENT A - Camas 20-Year WWTP Influent Flow and Rainfall

WWTP Design Capacity	
Peak Day Design Flow (MGD):	10.04
Max. Monthly Average Design (MMAD) Flow (MGD):	6.10
Design Population Equivalent:	28,075

Monthly Average Influent Flow (MGD) - MAY 1, 2003 to APRIL 30, 2023

Month	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	AVG
May	1.622	1.953	2.607	2.177	2.064	2.056	2.255	2.370	2.563	2.446	2.576	2.299	2.155	2.259	2.263	1.946	2.050	2.319	2.138	2.886	2.230	**2.249**
June	1.520	1.996	2.083	2.095	1.997	2.092	1.918	2.833	2.190	2.480	2.149	2.623	2.118	2.244	2.019	1.983	1.992	2.409	2.156	2.838	2.180	**2.186**
July	1.483	1.832	1.925	2.023	1.954	1.903	1.904	1.973	1.994	2.129	2.015	2.915	2.028	2.135	1.831	1.828	1.961	1.972	2.084	2.098	2.068	**2.003**
August	1.450	2.011	1.981	2.050	1.948	2.015	1.921	1.955	2.029	2.093	2.033	3.284	2.088	2.112	1.881	1.890	1.943	2.043	2.146	2.109	2.141	**2.053**
September	1.549	1.948	2.031	2.087	2.035	1.971	1.963	2.055	2.062	2.079	2.454	2.935	2.187	2.169	1.985	1.884	2.151	2.192	2.284	2.140	2.199	**2.112**
October	1.619	2.089	2.212	2.101	2.252	2.013	2.078	2.226	2.148	2.518	2.324	2.961	2.292	3.185	2.262	2.035	2.199	2.231	2.493	2.294	2.314	**2.278**
November	1.903	2.202	2.700	3.423	2.484	2.391	2.510	3.057	2.653	3.312	2.528	2.849	2.867	3.312	2.764	2.178	2.143	2.691	3.187	2.842	2.732	**2.701**
December	2.573	2.494	3.086	3.148	3.465	2.433	2.580	3.364	2.396	3.540	2.556	2.560	4.305	3.191	2.465	2.648	2.461	2.991	3.401	3.362	3.553	**2.980**
January	2.708	2.262	4.018	2.798	4.094	2.814	3.146	3.042	3.222	2.995	2.606	2.810	3.548	2.988	2.852	2.480	3.484	3.306	3.484	3.044	4.334	**3.144**
February	2.414	2.165	2.584	2.754	2.643	2.061	2.567	2.648	2.748	2.522	2.422	2.863	3.251	4.031	2.405	2.880	2.644	3.222	2.570	2.710	3.244	**2.731**
March	1.887	2.345	2.576	2.819	2.442	2.504	2.388	3.570	3.505	4.419	2.314	2.784	3.099	3.442	2.552	2.156	2.476	2.470	2.949	3.141	2.932	**2.799**
April	1.627	2.156	2.377	2.327	2.302	2.327	2.308	2.904	2.898	2.428	2.191	2.425	2.321	2.643	2.710	2.639	2.330	2.139	2.952	3.320	2.517	**2.469**
AVG	**1.863**	**2.121**	**2.515**	**2.483**	**2.473**	**2.215**	**2.295**	**2.666**	**2.534**	**2.747**	**2.347**	**2.776**	**2.688**	**2.809**	**2.332**	**2.212**	**2.320**	**2.499**	**2.654**	**2.732**	**2.704**	2.464
MAX	**2.708**	**2.494**	**4.018**	**3.423**	**4.094**	**2.814**	**3.146**	**3.570**	**3.505**	**4.419**	**2.606**	**3.284**	**4.305**	**4.031**	**2.852**	**2.880**	**3.484**	**3.306**	**3.484**	**3.362**	**4.334**	3.389
MIN	**1.450**	**1.832**	**1.925**	**2.023**	**1.948**	**1.903**	**1.904**	**1.955**	**1.994**	**2.079**	**2.015**	**2.299**	**2.028**	**2.112**	**1.831**	**1.828**	**1.943**	**1.972**	**2.084**	**2.098**	**2.068**	1.961
Annual I/I	**1.258**	**0.661**	**2.093**	**1.400**	**2.145**	**0.911**	**1.242**	**1.615**	**1.511**	**2.340**	**0.591**	**0.985**	**2.277**	**1.920**	**1.021**	**1.052**	**1.541**	**1.334**	**1.400**	**1.264**	**2.266**	1.428
% of MMAD Flow	21%	11%	34%	23%	35%	15%	20%	26%	25%	38%	10%	16%	37%	31%	17%	17%	25%	22%	23%	21%	37%	23%
% +/- vs Prior Year	-15%	-47%	217%	-33%	53%	-58%	36%	30%	-6%	55%	-75%	67%	131%	-16%	-47%	3%	47%	-13%	5%	-10%	79%	16%

YELLOW = BASE YEAR

Monthly Total Rainfall (in.) - MAY 1, 2003 to APRIL 30, 2024

Month	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	AVG
May	2.00	1.65	6.14	2.94	2.11	2.11	4.44	3.93	4.94	4.58	4.64	2.35	0.50	2.10	3.13	0.46	2.10	3.37	2.46	6.63	1.44	**3.05**
June	0.52	1.52	3.22	1.24	2.01	2.19	1.18	7.03	1.16	4.83	1.88	2.05	0.52	2.06	1.74	1.87	0.80	5.54	2.40	6.73	1.51	**2.48**
July	0.00	0.24	0.71	0.67	0.74	0.04	0.09	0.35	0.85	0.41	0.00	1.07	0.57	1.17	0.00	0.06	0.70	0.09	0.00	0.43	0.00	**0.39**
August	0.09	3.91	0.74	0.02	0.99	1.98	0.60	0.90	0.09	0.01	0.26	0.13	0.90	0.15	0.27	0.47	0.75	0.33	0.16	0.00	0.83	**0.65**
September	1.36	2.45	2.37	2.35	3.46	0.81	1.18	3.64	1.00	0.05	5.98	1.02	1.25	1.76	2.66	1.03	3.42	4.77	4.64	0.01	2.02	**2.25**
October	3.09	5.32	5.02	2.44	5.15	4.43	4.11	6.39	2.78	9.52	1.47	6.26	4.80	10.43	5.13	4.39	3.95	2.45	4.89	5.16	2.85	**4.76**
November	5.57	3.19	5.10	12.77	6.29	11.17	7.59	10.76	8.39	11.62	3.33	3.56	5.31	6.39	7.21	3.62	1.65	7.13	10.43	7.49	7.40	**6.95**
December	8.99	4.87	8.88	6.57	10.54	7.27	5.98	10.26	3.77	10.58	2.73	6.58	13.84	4.24	3.21	6.33	3.08	7.96	8.06	6.01	12.01	**7.23**
January	6.73	2.28	11.35	2.69	4.82	6.30	8.87	6.87	7.69	4.52	3.68	3.56	7.17	3.64	6.15	3.19	6.71	8.64	7.88	5.83	15.57	**6.39**
February	5.68	1.81	2.92	5.54	2.59	2.19	4.97	6.05	3.95	2.01	5.83	4.17	5.49	9.68	3.05	4.67	1.44	4.62	3.36	3.54	6.54	**4.29**
March	2.28	4.65	3.86	6.79	3.71	6.97	6.17	9.75	9.98	0.74	5.35	4.89	5.31	9.85	3.49	1.66	2.97	2.63	5.37	5.85	4.13	**5.07**
April	1.43	4.92	2.85	3.78	5.64	4.26	4.74	7.43	3.00	2.92	4.04	2.51	2.51	5.59	4.70	3.69	0.78	0.71	8.12	7.13	4.50	**3.87**
TOTAL	**37.74**	**36.81**	**53.16**	**47.80**	**48.05**	**49.72**	**49.92**	**73.36**	**47.60**	**51.79**	**39.19**	**38.15**	**48.17**	**57.06**	**40.74**	**31.44**	**28.35**	**48.24**	**57.77**	**54.81**	**58.80**	47.56
AVG	**3.15**	**3.07**	**4.43**	**3.98**	**4.00**	**4.14**	**4.16**	**6.11**	**3.97**	**4.32**	**3.27**	**3.18**	**4.01**	**4.76**	**3.40**	**2.62**	**2.36**	**4.02**	**4.81**	**4.57**	**4.90**	3.92
MAX	**8.99**	**5.32**	**11.35**	**12.77**	**10.54**	**11.17**	**8.87**	**10.76**	**9.98**	**11.62**	**5.98**	**6.58**	**13.84**	**10.43**	**7.21**	**6.33**	**6.71**	**8.64**	**10.43**	**7.49**	**15.57**	9.25
MIN	**0.00**	**0.24**	**0.71**	**0.02**	**0.74**	**0.04**	**0.09**	**0.35**	**0.09**	**0.01**	**0.00**	**0.13**	**0.50**	**0.15**	**0.00**	**0.06**	**0.70**	**0.09**	**0.00**	**0.00**	**0.00**	0.20

20-Year Rainfall Summary		
20-Year Average Annual Rainfall (in.):	47.56	
20-Year Maximum Annual Rainfal (in.):	73.36	(2010)
20-Year Minimum Annual Rainfall (in.):	28.35	(2019)

ATTACHMENT B

City of Camas WWTP (WA0020249) - Annual Infiltration and Inflow Report

May 2023 to April 2024

WWTP Design Capacity

Peak Hourly Hydraulic Design Flow (MGD):	**13.44**
Maximum Monthly Average Design Flow (MGD):	**6.10**
Design Population Equivalent:	**28,075**

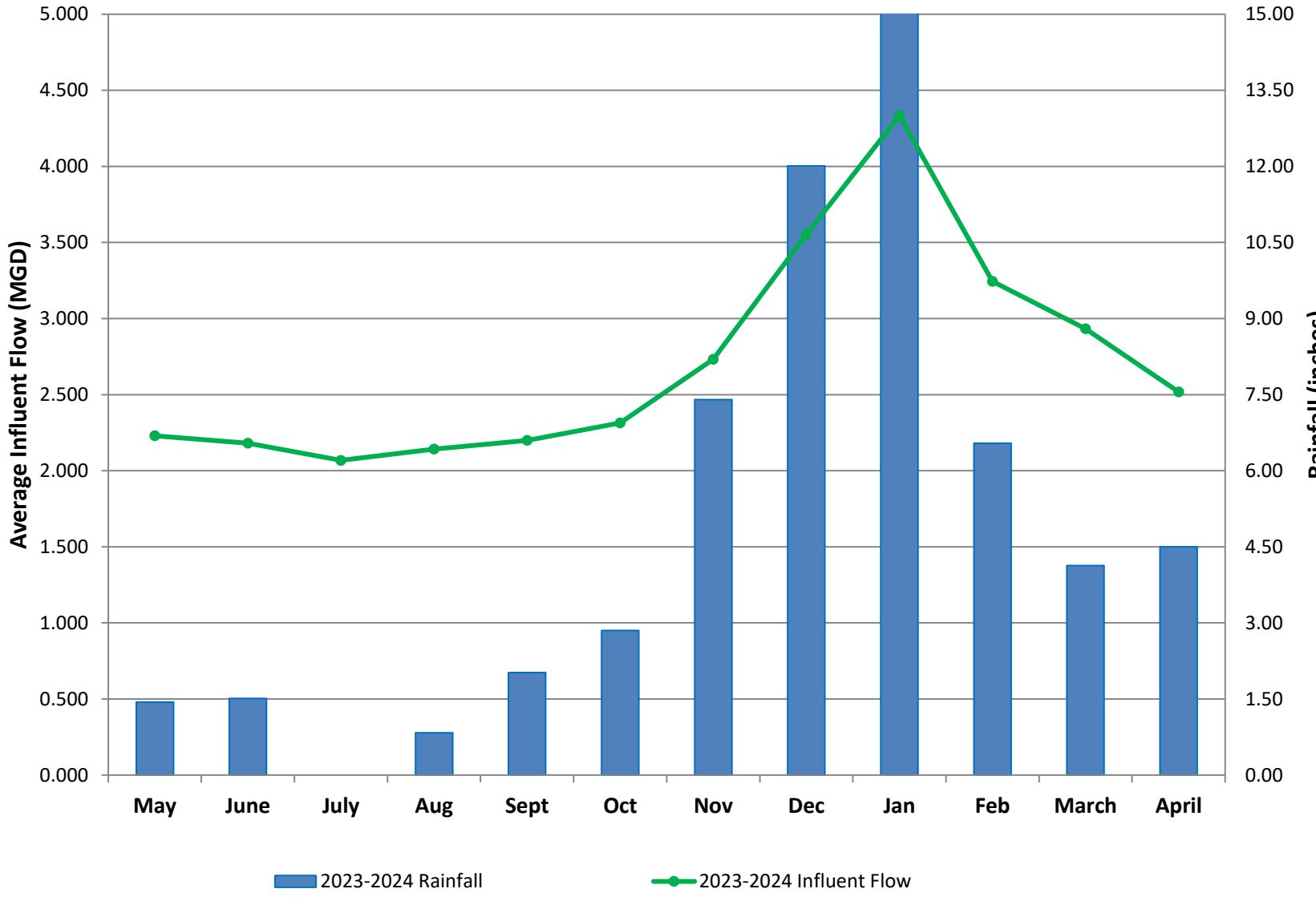
	Monthly Average WWTP Influent Flow (MGD)			Total Monthly Rainfall (inches)			Population Served			Additional Sewer Lines Added (ft.)		
Month	**2021**	**2022**	**2023**	**2021**	**2022**	**2023**	**2021**	**2022**	**2023**	**2021**	**2022**	**2023**
May	2.138	2.886	2.230	2.46	6.63	1.44	26,870	27,250	27,420	1,714	0	1,269
June	2.156	2.838	2.180	2.40	6.73	1.51	26,870	27,250	27,420	1,114	0	0
July	2.084	2.098	2.068	0.00	0.43	0.00	26,870	27,250	27,250	0	0	0
Aug	2.146	2.109	2.141	0.16	0.00	0.83	26,870	27,250	27,420	0	0	4,135
Sept	2.284	2.140	2.199	4.64	0.01	2.02	26,870	27,250	27,420	0	0	0
Oct	2.493	2.294	2.314	4.89	5.16	2.85	26,870	27,250	27,420	0	0	0
Nov	3.187	2.842	2.732	**10.43**	**7.49**	7.40	26,870	27,250	27,420	0	0	0
Dec	3.401	**3.362**	3.553	8.06	6.01	12.01	26,870	27,250	27,420	0	0	0
Jan	**3.484**	3.044	**4.334**	7.88	5.83	**15.57**	27,250	27,420	27,420	0	0	0
Feb	2.570	2.710	3.244	3.36	3.54	6.54	27,250	27,420	27,420	0	0	0
March	2.949	3.141	2.932	5.37	5.85	4.13	27,250	27,420	27,420	795	1,269	0
April	2.952	3.320	2.517	8.12	7.13	4.50	27,250	27,420	27,420	0	0	2,474
Period Total:	31.842	32.784	32.445	57.77	54.81	58.80			**Total Added (feet):**	3,623	1,269	7,878
Low Month:	2.084	2.098	2.068	0.00	0.00	0.00			**Total Added (miles):**	0.69	0.24	1.49
High Month:	**3.484**	**3.362**	**4.334**	**10.43**	**7.49**	**15.57**						
Annual Average:	2.654	2.732	2.704	4.81	4.57	4.90						
Period I/I:	1.400	1.264	2.266									

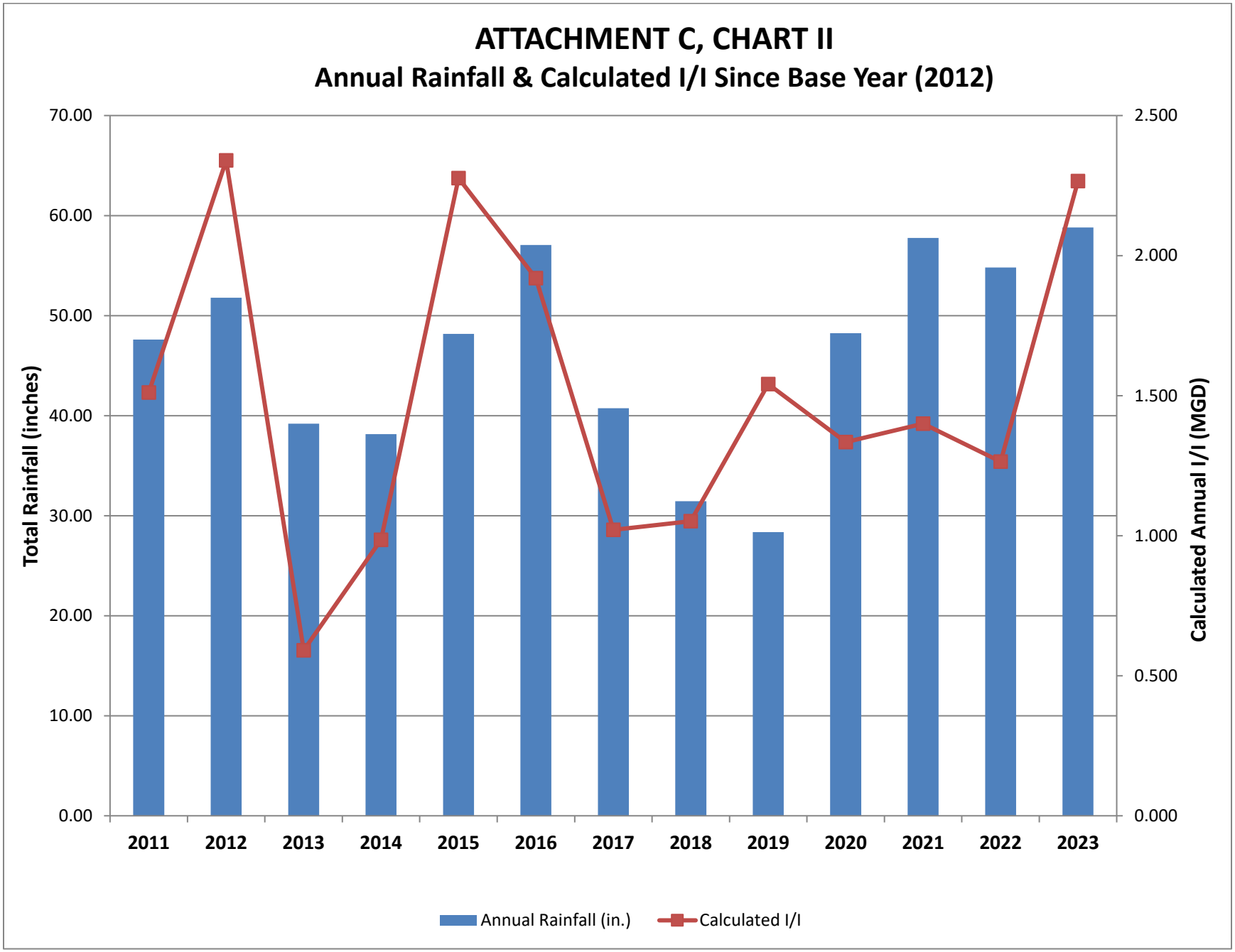
INFILTRATION/INFLOW SUMMARY

Year	I/I	% Increase/Decrease From Base I/I	% Increase/Decrease from Prior Year	% of Max Month. Design Flow	Total Rainfall
Base Year: 2011	***1.511***	***n/a***	***-6%***	***25%***	***47.60***
2021-2022	1.400	-7%	-7%	23%	57.77
2022-2023	1.264	-16%	-10%	21%	54.81
2023-2024	2.266	50%	79%	37%	58.80

ATTACHMENT C, CHART I

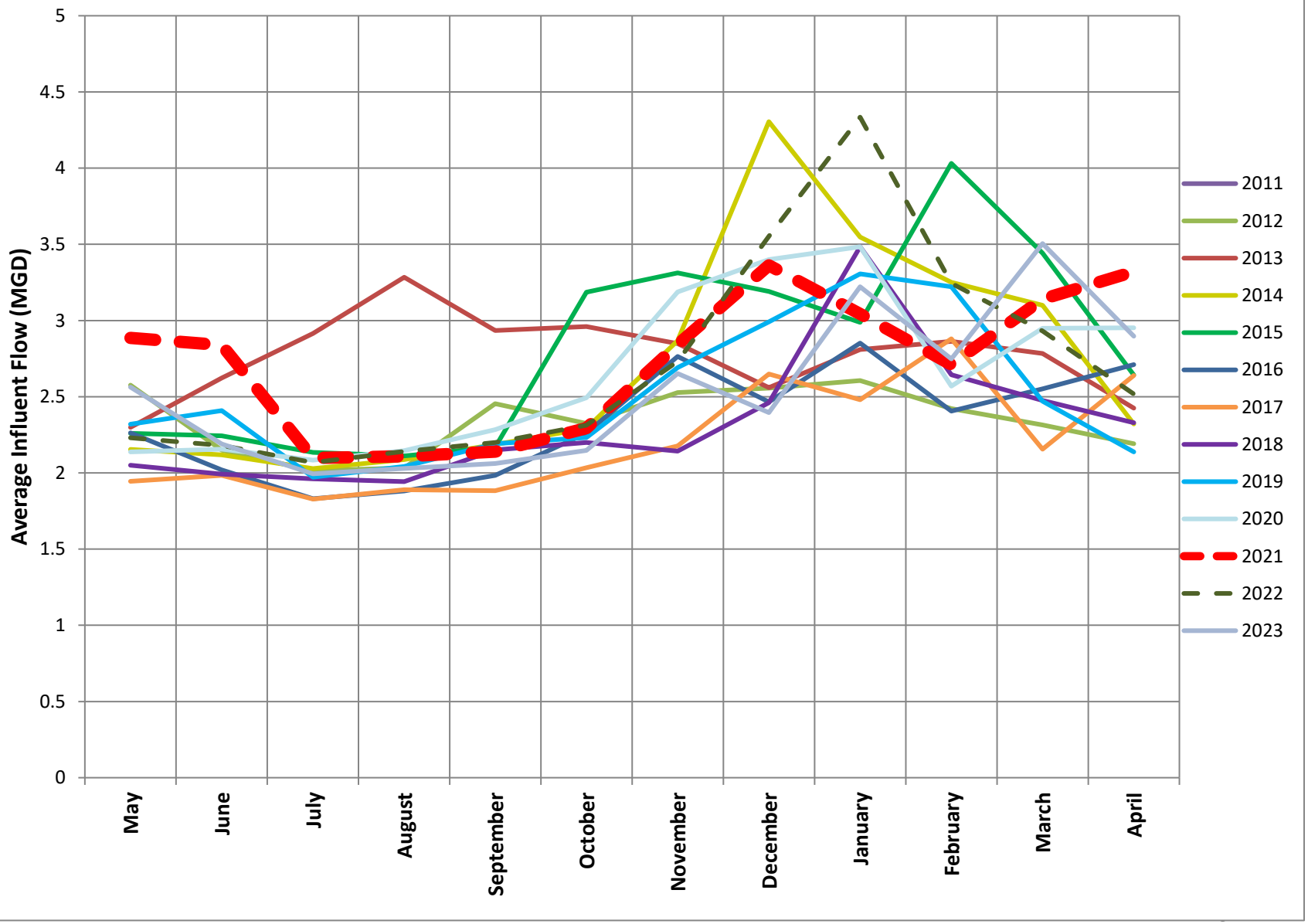
May 2023 - April 2024 Monthly Average Influent Flow and Monthly Total Rainfall




ATTACHMENT C, CHART II
Annual Rainfall & Calculated I/I Since Base Year (2012)
Total Rainfall (inches)
Calculated Annual I/I (MGD)
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
2.500
2.000
1.500
1.000
0.500
0.000
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Annual Rainfall (in.)
Calculated I/I

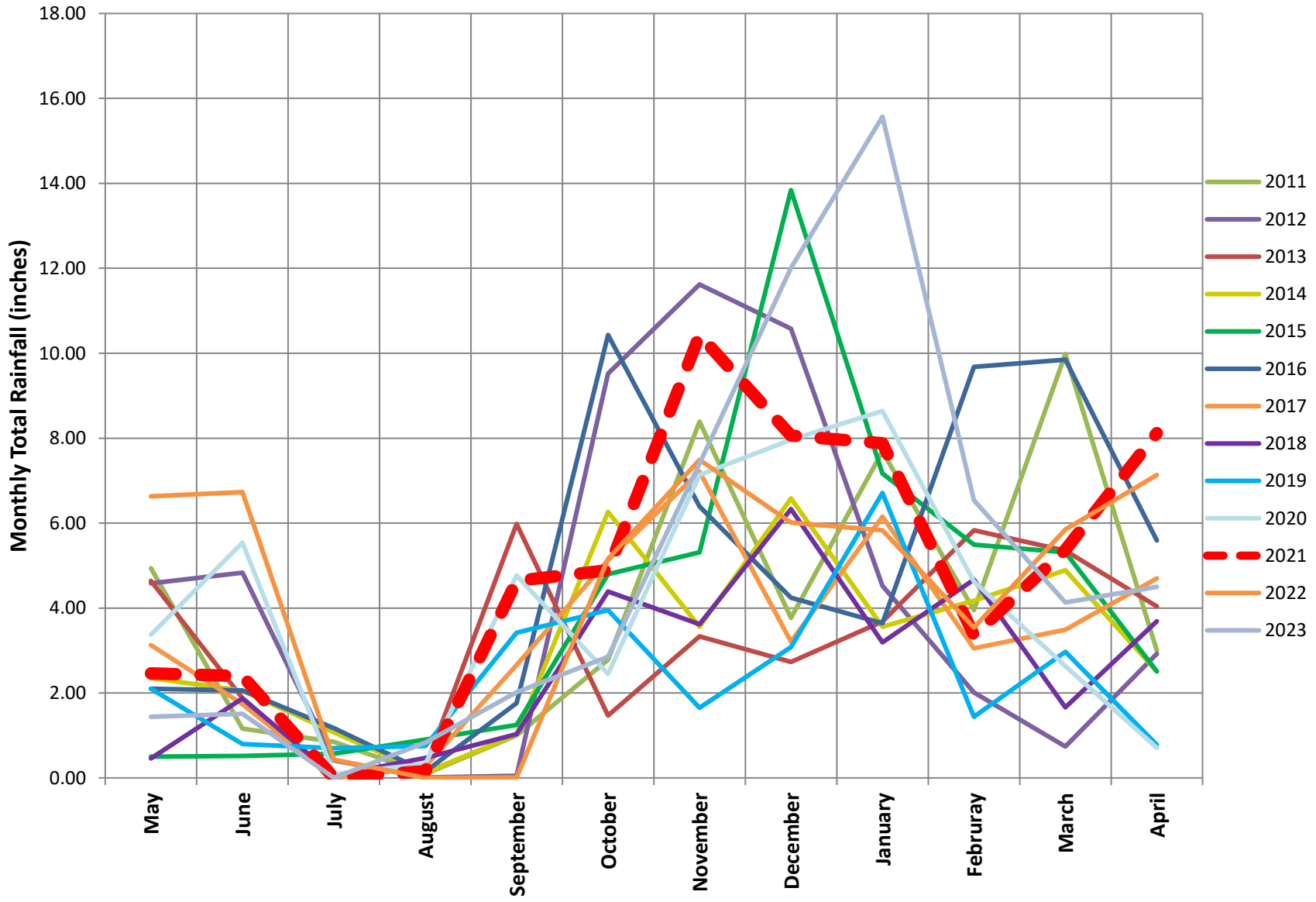
ATTACHMENT C, CHART III

WWTP Monthly Average Influent Flow Since Base Year (2011)



ATTACHMENT C, CHART IV

Monthly Total Rainfall Since Base Year (2011)



City of Camas Washington
Public Works Department
616 NE 4th Avenue
Camas, WA 98607

July 7, 2025

Carey Cholski
Washington State Department of Ecology
PO Box 47775
Olympia, WA 98504-7775

Subject: **May 2024 – April 2025 Annual Inflow and Infiltration Report**
City of Camas, WA Wastewater Treatment Facility (Permit No. WA0020249)

Ms. Cholski,

Pursuant to Section S4.E of our current NPDES Permit, enclosed is our annual Inflow and Infiltration (I/I) report. Section S4.E.3 of our permit states:

> *The Permittee must conduct an annual analysis of infiltration and inflow according to Ecology's guidance manual for treatment plant operators. This report shall consider the 12-month period May 1st through the following April 30th as the annual period and shall be submitted by July 15, 2017 and annually thereafter. This report shall include an update on the status of each inflow reduction project completed in fulfillment of S4.E.2 (above) including the funds expended or contractually obligated, and the proportion of the project completed as of the end of the reporting period. For each basin or sub-basin in which work has been done within the reporting period, the report shall include the estimated inflow rates before and after the project and the estimated effect on the overall Publicly Owned Treatment Works (POTW) inflow rate.*

According to Ecology's Information Manual for Treatment Plant Operators (Feb. 2004), an Annual I/I Report should include each of the following elements:

1. *The average monthly flow and total precipitation for each month for the past year together with a graph … plotting a comparison of precipitation versus influent flow.*
2. *The maximum monthly and peak hourly hydraulic design capacity for the plant.*

3. *The design population equivalent for the treatment plant and the population served by the facility, per month, for the past year.*
4. *The amount of I/I for each year since the base year and the percent of maximum monthly design capacity each year's I/I represents.*
5. *The percent increase or reduction in I/I for each year subsequent to the base year I/I.*
6. *The additional lengths of sewer lines added to the collection system, per month, for the past year. Also include a brief summary of any major sewer rehabilitation or I/I reduction projects.*

The following information and attachments are now being submitted to satisfy these requirements.

I. REPORTING PERIOD AND BASE YEAR

As described in Section S4.E.3 of our current NPDES permit, the annual period for our I/I report is May 1st through April 30th. Accordingly, please note that when this report refers to the "reporting period" or "year", it is referring to the 12-month period from May 1st through April 30th. For any particular year that is referenced in the report, it is denoting the May through April reporting year and the calendar year in which May falls.

For the purposes of selecting an appropriate Base Year, the past twenty years of historical precipitation and plant influent flow data are reviewed annually. A summary of the monthly precipitation totals and influent flow averages for the past twenty years are included in Attachment A.

Since our facility's 2016 I&I report, the May 2011-April 2012 reporting year has been used as the Base Year, as it has reflected Camas' average rainfall, population growth and disposition of the City's sanitary sewer collection system.

From analysis of the historical data, May 2011-April 2012 continues to best an average, annual rainfall in Camas and therefore continues to serve as the Base Year for the purposes of this report.

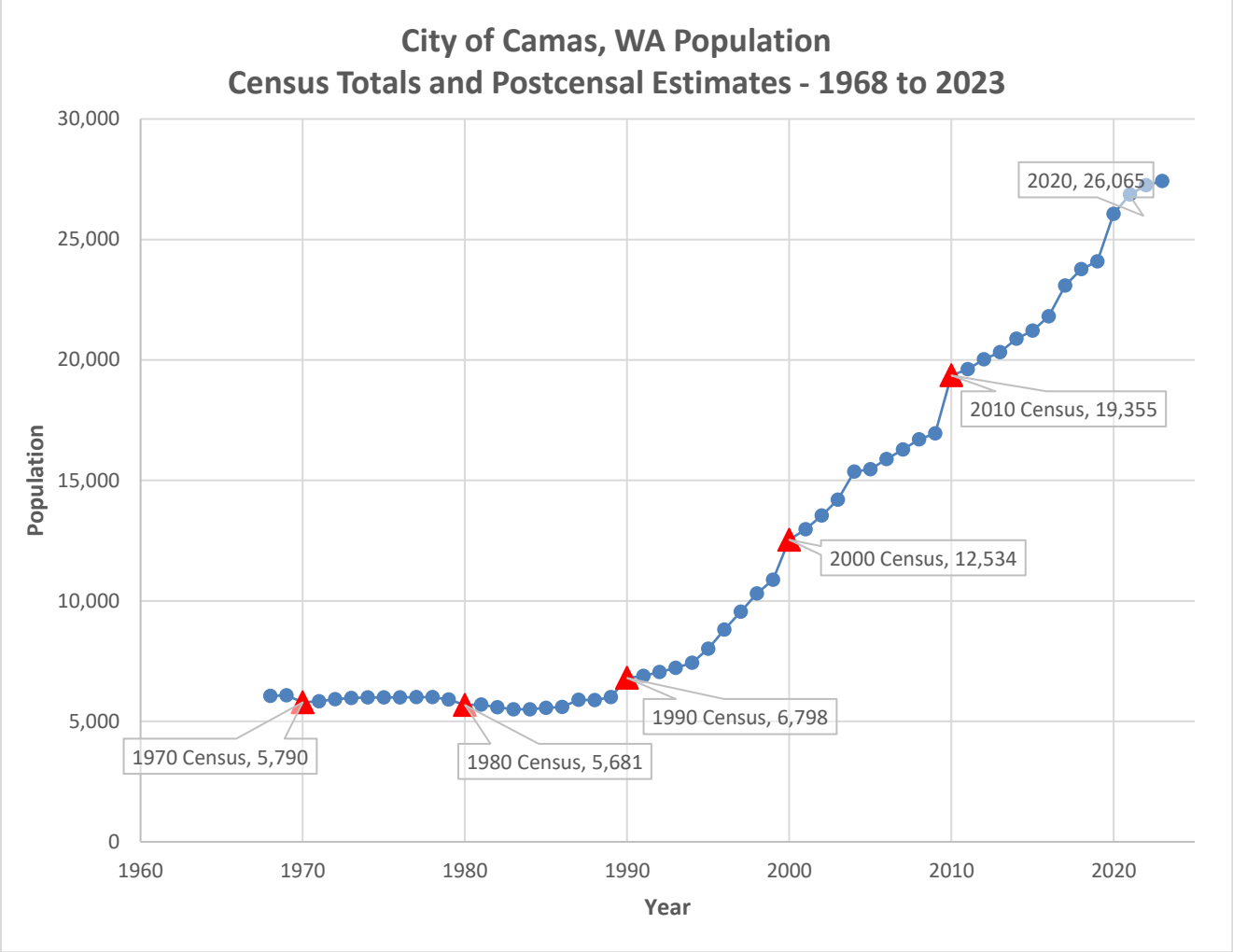
For the twenty-year period of May 1, 2003 to April 30, 2023, the average 12-month rainfall in Camas was 47.56 inches. From May 1, 2011 to April 30th 2012, the rainfall was 47.60, only 1.27 inches more than the twenty-year average. This represented the closest annual total to the twenty-year average, of all twenty years of data reviewed.

TABLE 1 - 12-Month May Through April Rainfall Totals, 2003-2023

	Average	Minimum	Base Year	Maximum
Annual Total Rainfall (in.)	47.56	28.35 (May 2019 – April 2020)	47.60 (May 2011-April 2012)	73.36 (May 2010-April 2011)

In addition to representing the 20-year median rainfall, using 2011-2012 as the "Base Year" incorporates the City's rapid growth that has occurred in the last 20 years. In I/I annual reports prior to 2016, the City of Camas had been using 1989 as the Base Year. Since 1989, the City of Camas has seen rapid growth in population and significant additions to its wastewater collection system. The May 2011-April 2012 period captures that growth,

which has taken place primarily after 1990. The chart below illustrates the City's annual, calendar year, population growth since 1968:



Historical Population Estimates for Camas, WA by Washington State Office of Financial Management
(https://ofm.wa.gov/washington-data-research/population-demographics/population-estimates/april-1-official-population-estimates)

II. INFLOW AND INFILTRATION ANALYSIS

Facility Design Parameters

The maximum monthly hydraulic design capacity for the Camas Wastewater Treatment Plant (WWTP) is 6.10 million gallons per day (MGD) and has a peak hourly hydraulic design capacity of 13.44 MGD. The Design Population Equivalent for the Camas WWTP is 28,075.

Calculated I/I and Annual Rainfall 20-Year History

The following chart is a summary of the calculated I/I, the percent of maximum monthly design capacity the calculated I/I represents, the percentage increase or decrease of I/I from the previous year and the total rainfall for each reporting year from May 2002 to April 2025:

TABLE 2 – Camas Calculated I/I & Rainfall

Year	Calculated I/I (MGD)	I/I as % of Design Capacity	I/I % Increase/Decrease from Prior Year	Total 12-Month Rainfall (in.)
2002	1.069	18%	-15%	41.48
2003	1.258	21%	+18%	37.74
2004	0.661	11%	-47%	36.81
2005	2.093	34%	+217%	53.16
2006	1.400	23%	-33%	47.80
2007	2.145	35%	+53%	48.05
2008	0.911	15%	-58%	49.72
2009	1.242	20%	+36%	49.92
2010	1.615	26%	+30%	73.36
2011	1.511	25%	-6%	47.60
2012	2.340	38%	+55%	51.79
2013	0.591	10%	-75%	39.19
2014	0.985	16%	+67%	38.15
2015	2.277	37%	+131%	48.17
2016	1.920	31%	-16%	57.06
2017	1.021	17%	-47%	40.74
2018	1.052	17%	+3%	31.44
2019	1.541	25%	+47%	28.35
2020	1.334	22%	-13%	48.24
2021	1.400	23%	+5%	57.77
2022	1.264	21%	-16%	54.81
2023	2.266	37%	+79%	58.80
2024	1.734	28%	-23%	55.00
Average				

Yellow Highlight = Base Year

Annual Report Form

Please see Attachment B for the Annual I/I Report form which summarizes the following data:

- The average monthly flow and total precipitation for each month, for the past three years.
- The calculated amount of I/I for each year.
- The percent of maximum monthly design capacity that each period's I/I represents.
- The population served by the facility, per month, for the past three years.
- The additional lengths of sewer lines added to the collection system, per month and per year, for the past three years.
- A summary of the I/I from the past three years, including a comparison with the selected Base Year (2011)

Charts

Please see Attachment C for several charts which plot I/I data to illustrate the following:

- Chart I: Comparison of precipitation versus influent flow for each month of the current reporting period.
- Chart II: Comparison of 12-month total precipitation and calculated I/I, for each year since the Base Year.
- Chart III: Monthly Average Influent Flow at the WWTP since the Base Year.
- Chart IV: Monthly Total Rainfall since the Base Year.

III. COLLECTION SYSTEM AND I/I REDUCTION PROJECTS AND MEASURES

Collection System Details

According to the City of Camas' General Sewer Plan, last updated in November of 2009, the city sanitary collection system was comprised of approximately 462,000 linear feet (87.5 miles) of pipe. Since 2009, approximately 165,515 linear feet of sewer line has been added, giving Camas approximately 627,515 linear feet (118 miles) of sewer line, as of the end of 2024.

In 2024/25, approximately 17,149 linear feet of new sanitary sewer line were added to the City's system. All of which were installed in connection with residential development projects occurring throughout the year.

Camas' collection system is comprised of a combination of both traditional gravity sewer, force mains, pressure sewer lines, and 28 lift stations. Please see Attachment B for the lengths of sewer lines added to the collection system, per month and per year, for the past three years.

If you have any questions regarding this report or require any additional information, please do not hesitate to contact the Camas Wastewater Treatment Facility at (360) 834-3263.

Best Regards,

Jacob Taylor

Jacob Taylor
Lead Wastewater Treatment Plant Operator

Cc: Rob Charles, Utilities Manager

ATTACHMENT A - Camas 20-Year WWTP Influent Flow and Rainfall

WWTP Design Capacity	
Peak Day Design Flow (MGD):	10.04
Max. Monthly Average Design (MMAD) Flow (MGD):	6.10
Design Population Equivalent:	28,075

Monthly Average Influent Flow (MGD) - MAY 1, 2004 to APRIL 30, 2024

Month	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	AVG
May	1.622	1.953	2.607	2.177	2.064	2.056	2.255	2.370	2.563	2.446	2.576	2.299	2.155	2.259	2.263	1.946	2.050	2.319	2.138	2.886	2.230	2.733	**2.271**
June	1.520	1.996	2.083	2.095	1.997	2.092	1.918	2.833	2.190	2.480	2.149	2.623	2.118	2.244	2.019	1.983	1.992	2.409	2.156	2.838	2.180	2.205	**2.187**
July	1.483	1.832	1.925	2.023	1.954	1.903	1.904	1.973	1.994	2.129	2.015	2.915	2.028	2.135	1.831	1.828	1.961	1.972	2.084	2.098	2.068	2.021	**2.004**
August	1.450	2.011	1.981	2.050	1.948	2.015	1.921	1.955	2.029	2.093	2.033	3.284	2.088	2.112	1.881	1.890	1.943	2.043	2.146	2.109	2.141	2.049	**2.053**
September	1.549	1.948	2.031	2.087	2.035	1.971	1.963	2.055	2.062	2.079	2.454	2.935	2.187	2.169	1.985	1.884	2.151	2.192	2.284	2.140	2.199	2.288	**2.120**
October	1.619	2.089	2.212	2.101	2.252	2.013	2.078	2.226	2.148	2.518	2.324	2.961	2.292	3.185	2.262	2.035	2.199	2.231	2.493	2.294	2.314	2.619	**2.294**
November	1.903	2.202	2.700	3.423	2.484	2.391	2.510	3.057	2.653	3.312	2.528	2.849	2.867	3.312	2.764	2.178	2.143	2.691	3.187	2.842	2.732	3.525	**2.739**
December	2.573	2.494	3.086	3.148	3.465	2.433	2.580	3.364	2.396	3.540	2.556	2.560	4.305	3.191	2.465	2.648	2.461	2.991	3.401	3.362	3.553	3.756	**3.015**
January	2.708	2.262	4.018	2.798	4.094	2.814	3.146	3.042	3.222	2.995	2.606	2.810	3.548	2.988	2.852	2.480	3.484	3.306	3.484	3.044	4.334	3.269	**3.150**
February	2.414	2.165	2.584	2.754	2.643	2.061	2.567	2.648	2.748	2.522	2.422	2.863	3.251	4.031	2.405	2.880	2.644	3.222	2.570	2.710	3.244	3.438	**2.763**
March	1.887	2.345	2.576	2.819	2.442	2.504	2.388	3.570	3.505	4.419	2.314	2.784	3.099	3.442	2.552	2.156	2.476	2.470	2.949	3.141	2.932	3.420	**2.827**
April	1.627	2.156	2.377	2.327	2.302	2.327	2.308	2.904	2.898	2.428	2.191	2.425	2.321	2.643	2.710	2.639	2.330	2.139	2.952	3.320	2.517	2.749	**2.481**
AVG	**1.863**	**2.121**	**2.515**	**2.483**	**2.473**	**2.215**	**2.295**	**2.666**	**2.534**	**2.747**	**2.347**	**2.776**	**2.688**	**2.809**	**2.332**	**2.212**	**2.320**	**2.499**	**2.654**	**2.732**	**2.704**	**2.565**	**2.464**
MAX	**2.708**	**2.494**	**4.018**	**3.423**	**4.094**	**2.814**	**3.146**	**3.570**	**3.505**	**4.419**	**2.606**	**3.284**	**4.305**	**4.031**	**2.852**	**2.880**	**3.484**	**3.306**	**3.484**	**3.362**	**4.334**	**3.756**	**3.389**
MIN	**1.450**	**1.832**	**1.925**	**2.023**	**1.948**	**1.903**	**1.904**	**1.955**	**1.994**	**2.079**	**2.015**	**2.299**	**2.028**	**2.112**	**1.831**	**1.828**	**1.943**	**1.972**	**2.084**	**2.098**	**2.068**	**2.021**	**1.961**
Annual I/I	**1.258**	**0.661**	**2.093**	**1.400**	**2.145**	**0.911**	**1.242**	**1.615**	**1.511**	**2.340**	**0.591**	**0.985**	**2.277**	**1.920**	**1.021**	**1.052**	**1.541**	**1.334**	**1.400**	**1.264**	**2.266**	**1.734**	**1.428**
% of MMAD Flow	21%	11%	34%	23%	35%	15%	20%	26%	25%	38%	10%	16%	37%	31%	17%	17%	25%	22%	23%	21%	37%	28%	23%
% +/- vs Prior Year	-15%	-47%	217%	-33%	53%	-58%	36%	30%	-6%	55%	-75%	67%	131%	-16%	-47%	3%	47%	-13%	5%	-10%	62%	37%	16%

YELLOW = BASE YEAR

Monthly Total Rainfall (in.) - MAY 1, 2004 to APRIL 30, 2024

Month	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	AVG
May	2.00	1.65	6.14	2.94	2.11	2.11	4.44	3.93	4.94	4.58	4.64	2.35	0.50	2.10	3.13	0.46	2.10	3.37	2.46	6.63	1.44	4.93	**3.13**
June	0.52	1.52	3.22	1.24	2.01	2.19	1.18	7.03	1.16	4.83	1.88	2.05	0.52	2.06	1.74	1.87	0.80	5.54	2.40	6.73	1.51	2.20	**2.46**
July	0.00	0.24	0.71	0.67	0.74	0.04	0.09	0.35	0.85	0.41	0.00	1.07	0.57	1.17	0.00	0.06	0.70	0.09	0.00	0.43	0.00	0.18	**0.38**
August	0.09	3.91	0.74	0.02	0.99	1.98	0.60	0.90	0.09	0.01	0.26	0.13	0.90	0.15	0.27	0.47	0.75	0.33	0.16	0.00	0.83	1.36	**0.68**
September	1.36	2.45	2.37	2.35	3.46	0.81	1.18	3.64	1.00	0.05	5.98	1.02	1.25	1.76	2.66	1.03	3.42	4.77	4.64	0.01	2.02	2.38	**2.26**
October	3.09	5.32	5.02	2.44	5.15	4.43	4.11	6.39	2.78	9.52	1.47	6.26	4.80	10.43	5.13	4.39	3.95	2.45	4.89	5.16	2.85	5.12	**4.78**
November	5.57	3.19	5.10	12.77	6.29	11.17	7.59	10.76	8.39	11.62	3.33	3.56	5.31	6.39	7.21	3.62	1.65	7.13	10.43	7.49	7.40	9.20	**7.05**
December	8.99	4.87	8.88	6.57	10.54	7.27	5.98	10.26	3.77	10.58	2.73	6.58	13.84	4.24	3.21	6.33	3.08	7.96	8.06	6.01	12.01	11.04	**7.40**
January	6.73	2.28	11.35	2.69	4.82	6.30	8.87	6.87	7.69	4.52	3.68	3.56	7.17	3.64	6.15	3.19	6.71	8.64	7.88	5.83	15.57	3.92	**6.28**
February	5.68	1.81	2.92	5.54	2.59	2.19	4.97	6.05	3.95	2.01	5.83	4.17	5.49	9.68	3.05	4.67	1.44	4.62	3.36	3.54	6.54	6.30	**4.38**
March	2.28	4.65	3.86	6.79	3.71	6.97	6.17	9.75	9.98	0.74	5.35	4.89	5.31	9.85	3.49	1.66	2.97	2.63	5.37	5.85	4.13	6.58	**5.07**
April	1.43	4.92	2.85	3.78	5.64	4.26	4.74	7.43	3.00	2.92	4.04	2.51	2.51	5.59	4.70	3.69	0.78	0.71	8.12	7.13	4.50	1.79	**3.87**
TOTAL	**37.74**	**36.81**	**53.16**	**47.80**	**48.05**	**49.72**	**49.92**	**73.36**	**47.60**	**51.79**	**39.19**	**38.15**	**48.17**	**57.06**	**40.74**	**31.44**	**28.35**	**48.24**	**57.77**	**54.81**	**58.80**	**55.00**	**47.89**
AVG	**3.15**	**3.07**	**4.43**	**3.98**	**4.00**	**4.14**	**4.16**	**6.11**	**3.97**	**4.32**	**3.27**	**3.18**	**4.01**	**4.76**	**3.40**	**2.62**	**2.36**	**4.02**	**4.81**	**4.57**	**4.90**	**4.58**	**3.92**
MAX	**8.99**	**5.32**	**11.35**	**12.77**	**10.54**	**11.17**	**8.87**	**10.76**	**9.98**	**11.62**	**5.98**	**6.58**	**13.84**	**10.43**	**7.21**	**6.33**	**6.71**	**8.64**	**10.43**	**7.49**	**15.57**	**11.04**	**9.25**
MIN	**0.00**	**0.24**	**0.71**	**0.02**	**0.74**	**0.04**	**0.09**	**0.35**	**0.09**	**0.01**	**0.00**	**0.13**	**0.50**	**0.15**	**0.00**	**0.06**	**0.70**	**0.09**	**0.00**	**0.00**	**0.00**	**0.18**	**0.20**

20-Year Rainfall Summary		
20-Year Average Annual Rainfall (in.):	47.89	
20-Year Maximum Annual Rainfal (in.):	73.36	(2010)
20-Year Minimum Annual Rainfall (in.):	28.35	(2019)

ATTACHMENT B

City of Camas WWTP (WA0020249) - Annual Infiltration and Inflow Report

May 2024 to April 2025

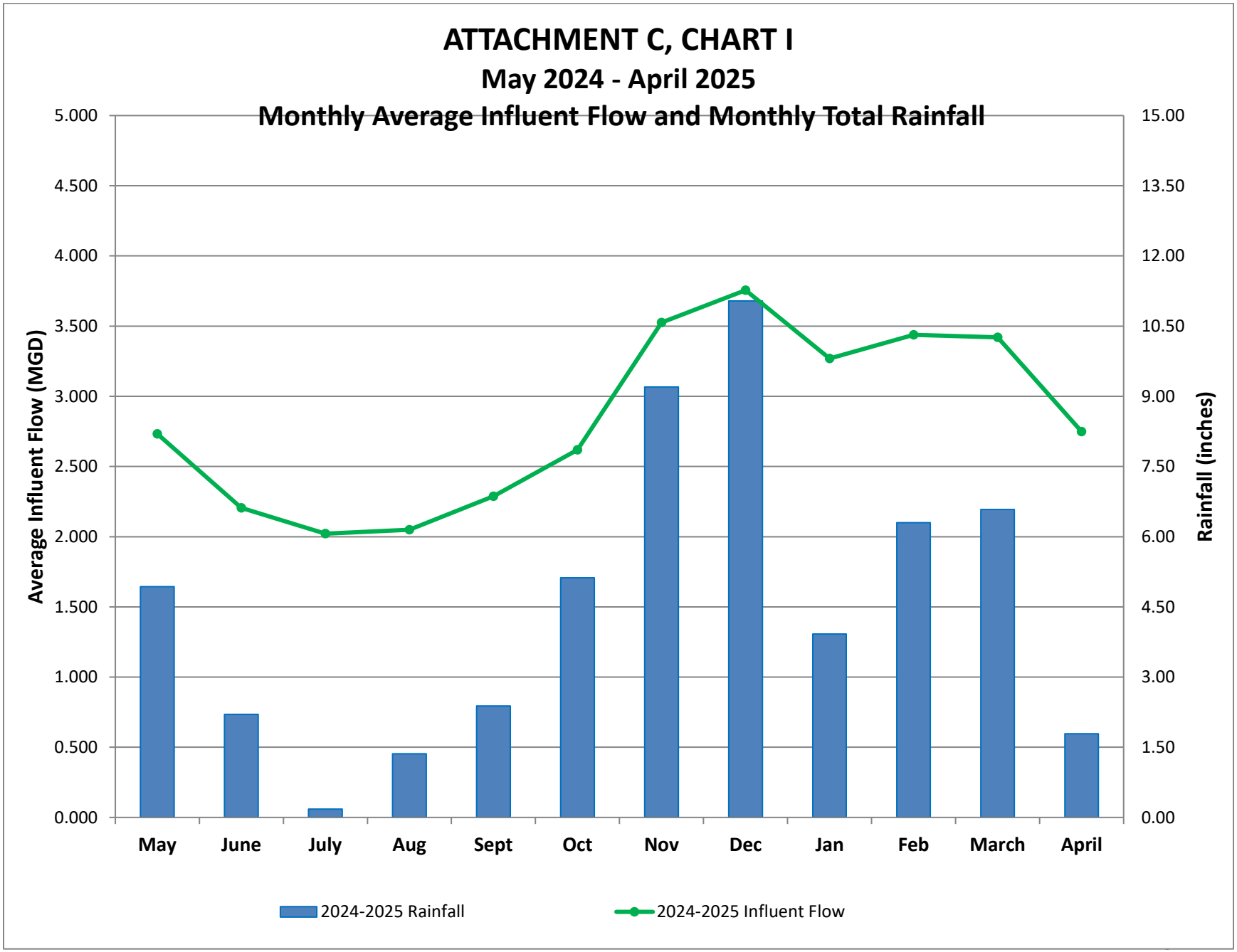
WWTP Design Capacity

Peak Hourly Hydraulic Design Flow (MGD):	**13.44**
Maximum Monthly Average Design Flow (MGD):	**6.10**
Design Population Equivalent:	**28,075**

	Monthly Average WWTP Influent Flow (MGD)			Total Monthly Rainfall (inches)			Population Served			Additional Sewer Lines Added (ft.)		
Month	**2022**	**2023**	**2024**	**2022**	**2023**	**2024**	**2022**	**2023**	**2024**	**2022**	**2023**	**2024**
May	2.886	2.230	2.733	6.63	1.44	4.93	27,250	27,420	27,420	0	1,269	1,269
June	2.838	2.180	2.205	6.73	1.51	2.20	27,250	27,420	27,420	0	0	0
July	2.098	2.068	2.021	0.43	0.00	0.18	27,250	27,250	27,250	0	0	0
Aug	2.109	2.141	2.049	0.00	0.83	1.36	27,250	27,420	27,420	0	4,135	4,135
Sept	2.140	2.199	2.288	0.01	2.02	2.38	27,250	27,420	27,420	0	0	0
Oct	2.294	2.314	2.619	5.16	2.85	5.12	27,250	27,420	27,420	0	0	0
Nov	2.842	2.732	3.525	**7.49**	7.40	9.20	27,250	27,420	27,420	0	0	0
Dec	**3.362**	3.553	**3.756**	6.01	12.01	**11.04**	27,250	27,420	27,420	0	0	0
Jan	3.044	**4.334**	3.269	5.83	**15.57**	3.92	27,420	27,420	27,660	0	0	1351
Feb	2.710	3.244	3.438	3.54	6.54	6.30	27,420	27,420	27,660	0	0	0
March	3.141	2.932	3.420	5.85	4.13	6.58	27,420	27,420	27,660	0	0	6098
April	3.320	2.517	2.749	7.13	4.50	1.79	27,420	27,420	27,660	0	2,474	4296
Period Total:	32.784	32.445	34.072	54.81	58.80	55.00			**Total Added (feet):**	0	7,878	17,149
Low Month:	2.098	2.068	2.021	0.00	0.00	0.18			**Total Added (miles):**	0.00	1.49	3.25
High Month:	**3.362**	**4.334**	**3.756**	**7.49**	**15.57**	**11.04**						
Annual Average:	2.732	2.704	2.839	4.57	4.90	4.58						
Period I/I:	1.264	2.266	1.734									

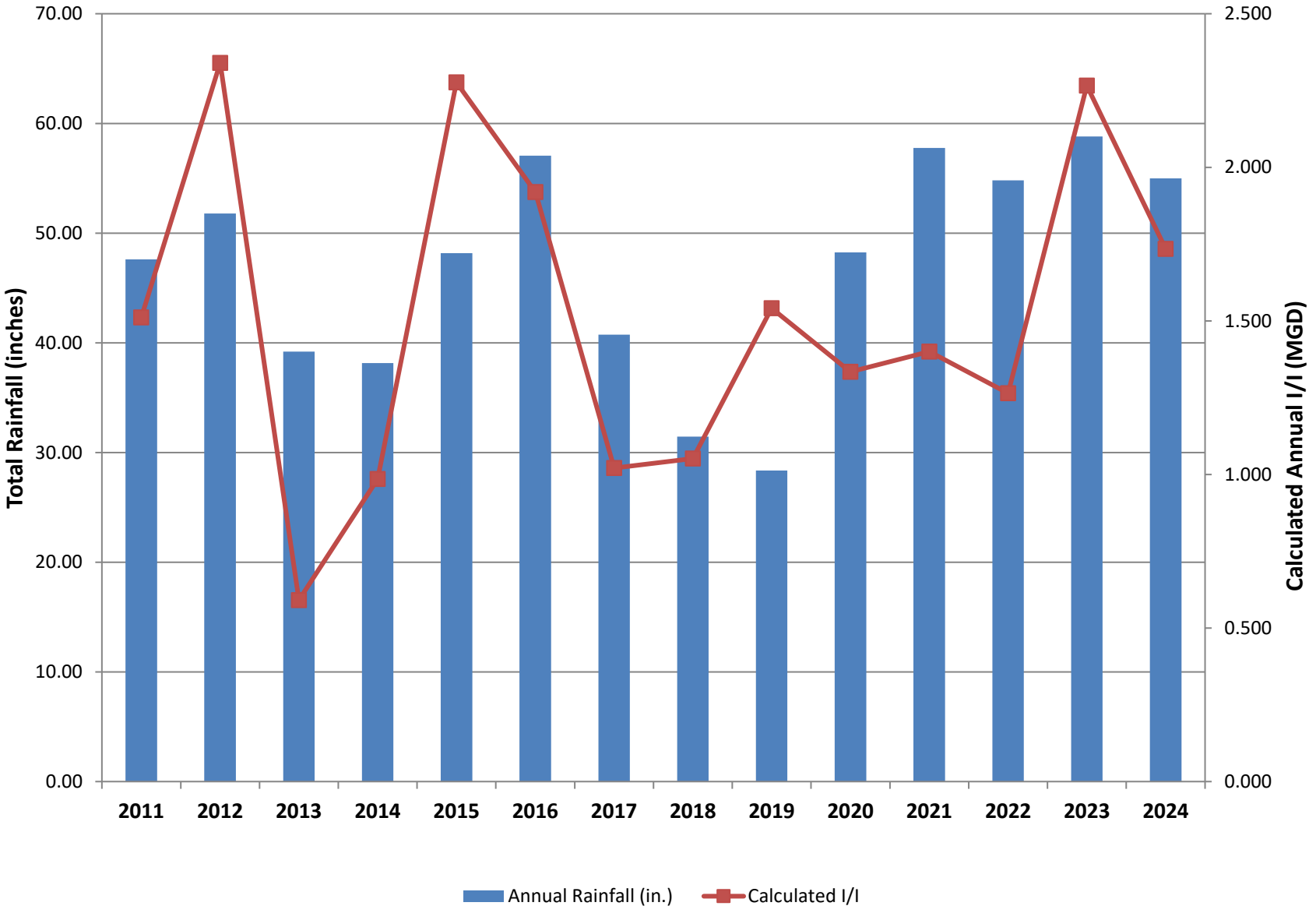
INFILTRATION/INFLOW SUMMARY

Year	I/I	% Increase/Decrease From Base I/I	% Increase/Decrease from Prior Year	% of Max Month. Design Flow	Total Rainfall
Base Year: 2011	***1.511***	***n/a***	***-6%***	***25%***	***47.60***
2022-2023	1.264	-16%	-16%	21%	54.81
2023-2024	2.266	50%	79%	37%	58.80
2024-2025	1.734	15%	-23%	28%	55.00


ATTACHMENT C, CHART I
May 2024 - April 2025
Monthly Average Influent Flow and Monthly Total Rainfall
Average Influent Flow (MGD)
Rainfall (inches)
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
15.00
13.50
12.00
10.50
9.00
7.50
6.00
4.50
3.00
1.50
0.00
May
June
July
Aug
Sept
Oct
Nov
Dec
Jan
Feb
March
April
2024-2025 Rainfall
2024-2025 Influent Flow

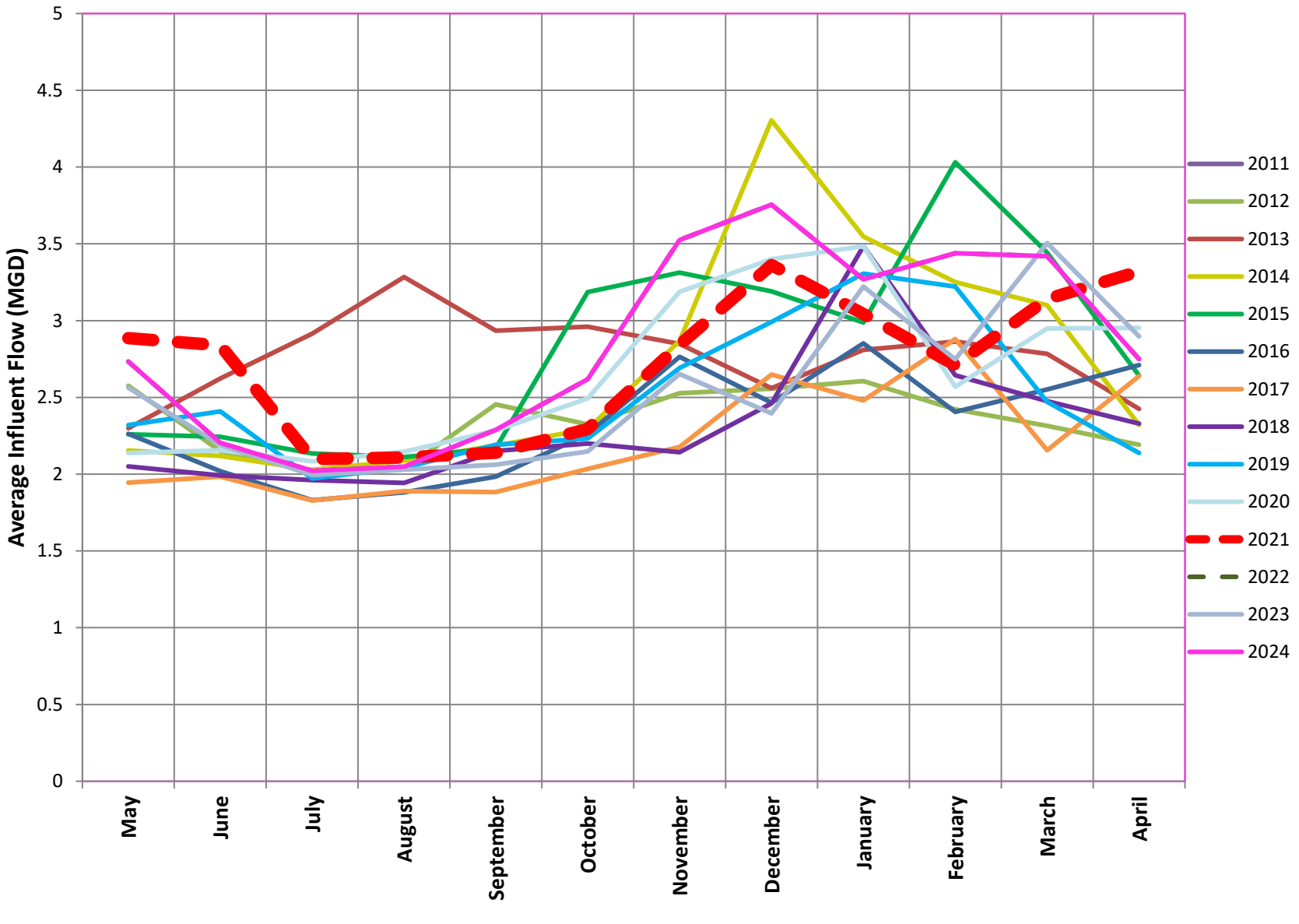
ATTACHMENT C, CHART II

Annual Rainfall & Calculated I/I Since Base Year (2011)



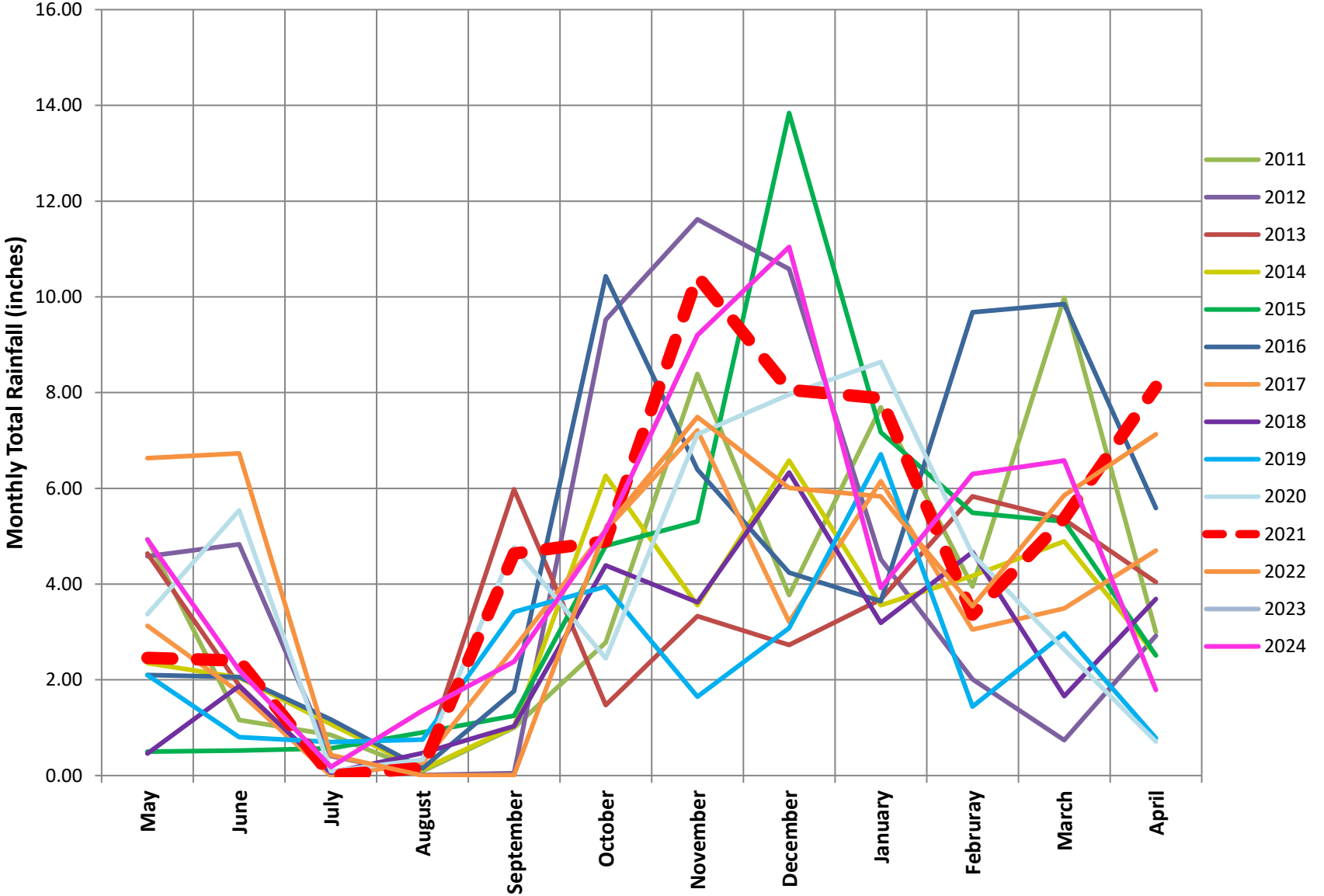
ATTACHMENT C, CHART III

WWTP Monthly Average Influent Flow Since Base Year (2011)



ATTACHMENT C, CHART IV

Monthly Total Rainfall Since Base Year (2011)



APPENDIX G

LOCAL LIMITS PROGRAM REPORTS

~ To be included in a future submittal. ~

APPENDIX H

WASTEWATER TREATMENT PLANT PERMITS

DEPARTMENT OF ECOLOGY
State of Washington

Issuance Date: July 1, 2025
Effective Date: August 1, 2025
Expiration Date: July 31, 2030

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT WA0020249

State of Washington
DEPARTMENT OF ECOLOGY

Southwest Region Office
PO Box 47775
Olympia, WA 98504-7775

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1342 et seq

City of Camas
616 Northeast 4th Avenue
Camas, Washington 98607

is authorized to discharge in accordance with the Special and General Conditions that follow.

Facility Location: 1129 Southeast Polk Street Camas, WA 98607
Treatment Type: Activated sludge with nutrient removal, pH adjustment, filtration and UV disinfection
Receiving Water: Columbia River, RM 121

Digitally signed by Kolosseus, Andrew (ECY)
Date: 2025.06.24 14:57:21 -07'00'

Andrew Kolosseus
Water Quality Section Manager
Southwest Region Office
Washington State Department of Ecology

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SUMMARY OF PERMIT SUBMITTALS

Refer to the Special and General Conditions of this permit for additional submittal requirements.

Table 1 - Summary of permit submittals

Permit section	Submittal	Frequency	First submittal date
S3.A	Monthly Discharge Monitoring Report (DMR)	Monthly	September 15, 2025
S3.A	Quarterly Discharge Monitoring Report (DMR)	Quarterly	January 15, 2026
S3.A	Annual Discharge Monitoring Report (DMR)	Annual	January 15, 2027
S3.F	Reporting permit violations	As necessary	
S4.B	Plans for maintaining adequate capacity	As necessary	
S4.D	Notification of new or altered sources	As necessary	
S5.F	Bypass notification	As necessary	
S5.G	Operations and maintenance manual review confirmation letter	Annually	October 15, 2025
S6.A	Notify Ecology when Industrial Users violate discharge prohibitions	As necessary	
S6.B.1	Notify Ecology of any proposed discharger which may be a SIU	As necessary	
S6.C	Industrial User survey submittal	1/permit cycle	July 31, 2028
S6.E	Local Limit Evaluation	Every 5 years	August 1, 2026
S8	Application for permit renewal	1/permit cycle	February 1, 2030
S9.A	Spill control plan update	As necessary	
S10.A	Sediment sampling and analysis plan	1/permit cycle	February 15, 2026
S10.B	Sediment data report	1/permit cycle	February 15, 2027
S11	Outfall Evaluation	Every 5 years	October 31, 2029
S12.A	Acute toxicity: effluent test results for permit renewal application	Twice per permit cycle	August 1, 2028 February 1, 2029
S13.A	Chronic toxicity: effluent test results for permit renewal application	Twice per permit cycle	August 1, 2028 February 1, 2029
G1	Notice of change in authorization	As necessary	
G4	Reporting planned changes	As necessary	
G5	Engineering report for construction or modification activities	As necessary	
G7	Notice of permit transfer	As necessary	
G10	Duty to provide information	As necessary	
G20	Compliance schedules	As necessary	
G21	Contract submittal	As necessary	

SPECIAL CONDITIONS

S1. Discharge limits

S1.A. Effluent limits

All discharges and activities authorized by this permit must comply with the terms and conditions of this permit. The discharge of any of the following pollutants more frequently than, or at a level in excess of, that identified and authorized by this permit violates the terms and conditions of this permit.

Beginning on the effective date of this permit, the Permittee may discharge treated domestic wastewater to the Columbia River at the permitted location subject to compliance with the following limits:

Table 2 – Effluent limits: Outfall 0001

Latitude: 45.57479° N Longitude: 122.391897° W

Parameter	Average Monthly [a]	Average Weekly [b]
Biochemical Oxygen Demand (5-day) (BOD_5)	20 mg/L	30 mg/L
BOD_5	842 lbs/day	1,264 lbs/day
BOD_5	85% removal of influent BOD_5	N/A
Total Suspended Solids (TSS)	20 mg/L	30 mg/L
TSS	1,017 lbs/day	1,525 lbs/day
TSS	85% removal of influent TSS	N/A
Heat Load [d]	5.87×10^8 kilocalories per day (kcal/day)	N/A

Parameter	Minimum	Maximum
pH	6.0 standard units	9.0 standard units

Parameter	Monthly Geometric Mean	Weekly Geometric Mean
Fecal Coliform Bacteria [c]	200/100 mL	400/100 mL

Parameter	Average Monthly	Average Weekly [b]
Total Ammonia (WQ-based) – June - September	20 mg/L	30 mg/L
Total Ammonia (WQ-based) – October - May	7 mg/L	11 mg/L

[a] Average monthly effluent limit means the highest allowable average of daily discharges over a calendar month. To calculate the discharge value to compare to the limit, you add the value of

each daily discharge measured during a calendar month and divide this sum by the total number of daily discharges measured.

[b] Average weekly discharge limit means the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week. See footnote c for bacteria calculations.

[c] Ecology provides directions to calculate the monthly and the 7-day geometric mean in the *Information Manual for Treatment Plant Operators* (Ecology, 2004).

[d] Applicable only from June 1 – September 30

S1.B. Mixing zone authorization

Mixing zone for Outfall 0001

The following paragraphs define the maximum boundaries of the mixing zones.

Chronic mixing zone

The width of the chronic mixing zone is limited ¼ of the width of the Columbia River (approximately 1,000 feet). The length of the chronic mixing zone extends 100 feet upstream and 321 feet downstream of the outfall. The mixing zone extends from the bottom to the top of the water column. The mixing zone must not utilize greater than 25% of the flow. The concentration of pollutants at the edge of the chronic zone must meet chronic aquatic life criteria and human health criteria.

Acute mixing zone

The width of the acute mixing zone is limited to a distance of 1,000 feet in any horizontal direction from the outfall. The length of the acute mixing zone extends 10 feet upstream and 32 feet downstream of the outfall. The mixing zone extends from the bottom to the top of the water column. The acute mixing zone must not utilize greater than 2.5% of the flow. The concentration of pollutants at the edge of the acute zone must meet acute aquatic life criteria.

Table 3 – Dilution factors

Criteria	Dilution factor
Acute Aquatic Life Criteria	27 (summer) 23 (winter)
Chronic Aquatic Life Criteria	185 (summer) 121 (winter)
Human Health Criteria - Carcinogen	185
Human Health Criteria - Non-carcinogen	185

S2. Monitoring requirements

S2.A. Monitoring schedule

The Permittee must monitor in accordance with the following schedule and the requirements specified in Appendix A.

Table 4 – Wastewater influent

Wastewater influent means the raw sewage flow from the collection system into the treatment facility. Sample the wastewater entering the headworks of the treatment plant excluding any side-stream returns from inside the plant.

Parameter	Units & speciation	Minimum sampling frequency	Sample type
Flow	MGD	Continuous [c]	Metered/Recorded
BOD_5	mg/L	4/week [h]	Composite Sample (24 hour) [a]
BOD_5	lbs/day	4/week	Calculated [b]
TSS	mg/L	4/week	Composite Sample (24 hour) [a]
TSS	lbs/day	4/week	Calculated [b]

Table 5 – Final wastewater effluent

Final wastewater effluent means wastewater exiting the last treatment process or operation. Typically, this is after or at the exit from the chlorine contact chamber or other disinfection process. The Permittee may take effluent samples for the BOD_5 analysis before or after the disinfection process. If taken after, the Permittee must dechlorinate and reseed the sample.

Parameter	Units & speciation	Minimum sampling frequency	Sample type
Flow	MGD	Continuous [c]	Metered/Recorded
BOD_5	mg/L	4/week [h]	Composite Sample (24 hour) [a]
BOD_5	lbs/day	4/week	Calculated [b]
BOD_5	% removal	Monthly [i]	Calculated [d]
TSS	mg/L	4/week	Composite Sample (24 hour) [a]
TSS	lbs/day	4/week	Calculated [b]
TSS	% removal	Monthly	Calculated [d]
Fecal Coliform [f]	# /100 ml	4/week	Grab [e]
E. coli [j]	#/100 ml	Monthly	Grab
pH [g]	standard units	Continuous [c]	Metered/Recorded
Temperature [k]	°C	Continuous	Metered/Recorded
Heat Load [l]	Kcal/day	Monthly (June – September)	Calculated
Total Ammonia	mg/L as N	4/week	Composite Sample (24 hour)

Table 6 – Permit renewal application requirements, final wastewater effluent

The Permittee must record and report the wastewater treatment plant flow discharged on the day it collects the sample for priority pollutant testing with the discharge monitoring report. Data collected for pretreatment monitoring (Table 7) may be used to satisfy this monitoring requirement.

Parameter	Units & speciation	Minimum sampling frequency	Sample type
Dissolved Oxygen	mg/L	Once per year	Grab [e]
Total Kjeldahl Nitrogen	mg/L as N	Once per year	24-Hour Composite
Nitrate plus Nitrite	mg/L as N	Once per year	24-Hour Composite
Oil and Grease	mg/L	Once per year	Grab
Phosphorus (Total)	mg/L as P	Once per year	24-Hour Composite
Total Dissolved Solids	mg/L	Once per year	24-Hour Composite
Total Hardness	mg/L	Once per year	24-Hour Composite
Cyanide	µg/L	Once per year	Grab
Total Phenolic Compounds	µg/L	Once per year	Grab
Priority Pollutants (PP) – Total Metals [m]	µg/L; ng/L for Mercury	Once per year	24-Hour Composite Grab for Mercury
PP – Volatile Organic Compounds	µg/L	Once per year	Grab
PP – Acid-extractable Compounds	µg/L	Once per year	24-Hour Composite
PP – Base-neutral Compounds	µg/L	Once per year	24-Hour Composite
PP – Dioxin	pg/L	Once per year	24-Hour Composite
PP – Pesticides/PCBs	µg/L	Once per year	24-Hour Composite

Table 7 – Pretreatment Monitoring

The Permittee must monitor the following parameters in the influent at the headworks, effluent, and biosolids in accordance with pretreatment requirements in Special Condition S6.D.

Parameter	Units & speciation	Minimum sampling frequency	Sample location(s)	Sample type
pH	Standard Units	Quarterly [n]	Influent Biosolids	Grab [e]
Oil and Grease	mg/L	Quarterly [n]	Influent Effluent	Grab
Cyanide	µg/L	Quarterly [n]	Influent Effluent	Grab
Total Phenolic Compounds	µg/L	Quarterly [n]	Influent Effluent	Grab
Chromium (hex), dissolved	µg/L	Quarterly [n]	Influent Effluent	24-Hour composite

Molybdenum, total	µg/L; mg/kg for biosolids	Quarterly [n]	Influent Biosolids	24-Hour composite
Priority Pollutants (PP) – Total Metals [m]	µg/L; ng/L for mercury; mg/kg for biosolids	Quarterly [n]	Influent Effluent Biosolids	24-Hour composite; Grab for mercury
PP – Volatile Organic Compounds	µg/L	Once per year	Influent Effluent	Grab
PP – Acid-extractable Compounds	µg/L	Once per year	Influent Effluent	24-Hour composite
PP – Base-neutral Compounds	µg/L	Once per year	Influent Effluent	24-Hour composite
PP – Dioxin	pg/L	Once per year	Influent Effluent	24-Hour Composite
PP – Pesticides/PCBs	µg/L or ng/L	Once per year	Influent Effluent	24-Hour composite

Table 8 – Additional monitoring

Monitoring type	Description
Sediment study	As specified in condition S10
Acute whole effluent toxicity testing	As specified in condition S12
Chronic whole effluent toxicity testing	As specified in condition S13

Footnotes:

[a] Twenty-four (24)-hour composite means a series of individual samples collected over a 24-hour period into a single container and analyzed as one sample.

[b] Calculated means figured concurrently with the respective sample, using the following formula: Concentration (in mg/L) X Flow (in MGD) X Conversion Factor (8.34) = lbs/day

[c] Continuous means uninterrupted except for brief lengths of time for calibration, power failure, or unanticipated equipment repair or maintenance. The time interval for the associated data logger must be no greater than 30 minutes. Sample every three hours when continuous monitoring is not possible.

[d] Calculate the percent removal of BOD_5 and TSS as follows: Percent (%) removal = [(Influent concentration (mg/L) – Effluent concentration (mg/L)]/[Influent concentration (mg/L)] x 100%

[e] Grab means an individual sample collected over a fifteen (15) minute, or less, period.

[f] Report a numeric value for fecal coliforms following the procedures in the Information Manual for Wastewater Treatment Plant Operators, Publication 04-10-020 (Ecology, 2004). Do not report a result as Too Numerous to Count (TNTC).

[g] Report the instantaneous maximum and minimum pH daily. Do not average pH values.

[h] 4/week means four (4) times during each calendar week and on a rotational basis throughout the days of the week.

[i] Monthly means once every calendar month during alternate weeks.

[j] *E. coli* and Fecal Coliform analyses must occur on the same day. Split a single grab sample upon collection, prior to laboratory analysis.

[k] Conduct temperature grab sampling when the effluent is at or near its daily maximum temperature, which usually occurs in the late afternoon. If measuring temperature continuously, report a daily maximum from half-hour measurements over a 24-hour period. Continuous monitoring instruments must achieve an accuracy of 0.2 degrees C, and the Permittee must verify accuracy annually.

[l] The average monthly head load is calculated as the product of the average monthly effluent temperature (°C) multiplied by the average monthly flow (MGD) and the conversion factor of 3.776×10^6. The average monthly temperature is the sum of the average daily temperature divided by the number of discharges measured during the month. The average monthly flow is the same value as historically reported as average monthly flow. It is the sum of all the flows in the month divided by the number of days in the month.

[m] Priority Pollutant Scans for Total Metals must use total recoverable metal laboratory methods for all parameters except for hexavalent chromium. The 40 Code of Federal Regulations (CFR) 136 method for hexavalent chromium measures only its dissolved form.

[n] Quarterly sampling periods are January through March, April through June, July through September and October through December starting October 1, 2025. Begin quarterly monitoring for the quarter beginning on October 1, 2025, and submit results by January 15, 2026.

S2.B. Sampling and analytical procedures

Samples and measurements taken to meet the requirements of this permit must represent the volume and nature of the monitored parameters, including representative sampling of any unusual discharge or discharge condition, including bypasses, upsets, and maintenance-related conditions affecting effluent quality.

Sampling and analytical methods used to meet the monitoring requirements specified in this permit must conform to the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136 (or as applicable in 40 CFR subchapter N [Parts 400–471] or 40 CFR subchapter O [Parts 501-503]) unless otherwise specified in this permit. Ecology may specify alternative methods for parameters without limits and for those parameters without an EPA approved test method in 40 CFR Part 136.

S2.C. Flow measurement, field measurement, and continuous monitoring devices

The Permittee must:

1. Select and use appropriate flow measurement, field measurement, and continuous monitoring devices and methods consistent with accepted scientific practices.
2. Install, calibrate, and maintain these devices to ensure the accuracy of the measurements is consistent with the accepted industry standard, the manufacturer's recommendation, and approved O&M manual procedures for the device and the wastestream.
3. Calibrate continuous monitoring instruments weekly unless it can demonstrate a longer period is sufficient based on monitoring records. The Permittee:
   a. May calibrate apparatus for continuous monitoring of dissolved oxygen by air calibration.
   b. Must calibrate continuous pH measurement instruments according to the manufacturer's requirements.
4. Calibrate micro-recording temperature devices, known as thermistors, using protocols from *Standard Operating Procedure EAP080, Version 2.2, Continuous Temperature Monitoring of Freshwater Rivers and Streams* (Ecology, 2022). Calibration as specified in this document is not required if the Permittee uses recording devices certified by the manufacturer.
5. Use field measurement devices as directed by the manufacturer and do not use reagents beyond their expiration dates.
6. Establish a calibration frequency for each device or instrument in the O&M manual that conforms to the frequency recommended by the manufacturer.
7. Calibrate flow-monitoring devices at a minimum frequency of at least one calibration per year.
8. Maintain calibration records for at least three years.

S2.D. Laboratory accreditation

The Permittee must ensure that all monitoring data required by Ecology for permit specified parameters is prepared by a laboratory registered or accredited under the provisions of Chapter 173-50 Washington Administrative Code (WAC), Accreditation of Environmental Laboratories. Flow, temperature, settleable solids, conductivity, pH, and internal process control parameters are exempt from this requirement. The Permittee must obtain accreditation for conductivity and pH if it must receive accreditation or registration for other parameters.

S2.E. Request for reduction in monitoring

The Permittee may request a reduction of the sampling frequency after twelve (12) months of monitoring. Ecology will review each request and at its discretion grant the request when it reissues the permit or by a permit modification.

The Permittee must:

1. Provide a written request.

2. Clearly state the parameters for which it is requesting reduced monitoring.
3. Clearly state the justification for the reduction.

S3. Reporting and recording requirements

The Permittee must monitor and report in accordance with the following conditions. Falsification of information submitted to Ecology is a violation of the terms and conditions of this permit.

S3.A. Discharge Monitoring Reports

The first monitoring period begins on the effective date of the permit (unless otherwise specified). The Permittee must:

1. Summarize, report, and submit monitoring data obtained during each monitoring period on the electronic Discharge Monitoring Report (DMR) form provided by Ecology within the Water Quality Permitting Portal[1]. Include data for each of the parameters tabulated in Special Conditions S2 and as required by the form. Report a value for each day sampling occurred (unless specifically exempted in the permit) and for the summary values (when applicable) included on the electronic form.
2. Submit DMRs no later than the dates specified below, unless otherwise specified in this permit.
3. Submit DMRs for parameters with the monitoring frequencies specified in S2 (monthly, quarterly, annual, etc.) at the reporting schedule identified below. The Permittee must:
   a. Submit **monthly** DMRs by the 15th day of the following month.
   b. Submit **quarterly** DMRs, unless otherwise specified in the permit, by the 15th day of the month following the monitoring period. Quarterly sampling periods are January through March, April through June, July through September, and October through December. The Permittee must submit the first quarterly DMR by (Reserved for Issuance) for the quarter beginning on (Reserved for Issuance).
   c. Submit **annual** DMRs, unless otherwise specified in the permit, by January 15th for the previous calendar year. The annual sampling period is a calendar year, starting (Reserved for Issuance).
4. Enter the “No Discharge” reporting code for an entire DMR, for a specific monitoring point, or a specific parameter as appropriate, if the Permittee did not discharge wastewater or a specific pollutant during a given monitoring period.
5. Report single analytical values below detection as “less than the Detection Level (DL)” by entering the < followed by the numeric value of the detection level (e.g. < 2.0) on the DMR. If the method used did not meet the minimum

[1] https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-guidance/WQWebPortal-guidance

DL and Quantitation Level (QL) identified in the permit report the actual QL and DL in the comments or in the location provided.

6. Report single analytical values between the DL and the QL by entering the estimated value, the code for estimated value/below quantitation limit (J) and any additional information in the comments.
7. When an outside laboratory performs the analysis, submit a copy of the laboratory report as an attachment using WQWebDMR. Contract laboratory reports must include the chain of custody and QA/QC results.
8. Submit bacteria monitoring results as follows:
   a. Do Not report zero for bacterial monitoring. Report as required by the laboratory method.
   b. Calculate and report an arithmetic average value for each day for bacteria if multiple samples were taken in one day.
   c. Calculate the geometric mean values for bacteria (unless otherwise specified in the permit) using the reported numeric value for all bacteria samples measured above the detection value except when it took multiple samples in one day. If multiple samples are taken in one day, use the arithmetic average for the day in the geometric mean calculation. Use the detection value for those samples measured below detection.
9. Report the test method used for analysis in the comments if the laboratory used an alternative method not specified in the permit and as allowed in Appendix A.
10. Calculate average values and calculated total values (unless otherwise specified in the permit) using:
    a. The reported numeric value for all parameters measured between the detection value and the quantitation value for the sample analysis.
    b. One-half (1/2) the detection value (for values reported below detection) if the lab detected the parameter in another sample from the same monitoring point for the reporting period.
    c. Zero (for values reported below detection) if the lab did not detect the parameter in another sample for reporting period.
11. Report single sample grouped parameters (for example: priority pollutants, PAHs, pulp and paper chlorophenolics, TTOs) on the WQWebDMR form and include: sample date, concentration detection, DL (as necessary), and laboratory QL (as necessary).

S3.B. Permit submittals and schedules

The Permittee must use the Water Quality Permitting Portal – Permit Submittals application (unless otherwise specified in the permit) to submit all permit-required reports by the date specified in the permit.

When another permit condition requires submittal of a paper (hard copy) report, the Permittee must ensure that it is postmarked or received by Ecology no later than the dates specified by this permit. Send these paper reports to Ecology at:

Water Quality Permit Coordinator
Department of Ecology
Southwest Region Office
P.O. Box 47775
Olympia, WA 98504-7775

S3.C. Records retention

The Permittee must retain records of all monitoring information for a minimum of three years. Such information must include all calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit. The Permittee must extend this period of retention during any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

S3.D. Recording of results

For each measurement or sample taken, the Permittee must record the following information:

1. The date, exact place, method, and time of sampling or measurement.
2. The individual who performed the sampling or measurement.
3. The date and time the analysis was performed.
4. The individual who performed the analysis.
5. The analytical technique or method used.
6. The results of all analyses.

S3.E. Additional monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by Special Condition S2 of this permit, then the Permittee must include the results of such monitoring in the calculation and reporting of the data submitted in the Permittee's DMR unless otherwise specified by Special Condition S2.

S3.F. Reporting permit violations

The Permittee must take the following actions when it violates or is unable to comply with any permit condition:

1. Immediately take action to stop, contain, and cleanup unauthorized discharges or otherwise stop the noncompliance and correct the problem.

The permittee must make reasonable attempts to collect a sample of any unusual discharge or discharge condition including prohibited bypasses, upsets,

and maintenance-related conditions affecting effluent quality. The sample must be representative of the volume and nature of the uncharacteristic discharge and must represent a relevant subset of parameters required to be monitored under section S2.A. The additional monitoring results must be reported on the monthly DMR, along with a note of explanation. Refer to the Information Manual for Treatment Plant Operators, Publication 04-10-020 (Ecology, 2004), for guidance on incorporating extra sampling results into DMR calculations.

2. Immediate reporting

The Permittee must immediately report (see definition of “immediate reporting” in Appendix C of the Fact Sheet) to Ecology and the local health jurisdiction at the numbers listed below, all:

- Failures of the disinfection system.
- Plant bypasses resulting in a discharge to a waterbody.
- Any upset that causes an exceedance of an effluent limit in the permit (See G.15, "Upset").
- Collection system overflows.
- Any other failures of the sewage system (pipe breaks, etc.).

Southwest Region Office	360-407-6300
Clark County Public Health	564-397-8000

The Permittee must also immediately report any sanitary sewer overflow (SSO) that discharges to a municipal separate storm sewer system (MS4) to the appropriate MS4 owner or operator.

3. Twenty-four (24) hour reporting

The Permittee must report the following to Ecology at the telephone number listed in S3.F.2, within 24 hours from the time the Permittee becomes aware of any of the following:

- Any violation of a maximum daily or instantaneous maximum discharge limit for any of the pollutants in Special Condition S1.A of this permit.
- Any noncompliance that may endanger health or the environment, unless previously reported under immediate reporting requirements.

4. Five-day follow up report

The Permittee must also submit a written report within five days of the time that the Permittee becomes aware of any reportable event under S3.F.2 or S3.F.3.

(See definition of “Days (compliance period interval)” in Appendix C of the Fact Sheet.)

Submit the written report electronically using the Water Quality Permitting Portal – Permit Submittals application.

The permittee may use any reporting form that includes all the required content listed in this section.

The report must contain:

a. A description of the noncompliance and its cause.
b. The period of noncompliance, including exact dates and times.
c. The estimated time the Permittee expects the noncompliance to continue if not yet corrected.
d. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.
e. If the noncompliance involves an overflow prior to the treatment works:
   (i) Indicate the type of event (e.g., combined sewer overflow, sanitary sewer overflow, or bypass event).
   (ii) Indicate the type of sewer overflow structure (e.g., manhole, combined sewer overflow outfall).
   (iii) Estimate the quantity (in gallons) of the untreated overflow.
   (iv) Indicate whether the noncompliance was related to wet weather; and
   (v) Indicate the types of human health and environmental impacts of the event.
f. Include a description of actions taken to stop, contain, and cleanup unauthorized discharges and to mitigate any associated environmental impacts.
g. If an ERTS number was assigned to the event when it was initially reported, include this number in the five-day follow up report for reference.
h. Identification of other agencies contacted per the emergency notification call list in S3.F.2.
i. If samples were taken to characterize the event, provide any analytical results that are available with the five-day report. If the data was collected at the same monitoring points and for parameters specified on the DMR, the sample results must also be reported on the DMR.

5. Waiver of written reports

   Ecology may waive the report required in S3.F.4 on a case-by-case basis if the Permittee has submitted a timely oral report. If a waiver is requested, the Permittee must obtain documentation of this waiver in writing or email from Ecology.

6. All other permit violation reporting

The Permittee must report all other permit violations when they submit monitoring reports under Special Condition S3.A. (Reporting). The reports must contain the information listed in S3.F.4. Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or from the resulting liability for failure to comply.

S3.G. Other reporting

1. Spills of oil or hazardous materials

In addition to the requirements in S3.F, the Permittee must report a spill of oil or hazardous materials in accordance with the requirements of Revised Code of Washington (RCW) 90.56.280 and WAC 173-303-145. Visit the website How to Report a Spill[2] for further instructions.

2. Failure to submit relevant or correct facts

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to Ecology, it must submit such facts or information promptly.

S3.H. Maintaining a copy of this permit

The Permittee must keep a copy of this permit at the facility and make it available upon request to Ecology inspectors.

S4. Facility loading

S4.A. Design criteria

The flows or waste loads for the permitted facility must not exceed the following design criteria:

Table 9 - Design criteria

Parameter	Unit
Maximum Month Design Flow (MMDF)	6.10 MGD
BOD_5 Influent Loading for Maximum Month	5,616 lbs/day
TSS Influent Loading for Maximum Month	8,011 lbs/day

S4.B. Plans for maintaining adequate capacity

1. The Permittee must submit a plan and a schedule for continuing to maintain capacity to Ecology when:
   a. The actual flow or waste load reaches 85 percent of any one of the design criteria in S4.A for three consecutive months.

[2] https://ecology.wa.gov/About-us/Get-involved/Report-an-environmental-issue/Report-a-spill

b. The projected plant flow or loading would reach design capacity within five years.

2. The plan and schedule must identify the actions necessary to maintain adequate capacity for the expected population growth and to meet the limits and requirements of the permit. The Permittee must consider the following topics and actions in its plan:
   a. Analysis of the present design and proposed process modifications.
   b. Reduction or elimination of excessive infiltration and inflow of uncontaminated ground and surface water into the sewer system.
   c. Limits on future sewer extensions or connections or additional waste loads.
   d. Modification or expansion of facilities.
   e. Reduction of industrial or commercial flows or waste loads.

Engineering documents associated with the plan must meet the requirements of WAC 173-240-060, "Engineering Report," and must be approved by Ecology prior to any construction.

S4.C. Duty to mitigate

The Permittee must take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

S4.D. Notification of new or altered sources

1. The Permittee must submit written notice to Ecology whenever any new discharge or a substantial change in volume or character of an existing discharge into the wastewater treatment plant is proposed which:
   a. Would interfere with the operation of, or exceed the design capacity of, any portion of the wastewater treatment plant.
   b. Is not part of an approved general sewer plan or approved plans and specifications.
   c. Is subject to pretreatment standards under 40 CFR Part 403 and Section 307(b) of the Clean Water Act.
2. This notice must include an evaluation of the wastewater treatment plant's ability to adequately transport and treat the added flow and/or waste load, the quality and volume of effluent to be discharged to the treatment plant, and the anticipated impact on the Permittee's effluent [40 CFR 122.42 (b)].

S5. Operation and maintenance

The Permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances), which are installed to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance also includes keeping a daily operation logbook (paper or electronic),

adequate laboratory controls, and appropriate quality assurance procedures. This provision of the permit requires the Permittee to operate backup or auxiliary facilities or similar systems only when the operation is necessary to achieve compliance with the conditions of this permit.

S5.A. Certified operator

This permitted facility must be operated by an operator certified by the state of Washington for at least a Class IV plant. This operator must be in responsible charge of the day-to-day operation of the wastewater treatment plant. An operator certified for at least a Class III plant must be in charge during all regularly scheduled shifts.

S5.B. Operation and maintenance program

The Permittee must:

1. Institute an adequate operation and maintenance program for the entire sewage system.
2. Keep maintenance records on all major electrical and mechanical components of the treatment plant, as well as the sewage system and pumping stations. Such records must clearly specify the frequency and type of maintenance recommended by the manufacturer and must show the frequency and type of maintenance performed.
3. Make maintenance records available for inspection at all times.

S5.C. Short-term reduction

The Permittee must schedule any facility maintenance, which might require interruption of wastewater treatment and degrade effluent quality, during non-critical water quality periods and carry this maintenance out according to the approved O&M manual or as otherwise approved by Ecology.

If a Permittee contemplates a reduction in the level of treatment that would cause a violation of permit discharge limits on a short-term basis for any reason, and such reduction cannot be avoided, the Permittee must:

1. Give written notification to Ecology, if possible, thirty (30) days prior to such activities.
2. Detail the reasons for, length of time of, and the potential effects of the reduced level of treatment.

This notification does not relieve the Permittee of its obligations under this permit.

S5.D. Electrical power failure

The Permittee must ensure that adequate safeguards prevent the discharge of untreated wastes or wastes not treated in accordance with the requirements of this permit during electrical power failure at the treatment plant and/or sewage lift

stations. Adequate safeguards include, but are not limited to, alternate power sources, standby generator(s), or retention of inadequately treated wastes.

The Permittee must maintain Reliability Class II (EPA 430-99-74-001) at the wastewater treatment plant. Reliability Class II requires a backup power source sufficient to operate all vital components and critical lighting and ventilation during peak wastewater flow conditions. Vital components used to support the secondary processes (i.e., mechanical aerators or aeration basin air compressors) need not be operable to full levels of treatment but must be sufficient to maintain the biota.

S5.E. Prevent connection of inflow

The Permittee must strictly enforce its sewer ordinances and not allow the connection of inflow (roof drains, foundation drains, etc.) to the sanitary sewer system.

S5.F. Bypass procedures

A bypass is the intentional diversion of waste streams from any portion of a treatment facility. This permit prohibits all bypasses except when the bypass is for essential maintenance, as authorized in special condition S5.F.1, or is approved by Ecology as an anticipated bypass following the procedures in S5.F.2.

1. Bypass for essential maintenance without the potential to cause violation of permit limits or conditions: This permit allows bypasses for essential maintenance of the treatment system when necessary to ensure efficient operation of the system. The Permittee may bypass the treatment system for essential maintenance only if doing so does not cause violations of effluent limits. The Permittee is not required to notify Ecology when bypassing for essential maintenance. However, the Permittee must comply with the monitoring requirements specified in special condition S2.B.
2. Anticipated bypasses for non-essential maintenance: Ecology may approve an anticipated bypass under the conditions listed below. This permit prohibits any anticipated bypass that is not approved through the following process.
    a. If a bypass is for non-essential maintenance, the Permittee must notify Ecology, if possible, at least ten (10) days before the planned date of bypass. The notice must contain:

        - A description of the bypass and the reason the bypass is necessary.
        - An analysis of all known alternatives which would eliminate, reduce, or mitigate the potential impacts from the proposed bypass.
        - A cost-effectiveness analysis of alternatives.
        - The minimum and maximum duration of bypass under each alternative.

- A recommendation as to the preferred alternative for conducting the bypass.
- The projected date of bypass initiation.
- A statement of compliance with SEPA.
- A request for modification of water quality standards as provided for in WAC 173-201A-410, if an exceedance of any water quality standard is anticipated.
- Details of the steps taken or planned to reduce, eliminate, and prevent recurrence of the bypass.

b. For probable construction bypasses, the Permittee must notify Ecology of the need to bypass as early in the planning process as possible. The Permittee must consider the analysis required above during the project planning and design process. The project-specific engineering report as well as the plans and specifications must include details of probable construction bypasses to the extent practical. In cases where the Permittee determines the probable need to bypass early, the Permittee must continue to analyze conditions up to and including the construction period in an effort to minimize or eliminate the bypass.
c. Ecology will determine if the Permittee has met the conditions of special condition S5.F.2 a and b and consider the following prior to issuing a determination letter, an administrative order, or a permit modification as appropriate for an anticipated bypass:

    - If the Permittee planned and scheduled the bypass to minimize adverse effects on the public and the environment.
    - If the bypass is unavoidable to prevent loss of life, personal injury, or severe property damage. “Severe property damage” means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.
    - If feasible alternatives to the bypass exist, such as:
        - The use of auxiliary treatment facilities.
        - Retention of untreated wastes.
        - Stopping production.
        - Maintenance during normal periods of equipment downtime, but not if the Permittee should have installed adequate backup equipment in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance.
        - Transport of untreated wastes to another treatment facility.

S5.G. Operations and maintenance (O&M) manual

1. The Permittee must:
   a. Review the O&M Manual at least annually and confirm this review by letter to Ecology by **October 15th** of each year.
   b. Submit to Ecology for review and approval substantial changes or updates to the O&M Manual.
   c. Keep the approved O&M Manual at the permitted facility.
   d. Follow the instructions and procedures of this manual.
2. In addition to the requirements of WAC 173-240-080(1) through (5), the O&M Manual must be consistent with the guidance in Section G1-4.4 in the *Criteria for Sewage Works Design (Orange Book)* (Ecology, 2023). The O&M Manual must include:
   a. Emergency procedures for cleanup in the event of wastewater system upset or failure.
   b. A review of system components which if failed could pollute surface water or could impact human health. Provide a procedure for a routine schedule of checking the function of these components.
   c. Wastewater system maintenance procedures that contribute to the generation of process wastewater.
   d. Reporting protocols for submitting reports to Ecology to comply with the reporting requirements in the discharge permit.
   e. Any directions to maintenance staff when cleaning or maintaining other equipment or performing other tasks which are necessary to protect the operation of the wastewater system (for example, defining maximum allowable discharge rate for draining a tank, blocking all floor drains before beginning the overhaul of a stationary engine).
   f. The treatment plant process control monitoring schedule.
   g. Minimum staffing adequate to operate and maintain the treatment processes and carry out compliance monitoring required by the permit.

S6. Pretreatment

The Permittee must work with Ecology to ensure that all industrial users (see “industrial user” and “industrial wastewater” definitions in the fact sheet glossary) of the publicly owned treatment works (POTW) comply with the pretreatment requirements of the federal Clean Water Act, Washington state law and the federal General Pretreatment Regulations. Pretreatment requirements apply to sewers, pipes, and other conveyances in addition to devices and systems used in the storage, treatment, recycling and reclamation of municipal sewage or industrial wastes of a liquid nature (see “POTW” definition in the fact sheet glossary).

S6.A. Duty to enforce discharge prohibitions

The Permittee must notify Ecology, within 30 days of becoming aware, if any industrial user violates the following discharge prohibitions and initiate enforcement action to promptly curtail any such discharge.

1. The Permittee must not authorize or knowingly allow the discharge of any pollutants into its POTW which may be reasonably expected to cause pass through or interference.
2. The Permittee must not authorize or knowingly allow the introduction of any of the following into their treatment works:
   a. Pollutants which create a fire or explosion hazard in the POTW (including but not limited to waste streams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 261.21).
   b. Pollutants which will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0, or greater than 11.0 standard units, unless the works are specifically designed to accommodate such discharges.
   c. Solid or viscous pollutants in amounts that could cause obstruction to the flow in the collection system or otherwise cause interference with the POTW.
   d. Any pollutant, including oxygen-demanding pollutants, (BOD_5, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the POTW.
   e. Petroleum oil, non-biodegradable cutting oil, or products of mineral origin in amounts that will cause interference or pass through.
   f. Pollutants which result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity which may cause acute worker health and safety problems.
   g. Heat in amounts that will inhibit biological activity in the POTW resulting in interference but in no case heat in such quantities that the temperature at the POTW headworks exceeds 40 degrees Celsius (104 degrees Fahrenheit) unless Ecology, upon request of the Permittee, approves alternate temperature limits in writing.
   h. Any trucked or hauled pollutants, except at discharge points designated by the Permittee.
   i. Wastewaters prohibited to be discharged to the POTW by the Dangerous Waste Regulations (chapter 173-303 WAC), unless authorized under the Domestic Sewage Exclusion (WAC 173-303-071).
3. The Permittee must not allow the following discharges to the POTW unless approved in writing by Ecology:
   a. Noncontact cooling water in significant volumes.
   b. Stormwater and other direct inflow sources.

c. Wastewaters significantly affecting system hydraulic loading, which do not require treatment, or would not be afforded a significant degree of treatment by the system.

S6.B. Identification of new industrial wastewater sources and notification of permit requirements

The Permittee must establish a process for authorizing industrial wastewater discharges.

The Permittee must:

1. Immediately notify Ecology of any proposed industrial wastewater discharges from a source which is or may be a significant industrial user (SIU).
2. Within 30 days of becoming aware, notify Ecology of existing industrial users which change operations or increase wastewater discharge volume in a manner which makes them an SIU.
3. Within 30 days of becoming aware, notify Ecology of existing, unpermitted industrial users that are an SIU.
4. Require all SIUs to obtain a state waste discharge permit (SWDP) from Ecology prior to accepting or as a condition of continuing to accept their industrial wastewater.

S6.C. Industrial user survey

The Permittee must complete an industrial user survey and must submit a report of the survey to Ecology by **July 31, 2028.** The Permittee should use Ecology's "Guidance Manual for Performing an Industrial User Survey" to develop and compile the survey. In addition to identifying new industrial users, the Permittee must reevaluate existing nondomestic users identified in previous surveys for significantly altered processes or discharge practices. The intent of the industrial user survey is to compile a master list of nondomestic users (commercial and industrial, including hauled waste) introducing pollutants to the POTW and identify significant industrial users. The survey must capture nondomestic users in the entire sewershed of the receiving POTW. If the Permittee receives wastewater to the POTW from other jurisdictions, the Permittee must identify nondomestic users in those jurisdictions as well.

The survey report must include:

1. A description of the survey procedures (information gathering methods) the Permittee used to develop the master list of nondomestic users.
2. Identification of other jurisdictions that contribute wastewater to the POTW, as well as the process used to identify nondomestic users in those jurisdictions.
3. Example survey forms.
4. A master list of nondomestic users. The master list must include:
   a. Names and addresses of all nondomestic users.

b. A description of the processes that affect or contribute to the user's wastewater.
c. The principal products and raw materials of each user that affects or contributes to the user's wastewater.
d. The average daily volume of wastewater discharged by each user, indicating the estimated amount attributable to process wastewater.
e. A statement of whether the user is subject to one or more categorical standards, and if so, under which category and subcategory.
f. A statement of whether the user is a significant industrial user and why (i.e. hydraulic or organic loading, categorical standards).
g. A statement whether the user is subject to local restrictions or requirements.
h. A statement whether any problems at the POTW, including upset, pass through, or interference, have been attributed to the user in the past 4.5 years.

S6.D. Monitoring requirements

The Permittee must:

1. Monitor the influent and effluent for the pollutants identified in Special Condition S2, any compounds identified because of Special Condition S6.E.8, and any other pollutants expected from non-domestic sources. Use the methods for collection, preservation, storage, and analysis, and monitoring frequencies, identified in Special Condition S2.
2. Monitor the sludge for the pollutants identified in Special Condition S2. Monitoring frequencies are identified in Special Condition S2.
3. Sample POTW influent and effluent on a day when industrial discharges are occurring at normal-to-maximum levels.
4. Obtain 24-hour composite samples for the analysis of acid and base/neutral extractable compounds and metals.
5. Ensure that all reported test data for metals represents the total amount of the constituents present in all phases, whether solid, suspended, or dissolved elemental or combined, including all oxidation states unless otherwise indicated.
6. Collect a sludge sample concurrently with a wastewater sample as a single grab of residual sludge. Sludge metals priority pollutant sampling and analysis must conform to EPA SW 846 6000 Series Methods and EPA SW 846 7000 Series Methods unless the Permittee requests an alternate method and Ecology has approved.
7. Collect grab samples for cyanide, phenols, and oils. Measure hexane soluble oils (or equivalent) only in the influent and effluent.
8. Make a reasonable attempt to identify all other substances and quantify all pollutants shown to be present by gas chromatograph/mass spectrometer

(GC/MS) analysis per 40 CFR 136, Appendix A, EPA Method 624.1 and EPA Method 625.1, in addition to quantifying pH, oil and grease, and all priority pollutants. The Permittee should attempt to make determinations of pollutants for each fraction, which produces identifiable spectra on total ion plots (reconstructed gas chromatograms). The Permittee may express results for non-substituted aliphatic compounds as total hydrocarbon content.

9. Use a laboratory whose computer data processing programs are capable of comparing sample mass spectra to a computerized library of mass spectra, with visual confirmation by an experienced analyst.
10. Conduct additional sampling and appropriate testing to determine concentration and variability, and to evaluate trends for all detected substances determined to be pollutants.

S6.E. Local Limit Evaluation

The Permittee must submit a written technical evaluation of the need to revise local limits under 40 CFR 403.5(c)(1) within 1 year of the permit effective date, on or before **August 1, 2026**, and every 5 years thereafter, or sooner if any of the following occur:

- A new industrial user(s) begins a discharge that may significantly impact the POTW, including but not limited to:
  - The flow is ≥5% of the average dry weather hydraulic or organic capacity of the POTW treatment plant, or
  - The flow represents a 25% or greater increase in the total industrial flow to the POTW, or
  - The discharge contains elevated levels of pollutants for which there are established local limits or permit limits, or
  - The discharge contains a new pollutant(s) of concern to the POTW.
- Any existing industrial user(s) modifies their discharge in a manner that may significantly impact the POTW as listed above.
- Changes or upgrades occur to the POTW's operations or treatment capacities.

The written technical evaluation submittal must include, at a minimum, the following:

1. Evaluation of the maximum allowable headworks loading and the maximum allowable industrial loading for each previously identified pollutant of concern.
   a. Evaluation must consider water quality in the receiving water, inhibition levels for biological processes at the treatment plant, sludge quality goals, and any other applicable, limiting factors.
   b. Evaluation of pollutants of additional pollutants of concern; including, hexavalent chromium. The Permittee must evaluate any other pollutants of concern based on impacts to water quality, sludge quality, and worker health and safety.

2. Narrative discussion of the need to revise allocated local limits.
3. All supporting calculations and a narrative of all assumptions used in the calculations.

The Permittee must notify Ecology of any local limit modifications that arise from a technical evaluation.

S7. Solid wastes

S7.A. Solid waste handling

The Permittee must handle and dispose of all solid waste material in such a manner as to prevent its entry into state ground or surface water.

S7.B. Leachate

The Permittee must not allow leachate from its solid waste material to enter state waters without providing all known, available, and reasonable methods of treatment, nor allow such leachate to cause violations of the State Surface Water Quality Standards, Chapter 173-201A WAC, or the State Ground Water Quality Standards, Chapter 173-200 WAC. The Permittee must apply for a permit or permit modification as may be required for such discharges to state ground or surface waters.

S8. Application for permit renewal or modification for facility changes

The Permittee must submit an application for renewal of this permit by **February 1, 2030.**

The Permittee must also submit a new application or addendum at least one hundred eighty (180) days prior to commencement of discharges, resulting from the activities listed below, which may result in permit violations. These activities include any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility.

S9. Spill control plan

S9.A. Spill control plan submittals and requirements

The Permittee must:

1. Review the plan at least annually and update the spill plan as needed.
2. Send changes to the plan to Ecology.
3. Follow the plan and any supplements throughout the term of the permit.

S9.B. Spill control plan components

The spill control plan must include the following:

1. A list of all oil and petroleum products and other materials used and/or stored on-site, which when spilled, or otherwise released into the environment, designate as Dangerous Waste (DW) or Extremely Hazardous Waste (EHW)

by the procedures set forth in WAC 173-303-070. Include other materials used and/or stored on-site which may become pollutants or cause pollution upon reaching state's waters.

2. A description of preventive measures and facilities (including an overall facility plot showing drainage patterns) which prevent, contain, or treat spills of these materials.
3. A description of the reporting system the Permittee will use to alert responsible managers and legal authorities in the event of a spill.
4. A description of operator training to implement the plan.

The Permittee may submit plans and manuals required by 40 CFR Part 112, contingency plans required by Chapter 173-303 WAC, or other plans required by other agencies, which meet the intent of this section.

S10. Sediment monitoring

S10.A. Sediment sampling and analysis plan

The Permittee must submit to Ecology for review and approval a sediment sampling and analysis plan for sediment monitoring by **February 15, 2026**. The purpose of the plan is to characterize or recharacterize sediment (the nature and extent of chemical contamination and biological toxicity) quality in the vicinity of the Permittee's discharge locations. The Permittee must follow the guidance provided in Appendix A of the *Sediment Cleanup User's Manual* (Ecology, 2021) (or most recent edition), Sampling Guidance for NPDES Permits under the Sediment Management Standards.

S10.B. Sediment data report

Following Ecology approval of the sediment sampling and analysis plan, the Permittee must collect sediments between August 15th and September 30th. The Permittee must submit to Ecology a sediment data report containing the results of the sediment sampling and analysis no later than **February 15, 2027**. The sediment data report must conform to the approved sediment sampling and analysis plan. In addition, the Permittee must follow the guidance provided in the Sediment Cleanup User's Manual, Appendix A: Sampling Guidance for NPDES Permits under the Sediment Management Standards (Ecology, 2021) (or most recent edition). The report must document when the data was successfully loaded into EIM as required below.

In addition to the sediment data report, submit the sediment chemical data, biological data, or both, to Ecology's Environmental Information System (EIM)[3]. Data

[3] https://ecology.wa.gov/Research-Data/Data-resources/Environmental-Information-Management-database

must be submitted to EIM according to the instructions on the EIM website. The EIM website provides information on submitting data, and a link to the EIM Help Center.

In addition to the EIM data submittal, Ecology's MyEIM[4] tools must be used to confirm that the submitted data was accurately entered into EIM. Any differences between the MyEIM analytical results and sediment data report must be identified and explained.

S11. Outfall Evaluation

The Permittee must inspect, every five years, the submerged portion of the outfall line and diffuser to document its integrity and continued function. If conditions allow for a photographic verification, the Permittee must include such verification in the report. By **October 31, 2029**, the Permittee must submit the inspection report to Ecology through the Water Quality Permitting Portal – Permit Submittals application. The Permittee must submit hard copies of any video files to Ecology as required by Permit Condition S3.B. The Portal does not support submittal of video files.

The inspector must at minimum:

- Assess the physical condition of the outfall pipe, diffuser, and associated couplings.
- Determine the extent of sediment accumulation in the vicinity of the diffuser.
- Ensure diffuser ports are free of obstructions and are allowing uniform flow.
- Confirm physical location (latitude/longitude) and depth of the diffuser section of the outfall.

S12. Acute toxicity

S12.A. Testing when there is no permit limit for acute toxicity

The Permittee must:

1. Conduct acute toxicity testing on the final effluent once in June 2028 and once in December 2028.
2. Conduct acute toxicity testing on a series of at least five concentrations of effluent, including 100 percent effluent and a control.
3. Use each of the following species and protocols for each acute toxicity test:

Table 10 - Freshwater acute toxicity tests

Acute Toxicity Tests	Species	Method
Fathead Minnow 96-Hour Static-Renewal Test	Pimephales Promelas	EPA-821-R-02-012

[4] https://ecology.wa.gov/Research-Data/Data-resources/Environmental-Information-Management-database/Using-MyEIM

Daphnid 48-Hour Static Test	Ceriodaphnia Dubia, Daphnia Pulex, OR Daphnia Magna	EPA-821-R-02-012

4. Submit a written report to Ecology no later than August 1, 2028, and February 1, 2029.

S12.B. Sampling and reporting requirements

1. The Permittee must submit all reports for toxicity testing in accordance with *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*, Publication 95-80 (Ecology, 2016). Reports must contain toxicity data, bench sheets, and reference toxicant results for test methods. In addition, the Permittee must submit toxicity test data in electronic format (CETIS export file preferred) for entry into Ecology's database.
2. The Permittee must collect 24-hour composite effluent samples for toxicity testing. The Permittee must cool the samples to 0 – 6 degrees Celsius during collection and send them to the lab immediately upon completion. The lab must begin the toxicity testing as soon as possible but no later than 36 hours after sampling was completed.
3. The laboratory must conduct water quality measurements on all samples and test solutions for toxicity testing, as specified in *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* (Ecology, 2016).
4. All toxicity tests must meet quality assurance criteria and test conditions specified in the EPA methods listed in Subsection C and *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* (Ecology, 2016). If Ecology determines any test results to be invalid or anomalous, the Permittee must repeat the testing with freshly collected effluent.
5. The laboratory must use control water and dilution water meeting the requirements of the EPA methods listed in Section A or pristine natural water of sufficient quality for good control performance.
6. The Permittee must conduct whole effluent toxicity tests on an unmodified sample of final effluent.
7. The Permittee may choose to conduct a full dilution series test during compliance testing in the order to determine dose response. In this case, the series must have a minimum of five effluent concentrations and a control. The series of concentrations must include the ACEC. The summer ACEC equals 3.7 percent effluent. The winter ACEC equals 4.3 percent effluent.
8. All whole effluent toxicity tests, effluent screening tests, and rapid screening tests that involve hypothesis testing must comply with the acute statistical power standard of 29 percent as defined in WAC 173-205-020. If the test does not meet the power standard, the Permittee must repeat the test on a fresh sample with an increased number of replicates to increase the power.

S13. Chronic toxicity

S13.A. Testing when there is no permit limit for chronic toxicity

The Permittee must:

1. Conduct chronic toxicity testing on final effluent once in June 2028 and once in December 2028.
2. Conduct chronic toxicity testing on a series of at least five concentrations of effluent and a control. This series of dilutions must include the seasonal ACEC. The summer ACEC equals 3.7 percent effluent; the winter ACEC equals 4.3 percent effluent. The series of dilutions should also contain the summer or winter CCEC of 0.83 and 0.54 percent effluent, respectively.
3. Compare the ACEC to the control using hypothesis testing at the 0.05 level of significance as described in Appendix H, EPA/600/4-89/001.
4. Submit a written report to Ecology no later than **August 1, 2028,** and **February 1, 2029.**
5. Perform chronic toxicity tests with all the following species and the most recent version of the following protocols:

Table 11 - Freshwater chronic toxicity tests

Freshwater Chronic Test	Species	Method
Fathead Minnow Survival and Growth	*Pimephales Promelas*	EPA-821-R-02-013
Water Flea Survival and Reproduction	*Ceriodaphnia Dubia*	EPA-821-R-02-013

S13.B. Sampling and reporting requirements

1. The Permittee must submit all reports for toxicity testing in accordance with *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* (Ecology, 2016). Reports must contain toxicity data, bench sheets, and reference toxicant results for test methods. In addition, the Permittee must submit toxicity test data in electronic format (CETIS export file preferred) for entry into Ecology's database.
2. The Permittee must collect 24-hour composite effluent samples for toxicity testing. The Permittee must cool the samples to 0 – 6 degrees Celsius during collection and send them to the lab immediately upon completion. The lab must begin the toxicity testing as soon as possible but no later than 36 hours after sampling was completed.
3. The laboratory must conduct water quality measurements on all samples and test solutions for toxicity testing, as specified in *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* (Ecology, 2016).

4. All toxicity tests must meet quality assurance criteria and test conditions specified in the EPA methods listed in Subsection C and *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* (Ecology, 2016). If Ecology determines any test results to be invalid or anomalous, the Permittee must repeat the testing with freshly collected effluent.
5. The laboratory must use control water and dilution water meeting the requirements of the EPA methods listed in Section A or pristine natural water of sufficient quality for good control performance.
6. The Permittee must conduct whole effluent toxicity tests on an unmodified sample of final effluent.
7. The Permittee may choose to conduct a full dilution series test during compliance testing in the order to determine dose response. In this case, the series must have a minimum of five effluent concentrations and a control. The series of concentrations must include the CCEC and the ACEC. The CCEC and the ACEC may either substitute for the effluent concentrations that are closest to them in the dilution series or be extra effluent concentrations. The summer CCEC equals 0.83 percent effluent. The winter CCEC equals 0.54 percent effluent. The summer ACEC equals 3.7 percent effluent. The winter ACEC equals 4.3 percent effluent
8. All whole effluent toxicity tests that involve hypothesis testing must comply with the chronic statistical power standard of 39 percent as defined in WAC 173-205-020. If the test does not meet the power standard, the Permittee must repeat the test on a fresh sample with an increased number of replicates to increase the power.

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GENERAL CONDITIONS

G1. Signatory requirements

1. All applications submitted to Ecology must be signed and certified.
   a. In the case of corporations, by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:

      - A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or
      - The manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

   b. In the case of a partnership, by a general partner.
   c. In the case of sole proprietorship, by the proprietor.
   d. In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

      Applications for permits for domestic wastewater facilities that are either owned or operated by, or under contract to, a public entity shall be submitted by the public entity.

2. All reports required by this permit and other information requested by Ecology must be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:
   a. The authorization is made in writing by a person described above and submitted to Ecology.
   b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. Changes to authorization. If an authorization under paragraph G1.2, above, is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph G1.2, above, must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.
4. Certification. Any person signing a document under this section must make the following certification:

   "I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

G2. Right of inspection and entry

The Permittee must allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

1. To enter upon the premises where a discharge is located or where any records must be kept under the terms and conditions of this permit.
2. To have access to and copy, at reasonable times and at reasonable cost, any records required to be kept under the terms and conditions of this permit.
3. To inspect, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.
4. To sample or monitor, at reasonable times, any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G3. Permit actions

This permit may be modified, revoked and reissued, or terminated either at the request of any interested person (including the permittee) or upon Ecology's initiative. However, the permit may only be modified, revoked and reissued, or terminated for the reasons specified in 40 CFR 122.62, 40 CFR 122.64 or WAC 173-220-150 according to the procedures of 40 CFR 124.5.

1. The following are causes for terminating this permit during its term, or for denying a permit renewal application:
   a. Violation of any permit term or condition.

b. Obtaining a permit by misrepresentation or failure to disclose all relevant facts.
c. A material change in quantity or type of waste disposal.
d. A determination that the permitted activity endangers human health or the environment or contributes to water quality standards violations and can only be regulated to acceptable levels by permit modification or termination.
e. A change in any condition that requires either a temporary or permanent reduction, or elimination of any discharge or sludge use or disposal practice controlled by the permit.
f. Nonpayment of fees assessed pursuant to RCW 90.48.465.
g. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.

2. The following are causes for modification but not revocation and reissuance except when the Permittee requests or agrees:
   a. A material change in the condition of the waters of the state.
   b. New information not available at the time of permit issuance that would have justified the application of different permit conditions.
   c. Material and substantial alterations or additions to the permitted facility or activities which occurred after this permit issuance.
   d. Promulgation of new or amended standards or regulations having a direct bearing upon permit conditions or requiring permit revision.
   e. The Permittee has requested a modification based on other rationale meeting the criteria of 40 CFR Part 122.62.
   f. Ecology has determined that good cause exists for modification of a compliance schedule, and the modification will not violate statutory deadlines.
   g. Incorporation of an approved local pretreatment program into a municipality's permit.
3. The following are causes for modification or alternatively revocation and reissuance:
   a. When cause exists for termination for reasons listed in 1.a through 1.g of this section, and Ecology determines that modification or revocation and reissuance is appropriate.
   b. When Ecology has received notification of a proposed transfer of the permit. A permit may also be modified to reflect a transfer after the effective date of an automatic transfer (General Condition G7) but will not be revoked and reissued after the effective date of the transfer except upon the request of the new Permittee.

G4. Reporting planned changes

The Permittee must, as soon as possible, but no later than one hundred eighty (180) days prior to the proposed changes, give notice to Ecology of planned physical

alterations or additions to the permitted facility, production increases, or process modification which will result in:

1. The permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b).
2. A significant change in the nature or an increase in quantity of pollutants discharged.
3. A significant change in the Permittee's sludge use or disposal practices.

Following such notice, and the submittal of a new application or supplement to the existing application, along with required engineering plans and reports, this permit may be modified or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G5. Plan review required

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications must be submitted to Ecology for approval in accordance with chapter 173-240 WAC. Engineering reports, plans, and specifications must be submitted at least one hundred eighty (180) days prior to the planned start of construction unless a shorter time is approved by Ecology. Facilities must be constructed and operated in accordance with the approved plans.

G6. Compliance with other laws and statutes

Nothing in this permit excuses the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. Transfer of this permit

In the event of any change in control or ownership of facilities from which the authorized discharge emanates, the Permittee must notify the succeeding owner or controller of the existence of this permit by letter, a copy of which must be forwarded to Ecology.

1. Transfers by Modification

   Except as provided in paragraph (2) below, this permit may be transferred by the Permittee to a new owner or operator only if this permit has been modified or revoked and reissued under 40 CFR 122.62(b)(2), or a minor modification made under 40 CFR 122.63(d), to identify the new Permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

2. Automatic Transfers

   This permit may be automatically transferred to a new Permittee if:

a. The Permittee notifies Ecology at least thirty (30) days in advance of the proposed transfer date.
b. The notice includes a written agreement between the existing and new Permittees containing a specific date transfer of permit responsibility, coverage, and liability between them.
c. Ecology does not notify the existing Permittee and the proposed new Permittee of its intent to modify or revoke and reissue this permit. A modification under this subparagraph may also be minor modification under 40 CFR 122.63. If this notice is not received, the transfer is effective on the date specified in the written agreement.

G8. Reduced production for compliance

The Permittee, in order to maintain compliance with its permit, must control production and/or all discharges upon reduction, loss, failure, or bypass of the treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

G9. Removed substances

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters must not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G10. Duty to provide information

The Permittee must submit to Ecology, within a reasonable time, all information which Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee must also submit to Ecology upon request, copies of records required to be kept by this permit.

G11. Other requirements of 40 CFR

All other requirements of 40 CFR 122.41 and 40 CFR 122.42 are incorporated in this permit by reference.

G12. Additional monitoring

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G13. Payment of fees

The Permittee must submit payment of fees associated with this permit as assessed by Ecology.

G14. Penalties for violating permit conditions

Any person who is found guilty of willfully violating the terms and conditions of this permit is deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars ($10,000) and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit may incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars ($10,000) for every such violation. Each and every such violation is a separate and distinct offense, and in case of a continuing violation, every day's continuance is deemed to be a separate and distinct violation.

G15. Upset

Definition – “Upset” means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limits if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

1. An upset occurred and that the Permittee can identify the cause(s) of the upset.
2. The permitted facility was being properly operated at the time of the upset.
3. The Permittee submitted notice of the upset as required in Special Condition S3.F.
4. The Permittee complied with any remedial measures required under S3.F of this permit.

In any enforcement action the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G16. Property rights

This permit does not convey any property rights of any sort, or any exclusive privilege.

G17. Duty to comply

The Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G18. Toxic pollutants

The Permittee must comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G19. Penalties for tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two (2) years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this condition, punishment shall be a fine of not more than $20,000 per day of violation, or by imprisonment of not more than four (4) years, or by both.

G20. Compliance schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit must be submitted no later than fourteen (14) days following each schedule date.

G21. Service agreement review

The Permittee must submit to Ecology any proposed service agreements and proposed revisions or updates to existing agreements for the operation of any wastewater treatment facility covered by this permit. The review is to ensure consistency with chapters 90.46 and 90.48 RCW as required by RCW 70.150.040(9). In the event that Ecology does not comment within a thirty-day (30) period, the Permittee may assume consistency and proceed with the service agreement or the revised/updated service agreement.

APPENDIX A – List of Pollutants, Analytical Methods, Detection Levels and Quantitation Levels

The Permittee must use the specified analytical methods, detection levels (DLs) [1] and quantitation levels (QLs) [2] in the following table for permit and application required monitoring unless:

- Another permit condition specifies other methods, detection levels, or quantitation levels.
- The method used produces measurable results in the sample and EPA has listed it as an EPA-approved method in 40 CFR Part 136.

If the Permittee uses an alternative method, not specified in the permit, and as allowed above, it must report the test method, DL, and QL on the discharge monitoring report or in the required report.

If the Permittee is unable to obtain the required DL and QL due to matrix effects, the Permittee must submit a matrix-specific detection level (MDL) and a quantitation level (QL) to Ecology with appropriate laboratory documentation when the detection levels are too high to provide results near or below criteria (or applicable permit limits).

The lists below include conventional pollutants (as defined in CWA section 502(6) and 40 CFR Part 122), toxic or priority pollutants as defined in CWA section 307(a)(1) and listed in 40 CFR Part 122 Appendix D, 40 CFR Part 401.15 and 40 CFR Part 423 Appendix A), and nonconventionals. 40 CFR Part 122 Appendix D (Table V) also identifies toxic pollutants and hazardous substances which are required to be reported by dischargers if expected to be present. This permit appendix A list does not include those parameters.

The list also includes:

- Dioxin and furan congeners identified using EPA Method 1613.

Appendix A Table 1 – Conventional pollutants

Pollutant	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
Biochemical Oxygen Demand		SM5210-B		2 mg/L
Biochemical Oxygen Demand, Soluble		SM5210-B [3]		2 mg/L

Fecal Coliform		SM 9221E, 9221F SM 9222D	N/A	Specified in method sample aliquot dependent
Oil and Grease (HEM) (Hexane Extractable Material)		1664 A or B	1,400	5,000
pH		SM4500-H+ B	N/A	N/A
Total Suspended Solids		SM2540-D		5 mg/L

Appendix A Table 2 - Nonconventional pollutants

Pollutant	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
Alkalinity, Total		SM2320-B		5 mg/L as $CaCO_3$
Aluminum, Total	7429-90-5	200.8	2.0	10
Ammonia, Total (as N)		SM4500-NH3-B and C/D/E/G/H		20
Barium Total	7440-39-3	200.8	0.5	2.0
BTEX (benzene +toluene + ethylbenzene + m,o,p xylenes)		EPA SW 846 8021/8260	1	2
Boron, Total	7440-42-8	200.8	2.0	10.0
Chemical Oxygen Demand		SM5220-D		10 mg/L
Chloride		SM4500-Cl B/C/D/E and SM4110 B		Sample and limit dependent
Chlorine, Total Residual		SM4500 Cl G	10	50
Cobalt, Total	7440-48-4	200.8	0.05	0.25
Color		SM2120 B/C/E		10 color units
Dissolved oxygen		SM4500-OC/OG		0.2 mg/L
E.coli		SM 9221B, 9221F, 9223B	N/A	Specified in method; sample aliquot dependent

Enterococci		EPA 1600 SM 9230B, 9230C, 9230D,	N/A	Specified in method; sample aliquot dependent
Flow		Calibrated device		
Fluoride	16984-48-8	SM4500-F E	25	100
Hardness, Total		SM2340B		200 as $CaCO_3$
Iron, Total	7439-89-6	200.7	12.5	50
Magnesium, Total	7439-95-4	200.7	10	50
Manganese, Total	7439-96-5	200.8	0.1	0.5
Molybdenum, Total	7439-98-7	200.8	0.1	0.5
Nitrate + Nitrite Nitrogen (as N)		SM4500-NO_3- E/F/H		100
Nitrogen, Total Kjeldahl (as N)		SM4500-N_{org}B/C and SM4500NH_3-B/C/D/EF/G/H		300
NWTPH Dx [4]		Ecology NWTPH Dx	250	250
NWTPH Gx [5]		Ecology NWTPH Gx	250	250
Phosphorus, Total (as P)		SM 4500 PB followed by SM4500-PE/PF	3	10
Salinity		SM2520-B		3 practical salinity units or scale (PSU or PSS)
Settleable Solids		SM2540 -F		Sample and limit dependent
Soluble Reactive Phosphorus (as P)		SM4500-P E/F/G	3	10
Sulfate (as mg/L SO_4)		SM4110-B		0.2 mg/L
Sulfide (as mg/L S)		SM4500-S2F/D/G		0.2 mg/L
Sulfite (as mg/L SO_3)		SM4500-SO3B		2 mg/L
Temperature		Analog recorder or micro-recording devices (thermistors)		0.2°C
Tin, Total	7440-31-5	200.8	0.3	1.5
Titanium, Total	7440-32-6	200.8	0.5	2.5

Total Coliform		SM 9221B SM 9222B	N/A	Specified in method; sample aliquot dependent
Total Organic Carbon		SM5310-B/C/D		1 mg/L
Total Dissolved solids		SM2540 C		20 mg/L

Appendix A Table 3 - Priority pollutants: Metals, chromium (hex), cyanide & total phenols

Priority pollutants	PP #	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
Antimony, Total	114	7440-36-0	200.8	0.3	1.0
Arsenic, Total	115	7440-38-2	200.8	0.1	0.5
Beryllium, Total	117	7440-41-7	200.8	0.1	0.5
Cadmium, Total	118	7440-43-9	200.8	0.05	0.25
Chromium (hex) dissolved	119	18540-29-9	SM3500-Cr C	0.3	1.2
Chromium, Total	119	7440-47-3	200.8	0.2	1.0
Copper, Total	120	7440-50-8	200.8	0.4	2.0
Lead, Total	122	7439-92-1	200.8	0.1	0.5
Mercury, Total	123	7439-97-6	1631E	0.0002	0.0005
Nickel, Total	124	7440-02-0	200.8	0.1	0.5
Selenium, Total	125	7782-49-2	200.8	1.0	1.0
Silver, Total	126	7440-22-4	200.8	0.04	0.2
Thallium, Total	127	7440-28-0	200.8	0.09	0.36
Zinc, Total	128	7440-66-6	200.8	0.5	2.5
Cyanide, Total	121	57-12-5	335.4	5	10
Cyanide, Weak Acid Dissociable	121		SM4500-CN I	5	10
Cyanide, Free Amenable to Chlorination (Available Cyanide)	121		SM4500-CN G	5	10
Phenols, Total	65		EPA 420.1		50

Appendix A Table 4 - Priority pollutants: Acid compounds

Priority pollutants	PP #	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
2-Chlorophenol	24	95-57-8	625.1	3.3	9.9
2,4-Dichlorophenol	31	120-83-2	625.1	2.7	8.1
2,4-Dimethylphenol	34	105-67-9	625.1	2.7	8.1
4,6-dinitro-o-cresol (2-methyl-4,6,-dinitrophenol)	60	534-52-1	625.1/1625B	24	72
2,4 dinitrophenol	59	51-28-5	625.1	42	126
2-Nitrophenol	57	88-75-5	625.1	3.6	10.8
4-Nitrophenol	58	100-02-7	625.1	2.4	7.2
Parachlorometa cresol (4-chloro-3-methylphenol)	22	59-50-7	625.1	3.0	9.0
Pentachlorophenol	64	87-86-5	625.1	3.6	10.8
Phenol	65	108-95-2	625.1	1.5	4.5
2,4,6-Trichlorophenol	21	88-06-2	625.1	2.7	8.1

Appendix A Table 5 - Priority pollutants: Volatile compounds

Priority pollutants	PP #	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
Acrolein	2	107-02-8	624.1	5	10
Acrylonitrile	3	107-13-1	624.1	1.0	2.0
Benzene	4	71-43-2	624.1	4.4	13.2
Bromoform	47	75-25-2	624.1	4.7	14.1
Carbon tetrachloride	6	56-23-5	624.1/601 or SM6230B	2.8	8.4
Chlorobenzene	7	108-90-7	624.1	6.0	18.0
Chloroethane	16	75-00-3	624/601	1.0	2.0
2-Chloroethylvinyl Ether	19	110-75-8	624.1	1.0	2.0
Chloroform	23	67-66-3	624.1 or SM6210B	1.6	4.8

Dibromochloromethane (chlordibromomethane)	51	124-48-1	624.1	3.1	9.3
1,2-Dichlorobenzene	25	95-50-1	624.1	1.9	7.6
1,3-Dichlorobenzene	26	541-73-1	624.1	1.9	7.6
1,4-Dichlorobenzene	27	106-46-7	624.1	4.4	17.6
Dichlorobromomethane	48	75-27-4	624.1	2.2	6.6
1,1-Dichloroethane	13	75-34-3	624.1	4.7	14.1
1,2-Dichloroethane	10	107-06-2	624.1	2.8	8.4
1,1-Dichloroethylene	29	75-35-4	624.1	2.8	8.4
1,2-Dichloropropane	32	78-87-5	624.1	6.0	18.0
1,3-dichloropropene (mixed isomers) (1,2-dichloropropylene)6	33	542-75-6	624.1	5.0	15.0
Ethylbenzene	38	100-41-4	624.1	7.2	21.6
Methyl bromide (Bromomethane)	46	74-83-9	624/601	5.0	10.0
Methyl chloride (Chloromethane)	45	74-87-3	624.1	1.0	2.0
Methylene chloride	44	75-09-2	624.1	2.8	8.4
1,1,2,2-Tetrachloroethane	15	79-34-5	624.1	6.9	20.7
Tetrachloroethylene	85	127-18-4	624.1	4.1	12.3
Toluene	86	108-88-3	624.1	6.0	18.0
1,2-Trans-Dichloroethylene (Ethylene dichloride)	30	156-60-5	624.1	1.6	4.8
1,1,1-Trichloroethane	11	71-55-6	624.1	3.8	11.4
1,1,2-Trichloroethane	14	79-00-5	624.1	5.0	15.0
Trichloroethylene	87	79-01-6	624.1	1.9	5.7
Vinyl chloride	88	75-01-4	624/SM6200B	1.0	2.0

Appendix A Table 6 - Priority pollutants: Base/neutral compounds

Priority pollutants	PP #	CAS number (if available)	Recommended analytical Protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
Acenaphthene	1	83-32-9	625.1	1.9	5.7

Acenaphthylene	77	208-96-8	625.1	3.5	10.5
Anthracene	78	120-12-7	625.1	1.9	5.7
Benzidine	5	92-87-5	625.1	44	132
Benzyl butyl phthalate	67	85-68-7	625.1	2.5	7.5
Benzo(a)anthracene	72	56-55-3	625.1	7.8	23.4
Benzo(b)fluoranthene (3,4-benzofluoranthene) [7]	74	205-99-2	610/625.1	4.8	14.4
Benzo(k)fluoranthene (11,12-benzofluoranthene) [7]	75	207-08-9	610/625.1	2.5	7.5
Benzo(a)pyrene	73	50-32-8	610/625.1	2.5	7.5
Benzo(ghi)Perylene	79	191-24-2	610/625.1	4.1	12.3
Bis(2-chloroethoxy)methane	43	111-91-1	625.1	5.3	15.9
Bis(2-chloroethyl)ether	18	111-44-4	611/625.1	5.7	17.1
Bis(2-chloro-1-methylethyl)Ether (Bis(2-chloroisopropyl)ether) [8]	42	108-60-1	625.1	5.7	17.1
Bis(2-ethylhexyl)phthalate	66	117-81-7	625.1	2.5	7.5
4-Bromophenyl phenyl ether	41	101-55-3	625.1	1.9	5.7
2-Chloronaphthalene	20	91-58-7	625.1	1.9	5.7
4-Chlorophenyl phenyl ether	40	7005-72-3	625.1	4.2	12.6
Chrysene	76	218-01-9	610/625.1	2.5	7.5
Dibenzo(a-h)anthracene (1,2,5,6-dibenzanthracene)	82	53-70-3	625.1	2.5	7.5
3,3-Dichlorobenzidine	28	91-94-1	605/625.1	16.5	49.5
Diethyl phthalate	70	84-66-2	625.1	1.9	5.7
Dimethyl phthalate	71	131-11-3	625.1	1.6	4.8
Di-n-butyl phthalate	68	84-74-2	625.1	2.5	7.5
2,4-dinitrotoluene	35	121-14-2	609/625.1	5.7	17.1
2,6-dinitrotoluene	36	606-20-2	609/625.1	1.9	5.7
Di-n-octyl phthalate	69	117-84-0	625.1	2.5	7.5
1,2-Diphenylhydrazine (as Azobenzene)	37	122-66-7	1625B/625.1	5.0	20
Fluoranthene	39	206-44-0	625.1	2.2	6.6
Fluorene	80	86-73-7	625.1	1.9	5.7

Hexachlorobenzene	9	118-74-1	612/625.1	1.9	5.7
Hexachlorobutadiene	52	87-68-3	625.1	0.9	2.7
Hexachlorocyclopentadiene	53	77-47-4	1625B/625.1	2.0	4.0
Hexachloroethane	12	67-72-1	625.1	1.6	4.8
Indeno(1,2,3-cd)Pyrene	83	193-39-5	610/625.1	3.7	11.1
Isophorone	54	78-59-1	625.1	2.2	6.6
Naphthalene	55	91-20-3	625.1	1.6	4.8
Nitrobenzene	56	98-95-3	625.1	1.9	5.7
N-Nitrosodimethylamine	61	62-75-9	607/625.1	2.0	4.0
N-Nitrosodi-n-propylamine	63	621-64-7	607/625.1	0.5	1.0
N-Nitrosodiphenylamine	62	86-30-6	625.1	1.0	2.0
Phenanthrene	81	85-01-8	625.1	5.4	16.2
Pyrene	84	129-00-0	625.1	1.9	5.7
1,2,4-Trichlorobenzene	8	120-82-1	625.1	1.9	5.7

Appendix A Table 7 - Base/neutral compounds – Ecology PBTs

Pollutant	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
Benzo(j)fluoranthene [7]	205-82-3	625	0.5	1.0
Benzo(r,s,t)pentaphene	189-55-9	625	1.3	5.0
Dibenzo (a,h)acridine	226-36-8	610M/625M	2.5	10.0
Dibenzo (a,j)acridine	224-42-0	610M/625M	2.5	10.0
Dibenzo(a,e)pyrene	192-65-4	610M/625M	2.5	10.0
Dibenzo(a,h)pyrene	189-64-0	625M	2.5	10.0
3-Methyl cholanthrene	56-49-5	625	2.0	8.0
Perylene	198-55-0	625	1.9	7.6

Appendix A Table 8 - Dioxin

Priority pollutant	PP #	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
2,3,7,8-Tetra-Chlorodibenzo-P-Dioxin (2,3,7,8 TCDD)	129	1746-01-6	1613B	1.3 pg/L	5 pg/L

Appendix A Table 9 - Pesticides and PCBs

Priority pollutants	PP #	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
Aldrin	89	309-00-2	608.3	4.0 ng/L	12 ng/L
alpha-BHC	102	319-84-6	608.3	3.0 ng/L	9.0 ng/L
beta-BHC	103	319-85-7	608.3	6.0 ng/L	18 ng/L
gamma-BHC (Lindane)	104	58-89-9	608.3	4.0 ng/L	12 ng/L
delta-BHC	105	319-86-8	608.3	9.0 ng/L	27 ng/L
Chlordane [9]	91	57-74-9	608.3	14 ng/L	42 ng/L
4,4'-DDT	92	50-29-3	608.3	12 ng/L	36 ng/L
4,4'-DDE	93	72-55-9	608.3	4.0 ng/L	12 ng/L
4,4' DDD	94	72-54-8	608.3	11ng/L	33 ng/L
Dieldrin	90	60-57-1	608.3	2.0 ng/L	6.0 ng/L
alpha-Endosulfan	95	959-98-8	608.3	14 ng/L	42 ng/L
beta-Endosulfan	96	33213-65-9	608.3	4.0 ng/L	12 ng/L
Endosulfan Sulfate	97	1031-07-8	608.3	66 ng/L	198 ng/L
Endrin	98	72-20-8	608.3	6.0 ng/L	18 ng/L
Endrin Aldehyde	99	7421-93-4	608.3	23 ng/L	70 ng/L
Heptachlor	100	76-44-8	608.3	3.0 ng/L	9.0 ng/L
Heptachlor Epoxide	101	1024-57-3	608.3	83 ng/L	249 ng/L
PCB-1242 [10]	106	53469-21-9	608.3	0.065	0.195
PCB-1254	107	11097-69-1	608.3	0.065	0.195
PCB-1221	108	11104-28-2	608.3	0.065	0.195

PCB-1232	109	11141-16-5	608.3	0.065	0.195
PCB-1248	110	12672-29-6	608.3	0.065	0.195
PCB-1260	111	11096-82-5	608.3	0.065	0.195
PCB-1016 [10]	112	12674-11-2	608.3	0.065	0.195
Toxaphene	113	8001-35-2	608.3	240 ng/L	720 ng/L

Appendix A Table 10 - Nonconventionals – dioxin & furan congeners

Pollutant	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
2,3,7,8- Tetrachlorodibenzo-p-dioxin (TCDD) (this is a priority pollutant also listed in Table 8)	1746-01-6	EPA 1613	1.3 pg/L	5 pg/L
Total TCDD	41903-57-5			
2,3,7,8- Tetrachlorodibenzofuran (TCDF)	51207-31-9		1.3 pg/L	5 pg/L
Total-TCDF	55722-27-5			
1,2,3,7,8- Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4			
Total-PeCDD	36088-22-9			
1,2,3,7,8- Pentachlorodibenzofuran (PeCDF)	57117-41-6			
2,3,4,7,8-PeCDF	57117-31-4			
Total-PeCDF	30402-15-4			
1,2,3,4,7,8- Hexachlorodibenzo-p-dioxin (HxCDD)	39227-28-6			
1,2,3,6,7,8-HxCDD	57653-85-7			
1,2,3,7,8,9-HxCDD	19408-74-3			
Total-HxCDD	34465-46-8			
1,2,3,4,7,8- Hexachlorodibenzofuran (HxCDF)	70648-26-9			
1,2,3,6,7,8-HxCDF	57117-44-9			
1,2,3,7,8,9-HxCDF	72918-21-9			
2,3,4,6,7,8-HxCDF	60851-34-5			

Total-HxCDF	55684-94-1			
1,2,3,4,6,7,8- Heptachlorodibenzo-p-dioxin (HpCDD)	35822-46-9			
Total-HpCDD	37871-00-4			
1,2,3,4,6,7,8- Heptachlorodibenzofuran (HpCDF)	67562-39-4			
1,2,3,4,7,8,9-HpCDF	55673-89-7			
Total-HpCDF	38998-75-3			
Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9			
Octachlorodibenzofuran (OCDF)	39001-02-0			

Footnotes

[1] Detection level (DL) – or method detection limit means the minimum concentration of an analyte (substance) that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results as determined by the procedure given in 40 CFR part 136, Appendix B.

[2] Quantitation Level (QL) – also known as Minimum Level (ML) – The term ‘‘minimum level’’ refers to either the sample concentration equivalent to the lowest calibration point in a method or a multiple of the method detection limit (DL), whichever is higher. Minimum levels may be obtained in several ways: They may be published in a method; they may be based on the lowest acceptable calibration point used by a laboratory; or they may be calculated by multiplying the DL in a method, or the DL determined by a laboratory, by a factor of 3. For the purposes of NPDES compliance monitoring, EPA considers the following terms to be synonymous: ‘‘quantitation limit,” ‘‘reporting limit,’’ and ‘‘minimum level’’.

[3] Soluble Biochemical Oxygen Demand – method note: First, filter the sample through a Millipore Nylon filter (or equivalent) - pore size of 0.45-0.50 um (prep all filters by filtering 250 ml of laboratory grade deionized water through the filter and discard). Then, analyze sample as per method 5210-B.

[4] Northwest Total Petroleum Hydrocarbons Diesel Extended Range OR NWTPH Dx – Analytical Methods for Petroleum Hydrocarbons https://apps.ecology.wa.gov/publications/documents/97602.pdf

[5] Northwest Total Petroleum Hydrocarbons Gasoline Extended Range OR NWTPH Gx – Analytical Methods for Petroleum Hydrocarbons https://apps.ecology.wa.gov/publications/documents/97602.pdf

[6] 1, 3-dichloroproylene (mixed isomers) – You may report this parameter as two separate parameters: cis-1, 3-dichlorpropropene (10061-01-5) and trans-1, 3-dichloropropene (10061-02-6).

[7] Total Benzofluoranthenes – Because Benzo(b)fluoranthene, Benzo(j)fluoranthene and Benzo(k)fluoranthene co-elute you may report these three isomers as total benzofluoranthenes.

[8] Bis(2-Chloro-1-Methylethyl) Ether – This compound was previously listed as Bis(2-Chloroisopropyl) Ether (39638-32-9)

[9] Chlordane – You may report alpha-chlordane (5103-71-9) and gamma-chlordane (5103-74-2) in place of chlordane (57-74-9). If you report alpha and gamma-chlordane, the DL/PQLs that apply are 14/42 ng/L.

[10] PCB 1016 & PCB 1242 – You may report these two PCB compounds as one parameter called PCB 1016/1242.

FACT SHEET FOR NPDES PERMIT WA0020249

City of Camas Wastewater Treatment Plant

Date of Public Notice: April 15, 2025

Permit Effective Date: August 1, 2025

Purpose of this fact sheet

This fact sheet explains and documents the decisions the Department of Ecology (Ecology) made in drafting the proposed National Pollutant Discharge Elimination System (NPDES) permit for the city of Camas wastewater treatment plant (WWTP).

This fact sheet complies with Section 173-220-060 of the Washington Administrative Code (WAC), which requires Ecology to prepare a draft permit and accompanying fact sheet for public evaluation before issuing an NPDES permit.

Ecology makes the draft permit and fact sheet available for public review and comment at least thirty (30) days before issuing the final permit. Copies of the fact sheet and draft permit for city of Camas, NPDES permit WA0020249, are available for public review and comment from **April 15, 2025, to May 16, 2025.** For more details on preparing and filing comments about these documents, please see Appendix A - Public Involvement Information.

The city of Camas reviewed the draft permit and fact sheet for factual accuracy. Ecology corrected any errors or omissions regarding the facility's location, history, discharges, or receiving water prior to publishing this draft fact sheet for public notice.

After the public comment period closes, Ecology will summarize substantive comments and provide responses to them. Ecology will include the summary and responses to comments in this fact sheet as Appendix E - Response to Comments and publish it when issuing the final NPDES permit. Ecology generally will not revise the rest of the fact sheet. The full document will become part of the legal history contained in the facility's permit file.

Summary

The city of Camas operates an activated sludge wastewater treatment plant that discharges to the Columbia River. Ecology issued the previous permit for this facility on September 25, 2015.

The proposed permit includes the same effluent limits for Biochemical Oxygen Demand (BOD_5), Total Suspended Solids (TSS), fecal coliform bacteria, and pH as the permit issued in 2015. Average monthly ammonia limits were continued in this permit and average weekly limits for ammonia were developed. Ecology added a new water quality-based limit for heat load based on the wasteload allocation from the Columbia

and Lower Snake River Temperature Total Maximum Daily Load (TMDL). The proposed permit requires the POTW to meet the 85% removal requirements for BOD_5 and TSS as several I/I reduction projects have removed these excessive flows from the collection system. The permit includes new monitoring requirements for *E. coli* and continues pretreatment related monitoring to support Ecology's implementation of the Federal Pretreatment and State Waste Discharge Permit programs.

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I. Introduction

The Federal Clean Water Act (FCWA, 1972, and later amendments in 1977, 1981, and 1987) established water quality goals for the navigable (surface) waters of the United States. One mechanism for achieving the goals of the Clean Water Act is the National Pollutant Discharge Elimination System (NPDES), administered by the federal Environmental Protection Agency (EPA). The EPA authorized the state of Washington to manage the NPDES permit program in our state. Our state legislature accepted the delegation and assigned the power and duty for conducting NPDES permitting and enforcement to Ecology. The Legislature defined Ecology's authority and obligations for the wastewater discharge permit program in 90.48 RCW (Revised Code of Washington).

The following regulations in the Washington Administrative Code (WAC) apply to domestic wastewater NPDES permits:

- Procedures Ecology follows for issuing NPDES permits (chapter 173-220 WAC)
- Discharge standards for domestic wastewater facilities (chapter 173 221 WAC)
- Water quality criteria for surface waters (chapter 173-201A WAC)
- Water quality criteria for ground waters (chapter 173-200 WAC)
- Whole effluent toxicity testing and limits (chapter 173-205 WAC)
- Sediment management standards (chapter 173-204 WAC)
- Submission of plans and reports for construction of wastewater facilities (chapter 173-240 WAC)

These rules require any treatment facility owner/operator to obtain an NPDES permit before discharging wastewater to state waters. They also help define the basis for limits on each discharge and for performance requirements imposed by the permit.

Under the NPDES permit program and in response to a complete and accepted permit application, Ecology must prepare a draft permit and accompanying fact sheet and make them available for public review before final issuance. Ecology must also publish an announcement (public notice) telling people where they can read the draft permit, and where to send their comments, during a period of thirty days (WAC 173-220-050). (See *Appendix A-Public Involvement Information* for more detail about the public notice and comment procedures). After the public comment period ends, Ecology may make changes to the draft NPDES permit in response to comment(s). Ecology will summarize the responses to comments and any changes to the permit in Appendix E.

II. Background information

Table 1 - Facility information

Applicant:	**City of Camas Wastewater Treatment Plant**
Facility name and address	City of Camas WWTP 1129 Southeast Polk Street Camas, WA 98607
Contact at facility	Jacob Taylor Wastewater Operations Supervisor 360-316-8925 jtaylor@cityofcamas.us
Responsible official	Steve Hogan Mayor 616 NE 4th Ave Camas, WA 98607 Telephone #:360-834-6864 Email: shogan@cityofcamas.us
Type of treatment	Activated sludge (Modified Ludzack-Ettinger) with selectors, alkalinity addition, anaerobic digestion, and effluent filtration.
Facility location (NAD83/WGS84 reference datum)	Latitude: 45.57866° N Longitude: 122.39447° W
Discharge waterbody name and location (NAD83/WGS84 reference datum)	Columbia River, RM 121 Latitude: 45.57479° N Longitude: 122.391897° W

Permit status

Issuance date of previous permit: September 25, 2015

Application for permit renewal submittal date: April 3, 2020

Inspection status

Date of last non-sampling inspection: January 7, 2025

Figure 1 - Facility location map



II.A. Facility description

1. History

The treatment facility for the city of Camas (City) was constructed in 1972 along the Columbia River in the southeastern portion of the sewer service area. The facility has undergone several modifications since original construction. The Phase I upgrade and expansion (primarily liquid stream) was completed in February of 2000. The Phase 2A upgrade primarily addressing solids treatment, including anaerobic digesters and sludge drying facilities occurred in 2012. Phase 2B, the most recent upgrade, occurred in 2014 and consisted of improved blower controls, the addition of a third secondary clarifier, new effluent filters and digester gas treatment facilities.

The EPA classifies the Camas Wastewater Treatment Plant as a major facility as design flows exceed 1 MGD.

2. Collection system status

The City of Camas sewer service area covers approximately 7,400 acres. The collection system includes conventional gravity sewers with lift stations, septic tank effluent pumping stations (STEP), septic tank effluent filter systems (STEF) and septic tank effluent gravity systems (STEG). Conventional gravity sewers are the most common type of conveyance within the city limits.

Portions of the service area served by conventional gravity sewers are from the 1920s. These early sections of the gravity sewer were constructed with vitrified clay pipe (VCP). Over time, most of the VCP was replaced with cast iron, concrete and eventually PVC. Gravity sewers range from four inch to 24-inches in diameter. The majority of gravity collection system is 8-inches in diameter. There are approximately 45 miles of gravity sewer mains in the service area.

Beginning in the mid-1980s, Camas required customers in the western portion of the sewer service area to connect using STE systems. STEP systems consist of a septic tank equipped with a pump at the outlet to convey effluent flows to the STEP transmission main. STEG systems consist of a septic tank with an outlet that conveys effluent flows by gravity to the STE transmission main. And STEF systems utilize a siphon to convey flows to the STE transmission main. Camas owns and maintains the residential STE systems. They pump out septage from the STE systems on an eight-year cycle. Commercial and industrial STE systems are owned and maintained by the property owner. Septage from commercial, industrial and residential STE systems receive treatment at the WWTP.

Twenty-nine lift stations convey sewage and septic tank effluent to the treatment plant when gravity sewers cannot be utilized. Thirteen lift stations serve the gravity system while fifteen serve the septic tank effluent (STE) systems. One lift station is dedicated to odor control. There is approximately 51,460 LF of forcemain ranging from 4 to 18-inches. The majority of lift stations serve a relatively small service area and have capacities of less than 500 gallons per minute (GPM); however, the main lift station has a capacity of 7,700 GPM and conveys the majority of the gravity collection system to the WWTP through an 18-inch diameter forcemain under Lacamas Creek.

Inflow and infiltration (I/I) from the STE systems is fairly low; however, historically, the inflow from the gravity collection system is fairly high. Since the 1970s, the city has an ongoing I/I reduction program. In 2020, the city conducted a follow up study to document the I/I reduction stemming from implementing recommendations from the 2016 I/I evaluation. This study showed that the City has observed a reduction in peak WWTP flows and high flow events, even though the population of the city and extent of the sewer system have both increased over the study period. As a result, the city’s WWTP no longer sees excessive I/I as defined by the EPA criteria. While excessive I/I may have been

addressed, the city has planned I/I reduction projects for the next five years. These include:

- Ongoing gravity main repair and replacement.
- Crown view pump station improvements.
- Lacamas Creek Pump Station improvements.

3. Treatment process

Liquid stream treatment at the Camas WWTP begins with climbing perforated filter screens at the plant headworks to remove larger material which is washed, compacted, and disposed of at the local landfill. Primary solids -liquid separation occurs in two circular primary clarifiers with the primary effluent discharging to a splitter box where it is combined with returned activated sludge (RAS) from the secondary clarifiers and split between three aeration basins (ABs), where biomass is aerated to promote biological oxidation. Secondary treatment in the ABs consists of influent channel selector zones followed by two anoxic zones and three aerobic zones to remove carbonaceous material and reduce ammonia concentrations. Magnesium hydroxide is added at the splitter box to provide supplemental alkalinity ahead of aeration.

Mixed liquor from the three ABs is combined and split between three secondary clarifiers. Each clarifier proves separation of the biomass from the secondary treatment process and discharges treated effluent to two mechanical disc filters. Ultraviolet disinfection is provided in an open channel system prior to discharge to the outfall in the Columbia River.

Disinfected effluent flows by gravity or is pumped to the outfall via three effluent pumps which are operated in a two duty, one standby configuration. The transition between gravity and pumped effluent flow occurs automatically when pumps are placed in “auto” mode. As the Columbia River level rises, gravity effluent discharge is stopped by closing the flap gate in the effluent manhole.

Solids from the primary clarifiers enter two hydro-cyclones and a grit classifier before thickening by via gravity thickener. Thickened primary sludge is then pumped to anaerobic digesters. Solids from the secondary clarifiers are removed and either pumped back to the aeration splitter box as RAS or wasted to a storage tank and thickened via rotary drum thickener. Thickened primary and secondary solids are combined in the anaerobic digesters for stabilization, removal of volatile solids and production of biogas. Digested sludge is dewatered by centrifuge and is then conveyed to a belt dryer which evaporates the remaining water content in the finished biosolids.

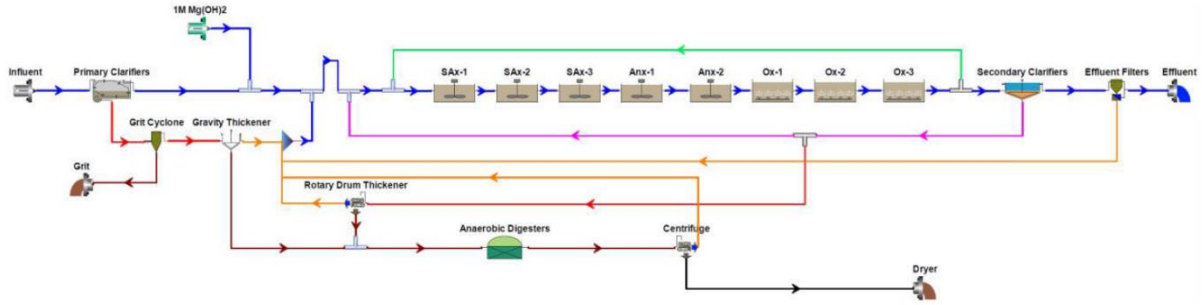
The Camas WWTP is a major facility as classified by EPA as it is over 1 MGD. It is also a Class IV facility requiring the operator in responsible charge of the facility to have a Group IV license.

The plant hours of operation are 5:00 am to 3:30 pm seven days per week.

There are four significant industrial users that have pretreatment permits issued by Ecology. Camas has not been delegated pretreatment authorities. The four industries permitted by Ecology that discharge to the Camas WWTP are:

- Analog Devices, Inc., ST0006154
- nLight Inc, ST0006270
- Northwest Paper Box Manufacturers, Inc., ST0005027
- TSMC Washington, LLC, ST0006200

Figure 2 – Process Flow Diagram



4. Solid wastes and residual solids

The treatment facilities remove solids during the treatment of the wastewater at the headworks (grit and screenings), and at the primary and secondary clarifiers, in addition to incidental solids (rags, scum, and other debris) removed as part of the routine maintenance of the equipment. The Camas WWTP drains grit, rags, scum, and screenings and disposes this solid waste at the local landfill. Solids removed from the primary and secondary clarifiers are thickened, treated by anaerobic digestion and dried before being land applied. This facility has met the solid waste requirements for screening, as required by WAC 173-308-205, by having screens with an aperture of less than 3/8-inch.

5. Discharge outfall

The treated and disinfected effluent flows into the Columbia River through a 36-inch corrugated metal pipe (CMP) and extends approximately 850 feet into the river channel. The diffuser portion of the outfall is located along the outer 150 feet of the pipe and is equipped with 16 vertical risers, each oriented vertically with rubber Tideflex check valve nozzles. The vertical risers discharge effluent perpendicular to the flow of the Columbia River.

II.B. Description of the receiving water

The Camas WWTP discharges to the Columbia River at River Mile (RM) 121. Other nearby point source outfalls include the Washougal WWTP and MS4 discharges. Significant nearby non-point sources of pollutants include diffuse stormwater and agricultural practices. Section IIIE of this fact sheet describes any receiving waterbody impairments.

The ambient background data used for this permit includes the following from the City of Camas Receiving Water Study Report (CH2M,2017):

Table 2 - Ambient background data

Parameter	Value
pH (Maximum / Minimum)	8.10/7.29 standard units
Total Ammonia-N	0.183 mg/L
Hardness	74.0 mg/L as CaCO3
Alkalinity	66.2 mg/L as CaCO3
Arsenic, dissolved	1.02 µg/L
Cadmium, dissolved	<0.03 µg/L
Chromium, dissolved	0.416 µg/L
Chromium, hexavalent, dissolved	0.086 µg/L
Copper, dissolved	1.43 µg/L
Lead, dissolved	0.064 µg/L
Mercury, dissolved	0.884 µg/L
Nickel, dissolved	0.604 µg/L
Selenium, dissolved	0.274 µg/L
Silver, dissolved	<0.025 µg/L
Thallium, dissolved	<0.025 µg/L
Zinc, dissolved	1.25 µg/L
Temperature	23.2 °C

II.C. Wastewater influent characterization

Camas WWTP reported the concentration of pollutants in the wastewater influent in the permit application and in discharge monitoring reports. The tabulated data represents the quality of the wastewater influent from October 1, 2019 – October 31, 2024.

Table 3 - Wastewater influent characterization

Parameter	Units	# of Samples	Average value	Maximum value
Flow	MGD	1858	2.6	7.8
Biochemical Oxygen Demand (BOD_5)	mg/L	1154	120	314
Biochemical Oxygen Demand (BOD_5)	lbs/day	1154	2,552	6,160
Total Suspended Solids (TSS)	mg/L	1176	128	380
Total Suspended Solids (TSS)	lbs/day	1156	2,742	12,421

Parameter	Units	# of Samples	Average value	Maximum value
Ammonia, Total	mg/L	1155	41.7	59.6
Antimony, Total Recoverable	µg/L	20	0.3	0.67
Arsenic, Total Recoverable	µg/L	20	0.9	1.26
Cadmium, Total Recoverable	µg/L	20	0.1	0.26
Chromium, Total Recoverable	µg/L	20	2.6	4.13
Chromium, Hexavalent	µg/L	20	79.1	490
Copper, Total Recoverable	µg/L	20	42.5	81.7
Cyanide, Total Recoverable	µg/L	20	5.1	20.0
Lead, Total Recoverable	µg/L	20	0.8	4.70
Mercury, Total Recoverable	ng/L	20	10.2	19.2
Molybdenum, Total Recoverable	µg/L	20	5.9	10.5
Nickel, Total Recoverable	µg/L	20	3.8	7.50
Oil & Grease	mg/L	20	18.5	37.2
Petroleum Hydrocarbons	µg/L	20	167	250
Selenium, Total Recoverable	µg/L	20	0.5	1.00
Silver, Total Recoverable	µg/L	20	0.1	0.38
Sulfate	µg/L	20	178,924	334,000
Zinc, Total Recoverable	µg/L	20	77.1	269

Parameter	Units	# of Samples	Minimum value	Maximum value
pH	SU	1858	6.9	9.7

II.D. Wastewater effluent characterization

Camas WWTP reported the concentration of pollutants in the discharge in the permit application and in discharge monitoring reports. The tabulated data represents the quality of the wastewater effluent discharged from October 1, 2019 – October 31, 2024.

Table 4 - Wastewater effluent characterization

Parameter	Units	# of Samples	Average value	Maximum value
Flow	MGD	1,858	2.96	8.24
Biochemical Oxygen Demand (BOD_5)	mg/L	1,157	3.68	22.4
Biochemical Oxygen Demand (BOD_5)	lbs/day	1,157	93.8	1,527
Total Suspended Solids (TSS)	mg/L	1,158	3.68	28.2
Total Suspended Solids (TSS)	lbs/day	1,158	91.3	1,922
Ammonia, Total	mg/L	1,156	0.297	5.17
Antimony, Total Recoverable	µg/L	20	0.240	0.345
Arsenic, Total Recoverable	µg/L	20	0.660	0.95
Butyl benzyl phthalate	µg/L	3	0.11	0.27
Cadmium, Total Recoverable	µg/L	20	0.015	0.022

Parameter	Units	# of Samples	Average value	Maximum value
Chlorine	mg/L	3	0.023	0.030
Chloroform	µg/L	4	0.55	0.71
Chromium, Total Recoverable	µg/L	20	0.536	0.970
Chromium, Hexavalent	µg/L	20	92.0	490
Copper, Total Recoverable	µg/L	20	5.80	11.1
Cyanide, Total Recoverable	µg/L	20	7.58	20.0
di-n-octyl phthalate	µg/L	3	0.15	0.22
Diethyl phthalate	µg/L	3	0.59	1.1
Dissolved Oxygen	mg/L	3	4.95	5.12
Fluoride	µg/L	20	2,584	4,150
Hardness, as $CaCO_3$	mg/L	4	168	238
Total Kjeldahl Nitrogen	mg/L	61	2.89	21.4
Lead, Total Recoverable	µg/L	20	0.099	0.150
Mercury, Total Recoverable	ng/L	20	0.653	1.01
Molybdenum, Total Recoverable	µg/L	20	4.09	8.20
Naphthalene	µg/L	3	0.16	0.45
Nickel, Total Recoverable	µg/L	20	1.94	2.82
Oil & Grease	mg/L	24	4.11	17.2
Petroleum Hydrocarbons	µg/L	20	158	250
Phenol	µg/L	3	1.96	5.5
Phosphate, Ortho-phosphate	mg/L	61	7.15	10
Phosphorus, Total	mg/L	61	7.62	27.2
Selenium, Total Recoverable	µg/L	20	0.680	1.00
Silver, Total Recoverable	µg/L	20	0.015	0.020
Sulfate	µg/L	20	176,770	241,000
Temperature	°C	3,716	19.9	24
Total Phenolic Compounds	µg/L	4	0.244	1.07
Zinc, Total Recoverable	µg/L	20	21.1	28.4

Parameter	Units	# of Samples	Maximum Monthly Geometric Mean	Maximum Weekly Geometric Mean
Fecal Coliform	#/100 mL	1061	51	213

Parameter	Units	# of Samples	Minimum value	Maximum value
pH	SU	1858	6.9	8.70

II.E. Summary of compliance with previous permit issued September 25, 2015

The previous permit placed effluent limits on BOD_5, TSS, ammonia, pH and fecal coliform bacteria.

Camas WWTP has not consistently complied with the effluent limits and permit conditions throughout the duration of the permit issued on September 25, 2015.

Ecology assessed compliance based on its review of the facility's discharge monitoring reports (DMRs) and on inspections.

The following table summarizes the violations that occurred during the permit term.

Table 5 - Violations, October 1, 2019 – October 31, 2024

Violation date	Parameter type	Unit type	Max limit	Measurement value quantity	Statistical base type	Violation
10/28/2019	pH (Hydrogen Ion) Daily Min	Standard Units	6	5.9	Single Sample	Numeric effluent violation
04/01/2020						Late Submittal of DMRs
06/01/2020						Late Submittal of DMRs
10/01/2020	Cyanide	Micrograms/L (ug/L)			Average	Analysis not Conducted
10/28/2020	Cyanide	Micrograms/L (ug/L)			Single Sample	Analysis not Conducted
10/01/2020	Petroleum Hydrocarbons	Micrograms/L (ug/L)			Average	Analysis not Conducted
10/28/2020	Petroleum Hydrocarbons	Micrograms/L (ug/L)			Single Sample	Analysis not Conducted
01/01/2022	Chlorine	Milligrams/L (mg/L)			Average	Analysis not Conducted
12/06/2022	Chlorine	Milligrams/L (mg/L)			Single Sample	Analysis not Conducted
01/01/2022	Dissolved Oxygen	Milligrams/L (mg/L)			Average	Analysis not Conducted
12/06/2022	Dissolved Oxygen	Milligrams/L (mg/L)			Single Sample	Analysis not Conducted
11/14/2022	pH (Hydrogen Ion) Daily Min	Standard Units	6	3	Single Sample	Numeric effluent violation*
12/27/2022	Biochemical Oxygen	Percent			Single Sample	Analysis not Conducted

Violation date	Parameter type	Unit type	Max limit	Measurement value quantity	Statistical base type	Violation
	Demand (BOD_5)					
12/29/2022	pH (Hydrogen Ion) Daily Min	Standard Units	6	3	Single Sample	Numeric effluent violation*
12/27/2022	Biochemical Oxygen Demand (BOD_5)	Lbs/Day			Single Sample	Analysis not Conducted
12/27/2022	Biochemical Oxygen Demand (BOD_5)	Milligrams/L (mg/L)			Single Sample	Analysis not Conducted
02/01/2023	pH (Hydrogen Ion) Daily Min	Standard Units	6	3	Single Sample	Numeric effluent violation*
03/08/2023	pH (Hydrogen Ion) Daily Min	Standard Units	6	3	Single Sample	Numeric effluent violation*
04/05/2023	pH (Hydrogen Ion) Daily Min	Standard Units	6	3	Single Sample	Numeric effluent violation*
05/06/2024	pH (Hydrogen Ion) Daily Min	Standard Units	6	4	Single Sample	Numeric effluent violation*
10/11/2024	pH (Hydrogen Ion) Daily Min	Standard Units	6	3	Single Sample	Numeric effluent violation*

*Note that the low pH excursions were related to instrumentation malfunction and not a true measurement of effluent pH.

The following table summarizes compliance with report submittal requirements over the permit term.

Table 6 - Permit submittals

Submittal name	Submittal status	Due date	Received date
Infiltration And Inflow Evaluation	Accepted	07/15/2016	07/15/2016
Infiltration And Inflow Evaluation	Accepted	07/15/2017	07/14/2017
Infiltration And Inflow Evaluation	Accepted	07/15/2018	07/13/2018
Infiltration And Inflow Evaluation	Accepted	07/15/2019	07/15/2019
Infiltration And Inflow Evaluation	Accepted	07/15/2020	06/10/2020
Infiltration And Inflow Evaluation	Submitted	07/15/2021	07/15/2021

Submittal name	Submittal status	Due date	Received date
Infiltration And Inflow Evaluation	Reviewed	07/15/2022	06/01/2022
Infiltration And Inflow Evaluation	Accepted	07/15/2023	06/21/2023
Infiltration And Inflow Evaluation	Accepted	07/15/2024	07/12/2024
Wasteload Assessment	Accepted	06/15/2016	06/14/2016
Wasteload Assessment	Accepted	06/15/2017	06/14/2017
Wasteload Assessment	Accepted	06/15/2018	06/15/2018
Wasteload Assessment	Accepted	06/15/2019	06/14/2019
Wasteload Assessment	Accepted	06/15/2020	06/12/2020
Wasteload Assessment	Accepted	06/15/2021	06/9/2021
Wasteload Assessment	Reviewed	06/15/2022	05/27/2022
Wasteload Assessment	Accepted	06/15/2023	05/24/2023
Wasteload Assessment	Accepted	07/15/2024	06/21/2024
O&M Manual Review Confirmation Letter	Accepted	10/15/2016	10/09/2015
O&M Manual Review Confirmation Letter	Submitted	10/15/2017	10/13/2017
O&M Manual Review Confirmation Letter	Accepted	10/15/2016	10/14/2016
O&M Manual Review Confirmation Letter	Accepted	10/15/2018	10/12/2018
O&M Manual Review Confirmation Letter	Reviewed	10/15/2019	10/14/2019
O&M Manual Review Confirmation Letter	Submitted	10/15/2020	10/13/2020
O&M Manual Review Confirmation Letter	Submitted	10/15/2021	10/11/2021
O&M Manual Review Confirmation Letter	Accepted	10/15/2022	09/27/2022
O&M Manual Review Confirmation Letter	Accepted	10/15/2023	10/03/2023
O&M Manual Review Confirmation Letter	Received	10/15/2024	10/17/2024
Industrial User Survey	Submitted	01/15/2017	01/14/2017
Industrial User Survey Update	Submitted	01/15/2019	01/15/2019
Industrial User Survey Update	Accepted	01/15/2021	01/15/2021
Industrial User Survey Update	Accepted	01/15/2023	01/13/2023
Local Limits Sampling & Evaluation Plan	Submitted	07/15/2017	07/14/2017
Local Limits Sampling & Evaluation Plan	Accepted	07/15/2017	09/22/2017
Results of Initial Screening	Accepted	12/01/2017	11/30/2017
Results of Local Limits Monitoring	Submitted	02/15/2019	02/08/2019
Local Limits Proposed for Ecology Approval	Submitted	07/15/2019	07/12/2019
Local Limits Proposed for Ecology Approval	Accepted	07/15/2019	10/2/2019

II.F. State environmental policy act (SEPA) compliance

State law exempts the issuance, reissuance or modification of any wastewater discharge permit from the SEPA process as long as the permit contains conditions that are no less stringent than federal and state rules and regulations (RCW 43.21C.0383). The exemption applies only to existing discharges, not to new discharges.

III. Proposed permit limits

Federal and state regulations require that effluent limits in an NPDES permit must be either technology- or water quality-based.

- Technology-based limits are based upon the treatment methods available to treat specific pollutants. Technology-based limits are set by the EPA and published as a regulation, or Ecology develops the limit on a case-by-case basis (40 CFR 125.3, and chapter 173-220 WAC).
- Water quality-based limits are calculated so that the effluent will comply with the Surface Water Quality Standards (chapter 173-201A WAC), Ground Water Standards (chapter 173-200 WAC), Sediment Quality Standards (chapter 173-204 WAC), or the Federal Water Quality Criteria Applicable to Washington (40 CFR 131.45).
- Ecology must apply the most stringent of these limits to each parameter of concern. These limits are described below.

The limits in this permit reflect information received in the application and from supporting reports (engineering, hydrogeology, etc.). Ecology evaluated the permit application and determined the limits needed to comply with the rules adopted by the state of Washington. Ecology does not develop effluent limits for all reported pollutants. Some pollutants are not treatable at the concentrations reported, are not controllable at the source, are not listed in regulation, and do not have a reasonable potential to cause a water quality violation.

Ecology does not usually develop limits for pollutants not reported in the permit application but may be present in the discharge. The permit does not authorize discharge of the non-reported pollutants. During the permit term, the facility's effluent discharge conditions may change from those conditions reported in the permit application. The facility must notify Ecology if significant changes occur in any constituent [40 CFR 122.42(a)]. Until Ecology modifies the permit to reflect additional discharge of pollutants, a permitted facility could be violating its permit.

III.A. Design criteria

Under WAC 173-220-150 (1)(g), flows and waste loadings must not exceed approved design criteria. Ecology approved design criteria for this facility's treatment plant in the General Sewer Plan/Wastewater Facility Plan prepared by Gray & Osborne, Inc (G&O, 2011). The table below includes design criteria from the referenced report.

Table 7 - Design criteria for Camas WWTP

Parameter	Design quantity
Maximum Month Design Flow (MMDF)	6.10 MGD
Monthly Average Dry Weather Flow	2.86 MGD
Peak Instantaneous Design Flow (PIDF)	13.44 MGD

Parameter	Design quantity
BOD_5 Loading for Maximum Month	5,616 lb/day
TSS Loading for Maximum Month	8,011 lb/day
Ammonia, Total as N for maximum month	1,956 lbs/day

III.B. Technology-based effluent limits

Federal and state regulations define some technology-based effluent limits for domestic wastewater treatment plants. These effluent limits are given in 40 CFR Part 133 (federal) and in chapter 173-221 WAC (state). Chapter 173-220-130 WAC requires that "effluent limitations shall not be less stringent than those based upon the treatment facility design efficiency contained in approved engineering plans and reports." The proposed permit includes technology-based limits based on the approved treatment facility design.

The table below identifies technology-based limits for pH and fecal coliform as listed in chapter 173-221 WAC. BOD_5 and TSS limits are based on design of the facility. Section III.F of this fact sheet describes the potential for water quality-based limits.

Table 8 - Technology-based limits

Parameter	Average Monthly	Average Weekly
BOD_5	20 mg/L	30 mg/L
BOD_5	The BOD_5 effluent concentration must not exceed fifteen percent (15%) of the average influent concentration	
TSS	20 mg/L	30 mg/L
TSS	The TSS effluent concentration must not exceed fifteen percent (15%) of the average influent concentration	

Parameter	Monthly Geometric Mean	Weekly Geometric Mean
Fecal coliform bacteria	200 organisms/100 mL	400 organisms/100 mL

Parameter	Daily Minimum	Daily Maximum
pH	6.0 standard units	9.0 standard units

Technology-based mass limits for BOD_5 and TSS are based on WAC 173-220-130(3)(b) and WAC 173 221-030(11)(b). Ecology calculated the monthly and weekly average mass limits for BOD_5 and TSS as follows:

Mass limit = CL x DF x CF, where:

CL = Technology-based concentration limit (mg/L)

DF = Maximum monthly average design flow (MGD)

CF = Conversion factor = 8.34

Technology-based mass limits for BOD_5 and TSS are based on WAC 173-220-130(3)(b), WAC 173 221 030(11)(b), WAC 173-220-130(1)(a) and (g), and WAC 173-221-040(1). Ecology calculated the monthly and weekly average mass limits for BOD_5 and TSS as follows:

Average monthly mass limit = Influent mass monthly design load (lbs/day) x 0.15

Average weekly mass limit = Average monthly mass limit x 1.5

Ecology uses the more stringent of the two methods for the mass limit in the proposed permit.

In previous permit cycles, the Camas WWTP was not held to the 85% removal requirement; however, the facility can now consistently meet this requirement given recent upgrades and reduction of I/I in the collection system. Therefore, Ecology will apply the 85% removal requirement to the discharge in this permit cycle.

Table 9 - Technology-based mass limits

Parameter	Concentration limit (mg/L)	Influent design load (lbs/day)	Mass limit (lbs/day)
BOD_5 Monthly Average	20		1,017
BOD_5 Weekly Average	30		1,525
BOD_5 Monthly Average		5,616	842
BOD_5 Weekly Average			1,264
TSS Monthly Average	20		1,017
TSS Weekly Average	30		1,525
TSS Monthly Average		8,011	1,202
TSS Weekly Average			1,802

III.C. Surface water quality-based effluent limits

The Washington State surface water quality standards (chapter 173-201A WAC) are designed to protect existing water quality and preserve the beneficial uses of Washington's surface waters. Waste discharge permits must include conditions that ensure the discharge will meet the surface water quality standards (WAC 173-201A-510). Water quality-based effluent limits may be based on an individual waste load allocation or on a waste load allocation developed during a basin wide total maximum daily load study (TMDL).

1. Numeric criteria for the protection of aquatic life and recreation

Numeric water quality criteria are listed in the water quality standards for surface waters (chapter 173-201A WAC). They specify the maximum levels of pollutants allowed in receiving water to protect aquatic life and recreation in and on the water. Ecology uses numeric criteria along with chemical and physical data for

the wastewater and receiving water to derive the effluent limits in the discharge permit. When surface water quality-based limits are more stringent or potentially more stringent than technology-based limits, the discharge must meet the water quality-based limits.

2. Numeric criteria for the protection of human health

Numeric criteria for the protection of human health are promulgated in Chapter 173-201A WAC and 40 CFR 131.45. These criteria are designed to protect human health from exposure to pollutants linked to cancer and other diseases, based on consuming fish and shellfish and drinking contaminated surface waters. The water quality standards also include radionuclide criteria to protect humans from the effects of radioactive substances.

3. Narrative criteria

Narrative water quality criteria (e.g., WAC 173-201A-240(1)) limit the toxic, radioactive, or other deleterious material concentrations that the facility may discharge to levels below those which have the potential to:

- Adversely affect designated water uses.
- Cause acute or chronic toxicity to biota.
- Impair aesthetic values.
- Adversely affect human health.

Narrative criteria protect the specific designated uses of all fresh waters (WAC 173-201A-200) and of all marine waters (WAC 173-201A-210) in the state of Washington.

4. Antidegradation

The purpose of Washington's Antidegradation Policy (WAC 173-201A-300-330) is to:

- Restore and maintain the highest possible quality of the surface waters of Washington.
- Describe situations under which water quality may be lowered from its current condition.
- Apply to human activities that are likely to have an impact on the water quality of surface water.
- Ensure that all human activities likely to contribute to a lowering of water quality, at a minimum, apply all known, available, and reasonable methods of prevention, control, and treatment (AKART).
- Apply three tiers of protection (described below) for surface waters of the state.

Tier I: ensures existing and designated uses are maintained and protected and applies to all waters and all sources of pollutions.

Tier II: ensures that waters of a higher quality than the criteria assigned are not degraded unless such lowering of water quality is necessary and in the overriding public interest. Tier II applies only to a specific list of polluting activities.

Tier III: prevents the degradation of waters formally listed as "outstanding resource waters," and applies to all sources of pollution.

A facility must prepare a Tier II analysis when all three of the following conditions are met:

- The facility is planning a new or expanded action.
- Ecology regulates or authorizes the action.
- The action has the potential to cause measurable degradation to existing water quality at the edge of a chronic mixing zone.

Facility specific requirements – This facility must meet Tier I requirements.

- Dischargers must maintain and protect existing and designated uses. Ecology must not allow any degradation that will interfere with, or become injurious to, existing or designated uses, except as provided for in chapter 173-201A WAC.
- For waters that do not meet assigned criteria, or protect existing or designated uses, Ecology will take appropriate and definitive steps to bring the water quality back into compliance with the water quality standards.
- Ecology's analysis described in this section of the fact sheet demonstrates that the proposed permit conditions will protect existing and designated uses of the receiving water.

5. Mixing zones

A mixing zone is the defined area in the receiving water surrounding the discharge port(s), where wastewater mixes with receiving water. Within mixing zones, the pollutant concentrations may exceed water quality numeric standards, so long as the discharge doesn't interfere with designated uses of the receiving water body (for example, recreation, water supply, and aquatic life and wildlife habitat, etc.) The pollutant concentrations outside of the mixing zones must meet water quality numeric standards.

State and federal rules allow mixing zones because the concentrations and effects of most pollutants diminish rapidly after discharge, due to dilution. Ecology defines mixing zone sizes to limit the amount of time any exposure to the end-of-pipe discharge could harm water quality, plants, or fish.

The state's water quality standards allow Ecology to authorize mixing zones for the facility's permitted wastewater discharges only if those discharges already

receive all known, available, and reasonable methods of prevention, control, and treatment (AKART). Mixing zones typically require compliance with water quality criteria within a specified distance from the point of discharge and must not use more than 25% of the available width of the water body for dilution (WAC 173-201A-400 (7)).

Ecology uses modeling to estimate the amount of mixing within the mixing zone. Through modeling Ecology determines the potential for violating the water quality standards at the edge of the mixing zone and derives any necessary effluent limits. Steady-state models are the most frequently used tools for conducting mixing zone analyses. Ecology chooses values for each effluent and for receiving water variables that correspond to the time period when the most critical condition is likely to occur. Each critical condition parameter, by itself, has a low probability of occurrence and the resulting dilution factor is conservative. The term “reasonable worst-case” applies to these values.

The mixing zone analysis produces a numerical value called a dilution factor (DF). A dilution factor represents the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. For example, a dilution factor of 4 means the effluent is 25% and the receiving water is 75% of the total volume of water at the boundary of the mixing zone. Ecology uses dilution factors with the water quality criteria to calculate reasonable potentials and effluent limits. Water quality standards include both aquatic life-based criteria and human health-based criteria. The former are applied at both the acute and chronic mixing zone boundaries; the latter are applied only at the chronic boundary. The concentration of pollutants at the boundaries of any of these mixing zones may not exceed the numerical criteria for that zone.

Each aquatic life acute criterion is based on the assumption that organisms are not exposed to that concentration for more than one hour and more often than one exposure in three years. Each aquatic life chronic criterion is based on the assumption that organisms are not exposed to that concentration for more than four consecutive days and more often than once in three years.

The two types of human health-based water quality criteria distinguish between those pollutants linked to non-cancer effects (non-carcinogenic) and those linked to cancer effects (carcinogenic). The human health-based water quality criteria incorporate several exposure and risk assumptions. These assumptions include:

- A 70-year lifetime of daily exposures.
- An ingestion rate for fish or shellfish measured in kg/day.
- An ingestion rate of two and four tenths (2.4) liters/day for drinking water (increased from two liters/day in the 2016 Water Quality Standards update).
- A one-in-one-million cancer risk for carcinogenic chemicals.

This permit authorizes a small acute mixing zone, surrounded by a chronic mixing zone around the point of discharge (WAC 173-201A-400). The water quality standards impose certain conditions before allowing the discharger a mixing zone:

a. Ecology must specify both the allowed size and location in a permit.

The proposed permit specifies the size and location of the allowed mixing zone (as specified below).

b. The facility must fully apply "all known, available, and reasonable methods of prevention, control and treatment" (AKART) to its discharge.

Ecology has determined that the treatment provided at the Camas WWTP meets the requirements of AKART (see "Technology-based Limits").

c. Ecology must consider critical discharge conditions.

Surface water quality-based limits are derived for the water body's critical condition (the receiving water and waste discharge condition with the highest potential for adverse impact on the aquatic biota, human health, and existing or designated waterbody uses). The critical discharge condition is often pollutant-specific or waterbody-specific.

Critical discharge conditions are those conditions that result in reduced dilution or increased effect of the pollutant. Factors affecting dilution include the depth of water, the density stratification in the water column, the currents, and the rate of discharge. Density stratification is determined by the salinity and temperature of the receiving water. Temperatures are warmer in the surface waters in summer. Therefore, density stratification is generally greatest during the summer months. Density stratification affects how far up in the water column a freshwater plume may rise. The rate of mixing is greatest when an effluent is rising. The effluent stops rising when the mixed effluent is the same density as the surrounding water. After the effluent stops rising, the rate of mixing is much more gradual. Water depth can affect dilution when a plume might rise to the surface when there is little or no stratification. Ecology's ***Permit Writer's Manual*** (Ecology, 2018) describes additional guidance on criteria/design conditions for determining dilution factors.

Table 10 - Critical conditions used to model the discharge

Critical condition	Value
Seven-day-average low river flow with a recurrence interval of ten years (7Q10)	81,400 cfs
River depth at the 7Q10 period	21 feet
River velocity	0.26 – 0.99 ft/sec
Maximum average monthly effluent flow for chronic and human health non-carcinogen	5.09 MGD

Critical condition	Value
Annual average flow for human health carcinogen	5.09 MGD
Maximum daily flow for acute mixing zone	10.04 MGD (Winter) 6.36 MGD (Summer)

Ecology obtained ambient data at critical conditions in the vicinity of the outfall from Ecology's ambient study conducted in 2007 from ambient station 28A100 located near the I-205 bridge at Vancouver, WA and the previous permit.

d. Supporting information must clearly indicate the mixing zone would not:

- Have a reasonable potential to cause the loss of sensitive or important habitat.
- Substantially interfere with the existing or characteristic uses.
- Result in damage to the ecosystem.
- Adversely affect public health.

Ecology established Washington State water quality criteria for toxic chemicals using EPA criteria. EPA developed the criteria using toxicity tests with numerous organisms and set the criteria to generally protect the species tested and to fully protect all commercially and recreationally important species.

EPA sets acute criteria for toxic chemicals assuming organisms are exposed to the pollutant at the criteria concentration for one hour. They set chronic standards assuming organisms are exposed to the pollutant at the criteria concentration for four days. Dilution modeling under critical conditions generally shows that both acute and chronic criteria concentrations are reached within minutes of discharge.

The discharge plume does not impact drifting and non-strong swimming organisms because they cannot stay in the plume close to the outfall long enough to be affected. Strong swimming fish could maintain a position within the plume, but they can also avoid the discharge by swimming away. Mixing zones generally do not affect benthic organisms (bottom dwellers) because the buoyant plume rises in the water column. Ecology has additionally determined that the effluent will not exceed 33 degrees C for more than two seconds after discharge; and that the temperature of the water will not create lethal conditions or blockages to fish migration.

Ecology evaluates the cumulative toxicity of an effluent by testing the discharge with whole effluent toxicity (WET) testing.

Ecology reviewed the above information, the specific information on the characteristics of the discharge, the receiving water characteristics and the discharge location. Based on this review, Ecology concluded that the discharge does not have a reasonable potential to cause the loss of sensitive or important habitat, substantially interfere with existing or characteristics uses, result in

damage to the ecosystem, or adversely affect public health if the permit limits are met.

e. The discharge/receiving water mixture must not exceed water quality criteria outside the boundary of a mixing zone.

Ecology conducted a reasonable potential analysis, using procedures established by the EPA and by Ecology, for each pollutant and concluded the discharge/receiving water mixture will not violate water quality criteria outside the boundary of the mixing zone if permit limits are met.

f. The size of the mixing zone and the concentrations of the pollutants must be minimized.

At any given time, the effluent plume uses only a portion of the acute and chronic mixing zone, which minimizes the volume of water involved in mixing. The plume mixes as it rises through the water column therefore much of the receiving water volume at lower depths in the mixing zone is not mixed with discharge. Similarly, because the discharge may stop rising at some depth due to density stratification, waters above that depth will not mix with the discharge. Ecology determined it is impractical to specify in the permit the actual, much more limited volume in which the dilution occurs as the plume rises and moves with the current.

Ecology minimizes the size of mixing zones by requiring dischargers to install diffusers when they are appropriate to the discharge and the specific receiving waterbody. When a diffuser is installed, the discharge is more completely mixed with the receiving water in a shorter time. Ecology also minimizes the size of the mixing zone (in the form of the dilution factor) using design criteria with a low probability of occurrence. For example, Ecology uses the expected 95th percentile pollutant concentration, the 90th percentile background concentration, the centerline dilution factor, and the lowest flow occurring once in every ten years to perform the reasonable potential analysis.

Because of the above reasons, Ecology has effectively minimized the size of the mixing zone authorized in the proposed permit.

g. Maximum size of mixing zone.

The authorized mixing zone does not exceed the maximum size restriction.

h. Acute mixing zone.

- The discharge/receiving water mixture must comply with acute criteria as near to the point of discharge as practicably attainable.

Ecology determined the acute criteria will be met at 10% of the distance (or volume fraction) of the chronic mixing zone at the ten-year low flow.

- The pollutant concentration, duration, and frequency of exposure to the discharge will not create a barrier to migration or translocation of indigenous organisms to a degree that has the potential to cause damage to the ecosystem.

As described above, the toxicity of any pollutant depends upon the exposure, the pollutant concentration, and the time the organism is exposed to that concentration. Authorizing a limited acute mixing zone for this discharge assures that it will not create a barrier to migration. The effluent from this discharge will rise as it enters the receiving water, assuring that the rising effluent will not cause translocation of indigenous organisms near the point of discharge (below the rising effluent).

- Comply with size restrictions.

The mixing zone authorized for this discharge complies with the size restrictions published in chapter 173-201A WAC.

i. Overlap of Mixing Zones.

This mixing zone does not overlap another mixing zone.

III.D. Designated uses and surface water quality criteria

Applicable designated uses and surface water quality criteria are defined in chapter 173-201A WAC. The table included below summarizes the criteria applicable to this facility's receiving water and its designated uses.

1. Freshwater aquatic life uses and associated criteria

Aquatic life uses are designated based on the presence of, or the intent to provide protection for the key uses. All indigenous fish and non-fish aquatic species must be protected in waters of the state in addition to the key species. The aquatic life uses for this receiving water are identified below.

Table 11 - Salmonid spawning, rearing, and migration

Criteria	Value
Temperature – Highest 7-DAD MAX	20.0°C (63.5°F)
Dissolved oxygen – Lowest 1-Day minimum	8.0 mg/L
Turbidity	5 NTU over background when the background is 50 NTU or less; or A 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
Total dissolved gas	Total dissolved gas must not exceed 110 percent of saturation at any point of sample collection.
pH	The pH must measure within the range of 6.5 to 8.5 with a human-caused variation within the above range of less than 0.5 units.

2. Recreational use and criteria

The recreational use for this receiving water is primary contact recreation. *E. coli* organism levels must not exceed a geometric mean value of 100 CFU or MPN per 100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained within the averaging period exceeding 320 CFU or MPN per 100 mL.

3. Water supply uses

The water supply uses are domestic, agricultural, industrial, and stock watering.

4. Miscellaneous freshwater uses

The miscellaneous freshwater uses are wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics.

III.E. Water quality impairments

The Columbia and Lower Snake Rivers are listed on the state's polluted waters list for high water temperatures that are above Washington water quality standards and can harm salmon. Because the Columbia and Snake Rivers cross multiple state boundaries and span almost 900 miles, the federal Environmental Protection Agency (EPA) established the Columbia and Lower Snake Rivers Temperature Total Maximum Daily Load (TMDL)[1] on May 20, 2020 (USEPA Region 10, 2021). The TMDL includes a waste load allocation for the Camas WWTP.

The other listing in the vicinity of the discharge includes a category 4A listing for total dissolved gas. The Total Dissolved Gas TMDL does not include a wasteload allocation for the Camas WWTP.

III.F. Evaluation of surface water quality-based effluent limits for narrative criteria

Ecology must consider the narrative criteria described in WAC 173-201A-260 when it determines permit limits and conditions. Narrative water quality criteria limit the toxic, radioactive, or other deleterious material concentrations that the facility may discharge which have the potential to adversely affect designated uses, cause acute or chronic toxicity to biota, impair aesthetic values, or adversely affect human health.

Ecology considers narrative criteria when it evaluates the characteristics of the wastewater and when it implements all known, available, and reasonable methods of treatment and prevention (AKART) as described above in the technology-based limits section. When Ecology determines if a facility is meeting AKART it considers the pollutants in the wastewater and the adequacy of the treatment to prevent the violation of narrative criteria.

[1] https://www.epa.gov/columbiariver/tmdl-temperature-columbia-and-lower-snake-rivers

In addition, Ecology considers the toxicity of the wastewater discharge by requiring whole effluent toxicity (WET) testing when there is a reasonable potential for the discharge to contain toxics. Ecology's analysis of the need for WET testing for this discharge is described later in the fact sheet.

III.G. Evaluation of surface water quality-based effluent limits for numeric criteria

1. Mixing zones and dilution factors

Pollutants in an effluent may affect the aquatic environment near the point of discharge (near field) or at a considerable distance from the point of discharge (far field). Toxic pollutants, for example, are near-field pollutants; their adverse effects diminish rapidly with mixing in the receiving water. Conversely, a pollutant such as biological oxygen demand (BOD) is a far-field pollutant whose adverse effect occurs away from the discharge even after dilution has occurred. Thus, the method of calculating surface water quality-based effluent limits varies with the point at which the pollutant has its maximum effect.

With technology-based controls (AKART), predicted pollutant concentrations in the discharge exceed water quality criteria. Ecology therefore authorizes a mixing zone in accordance with the geometric configuration, flow restriction, and other restrictions imposed on mixing zones by chapter 173-201A WAC.

The diffuser at Outfall 0001 is a 36-inch pipe which extends 850 feet from the North Bank of the Columbia River at river mile 121.2. The diffuser array is 150-feet long with a total of 16, 6-inch diameter Tideflex diffusers. The distance between ports is 10 feet and the diffuser depth is 21 feet below the Columbia River datum. Ecology obtained this information from the Dilution Ratio Study Report submitted in 2007 and refined in 2009 after the addition of the Tideflex valves.

Chronic mixing zone – WAC 173-201A-400(7)(a) specifies that mixing zones must not extend in a downstream direction from the discharge ports for a distance greater than 300 feet plus the depth of water over the discharge ports or extend upstream for a distance of over 100 feet, not utilize greater than 25% of the flow, and not occupy greater than 25% of the width of the water body. The mixing zone extends from the bottom to the top of the water column.

The chronic dilution factor below is based on a downstream distance of 318 feet.

Acute mixing zone – WAC 173-201A-400(8)(a) specifies that in rivers and streams a zone where acute toxics criteria may be exceeded must not extend beyond 10% of the distance towards the upstream and downstream boundaries of the chronic zone, not use greater than 2.5% of the flow and not occupy greater than 25% of the width of the water body. The mixing zone extends from the bottom to the top of the water column.

The acute dilution factor below is based on a downstream distance of 32 feet.

Ecology determined the dilution factors that occur within these zones at the critical condition using the 2007 mixing zone study approved by Ecology. The dilution factors are listed below.

Table 12 - Dilution factors

Criteria	Acute	Chronic
Aquatic Life	23 (winter) 27 (summer)	121 (winter) 185 (summer)
Human Health, Carcinogen		185
Human Health, Non-carcinogen		185

Ecology determined the impacts of dissolved oxygen deficiency, pH, fecal coliform, ammonia, metals, other toxics, and temperature as described below, using the dilution factors in the above table. The derivation of surface water quality-based limits also takes into account the variability of pollutant concentrations in both the effluent and the receiving water.

2. Dissolved Oxygen: BOD_5 and Ammonia Effects

Natural decomposition of organic material in wastewater effluent impacts dissolved oxygen in the receiving water at distances far outside of the regulated mixing zone. The 5-day Biochemical Oxygen Demand (BOD_5) of an effluent sample indicates the amount of biodegradable material in the wastewater and estimates the magnitude of oxygen consumption the wastewater will generate in the receiving water. The amount of ammonia-based nitrogen in the wastewater also provides an indication of oxygen demand in the receiving water.

Ecology modeled the impact of BOD_5 on the receiving water at critical condition and with the technology-based effluent limit for BOD_5 described under "Technology-Based Effluent Limits" above. The calculations to determine dissolved oxygen impacts are shown in Appendix D.

Ecology predicted no violation of the surface water quality standards for dissolved oxygen at the edge of the mixing zone due to the impacts of biochemical oxygen demand (BOD_5) under critical conditions. Therefore, the proposed permit contains the plant specific technology-based effluent limit for BOD_5. The permit also does not contain a limit on ammonia based on dissolved oxygen impacts (ammonia toxicity is examined elsewhere in this fact sheet).

3. pH

Ecology modeled the impact to receiving waters under critical conditions using technology-based limits for pH (6.0 – 9.0) and the *pH-mix-fresh* worksheet in Ecology's PermitCalc spreadsheet. Appendix D includes the model results. Model calculations predict no violation of the pH criteria under critical conditions.

4. Bacteria

In the previous permit cycle, Ecology modeled the number of fecal coliform by simple mixing analysis using the technology-based limit of 400 organisms per 100 mL and a dilution factor of 121. That analysis showed no violation of the fecal coliform recreational use criterion under critical conditions. The domestic technology-based limits for fecal coliform in WAC 173-221 are still in effect. Without effluent data for *E. coli*, Ecology cannot determine whether the discharge will violate the recreational use criterion for *E. coli*. Given that the characteristics of the receiving water and the discharge have not changed substantially since the analysis conducted in the previous permit cycle, and the transition is a change in bacterial indicator not more or less stringent than the previous criterion, the proposed permit will maintain the technology-based effluent limit for fecal coliform. In addition, the permittee will be required to monitor for both fecal coliform and *E. coli*. Ecology will then use this data to assess the reasonable potential to exceed the applicable recreational use criterion in the next iteration of this permit.

5. Turbidity

Ecology evaluated the impact of turbidity based on the range of turbidity in the effluent and turbidity of the receiving water. Ecology expects no violations of the turbidity criteria outside the designated mixing zone provided the facility meets its technology-based total suspended solids permit limits.

6. Toxic pollutants – aquatic life criteria

Federal regulations at 40 CFR 122.44 require Ecology to place limits in NPDES permits on toxic chemicals in an effluent whenever there is a reasonable potential for those chemicals to exceed the surface water quality criteria. Ecology does not exempt facilities with technology-based effluent limits from meeting the surface water quality standards.

The following toxic pollutants are present in the discharge: ammonia and heavy metals. Ecology conducted a reasonable potential analysis (See Appendix D) on these parameters to determine whether it would require effluent limits in this permit.

Ammonia's toxicity depends on that portion which is available in the unionized form. The amount of unionized ammonia depends on the temperature and pH in the receiving freshwater. To evaluate ammonia toxicity, Ecology used the available receiving water information and Ecology spreadsheet tools.

Valid ambient background data were available for ammonia and heavy metals (See Table 2). Ecology used all applicable data to evaluate reasonable potential for this discharge to cause a violation of water quality standards. If no data was available, zero was used for background concentrations.

Ecology determined that ammonia pose no reasonable potential to cause or contribute to exceedances of the water quality criteria at the critical conditions using procedures given in the ***Technical Support Document for Water Quality-Based Toxics Control*** (EPA/505/2-90-001) (USEPA, 1991) (Appendix D) and as described above. Ecology's determination assumes that this facility meets the other effluent limits of this permit. However, the Camas WWTP has had an ammonia limit in the previous permit and therefore is subject to anti-backsliding provisions of the Clean Water Act since absent a limit, there is no assurance that treatment for ammonia would continue. Average weekly limits were added to satisfy 40 CFR 122.45(d) which requires effluent limits for continuous discharger be expressed in short- and long-term limits.

Ecology found that hexavalent chromium has a reasonable potential to cause or contribute to a violation of water quality standards. However, the POTW is not a source for this pollutant. Rather than assess an effluent limit for this pollutant in this permit cycle, Ecology has required the city to reevaluate its local limits and develop a local limit for hexavalent chromium. The facility must also sample influent and effluent for hexavalent chromium on a quarterly basis throughout the permit term. In the event that the city cannot control the source of hexavalent chromium in the collection system, Ecology will reopen the proposed permit and implement an effluent limit using methods from the ***Technical Support Document for Water Quality-Based Toxics Control*** (EPA/505/2-90-001) (USEPA, 1991).

7. Temperature

The state temperature standards (WAC 173-201A, WAC 173-201A-200, WAC 173-201A-600, and WAC 173-201A-602) include multiple elements:

a. Annual summer maximum threshold criteria (June 15 to September 15)
b. Supplemental spawning and rearing season criteria (September 15 to June 15)
c. Incremental warming restrictions
d. Guidelines on preventing acute lethality and barriers to migration of salmonids

Ecology evaluates each criterion independently to determine reasonable potential and derive permit limits.

a. Annual summer maximum and supplementary spawning/rearing criteria

Each water body has an annual maximum temperature criterion [WAC 173-201A-200(1)(c), and WAC 173-201A-602, Table 602]. These threshold criteria (e.g., 12, 16, 17.5, 20°C) protect specific categories of aquatic life by controlling the effect of human actions on summer temperatures.

Some waters have an additional threshold criterion to protect the spawning and incubation of salmonids (9°C for char and 13°C for salmon and trout) [WAC 173-201A-602, Table 602]. These criteria apply during specific date-windows.

The threshold criteria apply at the edge of the chronic mixing zone. Criteria for most fresh waters are expressed as the highest 7-Day average of daily maximum temperature (7-DADMax). The 7-DADMax temperature is the arithmetic average of seven consecutive measures of daily maximum temperatures. Criteria for some fresh waters are expressed as the highest 1-Day annual maximum temperature (1-DMax).

b. Incremental warming criteria

The water quality standards limit the amount of warming human sources can cause under specific situations [WAC 173-201A-200(1)(c)(i)-(ii)]. The incremental warming criteria apply at the edge of the chronic mixing zone.

At locations and times when background temperatures are cooler than the assigned threshold criterion, point sources are permitted to warm the water by only a defined increment. These increments are permitted only to the extent doing so does not cause temperatures to exceed either the annual maximum or supplemental spawning criteria.

c. Guidelines to prevent acute lethality or barriers to migration of salmonids. These site-level considerations do not override the temperature criteria listed above.
   i. Instantaneous lethality to passing fish: The upper 99th percentile daily maximum effluent temperature must not exceed 33°C, unless a dilution analysis indicates ambient temperatures will not exceed 33°C two seconds after discharge.
   ii. General lethality and migration blockage: The temperature at the edge of a chronic mixing zone must not exceed either a 1DMax of 23°C or a 7DADMax of 22°C. When adjacent downstream temperatures are 3°C or cooler, the 1DMax at the edge of the chronic mixing zone must not exceed 22°C.
   iii. Lethality to incubating fish: The temperature must not exceed 17.5°C at locations where eggs are incubating.

Reasonable potential analysis

EPA has completed a temperature TMDL, Columbia and Lower Snake Rivers Temperature Total Maximum Daily Load (TMDL)[2] and established a wasteload allocation for this discharge. The proposed permit includes an effluent limit for temperature derived from the completed TMDL.

[2] https://www.epa.gov/columbiariver/tmdl-temperature-columbia-and-lower-snake-rivers

III.H. Evaluation of human health-based water quality criteria

Washington's water quality standards include numeric human health-based criteria for priority pollutants that Ecology must consider when writing NPDES permits.

Ecology determined the effluent may contain chemicals of concern for human health, based on the facility's status as an EPA major discharger and data or information indicating the discharge contains regulated chemicals.

Ecology evaluated the discharge's potential to violate the water quality standards as required by 40 CFR 122.44(d) by following the procedures published in the ***Technical Support Document for Water Quality-Based Toxics Control*** (EPA/505/2-90-001) (USEPA, 1991) and Ecology's Permit Writer's Manual (Ecology, 2018) to make a reasonable potential determination. The evaluation showed that . the discharge has no reasonable potential to cause a violation of water quality standards, and an effluent limit is not needed.

III.I. Sediment quality

The aquatic sediment standards (chapter 173-204 WAC) protect aquatic biota and human health. Under these standards Ecology may require a facility to evaluate the potential for its discharge to cause a violation of sediment standards (WAC 173-204-400). You can obtain additional information about sediments at the Aquatic Lands Cleanup Unit website[3].

Ecology determined that this discharge has potential to cause a violation of the sediment quality standards because the facility has not performed NPDES related sediment sampling and there is no sediment data available in the vicinity of the outfall. Furthermore, sediment sampling is recommended once over the permit lifetime for treatment plants with a discharge greater than 1MGD and less than 10 MGD. The proposed permit includes a Special Condition requiring Camas WWTP to demonstrate either:

- The point of discharge is not an area of deposition, or
- Toxics do not accumulate in the sediments even though the point of discharge is a depositional area.

III.J. Groundwater quality limits

The groundwater quality standards (chapter 173-200 WAC) protect beneficial uses of groundwater. Permits issued by Ecology must not allow violations of those standards (WAC 173-200-100).

The Camas WWTP does not discharge wastewater to the ground. No permit limits are required to protect groundwater.

[3] https://ecology.wa.gov/Spills-Cleanup/Contamination-cleanup/Sediment-cleanups

III.K. Whole effluent toxicity

The water quality standards for surface waters forbid discharge of effluent that has the potential to cause toxic effects in the receiving waters. Many toxic pollutants cannot be measured by commonly available detection methods. However, laboratory tests can measure toxicity directly by exposing living organisms to the wastewater and measuring their responses. These tests measure the aggregate toxicity of the whole effluent, so this approach is called whole effluent toxicity (WET) testing. Some WET tests measure acute toxicity and other WET tests measure chronic toxicity.

- Acute toxicity tests measure mortality as the significant response to the toxicity of the effluent. Dischargers who monitor their wastewater with acute toxicity tests find early indications of any potential lethal effect of the effluent on organisms in the receiving water.
- Chronic toxicity tests measure various sublethal toxic responses, such as reduced growth or reproduction. Chronic toxicity tests often involve either a complete life cycle test on an organism with an extremely short life cycle, or a partial life cycle test during a critical stage of a test organism's life. Some chronic toxicity tests also measure organism survival.

Laboratories accredited by Ecology for WET testing must use the proper WET testing protocols, fulfill the data requirements, and submit results in the correct reporting format according to the procedures in the ***Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria***, Publication 95-80 (Ecology, 2016). Ecology recommends that each regulated facility send a copy of the acute or chronic toxicity sections(s) of its NPDES permit to the laboratory.

WET testing conducted during effluent characterization showed no reasonable potential for effluent discharges to cause receiving water acute toxicity. The proposed permit will not include an acute WET limit. The City of Camas must retest the effluent before submitting an application for permit renewal.

- If this facility makes process or material changes which, in Ecology's opinion, increase the potential for effluent toxicity, then Ecology may (in a regulatory order, by permit modification, or in the permit renewal) require the facility to conduct additional effluent characterization. The Camas WWTP may demonstrate to Ecology that effluent toxicity has not increased by performing additional WET testing and/or chemical analyses after the process or material changes have been made. Ecology recommends that the Permittee check with it first to make sure that Ecology will consider the demonstration adequate to support a decision to not require an additional effluent characterization.
- If WET testing conducted for submittal with a permit application fails to meet the performance standards in WAC 173-205-020, Ecology will assume that effluent toxicity has increased.

WET testing conducted during effluent characterization showed no reasonable potential for effluent discharges to cause receiving water chronic toxicity. The proposed permit will not include a chronic WET limit. The City of Camas must retest the effluent before submitting an application for permit renewal.

- If this facility makes process or material changes which, in Ecology's opinion, increase the potential for effluent toxicity, then Ecology may (in a regulatory order, by permit modification, or in the permit renewal) require the facility to conduct additional effluent characterization
- If WET testing conducted for submittal with a permit application fails to meet the performance standards in WAC 173-205-020, Ecology will assume that effluent toxicity has increased. The Camas WWTP may demonstrate to Ecology that effluent toxicity has not increased by performing additional WET testing after the process or material changes have been made.

III.L. Comparison of effluent limits with the previous permit issued on September 25, 2015

Table 13 - Comparison of previous and proposed effluent limits – Outfall 0001

Limit	Basis of Limit	Existing permit limit	Proposed permit limit
Biochemical Oxygen Demand (5-day) – Average Monthly	Technology	20 mg/L;1,017 lbs/day; 74% Removal	20 mg/L;842 lbs/day; 85% Removal
Biochemical Oxygen Demand (5-day) – Average Weekly	Technology	30 mg/L; 1,525 lbs/day	30 mg/L; 1,264 lbs/day
Total Suspended Solids – Average Monthly	Technology	20 mg/L;1,017 lbs/day; 76% Removal	20 mg/L;1,017 lbs/day; 85% Removal
Total Suspended Solids – Average Weekly	Technology	30 mg/L; 1,525 lbs/day	30 mg/L; 1,525 lbs/day
Fecal Coliform Bacteria – Monthly Geometric Mean	Technology	200/100 mL	200/100 mL
Fecal Coliform Bacteria – Weekly Geometric Mean	Technology	400/100 mL	400/100 mL
pH – Daily Minimum	Technology	6.0	6.0
pH – Daily Maximum	Technology	9.0	9.0
Total Ammonia (June - September) – Average Monthly	WQ	20 mg/L	20 mg/L
Total Ammonia (June - September) – Average Weekly	WQ	n/a	30 mg/L
Total Ammonia (May - October) – Average Monthly	WQ	7 mg/L	7 mg/L
Total Ammonia (May - October) – Average Weekly	WQ	n/a	11 mg/L
Heat Load – Average Monthly (June 1 – September 30)	WQ	n/a	5.87×10^8 kcal/day

IV. Monitoring requirements

Ecology requires monitoring, recording, and reporting (WAC 173-220-210 and 40 CFR 122.41) to verify that the treatment process is functioning correctly and that the discharge complies with the permit's effluent limits.

If a facility uses a contract laboratory to monitor wastewater, it must ensure that the laboratory uses the methods and meets or exceeds the method detection levels required by the permit. The permit describes when facilities may use alternative methods. It also describes what to do in certain situations when the laboratory encounters matrix effects. When a facility uses an alternative method as allowed by the permit, it must report the test method, detection level (DL), and quantitation level (QL) on the discharge monitoring report or in the required report.

IV.A. Wastewater monitoring

The monitoring schedule is detailed in the proposed permit under Special Condition S2. Specified monitoring frequencies consider the quantity and variability of the discharge, the treatment method, past compliance, significance of pollutants, and cost of monitoring. The required monitoring frequency is consistent with agency guidance given in the current version of Ecology's ***Permit Writer's Manual,*** Publication 92-109 (Ecology, 2018) for an activated sludge treatment plant, over 5 MGD maximum monthly average flow.

Monitoring of sludge quantity and quality is necessary to determine the appropriate uses of the sludge. Biosolids monitoring is required by the current state and local solid waste management program and by EPA under 40 CFR 503.

Ecology has required monitoring of both fecal coliform and *E. coli* in the permit application. This dual monitoring will help inform both Ecology and City of Camas of the correlation between the two indicators. Dual monitoring requirements consist of splitting a sample once per month and analyzing that sample for fecal coliform and *E. coli.*

In addition, the proposed permit requires quarterly oil and grease and priority pollutant metals analyses for influent, effluent and biosolids. The proposed permit also requires annual priority pollutant analyses required for POTWs in the influent, effluent and biosolids.

IV.B. Lab accreditation

Ecology requires that facilities must use a laboratory registered or accredited under the provisions of chapter 173-50 WAC, Accreditation of Environmental Laboratories, to prepare all monitoring data (with the exception of certain parameters). Ecology accredited the laboratory at this facility for:

Table 14 - Accredited parameters

Parameter name	Category	Method name	Matrix description
Solids, Total Suspended	General Chemistry	SM 2540 D-2011	Non-Potable Water
pH	General Chemistry	SM 4500-H+ B-2011	Non-Potable Water
Ammonia	General Chemistry	Hach 10205 5th ED 2008 Method	Non-Potable Water
Dissolved Oxygen	General Chemistry	SM 4500-O G-2011	Non-Potable Water
Biochemical Oxygen Demand (BOD)	General Chemistry	SM 5210 B-2011	Non-Potable Water
Fecal coliform-count	Microbiology	SM 9222 D (mFC)-06	Non-Potable Water

V. Other permit conditions

V.A. Reporting and record keeping

Ecology based Special Condition S3 on its authority to specify any appropriate reporting and record keeping requirements to prevent and control waste discharges (WAC 173-220-210).

V.B. Prevention of facility overloading

Overloading of the treatment plant is a violation of the terms and conditions of the permit. To prevent this from occurring, RCW 90.48.110 and WAC 173-220-150 require Camas WWTP to:

- Take the actions detailed in proposed permit Special Condition S4.
- Design and construct expansions or modifications before the treatment plant reaches existing capacity.
- Report and correct conditions that could result in new or increased discharges of pollutants.

Special Condition S4 restricts the amount of flow.

V.C. Operation and maintenance

The proposed permit contains Special Condition S5 as authorized under RCW 90.48.110, WAC 173-220-150, chapter 173-230 WAC, and WAC 173-240-080. Ecology included it to ensure proper operation and regular maintenance of equipment, and to ensure that the Camas WWTP takes adequate safeguards so that it uses constructed facilities to their optimum potential in terms of pollutant capture and treatment.

Special Condition S5 requires facility name to review and update as needed an operation and maintenance manual as required by state regulation for the construction of wastewater treatment facilities (WAC 173-240-080). Implementation of the procedures in the operation and maintenance manual ensures the facility's compliance with the terms and limits in the permit.

V.D. Pretreatment

Ecology administers the National Pretreatment Program under the terms of the "National Pollutant Discharge Elimination System (NPDES) Memorandum of Agreement Between the State of Washington and the United States Environmental Protection Agency Region 10" (1986), including any revisions, modifications, or amendments to the Memorandum of Agreement, and 40 CFR Part 403.

Under this delegation of authority, Ecology will serve as either: a) the Control Authority for those industrial users who introduce pollutants into a POTW which has not been approved to have a Pretreatment Program or b) the Approval Authority for an approved Pretreatment Program.

The City of Camas does not have an approved pretreatment program. Therefore, Ecology acts as the Control Authority pursuant to 40 CFR Part 403.10(e). In the Camas sewer service area, in accordance with WAC 173-216, Ecology issues permits for the wastewater discharges from the nondomestic users identified in Table 15.

Table 15 - Permitted nondomestic users

Facility Name	Permit Number	Industrial User Type	Permit Effective-Expiration Dates
Analog Devices, Inc	ST0006154	Categorical – semiconductors and related devices	09/01/2020-08/31/2025
nLight Inc, Camas	ST0006270	Categorical-semiconductors and related devices	09/01/2021-08/31/2026
Northwest Paper Box Manufactures, Inc	ST0005027	Minor industrial user – ink formulation and printing	05/01/2024-04/30/2029
TSMC Washington, LLC	ST0006200	Categorical – semiconductor integrated circuit fabrication	03/1/2025 – 02/28/2030

1. Duty to enforce discharge prohibitions

This provision prohibits the publicly owned treatment works (POTW) from authorizing, permitting, or allowing an industrial discharger to discharge certain types of waste into the sanitary sewer.

- The first section prohibits the POTW from accepting pollutants which causes “pass through” or “interference”. This general prohibition is from 40 CFR §403.5(a). Appendix C of this fact sheet defines these terms.
- The second section reinforces specific state and federal pretreatment prohibitions found in 40 CFR §403.5(b) and WAC 173-216-060 . The POTW

may not accept wastes which violate the specific state and federal discharge prohibitions. Wastewaters with the following characteristics are prohibited:

- Wastewaters prohibited to be discharged by the Dangerous Waste Regulations in 173-303 WAC.
- Explosive or flammable.
- Have too high or low of a pH (too corrosive, acidic or basic).
- May cause a blockage such as grease, sand, rocks, or viscous materials.
- Heat in amounts that will inhibit biological activity at the POTW.
- Are of sufficient strength or volume to interfere with treatment.
- Contain too much petroleum-based oils, mineral oil, or cutting fluid.
- Create noxious or toxic gases at any point.

- The third section reflects state prohibitions [WAC 173-216-060(2)(b)(vii)] on the POTW accepting certain types of discharges unless the discharge has received prior written authorization from Ecology. These discharges include:
  - Cooling water in significant volumes.
  - Stormwater and other direct inflow sources.
  - Wastewaters significantly affecting system hydraulic loading, which do not require treatment.

2. Requirements for performing an industrial user survey

The Camas WWTP receives wastewater from the permitted significant industrial user(s) identified in Table 15. The Camas WWTP serves many other industrial and commercial users, some of which have the potential to be or become, with changed processes, significant industrial users [40 CFR §403.3(v)]. A significant industrial user is a nondomestic indirect discharger (user) subject to categorical pretreatment standards under 40 CFR §403.6 and 40 CFR Chapter I, Subchapter N or any other nondomestic indirect discharger that meets any of the following:

- Discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blowdown wastewater).
- Contributes a process wastestream that makes up 5% or more of the average dry weather hydraulic or organic capacity of the POTW.
- Is designated as such by the Permittee or Ecology on the basis that the nondomestic indirect discharger has a reasonable potential to adversely affect the POTW's operation.

The purpose of the IU Survey is to identify all facilities that may be subject to pretreatment standards or requirements so that Ecology can take appropriate

measures to control these discharges. The steps the POTW must document in their IU Survey submittal include:

d. The POTW must develop a master list of nondomestic users (commercial and industrial).This list must be based on several sources of information including business licenses, and water and sewer billing records.
e. The POTW must canvas all the potential sources. The POTW must identify categories of nondomestic users and have potentially significant users complete a survey form.
f. The POTW must identify SIUs in all areas served by the POTW.

Ecology uses the industrial user survey as a major mechanism to determine which nondomestic users merit further controls, such as a state waste discharge permit. Ecology describes the information needed in the survey submittal to allow Ecology to make permitting decision in the manual “Performing an Industrial User Survey”. Where surveys are incomplete, Ecology may take such enforcement as appropriate and/or require the POTW to develop a fully delegated pretreatment program.

The proposed permit requires the city of Camas to conduct an industrial user survey to determine the extent of compliance of all industrial users of the sanitary sewer and wastewater treatment facility with federal pretreatment regulations [40 CFR Part 403 and CWA Sections 307(b) and CWA Section 308)], with state regulations (chapter 90.48 RCW and chapter 173-216 WAC), and with local ordinances.

3. Identification of new nondomestic wastewater sources and notification of permit requirements

The permit requires non-delegated POTWs to take “continuous, routine measures to identify and authorize nondomestic wastewater discharges. Examples of such routine measures include regular review of business license and building permit applications, advertisements, and personal reconnaissance. Collection system operators should be trained on what to look for so they can identify and report new industrial dischargers. The Camas WWTP may not allow SIUs to discharge prior to receiving a permit from Ecology and must notify all industrial users of their responsibility to apply for a State Waste Discharge Permit. The POTW must also notify Ecology.

4. Pretreatment Monitoring / Local Limits Evaluation

Pretreatment monitoring is required to determine if pollutants interfere with the treatment processes or pass through the plant to the biosolids or receiving water. Parameters required for pretreatment-related monitoring include priority pollutants [40 CFR Part 122 Appendix D], as well as parameters with environmental criteria. Monitoring requirements allow the POTW to comply with NPDES permit application monitoring [40 CFR 122.21(j)]. POTWs use this

monitoring data to also develop and evaluate local limits. POTWs with local limits are required to evaluate local limits after permit issuance or every 5 years, or when certain situations arise that are likely to affect POTW headworks loading or treatment efficiency.

The city of Camas developed local limits in the previous permit cycle for several pollutants of concern. The proposed permit requires the city to assess the efficacy of the existing local limits and to develop an additional local limit for hexavalent chromium. Ecology will use these reevaluated local limits as the basis for effluent limits in any pretreatment permit developed that discharges to the Camas WWTP.

V.E. Spill plan

This facility stores a quantity of chemicals on-site that have the potential to cause water pollution if accidentally released. Ecology can require a facility to develop best management plans to prevent this accidental release [Section 402(a)(1) of the Federal Water Pollution Control Act (FWPCA) and RCW 90.48.080].

The Camas WWTP developed a plan for preventing the accidental release of pollutants to state waters and for minimizing damages if such a spill occurs. The proposed permit requires the facility to review this plan and update as necessary. Any updates must be submitted to Ecology.

V.F. Solid waste

To prevent water quality problems the facility is required in permit Special Condition S7 to store and handle all residual solids (grit, screenings, scum, sludge, and other solid waste) in accordance with the requirements of RCW 90.48.080 and state water quality standards.

The final use and disposal of sewage sludge from this facility is regulated by U.S. EPA under 40 CFR 503, and by Ecology under chapter 70.95J RCW, chapter 173-308 WAC “Biosolids Management,” and chapter 173-350 WAC “Solid Waste Handling Standards.” The disposal of other solid waste is under the jurisdiction of the Clark County Health Department.

Requirements for monitoring sewage sludge and record keeping are included in this permit. Ecology will use this information, required under 40 CFR 503, to develop or update local limits.

V.G. Outfall evaluation

The proposed permit requires the city of Camas to conduct an outfall inspection and submit a report detailing the findings of that inspection (Special Condition S11). The inspection must evaluate the physical condition of the discharge pipe and diffusers and evaluate the extent of sediment accumulations in the vicinity of the outfall.

V.H. General conditions

Ecology bases the standardized General Conditions on state and federal law and regulations. They are included in all individual domestic wastewater NPDES permits issued by Ecology.

VI. Permit issuance procedures

VI.A. Permit modifications

Ecology may modify this permit to impose numeric limits, if necessary to comply with water quality standards for surface waters, with sediment quality standards, or with water quality standards for groundwaters, after obtaining new information from sources such as inspections, effluent monitoring, outfall studies, and effluent mixing studies.

Ecology may also modify this permit to comply with new or amended state or federal regulations.

VI.B. Proposed permit issuance

This proposed permit includes all statutory requirements for Ecology to authorize a wastewater discharge. The permit includes limits and conditions to protect human health and aquatic life, and the beneficial uses of waters of the state of Washington. Ecology proposes to issue this permit for a term of five years.

VII. References for text and appendices

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Washington State Department of Transportation. (2023). *Standard Specifications for Road, Bridge, and Municipal Construction, M 41-10.* Retrieved from https://www.wsdot.wa.gov/publications/manuals/fulltext/M41-10/SS.pdf

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Water Pollution Control Federation. (1976). *Chlorination of Wastewater.*

Washington State and Ecology website general reference links:

Laws and Regulations[4]

Permit and Wastewater Related Information[5]

[4] http://leg.wa.gov/LawsAndAgencyRules/Pages/default.aspx
[5] https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-guidance

Appendix A – Public Involvement Information

Ecology proposes to reissue (or issue) a permit to Camas WWTP. The permit includes wastewater discharge limits and other conditions. This fact sheet describes the facility and Ecology's reasons for requiring permit conditions.

Ecology placed a Public Notice of Application on June 11, 2020, and June 17, 2020, in the Battle Ground Reflector to inform the public about the submitted application and to invite comment on the reissuance (or issuance) of this permit.

Ecology will place a Public Notice of Draft on April 15, 2025, in the Columbian to inform the public and to invite comment on the proposed draft National Pollutant Discharge Elimination System permit and fact sheet.

The notice:

- Tells where copies of the draft Permit and Fact Sheet are available for public evaluation (a local public library, the closest Regional or Field Office, posted on our website).
- Offers to provide the documents in an alternate format to accommodate special needs.
- Urges people to submit their comments, in writing, before the end of the Comment Period
- Tells how to request a public hearing of comments about the proposed NPDES permit.
- Explains the next step(s) in the permitting process.

Frequently Asked Questions about Effective Public Commenting[6]

You may obtain further information from Ecology by writing to the address listed below.

Water Quality Permit Coordinator Department of Ecology
Southwest Region Office
P.O. Box 47775
Olympia, WA 98504-7775

The primary author of this permit and fact sheet is **M. Eleanor Key Ott, P.E.**

[6] https://apps.ecology.wa.gov/publications/SummaryPages/0307023.html

Appendix B – Your Right to Appeal

You have a right to appeal this permit to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of the final permit. The appeal process is governed by chapter 43.21B RCW and chapter 371-08 WAC. “Date of receipt” is defined in RCW 43.21B.001(2) (see glossary).

To appeal you must do the following within 30 days of the date of receipt of this permit:

- File your appeal and a copy of this permit with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours as defined in WAC 371-08-305 and -335. “Notice of appeal” is defined in WAC 371-08-340.
- Serve a copy of your appeal and this permit on the Department of Ecology by mail, in person, or by email (see addresses below).
- You must also comply with other applicable requirements in chapter 43.21B RCW and chapter 371-08 WAC.

Filing with the PCHB

For the most current information regarding filing with the PCHB:
visit https://eluho.wa.gov/[7] or call 360-664-9160.

Service on Ecology

Street Address:

Department of Ecology
Attn: Appeals Processing Desk
300 Desmond Drive SE
Lacey, WA 98503

Mailing Address:

Department of Ecology
Attn: Appeals Processing Desk
PO Box 47608
Olympia, WA 98504-7608

E-Mail Address:

ecologyappeals@ecy.wa.gov

[7] https://eluho.wa.gov/

Appendix C – Glossary

1-DMax or 1-day maximum temperature – The highest water temperature reached on any given day. This measure can be obtained using calibrated maximum/minimum thermometers or continuous monitoring probes having sampling intervals of thirty minutes or less.

7-DADMax or 7-day average of the daily maximum temperatures – The arithmetic average of seven consecutive measures of daily maximum temperatures. The 7-DADMax for any individual day is calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the three days prior and the three days after that date.

Acute toxicity – The lethal effect of a compound on an organism that occurs in a short time period, usually 48 to 96 hours.

AKART – The acronym for “all known, available, and reasonable methods of prevention, control and treatment.” AKART is a technology-based approach to limiting pollutants from wastewater discharges, which requires an engineering judgment and an economic judgment. AKART must be applied to all wastes and contaminants prior to entry into waters of the state in accordance with RCW 90.48.010 and RCW 90.48.520, WAC 173-200-030(2)(c)(ii), and WAC 173-216-110(1)(a).

Alternate point of compliance – An alternative location in the groundwater from the point of compliance where compliance with the groundwater standards is measured. It may be established in the groundwater at locations some distance from the discharge source, up to, but not exceeding the property boundary and is determined on a site-specific basis following an AKART analysis. An “early warning value” must be used when an alternate point is established. An alternate point of compliance must be determined and approved in accordance with WAC 173-200-060(2).

Ambient water quality – The existing environmental condition of the water in a receiving water body.

Ammonia – Ammonia is produced by the breakdown of nitrogenous materials in wastewater. Ammonia is toxic to aquatic organisms, exerts an oxygen demand, and contributes to eutrophication. It also increases the amount of chlorine needed to disinfect wastewater.

Annual average design flow (AADF) – average of the daily flow volumes anticipated to occur over a calendar year.

Average monthly (intermittent) discharge limit – The average of the measured values obtained over a calendar months’ time taking into account zero discharge days.

Average monthly discharge limit – The average of the measured values obtained over a calendar months’ time.

Background water quality – The concentrations of chemical, physical, biological or radiological constituents or other characteristics in or of groundwater at a particular point in time upgradient of an activity that has not been affected by that activity, [WAC 173-200-020(3)]. Background water quality for any parameter is statistically defined as the 95% upper tolerance interval with a 95% confidence based on at least eight hydraulically upgradient water quality samples. The eight samples are collected over a period of at least one year, with no more than one sample collected during any month in a single calendar year.

Best management practices (BMPs) – Schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the state. BMPs include treatment systems, operating procedures, and practices to control: plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. BMPs may be further categorized as operational, source control, erosion and sediment control, and treatment BMPs.

BOD_5 – Determining the five-day Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of organic material present in an effluent that is utilized by bacteria. The BOD_5 is used in modeling to measure the reduction of dissolved oxygen in receiving waters after effluent is discharged. Stress caused by reduced dissolved oxygen levels makes organisms less competitive and less able to sustain their species in the aquatic environment. Although BOD_5 is not a specific compound, it is defined as a conventional pollutant under the federal Clean Water Act.

Bypass – The intentional diversion of waste streams from any portion of a treatment facility.

Categorical pretreatment standards – National pretreatment standards specifying quantities or concentrations of pollutants or pollutant properties, which may be discharged to a POTW by existing or new industrial users in specific industrial subcategories.

Chlorine – A chemical used to disinfect wastewaters of pathogens harmful to human health. It is also extremely toxic to aquatic life.

Chronic toxicity – The effect of a compound on an organism over a relatively long time, often 1/10 of an organism's lifespan or more. Chronic toxicity can measure survival, reproduction or growth rates, or other parameters to measure the toxic effects of a compound or combination of compounds.

Clean water act (CWA) – The federal Water Pollution Control Act enacted by Public Law 92 500, as amended by Public Laws 95-217, 95-576, 96-483, 97-117; USC 1251 et seq.

Compliance inspection-without sampling – A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations.

Compliance inspection-with sampling – A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations. In addition, it includes as a minimum, sampling and analysis for all parameters with limits in the permit to ascertain compliance with those limits; and, for municipal facilities, sampling of influent to ascertain compliance with the 85 percent removal requirement. Ecology may conduct additional sampling.

Composite sample – A mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing discrete samples. May be "time-composite" (collected at constant time intervals) or "flow-proportional" (collected either as a constant sample volume at time intervals proportional to stream flow or collected by increasing the volume of each aliquot as the flow increased while maintaining a constant time interval between the aliquots).

Construction activity – Clearing, grading, excavation, and any other activity, which disturbs the surface of the land. Such activities may include road building; construction of residential houses, office buildings, or industrial buildings; and demolition activity.

Continuous monitoring – Uninterrupted, unless otherwise noted in the permit.

Critical condition – The time during which the combination of receiving water and waste discharge conditions have the highest potential for causing toxicity in the receiving water environment. This situation usually occurs when the flow within a water body is low, thus, its ability to dilute effluent is reduced.

Date of receipt – This is defined in RCW 43.21B.001(2) as five business days after the date of mailing; or the date of actual receipt, when the actual receipt date can be proven by a preponderance of the evidence. The recipient's sworn affidavit or declaration indicating the date of receipt, which is unchallenged by the agency, constitutes sufficient evidence of actual receipt. The date of actual receipt, however, may not exceed forty-five days from the date of mailing.

Days (compliance period interval) – When the compliance period is stated in days: (A) exclude the day of the event that triggers the period; (B) count every day, including intermediate Saturdays, Sundays, and legal holidays; and (C) include the last day of the period, but if the last day is a Saturday, Sunday, or legal holiday, the period continues to run until the end of the next day that is not a Saturday, Sunday, or legal holiday.

Detection level – or method detection limit means the minimum concentration of an analyte (substance) that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results as determined by the procedure given in 40 CFR part 136, Appendix B.

Dilution factor (DF) – A measure of the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. Expressed as the inverse of the percent effluent fraction, for example, a dilution factor of 10 means the effluent comprises 10% by volume and the receiving water 90%.

Distribution uniformity – The uniformity of infiltration (or application in the case of sprinkle or trickle irrigation) throughout the field expressed as a percent relating to the average depth infiltrated in the lowest one-quarter of the area to the average depth of water infiltrated.

Early warning value – The concentration of a pollutant set in accordance with WAC 173-200-070 that is a percentage of an enforcement limit. It may be established in the effluent, groundwater, surface water, the vadose zone or within the treatment process. This value acts as a trigger to detect and respond to increasing contaminant concentrations prior to the degradation of a beneficial use.

Enforcement limit – The concentration assigned to a contaminant in the groundwater at the point of compliance for the purpose of regulation, [WAC 173-200-020(11)]. This limit assures that a groundwater criterion will not be exceeded, and that background water quality will be protected.

Engineering report – A document that thoroughly examines the engineering and administrative aspects of a particular domestic or industrial wastewater facility. The report must contain the appropriate information required in WAC 173-240-060 or WAC 173-240-130.

Enterococci – A subgroup of fecal streptococci that includes *S. faecalis*, *S. faecium*, *S. gallinarum*, and *S. avium*. The enterococci are differentiated from other streptococci by their ability to grow in 6.5% sodium chloride, at pH 9.6, and at 10°C and 45°C.

E. coli – A bacterium in the family Enterobacteriaceae named Escherichia coli and is a common inhabitant of the intestinal tract of warm-blooded animals, and its presence in water samples is an indication of fecal pollution and the possible presence of enteric pathogens.

Fecal coliform bacteria – Fecal coliform bacteria are used as indicators of pathogenic bacteria in the effluent that are harmful to humans. Pathogenic bacteria in wastewater discharges are controlled by disinfecting the wastewater. The presence of high numbers of fecal coliform bacteria in a water body can indicate the recent release of untreated wastewater and/or the presence of animal feces.

Grab sample – A single sample or measurement taken at a specific time or over as short a period of time as is feasible.

Groundwater – Water in a saturated zone or stratum beneath the surface of land or below a surface water body.

Immediate reporting – Report permit violations immediately without delay of any interval of time from the moment the permittee becomes aware of the violation. Priority should first be given to stopping an active noncompliance.

Industrial user – A discharger of wastewater to the sanitary sewer that is not sanitary wastewater or is not equivalent to sanitary wastewater in character.

Industrial wastewater – Water or liquid-carried waste from industrial or commercial processes, as distinct from domestic wastewater. These wastes may result from any process or activity of industry, manufacture, trade or business; from the development of any natural resource; or from animal operations such as feed lots, poultry houses, or dairies. The term includes contaminated stormwater and, also, leachate from solid waste facilities.

Interference – A discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

- Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and
- Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to subtitle D of the SWDA), sludge regulations appearing in 40 CFR Part 507, the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act.

Local limits – Specific prohibitions or limits on pollutants or pollutant parameters developed by a POTW.

Major facility – A facility discharging to surface water with an EPA rating score of > 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

Maximum daily discharge limit – The highest allowable daily discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. The daily discharge is calculated as the average measurement of the pollutant over the day.

Maximum day design flow (MDDF) – The largest volume of flow anticipated to occur during a one-day period, expressed as a daily average.

Maximum month design flow (MMDF) – The largest volume of flow anticipated to occur during a continuous 30-day period, expressed as a daily average.

Maximum week design flow (MWDF) – The largest volume of flow anticipated to occur during a continuous 7-day period, expressed as a daily average.

Method detection limit (MDL) – See Detection level.

Minor facility -- A facility discharging to surface water with an EPA rating score of < 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

Mixing zone – An area that surrounds an effluent discharge within which water quality criteria may be exceeded. The permit specifies the area of the authorized mixing zone that Ecology defines following procedures outlined in state regulations (chapter 173-201A WAC).

National pollutant discharge elimination system (NPDES) – Section 402 of the Clean Water Act, the federal wastewater permitting system for discharges to navigable waters of the United States. Many states, including the state of Washington, have been delegated the authority to issue these permits. NPDES permits issued by Washington State are joint NPDES/State permits issued under both state and federal laws.

pH – The pH of a liquid measures its acidity or alkalinity. It is the negative logarithm of the hydrogen ion concentration. A pH of 7 is defined as neutral and large variations above or below this value are considered harmful to most aquatic life.

Pass-through – A discharge which exits the POTW into waters of the State in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation), or which is a cause of a violation of State water quality standards.

Peak hour design flow (PHDF) – The largest volume of flow anticipated to occur during a

one-hour period, expressed as a daily or hourly average.

Peak instantaneous design flow (PIDF) – The maximum anticipated instantaneous flow.

Point of compliance – The location in the groundwater where the enforcement limit must not be exceeded, and a facility must comply with the Ground Water Quality Standards. Ecology determines this limit on a site-specific basis. Ecology locates the point of compliance in the groundwater as near and directly downgradient from the pollutant source as technically, hydrogeologically, and geographically feasible, unless it approves an alternative point of compliance.

Potential significant industrial user (PSIU) – A potential significant industrial user is defined as an Industrial User that does not meet the criteria for a Significant Industrial User, but which discharges wastewater meeting one or more of the following criteria:

- Exceeds 0.5 % of treatment plant design capacity criteria and discharges <25,000 gallons per day or;
- Is a member of a group of similar industrial users which, taken together, have the potential to cause pass through or interference at the POTW (e.g. facilities which develop photographic film or paper, and car washes).

Ecology may determine that a discharger initially classified as a potential significant industrial user should be managed as a significant industrial user.

Quantitation level (QL) – also known as Minimum level (ML) – The term ‘‘minimum level’’ refers to either the sample concentration equivalent to the lowest calibration point in a method or a multiple of the method detection limit (DL), whichever is higher. Minimum levels may be obtained in several ways: They may be published in a method; they may be based on the lowest acceptable calibration point used by a laboratory; or they may be calculated by multiplying the DL in a method, or the DL determined by a laboratory, by a factor of 3. For the purposes of NPDES compliance monitoring, EPA considers the following terms to be synonymous: ‘‘quantitation limit,’’ ‘‘reporting limit,’’ and ‘‘minimum level’’.

Reasonable potential – A reasonable potential to cause or contribute to a water quality violation, or loss of sensitive and/or important habitat.

Responsible corporate officer – A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or have gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures (40 CFR 122.22).

Sample Maximum – No sample may exceed this value.

Significant industrial user (SIU) –

- All industrial users subject to Categorical Pretreatment Standards under 40 CFR Chapter I, Subchapter N and 40 CFR 403.6 and;
- Any other industrial user that: discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blow-down wastewater); contributes a process wastestream that makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the Control Authority* on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement [in accordance with 40 CFR 403.8(f)(6)].

Upon finding that the industrial user meeting the criteria in the second paragraph has no reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement, the Control Authority* may at

any time, on its own initiative or in response to a petition received from an industrial user or POTW, and in accordance with 40 CFR 403.8(f)(6), determine that such industrial user is not a significant industrial user.

*The term "Control Authority" refers to the Washington State Department of Ecology in the case of non-delegated POTWs or to the POTW in the case of delegated POTWs.

Slug discharge – Any discharge of a non-routine, episodic nature, including but not limited to an accidental spill or a non-customary batch discharge to the POTW. This may include any pollutant released at a flow rate that may cause interference or pass through with the POTW or in any way violate the permit conditions or the POTW's regulations and local limits.

Soil scientist – An individual who is registered as a Certified or Registered Professional Soil Scientist or as a Certified Professional Soil Specialist by the American Registry of Certified Professionals in Agronomy, Crops, and Soils or by the National Society of Consulting Scientists or who has the credentials for membership. Minimum requirements for eligibility are: possession of a baccalaureate, masters, or doctorate degree from a U.S. or Canadian institution with a minimum of 30 semester hours or 45 quarter hours professional core courses in agronomy, crops or soils, and have 5, 3, or 1 years, respectively, of professional experience working in the area of agronomy, crops, or soils.

Solid waste – All putrescible and non-putrescible solid and semisolid wastes including, but not limited to, garbage, rubbish, ashes, industrial wastes, swill, sewage sludge, demolition and construction wastes, abandoned vehicles or parts thereof, contaminated soils and contaminated dredged material, and recyclable materials.

Soluble BOD_5 – Determining the soluble fraction of Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of soluble organic material present in an effluent that is utilized by bacteria. Although the soluble BOD_5 test is not specifically described in Standard Methods, filtering the raw sample through at least a 1.2 um filter prior to running the standard BOD_5 test is sufficient to remove the particulate organic fraction.

State waters – Lakes, rivers, ponds, streams, inland waters, underground waters, salt waters, and all other surface waters and watercourses within the jurisdiction of the state of Washington.

Stormwater – That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a stormwater drainage system into a defined surface water body, or a constructed infiltration facility.

Technology-based effluent limit – A permit limit based on the ability of a treatment method to reduce the pollutant.

Total coliform bacteria – A microbiological test, which detects and enumerates the total coliform group of bacteria in water samples.

Total dissolved solids – That portion of total solids in water or wastewater that passes through a specific filter.

Total maximum daily load (TMDL) – A determination of the amount of pollutant that a water body can receive and still meet water quality standards.

Total suspended solids (TSS) – Total suspended solids is the particulate material in an effluent. Large quantities of TSS discharged to a receiving water may result in solids accumulation. Apart from any toxic effects attributable to substances leached out by water, suspended solids may kill fish, shellfish, and other aquatic organisms by causing abrasive injuries and by clogging the gills and respiratory passages of various aquatic fauna. Indirectly, suspended solids can screen out light and can promote and maintain the development of noxious conditions through oxygen depletion.

Upset – An exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, lack of preventative maintenance, or careless or improper operation.

Water quality-based effluent limit – A limit imposed on the concentration of an effluent parameter to prevent the concentration of that parameter from exceeding its water quality criterion after discharge into receiving waters.

Appendix D — Technical Calculations

Simple Mixing:

Ecology uses simple mixing calculations to assess the impacts of certain conservative pollutants, such as the expected increase in fecal coliform bacteria at the edge of the chronic mixing zone boundary. Simple mixing uses a mass balance approach to proportionally distribute a pollutant load from a discharge into the authorized mixing zone. The approach assumes no decay or generation of the pollutant of concern within the mixing zone. The predicted concentration at the edge of a mixing zone (C_{mz}) is based on the following calculation:

$C_{mz} = C_a + [(C_e – C_a)/DF]$

C_a = ambient concentration

C_e = effluent concentration

DF = dilution factor

Reasonable Potential Analysis:

Ecology uses spreadsheet tools to determine reasonable potential (to cause or contribute to violations of the aquatic life and human health water quality numeric standards) and to calculate effluent limits. The process and formulas for determining reasonable potential and effluent limits in these spreadsheets come from the Technical Support Document for Water Quality-based Toxics Control, (EPA 505/2-90-001) (USEPA, 1991).

Calculation of Water Quality-Based Effluent Limits:

Ecology calculates water quality-based effluent limits by the two-value wasteload allocation process as described on page 100 of the TSD (USEPA, 1991) and shown below.

1. Calculate the acute wasteload allocation WLA_a by multiplying the acute criteria by the acute dilution factor and subtracting the background factor. Calculate the chronic wasteload allocation (WLA_c) by multiplying the chronic criteria by the chronic dilution factor and subtracting the background factor.

WLA_a = (acute criterion x DF_a) – (background concentration x (DF_a – 1))

WLA_c = (chronic criterion x DF_c) – (background concentration x (DF_a – 1))

Where:

DF_a = acute dilution factor

DF_c = chronic dilution factor

2. Calculate the long-term averages (LTA_a and LTA_c) which will comply with the wasteload allocations WLA_a and WLA_c.

$LTA_a = WLA_a \times e^{(0.5\sigma^2 - z\sigma)}$

Where:

$\sigma^2 = \ln(CV^2 + 1)$

$z = 2.326$

CV = coefficient of variation = standard deviation/mean

$LTA_c = WLA_c \times e^{(0.5\sigma^2 - z\sigma)}$

Where:

$\sigma^2 = \ln(CV^2/4 + 1)$

$z = 2.326$

3. Use the smallest LTA of the LTA_a or LTA_c to calculate the maximum daily effluent limit (MDL) and the monthly average effluent limit (AML).

$MDL = LTA \times e^{(z\sigma - 0.5\sigma^2)}$

Where:

$\sigma^2 = \ln(CV^2 + 1)$

$z = 2.326$ (99^{th} percentile)

LTA = limiting long-term average

$AML = LTA \times e^{(z\sigma - 0.5\sigma^2)}$

Where:

$\sigma^2 = \ln(CV^2/n + 1)$

n = number of samples per month

$z = 1.645$ (95^{th} percentile)

LTA = limiting long-term average

Dilution Factor Calculations and Receiving Water Critical Conditions

Step 1: Enter Waterbody Type

Water Body Type	Freshwater

Facility Name	Camas WWTP
Receiving Water	Columbia River

Step 2: Enter Dilution Factors -OR- Calculate DFs by entering Facility/Receiving Water Flow Data

Do you want to enter dilution factors -or- flow data?	Dilution Factors

	Max Dilution Factor Allowed
Aquatic Life - Acute	23.0
Aquatic Life - Chronic	121.0
HH-Non-Carcinogen	185.0
HH-Carcinogen	185.0
Whole river at 7Q10	

Step 3: Enter Critical Data

	Effluent	Receiving Water
Temp, °C	25.7	23.2
pH, s.u. (for ammonia and pHmix)	7.3	8.1
pH, s.u. (for pentachlorophenol)	6.6	7.29
Alkalinity, mg/L as CaCO3	100	74
Hardness, mg/L CaCO3	168	66.2
Salinity, psu		0
Receiving water TSS, mg/L (leave blank if unknown)		
If TSS is annual data, enter 'A'; if from critical period, enter 'S'; If no TSS, leave blank		

Step 4: Specifiy if using 'Mixed' values for hardness, temperature, and pH

	Use 'Mixed Hardness' (Y/N)	Use 'Mixed Max Temp' (Y/N)	Use 'Mixed pH (Y/N)
	N	N	N
Acute Zone Boundary	70.6	23.3	8.0
Chronic Zone Boundary	67.0	23.2	8.1
Whole river at 7Q10			

Reasonable Potential Calculation

Facility	Camas WWTP
Water Body Type	Freshwater
Rec. Water Hardness	66.2 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	23.0	121.0
Human Health Carcinogenic		185.0
Human Health Non-Carcinogenic		185.0

Pollutant, CAS No. & NPDES Application Ref. No.			AMMONIA, Criteria as Total NH3	ANTIMONY (INORGANIC) 7440360 1M	ARSENIC (dissolved) 7440382 2M	BUTYLBENZYL PHTHALATE 85687 15B	CADMIUM - 7440439 4M Hardness dependent	CHLOROFORM 67663 11V	CHROMIUM(TRI) - 16065831 5M Hardness dependent	CHROMIUM(HEX) 18540299	COPPER - 744068 6M Hardness dependent	CYANIDE 57125 14M	DIETHYL PHTHALATE 84662 24B
Effluent Data	# of Samples (n)		1156	20	20	3	20	4	20	20	20	20	3
	Coeff of Variation (Cv)		2.02	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		1,455		0.95	0.27	0.022	0.71	0.97	420	8.3	20	1.1
	Calculated 50th percentile Effluent Conc. (when n>10)			0.237							5.47	7.5	
Receiving Water Data	90th Percentile Conc., ug/L		183		0		0.015		0.416	0.086	1.43	0	
	Geo Mean, ug/L			0		0		0			0	0	0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	4,641	-	360	-	2.36749	-	391.424	15	11.5366	22	-
		Chronic	589	-	190	-	0.75995	-	126.974	10	7.97908	5.2	-
	WQ Criteria for Protection of Human Health, ug/L		-	6	-	0.013	-	100	-	-	1300	9	200
	Metal Criteria Translator, decimal	Acute	-	-	1	-	0.943	-	0.316	-	0.996	-	-
		Chronic	-	-	1	-	0.943	-	0.86	-	0.996	-	-
	Carcinogen?		N	N	Y	N	N	Y	N	N	N	N	N

Aquatic Life Reasonable Potential

Effluent percentile value		0.950	0.950	0.950	0.950	0.950	0.950	0.950	
s	$s^2=\ln(CV^2+1)$	1.275	0.555	0.555	0.555	0.555	0.555	0.555	
Pn	$Pn=(1-\text{confidence level})^{1/n}$	0.997	0.861	0.861	0.861	0.861	0.861	0.861	
Multiplier		1.00	1.36	1.36	1.36	1.36	1.36	1.36	
Max concentration (ug/L) at edge of...	Acute	238	0.056	0.016	0.416	25.000	1.858	1.187	
	Chronic	194	0.011	0.015	0.422	4.822	1.511	0.226	
Reasonable Potential? Limit Required?		**NO**	**NO**	**NO**	**NO**	**YES**	**NO**	**NO**	

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month		4	
LTA Coeff. Var. (CV), decimal		0.6	
Permit Limit Coeff. Var. (CV), decimal		0.6	
Waste Load Allocations, ug/L	Acute	343.108	
	Chronic	1199.68	
Long Term Averages, ug/L	Acute	110.166	
	Chronic	632.751	
Limiting LTA, ug/L		110.166	
Metal Translator or 1?		1.00	
Average Monthly Limit (AML), ug/L		**171.0**	
Maximum Daily Limit (MDL), ug/L		**343.1**	

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$	0.55451	0.55451	0.55451	0.55451	0.55451	0.55451
Pn	$Pn=(1-\text{confidence level})1/n$	0.861	0.368	0.473	0.861	0.861	0.368
Multiplier		0.54811	1.20486	1.03846	0.54811	0.54811	1.20486
Dilution Factor		185	185	185	185	185	185
Max Conc. at edge of Chronic Zone, ug/L		0.00128	0.00176	4.0E-03	0.02957	0.04054	0.00716
Reasonable Potential? Limit Required?		**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Human Health Limit Calculation

# of Compliance Samples Expected per month	
Average Monthly Effluent Limit, ug/L	
Maximum Daily Effluent Limit, ug/L	

Comments/Notes:

References: WAC 173-201A,
Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Reasonable Potential Calculation - Page 2

Facility	Camas WWTP
Water Body Type	Freshwater
Rec. Water Hardness	66.2 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	23.0	121.0
Human Health Carcinogenic		185.0
Human Health Non-Carcinogenic		185.0

Pollutant, CAS No. & NPDES Application Ref. No.			LEAD - 7439921 7M Dependent on hardness	MERCURY 7439976 8M	NAPHTHALENE 91203 39B	NICKEL - 7440020 9M - Dependent on hardness	PHENOL 108952 10A	SELENIUM 7782492 10M	SILVER - 7740224 11M dependent on hardness.	ZINC- 7440666 13M hardness dependent			
Effluent Data	# of Samples (n)		20	20	3	20	3	20	20	20			
	Coeff of Variation (Cv)		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		0.15	0.00091		2.82	5.5	1	0.02	28.4			
	Calculated 50th percentile Effluent Conc. (when n>10)			0.00067		2		1		20.9			
Receiving Water Data	90th Percentile Conc., ug/L		0.064	0.00088		0.604		0.274	0.025	1.25			
	Geo Mean, ug/L			0		0	0	0		0			
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	41.1023	2.1	-	998.452	-	20	1.69705	80.6898			
		Chronic	1.6017	0.012	-	110.886	-	5	-	73.6821			
	WQ Criteria for Protection of Human Health, ug/L		-	0.14	-	80	9000	60	-	1000			
	Metal Criteria Translator, decimal	Acute	0.466	0.85	-	0.998	-	-	0.85	0.996			
		Chronic	0.466	-	-	0.997	-	-	-	0.996			
	Carcinogen?		N	N	N	N	N	N	N	N			

Aquatic Life Reasonable Potential

Effluent percentile value			0.950	0.950		0.950		0.950	0.950	0.950			
s	$s^2=\ln(CV^2+1)$		0.555	0.555		0.555		0.555	0.555	0.555			
Pn	$Pn=(1-\text{confidence level})^{1/n}$		0.861	0.861		0.861		0.861	0.861	0.861			
Multiplier			1.36	1.36		1.36		1.36	1.36	1.36			
Max concentration (ug/L) at edge of...		Acute	0.065	0.001		0.745		0.321	0.025	2.874			
		Chronic	0.064	0.001		0.631		0.283	0.025	1.559			
Reasonable Potential? Limit Required?			**NO**	**NO**		**NO**		**NO**	**NO**	**NO**			

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month													
LTA Coeff. Var. (CV), decimal													
Permit Limit Coeff. Var. (CV), decimal													
Waste Load Allocations, ug/L		Acute											
		Chronic											
Long Term Averages, ug/L		Acute											
		Chronic											
Limiting LTA, ug/L													
Metal Translator or 1?													
Average Monthly Limit (AML), ug/L													
Maximum Daily Limit (MDL), ug/L													

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$		0.55451	0.55451	0.55451	0.55451		0.55451					
Pn	$Pn=(1-\text{confidence level})^{1/n}$		0.861	0.861	0.368	0.861		0.861					
Multiplier			0.54811	0.54811	1.20486	0.54811		0.54811					
Dilution Factor			185	185	185	185		185					
Max Conc. at edge of Chronic Zone, ug/L			3.6E-06	0.01081	0.03582	5.4E-03		0.11297					
Reasonable Potential? Limit Required?			**NO**	**NO**	**NO**	**NO**		**NO**					

Human Health Limit Calculation

# of Compliance Samples Expected per month													
Average Monthly Effluent Limit, ug/L													
Maximum Daily Effluent Limit, ug/L													

Comments/Notes:

References: WAC 173-201A,
Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Calculation of Dissolved Oxygen at Chronic Mixing Zone

INPUT	
Chronic Dilution Factor	121.0
Receiving Water DO Concentration, mg/L	8.1
Effluent DO Concentration, mg/L	5.1
Effluent Immediate DO Demand (IDOD), mg/L	2
Surface Water Criteria, mg/L	*8*
OUTPUT	
DO at Mixing Zone Boundary, mg/L	**8.06**
DO decrease caused by effluent at chronic boundary, mg/L	**0.04**

Conclusion: At design flow, the discharge has no reasonable potential to violate water quality standards for dissolved oxygen.

References: EPA/600/6-85/002b and EPA/430/9-82-011

Calculation of pH of a Mixture of Two Flows

Based on the procedure in EPA's DESCON program (EPA, 1988. Technical Guidance on Supplementary Stream Design Conditions for Steady State Modeling. USEPA Office of Water, Washington D.C.)

INPUT	Test low effluent pH at the Chronic Boundary	Test high effluent pH at the Chronic Boundary
1. Dilution Factor at Mixing Zone Boundary	121.0	121.0
2. Ambient/Upstream/Background Conditions		
Temperature (deg C):	23.20	23.20
pH:	8.1	7.3
Alkalinity (mg CaCO3/L):	74.00	74.00
3. Effluent Characteristics		
Temperature (deg C):	25.70	25.70
pH:	6.0	9.0
Alkalinity (mg CaCO3/L):	100.00	100.00
4. Aquatic Life Use Designation	ther species (salmonid/redband trout/warmwater specie	
OUTPUT		
1. Ionization Constants		
Upstream/Background pKa:	6.36	6.36
Effluent pKa:	6.35	6.35
2. Ionization Fractions		
Upstream/Background Ionization Fraction:	0.98	0.90
Effluent Ionization Fraction:	0.31	1.00
3. Total Inorganic Carbon		
Upstream/Background Total Inorganic Carbon (mg CaCO3/L):	75	83
Effluent Total Inorganic Carbon (mg CaCO3/L):	322	100
4. Condtions at Mixing Zone Boundary		
Temperature (deg C):	23.22	23.22
Alkalinity (mg CaCO3/L):	74.21	74.21
Total Inorganic Carbon (mg CaCO3/L):	77.39	82.66
pKa:	6.36	6.36
5. Allowable pH change	0.50	0.50
RESULTS		
pH at Mixing Zone Boundary:	7.7	7.3
pH change at Mixing Zone Boundary:	0.37	0.00
Is permit limit needed?	NO	NO

Freshwater Un-ionized Ammonia Criteria Calculation

Based on Chapter 173-201A WAC, amended November 20, 2006

		mixed @ Acute Boundary	mixed @ Chronic Boundary	mixed @ Whole River
INPUT				
1. Receiving Water Temperature (deg C):	23.2	23.3	23.2	#VALUE!
2. Receiving Water pH:	8.1	8.0	8.1	#VALUE!
3. Is salmonid habitat an existing or designated use?	Yes	Yes	Yes	Yes
4. Are non-salmonid early life stages present or absent?	Present	Present	Present	Present
OUTPUT				
Using mixed temp and pH at mixing zone boundaries?	no			
Ratio	13.500	13.500	13.500	#VALUE!
FT	1.400	1.400	1.400	#VALUE!
FPH	1.000	1.007	1.000	#VALUE!
pKa	9.302	9.299	9.301	#VALUE!
Unionized Fraction	0.059	0.047	0.056	#VALUE!
Unionized ammonia NH3 criteria (mg/L as NH_3)				
Acute:	0.333	0.326	0.000	#VALUE!
Chronic:	0.042	0.042	0.042	#VALUE!
RESULTS				
Total ammonia nitrogen criteria (mg/L as N):				
Acute:	4.641	5.754		#VALUE!
Chronic:	0.589		0.620	#VALUE!

Streeter-Phelps Analysis of Critical Dissolved Oxygen Sag

INPUT			
1. EFFLUENT CHARACTERISTICS			
Discharge (cfs):			9.44
$CBOD_5$ (mg/L):			5
NBOD (mg/L):			3
Dissolved Oxygen (mg/L):			5
Temperature (deg C):			24
2. RECEIVING WATER CHARACTERISTICS			
Upstream Discharge (cfs):			81400
Upstream $CBOD_5$ (mg/L):			1.5
Upstream NBOD (mg/L):			0.2
Upstream Dissolved Oxygen (mg/L):			9
Upstream Temperature (deg C):			23
Elevation (ft NGVD):			75
Downstream Average Channel Slope (ft/ft):			0.00088
Downstream Average Channel Depth (ft):			21
Downstream Average Channel Velocity (fps):			0.98
3. REAERATION RATE (Base e) at 20 deg C (day^{-1}):			0.13
Reference	Applic. Vel (fps)	Applic. Dep (ft)	Suggested Values
Churchill	1.5 - 6	2 - 50	0.07
O'Connor and Dobbins	0.1 - 1.5	2 - 50	0.13
Owens	0.1 - 6	1 - 2	0.08
Tsivoglou-Wallace	0.1 - 6	0.1 - 2	1.99
4. BOD DECAY RATE (Base e) AT 20 deg C (day^{-1}):			0.07
(or use *Wright and McDonnell eqn, 1979, for small rivers.) Enter this value -->*			0.04

OUTPUT	
1. INITIAL MIXED RIVER CONDITION	
$CBOD_5$ (mg/L):	1.5
NBOD (mg/L):	0.2
Dissolved Oxygen (mg/L):	9.0
Temperature (deg C):	23.0
2. TEMPERATURE ADJUSTED RATE CONSTANTS (Base e)	
Reaeration (day^-1):	0.14
BOD Decay (day^-1):	0.08
3. CALCULATED INITIAL ULTIMATE CBODU AND TOTAL BODU	
Initial Mixed CBODU (mg/L):	2.2
Initial Mixed Total BODU (CBODU + NBOD, mg/L):	2.4
4. INITIAL DISSOLVED OXYGEN DEFICIT	
Saturation Dissolved Oxygen (mg/L):	8.555
Initial Deficit (mg/L):	-0.44
5. TRAVEL TIME TO CRITICAL DO CONCENTRATION (days):	11.48
6. DISTANCE TO CRITICAL DO CONCENTRATION (miles):	184.06
7. CRITICAL DO DEFICIT (mg/L):	0.55
8. CRITICAL DO CONCENTRATION (mg/L):	**8.00**

Appendix E — Response to Comments

No comments were received during the public comment period.

APPENDIX I

EVALUATION OF THE WASTEWATER TREATMENT FACILITY REPORT

General Sewer Plan

Evaluation of the Wastewater Treatment Facility



March 2026 / DRAFT

General Sewer Plan

Evaluation of the Wastewater Treatment Facility

March 2026 / DRAFT

This document is released for the purpose of information exchange review and planning only under the authority of Matthew M. Huang, March 12, 2026, State of Washington PE No. 54002.

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Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
AAD	annual average day
AADF	annual average day flow
AAF	average annual flow
ADF	average day flow
AOR	Actual (field) oxygen requirement
aSRT	aerobic solids retention time
aSRT	aerobic solids retention times
BNR	biological nutrient removal
BOD5	five-day biochemical oxygen demand
BODrem	Five-day biochemical oxygen demand removed (in biological process)
Ca	calcium
$CaCO_3$	calcium carbonate
Carollo	Carollo Engineers
$cBOD_5$	five-day carbonaceous biochemical oxygen demand
cf	cubic feet
CFU	colony-forming unit
CFU/100 mL	colony-forming units per 100 milliliters
CFU/mL	colony-forming units per milliliter
CIP	Capital Improvement Program
City	City of Camas
CMP	corrugated metal pipe
COD	chemical oxygen demand
DO	dissolved oxygen
DS	dry solids
DSHT	Digested Sludge Holding Tank
DT/d	dry ton per day
Ecology	Washington Department of Ecology
EOPCC	Engineer's Opinion of Probable Cost of Construction
f	filtered
ff	filtered and flocculated
gpd	gallons per day
gpd/sf	gallons per day per square foot
gpm	gallons per minute
GSP	General Sewer Plan

hp	horsepower
HST	high speed turbo
IR	internal recycle
ISS	inert suspended solids
kcal/d	kilocalories per day
kVA	kilovolt-amperes
kW	kilowatt
lb H20/hr	pounds of water per hour
lb SS/lb	pounds of suspended solids per pound
lbs/hr	pounds per hour
MADF	monthly average day flow
MCC	motor control center
MCRT	minimum mean cell residence time
MD	maximum day
MDDL	maximum day design mass load
MDF	maximum day flow
mg	milligrams
Mg	magnesium
MG	million gallons
mg/L	milligrams per liter
MG/yr	million gallons per year
mgd	million gallons per day
mL	milliliter
ML	mixed liquor
mL/g	milliliters per gram
MLSS	mixed liquor suspended solids
MLVSS	mixed liquor volatile suspended solids
mm	millimeters
MMAD	maximum month average day
MMDF	maximum month average day design flow
MMF	maximum month flow
MSL	mean sea level
MWAD	maximum week average day
MWDF	maximum week design flow
MWDL	maximum week average day design mass load
MWF	maximum week flow
N	nitrogen
N/A	not applicable
N/L	nitrogen per liter

NFPA	National Fire Protection Association
NH3	ammonia
NH4	ammonium
No.	number
NPDES	National Pollutant Discharge Elimination System
NPW	non-potable water
O&M	operations and maintenance
OP	ortho-phosphorus
OTE	oxygen transfer efficiency
P/L	phosphorus per liter
PFAS	per- and polyfluoroalkyl substances
PHDF	peak hour design flow
PHDL	peak hour design mass load
PHF	peak hour flow
PHL	peak hour loading
PIDF	peak instantaneous design flow
PLC	programmable logic controller
ppd	pounds per day
ppd/sf	pounds per day per square foot
psig	pounds per square inch gauge
RAS	return activated sludge
RDT	rotary drum thickener
RPA	Reasonable Potential Analysis
S/L	solids per liter
SCADA	supervisory control and data acquisition
scfm	standard cubic feet per minute
sf	square feet
SLR	solids loading rate
SOR	surface overflow rate
SOTE	standard oxygen transfer efficiency
SPA	state point analysis
SRT	solids retention time
STEP	septic tank effluent pump
SU	standard units
SVI	sludge volume index
SWBD	switch board
SWD	side water depth
TDH	total dynamic head
TKN	total Kjeldahl nitrogen

TP	total phosphorus
TS	total solids
TSS	total suspended solids
UV	ultraviolet
UVT	ultraviolet transmittance
VFA	volatile fatty acids
VFD	variable frequency drive
VSR	volatile solids reduction
VSS	volatile suspended solids
WAS	waste activated sludge
WRF	water reclamation facility
WWTF	wastewater treatment facility

SECTION 1 INTRODUCTION

The City of Camas (City) serves the water quality needs of approximately 8,500 residential, industrial, and commercial accounts by maintaining and operating its wastewater treatment facility (WWTF), which has the design treatment capacity and influent loadings summarized in Table 1. The City's sewer service area covers approximately 7,600 acres.

Table 1 Existing Treatment Design Capacity and Pollutant Loadings

Flow Parameter	Value
AAF(2)	5.3 mgd
MADF(1)	2.73 mgd
MMDF(2)	6.1 mgd
PIDF(2)	13.44 mgd
5-day Biochemical Oxygen Maximum Month Loading(2)	5,616 ppd
TSS Maximum Month Loading(2)	8,011 ppd
TKN, as N Maximum Month Loading(2)	2,573 ppd

Notes:
(1) Historical monthly average day flow from 2022-2024 plant data.
(2) Design values from 2014 - Phase 2B WWTF Improvements Record Drawings.
AAF - average annual flow; mgd - million gallons per day; MADF - monthly average day flow; MMDF - maximum month design flow; N - nitrogen; PIDF - peak instantaneous design flow; ppd - pounds per day, TKN - total Kjeldahl nitrogen; TSS - total suspended solids.

To support the development of the City's 2025 General Sewer Plan (GSP), a unit process analysis was conducted to identify shortfalls in plant capacity that could prevent the City from reliably treating and disposing of projected flows and loadings through the planning period (i.e., year 2045). To address these deficiencies, an alternatives analysis of the most viable improvement options was completed, resulting in the development of several projects to be incorporated into the 2025 GSP's Capital Improvement Program (CIP).

This report summarizes the methods and results of these tasks, defining the condition and capacities of the WWTF's unit processes and presenting sequenced recommendations that will enable the City to reliably and cost-effectively serve its customers now and into the future.

SECTION 2 CURRENT NPDES PERMIT

The treated and disinfected effluent is discharged from the WWTF into the Columbia River through a 36-inch corrugated metal pipe that extends approximately 850 feet into the river channel. The City's WWTF effluent must comply with limits on five day biochemical oxygen demand (BOD_5), TSS, ammonia, pH, and fecal coliform bacteria as required under its National Pollutant Discharge Elimination System (NPDES) permit. The current permit (No. WA0020249) was issued by the Washington Department of Ecology (Ecology) on August 1, 2025. The City will continue to work with Ecology to ensure compliance with the discharge limits summarized in Table 2.

A Reasonable Potential Analysis (RPA) was prepared to identify any new reasonable potential for the projected 2035 discharges to cause or contribute to any excursions above state water quality standards with the current design effluent water quality. This updated RPA used spreadsheets developed by Ecology with the projected maximum daily discharge and no other changes compared to the RPA prepared for the current NPDES permit. The updated RPA was conducted to identify any new reasonable potentials that would require infrastructure or process modifications to be addressed in the current capital improvement planning. The updated RPA, included in Appendix A, did not identify any new reasonable potentials.

Table 2 NPDES Permit Effluent Limits for Permit No. WA0020249

Parameter	Average Monthly	Average Weekly
Biological oxygen demand (BOD_5)	▪ 20 mg/L ▪ 842 ppd ▪ 85% removal	▪ 30 mg/L ▪ 1,264 ppd
TSS	▪ 20 mg/L ▪ 1,017 ppd ▪ 85% removal	▪ 30 mg/L ▪ 1,525 ppd
Ammonia (NH_3 as N) during summer(1)	▪ 20 mg/L	▪ 30 mg/L
Ammonia (NH_3 as N) during winter(2)	▪ 7 mg/L	▪ 11 mg/L
Parameter	**Minimum**	**Maximum**
pH	• 6 SU	• 9 SU
Parameter	**Monthly Geometric Mean**	**7-Day Geometric Mean**
Fecal coliform bacteria	▪ 200/100 mL	▪ 400/100 mL
Heat Load during summer(1)	▪ $5.87x10^8$ kcal/d	

Notes:
(1) Summer months include June through September.
(2) Winter months include October through May (inclusively).
kcal/d - kilocalories per day; mg/L - milligrams per liter; mL - milliliter; NH_3 - ammonia; SU - standard units.

SECTION 3 PAST EVALUATION OF REUSE

In the 2010 iteration of the general sewer plan, the City explored their potential to practice wastewater reclamation, or the production and beneficial use of reclaimed water. As such, an evaluation was completed to understand the feasibility of reusing effluent from the WWTF or constructing a new water reclamation facility (WRF) to treat wastewater for reuse.

The evaluation determined that, though environmental and social benefits are difficult to quantify and assess, the City and their surrounding communities can benefit indirectly from the use of reclaimed water in the following ways:

- Development of additional outdoor recreational sites for the community.
- Irrigation of parks and playfields, which can potentially increase property values.
- Conservation of the quality and quantity of the City's water resources.
- A flexible and reliable alternative water source for industrial water customers.

The previous study identified peak day demands of 0.338 mgd of reclaimed water irrigation and an annual irrigation demand of 46 million gallons per year (MG/yr).

However, the evaluation also confirmed that the production of reclaimed water is only economically feasible if the cost of producing reclaimed water is less than or equal to the cost of purchasing water or developing additional water rights.

Capital, operation, and maintenance costs for two alternative approaches to implementing reuse were taken from the 2010 GSP and converted from 2006 dollars to 2025 dollars. The two alternatives are: 1) Modify existing WWTF and 2) construct satellite WRF. A new 20-year present worth analysis was conducted with the updated values. Both the 2010 GSP and the current 20-year present worth analysis found that neither the costs to modify the existing WWTF nor construct a satellite WRF were less than or equal to the cost of developing additional water rights, which are available at notably lower costs. The cost to develop and acquire additional water rights was expected to not exceed 5 million dollars in 2006, which would be 15 million dollars in 2025.

Comparisons of the two alternatives are shown in Table 3. Alternative 1 has a 20-year present worth of $30.5 million dollars and Alternative 2 has a 20-year present worth of $81.7 million dollars. Even for Alternative 1, at a $30.5 million cost and an irrigation demand of 46 MG/yr, over a 20 year period, the cost of the reclaimed water is over $33,000 per million gallons (MG) produced, which is far more expensive than the cost to develop and acquire additional water rights. Therefore, water reclamation and reuse were determined to be economically infeasible at this time and not pursued at the City's WWTF.

Chapter 10 of the *2010 General Sewer/Wastewater Facility Plan* (Gray & Osbourne, Inc. 2010) documents the feasibility evaluation of reuse in further detail.

Table 3 Reuse Alternative Cost Comparison

	Alternative 1 Modify Existing WWTF	Alternative 2 Construct Satellite WRF
Capital Cost(1)	$24,414,000	$68,235,000
Annual O&M Cost(2)	$317,000	$705,000
20-year Present Worth(3)	$30,457,000	$81,662,000

Notes:
(1) 2010 general sewer plan used 2006 costs. The Handy-Whitman Index for the Pacific Region in July 2006 and July 2025 were used.
(2) 2010 general sewer plan reported 2004 costs. Costs were updated using the Handy-Whitman Index for the Pacific Region in January 2004.
(3) Discount rate assumed 5% bond repayment rate and 4% inflation for a total rate of 1%.
O&M - operations and maintenance.

SECTION 4 REVIEW OF PLANT HISTORICAL DATA

Carollo Engineers (Carollo) reviewed three years of plant operating data from January 2022 through December 2024. Historical flows and loadings were used to establish current operating conditions as well as design criteria for the projected 2045 flows and loads.

Tables 4 and 5 summarize the historical influent and primary effluent flows, pollutant concentrations, and loadings.

Table 4 Historical Plant Influent and Primary Effluent Summary(1)

Parameter	Flow (mgd)	BOD_5 (mg/L)	TSS (mg/L)	NH_4 (mg/L)
Plant Influent Average	2.73	122	134	40.2
Plant Influent Minimum	1.33	48.8	39.0	9.7
Plant Influent Maximum	7.80	314	380	59.3
Primary Effluent Average	-	66.6	38.6	-
Primary Effluent Minimum	-	17.7	10.0	-
Primary Effluent Maximum	-	801	201	-

Notes:
(1) Based on plant data from 2022 to 2024.
NH_4 - ammonium.

Table 5 Historical Plant Influent and Primary Effluent Pollutant Loadings Summary

Parameter	2022 Average	2023 Average	2024 Average	2022-2024 Average
Plant Influent Flow, MG	2.71	2.64	2.85	2.73
Plant Influent BOD_5 Mass Loading, ppd	2,500	2,770	2,770	2,680
Plant Influent TSS Mass Loading, ppd	2,870	3,150	2,910	2,977
Plant Influent TKN Mass Loading, ppd(1)	1,320	1,240	1,210	1,257
Primary Effluent BOD_5 Mass Loading, ppd	2,100	1,550	1,550	1,733
Primary Effluent TSS Mass Loading, ppd	1,380	921	829	1,043

Notes:
(1) TKN loadings based on assumed NH_4/TKN ratio of 0.70.

4.1 Additional Influent Wastewater Sampling

The City conducted additional influent wastewater sampling on three separate days - May 14, 2025, June 25, 2025, and July 23, 2025. Influent samples were tested for TSS, volatile suspended solids (VSS), volatile fatty acids (VFA), cBOD5, TKN, NH_3-N, ortho-phosphorus (OP), and total phosphorus (TP) during the sampling effort.

Tables 6 and 7 present summaries of the special sampling conducted in May, June, and July 2025 to characterize the influent wastewater and some of the in-plant recycle streams.

Table 6 Additional Influent Wastewater Sampling Summary (May 14, June 25, and July 22, 2025)

Parameter	Units	May 14, 2025	June 25, 2025	July 22, 2025	Average Concentration
Influent Temperature	°C			23.6	23.6
Influent pH	pH units			7.33	7.33
Influent Alkalinity	mg/L as $CaCO_3$	267	241	276	261
Influent COD	mg/L	200	228	241	223
Influent fCOD	mg/L	118	132	136	129
Influent ffCOD	mg/L	78.1	71.3	78.9	76.1
Influent TKN	mg/L	48.8	51.6	49.7	49.2

Parameter	Units	May 14, 2025	June 25, 2025	July 22, 2025	Average Concentration
Influent TP	mg/L	4.88	15.1	31.5	17.1
Influent Mg	mg/L	21.4	9.46	12.2	14.3
Influent Ca	mg/L	76.2	67	59	67.4
Influent Acetic acid	mg/L	4.5	3.3	2.8	3.5
Total VFAs	mg/L	4.5	3.3	2.8	3.5

Notes:
°C - degrees Celsius; Ca - calcium; $CaCO_3$ - calcium carbonate; COD - chemical oxygen demand; f - filtered; ff - filtered and flocculated; Mg - magnesium.

Table 7 Additional Operational Data from Special Sampling Days (May 14, June 25, and July 22, 2025)

Parameter	Average BOD_5 Concentration	Average Ammonia Concentration	Average TSS Concentration	Average VSS Concentration
Influent Wastewater (mg/L)	124	46.8	140	126
Primary Clarifier Effluent (mg/L)	89		60	50
Plant Effluent (mg/L)	4.3	2.5	3.2	3.0
Plant Drain Pump Station No. 1 (mg/L)		148.5		
Plant Drain Pump Station No.2 (mg/L)		7.3		
RDT Filtrate (mg/L)	116		297	88.5
Centrate (mg/L)	69			
RAS (mg/L)			5,687	4,497

Notes:
No. - number; RAS - return activated sludge; RDT - rotary drum thickener.

4.2 Historical Plant Performance

Table 8 summarizes the historical plant performance data from January 2022 through December 2024.

Table 8 Historical Plant Performance Data (January 2022 through December 2024)

Parameter	Average	Minimum	Maximum
Primary Effluent BOD_5 (mg/L)	65	18	169
% Removal, Primary Clarifiers, BOD_5	47%	46%	64%
Primary Effluent TSS (mg/L)	39	10	201
% Removal, Primary Clarifiers, TSS	71%	47%	74%
Aeration MLSS (mg/L)	2,356	1,250	11,130
Aeration MLVSS (mg/L)	1,816	1,110	2,480
MLVSS:MLSS ratio, %	77%		
Aeration SVI (mL/g)	91		162(2)
Aerobic Sludge Retention Time, SRT, days	6		
Total Sludge Retention Time, SRT, days	10.4		
RAS TSS (mg/L)	6,201	1,540	14,500
Effluent BOD_5, mg/L	3.7	1.7	22.2

Parameter	Average	Minimum	Maximum
Effluent TSS (mg/L)	3.6	1.9	28.2
Effluent TKN (mg/L)	0.4	0	7.4
Effluent NH_3-N (mg/L)	0.3	0	5.2
Effluent pH (SU)	7.1	6.5	7.5
Effluent Wastewater Temperature (°C)	19	13	
Effluent Fecal Coliform, CFU/100 mL	32.8	1	1,510
Effluent Alkalinity, mg/L as $CaCO_3$	244	242	247
Effluent UVT (%)	75	43	85
Magnesium Hydroxide usage (gpd)	370	34	600

Notes:
(1) TKN loadings based on assumed NH_4/TKN ratio of 0.70.
(2) 90th percentile of daily data.
CFU/100 mL - colony-forming units per 100 milliliters; gpd - gallons per day; mL/g - milliliters per gram; MLSS - mixed liquor suspended solids; MLVSS - mixed liquor volatile suspended solids; SRT - solids retention time; SVI - sludge volume index; UVT - ultraviolet transmittance; WAS - waste activated sludge

SECTION 5 PLANT UNIT PROCESSES AND UNIT OPERATIONS

This section presents an evaluation of each unit treatment process, comparing the rated or installed capacity with the treatment requirements under current and projected flows and loadings through the 2045 planning year. Any deficiencies or limitations in the plant's installed capacity to meet regulatory and operational requirements by 2045 are also summarized.

To this end, the unit process analysis was completed through the following sequential tasks:

- Compiled and analyzed three years of WWTF data (January 2022 through December 2024).
- Developed a hydraulic model of the collection system to estimate future ADF, maximum month flow (MMF), maximum day flow (MDF), and peak hour flows (PHF) at the WWTF.
- Estimated future flows and mass loadings anticipated through the planning year 2045.
- Prepared spreadsheet-based capacity estimates of existing liquid and solids processes to meet anticipated permit conditions under current and future influent characteristics.
- Updated and recalibrated hydraulic and BioWin models with recent plant data (May to June 2025) to assess future flow and loading impacts on facility performance. Both models were originally developed for the 2024 GSP and were updated and recalibrated using recent plant data. Monthly operating data from May 2025 was used to calibrate the BioWin model.
- Conducted plant tours in June 2025 to review and update prior condition assessments prepared as part of the 2024 GSP and identify any limitations.
- Using both the spreadsheet-based capacity assessment and the results of the calibrated hydraulic and BioWin models, determined future treatment capacities required for each unit process and estimated the optimal timing of necessary plant improvements.

The following sections highlight key points and findings from the above tasks.

5.1 Projected Plant Influent Flows and Loads

Table 9 summarizes the past year (2024) and projected (2045) flows and loads that must be treated and discharged to the Columbia River. These projections were developed based on historical influent flows and raw wastewater pollutant concentrations, typical septage and septic tank effluent pump (STEP) system characteristics, population growth projections, and industrial flow contributions. Projected future flows are based on Comprehensive Plan 2045 land uses and wastewater flow factors developed for the various land uses as part of the 2025 GSP. Chapter 3 Basis of Planning provides details on the methods used to develop these flow and load projections.

Table 9 Year 2045 Projected Flows and Estimated Influent Pollutant Characteristics

Parameter	Criteria	Units	Year 2045 Value
Influent Flow	AAF	mgd	5.36
	Maximum Month Peaking Factor	----	1.4
	MMF	mgd	7.5
	Maximum Week Peaking Factor	----	1.4
	MWF	mgd	8.6
	Maximum Day Peaking Factor	----	2.0
	MDF	mgd	10.7
	Peak Hour Peaking Factor	----	3.80
	PHF	mgd	20.4
	Peak Instantaneous Design Peaking Factor	----	4.15
	PIDF	mgd	22.2
$cBOD_5$[1]	AAD	mg/L	135
	AAD Mass	ppd	6,035
	MMAD Peaking Factor	----	1.25
	MMAD Mass	ppd	7,544
	MWAD Peaking Factor	----	1.4
	MWAD Mass	ppd	8,449
	MD Peaking Factor	----	1.5
	MD Mass	ppd	9,052
TSS	AAD	mg/L	130
	AAD Mass	ppd	5,811
	MMAD Peaking Factor	----	1.25
	MMAD Mass	ppd	7,264
	MWAD Peaking Factor	----	1.4
	MWAD Mass	ppd	8,136
	MD Peaking Factor	----	1.6
	MD Mass	ppd	9,298

Parameter	Criteria	Units	Year 2045 Value
TKN	AAD	mg/L	55
	AAD Mass	ppd	2,459
	MMAD Peaking Factor	----	1.15
	MMAD Mass	ppd	2,827
	MWAD Peaking Factor	----	1.20
	MWAD Mass	ppd	2,950
	MD Peaking Factor	----	1.4
	MD Mass	ppd	3,442

Notes:
AAD - annual average day; MD - maximum day; MMAD - maximum month average day; MWAD - maximum week average day; MWF - maximum week flow.

5.2 Spreadsheet Based Assessment of Activated Sludge Treatment Capacity

A spreadsheet-based desktop capacity analysis of the existing activated sludge treatment process was performed using current and projected influent wastewater characteristics to evaluate compliance with the effluent permit conditions. The analysis used the future flows and loads summarized in Table 9. Five-day carbonaceous biochemical oxygen demand ($cBOD_5$) values were increased by 10 percent for the purpose of sizing the activated sludge process. This was done to account for the effect of the nitrification inhibitor used in standard $cBOD_5$ tests.

Table 10 presents the process assumptions used for the desktop capacity analysis.

Table 10 Process Assumptions for Capacity Check of the Activated Sludge Process

Parameter	Criteria	Units	Value
Water Temperature	Minimum	°C	15.0
	Maximum	°C	26.0
Air Temperature	Minimum	°C	1.0
	Maximum	°C	35.0
Relative Humidity	Minimum (during summer)	%	60
	Maximum (during winter)	%	90
Site Elevation		Feet above MSL	40
Oxygen demand peak factor	Peak Loading	----	2.0
Process DO concentration (1)		mg/L	0.5 – 2.0
Aerobic SRT	Nitrification Safety Factor	----	2.0
	Minimum	days	8.0
Net Yield	MMAD	lb SS/lb $cBOD_5$	0.9
Clarifier Settling	SVI (98th Percentile)	mL/g	160
	SVI Formula	----	Diagger-Roper
	Clarifier Safety Factor	----	1.3
	Peak Surface Overflow Rate	gpd/sf	1,200

Parameter	Criteria	Units	Value
No. of Aeration Basins			3
Total Volume of Aeration Basins	All 3 Basins Combined	MG (cf)	2.263 (302,580)
	Anaerobic Selector Volume (2)	MG (cf)	0.133 (17,801)
	Anoxic Volume (2)	MG (cf)	0.810 (108,367)
	Aeration Volume (2)	MG (cf)	1.319 (176,412)
Primary Clarifier BOD_5 and TSS Removals	AAD	% (BOD_5/TSS)	30/54(3)
	MMAD		26/47
	MWAD		25/44
	MD		19/34
No. of Secondary Clarifiers			3(4)
Diameter of Secondary Clarifiers		feet	75

Notes:
(1) Spatial DO concentration in the aerobic zone. The maximum is 2.0 mg/L assumed during typical average day conditions and 0.5 mg/L at peak oxygen demand condition.
(2) Total Volume for all three Basins.
(3) The average BOD_5 removal of the existing primary clarifiers is ~46%.
(4) One of the secondary clarifiers (No. 1) is offline and needs to be demolished and rebuilt.
cf - cubic feet; DO - dissolved oxygen; lb SS/lb - pounds of suspended solids per pound; MSL - mean seal level.

The City's WWTF does not use Secondary Clarifier No. 1 because its flat bottom severely limits the withdrawal of settled mixed liquor, thereby negatively affecting RAS rates and the associated treatment capacity.

Activated sludge capacity curves are a graphical tool that can be used to estimate the treatment capacity of an activated sludge process. The operating MLSS concentration is the one parameter that is common to establishing the integrated or combined capacity of the biological reactors and the secondary clarifiers. Capacity curves use the MLSS concentration to graphically illustrate this integrated capacity of both unit processes as a function of the MLSS concentration. The capacity of the biological reactors increases linearly with increasing MLSS concentration while the clarifier capacity is an exponential function that increases with decreasing MLSS concentration. Therefore, the intersection of the aeration tank and clarifier curves represents the maximum capacity of the integrated process under the assumptions used to construct the graph (SRT, net yield, SVI, safety factors, etc.). However, the activated sludge process can operate successfully at any point on the capacity graph that is under both the aeration tank curve and the clarifier curve.

Figure 1 presents a capacity chart for the current operating conditions with two secondary clarifiers in service, based on the average values summarized in Table 8 for plant performance. The current capacity is estimated to range from approximately 3.1 to 4.6 mgd, depending on the SVI, using the maximum week organic loading for the biological reactors and the peak hour flow for secondary clarifier capacity, in accordance with Table G2-1 of the *Criteria for Sewage Works Design* (August 2008, Ecology).

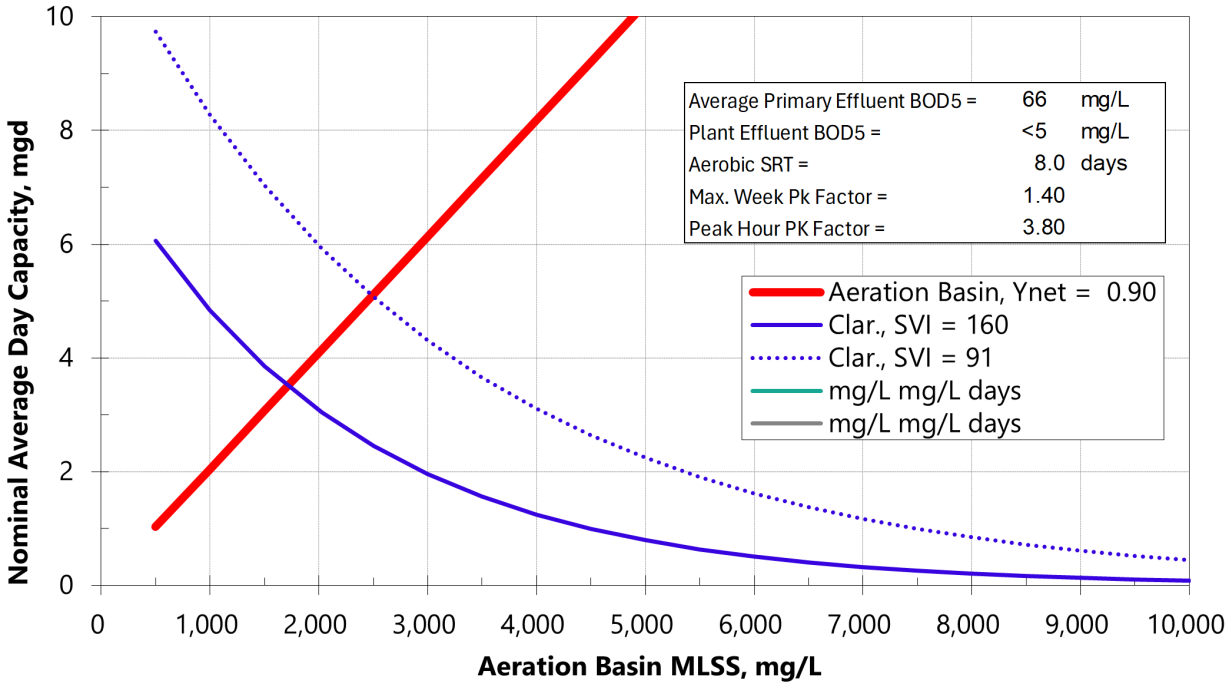


Figure 1 Capacity Chart - Current Operations with Three Aeration Tanks and Two Secondary Clarifiers

Capacity curves (and steady-state process simulation models) assume or predict the biomass inventory and the resulting MLSS concentration that results from a constant uniform plant influent flow with the assumed pollutant concentrations, thus these capacity estimates are relatively conservative. Peak flows and influent loads to wastewater treatment facilities are dynamic, short duration events during which both flow and pollutant mass loads vary. For maximum day and peak hour events, the MLSS concentration remains near the pre-storm MLSS concentration and not at the much higher concentration that would develop if the peak loads lasted for multiple days. While the MLSS concentrations will increase over the course of maximum week events, dynamic simulations are required to quantify the expected increase in MLSS concentrations and the resulting effect on treatment capacity.

In addition, during wet weather periods activated sludge processes can be operated at lower SRTs with lower MLSS concentrations to reduce the stress on the secondary clarifiers.

Secondary clarifiers will experience different behavior during peak flow events that cannot be accurately predicted using steady-state methods. Secondary clarifiers perform normally until the solids loading rate exceeds the capacity of the clarifier(s) at which time the sludge blanket will begin to propagate upwards in the clarifier. Depending on the magnitude and duration of the peak flows, the depth of the sludge blanket may or may not increase enough to result in large concentrations of TSS leaving in the clarifier effluent. Again, dynamic models can provide much better predictions of wet weather performance and thus help to size the treatment facilities appropriately.

For the reasons discussed above, common industry practice when using steady-state methods evaluates the capacity of activated sludge processes using the maximum month mass loadings and either maximum day or PHFs. This better portrays the condition that the secondary clarifiers will experience during peak flow events. Under maximum month organic loads and MDFs, the existing WWTF has an estimated capacity between about 4.4 and 6.3 mgd with three aeration tanks and two secondary clarifiers in service.

5.3 State Point Analysis

The relationship between MLSS concentrations, plant flows, and clarifier capacity can also be illustrated by another graphical method commonly called state point analysis as described below.

A clarifier state point analysis determines the effect of operating conditions on secondary clarifier capacity by comparing the actual solids loading to the theoretical maximum solids loading rate in pounds per day per square foot (ppd/sf) of the clarifier surface area as a function of the MLSS concentration. Key factors in a state point analysis are the MLSS concentration, the flow fed to the clarifiers, and the settling velocity of the MLSS as predicted by the selected correlation between SVI and settling velocity. State point analyses are very useful for predicting the ability of secondary clarifiers to operate successfully under peak flow conditions.

The state point diagram is constructed by drawing overflow and RAS underflow lines on a graph of MLSS concentration versus clarifier solids loading rate together with a solids flux curve. The solids flux curve represents the maximum possible solids loading rate to the clarifier as a function of MLSS concentration while maintaining the desired solids separation efficiency. The overflow line starts from the origin, with a slope equal to the overflow rate on the clarifiers in gallons per day per square foot (gpd/sf). The RAS line is drawn from the intersection of the overflow line and the MLSS concentration to the RAS concentration on the horizontal axis. The intersection of the overflow and RAS underflow operating lines (or state point) represents the operating point for the clarifier. If the operating point is underneath the solids flux curve and the RAS line remains below the falling limb of the solids flux curve, the clarifier is in a safe operating mode. Secondary clarifiers must operate successfully under design maximum day and peak hour flows without failing.

A state point analysis of the secondary clarifiers at the WWTF was conducted, and the results for peak flow conditions are shown in Figure 2. The state point diagram represents estimated settling characteristics based on the Daigger and Roper correlation between SVI and MLSS settling velocity. While a clarifier safety factor of 1.3 is typically used, the analysis indicates that with four secondary clarifier s online, the facility will be able to treat the 2045 design PHF of 20.4 mgd at a maximum MLSS concentration of 2,800 mg/L with no clarifier safety factor (SF = 1.0).

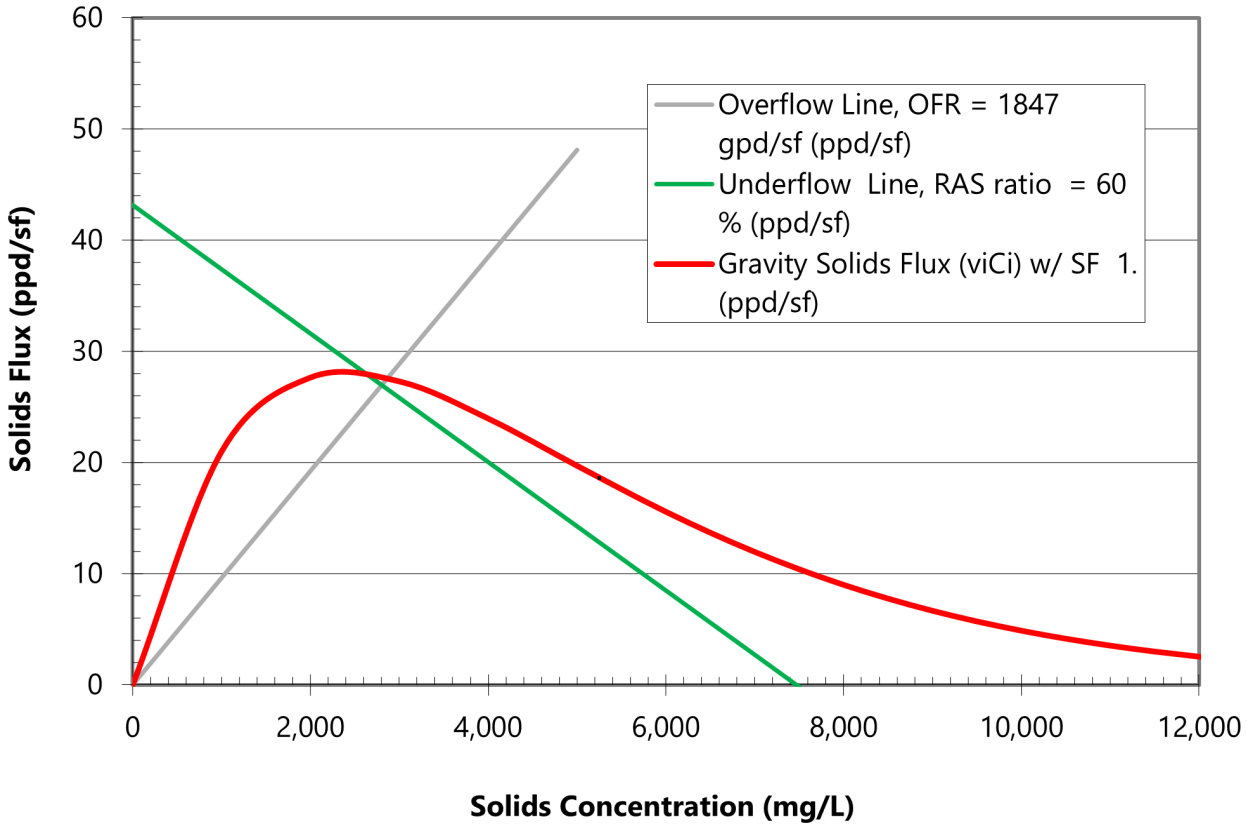


Figure 2 State Point Analysis - 2045 Peak Hour Flow with Four Secondary Clarifiers On-line

The desktop analysis indicates that the City should reconstruct Secondary Clarifier No. 1 with a new sloped bottom and spiral scraper mechanism identical to the existing Secondary Clarifier No. 3, as well as constructing a fourth Secondary Clarifier (No. 4) in the future (by 2040) to provide adequate capacity to treat flows and loads through 2045 and beyond.

The statistical evaluation of historical plant data revealed periodic occurrences of sludge bulking in the BNR process. For the three years of data examined there were three periods where the SVI's exceeded the proposed design SVI of 160. A chronological chart of daily SVIs and a frequency of occurrence chart are provided in Appendix B.

Although these periods present less than 10 percent of the days in that two-year period, they are a concern as they indicate that the current method of bulking control (chlorination) takes weeks to be effective. All three episodes occurred in winter or early spring when peak wet weather flows typically occur. The secondary clarifiers could fail in the future (when both plant flow and peak flows are projected to be higher than existing flows) if the peak flows occur during a bulking episode.

There have been significant advances in the last decade in the use of selectors and other methods of obtaining a densified activated sludge that provides lower and more stable operating SVIs. It is recommended that the WWTF evaluate the causes of the bulking including identification of the causative organisms and evaluate the feasibility of implementing at least one of the methods before or during the next design and construction project at the WWTF.

5.4 Process Simulation (BioWin Modeling)

For this update to the GSP the BioWin process simulation model developed for the previous version of the GSP was updated and calibrated with new data. Process simulation models like BioWin and others are computer applications consisting of simplified, mathematical representations of real-world physical, chemical, and biological treatment processes. They represent the state-of-the-art for the evaluation of biological wastewater treatment processes like those used at the City WWTF.

All process modeling was done with the BioWin Process Simulator Version 6.3 developed by EnviroSim Associates Ltd. BioWin simulates biological, chemical, and physical reactions using an integrated process model, and provides simulation results in user defined tables and charts. BioWin can model 82 different processes with up to 50 state variables and nine types of biomasses. This typically results in reliable predictions of expected performance for most commonly used biological wastewater treatment systems.

This calibration of the BioWin model for the WWTF used model defaults and assumptions refined using four categories of plant information including:

- Physical Plant Data - This is the dimensional data (e.g., volume, surface area) and configuration of the unit treatment processes.
- Influent Data - This is the influent flow and concentration data, including characterization of influent wastewater composition in terms of various fractions such as the particulate, colloidal, and soluble fractions of organic materials.
- Plant Operational Data - This includes RAS and WAS flow and mass rates, mixed liquor recycle rates, and DO concentrations in the aeration basins, etc.
- Kinetic and Stoichiometric Coefficients - For typical domestic wastewater modification of kinetic and stoichiometric coefficients is not necessary.

For this update to the GSP the BioWin model was calibrated using existing treatment facility operational data from January 2022 through December 2024 supplemented by data obtained from the special sampling events, and by running a dynamic simulation using the daily plant influent and effluent values (BOD_5, TSS, NH_3) and MLSS concentrations from May 2025.

Once the calibration effort was deemed acceptable, parameters were established for future conditions under which the WWTF must operate. Specifically, this effort adopted the flows and load projections presented in Tables 4 and 5 while assuming that effluent limits on ammonia would be as low as 7 mg/L for all scenarios. This is the highest allowable average monthly winter concentration of ammonia. Monthly averages are calculated from the sum of the measured daily discharge concentrations divided by the sum of the number of measurements over a calendar month.

5.4.1 Model Configuration

Figure 3 provides the process flow diagram used for the process simulations for the existing WWTF.

The key geometric features of the process as input to the model are summarized in Tables 11, 12, and 13. Detailed information on the proposed tank geometry from which the model input was derived are provided in Appendix C along with the geometry input to the model.

Table 11 Summary Geometry for the Bioreactors in the BioWin Model of the Wastewater Treatment Facility(1)

Zone	2025		2045	
	Zone Volume (MG)	Fraction Total (%)	Zone Volume (MG)	Fraction Total (%)
Selector	0.088	5.8%	0.066	2.9%
Anoxic(2)	0.270	17.9%	0.876	38.7%
Aeration	1.149	76.2%	1.320	58.4%
Total	1.507	100.0%	2.262	100.0%
Total anoxic(2)	0.238	23.8%	0.942	41.6%
Total aerobic	0.762	76.2%	1.320	58.4%

Notes:
(1) Simulations of 2025 conditions assumed two bioreactors and two secondary clarifiers in service; simulations of 2045 conditions assumed three bioreactors and four secondary clarifiers in service.
(2) For simulations of 2045 conditions the mixed liquor recycle was directed to the first anoxic zone and the second anoxic zone was simulated as an aerated bioreactor. The same, modified configurated was used for all bioreactors.

Table 12 Tank Geometry for Additional Unit Processes Used in the Wastewater Treatment Facility Process Simulation Model

Tank/Zone	No.	Diameter (feet)	Depth (feet)	Unit Area (sf)	Unit Volume (MG)	Total Area (sf)	Total Volume (MG)
Primary clarifiers	2	60.00	10.00	2,827	0.21	5,655	0.42
Secondary clarifiers(1)(2)	2/4	75.00	14.00	4,418	0.46	8,836	0.92
Anaerobic digesters	2	32.00	29.50	804	0.177	1,608	0.355
Gravity sludge thickener	1	30.00	10.00	707	0.053	707	0.053

Notes:
(1) Models of the existing process assumed two of the three existing secondary clarifiers were in service. Models simulating 2045 MMAD operation assumed four clarifiers in service.
(2) All model simulations used a clarifier depth of 14 feet. However, all existing clarifiers have different SWD. New clarifiers (No. 1 and No. 4) would be 75 foot diameter and have a 17 foot SWD to match existing clarifier No. 2. Clarifier No. 3 is shallower at 14 feet SWD.
sf - square feet; SWD - side water depth.

For simulations of 2025 conditions the WAS flow rate was controlled to match the historical mixed liquor suspended solids concentrations in the biological nutrient removal (BNR) process. For the 2045 simulations the WAS flow rate was controlled to provide the desired aerobic solids retention time (aSRT).

For all simulations, the RAS flow rate was held constant at a flow ratio of 0.6: 1 relative to the influent flow to match the historical data.

For both the 2025 and 2045 simulations the Internal mixed liquor recycle flow was held constant at 9 mgd to match the reported capacity of the internal recycle pumps. This is a total mixed liquor recycle ratio of 3.2: 1 relative to the current influent flow at 2.8 mgd and about 1.7: 1 for 2045 ADF. For the 2025 calibration the mixed liquor recycle was split with about half directed to the first selector zone and half to the third selector zone. For the simulations of future conditions, the mixed liquor recycle was directed to the first anoxic zone.

Supplemental alkalinity was assumed to be provided by adding magnesium hydroxide with a concentration of 7.7 pounds per gallon or 923,593 mg/L. For modeling purposes, magnesium hydroxide

was used for supplemental alkalinity as this is the chemical currently used by the plant. However, adding magnesium to the process increases the potential for struvite formation. It is recommended that the plant evaluate the use of an alternative source of supplemental alkalinity. No supplemental carbon was added in the simulations since the WWTF does not have a limit on oxidized nitrogen. However, maximizing denitrification in the BNR process through operation changes should recover a fraction of the alkalinity consumed by nitrification and reduce the need for supplemental alkalinity.

Assumed solids recoveries used in the model for the solids processing units and filters are provided in Table 13. The solids recovery for the sludge thickeners was adjusted to approximate the historical thickened sludge concentrations. Effluent filtration was simulated using the BioWin Separator – Dewatering unit with an assumed 55 percent removal of suspended solids to match historical performance. The filter backwash flow rate was set to 2 percent of the influent flow.

Table 13 Solids Recovery Assumed in Process Simulation Model

Unit Process	Assumed Solids Recovery (%)	
	May 2025 Calibration	2045 Average Day Maximum Month
Primary Clarifiers(1)	70	34 - 54
Gravity Thickener	95	95
Rotary Drum Thickener	85	85
Centrifuge	88	88
Dryer	95	95
Tertiary Filters(2)	35	55

Notes:
(1) Primary clarifier TSS removal was varied as a function of the surface loading rate using a common correlation between SLR and TSS removal.
(2) In the BioWin model, tertiary filtration was simulated using the solids separation module. As this module uses a constant TSS removal percentage regardless of influent flow or TSS, the assumed TSS removal by the filters in the model was adjusted so that the predicted TSS in the filter effluent would be consistent with expected performance.

Aeration was modeled in the BNR train by setting the operating DO concentrations and letting the model predict airflow and the actual oxygen transfer rates (AOR). The model default values were used for alpha (0.50) and beta (0.95) for the calibration runs and changed to 0.55 and 0.99 for the 2045 simulations. Both sets of values are conservative estimates of the ability to transfer oxygen in the mixed liquor of a BNR process using typical 9-inch circular fine pore diffusers. The aeration profile is provided in Table 14.

Table 14 Dissolved Oxygen Input for Biological Nutrient Removal Train in Process Simulation Model

Element	2025	2045
Selector 1	Unaerated	Unaerated
Selector 2	Unaerated	Unaerated
Selector 3	Unaerated	Unaerated
Anoxic 1	Unaerated	Unaerated
Anoxic 2	Unaerated	2.0
Aeration 1	0.5	2.0
Aeration 2	1.0	2.0
Aeration 3	1.0	2.0

5.4.2 Influent Wastewater Characteristics

The flows and concentrations input to the model were developed from the statistical analysis of the historical data from 2022 through 2024 and the special sampling data (presented previously in Tables 6 and 7) and are shown in Table 15. The BioWin Influent Specifier was used to estimate the values for the influent parameters and characteristic fractions needed for the process simulations but not typically measured. For the 2045 simulations the estimated influent fractions from May, June and July 2025 were averaged.

All May 2025 simulations were done using the reported daily mixed liquor temperatures while all the 2045 simulations assumed a wintertime wastewater temperature of 15°C.

Table 15 BioWin Model Influent Parameters(1)

Name	Units	2025	2045
Flow	mgd	2.8	7.5
COD	mg COD/L	260	300
TKN	mg N/L	60	55
TP	mg P/L	4.5	3.0
TS	mg S/L	10	62
Nitrate	mg N/L	0	0
pH	SU	7.2	7.3
Alkalinity	mg $CaCO_3$/L	260	260
ISS	mg ISS/L	34	13
Ca	mg/L	60	67.4
Mg	mg/L	10	14.3
DO	mg/L	0	0
Water Temperature	°C	15	15

Notes:
(1) For 2025, these are the average values for May 2025. For 2045 these are the design average day maximum month values.
ISS - inert suspended solids; mg - milligrams; N/L - nitrogen per liter; P/L - phosphorus per liter; S/L - solids per liter; TS - total solids.

The process configuration used in the BioWin model is presented in Figure 3 for the existing WWTF. The future configuration is identical with the exception that all the internal mixed liquor recycle is returned to the first pre-anoxic zone.

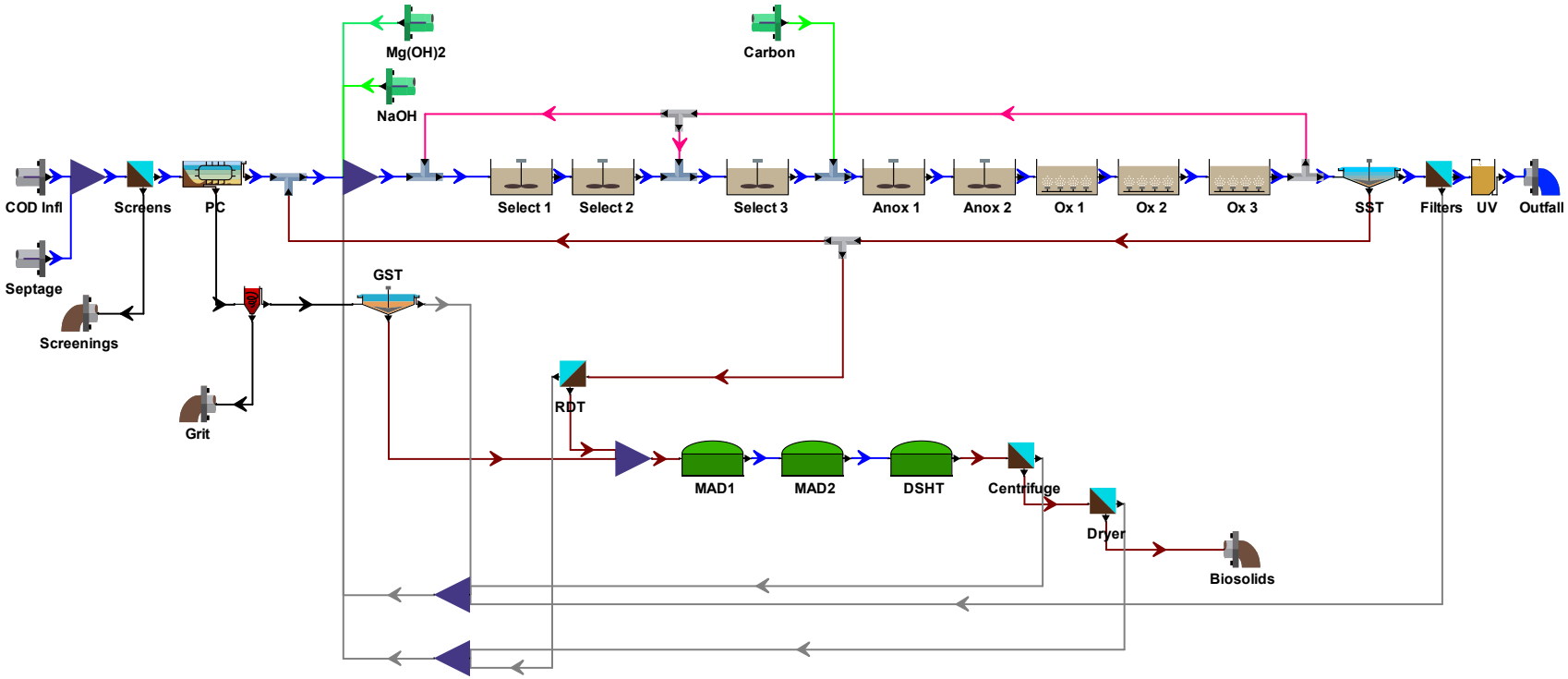


Figure 3 Process Flow Diagram Used in the BioWin Model of the Existing Camas Wastewater Treatment Facility

5.4.3 Model Kinetic and Stoichiometric Parameters

Model default values were used for kinetic and stoichiometric parameters except for the maximum specific growth rates for ordinary heterotrophic organisms and ammonia oxidizing bacteria. The values for these two parameters were set at 2.0 day^{-1} and 0.70 day^{-1} respectively to better match the predicted effluent $cBOD_5$ and ammonium concentrations to reported concentrations. This suggests that there may be one or more toxic compounds in the raw wastewater that inhibit the growth of both heterotrophs and nitrifiers. This is typical of the semiconductor industry.

The settling coefficients for the Modified Vesilind equation used in BioWin were changed to be representative of a mixed liquor with a SVI of 160 using the Daigger correlation between SVI and mixed liquor settling velocities. The values used were 0.340 feet per minute for the maximum Vesilind settling velocity and 0.418 liters per gram for the Vesilind hindered zone settling parameter.

5.4.4 Model Results

Model calibration simulations were performed at existing average daily flows and pollutant concentrations for May 2025 were applied for several purposes including:

- Checking predicted effluent quality.
- Checking historical MLSS for May 2025 against predicted performance.
- Checking predicted MLSS for 2045 average day maximum month mass loads at the desired minimum aerobic solids retention time of eight days.
- Preparing a mass balance for the treatment plant for the 2045 average day maximum month mass loads.

For the 2045 simulations, the main purpose of the simulations was to verify that proposed improvements would result in a robust facility that treats the projected future flows and mass load while meeting the current NPDES permit requirements.

Summaries of the actual and predicted effluent concentrations for the key effluent parameters from the May 2025 calibration simulations are provided in Tables 16 and 17. For those parameters that are monitored by the plant, the predicted effluent concentrations are close to those measured. As can be seen in Table 16, the predicted concentrations match the measured values reasonably well.

Table 16 Summary of Predicted Effluent Concentrations(1)

Parameters	Predicted Concentration (mg/L)(2)	Reported Concentration (mg/L)
Alkalinity (mg $CaCO_3$/L)	256	244
BOD – Total	2.5	3.3
COD - Total	26	---
TSS	3.6	2.8
N - Ammonia	0.19	0.31
N - TKN	2.2	0.44
N - Nitrate	37	---
N - Nitrite + Nitrate	37	---

Parameters	Predicted Concentration (mg/L)(2)	Reported Concentration (mg/L)
N - Nitrite	0.06	---
N - Total inorganic N	37.2	---
TP	4.6	---
pH	7.0	7.3

Notes:
(1) For May 2025
(2) At 19.4 °C, 8.7-day aerobic SRT, IR ratio = 3.2: 1, RAS ratio = 0.6: 1.

The solids balance produced by the BioWin simulation for May 2025 did not match the available operating data in one key aspect. There is a notable difference between the model predictions for the mass of WAS and the value reported by the plant in the historical data.

This discrepancy in the predicted versus measured waste sludge values also shows when comparing the predicted net sludge yield with that calculated from the plant data. The net sludge is the mass of suspended solids wasted from an activated sludge process divided by the mass of $cBOD_5$ removed in the process. This parameter provides a simple way to check or estimate the mass of sludge produced in an activated sludge process and the value is generally in the range of 0.6 to 1.0. The net sludge yield predicted by the process model is about 0.7 to 0.9 while the value calculated from the plant data is about 1.5.

There could be several reasons causing this difference between the predicted and measured WAS. These include the following:

- A historically non-representative sample location for the WAS.
- An inaccurate measurement of WAS mass. Many facilities have difficulty accurately measuring the WAS mass because they use total daily WAS flow but a TSS measurement from one grab sample to calculate mass. Since WAS TSS concentrations typically vary on a diurnal cycle this introduces the potential for error in the mass calculation.
- Inefficient operation of unit processes used to treat the solids generated by the treatment process. Low solids capture in a thickener or dewatering unit can recycle significant quantities of TSS which results in the need to operate with higher WAS rates.

5.4.5 Process Simulations

Finally, the BioWin model was used to model performance of the entire WWTF under the following anticipated future conditions:

- TSS removal rates of 54, 47, 44 and 34 percent were assumed for the primary clarifiers under 2045 AAD conditions, MMAD and MWAD and MD conditions.
- A minimum aSRT of 8.0 days under maximum month conditions and 6.05 days under maximum week conditions. These aerobic SRT result in nitrification safety factor of 2.9 and 2.2 under maximum month and maximum week flow conditions, respectively.
- A SVI, which is a quantification of MLSS settling velocity, of 160 mL/g.

The final clarifiers are expected to perform satisfactorily under the peak hour flow of 20.4 mgd at MLSS concentrations up to about 2,800 mg/L. Under maximum month mass loads, which will produce the maximum MLSS concentrations sent to the final clarifiers, the predicted MLSS concentration is about 3,000 mg/L with two primaries in service (~44 percent TSS removal). In addition to the process considerations, operating with two primaries under the predicted future PHFs, is expected to cause overflows in the headworks.

Although the plant should operate satisfactorily during anticipated future peak flows, due to the uncertainties inherent in predicting influent and operating conditions 20 years in the future, it is recommended to add a third primary clarifier. This will provide the following benefits to the WWTF:

- Maintain or increase primary clarifier BOD_5 and TSS removal efficiency.
- Decrease operating MLSS concentrations in the BNR process thus putting less stress on the final clarifiers during peak flows. With three primaries in operation, the predicted maximum month MLSS concentration drops to about 2,500 mg/L.
- Decrease process airflow demands thus facilitating the replacement of the existing multistage centrifugal blowers in the existing blower room.
- Lower process air power demands and thus reduce power consumption.
- Increase organic loadings to the anaerobic digesters thus increasing gas production and potentially lowering supplemental gas needed for the dryer.

Due to the decrease in primary clarifier performance with increasing surface loading rates, the maximum mass of primary sludge produced and the maximum concentrations of BOD5 and TSS in the primary effluent are expected to occur under maximum day loading.

5.5 Hydraulic Modeling

Carollo Engineers' Hydraulix® modeling software was used to establish the hydraulic capacities of individual unit processes and water surface elevations under 2045 peak flows. The model was built as part of previous GSP and modifications were made to the model based on the improvements made at the facility since the model was originally created in 2019. Hydraulic improvements shown in Figure 3 were implemented in the model to accommodate 2045 PIDF. More specifically, this software modeled the flow through the WWTF by calculating both the energy grade lines and hydraulic grade lines according to the head loss and velocity at each hydraulic element under various influent flow conditions identified in Table 17.

Table 17 Hydraulic Modeling Assumptions (Year 2045 Peak Instantaneous Day Flow)

Unit Process	2045 PIDF (22.3 mgd)	Assumptions
Plant Headworks	11.15 mgd per screen with 30% blinding and maximum headloss of 10 inches	Need minimum 12 inches freeboard at PIDF.
Primary Clarifiers	7.4 mgd/clarifier (3 online)	Flow split evenly between primary clarifiers. Bypass pipe available if one primary clarifier is out of service.
Aeration Basin Influent Flow Splitter Box	22.2 mgd + 60% RAS + 0.72 mgd (drain pump station 1) + 0.72 mgd (pump station 2) = 35.9 mgd	Replacement of aeration basin splitter box.

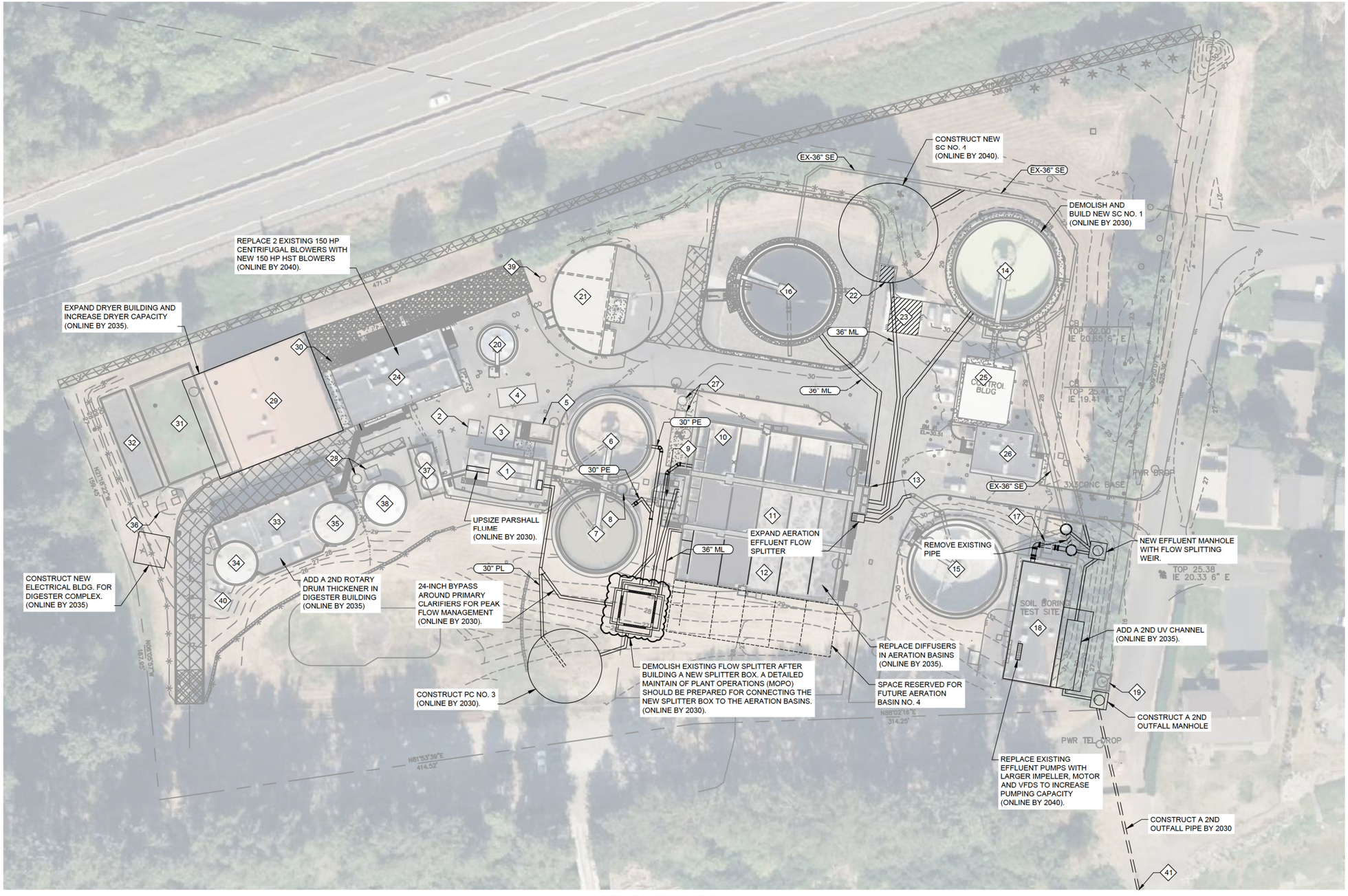
Unit Process	2045 PIDF (22.3 mgd)	Assumptions
Aeration Basins	7.4 mgd/basin (3 online) + 4.5 mgd IR/basin = 11.9 mgd/basin	Capacity of IR capped at 3,125 gpm (4.5 mgd)
Secondary Clarifiers	7.8 mgd/clarifier (3 online)	With Plant Drain Pump Stations online.
Tertiary Filters	2 filters online (each at 3 mgd) with 12 inches of headloss	Existing filter bypass utilized for flow over 6 mgd.
UV Disinfection	11.1 mgd (channel)	New UV channel. Upstream new effluent manhole with flow splitting weir to split flow between tertiary treatment.
Columbia River Outfall	11.1 mgd/outfall	Columbia River Water Elevation is assumed to be 15.0 feet.

Notes:
gpm - gallons per minute; IR - internal recycle; UV – ultraviolet.

Each individual unit process was considered "at risk" when the model indicated less than 18 inches of freeboard in a structure or less than six inches of fall from flow over a weir to the downstream water surface. A unit process was considered "overloaded," or as having a true hydraulic limitation when the model indicated less than 12 inches of freeboard or a weir was submerged. Less than 12 inches of freeboard in an open channel puts the WWTF at risk of flow overtopping a structure.

The following improvements are recommended to accommodate the 2045 peak flows. Refer to the proposed site plan showing new facilities (Figure 4 and 5) and details presented in Section 7:

1. Add a new secondary parallel UV disinfection channel with 3 UV banks identical to the ongoing UV improvements by 2040.
2. Construct a second outfall pipe and new effluent manhole for flow from new UV channel
3. Reconfigure secondary effluent piping to new effluent manhole with flow splitting weir to split flow between the two UV channels.
4. Demolish and construct existing Secondary Clarifier No. 1 and construct a new Secondary Clarifier No. 4.
    a. Upsize secondary clarifier influent piping to 36 inch mixed liquor (for all four secondary clarifiers).
    b. Expand secondary clarifier influent splitter box to accommodate for Secondary Clarifier No. 4.
5. Construct a new aeration basin influent flow splitting structure as shown on the site plan.
    a. Construct new 36 inch mixed liquor piping to the aeration basins between the aeration basin splitter box structure.
    b. Upsize primary clarifier effluent piping to 30 inch primary effluent and connect to new aeration basin splitter box.
6. Construct Primary Clarifier No. 3 and 30 inch primary clarifier bypass pipe from the headworks effluent box to the new aeration basin splitter box structure.
7. Upsize the Parshall Flume throat size in the existing headworks structure.



0 20' 40' 80'

SCALE: 1" = 40'

LEGEND:

1. HEADWORKS
2. SEPTAGE RECEIVING VALVE VAULT
3. SEPTAGE RECEIVING TANKS
4. SEPTAGE TRUCK UNLOADING PAD
5. VACTOR TRUCK UNLOADING PAD
6. PRIMARY CLARIFIER NO. 1
7. PRIMARY CLARIFIER NO. 2
8. PRIMARY CLARIFIER SCUM PUMP STATION
9. AERATION BASIN SPLITTER BOX
10. AERATION BASIN NO. 1
11. AERATION BASIN NO. 2
12. AERATION BASIN NO. 3
13. SECONDARY CLARIFIER SPLITTER BOX
14. SECONDARY CLARIFIER NO. 1
15. SECONDARY CLARIFIER NO. 2
16. SECONDARY CLARIFIER NO. 3
17. EFFLUENT FLOW METER VAULT
18. UV DISINFECTION / EFFLUENT PUMP STATION
19. EFFLUENT MANHOLE
20. GRAVITY THICKENER
21. SEPTAGE / CENTRATE / WAS STORAGE TANKS
22. STORAGE SHED (DEMOLISHED)
23. GARAGE (DEMOLISHED)
24. EQUIPMENT BUILDING
25. CONTROL BUILDING NO. 1
26. CONTROL BUILDING NO. 2
27. PLANT DRAIN PUMP STATION NO. 1
28. PLANT DRAIN PUMP STATION NO. 2
29. MODIFIED BIOSOLIDS DRYER BUILDING
30. SUCTION / DISCHARGE DRAIN MANHOLE
31. BIOFILTER NO. 1
32. BIOFILTER NO. 2
33. DIGESTER BUILDING
34. ANAEROBIC DIGESTER NO. 1
35. ANAEROBIC DIGESTER NO. 2
36. WASTE GAS BURNER
37. ALKALINITY CONTROL SYSTEM
38. DIGESTED SLUDGE HOLDING TANK
39. LOOP SEAL MANHOLE
40. DIGESTER GAS SCRUBBING SYSTEM
41. OUTFALL

OVERALL SITE PLAN

SCALE: 1" = 40'-0"

Figure 4
Proposed Site Plan Showing Hydraulic Improvements at City of Camas Wastewater Treatment Facility

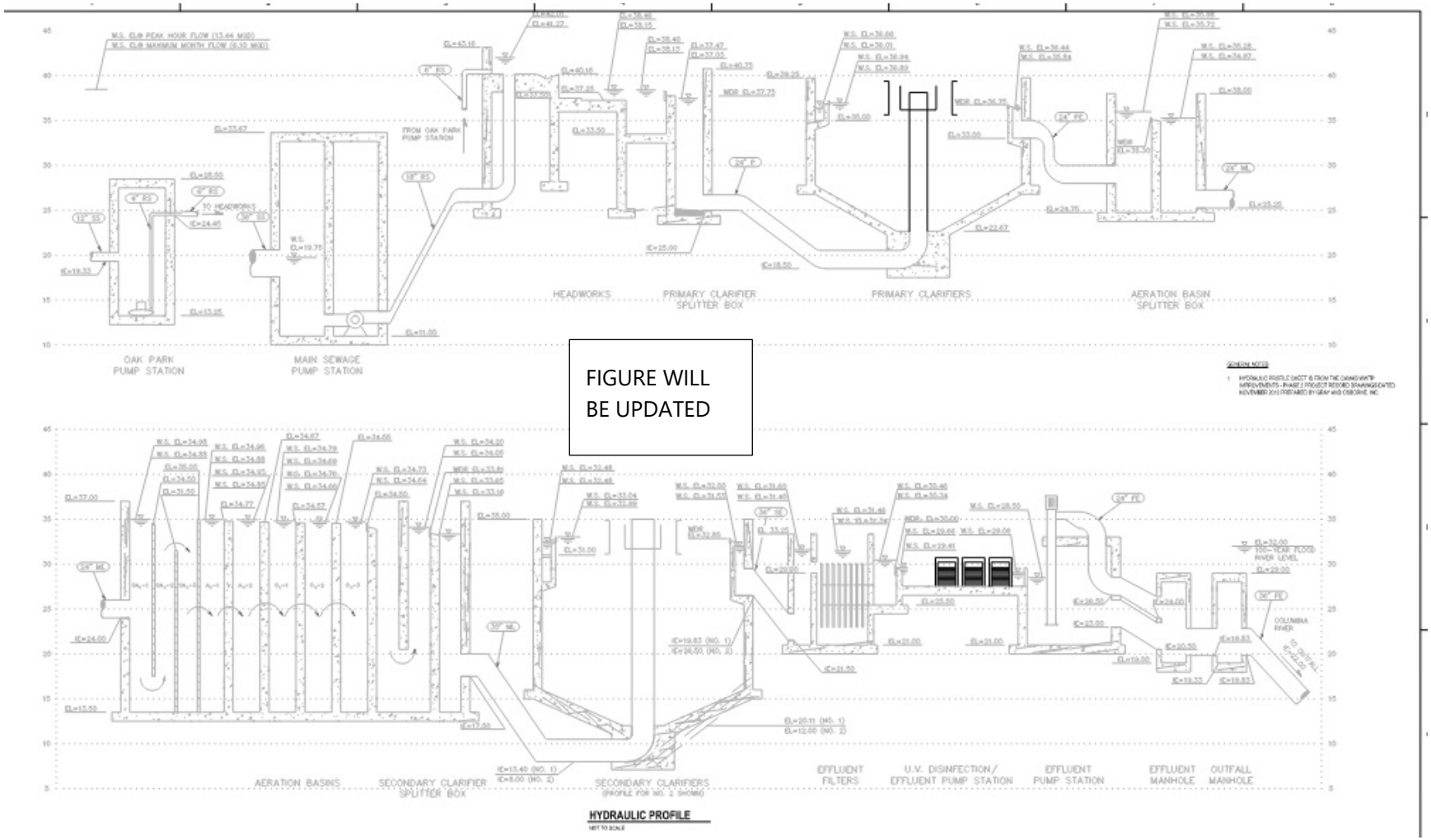


Figure 5 2045 Hydraulic Profile at Peak Instantaneous Design Flow

SECTION 6 CONDITION ASSESSMENT

A condition assessment was conducted as part of the 2024 GSP to identify major facility deficiencies and establish general priority ratings for mechanical equipment, treatment units, structures, and electrical, instrumentation, and control systems. The compiled information was updated during the plant tours conducted in June 2025 as part of the 2025 GSP to determine which portions of the facility can be retained, which require major upgrades, and which should be abandoned or replaced.

To begin, the assessment team reviewed drawings and design criteria for each unit process, including the recommended WWTF redundancy criteria for flows and loads as published in the *Criteria for Sewage Works Design* (August 2008, Department of Ecology) and summarized in Table 2.4 of Chapter 2.

Table 18 summarizes each key WWTF component's condition and rated capacity.

Next, the team discussed maintenance history, plant shortcomings, and general operational issues with City staff, who also accompanied the team on walk-through inspections of the WWTF following the general occurrence of the processes and associated major equipment in the direction of flow.

Table 18 2025 Condition Assessment Summary

WWTF Component	Rated Capacity	2019 Condition Assessment associated with 2024 GSP[1]	2025 Condition Assessment
Plant Headworks			
Influent Pipe	▪ N/A	▪ Headworks influent pipe configuration occasionally causes upstream overflow at the Parshall Flume during high flows.	▪ Same observation as in 2024 Condition Assessment. Influent piping should be modified by installing a rigid plate or concrete cover.
Influent Screens and associated washer/compactors	▪ Two mechanical screens. 7 mgd per screen, total 14 mgd. ▪ Washer/compactors are rated for 10 cf per hour.	▪ No significant condition issues identified.	▪ One of the influent screens needs a bearing replacement, and the plant is planning on doing this repair in-house.
Manual Bar Rack	▪ One manual bar rack.	▪ No significant condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Slide Gates	▪ Seven slide gates.	▪ No significant condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Primary Clarifiers	▪ 60 foot diameter, 10 foot SWD. ▪ SOR - 3,608 gpd/sf at PHF with both units operational.	▪ No significant condition issues identified.	▪ Severe corrosion of clarifier mechanisms; city replacing internals of both clarifiers as part of ongoing project
Aeration Basin Influent flow splitter box	▪ N/A	▪ N/A	▪ One shaft mixer was non-operational; staff noted the structure's freeboard is limited during high-flow events.
Aeration Basins	▪ Three aeration basins – 120 feet long, 40 feet wide and 21 feet SWD. ▪ ~3.9 to 5.7 mgd on max. week loading (3 aeration basins, 3 secondary clarifiers at SVI of 90 - 160 mL/g).	▪ Flow split between the 3 basins is uneven. ▪ Weir walls between the zones are uneven. Wooden walls in anaerobic zones	▪ Same observation as in 2024 Condition Assessment. Also, the internal recycle from the end of the aerobic zone is sent to the end of the anaerobic zone.
Secondary Clarifiers	▪ Three 75 foot diameter secondary clarifiers, 15 foot SWD.	▪ Secondary Clarifier. No. 1 is non-operational due to its flat bottom	▪ Same observation as in 2024 Condition Assessment.
Aeration System	▪ Four 150 hp centrifugal blowers. ▪ Firm capacity of 4,890 scfm at 10 psig.	▪ Unable to control blowers when operating multiple in parallel	▪ Same observation as in 2024 Condition Assessment. City is replacing two 150 hp blowers with 100 hp high speed turbos ; however, the new and old blowers will not be able to operate together.
Effluent Filters	▪ Two Cloth disk filters (10 micron). 3 mgd per filter, total 6 mgd.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment. Plant staff indicated the filters are backwashing 30% of the time, which is higher than the anticipated 20% or less.
UV Channel	▪ Four UV banks. ▪ 13.7 mgd at 65% UVT.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment. City is replacing the existing UV system with new UV system as part of an ongoing project.
Effluent Transfer Pumps	▪ Three 4,550 gpm at 16 feet TDH, 30 hp pumps. Firm Capacity is 13.09 mgd	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Non-potable Water Transfer Pumps	▪ Three 200 gpm at 185 feet TDH, 15 hp pumps.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment. City is replacing the motors for these pumps with new motors and variable frequency drives as part of an ongoing project.
RAS Pumps	▪ Each SC has two RAS pumps. ▪ Secondary Clarifier No. 1 has two pumps 1,000 gpm each. ▪ Secondary Clarifier No. 2 has two pumps 1,050 gpm each. ▪ Secondary Clarifier No. 3 has two pumps 1,400 gpm each.	▪ No condition issues identified. Secondary Clarifier No. 1 is not operation.	▪ Same observation as in 2024 Condition Assessment. ▪ City is replacing the VFD for a couple of RAS pumps as part of an ongoing project.
WAS Pumps	▪ Each Secondary Clarifier has one WAS pump. ▪ Secondary Clarifier No. 1 has one pump 85 gpm. ▪ Secondary Clarifier No. 2 has one pump 85 gpm. ▪ Secondary Clarifier No. 3 has one pump 240 gpm.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Primary Sludge Pumps	▪ Two pumps. Each 220 gpm.	▪ No condition issues identified.	▪ One of the PS pumps was making a very loud noise.
Internal Recycle Pumps	▪ Each Aeration Basin has one submersible pump. 3,125 gpm.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.

WWTF Component	Rated Capacity	2019 Condition Assessment associated with 2024 GSP[1]	2025 Condition Assessment
Degritting Cyclone ang grit classifier	▪ Two units. Each 220 gpm.	▪ End of useful life.	▪ Same observation as in 2024 Condition Assessment. City is replacing both units with new as part of an ongoing project.
Gravity Thickener	▪ One unit. 30 feet diameter, 10 feet SWD.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Thickened Primary Sludge Pumps	▪ Two units. Progressive Cavity pumps, 130 gpm each.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Rotary Drum Thickener	▪ One unit. 100-300 gpm.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Thickened WAS Pumps	▪ Two units. Progressive Cavity pumps, 50 gpm each.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Anaerobic Digesters and Digested Sludge Holding Tank (DSHT)	▪ Two anaerobic digester tanks. 32 feet diameter, 29 feet SWD. ▪ One DSHT tank. 32 feet diameter, 29 feet SWD.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Anaerobic Digester mixing and heating equipment	▪ Each digester has one draft tuber mixer and spiral heat exchanger. ▪ One hot water boiler with hot water pumps.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Digested Sludge Pumps	▪ Two units. Progressive Cavity pumps, 130 gpm each.	▪ N/A	▪ N/A
Dewatering Centrifuge	▪ One unit. 130 gpm at 2-2.5% solids.	▪ Near end of useful life.	▪ No issues observed with the existing unit. ▪ City is adding one new centrifuge (second unit) as part of an ongoing project.
Sludge Thermal Dryer	▪ One complete belt-drying system.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Plant Drain Pump Station No. 1	▪ Two submersible pumps. 250 gpm each.	▪ Shows signs of concrete corrosion and pumps at the end of useful life.	▪ Same observation as in 2024 Condition Assessment.
Plant Drain Pump Station No. 2	▪ Two submersible pumps. 450 gpm each.	▪ Shows signs of concrete corrosion and pumps at the end of useful life.	▪ Same observation as in 2024 Condition Assessment.
Electrical Components			
Utility Transformer No. 1	▪ 500 kVA	▪ N/A	▪ Owned and maintained by power utility. ▪ Utility Transformer No.1 shows some signs of rusting but no major concerns.
UV Electrical Room MDS-UV MCC-D1 MCC-D2 MCC-D3	▪ N/A	▪ N/A	▪ No major issues observed. ▪ City is replacing the UV system and associated power distribution panels and a new automatic transfer switch.
Old Controls Building MCC-A PLC-A Network Rack Transformer TL and Panel L	▪ N/A	▪ N/A	▪ The main concern in this building is the working clearance around electrical equipment seems low increasing likelihood of tripping hazard.
Utility Transformer No. 2	▪ 1000 kVA	▪ N/A	▪ Owned and maintained by power utility. ▪ Utility Transformer No. 2 shows some signs of rusting but no major concerns.
Equipment Blower Building MDS-EB MCC-C1/C1A MCC-C2/C2A Blower VFDs	▪ N/A	▪ N/A	▪ No major issues observed. ▪ City is replacing as part of an ongoing project the following: ▪ Two blowers and associated VFDs. ▪ New centrifuge control panels and VFDs

WWTF Component	Rated Capacity	2019 Condition Assessment associated with 2024 GSP(1)	2025 Condition Assessment
Emergency Generator	▪ 250 kW	▪ N/A	▪ City is replacing with new 450 kW generator as part of an ongoing project.
Digester Electrical Building SWBD-F MCC-F	▪ N/A	▪ N/A	▪ Main concern in this room is that it seems to be sharing walls with process areas. As such, it is very important to understand hazardous area classification of the area per NFPA 820. ▪ City is adding a new MCC-F as part of the ongoing project.
Biosolids Electrical Building SWBD-F MCC-F	▪ N/A	▪ N/A	▪ Main concern in this room is that it seems to be sharing walls with process areas. As such, it is very important to understand hazardous area classification of the area per NFPA 820.
Instrumentation and Controls			
SCADA system	▪ N/A	▪ N/A	▪ The current control system operates on standalone desktop PCs. When the remote display interface is engaged, control functionality on the primary desktop becomes inaccessible. This configuration presents a single point of failure and limits operational flexibility. To address this, a transition to a multi-user control architecture is recommended. Additionally, the system must support routine Windows updates without requiring downtime of the primary control workstation, which currently manages all plant operations.
PLC Infrastructure and Upgrade Status	▪ N/A	▪ N/A	▪ Progress on PLC upgrades have progressed. Several PLC components in use have reached end-of-life status, posing reliability and supportability risks. It is strongly advised to prioritize the replacement of these legacy PLCs to ensure continued system integrity and maintainability.

Notes:
(1) Condition Assessment performed as part of the 2024 GSP.
DSHT - Digested Sludge Holding Tank; hp - horsepower; kVA - kilovolt-amperes; kW - kilowatt; MCC - motor control center; N/A - not applicable; NFPA - National Fire Protection Association; PLC - programmable logic controller; psig - pounds per square inch gauge; SCADA - supervisory control and data acquisition; scfm - standard cubic feet per minute; SOR - surface overflow rate; SWBD - switch board; VFD - variable frequency drive; TDH - total dynamic head.

SECTION 7 RECOMMENDATIONS FOR CAPITAL IMPROVEMENTS

Based on the projected 2045 flows and loads, the following paragraphs provide a summary of the comprehensive analysis of each unit process and recommendations for improvements. Opinions of probable construction cost will be developed and included in the GSP.

7.1 Preliminary Treatment

The preliminary treatment facilities consist of a headworks structure with influent flow measurement through a Parshall flume, followed by in-channel fine screening. Two mechanically cleaned perforated plate screens with 6 millimeters (mm) openings are provided, each rated for a capacity of 7 mgd. One screen was installed as part of the Phase 1 improvements (2002), and the second was added during the Phase 2 improvements (2012). Each screen includes a washer/compactor to reduce the volume and weight of screenings before discharge into a dumpster located at grade level. A manual bar rack is installed in the bypass channel.

The Parshall flume (2 foot throat) measures influent flow to the treatment plant and was observed to be operating properly. An automatic flow-proportional sampler located near the flume collects raw influent wastewater samples.

Table 19 provides the design criteria for Plant Headworks for 2045 GSP.

Table 19 Plant Headworks Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	Hydraulic - PIDF Organic or Solids Loading - N/A
Class 1 Reliability Criteria	1 backup screen required
2045 PIDF	22.2 mgd
Parshall Flume	2 foot wide throat with Ultrasonic level sensor
No. of Influent Mechanical Screens	2
Flow per Mechanical Screen	11.1 mgd
Opening Size	6 mm
% Blinding	30%
Downstream Water Level at PIDF	2.4 feet
Maximum Headloss at PIDF and 30% Blinding	10 inches
No. of Washer/Compactors	2 (1 per screen)
Capacity of Washer/Compactor	70 cubic feet per hour
No. of Manual Bar Rack	1
Opening Size	3/4 inch

Recommendations for Improvements

1. Address the influent piping orientation at the headworks to prevent spraying of the influent wastewater during peak flow events. Add a concrete cap over the portion of the channel where the influent pipe enters vertically into the structure upstream of the Parshall Flume.
2. Conduct a structural investigation and perform required structural repairs and add appropriate coatings to the channels.
3. Remove the existing influent channel and Parshall flume. Replace the Parshall flume with the next larger size (3.0 feet throat) along with the influent channel.
4. Given the age and current condition of the screens, it is recommended to replace the two screens and associated washer/compactors by 2030. Based on correspondence with the screen manufacturer (Kusters Water Division - Zima Corporation), the existing screens have sufficient capacity to handle the 2045 PIDF of 22.2 mgd with both mechanical screens operating (11.1 mgd per screen) at the design blinding of 30 percent. If one of the screens is out of service, the bypass channel should be able to process the remaining flow. A budget proposal was requested to prepare a cost estimate to replace the two mechanical screens with new screens.
5. Replace all seven slide gates at the same time as replacing the influent screens.
6. It is recommended that the City collect appropriate samples to measure incoming TKN and NH_3 as well as influent alkalinity daily.

7.2 Septage Receiving Station

The Camas WWTF is equipped to receive septage from septage and vactor trucks. The septage receiving station has concrete unloading pads which convey the septage to a screening channel. The channel includes a mechanical screen with a dewatering chamber. The screened septage flows into a below grade concrete receiving tank equipped with submersible pumps.

Recommendations for Improvements

1. The City is replacing the septage screening equipment as part of an ongoing project. Therefore, no recommendations for further improvements are made at this time.

7.3 Primary Treatment

The screened wastewater flows through the plant headworks to the primary treatment splitter box downstream of the screens. The splitter box directs the flow towards two circular primary clarifiers (No. 1 and No. 2). A third splitter box segment is available to direct the flow to a future primary clarifier (No. 3).

Table 20 provides the design criteria for Primary Clarifiers for 2045 GSP

Table 20 Primary Clarifiers Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	Hydraulic - PHDF + Recirculation Organic or Solids Loading - PHDL (TSS)
Class 1 Reliability Criteria	50% of PHF with largest unit out of service
Surface Overflow Rate – SOR (Table T2-2, *Criteria for Sewage Design Works, August 2008*)	AADF - 800 to 1,200 gpd/sf PHF - 2,000 to 3,000 gpd/sf

WWTF Component and Parameter	2045 Design Criteria
2045 AADF	5.36 mgd
2045 MWAD Flow	7.5 mgd
2045 PHDF	20.4 mgd
2045 Average Day Influent TSS Loading	5,811 ppd
2045 Maximum Week Influent TSS Loading	8,136 ppd
2045 Maximum Day Influent TSS Loading	16,853 ppd
No. of Primary Clarifiers	3
Diameter of Primary Clarifier	60 feet
Effective settling area, each	2,827 sf
Effective settling area, total	8,482
SOR at AADF all Primary Clarifier s in service	632 gpd/sf
SOR at MWAD all Primary Clarifier s in service	1,011 gpd/sf
SOR at PHF all Primary Clarifier s in service	1,011 gpd/sf
SOR at 50% of PHF with 1 unit of service	2,401 gpd/sf
TSS removal in Primary Clarifier at 2045 ADF(1)	63%
TSS removal in Primary Clarifier at 2045 Max Week Flow (1)	52%
TSS removal in Primary Clarifier at 2045 Max Day Flow (1)	28%
2045 Minimum Primary Sludge(2)	1,500 ppd
2045 Maximum Primary Sludge(3)	4,5 ppd
2045 Minimum Primary Sludge(2)	5,000 gpd at 1%
2045 Maximum Primary Sludge(3)	40,000 gpd at 3.0%
Gravity Thickener Surface Area	707 sf
2045 Maximum Gravity Thickener Overflow rate	220 gpd/sf

Notes:
(1) Extrapolated from literature data for removal of TSS in primary clarifiers at various SORs with no recirculation and chemical addition.
(2) Calculated using 40% of 2045 estimated average day primary sludge production.
(3) Calculated using 2045 Maximum Week TSS loading and TSS removal in PC
(4) Calculated using the 2045 minimum primary sludge at 3.0% TS.
(5) Calculated using the 2045 maximum primary sludge at 1.0% TS.
AADF - annual average day flow; ADF - average day flow; PHDF - peak hour design flow; PHDL - peak hour design mass load.

Recommendations for Improvements

1. Add a weir, dropbox and piping as needed to construct a bypass around the primary clarifiers. This bypass will direct all flows greater than the maximum day flows (~10.7 mgd) around the primary clarifiers. A bypass is required whether or not a third primary clarifier is constructed because the new riser pipes being installed in the existing primary clarifiers under the current construction project do not have the needed hydraulic capacity for future peak flows.
2. To allow for robust operations during peak flow conditions and facilitate passing design peak hydraulic flows, a third primary clarifier should be added. This will maintain high removals of BOD_5 and TSS during normal operation and allow operation of the aeration tanks at lower MLSS concentrations during maximum month organic loadings. The lower operating MLSS concentrations

will in turn improve the ability of the secondary clarifiers to pass peak hour flows without significant degradation in performance. Adding a third primary clarifier will also reduce oxygen demands in the BNR process and increase gas production in the digesters, both of which will help to minimize power consumption in the future. Lower design oxygen demands will also facilitate the replacement of the existing multi-stage centrifugal blowers in the existing blower room.

7.4 Secondary Treatment

The primary clarifier effluent flows to the aeration basin influent flow splitter box. This splitter box also receives RAS and in-plant recycle flows from Plant Drain Pump Stations No. 1 and 2, which primarily consist of filtrate from the sludge thickeners and centrate from the dewatering centrifuges.

The secondary treatment process consists of three aeration basins with anaerobic selector zones, anoxic zones, and aerobic zones. Each basin is equipped with an IR pump that conveys nitrates formed in the aerobic zones back to the anoxic zones for partial nitrogen removal. The aerobic zones contain fine-pore diffusers, with air supplied by aeration blowers located in the Equipment Building.

Flow from the aeration basins is distributed to three circular secondary clarifiers via a flow-splitting structure. In the clarifiers, the MLSS are separated from the treated water, and the settled sludge is returned to the AB influent splitter box as RAS while the effluent flows downstream to the filters and UV disinfection.

Table 21 provides the design criteria for the Secondary Treatment (aeration basin and secondary clarifier) for 2045 GSP. The spreadsheet based activated sludge calculations as presented in Table 13 and the State Point Analysis presented previously indicate that a fourth secondary clarifier must be added to handle the 2045 peak flows (peak SOR < 1,200 gpd/sf).

Table 21 Secondary Treatment Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	Aeration Basin Hydraulic - MWDF Organic or Solids Loading - MWDL (BOD) Secondary Clarifier Hydraulic - PHDF + Recirculation Organic or Solids Loading - PHDL (TSS)
Class 1 Reliability Criteria	Minimum 2 aeration basins of equal size 75% of PHF with largest unit out of service
Surface Overflow Rate - SOR (Table T3-2, *Criteria for Sewage Design Works, August 2008*)	MLSS - 1,500 to 3,000 mg/L; SVI- 150 mL/g PHF - 1,200 gpd/sf
2045 AADF	5.36 mgd
2045 MWAD	8.6 mgd
2045 PHDF	20.4 mgd
Primary Clarifier Average Effluent BOD_5	60 - 90 mg/L
2045 Maximum Week BOD loading to Aeration Basins	5,300 ppd
Minimum Wastewater Temperature	15 °C

WWTF Component and Parameter	2045 Design Criteria
Aeration Basins	
No. of aeration basins	3
Total Volume	2.26 MG (302,400 cf)
Total Anaerobic Volume	0.13 MG (17,640 cf)
Total Anoxic Volume	0.41 MG (54,180 cf)
Total Aerobic Volume	1.725 MG (230,555 cf)
MLSS Concentration	~1,500 to 3,000 mg/L
aSRT	8 days
Net Yield	0.9 lb TSS/lb BOD
Average Day WAS produced	3,700 ppd
Maximum Week WAS produced	5,400 ppd
Secondary Clarifiers	
No. of Secondary Clarifiers	4
Secondary Clarifier Diameter	75 feet
Secondary Clarifier SWD	15 feet
RAS Rate	60%
Effective Settling Area per Secondary Clarifier	4,418 sf
SOR at AADF all Secondary Clarifiers in service	303 gpd/sf
SOR at PHF all Secondary Clarifiers in service	1,153 gpd/sf
SOR at 75% PHF with 1 unit out of service	1,153 gpd/sf
SLR at PHF	28.8 lb/sf/d

Notes:.
MWDF - maximum week design flow; MWDL - maximum week average day design mass load; SLR - solids loading rate.

- **RAS Pumping**: Each secondary clarifier has two RAS pumps (one duty/one standby). Secondary Clarifier No. 1 has two RAS pumps, each with capacity of 1,000 gpm. Secondary Clarifier No. 2 has two RAS pumps, each with capacity of 1,050 gpm. Secondary Clarifier No. 3 has two RAS pumps, each with capacity of 1,400 gpm. The current total RAS flow capacity is 6,900 (9.92 mgd) with firm capacity, with one pump per clarifier in operation, is 3,450 gpm (4.96 mgd). To achieve a design RAS rate of 60 percent of influent flow, the RAS flow of 12.2 mgd (8,500 gpm) is required at the 2045 peak flows. With four secondary clarifiers, a total of six RAS pumps, each with a capacity of 1,400 gpm will be sufficient to meet these criteria.
- **Internal Recycle Pumping**: Each aeration basin has a submersible IR pump with a capacity of 3,125 gpm (4.5 mgd). With three aeration basins, and assuming an even flow split, each aeration basin will receive a maximum week flow of 2.86 mgd. The IR rate at this flow will be 2.5 times the average day influent flow. Ideally the IR rate should be between 2.5 to 4 Q to achieve good denitrification, provided sufficient carbon and adequate anoxic volume are available. The BOD_5:TKN ratio in the influent flow to the aeration basins is 1.3:1 which is significantly deficient for any denitrification. Therefore, supplemental carbon will be required to achieve good denitrification and recover some alkalinity. For this evaluation, no changes to the IR rate or pumps are recommended.

Recommendations for Improvements:

1. By Year 2030:
    a. Relocate the internal recycle piping such that the recycle is introduced just upstream of the first of the two anoxic zones and not in the last anerobic zone for the three existing aeration basins.
    b. The baffle walls that divide the zones within the existing aeration basins' should be repoured to a smooth level. Plywood baffle walls in the anaerobic selector zone should be removed and replaced with 316 stainless steel baffle plates for rigidity.
    c. In conjunction with the replacement of the selector walls, the ability to improve the settling characteristics of the mixed liquor by reconfiguring the selector zones should be evaluated, and modifications implemented if deemed advantageous.
    d. Demolish and rebuild Secondary Clarifier No. 1 to match the size, slope, and other criteria of Secondary Clarifier No. 3. Install new RAS, WAS, and Scum pumps matching the size of those serving Secondary Clarifier No. 3. This Secondary Clarifier No. 1 should be constructed by 2030.
    e. Replace the RAS pumps for Secondary Clarifier No. 2 to match the size (1,400 gpm) as that of Secondary Clarifier No. 3 by 2030.
    f. Implementing hydraulic SRT control - a simpler hydraulic SRT control system should be programmed in the plant PLC using the following formula to estimate the aSRT:

$$\mathrm{aSRT} = \frac{V_a}{Q_w} \cdot \frac{R + {Q_w}/{Q}}{1+R}$$

Where:
Q_w = wasting rate, mgd.
V_a = online aeration basin volume, MG.
Q = averaged forward flow, mgd.
R = RAS recycle ratio, unitless.
aSRT = desired aSRT, days.

From this formula, the required wasting rate can be calculated based on the online aeration volume, the plant forward (influent) flow, the RAS recycle ratio (R), and the desired aSRT without measuring the MLSS concentration or the return activated sludge suspended solids concentration.

2. By year 2035:
    a. Replace the diffusers in the existing three aeration basins by 2035. Add diffusers to the second of the two anoxic zones in each aeration basin to convert it to a swing zone. Supports for diffusers in the swing zone should be adequately designed to withstand the forces exerted by the existing submersible mixers.
3. By year 2040:
    a. Construct a new Secondary Clarifier No. 4 with new RAS, WAS and scum pumps matching the size of that of Secondary Clarifier No. 3. This Secondary Clarifier No. 4 should be constructed by 2040.
    b. Construct a new Aeration Basin No. 4 with fine bubble diffusers and aeration piping and IR pump matching the size of the existing aeration basin. With four aeration basins, the plant can take one of the aeration basins out of service for cleaning and preventative maintenance and still maintain an 8-day SRT necessary for stable complete nitrification using three aeration basin with adding air to the swing zone and operating all four secondary clarifiers.

7.5 Aeration Blowers

There are four aeration blowers, multistage centrifugal blowers, each providing an airflow of 1,630 scfm at ~10 psig with 150 hp motors. The firm capacity of these blowers is 4,890 scfm with one unit out of service. Based on discussions with the plant staff, there are issues operating more than 2 blowers in parallel without overloading the motors.

The City is planning to replace two existing blowers with new high-speed turbo (HST) blowers, each providing an airflow from 667 to 1,334 scfm with a 100 hp motor. As part of this project, the blower controls will also be revised to allow parallel operation of the four blowers. With this upgrade, the firm capacity of the blower system will drop to 4,300 scfm at ~10 psig.

Table 22 provides the design criteria for the aeration blowers and diffusers for 2045 GSP.

Table 22 Aeration Blowers Design Criteria

WWTF Component and Parameter	2045 Annual Average Design Criteria	2045 Maximum Week Design Criteria	2045 Maximum Day Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	PHDL (BOD and TKN loading)		
2045 BOD loading to Aeration Basins	4243	5,400	9,421
2045 TKN loading to Aeration Basins	2,600	3,700	5268
AOR (ppd)	13,800	19,300	23,300
Standard Oxygen Demand (SOR) (ppd)	35,300	49,300	50,800
Diffuser submergence (feet)	20	20	20
Spatial DO Concentration (mg/L)	2.0	2.0	0.5
AOR/SOR	0.39	0.39	0.46
SOTE, %/foot	2.3%	2.2%	2.2%
SOTE, %	46.3%	44.9%	44.3%
Field OTE, %	18.2%	17.6%	20.3%
Total airflow (scfm)	3,100	4,500	4,600
Total No. of Diffusers	2,000	2,000	2,000
Airflow per diffuser	1.25	1.8	2.2
AT/AD (assuming 9-inch diffusers)	16.6	16.6	16.6
Aeration Blowers			
No. of Blower	4	4	4
Capacity of 2 HSTs (1)	2,667	2,667	2,667
Capacity of new 2 HSTs (2)	4,666	4,666	4,666
Firm Capacity w/ largest unit out of service	5,000	5,000	5,000

Notes:
(1) City is planning to replace two of the existing centrifugal blowers with HST blowers.
(2) Assumes the remaining two existing centrifugal blowers will also be replaced with HST blowers in the future.
AOR - actual oxygen demand; OTE - oxygen transfer efficiency; SOTE - standard oxygen transfer efficiency.

While the governing design criteria is the peak hour loading (PHL) for BOD and TKN, the proposed design assumes that the aeration equipment will be sized to handle the maximum week loadings. During PHL which only would last for an hour or so, it is assumed that the BOD and TKN loading will be significantly diluted and the PHL will be less than or equal to the maximum week loadings.

Recommendations for Improvements

1. Remove and replace the two existing 150 hp multistage centrifugal blowers with two 150 hp HST blowers. It is assumed that all four blowers will need to be on-line to satisfy the 2045 peak oxygen demand.

7.6 Tertiary Filtration

The filtration system consists of two parallel cloth disk, inside-out, filters, located in the UV Disinfection/Effluent Pump Station building. In the future as peak flows increase, it has been decided to bypass flows above the capacity of the existing filters (about 6.0 mgd) directly to the outfall. This is feasible as tertiary filtration is believed not to be necessary to meet the ammonia and TSS requirements of the NPDES permit if other modifications are made to the WWTP as discussed in this report.

Table 23 provides the design criteria for tertiary filtration for 2045 GSP.

Table 23 Tertiary Filtration Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	Hydraulic – Pass all flows requiring tertiary treatment Organic or Solids Loading - N/A
2045 AADF	5.36 mgd
2045 PHDF	20.4 mgd
2045 PIDF	22.2 mgd
2045 Annual Average Secondary Clarifier Effluent TSS	10 mg/L
2045 Maximum Secondary Clarifier Effluent TSS	20 mg/L
2045 Maximum Filtered Effluent TSS	5 mg/L
Filter Submerged Area per Unit	470 sf
Filter Submerged Area, Total	940 sf
Maximum filter hydraulic loading	4.43 gpm/sf
Filter Capacity, per Unit	3.0 mgd
Filter Capacity, Total	6.0 mgd
Maximum headloss (PHF) for each filter	12 inches

Notes:
(1) Proposal was requested from Kruger. They recommend three filter units, Model HPF2230-IF (2 duty/1 standby), each with a filtration area of 1,990 sf (submerged are 1,294 sf).

Recommendations for Improvements

1. As the existing tertiary filters approach the end of their useful life, they should be replaced with similar units.

7.7 UV Disinfection

The UV disinfection system consists of an open-channel horizontal gravity flow system with a weighted weir control gate on the downstream side of the UV disinfection banks, located in the UV Disinfection/Effluent Pump Station building. The City is planning to replace the existing UV Trojan 3000+ system with a new Trojan 3000+ system as part of an ongoing project.

Table 24 provides the design criteria for the UV disinfection system for 2045 GSP.

Table 24 UV Disinfection System Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	Hydraulic - Pass all flows Organic or Solids Loading - NA
2045 AADF	5.36 mgd
2045 PHDF	20.4 mgd
2045 PIDF	22.2 mgd
Maximum Influent TSS	5 mg/L
Minimum UVT	65%
Effluent temperature	33 °F (minimum) and 85 °F (maximum)
Effluent fecal coliforms	200 CFU/mL, monthly geometric mean of daily grab samples
No. of UV channel	1 (existing) + 1 (new)
No. of UV banks per channel	3
Type of UV	Trojan UV 3000+ (low pressure high intensity lamps)

Notes:
°F - degrees Fahrenheit; CFU/mL - colony-forming units per milliliter.

Recommendations for Improvements

1. Construct a new second UV channel outside the existing building on the west to allow disinfection of the entire plant effluent at PHF (22.2 mgd). These improvements are anticipated to be needed by 2040 if not sooner.

7.8 Effluent Pump Station and Pumps

Following the UV disinfection, treated effluent discharges to the effluent pump wet well in the UV Disinfection Building, and eventually through the 36-inch outfall pipe to the Columbia River. The effluent wet well is divided into two compartments by a sluice gate. The UV disinfection channel discharges into the first compartment. Under gravity discharge conditions, effluent discharges from the first compartment to the effluent wet well through a 36-inch pipe to the effluent manhole. This manhole contains a flap gate to prevent the river water backing up into the effluent wet well during high river flow conditions. Effluent then flows by gravity from the effluent manhole to the Outfall manhole through a 36 inch pipe.

Under high river water level conditions, when the headloss is too great for gravity flow to the Columbia River, the effluent is pumped using three vertical propeller effluent pumps, located in the second compartment of the effluent wet well. Each pump has a capacity of 4,550 gpm (6.54 mgd). The total capacity of the effluent transfer pump station is 19.6 mgd with a firm capacity of 13.09 mgd.

Table 25 provides the design criteria for upgrades to the Effluent Pumps for 2045 GSP.

Table 25 Effluent Pump Station Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	Hydraulic - Pass all flows Organic or Solids Loading - NA
2045 AADF	5.35 mgd
2045 PHDF	19.3 mgd
2045 PIDF	22.2 mgd
No. of Pumps	3
Capacity of each pump required	7.4 mgd (5,145 gpm)
TDH	21 feet

Recommendations for Improvements

1. The process implications of exceeding the effluent pumps' capacity are catastrophic, under the high river level conditions., Such conditions could quickly submerge upstream plant processes. Therefore, it is recommended to replace the existing pumps with larger impeller, motor, and associated VFDs to allow pumping of the entire plant effluent (PIDF of 22.2 mgd).

7.9 Solids Treatment

7.9.1 Primary Sludge Pumping, Degritting and Thickening

The two primary clarifiers are equipped with three primary sludge pumps (two duty/one standby), each with a capacity of 220 gpm. These pumps are sufficiently sized for the 2045 flows and loads (2045 primary sludge volume is estimated to be in the range of 6,000 gpd to 50,000 gpd at 1.0 to 3.0 percent total solids). These units pump the primary sludge settled at the bottom of the primary clarifiers to a degritting system, located in the Equipment Building.

The degritted primary sludge is thickened using a gravity thickener. The thickener is a below grade circular concrete tank, 30 feet diameter, 10 feet side water depth. Thickened primary sludge is pumped using two progressive cavity pumps, each 130 gpm to the anaerobic digesters. During the site visit in June 2025, one of the thickened primary sludge was dismantled for repairs.

Recommendations for Improvements

The City is planning to replace the two primary sludge degritting equipment (hydrocyclones and classifiers) with new. Sludge Pumping equipment should last for 10 to 15 years depending on the amount of grit and wear and tear they experience. Pumps should be repaired and replaced as needed. No additional recommendations for any primary sludge and degritting equipment are made at this time.

1. Anaerobic digesters perform best when a constant and consistent feed rate is maintained. Based on the observations from previous GSP, the thickened primary sludge pumps are too large for the system. As such, the existing units are recommended for replacement with new, appropriately sized, 70 gpm progressive cavity pumps.

7.9.2 WAS Pumping and Thickening System

There are three plunger type WAS pumps for Secondary Clarifier Nos. 1 and 2, located in the existing Control Building, each rated at a capacity of 85 gpm. Secondary Clarifier No. 3 has a submersible centrifugal WAS pump near the clarifier rated for 240 gpm. These pumps convey the WAS from the three secondary clarifiers to a WAS storage tank, which is subsequently thickened using a RDT. Alternatively, the WAS can be transferred to the gravity thickener to be co-thickened with the primary sludge, during periods when the RDT is not operational. Thickened WAS is pumped to the anaerobic digesters.

Table 26 provides the design criteria for WAS pumping and thickening for 2045 GSP.

Table 26 Waste Activated Sludge Pumping and Thickening System Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	MDDL (BOD_5 loading)
2045 Average Day Influent BOD_5 Loading	6,000 ppd
2045 Maximum Day Influent BOD_5 Loading	8,500 ppd
BOD_5 Removal in Primary Clarifier at 2045 ADF(1)	35%
BOD_5 Removal in Primary Clarifier at 2045 Maximum Day Flow (1)	29%
2045 Annual Average Day BOD_5 Loading to Aeration Basins	4,200 ppd
2045 Maximum Day BOD_5 Loading to Aeration Basins(2)	6,000 ppd
Net Yield	0.9 lb TSS/lb BODrem
WAS concentration (% TS)	0.50%
2045 Average Day WAS Sludge	81,400 gpd
2045 Maximum Day WAS Sludge	126,000 gpd
Capacity of Existing WAS Storage Tank	145,000 gallons
Hydraulic Detention Time, 2045 Average Day WAS	1.8 days
Hydraulic Detention Time, 2045 Maximum Day WAS	1.2 days
RDT Feed Pump capacity	250 gpm
RDT Feed Rate	100-300 gpm
Thickened WAS concentration (%TS)	5%
2045 Average Day Thickened WAS	6,900 gpd
2045 Maximum Day Thickened WAS	10,700 gpd

Notes:
BODrem - five-day biochemical oxygen demand removed (in biological process); MDDL - maximum day design mass load.

Recommendations for Improvements

Sludge Pumping equipment should last for 10 to 15 years depending on the amount of grit and wear and tear they experience. Pumps should be repaired and replaced as needed. No recommendations for any WAS pumping equipment are made at this time.

1. There is only one RDT for WAS thickening. The RDT has been in service for more than 10 years. The previous GSP recommended adding a second RDT for redundancy and reliability. During the 2025 Condition Assessment walkthrough, a concern with the existing Digester Complex electrical room was raised, which is that it shares walls with process areas. As such, it may not meet the hazardous area

classification of the area per NFPA 820. It is therefore proposed that a new electrical building be constructed to the west of the Digester complex serving all the digester equipment as shown in Figure 4. This will allow space to relocate and add the second RDT for reliability and redundancy.

7.9.3 Anaerobic Digestion and Waste Gas Flare

The WWTF currently has two anaerobic digesters and one digested sludge holding tank. Each digester is a cylindrical concrete tank, 32 feet diameter with 29.5 feet SWD and a volume of 177,000 gallons. The digesters have fixed steel cover and a top mounted draft tube mixer. Gas produced by the digester is used as fuel for the hot water boiler while remaining gas is also used for the sludge dryer. There is a gas flare for flaring excess gas. There are three digester recirculation rotary lobe pumps, each with a capacity of 200 gpm (1 for each digester with a common standby pump). These pumps recirculate the digester sludge through a spiral heat exchanger.

The digested sludge holding tank is also a cylindrical concrete tank, 32 feet diameter, 14 feet SWD and volume of 84,000 gallons.

The digesters receive thickened primary and waste activated sludge and primary and secondary scum. The digesters are operated in a mesophilic temperature range to produce minimum Class B biosolids with a minimum volatile solids reduction of 38 percent or by achieving a geometric mean of 7 fecal coliform samples ≤ 2,000,000 most probable number or CFU per gram total solids (dry weight basis) by operating the digesters at a minimum mean cell residence time (MCRT) of 15 days at 35°C.

Table 27 provides the design criteria for Anaerobic Digesters for 2045 GSP. 2045 Design Criteria are projected loadings.

Table 27 Anaerobic Digestion System Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	MDDL (BOD_5 loading)
2045 Average Day Primary Sludge	3,600 ppd
2045 Maximum Day Primary Sludge	4,200 ppd
2045 Average Day Thickened Primary Sludge	13,500 gpd
2045 Maximum Day Thickened Primary Sludge	9,700 gpd
2045 Average Day Thickened WAS	2,900 ppd
2045 Maximum Day Thickened WAS	4,500 ppd
2045 Average Day Thickened WAS	6,900 gpd
2045 Maximum Day Thickened WAS(1)	10,500 gpd
2045 Average Day Combined (Thickened Primary Sludge +WAS)	6,300 ppd
2045 Maximum Day Combined (Thickened Primary Sludge +WAS)	8,400 ppd
2045 Average Day Combined (Thickened Primary Sludge +WAS)	15,000 gpd
2045 Maximum Day Combined (Thickened Primary Sludge +WAS)	20,200 gpd
Volume of each Anaerobic Digester	177,000 gallons
Total Volume of Anaerobic Digesters	354,000 gallons
MCRT 2045 Average Day Condition	23.6 days
MCRT 2045 Maximum Day Condition	17.5 days

Notes:
(1) Maximum day waste activated sludge production estimated from steady-state BioWin simulation using 2045 design maximum week biological nutrient removal influent mass loads.

Recommendations for Improvements

Digester equipment should last for 20 to 25 years depending on the amount of grit and wear and tear they experience. Pumps should be repaired and replaced as needed. The digester tanks should last for 50 years. No recommendations for the Anaerobic Digestion system are made at this time.

7.9.4 Dewatering Centrifuge

The WWTF currently has one dewatering centrifuge. The centrifuge has a hydraulic capacity of 160 gpm (230,400 gpd) to process digested sludge with a feed concentration range of 2.0 to 2.5 percent solids. The centrifuge is designed to produce a dewatered cake with a minimum 20 percent total solids and at 90 percent solids capture ratio. Polymer solution is added to the sludge for chemical conditioning and help with dewatering.

Table 28 provides the design criteria for dewatering centrifuges for 2045 GSP.

Table 28 Centrifuge Dewatering Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	MDDL (BOD_5 loading)
2045 Average Day Combined (Thickened Primary Sludge +WAS)	6,300 ppd
2045 Maximum Day Combined (Thickened Primary Sludge +WAS)	8,400 ppd
VSS:TSS ratio	0.75
Minimum VSR in Digester No. 6	38%
2045 Average Day Digested Sludge	3,000 ppd
2045 Maximum Day Digested Sludge	4,300 ppd
Digested sludge minimum % solids	2.5%
2045 Average Day Digested sludge	14,100 gpd
2045 Maximum Day Digested sludge	20,600 gpd
Centrifuge hydraulic capacity	160 gpm
2045 Average Day Centrifuge operation	1.5 hours
2045 Maximum Day Centrifuge operation	3.6 hours
Dewatered Cake	20%
2045 Average Day Dewatered Cake	6.3 wet tons per day
2045 Maximum Day Dewatered Cake	10.8 wet tons per day
2045 Average Day Dewatered Cake(1)	200 cf/d
2045 Maximum Day Dewatered Cake(1)	300 cf/d

Notes:
(1) Assumes 60 lb/cf for density of dewatered cake.
VSR - volatile solids reduction.

Recommendations for Improvements

The City is planning to add a second dewatering centrifuge as part of an ongoing project. With two dewatering centrifuges, the plant should be able to process the anaerobically digested sludge for the foreseeable future and therefore no recommendations are made at this time.

7.9.5 Biosolids Belt Dryer

The WWTF currently has one sludge belt drying system. The dryer uses the 20 percent dewatered cake to produce 92 percent dried pellets. The pellets are sold to a local farmer as fertilizer. The digester gas and natural gas are used for the drying of solids.

Table 29 provides the design criteria for dewatering centrifuges for 2045 GSP.

Table 29 Sludge Belt Dryer Design Criteria

WWTF Component and Parameter	2045 Design Criteria
2045 Average Day Sludge Production	1.3 DT/d
2045 Maximum Day Sludge Production	1.8 DT/d
2045 Average Day Sludge Production	2,500 ppd
2045 Maximum Day Sludge Production	6,100 ppd
Design Cake Dryness	20% DS
Dryer Operations	7 days per week
Hours of Operation	24 hours per day
2045 Average Day Dryer Cake Feed	930 wet lb/hr
2045 Maximum Day Dryer Cake Feed	1,200 wet lb/hr
Final Product Dryness	92% DS
2045 Average Day Final Product	200 wet lb/hr
2045 Maximum Day Final Product	270 wet lb/hr
2045 Average Day Evaporation Rate	730 lb H2O/hr
2045 Maximum Day Evaporation Rate	980 lb H2O/hr
Maximum Evaporation Rate for the existing Belt Dryer	1,100 lb H2O/hr
Dryer Capacity Utilization	89%

Notes:
DS - dry solids; DT/d - dry ton per day; lb H20/hr - pounds of water per hour; lbs/hr - pounds per hour.

Recommendations for Improvements

The sludge dryer will need to be operated 7 days a week, 24 hours a day to process the maximum day sludge produced. Alternatively, if the capacity of the dryer is exceeded, the cake can be diverted for off-site disposal. The sludge dryer was installed in 2014 and is about 10+ years old. Typical sludge drying equipment will need major overhaul in the next 10 years (20-year life). City should plan to replace the dryer in the next 10 to 15 years. However, for the 2025 GSP, a firm recommendation is not made as some of the regulations, in particular with respect to per- and polyfluoroalkyl substances (PFAS) in biosolids are still evolving.

7.9.6 Plant Drain Pump Stations

7.9.6.1 Plant Drain Pump Station No. 1

This station is in the yard between Primary Clarifier No. 1 and the Aeration Basins on the north side. It is equipped with two submersible pumps, each rated for 250 gpm, installed in a pre-cast reinforced concrete wet well. The pump station collects floor drains and process water from several treatment units including centrate from the dewatering centrifuges, gravity thickener overflow, grit classifier overflow, and effluent filter backwash.

Recommendations for Improvements

The condition assessment noted signs of concrete corrosion, and its pumps are nearing the end of useful life. As such, it is recommended that Pump Station No. 1 be rehabilitated by:

- Replacing the pumps with larger capacity pumps (500 gpm each).
- Installing a liner in the wet-well to extend the line of the existing structure.
- Replacing control panel, pump guide rails, and discharge piping within the wet well.
- Adding a totalizing flow meter and composite sampler.

7.9.6.2 Plant Drain Pump Station No. 2

This station is in the yard between the digested sludge holding tank and the headworks. It is equipped with two submersible pumps, each rated for 450 gpm, installed in a pre-cast reinforced concrete wet-well. The pump station collects floor drains and process water from several treatment units including drains from the digester building, the abandoned Biofilters No. 1 and No. 2, and filtrate from the RDT.

Recommendations for Improvements

The condition assessment noted signs of concrete corrosion, and its pumps are nearing the end of useful life. As such, it is recommended that Pump Station No. 2 be rehabilitated by:

- Replacing the pumps (500 gpm each).
- Installing a liner in the wet well to extend the line of the existing structure.
- Replacing control panel, pump guide rails, and discharge piping within the wet well.
- Adding a totalizing flow meter and composite sampler

7.9.7 Non-potable Water Pumps

The non-potable water (NPW) is pumped from the compartment of the effluent wet well downstream of the UV disinfection and are located in the UV Disinfection Building. Three vertical turbine pumps, each with a capacity of 200 gpm at 185 feet TDH (80 pounds per square inch) lift the disinfected effluent out of the wet well to a NPW distribution system. The combined pump discharge line to the surge tank is equipped with a duplex-type strainer, flow meter, and a pressure switch.

Recommendations for Improvements

The City is planning to install new VFDs for each of the three NPW pumps and a new motorized strainer as part of an ongoing project. No recommendations are made at this time.

7.9.8 WWTF Electrical System Upgrades

The plant operates with two separate utility feeds. The first, a 500 kVA service ("UT1"), is located on the southwest side of the UV Building and supplies power to the main distribution switchboard MDS-UV and MCC-A in the Old Controls Building. The second, a 1000 kVA service ("UT2"), is located on the north side of the Equipment/Blower Building and feeds the second main distribution switchboard, MDS-EB. Each switchboard has its own 250 kW standby generator, which provides backup power for most—but not all—connected loads. MCC-A, MCC-D3, SWBD-F, and SWBD-G are not currently supported by generator backup.

The plant was originally built in 1972, with major electrical upgrades completed in 1992, 2002, and 2012. MDS-UV distributes power to MCC-D1, MCC-D2, MCC-D3, and the UV systems serving the secondary and tertiary treatment areas on the east side. MDS-EB supplies power to blowers, MCC-C1, MCC-C2, SWBD-F, and SWBD-G, which support influent, aeration, digester, and solids processes on the west side. The 2002 upgrades included installation of MDS-UV, MDS-EB, the standby generators, MCC-D1, MCC-D2, MCC-D3, MCC-C1, and MCC-C2, while the 2012 upgrades included SWBD-F, MCC-F, SWBD-G, and MCC-G.

MCC-A appears to be the only remaining major electrical gear from before the 2002 upgrade, likely from the 1992 installation. It currently serves two WAS pumps, one general-purpose sludge pump, a compressor, two heaters, and a hoist. Carollo recommends removing MCC-A from the plant's distribution system and refeeding its remaining loads from nearby sources. Also, the Old Controls building houses MCC-A, which is also likely controlling the loads fed from MCC-A. Carollo recommends removing PLC-A, and controlling the current PLC-A loads from another nearby PLC. This would allow the Old Controls Building to be fully repurposed as a maintenance and workshop area, which reflects its current use. The electrical equipment installed in 2002 remains in generally good condition and does not require immediate replacement; upgrades should instead coincide with future plant process improvement projects to minimize repeated modifications. However, when replacing gear in the UV or Equipment Building electrical rooms, updated layouts will likely be required to meet current National Electrical Code working clearance standards. Electrical gear from 2012 remains in excellent condition and does not need replacement in the near term.

During the site visit, it was also noted that the water utility has no in-house electrician or instrumentation technician and no on-call agreements with outside specialists. Carollo recommends establishing either internal staffing or on-call contracts with qualified electricians and system integrators to ensure prompt response to electrical and controls issues.

No arc flash labels were found on the plant's distribution equipment, and the owner confirmed that an Electrical System Study is not maintained. Carollo recommends completing this study as soon as possible and applying arc flash labels in accordance with Occupational Safety and Health Administration requirements to ensure worker safety.

The owner also reported that the last major flood affecting the plant occurred in 1997. Carollo recommends a comprehensive flood risk analysis for all major electrical and control systems to assess vulnerabilities and strengthen flood resilience.

Electrical rooms from the 2002 upgrade were found to be dusty, poorly ventilated, and not fully sealed from adjacent areas. These conditions can accelerate equipment degradation and lead to premature failures of PLCs, VFDs, and network components. Carollo recommends installing dedicated ventilation

systems, sealing the rooms from process and generator areas, and performing heating, ventilation, and air conditioning load calculations to determine whether air-handling units or cooling systems are needed to manage internal temperatures.

Throughout the plant, exposed network hardware, wiring, and cables were also observed, leaving them at risk of accidental damage. Carollo recommends installing dedicated, wall-mounted network enclosures and routing all cables through conduits for better protection and organization.

To ensure regulatory compliance, and safety, Carollo further recommends conducting a hazardous area classification study per NFPA 820 and upgrading any areas that do not meet code.

Lastly, extensive corrosion was noted on outdoor conduits and equipment enclosures at several locations, including the influent/screens structure and biological basins. Carollo recommends replacing these components with PVC-coated or corrosion-resistant materials to enhance reliability and reduce any potential disruptions to plant operations due to power or control failures.

7.9.9 Facility Control Systems, Including the PLC and Central SCADA

Multiple network switches are currently installed in operational areas where they are exposed to environmental conditions. To mitigate risks associated with dust, moisture, and physical damage, it is strongly recommended that these switches be relocated into protective enclosures, consistent with best practices already implemented elsewhere on site. As a short term fix to minimize the risks to the network switches, it is recommended that dust filter foam be placed over vents on the switches to reduce the intrusion of dust. Additionally, placing tape over unused network ports on the face of the switch is recommended until an enclosure is provided for the switches.

It was observed that the centrifuge cannot initiate operations when the system is in Automatic mode. Manual intervention is required to start the centrifuge, after which the system can be returned to Automatic. This behavior indicated a controls problem and should be investigated and resolved.

The Magnesium Oxide tank level sensors are ultrasonic instruments. These are highly susceptible to condensate in the tank and will provide false readings. This sensor should be replaced with a Guided Wave Radar level instrument to eliminate the noise caused by condensate.

APPENDIX A

REASONABLE POTENTIONAL ANALYSIS

PROJECT MEMORANDUM

CITY OF CAMAS

General Sewer Plan Update

Project No.: 203710
Date: January 7, 2026
Prepared By: Y. Yerbich-Louman
Reviewed By: Matt Huang
Subject: Reasonable Potential Analysis

The Washington State Department of Ecology (DOE) drafted a proposed National Pollutant Discharge Elimination System (NPDES) Permit WA0020249 for the City of Camas wastewater treatment plant (WWTP) with an effective date of August 1, 2025. As a part of these efforts, DOE conducted a reasonable potential analysis (RPA) for the predicted WWTP discharge in 2045 using a maximum daily discharge value of 10.04 million gallons per day (mgd).

The maximum daily discharge in planning year 2045 is projected to be 10.70 mgd. The DOE-developed *Spreadsheets for Water Quality-Based NPDES Permit Calculations* was used to generate an updated RPA with the projected maximum daily discharge and no other changes compared to the original RPA prepared for the draft permit. The updated RPA was conducted to identify any new reasonable potentials as a result of the updated maximum daily discharge value that would require infrastructure or process modifications to be addressed in capital improvement planning.

The updated RPA indicated that no new reasonable potentials were identified. The updated RPA results are provided in the following pages.

Dilution Factor Calculations and Receiving Water Critical Conditions

Step 1: Enter Waterbody Type

Water Body Type	Freshwater

Facility Name	Camas WWTP
Receiving Water	Columbia River

Step 2: Enter Dilution Factors -OR- Calculate DFs by entering Facility/Receiving Water Flow Data

Do you want to enter dilution factors -or- flow data?	Flow Data

	Annual Average	Max Monthly Average	Daily Max
Facility Flow, MGD	5.36	7.5	10.7
Facility Flow, cfs (calculated)	8.29	11.60	16.55

	Condition	Receiving Water Flow, cfs	Allowable % of river flow	Max Dilution Factor Allowed
Aquatic Life - Acute	7Q10	81400	0.0042	**21.7**
Aquatic Life - Chronic	7Q10	81400	0.0229	**113.6**
HH-Non-Carcinogen	30Q5	113960	0.02508	**173.7**
HH-Carcinogen	Harmonic Mean	244200	0.0117	**173.6**
Whole river at 7Q10	7Q10	81400		

Step 3: Enter Critical Data

	Effluent	Receiving Water
Temp, °C	25.7	23.2
pH, s.u.	7.3	7.7
Alkalinity, mg/L as CaCO3	100	66.2
Hardness, mg/L CaCO3	168	74
Salinity, psu		
Receiving water TSS, mg/L (leave blank if unknown)		
If TSS is annual data, enter 'A'; if from critical period, enter 'S'; If no TSS, leave blank		

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Reasonable Potential Calculation

Facility	Camas WWTP
Water Body Type	Freshwater
Rec. Water Hardness	74 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	21.7	113.6
Human Health Carcinogenic		173.7
Human Health Non-Carcinogenic		173.6

10

			1	2	3	4	5	6	7	8	9	
Pollutant, CAS No. & NPDES Application Ref. No.			AMMONIA, Criteria as Total NH3	ANTIMONY (INORGANIC) 7440360 1M	ARSENIC (dissolved) 7440382 2M	BUTYLBENZYL PHTHALATE 85687 15B	CADMIUM - 7440439 4M Hardness dependent	CHLOROFORM 67663 11V	CHROMIUM(TRI) -16065831 5M Hardness dependent	CHROMIUM(HEX) 18540299 - Dissolved	COPPER - 744058 6M Hardness dependent	CYANIDE 57125 14M	DIETHYLPHTHALATE 84662 24B
Effluent Data	# of Samples (n)		1156	20	20	3	20	4	20	20	20	20	3
	Coeff of Variation (Cv)		2.02	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		1,455		0.95	**0.27**	**0.22**	0.71	0.97	420	8.3	20	1.1
	Calculated 50th percentile Effluent Conc. (when n>10)			0.237							5.47	7.5	
Receiving Water Data	90th Percentile Conc., ug/L		183	0	0	**0**	**0.015**	0	0.416	0.086	1.43	0	
	Geo Mean, ug/L			0		**0**		0		0	0	0	0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	#REF!	-	360	-	**2.67143**	-	428.811	**15**	12.813	22	-
		Chronic	#REF!	-	190	-	**0.82523**	-	139.102	**10**	8.7758	5.2	-
	WQ Criteria for Protection of Human Health, ug/L		-	6	-	**0.013**	-	100	-	-	1300	9	200
	Metal Criteria Translator, decimal	Acute	-	-	1	-	0.943	-	0.316	-	0.996	-	-
		Chronic	-	-	1	-	0.943	-	0.86	-	0.996	-	-
	Carcinogen?		N	N	Y	N	N	Y	N	N	N	N	N

Aquatic Life Reasonable Potential

Effluent percentile value		0.950	0.950	0.950	0.950	0.950	0.950	0.950	
s	$s^2=\ln(CV^2+1)$	1.275	0.555	0.555	0.555	0.555	0.555	0.555	
Pn	Pn=(1-confidence level)$^{1/n}$	0.997	0.861	0.861	0.861	0.861	0.861	0.861	
Multiplier		1.00	1.36	1.36	1.36	1.36	1.36	1.36	
Max concentration (ug/L) at edge of…	Acute	242	0.060	0.027	0.416	26.549	1.885	1.260	
	Chronic	194	0.011	0.017	0.422	5.130	1.517	0.240	
Reasonable Potential? Limit Required?		**#REF!**	**NO**	**NO**	**NO**	**YES**	**NO**	**NO**	

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month						4			
LTA Coeff. Var. (CV), decimal						0.6			
Permit Limit Coeff. Var. (CV), decimal						0.6			
Waste Load Allocations, ug/L	Acute					323.030515			
	Chronic					1126.43826			
Long Term Averages, ug/L	Acute					103.719676			
	Chronic					594.12121			
Limiting LTA, ug/L						103.719676			
Metal Translator or 1?						1.00			
Average Monthly Limit (AML), ug/L						**161.0**			
Maximum Daily Limit (MDL), ug/L						**323.0**			

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$	0.554513029	0.55451303	0.55451		0.5545	0.5545	0.5545
Pn	Pn=(1-confidence level)1/n	0.861	0.368	0.473		0.861	0.861	0.368
Multiplier		0.548111032	1.20486058	1.03846		0.5481	0.5481	1.2049
Dilution Factor		173.6066127	173.606613	173.666		173.61	173.61	173.61
Max Conc. at edge of Chronic Zone, ug/L		0.001365155	0.00187385	4.2E-03		0.0315	0.0432	0.0076
Reasonable Potential? Limit Required?		**NO**	**NO**	**NO**		**NO**	**NO**	**NO**

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Reasonable Potential Calculation - Page 2

Facility	Camas WWTP
Water Body Type	Freshwater
Rec. Water Hardness	74 mg/L

Dilution Factors:
Aquatic Life
Human Health Carcinogenic
Human Health Non-Carcinoge

			11	12	13	14	15	16	17	18
Pollutant, CAS No. & NPDES Application Ref. No.			LEAD - 7439921 7M Dependent on hardness	MERCURY 7439976 8M	NAPHTHALENE 91203 39B	NICKEL - 7440020 9M - Dependent on hardness	PHENOL 108952 10A	SELENIUM 7782492 10M	SILVER - 7740224 11M dependent on hardness.	ZINC- 7440666 13M hardness dependent
Effluent Data	# of Samples (n)		20	20	3	20	3	20	20	20
	Coeff of Variation (Cv)		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		0.15	0.0009	2.07	2.02	5.5	1	0.02	26.4
	Calculated 50th percentile Effluent Conc. (when n>10)			0.0007		2		1		20.9
Receiving Water Data	90th Percentile Conc., ug/L		0.064	0.0009	0	0.604		0.274	0.025	1.25
	Geo Mean, ug/L			0	0	0	0	0		0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	46.461	2.1	-	1097.1	-	20	2.05541	88.676
		Chronic	1.8105	0.012	-	121.84	-	5	-	80.975
	WQ Criteria for Protection of Human Health, ug/L		-	0.14	-	80	9000	60	-	1000
	Metal Criteria Translator, decimal	Acute	0.466	0.85	-	0.998	-	-	0.85	0.996
		Chronic	0.466	-	-	0.997	-	-	-	0.996
	Carcinogen?		N	N	N	N	N	N	N	N

Aquatic Life Reasonable Potential

Effluent percentile value		0.950	0.950	0.950	0.950	0.950	0.950	
s	$s^2=\ln(CV^2+1)$	0.555	0.555	0.555	0.555	0.555	0.555	
Pn	Pn=(1-confidence level)$^{1/n}$	0.861	0.861	0.861	0.861	0.861	0.861	
Multiplier		1.36	1.36	1.36	1.36	1.36	1.36	
Max concentration (ug/L) at edge of…	Acute	0.065	0.001	0.703	0.324	0.025	2.849	
	Chronic	0.064	0.001	0.623	0.284	0.025	1.555	
Reasonable Potential? Limit Required?		**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month									
LTA Coeff. Var. (CV), decimal									
Permit Limit Coeff. Var. (CV), decimal									
Waste Load Allocations, ug/L	Acute								
	Chronic								
Long Term Averages, ug/L	Acute								
	Chronic								
Limiting LTA, ug/L									
Metal Translator or 1?									
Average Monthly Limit (AML), ug/L									
Maximum Daily Limit (MDL), ug/L									

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$	0.5545	0.5545	0.55451	0.55451		0.5545	
Pn	Pn=(1-confidence level)1/n	0.861	0.861	0.368	0.861		0.861	
Multiplier		0.5481	0.5481	1.20486	0.54811		0.5481	
Dilution Factor		173.61	173.61	173.607	173.607		173.61	
Max Conc. at edge of Chronic Zone, ug/L		4E-06	0.0115	0.03817	5.8E-03		0.1204	
Reasonable Potential? Limit Required?		**NO**	**NO**	**NO**	**NO**		**NO**	

Calculation of Fecal Coliform at Chronic Mixing Zone

INPUT	
Chronic Dilution Factor	113.6
Receiving Water Fecal Coliform, #/100 ml	
Effluent Fecal Coliform - worst case, #/100 ml	400
Surface Water Criteria, #/100 ml	*14*
OUTPUT	
Fecal Coliform at Mixing Zone Boundary, #/100 ml	**4**
Difference between mixed and ambient, #/100 ml	4

Conclusion: At design flow, the discharge has no reasonable potential to violate water quality standards for fecal coliform.

Calculation of Dissolved Oxygen at Chronic Mixing Zone

INPUT	
Chronic Dilution Factor	113.6
Receiving Water DO Concentration, mg/L	8.1
Effluent DO Concentration, mg/L	5.1
Effluent Immediate DO Demand (IDOD), mg/L	2
Surface Water Criteria, mg/L	*8*
OUTPUT	
DO at Mixing Zone Boundary, mg/L	**8.06**
DO decrease caused by effluent at chronic boundary, mg/L	**0.04**

Conclusion: At design flow, the discharge has no reasonable potential to violate water quality standards for dissolved oxygen.

References: EPA/600/6-85/002b and EPA/430/9-82-011

Freshwater Temperature Reasonable Potential and Limit Calculation

Based on WAC 173-201A-200(1)(c)(i)--(ii) and the Water Quality Program Guidance. All data inputs must meet WQ guidelines. The Water Quality temperature guidance document may be found at: https://fortress.wa.gov/ecy/publications/summarypages/0610100.html

	Core Summer Critera	Supplemental Criteria
INPUT	**July 1-Sept 14**	**Sept 15-July 1**
1. Chronic Dilution Factor at Mixing Zone Boundary	113.6	113.6
2. 7DADMax Ambient Temperature (T) (Upstream Background 90th percentile)	21.5 °C	12.6 °C
3. 7DADMax Effluent Temperature (95th percentile)	22.0 °C	16.0 °C
4. Aquatic Life Temperature WQ Criterion in Fresh Water	22.0 °C	
OUTPUT		
5. Temperature at Chronic Mixing Zone Boundary:	21.5 °C	12.6 °C
6. Incremental Temperature Increase or decrease:	0.0 °C	0.0 °C
7. Maximum Allowable Incremental Temperature Increase:	1.0 °C	0.3 °C
8. Maximum Allowable Temperature at Mixing Zone Boundary:	22.0 °C	12.9 °C
A. If ambient temp is warmer than WQ criterion		
9. Does temp fall within this warmer temp range?	NO	YES
10. Temperature Limit if Required:	---	NO LIMIT
B. If ambient temp is cooler than WQ criterion but within 28/(T_{amb}+7) and within 0.3 °C of the criterion		
11. Does temp fall within this incremental temp. range?	NO	---
12. Temp increase allowed at mixing zone boundary, if required:	---	---
C. If ambient temp is cooler than (WQ criterion-0.3) but within 28/(T_{amb}+7) of the criterion		
13. Does temp fall within this Incremental temp. range?	YES	---
14. Temp increase allowed at mixing zone boundary, if required:	NO LIMIT	---
D. If ambient temp is cooler than (WQ criterion - 28/(T_{amb}+7))		
15. Does temp fall within this Incremental temp. range?	NO	---
16. Temp increase allowed at mixing zone boundary, if required:	---	---
RESULTS		
17. Do any of the above cells show a temp increase?	**NO**	**NO**
18. Temperature Limit if Required?	**NO LIMIT**	**NO LIMIT**

Calculation of pH of a Mixture of Two Flows

Based on the procedure in EPA's DESCON program (EPA, 1988. Technical Guidance on Supplementary Stream
USEPA Office of Water, Washington D.C.)

INPUT	
	@ Acute Boundary
1. Dilution Factor at Mixing Zone Boundary	121.0
2. Ambient/Upstream/Background Conditions	
Temperature (deg C):	23.20
pH:	8.10
Alkalinity (mg CaCO3/L):	74.00
3. Effluent Characteristics	
Temperature (deg C):	25.70
pH:	6.00
Alkalinity (mg CaCO3/L):	100.00
4. Aquatic Life Use Designation	Other species (salmonid/redb
OUTPUT	
1. Ionization Constants	
Upstream/Background pKa:	6.36
Effluent pKa:	6.35
2. Ionization Fractions	
Upstream/Background Ionization Fraction:	0.98
Effluent Ionization Fraction:	0.31
3. Total Inorganic Carbon	
Upstream/Background Total Inorganic Carbon (mg CaCO3/L):	75
Effluent Total Inorganic Carbon (mg CaCO3/L):	322
4. Condtions at Mixing Zone Boundary	
Temperature (deg C):	23.22
Alkalinity (mg CaCO3/L):	74.21
Total Inorganic Carbon (mg CaCO3/L):	77.39
pKa:	6.36
5. Allowable pH change	0.50
RESULTS	
pH at Mixing Zone Boundary:	**7.73**
pH change at Mixing Zone Boundary:	0.37
Is permit limit needed?	NO

Streeter-Phelps Analysis of Critical Dissolved Oxygen Sag

INPUT	
1. EFFLUENT CHARACTERISTICS	
Discharge (cfs):	9.44
$CBOD_5$ (mg/L):	5
NBOD (mg/L):	3
Dissolved Oxygen (mg/L):	5
Temperature (deg C):	24
2. RECEIVING WATER CHARACTERISTICS	
Upstream Discharge (cfs):	81400
Upstream $CBOD_5$ (mg/L):	1.5
Upstream NBOD (mg/L):	0.2
Upstream Dissolved Oxygen (mg/L):	9
Upstream Temperature (deg C):	23
Elevation (ft NGVD):	75
Downstream Average Channel Slope (ft/ft):	0.00088
Downstream Average Channel Depth (ft):	21
Downstream Average Channel Velocity (fps):	0.98
3. REAERATION RATE (Base e) at 20 deg C (day^{-1}):	0.13

Reference	Applic. Vel (fps)	Applic. Dep (ft)	Suggested Values
Churchill	1.5 - 6	2 - 50	0.07
O'Connor and Dobbins	0.1 - 1.5	2 - 50	0.13
Owens	0.1 - 6	1 - 2	0.08
Tsivoglou-Wallace	0.1 - 6	0.1 - 2	1.99

4. BOD DECAY RATE (Base e) AT 20 deg C (day^{-1}):	0.07
(or use *Wright and McDonnell eqn, 1979, for small rivers.) Enter this value -->*	0.04

OUTPUT	
1. INITIAL MIXED RIVER CONDITION	
$CBOD_5$ (mg/L):	1.5
NBOD (mg/L):	0.2
Dissolved Oxygen (mg/L):	9.0
Temperature (deg C):	23.0
2. TEMPERATURE ADJUSTED RATE CONSTANTS (Base e)	
Reaeration (day^-1):	0.14
BOD Decay (day^-1):	0.08
3. CALCULATED INITIAL ULTIMATE CBODU AND TOTAL BODU	
Initial Mixed CBODU (mg/L):	2.2
Initial Mixed Total BODU (CBODU + NBOD, mg/L):	2.4
4. INITIAL DISSOLVED OXYGEN DEFICIT	
Saturation Dissolved Oxygen (mg/L):	8.555
Initial Deficit (mg/L):	-0.44
5. TRAVEL TIME TO CRITICAL DO CONCENTRATION (days):	11.48
6. DISTANCE TO CRITICAL DO CONCENTRATION (miles):	184.06
7. CRITICAL DO DEFICIT (mg/L):	0.55
8. CRITICAL DO CONCENTRATION (mg/L):	**8.00**

APPENDIX B

STATE POINT ANALYSIS

STATE POINT ANALYSES

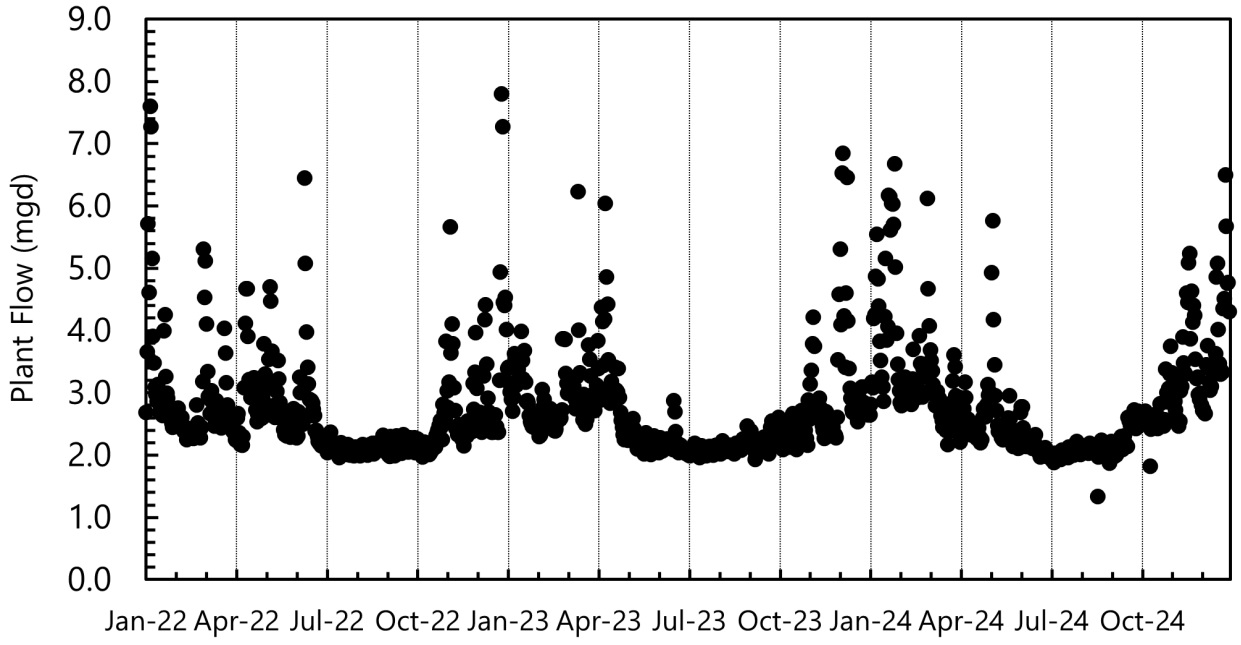


Figure B.1 Chronological Daily Influent Flow, January 2022 to December 2024

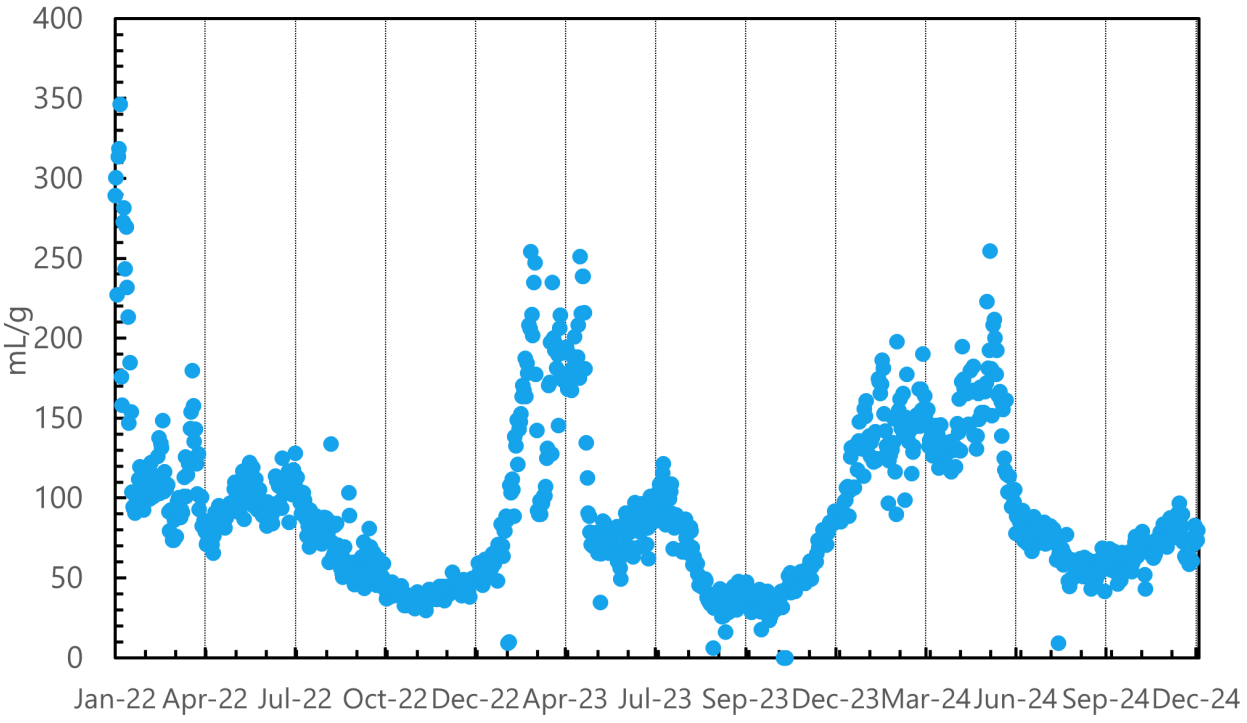


Figure B.2 Chronological SVI, January 2022 to December 2024

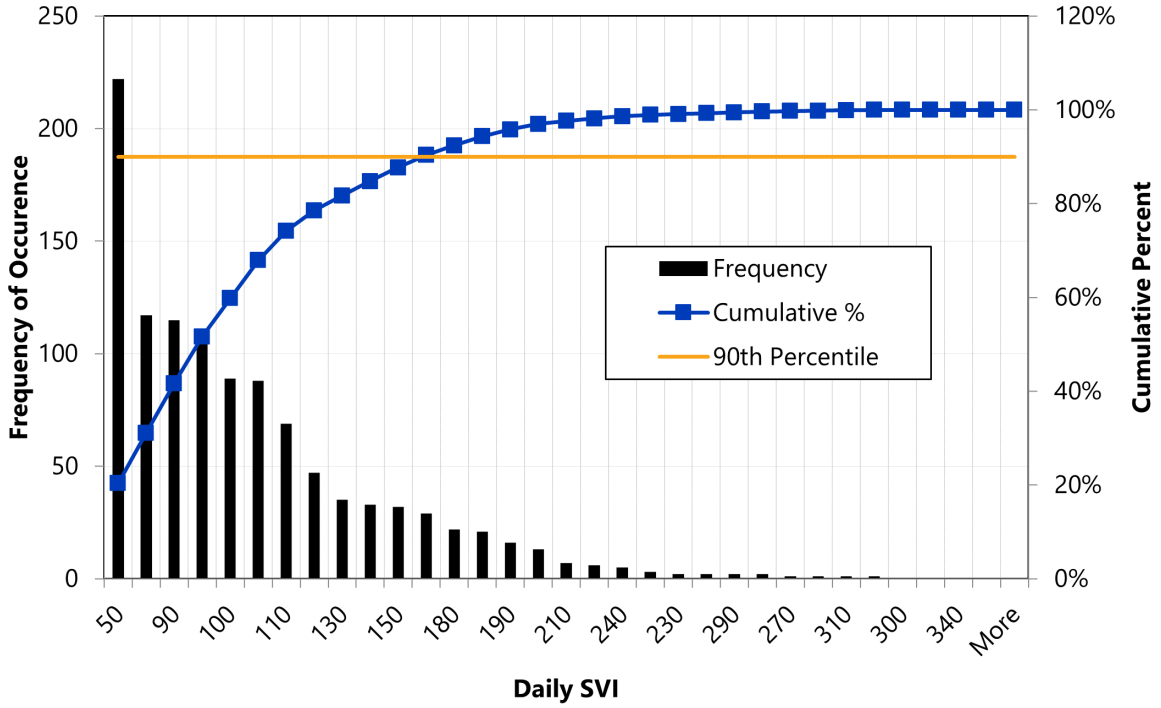


Figure B.3 Histogram of SVI Values (Frequency of occurrence and cumulative percent) from January 2022 to December 2024

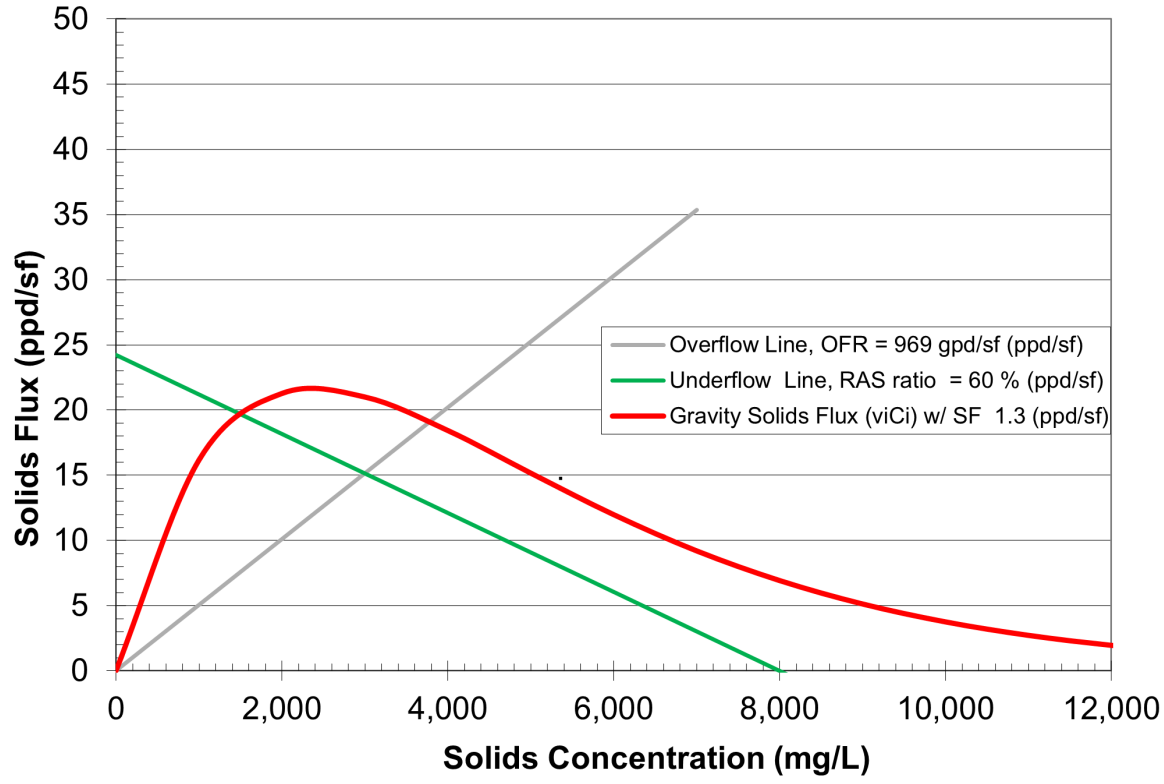


Figure B.4 State Point Analysis at Maximum Day Conditions

Notes: Four Secondary clarifiers, Flow = 10.7 mgd, MLSS = 3,000 mg/L, SVI = 160, Safety Factor = 1.3

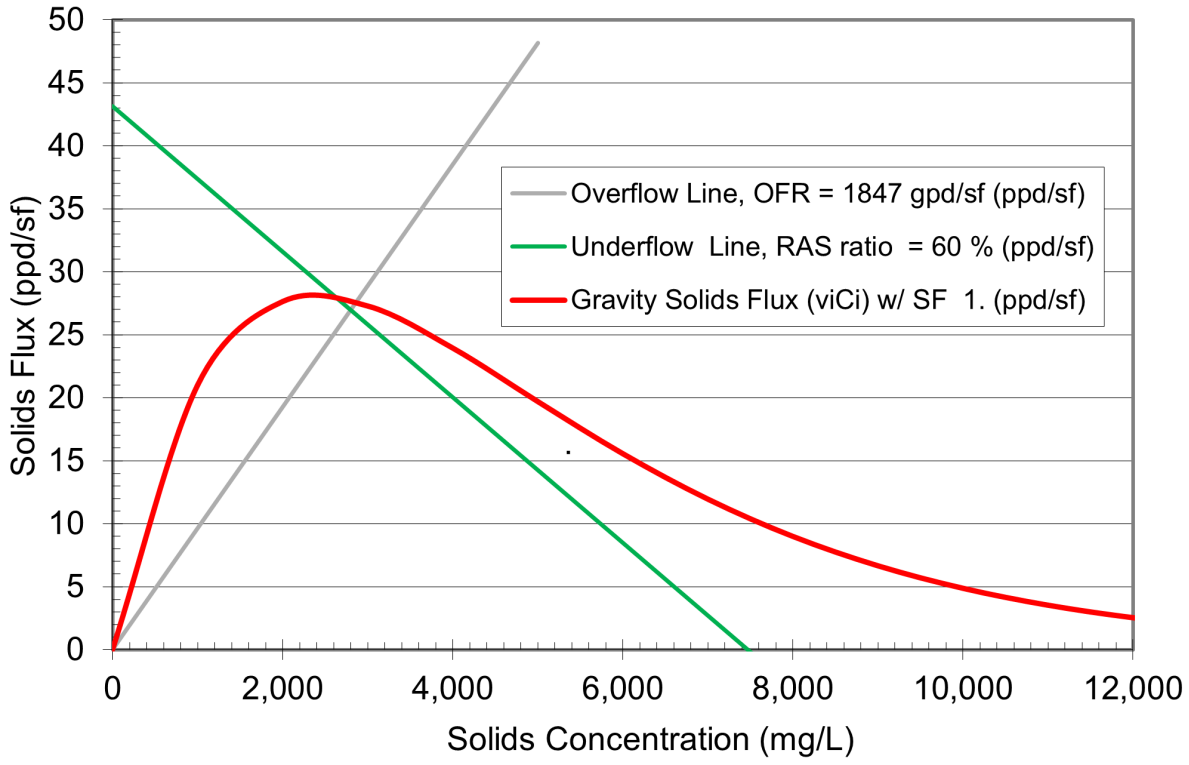


Figure B.5 State Point Analysis at Peak Hour Conditions

Notes: Four Secondary clarifiers, Flow = 20.4 mgd, MLSS = 2,800 mg/L, SVI = 160, Safety Factor = 1.0

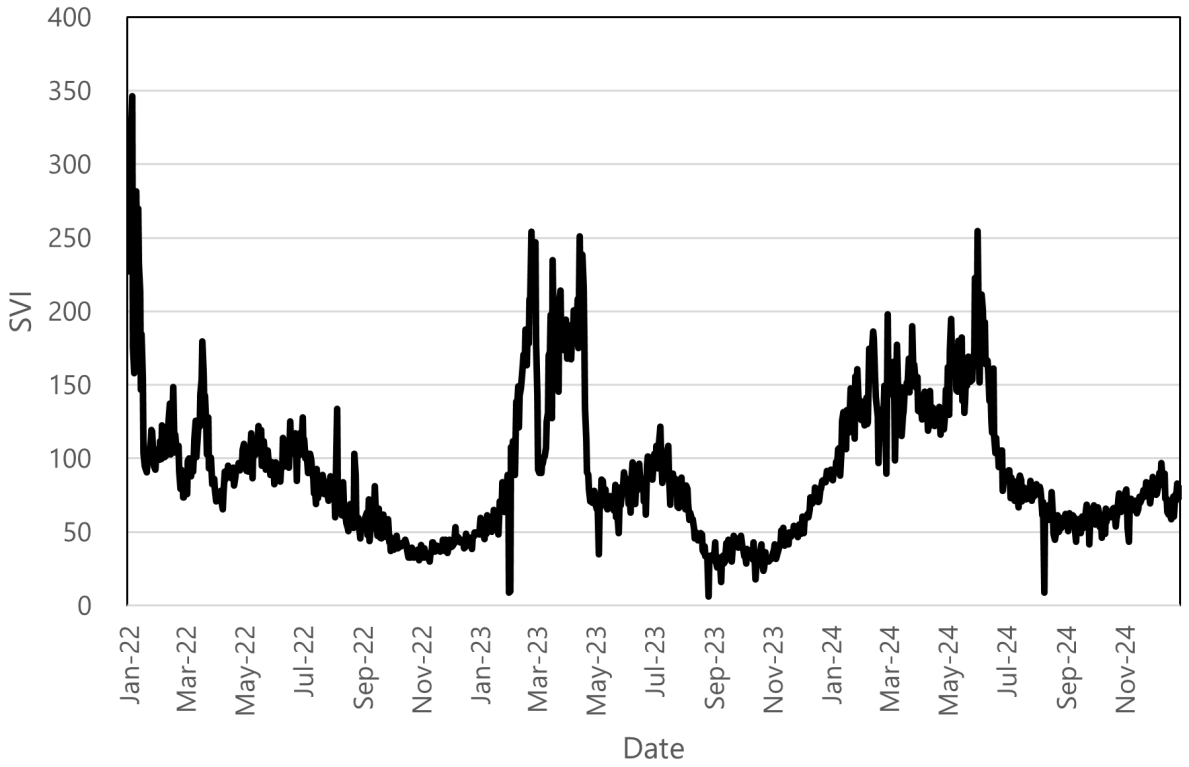


Figure B.6 Chronological Plot of Daily SVIs at the WWTF from January 2022 through December 2024

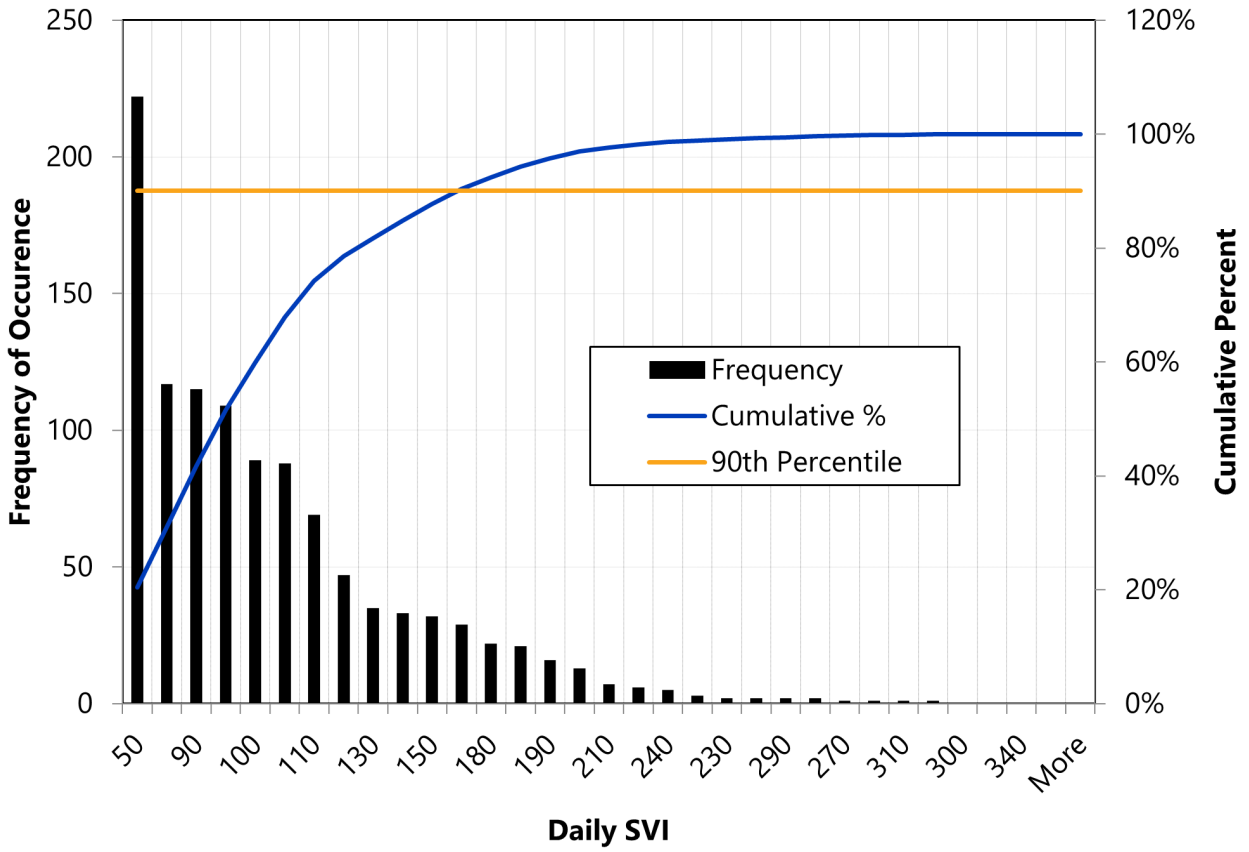


Figure B.7 Frequency of Occurrence Plot of Daily SVIs at the WWTF from January 2022 through December 2024

APPENDIX C

BIOWIN DATA

BIOWIN DATA

Geometry

Table C.1 Biowin Process Geometry

Tank/Zone	No.	Length	Width	Depth	Diameter	Unit Area	Total Area	Unit Volume	Total Volume
Primary Clarifiers	2			10.00	60.00	2,827	5,655	0.211	0.423
Selector Zones									
Zone 1	3	10.00	7.00	21.00		70	210	0.011	0.033
Zone 2	3	10.00	7.00	21.00		70	210	0.011	0.033
Zone 3	3	20.00	7.00	21.00		140	420	0.022	0.066
Subtotal		40.00				280	840	0.044	0.132
Anoxic Zones									
Zone 1	3	21.50	40.00	21.00		860	2,580	0.135	0.405
Zone 2	0					0	0	0.000	0.000
Subtotal		21.50				860	2,580	0.135	0.405
Total							3,420		0.537
Aeration Zones									
Zone 2 Anoxic	3	21.50	40.00	21.00		860	2,580	0.135	0.405
Zone 1	3	23.33	40.00	21.00		933	2,800	0.147	0.440
Zone 2	3	23.33	40.00	21.00		933	2,800	0.147	0.440
Zone 3	3	23.33	40.00	21.00		933	2,800	0.147	0.440
Subtotal		91.49				3,660	10,979	0.575	1.725
Total BNR						4,800	14,399	0.754	2.262
Secondary Clarifiers									
SC No. 1	1			17.00	75.00	4,418	4,418	0.562	0.562
SC No. 2	1			17.00	75.00	4,418	4,418	0.562	0.562
SC No. 3	1			14.00	75.00	4,418	4,418	0.463	0.463
SC No. 4	1			17.00	75.00	4,418	4,418	0.562	0.562
Subtotal							17,671		2.148

Notes:
BNR - biological nutrient removal; SC - secondary clarifier.

Table C.2 Tank Geometry in Process Simulation Model

Element name	Volume (MG)	Area (sf)	Depth (feet)	Aeration
PC	0.423	5,655	10.00	---
Selector 1	0.022	140	21.00	Mixed
Selector 2	0.022	140	21.00	Mixed
Selector 3	0.044	280	21.00	Mixed
Anoxic 1	0.41	2,610	21.00	Mixed
Anoxic 2	0.27	1,679	21.00	Mixed
Oxic 1	0.293	1,865	21.00	Aerated
Oxic 2	0.293	1,865	21.00	Aerated
Oxic 3	0.293	1,865	21.00	Aerated
SST	0.859	8,834	13.00	---
GST	5.283	540	13.12	---
MAD1	0.355	1,609	29.50	Mixed
MAD2	0.355	1,609	29.50	Mixed
DSHT	0.084	802	14.00	----

Notes:
DSHT - digested sludge holding tank; GST - gravity sludge thickener; MAD - mesophilic anaerobic digester; PC - primary clarifier; sf - square feet; SST - secondary settling tank.

APPENDIX D

WASHINGTON DEPARTMENT OF ECOLOGY AND USEPA DESIGN AND RELIABLITY CRITERIA

WASHINGTON DEPARTMENT OF ECOLOGY AND USEPA DESIGN AND RELIABLITY CRITERIA

Table D.1 Design Condition Summary(1)

Unit Processes	Flow (F)	Organic or Solids Loading (L)
All plant pumping, conveyance channels, pipes, and flow structures	PIDF	N/A
Primary and secondary clarifiers	PHDF + recirculation flow for overflow rate and weir loading rate.	PHDL (TSS loading rate to clarifiers)(2)
Biological reactor	MWDF	MWDL (BOD_5 loading to reactor(s))(2)
	MDDF	MDDL (BOD_5 loading to reactors)(2)
Aeration equipment for substrate removal	N/A	PHDL (BOD_5 and for nitrifying systems, TKN loading rate to biological reactor(s))(2)
Plant liquid stream pumping equipment	PIDF	N/A
Filters used for secondary effluent polishing	Pass all flows requiring tertiary treatment	N/A
Primary and secondary sludge wasting equipment	N/A	MDDL (BOD_5 and TSS loading to primary clarifiers and/or biological reactor(s))(2)
Sludge digestion and dewatering equipment	N/A	MDDL (BOD_5 loading to reactor(s))(2)
Disinfection (non-reuse and non-reliability Class I plants)	MDDF (for disinfection requirements, PHDF (for hydraulic considerations)	N/A
Disinfection (reuse and reliability Class I plants)	All flows	N/A

Notes:
(1) Source: Department of Ecology, State of Washington. August 2008 (Revised May 2023). Criteria for Sewage Works Design. Publication # 98-37 WQ. Olympia, Washington.
(2) Organic or solids loading parameters are to be computed with the same time intervals as hydraulic loadings.
(3) Continuous flow routing analysis to ensure the discharge from the equalization basin does not exceed the hydraulic design limit for the downstream unit processes.

BOD_5 - 5-day biological oxygen demand; MDDF - maximum day design flow; MDDL - maximum day design load; MWDF - maximum week design flow; MWDL - maximum week design load; N/A - not applicable; PHDF - peak hour design flow; PHDL - peak hour design load; PIDF - peak instantaneous design flow; TKN - total Kjeldahl nitrogen; TSS - total suspended solids.

Table D.2 General Requirements for Each Reliability Classification(1)

Reliability Class	General Requirements
I	For components included in the design of Reliability Class I works, the following backup requirements apply: ▪ **Mechanically Cleaned Bar Screens**. A backup bar screen, designed for mechanical or manual cleaning, shall be provided. Facilities with only two bar screens shall have at least one bar screen designed to permit manual cleaning. ▪ **Pumps**. A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow. ▪ **Comminution Facility**. If comminution of the total wastewater flow is provided, an overflow bypass with a manually-installed or mechanically-cleaned bar screen shall be provided. The hydraulic capacity of the comminutor overflow bypass should be sufficient to pass the peak flow with all comminution units out of service. ▪ **Primary Sedimentation Basins**. The units should be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units should have a design flow capacity of at least 50% of the total design flow. ▪ **Final Sedimentation Basins and Trickling Filters**. The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 75% of the total design flow. ▪ **Activated Sludge Process Components**: » **Aeration Basin**. A backup basin will not be required; however, at least two equal-volume basins shall be provided. (For the purpose of this criterion, the two zones of a contact stabilization process are considered as only one basin.) » **Aeration Blowers or Mechanical Aerators**. There shall be a sufficient number of blowers or mechanical aerators to enable the design oxygen transfer to be maintained with the largest-capacity-unit out of service. It is permissible for the backup unit to be an uninstalled unit, provided that the installed units can be easily removed and replaced. However, at least two units shall be installed. » **Air Diffusers**. The air diffusion system for each aeration basin shall be designed so that the largest section of diffusers can be isolated without measurably impairing the oxygen transfer capability of the system. ▪ **Disinfectant Contact Basins**. The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the total design flow.
II	The Reliability Class I requirements shall apply except as modified below: ▪ D/E. **Primary and Final Sedimentation Basins and Trickling Filters**. The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the design basin flow.
III	The Reliability Class I requirements shall apply except as modified below: ▪ D/E. Primary and Final Sedimentation Basins. There shall be at least two sedimentation basins. » Activated Sludge Process Components. » Aeration Basin. A single basin is permissible. **Aeration Blowers/Mechanical Aerators or Rotors**. There shall be at least two blowers, mechanical aerators, or rotors available for service. It is permissible for one of the units to be uninstalled, provided that the installed unit can be easily removed and replaced. Aeration must be provided to maintain sufficient DO in the tanks to maintain the biota.

Notes:
(1) Source: From Department of Ecology, State of Washington. August 2008 (Revised May 2023). Criteria for Sewage Works Design. Publication # 98-37 WQ. Olympia, Washington.

Table D.3 Summary of Class I Reliability Criteria for Wastewater Treatment Facilities(1)

Plant Component	Class I Reliability (2)	Design Flow/Load(3)
Hydraulic Elements	Peak flow with largest unit out of service.	Peak hour
Primary Sedimentation	50% design flow with largest unit out of service.	Average day / peak hour
Aeration System	Design transfer with largest unit out; backup may be uninstalled; minimum 2 installed units.	Maximum day / maximum week
Biological Treatment Systems	Minimum 2 equal volumes; no backup required.	Annual average / maximum month
Secondary Clarifiers	75% design flow with largest unit out of service.	Maximum day / peak hour
Disinfection	50% design flow with largest unit out of service.	Average day / peak hour
Filtration	75% design flow with largest unit out of service.	Average day / peak hour
Sludge Facilities		
Digestion	Minimum 2 tanks.	Maximum month
Mixing	Design capacity with one unit out.	
Dewatering	Design capacity with one unit out.	

Notes:
(1) Source: U.S. Environmental Protection Agency. 1974. Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability. Publication No. EPA-430-99-74-001, Washington, D.C.
(2) Reliability - A measurement of the ability of a component or system to perform its designated function without failure. In the referenced Technical Bulletin, reliability pertains to mechanical, electric, and fluid systems and components only and includes the maintainability of those systems and components. Reliability of biological processes, operator training, process design, or structural design is not within the scope of the referenced publication.
(3) Fluid System - A system within the treatment works which contains liquid or gaseous fluids. This includes the main wastewater treatment system, parts of the sludge handling and disposal system, and auxiliary systems.
(4) Design Flow – That flow used as the basis of design of a component and/or system.
(5) Peak Wastewater Flow - The maximum wastewater flow expected during the design period of the treatment works.
(6) Hydraulic Capacity - The maximum flow capacity of a component which does not result in flooding or overflowing.
(7) Reliability Class I – Works which discharge into navigable waters that could be permanently or unacceptably damaged by effluent which was degraded in quality for only a few hours. Examples of Class I Works might be those discharging near drinking water reservoirs, into shellfish waters, or in close proximity to areas used for water contact sports.

APPENDIX E

DESIGN INFLUENT PARAMETERS

DESIGN INFLUENT PARAMETERS

Table E.1 Existing Influent Flows

Flow Condition	Units	May 2025	2045
AADF	mgd	2.56	5.36
MMADF	mgd	___	7.5
MWADF	mgd	___	8.6
Max Day Flow	mgd	3.11	10.7
Peak Hour Flow	mgd	----	20.4
	gpm		14,200

Notes:
AADF - annual average day flow; MMADF - maximum month average day flow; MWADF - maximum week average day flow.

Table E.2 Historical Influent and Primary Effluent Concentrations (mg/L)

Parameter	Flow	BOD_5	TSS	NH3
	(mgd)	(mg/L)	(mg/L)	(mg/L)
Influent				
Average	2.73	121.49	133.82	40.33
Minimum	1.33	48.80	39.00	9.74
Maximum	7.80	313.90	380.00	59.30
Standard deviation	0.85	29.92	46.49	8.63
No. of data points (n)	1,095	722	726	725
Coefficient of variation	0.31	0.25	0.35	0.21
Primary Effluent				
Average		72.09	43.03	
Minimum		17.70	10.00	
Maximum		801.10	201.00	
Standard deviation		36.06	17.65	
No. of data points (n)		540	599	
Coefficient of variation		0.50	0.41	

Table E.3 Historical Influent and Primary Effluent Mass Loads (ppd)

Parameter	2022	2023	2024
Influent			
Flow	2.71	2.64	2.85
BOD_5	2,498.30	2,773.30	2,771.85
TSS	2,872.54	3,153.41	2,911.42
TKN	1,322.18	1,237.17	1,209.36

Parameter	2022	2023	2024
Primary Effluent			
BOD_5	2,094.96	1,551.04	1,550.93
TSS	1,380.04	920.99	828.93
TKN	-	-	-

Notes:
BOD_5 - 5-day biological oxygen demand; TSS - total suspended solids; TKN - total Kjeldahl nitrogen.

Table E.4 Historical Effluent Concentrations (mg/L)

Parameter	2022	2023	2024
Final Effluent			
BOD_5	4.05	4.01	3.20
TSS	4.05	3.47	3.20
NH3	0.29	0.32	0.31

Table E.5 BioWin Model Influent Mass Loads by Average Period

Averaging Period	Units	Flow	BOD_5	TSS	TKN	TP
AAD	ppd	5.36	5,932	5,643	2,460	134
MMAD	ppd	6.80	7,525	7,158	3,121	170
MWAD	ppd	7.60	8,410	8,001	3,488	190
MD	ppd	13.3	14,718	14,001	6,105	333

Notes:
AAD - annual average day; MMAD - maximum month average day; MWAD - maximum week average day; MD - maximum day.

Table E.6 Predicted BNR Influent Flow and Mass Loads

Averaging Period	Units	PC Effluent	PS 1	PS 2	Total	Total Sidestream	Sidestream Concentration
Flow							
AADF	mgd	5.29	0.18	0.08	5.55	0.26	
MMADF	mgd	6.71	0.23	0.08	7.01	0.30	
MWADF	mgd	7.49	0.27	0.07	7.83	0.35	
MDF	mgd	10.56	0.36	0.13	11.06	0.50	
cBOD5							
AAD	ppd	3,866	194	182	4,243	376	176
MMAD	ppd	4,714	272	221	5,207	493	194
MWAD	ppd	5,369	346	256	5,971	602	209
MD	ppd	8,321	634	466	9,421	1,100	266
TSS							
AAD	ppd	2,596	765	682	4,043	1,448	676
MMAD	ppd	3,007	859	992	4,858	1,851	730
MWAD	ppd	3,520	1,239	940	5,699	2,179	756
MD	ppd	6,083	2,102	1,490	9,674	3,592	868

Averaging Period	Units	PC Effluent	PS 1	PS 2	Total	Total Sidestream	Sidestream Concentration
TKN							
AAD	ppd	2,370	173	56	2,600	229	107
MMAD	ppd	3,002	213	78	3,293	291	115
MWAD	ppd	3,351	253	78	3,682	331	115
MD	ppd	4,750	395	123	5,268	518	125

Table E.7 Plant Sludge Production Predicted by the BioWin Model

Averaging Period	Units	Primary Sludge	Thickened PS	Waste Activated Sludge	Thickened WAS	Total TPS + TWAS	Digested Sludge	Dewatered Sludge Cake	Dried Sludge
AAD	ppd	3,555	3,377	3,388	2,880	6,256	2,946	2,504	2,379
MMAD	ppd	4,009	3,808	4,519	3,842	7,650	3,655	3,290	2,961
MWAD	ppd	4,160	3,952	5,273	4,482	8,434	4,303	3,658	3,475
MD	ppd	3,920	3,724	10,093	8,579	12,304	7,157	6,083	5,779

APPENDIX F

BIOWIN MODEL INFLUENT WASTEWATER FRACTIONS

BIOWIN MODEL INFLUENT WASTEWATER FRACTIONS

Table F.1 Design Influent Wastewater Fractions

Wastewater Fraction	Units	Default	May 2025	2045 MMAD
Readily biodegradable (including Acetate)	g COD/g of total COD	0.16	0.1346	0.10
Volatile fatty acids	g VFA COD/g rbCOD	0.15	0.1429	0.13
Acetate	g COD/g of readily biodegradable COD	1.00	1.00	1.00
Non-colloidal slowly biodegradable	g COD/g of slowly degradable COD	0.75	0.7162	0.75
Unbiodegradable soluble	g COD/g of total COD	0.05	0.0577	0.14
Unbiodegradable particulate	g COD/g of total COD	0.13	0.0546	0.11
Cellulose fraction of unbiodegradable particulate	g COD/g COD	0.5	0.5	0.50
Ammonia	g NH_3-N TKN	0.66	0.6667	0.92
Particulate organic nitrogen	g N Organic N	0.5	0.5	0.50
Soluble unbiodegradable TKN	g N TKN	0.02	0.02	0.02
N:COD ratio for unbiodegradable part. COD	g N COD	0.07	0.07	0.07
Phosphate	g PO4-P/TP	0.5	0.4889	0.81
P:COD ratio for unbiodegradable part. COD	g P COD	0.022	0.022	0.02
Reduced sulfur (H2S)	g S S	0.15	0.15	0.20
Ordinary heterotrophic COD fraction	g COD/g of total COD	0.02	0.02	0.02
Methylotrophic COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Ammonia oxidizing COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Nitrite oxidizing COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Anaerobic ammonia oxidizing COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Phosphorus accumulating COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Propionic acetogenic COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Acetoclastic methanogenic COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04

Wastewater Fraction	Units	Default	May 2025	2045 MMAD
Hydrogenotrophic methanogenic COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Sulfur oxidizing COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Sulfur reducing propionic acetogenic COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Sulfur reducing acetotrophic COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	0.00
Sulfur reducing hydrogenotrophic COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	0.00
Endogenous products COD fraction	g COD/g of total COD	0	0	0.00

Notes:
COD - chemical oxygen demand; g - grams; MMAD - maximum month average day; N - nitrogen; P - phosphate; S - sulfur; TKN - total Kjeldahl nitrogen; VFA - volatile fatty acids.

APPENDIX G

MODEL SIMULATION RESULTS

MODEL SIMULATION RESULTS

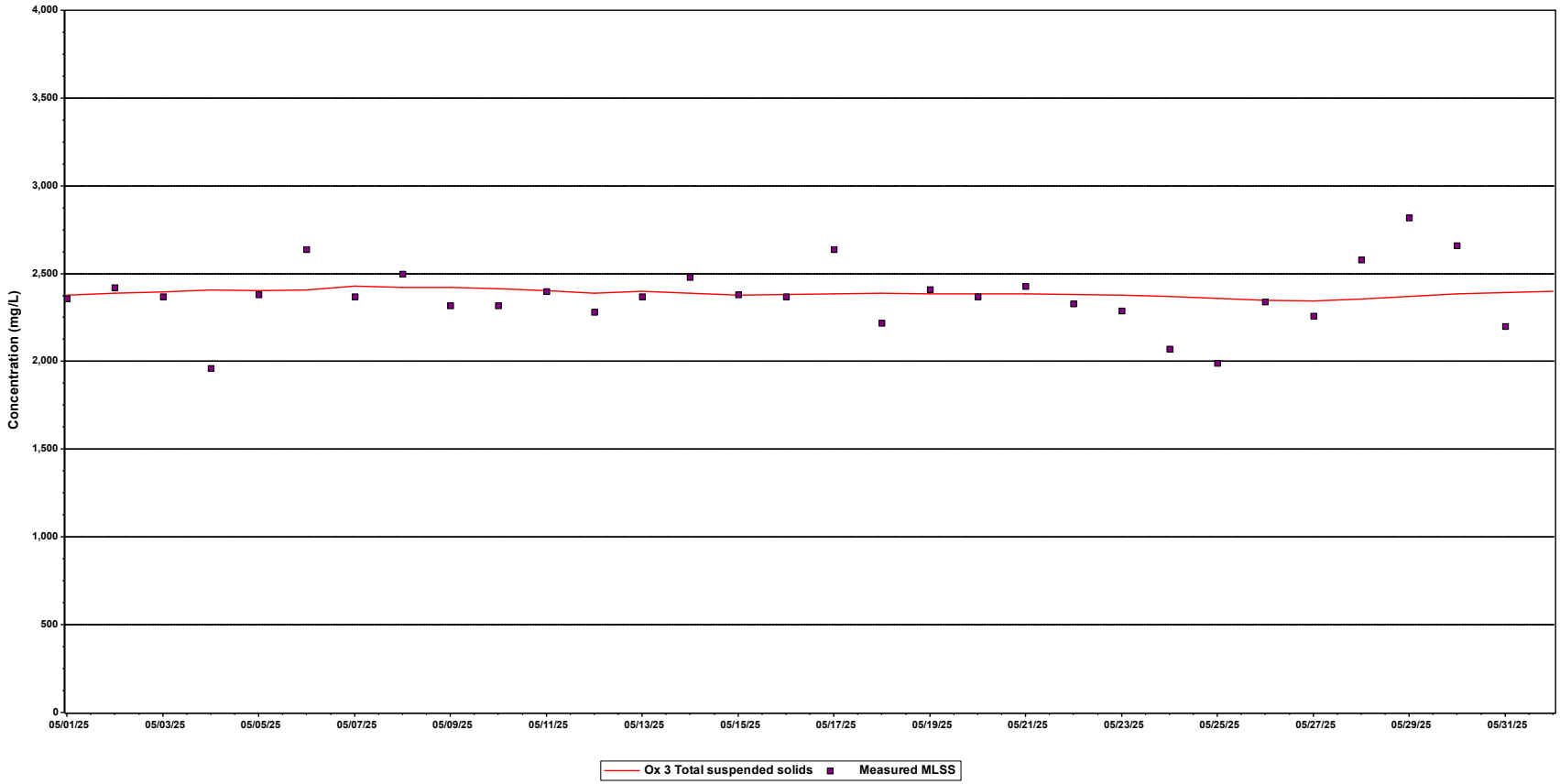


Figure G.1 Predicted Mixed Liquor Suspended Solids Versus Measured Concentrations for the Wastewater Treatment Facility for May 2025

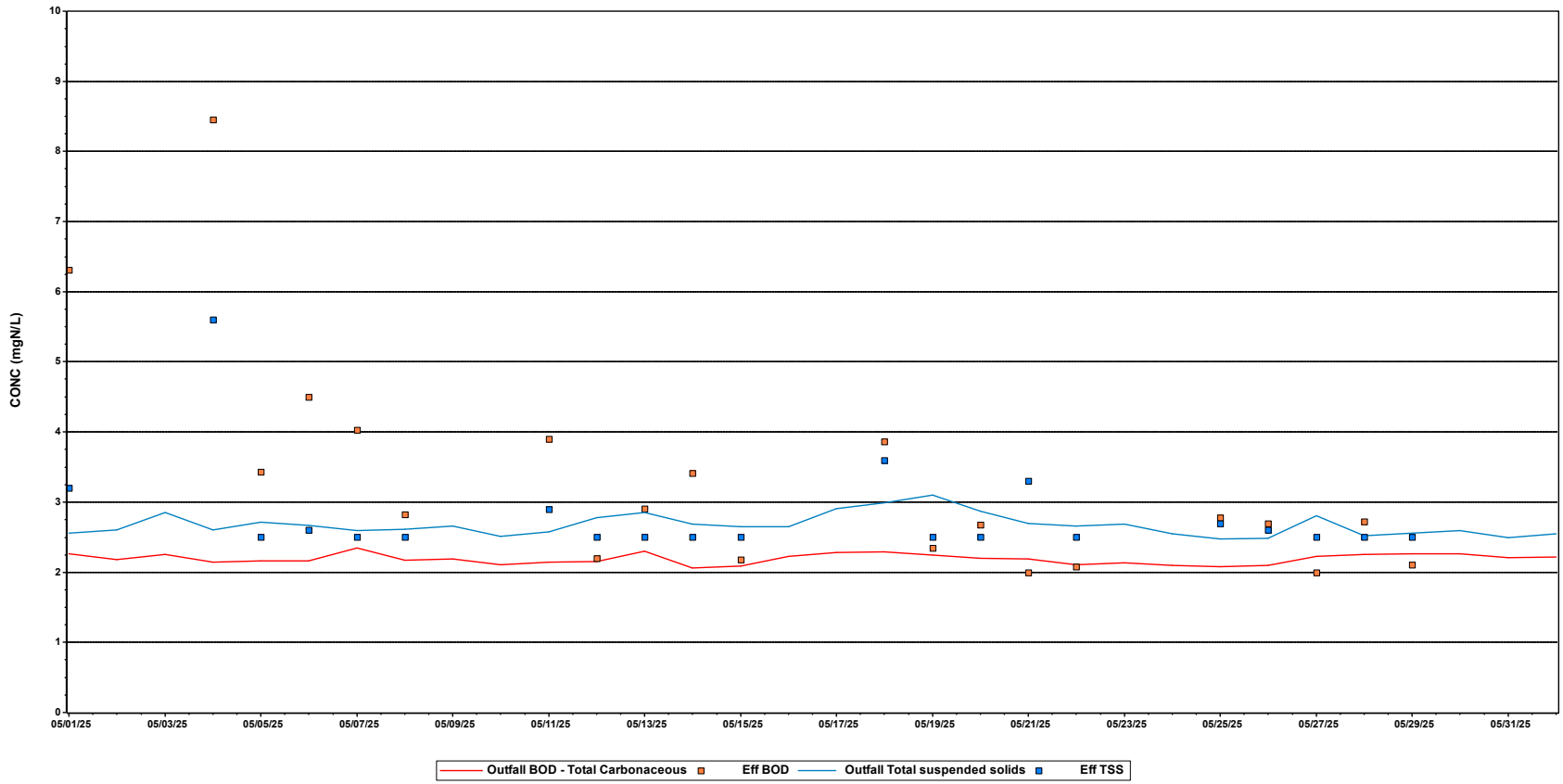


Figure G.2 Predicted versus Measured Effluent $cBOD_5$ and Total Suspended Solids Concentrations for May 2025

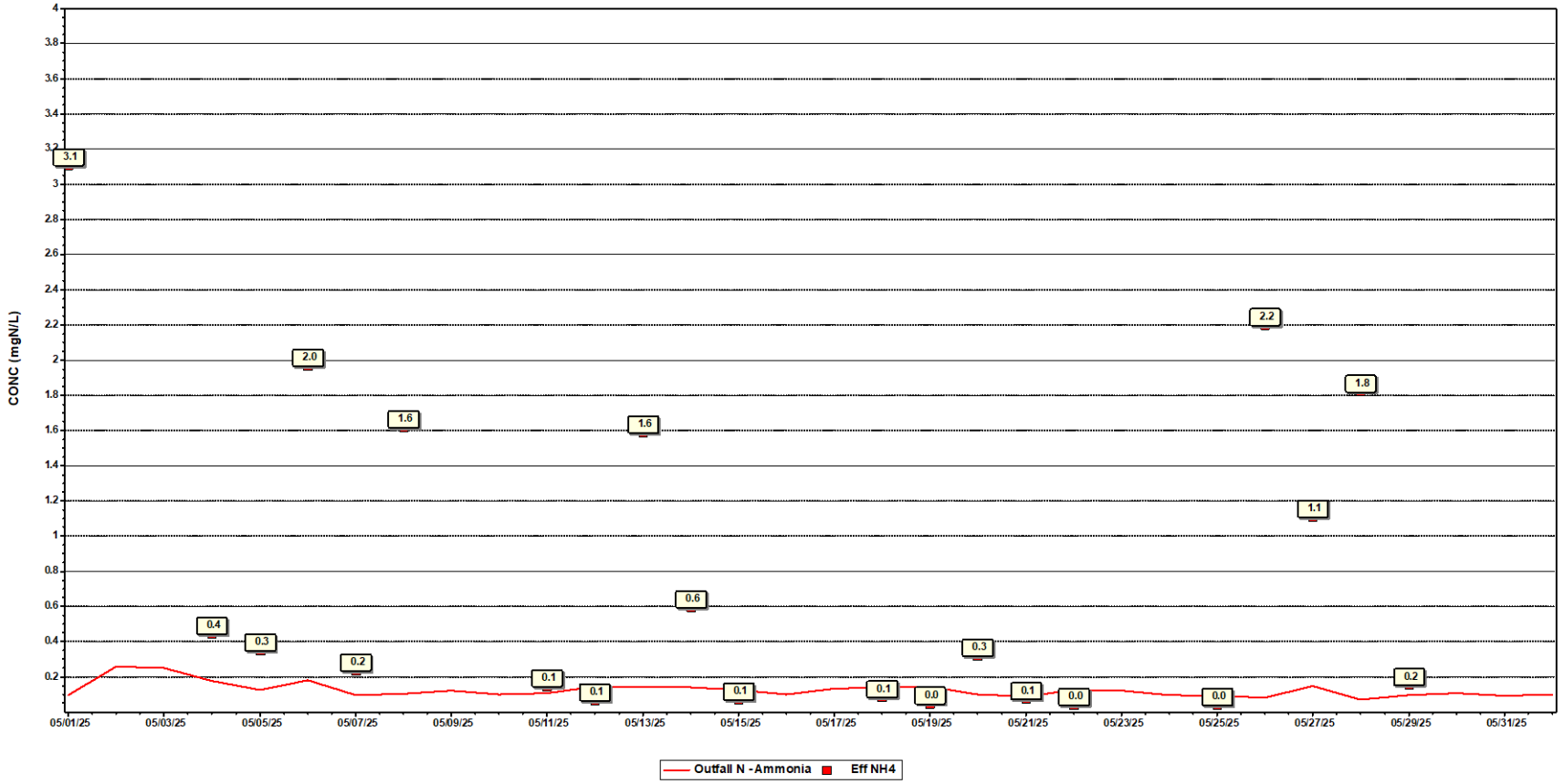


Figure G.3 Predicted versus Measured Effluent Ammonium Concentrations for May 2025

APPENDIX J

REASONABLE POTENTIAL ANALYSIS PROJECT MEMORANDUM

PROJECT MEMORANDUM

CITY OF CAMAS

General Sewer Plan Update

Project No.: 203710
Date: January 7, 2026
Prepared By: Y. Yerbich-Louman
Reviewed By: Matt Huang
Subject: Reasonable Potential Analysis

The Washington State Department of Ecology (DOE) drafted a proposed National Pollutant Discharge Elimination System (NPDES) Permit WA0020249 for the City of Camas wastewater treatment plant (WWTP) with an effective date of August 1, 2025. As a part of these efforts, DOE conducted a reasonable potential analysis (RPA) for the predicted WWTP discharge in 2045 using a maximum daily discharge value of 10.04 million gallons per day (mgd).

The maximum daily discharge in planning year 2045 is projected to be 10.70 mgd. The DOE-developed *Spreadsheets for Water Quality-Based NPDES Permit Calculations* was used to generate an updated RPA with the projected maximum daily discharge and no other changes compared to the original RPA prepared for the draft permit. The updated RPA was conducted to identify any new reasonable potentials as a result of the updated maximum daily discharge value that would require infrastructure or process modifications to be addressed in capital improvement planning.

The updated RPA indicated that no new reasonable potentials were identified. The updated RPA results are provided in the following pages.

Dilution Factor Calculations and Receiving Water Critical Conditions

Step 1: Enter Waterbody Type

Water Body Type	Freshwater

Facility Name	Camas WWTP
Receiving Water	Columbia River

Step 2: Enter Dilution Factors -OR- Calculate DFs by entering Facility/Receiving Water Flow Data

Do you want to enter dilution factors -or- flow data?	Flow Data

	Annual Average	Max Monthly Average	Daily Max
Facility Flow, MGD	5.36	7.5	10.7
Facility Flow, cfs (calculated)	8.29	11.60	16.55

	Condition	Receiving Water Flow, cfs	Allowable % of river flow	Max Dilution Factor Allowed
Aquatic Life - Acute	7Q10	81400	0.0042	**21.7**
Aquatic Life - Chronic	7Q10	81400	0.0229	**113.6**
HH-Non-Carcinogen	30Q5	113960	0.02508	**173.7**
HH-Carcinogen	Harmonic Mean	244200	0.0117	**173.6**
Whole river at 7Q10	7Q10	81400		

Step 3: Enter Critical Data

	Effluent	Receiving Water
Temp, °C	25.7	23.2
pH, s.u.	7.3	7.7
Alkalinity, mg/L as CaCO3	100	66.2
Hardness, mg/L CaCO3	168	74
Salinity, psu		
Receiving water TSS, mg/L (leave blank if unknown)		
If TSS is annual data, enter 'A'; if from critical period, enter 'S'; If no TSS, leave blank		

Instructions

Reasonable Potential Calculation

Facility	Camas WWTP
Water Body Type	Freshwater
Rec. Water Hardness	74 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	21.7	113.6
Human Health Carcinogenic		173.7
Human Health Non-Carcinogenic		173.6

10

			1	2	3	4	5	6	7	8	9
Pollutant, CAS No. & NPDES Application Ref. No.			AMMONIA, Criteria as Total NH3	ANTIMONY (INORGANIC) 7440360 1M	ARSENIC (dissolved) 7440382 2M	BUTYLBENZYL PHTHALATE 85687 15B	CADMIUM - 7440439 4M Hardness dependent	CHLOROFORM 67663 11V	CHROMIUM(TRI) -16065831 5M Hardness dependent	CHROMIUM(HEX) 18540299 - Dissolved	COPPER - 744058 6M Hardness dependent	CYANIDE 57125 14M
Effluent Data	# of Samples (n)		1156	20	20	3	20	4	20	20	20	20
	Coeff of Variation (Cv)		2.02	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		1,455		0.95	**0.27**	**0.22**	0.71	0.97	420	8.3	20
	Calculated 50th percentile Effluent Conc. (when n>10)			0.237							5.47	7.5
Receiving Water Data	90th Percentile Conc., ug/L		183	0	0	**0**	**0.015**	0	0.416	0.086	1.43	0
	Geo Mean, ug/L			0		**0**		0		0	0	0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	#REF!	-	360	-	**2.67143**	-	428.811	**15**	12.813	22
		Chronic	#REF!	-	190	-	**0.82523**	-	139.102	**10**	8.7758	5.2
	WQ Criteria for Protection of Human Health, ug/L		-	6	-	**0.013**	-	100	-	-	1300	9
	Metal Criteria Translator, decimal	Acute	-	-	1	-	0.943	-	0.316	-	0.996	-
		Chronic	-	-	1	-	0.943	-	0.86	-	0.996	-
	Carcinogen?		N	N	Y	N	N	Y	N	N	N	N

			10	11	12	13	14	15	16	17	18
Pollutant, CAS No. & NPDES Application Ref. No.			DIETHYLPHTHALATE 84662 24B	LEAD - 7439921 7M Dependent on hardness	MERCURY 7439976 8M	NAPHTHALENE 91203 39B	NICKEL - 7440020 9M - Dependent on hardness	PHENOL 108952 10A	SELENIUM 7782492 10M	SILVER - 7740224 11M dependent on hardness.	ZINC- 7440666 13M hardness dependent
Effluent Data	# of Samples (n)		3	20	20	3	20	3	20	20	20
	Coeff of Variation (Cv)		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		1.1	0.15	0.0009	2.07	2.02	5.5	1	0.02	26.4
	Calculated 50th percentile Effluent Conc. (when n>10)				0.0007		2		1		20.9
Receiving Water Data	90th Percentile Conc., ug/L			0.064	0.0009	0	0.604		0.274	0.025	1.25
	Geo Mean, ug/L		0		0	0	0	0	0		0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	-	46.461	2.1	-	1097.1	-	20	2.05541	88.676
		Chronic	-	1.8105	0.012	-	121.84	-	5	-	80.975
	WQ Criteria for Protection of Human Health, ug/L		200	-	0.14	-	80	9000	60	-	1000
	Metal Criteria Translator, decimal	Acute	-	0.466	0.85	-	0.998	-	-	0.85	0.996
		Chronic	-	0.466	-	-	0.997	-	-	-	0.996
	Carcinogen?		N	N	N	N	N	N	N	N	N

Aquatic Life Reasonable Potential

Effluent percentile value			0.950	0.950	0.950	0.950	0.950	0.950	0.950
s	$s^2=\ln(CV^2+1)$		1.275	0.555	0.555	0.555	0.555	0.555	0.555
Pn	Pn=(1-confidence level)$^{1/n}$		0.997	0.861	0.861	0.861	0.861	0.861	0.861
Multiplier			1.00	1.36	1.36	1.36	1.36	1.36	1.36
Max concentration (ug/L) at edge of…		Acute	242	0.060	0.027	0.416	26.549	1.885	1.260
		Chronic	194	0.011	0.017	0.422	5.130	1.517	0.240
Reasonable Potential? Limit Required?			**#REF!**	**NO**	**NO**	**NO**	**YES**	**NO**	**NO**

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month			4
LTA Coeff. Var. (CV), decimal			0.6
Permit Limit Coeff. Var. (CV), decimal			0.6
Waste Load Allocations, ug/L		Acute	323.030515
		Chronic	1126.43826
Long Term Averages, ug/L		Acute	103.719676
		Chronic	594.12121
Limiting LTA, ug/L			103.719676
Metal Translator or 1?			1.00
Average Monthly Limit (AML), ug/L			**161.0**
Maximum Daily Limit (MDL), ug/L			**323.0**

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$	0.554513029	0.55451303	0.55451	0.5545	0.5545	0.5545
Pn	Pn=(1-confidence level)1/n	0.861	0.368	0.473	0.861	0.861	0.368
Multiplier		0.548111032	1.20486058	1.03846	0.5481	0.5481	1.2049
Dilution Factor		173.6066127	173.606613	173.666	173.61	173.61	173.61
Max Conc. at edge of Chronic Zone, ug/L		0.001365155	0.00187385	4.2E-03	0.0315	0.0432	0.0076
Reasonable Potential? Limit Required?		**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Instructions

Reasonable Potential Calculation - Page 2

Facility	Camas WWTP
Water Body Type	Freshwater
Rec. Water Hardness	74 mg/L

Dilution Factors:
Aquatic Life
Human Health Carcinogenic
Human Health Non-Carcinoge

Aquatic Life Reasonable Potential

Effluent percentile value			0.950	0.950	0.950	0.950	0.950	0.950
s	$s^2=\ln(CV^2+1)$		0.555	0.555	0.555	0.555	0.555	0.555
Pn	Pn=(1-confidence level)$^{1/n}$		0.861	0.861	0.861	0.861	0.861	0.861
Multiplier			1.36	1.36	1.36	1.36	1.36	1.36
Max concentration (ug/L) at edge of…		Acute	0.065	0.001	0.703	0.324	0.025	2.849
		Chronic	0.064	0.001	0.623	0.284	0.025	1.555
Reasonable Potential? Limit Required?			**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month			
LTA Coeff. Var. (CV), decimal			
Permit Limit Coeff. Var. (CV), decimal			
Waste Load Allocations, ug/L		Acute	
		Chronic	
Long Term Averages, ug/L		Acute	
		Chronic	
Limiting LTA, ug/L			
Metal Translator or 1?			
Average Monthly Limit (AML), ug/L			
Maximum Daily Limit (MDL), ug/L			

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$	0.5545	0.5545	0.55451	0.55451	0.5545
Pn	Pn=(1-confidence level)1/n	0.861	0.861	0.368	0.861	0.861
Multiplier		0.5481	0.5481	1.20486	0.54811	0.5481
Dilution Factor		173.61	173.61	173.607	173.607	173.61
Max Conc. at edge of Chronic Zone, ug/L		4E-06	0.0115	0.03817	5.8E-03	0.1204
Reasonable Potential? Limit Required?		**NO**	**NO**	**NO**	**NO**	**NO**

Calculation of Fecal Coliform at Chronic Mixing Zone

INPUT	
Chronic Dilution Factor	113.6
Receiving Water Fecal Coliform, #/100 ml	
Effluent Fecal Coliform - worst case, #/100 ml	400
Surface Water Criteria, #/100 ml	*14*
OUTPUT	
Fecal Coliform at Mixing Zone Boundary, #/100 ml	**4**
Difference between mixed and ambient, #/100 ml	4

Conclusion: At design flow, the discharge has no reasonable potential to violate water quality standards for fecal coliform.

Calculation of Dissolved Oxygen at Chronic Mixing Zone

INPUT	
Chronic Dilution Factor	113.6
Receiving Water DO Concentration, mg/L	8.1
Effluent DO Concentration, mg/L	5.1
Effluent Immediate DO Demand (IDOD), mg/L	2
Surface Water Criteria, mg/L	*8*
OUTPUT	
DO at Mixing Zone Boundary, mg/L	**8.06**
DO decrease caused by effluent at chronic boundary, mg/L	**0.04**

Conclusion: At design flow, the discharge has no reasonable potential to violate water quality standards for dissolved oxygen.

References: EPA/600/6-85/002b and EPA/430/9-82-011

Freshwater Temperature Reasonable Potential and Limit Calculation

Based on WAC 173-201A-200(1)(c)(i)--(ii) and the Water Quality Program Guidance. All data inputs must meet WQ guidelines. The Water Quality temperature guidance document may be found at: https://fortress.wa.gov/ecy/publications/summarypages/0610100.html

	Core Summer Critera	Supplemental Criteria
INPUT	**July 1-Sept 14**	**Sept 15-July 1**
1. Chronic Dilution Factor at Mixing Zone Boundary	113.6	113.6
2. 7DADMax Ambient Temperature (T) (Upstream Background 90th percentile)	21.5 °C	12.6 °C
3. 7DADMax Effluent Temperature (95th percentile)	22.0 °C	16.0 °C
4. Aquatic Life Temperature WQ Criterion in Fresh Water	22.0 °C	
OUTPUT		
5. Temperature at Chronic Mixing Zone Boundary:	21.5 °C	12.6 °C
6. Incremental Temperature Increase or decrease:	0.0 °C	0.0 °C
7. Maximum Allowable Incremental Temperature Increase:	1.0 °C	0.3 °C
8. Maximum Allowable Temperature at Mixing Zone Boundary:	22.0 °C	12.9 °C
A. If ambient temp is warmer than WQ criterion		
9. Does temp fall within this warmer temp range?	NO	YES
10. Temperature Limit if Required:	---	NO LIMIT
B. If ambient temp is cooler than WQ criterion but within 28/(T_{amb}+7) and within 0.3 °C of the criterion		
11. Does temp fall within this incremental temp. range?	NO	---
12. Temp increase allowed at mixing zone boundary, if required:	---	---
C. If ambient temp is cooler than (WQ criterion-0.3) but within 28/(T_{amb}+7) of the criterion		
13. Does temp fall within this Incremental temp. range?	YES	---
14. Temp increase allowed at mixing zone boundary, if required:	NO LIMIT	---
D. If ambient temp is cooler than (WQ criterion - 28/(T_{amb}+7))		
15. Does temp fall within this Incremental temp. range?	NO	---
16. Temp increase allowed at mixing zone boundary, if required:	---	---
RESULTS		
17. Do any of the above cells show a temp increase?	**NO**	**NO**
18. Temperature Limit if Required?	**NO LIMIT**	**NO LIMIT**

Calculation of pH of a Mixture of Two Flows

Based on the procedure in EPA's DESCON program (EPA, 1988. Technical Guidance on Supplementary Stream
USEPA Office of Water, Washington D.C.)

INPUT	
	@ Acute Boundary
1. Dilution Factor at Mixing Zone Boundary	121.0
2. Ambient/Upstream/Background Conditions	
Temperature (deg C):	23.20
pH:	8.10
Alkalinity (mg CaCO3/L):	74.00
3. Effluent Characteristics	
Temperature (deg C):	25.70
pH:	6.00
Alkalinity (mg CaCO3/L):	100.00
4. Aquatic Life Use Designation	Other species (salmonid/redb
OUTPUT	
1. Ionization Constants	
Upstream/Background pKa:	6.36
Effluent pKa:	6.35
2. Ionization Fractions	
Upstream/Background Ionization Fraction:	0.98
Effluent Ionization Fraction:	0.31
3. Total Inorganic Carbon	
Upstream/Background Total Inorganic Carbon (mg CaCO3/L):	75
Effluent Total Inorganic Carbon (mg CaCO3/L):	322
4. Condtions at Mixing Zone Boundary	
Temperature (deg C):	23.22
Alkalinity (mg CaCO3/L):	74.21
Total Inorganic Carbon (mg CaCO3/L):	77.39
pKa:	6.36
5. Allowable pH change	0.50
RESULTS	
pH at Mixing Zone Boundary:	**7.73**
pH change at Mixing Zone Boundary:	0.37
Is permit limit needed?	NO

Streeter-Phelps Analysis of Critical Dissolved Oxygen Sag

INPUT			
1. EFFLUENT CHARACTERISTICS			
Discharge (cfs):			9.44
$CBOD_5$ (mg/L):			5
NBOD (mg/L):			3
Dissolved Oxygen (mg/L):			5
Temperature (deg C):			24
2. RECEIVING WATER CHARACTERISTICS			
Upstream Discharge (cfs):			81400
Upstream $CBOD_5$ (mg/L):			1.5
Upstream NBOD (mg/L):			0.2
Upstream Dissolved Oxygen (mg/L):			9
Upstream Temperature (deg C):			23
Elevation (ft NGVD):			75
Downstream Average Channel Slope (ft/ft):			0.00088
Downstream Average Channel Depth (ft):			21
Downstream Average Channel Velocity (fps):			0.98
3. REAERATION RATE (Base e) at 20 deg C (day^{-1}):			0.13
	Applic.	Applic.	Suggested
Reference	Vel (fps)	Dep (ft)	Values
Churchill	1.5 - 6	2 - 50	0.07
O'Connor and Dobbins	0.1 - 1.5	2 - 50	0.13
Owens	0.1 - 6	1 - 2	0.08
Tsivoglou-Wallace	0.1 - 6	0.1 - 2	1.99
4. BOD DECAY RATE (Base e) AT 20 deg C (day^{-1}):			0.07
(or use *Wright and McDonnell eqn, 1979, for small rivers.) Enter this value -->*			0.04

OUTPUT	
1. INITIAL MIXED RIVER CONDITION	
$CBOD_5$ (mg/L):	1.5
NBOD (mg/L):	0.2
Dissolved Oxygen (mg/L):	9.0
Temperature (deg C):	23.0
2. TEMPERATURE ADJUSTED RATE CONSTANTS (Base e)	
Reaeration (day^-1):	0.14
BOD Decay (day^-1):	0.08
3. CALCULATED INITIAL ULTIMATE CBODU AND TOTAL BODU	
Initial Mixed CBODU (mg/L):	2.2
Initial Mixed Total BODU (CBODU + NBOD, mg/L):	2.4
4. INITIAL DISSOLVED OXYGEN DEFICIT	
Saturation Dissolved Oxygen (mg/L):	8.555
Initial Deficit (mg/L):	-0.44
5. TRAVEL TIME TO CRITICAL DO CONCENTRATION (days):	11.48
6. DISTANCE TO CRITICAL DO CONCENTRATION (miles):	184.06
7. CRITICAL DO DEFICIT (mg/L):	0.55
8. CRITICAL DO CONCENTRATION (mg/L):	**8.00**

APPENDIX K

CONDITION ASSESSMENT OF CAMAS WASTEWATER TREATMENT FACILITY PROJECT MEMORANDUM

PROJECT MEMORANDUM

CITY OF CAMAS

General Sewer Plan Update

Project No.:	203710
Date:	7/17/2025
Prepared By:	Sudhan Paranjape, Sanjit Khanal, Dennis Clinefelter (Carollo Engineers), Ron Reardon (Reardon Engineering LLC)
Reviewed By:	Kate Bandettini, Matt Huang
Subject:	Condition Assessment of Camas Wastewater Treatment Plant

This document is released for the purpose of information exchange review and planning only under the authority of Matthew M. Huang, July 21, 2025, Washington PE# 54002.

1.0 PROCESS ASSESSMENT

1.1 Summary

A plant condition assessment of the Camas Wastewater Treatment Plant (WWTP) was conducted on June 11 and 12.

On June 11, Sudhan Paranjape, Kate Bandettini, and Ron Reardon toured the entire plant with Jacob Taylor, the current Plant Operations Supervisor, to learn more about the facility, including current operating protocols and the condition of the plant's mechanical equipment and processes. On June 12, Sanjit Khanal (electrical engineer) and Dennis Clinefelter (instrumentation and controls specialist) also joined. Sanjit and Dennis inspected the electrical and instrumentation and controls (I&C) equipment while Sudhan, Kate, and Ron spent the day doing more detailed assessments of selected areas of the plant. During the second day they concentrated on areas on the plant site that could be used or modified to achieve the projected capacity requirements for the current planning period. The visit was successful as far as gaining an understanding of the plant capabilities and potential modifications that could be made to expand plant treatment capacity in the future.

1.2 Notes on Condition Assessment

1. All influent raw wastewater is pumped to the plant from either the Main Pump Station (PS) or the Oak Park PS. The Main PS has variable frequency drives, and the pumping rate ramps up and down with the flow. The Oak Park PS has constant speed pumps that operate off wetwell level. This results in surges in the flow received at the WWTP.
2. In 2023 the average daily flow was 2.7 mgd while the peak flow was roughly three times the average flow. The detailed statistical analysis that has been completed on the plant's historical data is available on the project folder on ProjectWise.

3. The septic tanks connected to the City of Camas's (City) wastewater collection system are pumped out about once every five to eight years and the septage hauled to the WWTP. This includes both the septic tank effluent pumping (STEP, operates with pumps) and septic tank effluent filter (STEF, which operates by gravity) installations. Plant staff estimated Camas has about 6,000 STEP and STEF tanks. Septic tank pumping is now done by contract and only during the summer months. During the summer, the plant receives about 10 to 11 tanker truckloads per day but only on weekdays. This imposes an additional dynamic load on the activated sludge process. The influent total suspended solids (TSS) concentrations are less than 100 milligrams per liter (mg/L) without STEP pumping and in the range of 150 to 300 mg/L with STEP pumping.
4. Parts of the plant flooded in the 1997 Columbia River flood. During the 1997 flood, the river crested at an elevation of 22.5 feet on January 3 at the Port of Vancouver. See https://clark.wa.gov/public-works/columbia-river-and-flooding. The grade elevation is about 30 feet in much of the plant site. The top of wall (TOW) elevation for the aeration tanks is 37.00 feet. The plant has no flood protection.
5. The City of Vancouver, Washington and Church & Dwight (C&W), a local industry located in Vancouver, have approached the City of Camas about the potential for Church & Dwight to truck their wastewater to the Camas WWTP instead of discharging it to the Vancouver WWTP as it does now. The driver behind this is to make more treatment capacity at the Vancouver plant available for domestic wastewater and would decrease their industrial client load by about 3 percent. The discharge was said to come from the manufacture of chewable vitamins for children (Li'l Critters); https://www.lilcritters.com/).

   The C&W wastewater was said to have a five-day carbonaceous biochemical oxygen demand (cBOD5) concentration of about 15,000 mg/L and a volume of about 30,000 gallons per day (gpd). The mass load associated with the Church & Dwight wastewater (about 3,800 pounds per day) would be a substantial increase to the CWWTP's current loading, but the additional carbon could be beneficial for both improved liquid treatment (enhanced denitrification) and biosolids treatment (increased digester gas production). A chemical analysis of the waste should be done to determine the chemical oxygen demand (COD), cBOD5, total Kjeldahl nitrogen (TKN), total phosphorus (TP), pH, alkalinity and cations, and total dissolved solids (TDS).
6. The paper mill in Camas (Georgia Pacific) treats its own wastewater although it may send its sanitary wastes to the Camas WWTP.
7. The plant headworks structure has two Kusters perforated plate screens with 3/8-inch (approximately 9 millimeter [mm]) openings as reported by plant staff. The 2012 O&M manual states the opening size is 6 mm. One of the influent screens needs a bearing replacement, and the plant is planning on performing this repair in-house. One of the screen nameplates shows the screen installation date of 2007, while the other screen installation date is 2010. Each screen has a washer/compactor to reduce volume and weight of screenings before dumping into a dumpster beneath at grade level.
8. The plant has four automatic samplers:
   a. Influent (flow proportional).
   b. Effluent (flow proportional).
   c. Primary effluent (timed composite; grab samples once per hour).
   d. Waste sludge (timed composite; grab samples once per hour).

9. The plant struggled in the past with finding a satisfactory seed source for their cBOD5 tests. Now they make their own glucose and glutamic acid (GGA), 500 milliliters (mL) per week, seed from the primary effluent composite sample.
10. The plant is currently operating with one primary clarifier, two aeration tanks and one final clarifier. During the winter wet season, the plant will put both primary clarifiers and one more final clarifier in service. Final Clarifier #1 is out of service, so the plant relies on Final Clarifiers #2 and #3 during the winter month. Final Clarifier #1 has a flat bottom, and therefore, sludge is not appropriately scrapped to the center sump. In the future, if this clarifier needs to be used, it may require either adding a slope to the bottom for proper sludge collection or demolish and build a new slopped bottom clarifier in its place.
11. The primary sludge pumps operate 24 hours a day at an estimated flow of 250 gallons per minute (gpm). During the assessment, Primary Sludge Pump #3 was experiencing a motor issue and making excessive noise. The primary sludge is thin, and they do not typically carry a blanket. The sludge is degritted using hydrocyclones, which are near their useful life. Degritted sludge flows to the gravity thickener. The hydrocyclones will be replaced with new equipment as part of an ongoing plant improvements project (HDR Task Order #4).
12. The influent splitter box has an unbalanced flow split. A computational fluid dynamics (CFD) study is recommended to understand the mixing of the recycle streams and influent in this chamber.
13. Overall, there is not a lot of elevation drop through the primary liquid treatment train, raising overflow concerns. During high rain events in the winter, launder troughs in the primaries have reportedly backed up to the weirs in the influent splitter box.
14. The plant adds about 375 gpd of magnesium hydroxide ($Mg(OH)_2$) to the aeration tank influent splitter box to supplement the alkalinity in the influent wastewater. The pH of the activated sludge process is monitored at the aeration tank effluent. This introduces a lag in making changes in the Mg(OH)2 feed to respond to changes in the pH. To counter this, the plant has set a low pH alarm of 6.7. This gives the operating staff sufficient time to increase Mg(OH)2 addition to avoid effluent pH violations. This is important if the pH drops at night.
15. The activated sludge process currently reduces the influent ammonia ($NH4^+$) from about 45 mg/L down to less than 0.1 mg/L. Both WaferTech and Analog Devices discharge wastewater to the Camas wastewater system that contain appreciable amounts of ammonia. Plant staff report they receive about 2,800-gallon loads every other day from WaferTech.
16. The plant has problems with struvite (NH_4MgPO_4) scaling in the digesters and the sludge processes downstream of the digesters. This scaling could be exacerbated by using $Mg(OH)_2$ and by enhanced biological phosphorus removal (EBPR) if it is occurring in the activated sludge process. Struvite buildup occurs in the condenser and the solids drying system (operators must take the doors off and clean once per week) and blockages in the centrate piping to plant drain Pump Station #1.
17. The plant cannot operate with just one aeration basin. The reason for this was not immediately clear.
18. The activated sludge process is controlled primarily by use of the aerobic mean cell residence time (aMCRT). This is approximated by the detention time of volatile suspended solids (VSS) in the aerated portion of the activated sludge process. The mixed liquor volatile suspended solids (MLVSS) concentration is measured once per week. The target aMCRT is 10 days in winter and 11 days in summer. The plant uses an Excel spreadsheet to calculate and track the aMCRT.

19. The plant occasionally experiences minor bulking and scum formation. The bulking occurs periodically and may be related to seasonal changes or STEP pumping. The bulking is controlled by dosing sodium hypochlorite to the return activated sludge (RAS). Chlorination for about a week is typically sufficient to control the problem. When chlorinating the RAS, they add about 55 gpd of 12 percent hypochlorite.
20. The RAS pumps have variable frequency drives (VFD) and are paced from the influent flow measurement. The rate is typically 50 percent of influent flow when operating one clarifier and 30 percent (per clarifier?) when operating two clarifiers.
21. The aeration tanks have membrane disc diffusers and luminescent dissolved oxygen (LDO)-type dissolved oxygen (DO) probes. The plant wants to look at adding ammonia-based aeration control (ABAC).
22. Clarifier No. 1 is no longer used. Clarifier No. 2 is used in the winter, but it does not have sludge wasting capabilities. Final Clarifier No. 3 operates year-round and is the only location from which sludge is wasted.
23. The WAS pumps operate on a 180-minute cycle (eight cycles per day). The wasting rate is varied by changing the pump runtime. The WAS pump is currently on for 44 minutes and off for 136 minutes.
24. The effluent filters are Veolia/Hydrotech inside-out disc filters. The filters work well, and the plant staff is happy with them. They were originally installed to combat high TSS in the clarifier effluent that was caused by bulking.
25. The plant has only one waste activated sludge (WAS) thickener and needs a redundant unit as operation of the sludge process is dependent on it. The WAS concentration ranges from 4,000 to 6,000 mg/L. The rotary drum thickener (RDT) increases this to about 7 percent (70,000 mg/L).
26. Thickener feed pump in the downstairs of the equipment building appeared to have seal issues and had accumulation of dropping underneath the pump head.
27. Staff reported that an internal mixed liquor suspended solids (MLSS) recycle pump had unintentionally tripped recently. The pump's structure is severely corroded, and the operators do not have accessibility for easily repairing these pumps.
28. The dewatering centrifuge increases the digested sludge concentration to about 22 percent to 25 percent total solids. The centrifuge runs about every other day.
29. The plant has an Andritz belt-type sludge drier. It operates from eight to ten hours every day. The dried sludge solids have a concentration of about 95 percent to 98 percent total solids.
30. The plant will soon be undergoing an upgrade project, designed by HDR (Task Order No. 4). Bids were recently received for this project. The bid prices were between about $9.1 million and $10.4 million. It was unknown if an award had been made at the time of the condition assessment. This project includes the following:
    a. Replacement of the grit classifiers.
    b. Install a second dewatering centrifuge. The City has already purchased the centrifuge.
    c. Increase in the septage receiving capacity.
    d. Replacement of two of the multi-stage centrifugal blowers (Hoffman) with high-speed turbo blowers (Neuros) and associated controls modification to have two turbo blowers operate in tandem with two centrifugal blowers.

e. Replacement of the internal mechanisms in the primary clarifiers with all 316 stainless steel (SS).
f. Replacing the ultraviolet (UV) disinfection system with new UV equipment and controls.
g. Moving the electrical generator out of the Equipment Building.

31. The plant recently had the channels in the headworks structure rehabilitated (recoated) due to extensive damage to the concrete from hydrogen sulfide (H2S). The splitter box upstream of the Aeration Basins is suffering from the same deterioration from sulfide (H2S) as the influent channel.
32. The plant uses biofilter beds for odor control, but it is reported that they do not function well. The plant also has a chemical scrubber system for some of the plant's foul air.
33. The plant's new National Pollutant Discharge Elimination System (NPDES) permit has a requirement for monitoring the effluent temperature. Washington State Department of Ecology (WDOE) requires temperature sensors be accurate to 0.2 degrees Celsius. The temperature measurement in pH probes is only accurate to 0.5 degrees Celsius.
34. The plant uses a computerized maintenance management system (CMMS) called FIIX.
35. The plant staffing is currently staffed as follows:
    a. One lead operator.
    b. Two mechanics.
    c. One lab tech.
    d. One biosolids operator.
    e. One ?.
36. The plant currently has two open operator positions. An operations supervisor is anticipated to start in August 2025.
37. The plant is staffed from 5:00 a.m. to 3:30 p.m. and 7:00 a.m. to 3:30 p.m. on weekdays, plus one operator works 7:00 a.m. to 3:30 p.m. on weekends.
38. The plant operation and maintenance (O&M) manuals are not kept updated.

1.3 Future Alternatives

Several concepts were considered during the condition assessment that could be used to facilitate expansion of plant capacity. They include the following:

1. Three overall conceptual alternatives are available for increasing treatment capacity as follows:
    a. Expand capacity using traditional methods - likely the preferred alternative if sufficient land is available and the costs are competitive.
    b. Expand capacity using innovative methods - technologies like step-feed biological nutrient removal (BNR), membrane bioreactor (MBR), integrated fixed-film activated sludge (IFAS), and aerobic granular sludge (AGS) can provide more treatment capacity in a smaller footprint.
    c. Construct a new treatment facility - this is an unlikely alternative but might be an option if there is insufficient area available on the existing site, or the costs for expansion would be higher than a new facility.
2. The process could be modified to include step-feed for peak flows. This would increase the capacity of the final clarifiers by allowing the plant to operate at a higher MLSS concentration during dry weather thus increasing the overall treatment capacity.

3. Clarifier No. 1 no longer functions adequately and is never used. It could be demolished and a new final clarifier constructed at the same location.
4. Space is available between the existing plant process tanks and the access road along the river. This area could be sufficient for one or two more aeration tanks, and a third primary clarifier.
5. The existing centrate/septage/WAS storage tank could be replaced with a fourth secondary clarifier, and the storage volume provided elsewhere on the site.
6. The primary clarifiers could be abandoned or converted to anaerobic and anoxic tanks. This would improve influent carbon management and provide nutrient removal in the activated sludge process, while reducing or potentially eliminating the MgOH feed. Demolishing primary clarifiers and building new anaerobic tanks in their place can make sufficient head available to either modify or replace the aeration tank influent splitter box to provide a more accurate flow split to the aeration basins.
7. The land to the west of the existing plant is reported to be owned by the City; however, the ground elevation is significantly lower than the existing plant site and is in the flood plain. Because of the lower elevation, the land to the west of the existing plant would require significant fill, or a dike or another method of flood protection.
8. The electrical equipment in the digester building could be removed and relocated on the site, and another thickener could be added in this area. There are hazardous occupancy concerns about the electrical equipment located directly next to the digester wall in the digester building.
9. The City would like to make modifications to the sludge cake conveyor system from the dewatering centrifuge to allow diversion of the cake to a truck unloading station to dispose of dewatered cake, should the dryer be out of service, as a contingency plan.
10. It is understood that the City of Vancouver is investigating alternatives to phase out the aging sludge incinerator at its Westside Wastewater Treatment Facility (WTF). City of Vancouver staff have shown interest in visiting the Camus belt dryer. Since the belt dryer is also nearing its useful life, Camas could partner with Vancouver to build a regional biosolids handling plant using thermal drying technology. If per- and polyfluoroalkyl substances (PFAS) turn out to be a concern in the future to limit the beneficial use of the dried pellets, thermal drying can be appended with pyrolysis treatment for PFAS treatment.

2.0 ELECTRICAL ASSESSMENT

2.1 Introduction

The City mentioned that the WWTP was first constructed in 1972, but the current general layout is from upgrades done in 1992 and 2002. A large portion of the electrical distribution equipment is from the 2002 plant upgrades retrofitted in subsequent plant upgrades. The WWTP is fed from two utility transformers: a 500-kilovolt amp (kVA) "UT1" located on the southwest side of UV Building, and a 1,000-kVA "UT2" located on the north side of Equipment/Blower Building.

2.2 Condition Assessment

The City was asked about the major electrical issues seen at the WWTP and noted that there are no major issues with electrical system, other than occasional power blips from the electrical utility feed. The City

noted that the existing two 250-kilowatt (kW) generators have been able to back up the WWTP during such electrical utility outages.

It was noted during the site visit that the water utility does not have a dedicated electrician or instrumentation technician in their team. The City also noted that they do not have any on-call contracts with an independent electrician or system integrator. Carollo recommends having an in-house electrician and controls technician or maintaining on-call contracts with independent electricians (electrical contractors) and systems integrators. It is likely that since there has not been a major electrical or controls failure at the WWTP this has not been an issue, but if that were to happen, the electrician and system integrator could help solve the problem sooner with their dedicated expertise in those particular fields.

Furthermore, it was noted during the site visit that none of the electrical distribution equipment had an arc flash labels on them. The City noted that they do not maintain an electrical system study for the plant. The Occupational Safety and Health Administration (OSHA) recommends an electrical system study after five years or after a major plant upgrade for the safety of electricians who work on this distribution equipment. Carollo recommends having an electrical system study done immediately and arc flash labels applied to all electrical distribution equipment.

The City noted during the condition assessment site visit that the last major flood that put most of the WWTP underwater was in 1997. Carollo recommends doing a flood risk analysis of all major electrical distribution equipment and control panels to assess the risks.

2.2.1 Utility Transformer "UT1", 500kVA

The first utility transformer "UT1" 500-kVA, located on the southwest side of the UV Building, has two separate feeders, one feed going to MDS-UV located in the UV Building electrical room, and the second feed going to MCC-A located in the Old Controls Building, as shown on Figure 1 and Figure 2.

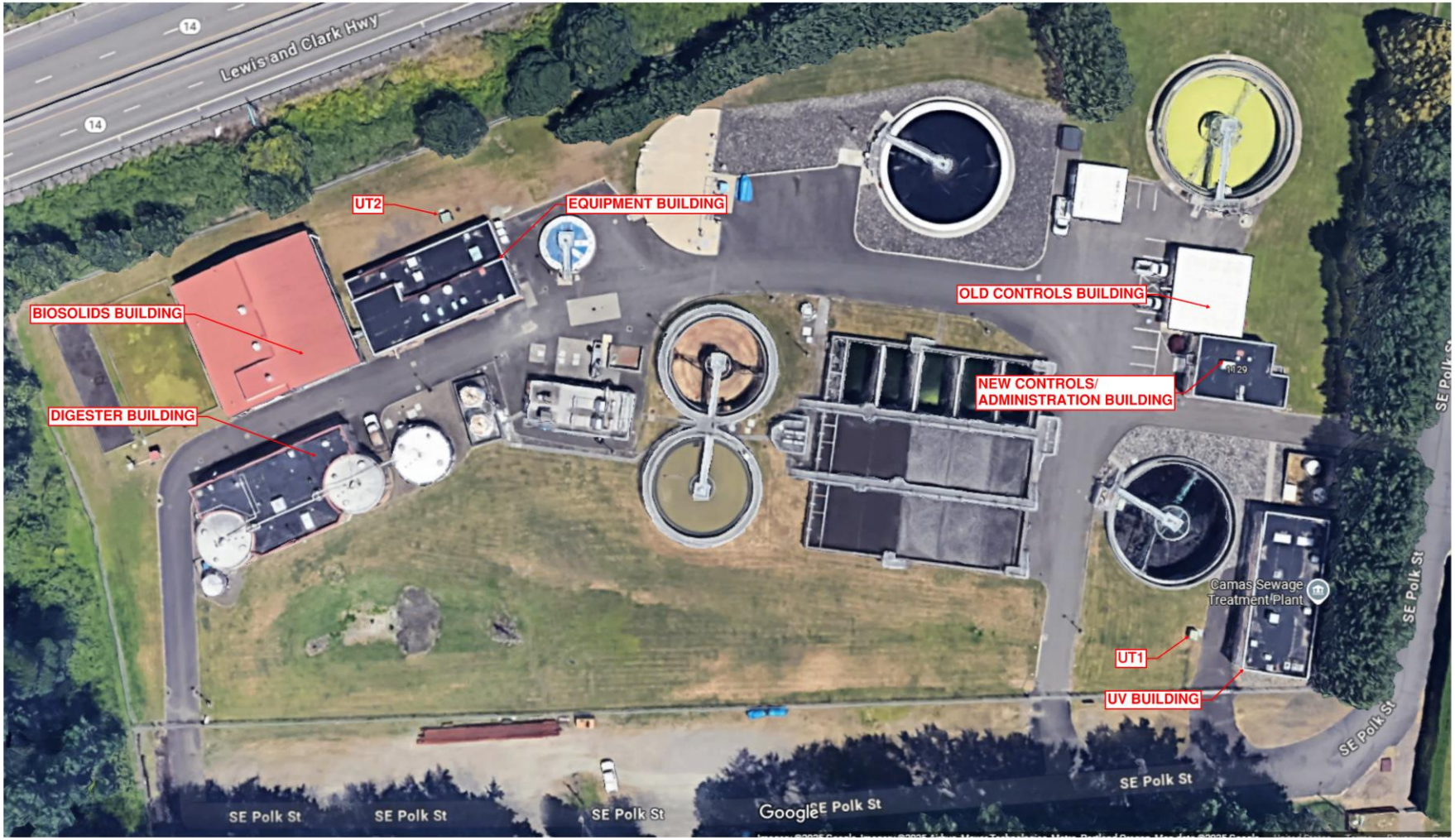


Figure 1 Site Layout

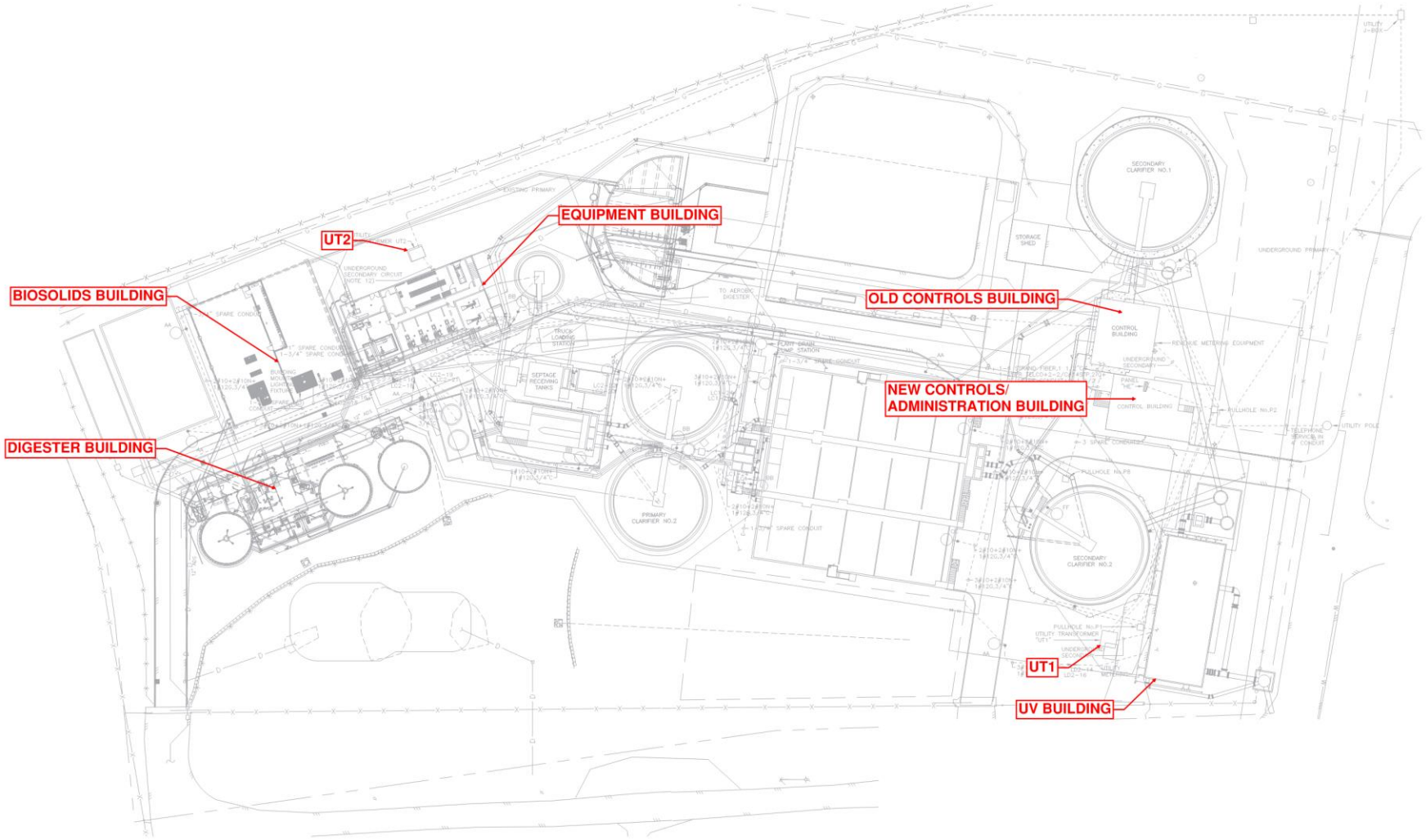


Figure 2 Simplified Site Plan

3.0 INSTRUMENTATION AND CONTROLS ASSESSMENT

The previous report called out needed upgrades for programmable logic controllers (PLC) and the supervisory control and data acquisition (SCADA) system. There has been some limited progress with the PLC upgrades. However, the risk remains, as evidenced in a cabinet fire during the 2023-2023 timeframe to PLC D1, to all PLC hardware that has not been upgraded. This applies to both the general plant PLCs as well as vendor-provided equipment with PLCs. For example, the Biosolids Dryer PLCs use the Rockwell Automation 1756-L6x series processor, which has been discontinued since 2017. Additionally, the continued usage of ControlNet upgrade options exist for just the processor. However, the version of the chassis for the PLC must be investigated to determine which path for upgrades is available.

The WWTP's existing Wonderware SCADA application is still installed on just a single computer. Only one operator can use the system at a time. While observing the historian with the operator, an operator in the field needed to interact with the SCADA system and took over control, without any notification to the operator in the control room. The move to a server-based system with redundancy should be prioritized to ensure multi-user operations of the plant.

The following upgrades are still recommended:

1. Replace the existing SCADA server with matching redundant SCADA servers.
2. Upgrade the SCADA human-machine interface (HMI) application to a redundant configuration.
3. Add a SCADA reporting application.
4. Rebuild HMI graphics to take advantage of increased system functionality, correct existing errors with data collection and display, and provide robust communications with the upgraded PLC hardware.
5. Integrate the existing Hach Water Information Management System (WIMS) data with the SCADA historian and reporting applications.

Additional upgrades for SCADA server:

1. Add an alarm historian to allow monitoring of specific alarms to understand if alarms are being repeated and should be addressed, or a one-time alarm that requires immediate action.
2. Add individual user logins to identify who did what and when to facilitate training when the incorrect action had been taken. Additionally, this improves site security as only individuals allowed to log in can make changes to system operations.
3. Follow International Society of Automation (ISA) 101.01 Human Machine Interfaces for Process Automation Systems recommendations for graphics used on SCADA screens.

During the walk around the site, several housekeeping items were identified that will affect equipment lifespans:

1. Network equipment enclosures are located in a couple of rooms. Comparing the switches located within enclosures to those not within enclosures shows a dramatic increase in dirt and dust on the switches. Dirt and dust accumulating within the network equipment will cause overheating conditions and failure of the equipment.
2. Loose network cables could be trip hazards.

3. The pH and flowmeter above the influent are in a highly corrosive environment with no protection for cables or transmitters.
4. Sunshields are highly recommended for all outdoor instrument transmitters not facing north. On one flowmeter, the sunshield was broken off and sitting on the pipe nearby.

The magnesium oxide tank utilizes an ultrasonic level probe that has generated false positive alarms due to condensation buildup on probe head. It is recommended to replace the ultrasonic in locations where there is condensation due to the incorrect readings that occur.

The centrifuge was unable to start in Automatic. Instead, it was started by using a switch installed inline as a workaround, and then after the centrifuge was started, flipping the system back to Auto.

Equipment tagging outside of the biosolids dryer was nonexistent. A site-wide tagging of equipment/instruments/valves is recommended to reduce human errors when an operator is manually operating equipment.

There is a lack of maintenance/storage facility, resulting in insufficient clearance in front of electrical panels. An accumulation of materials exists within the generator room. The generator is moving outdoors, but until such time the room should not be used for storage, nor should flammable materials be stored within the generator rooms.

APPENDIX L

CIP PROJECT SHEET

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-01
Project Title: NW 6th Place West Improvements
Facility Type: Gravity Main
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: This system has a deficiency from MH 10-1-8 and 10-1-6 which must be improved. Model surcharging and manhole flooding at manholes 10-1-8 and 10-1-6 revealed the need for upsizing. To alleviate surcharging, 422 LF of pipe between manholes 10-6-1 and 10-1-11 should be upsized from 8- to 12-inch, 809 LF of pipes from manhole 10-1-11 to 10-1-7 should be upsized from 8-inch to 15-inch, 472 LF of pipes between 10-1-7 to Lower/South Prune Hills wet well should be upsized from 12-inch to 18-inch. This project is a gravity pipeline along NW 6th Place, just upstream of Lower/South Prune Hills Lift Station. This project is primarily driven by existing capacity deficiency during peak wet weather however some infill development provides additional flow at buildout. Therefore, cost has been distributed 25% to future gorwth and 75% existing and matches the split for the South Prune Hill LS capacity project.

Reasoning Capacity Upgrade Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
12-inch diameter	422	LF	$ 300	$ 126,500	$ 38,000	$ 91,500		$256,000
15-inch diameter	809	LF	$ 378	$ 306,000	$ 92,000	$ 222,000		$620,000
18-inch diameter	472	LF	$ 442	$ 208,500	$ 62,500	$ 151,000		$422,000
Total Anticipated Project								$ 1,298,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

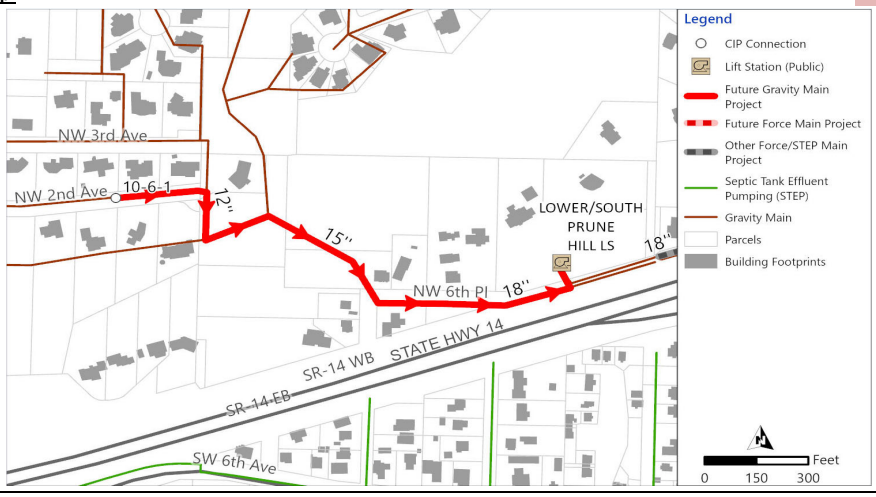
Project Type	Percent	Cost
Growth:	25%	$ 324,500
Upgrade:	75%	$ 973,500
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 1,298,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2034	$ 1,298,000
Total		$ 1,298,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-02
Project Title: NW 6th Place East Improvements
Facility Type: Gravity Main
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: This system has a deficiency from MH 10-1-3 and 10-1-1 which must be improved. Model surcharging and manhole flooding at manholes 10-1-3 and 10-1-1 revealed the need for upsizing. To alleviate surcharging, 682 LF of pipe between manhole 10-1-3 to manhole West Camas wet well should be upsized from 8-inch to 21-inch. This project is a gravity pipeline along NW 6th Place between Lower/South Prune Hills PS and West Camas PS, at an approximate depth of 5 to 10 feet.

Reasoning Capacity Upgrades

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
21-inch diameter	682	LF	$ 504	$ 343,500	$ 103,000	$ 248,500		$695,000

Total Anticipated Project Cost	$ 695,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

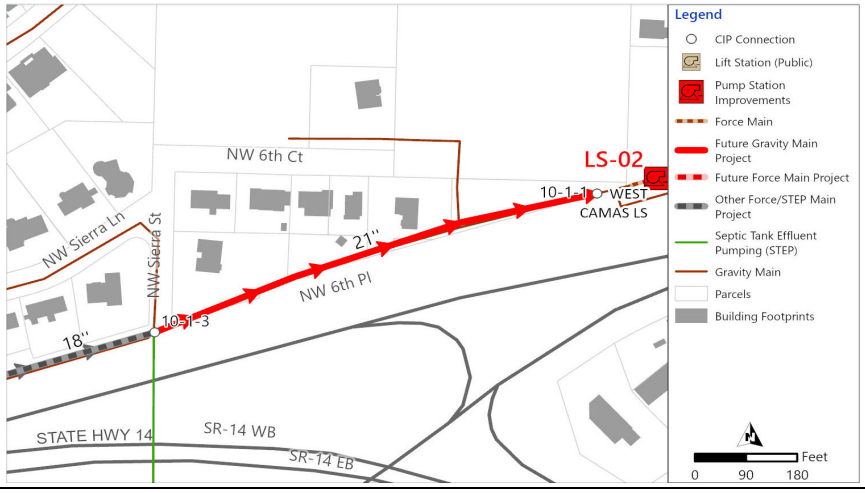
Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 695,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 695,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2032	$ 695,000
Total		$ 695,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-03
Project Title: NW 6th Place Avenue West Improvements
Facility Type: Gravity Main
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: There is a deficiency present and the existing gravity main must be upsized to accommodate growth and stop flooding. Model surcharging and manhole flooding at manholes 1-1-10, 1-1-6, and 1-1-4 revealed the need for upsizing. To alleviate surcharging, 1,943 LF of pipe between manholes 1-1-10 and 2-1-11 should be upsized from 12- to 24-inch, and 592 LF of pipe between manholes 2-1-11 and 2-1-9 should be upsized from 12- to 21-inch. This project is a gravity pipeline along NW 6th Avenue, downstream of the West Camas PS and through Forest Home Park, at an approximate depth of five feet.

Reasoning Capacity Upgrades

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
24-inch diameter	1,943	LF	$ 576	$ 1,119,000	$ 335,500	$ 810,500		$2,265,000
21-inch diameter	592	LF	$ 504	$ 298,500	$ 89,500	$ 216,000		$604,000

Total Anticipated Project	$ 2,869,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

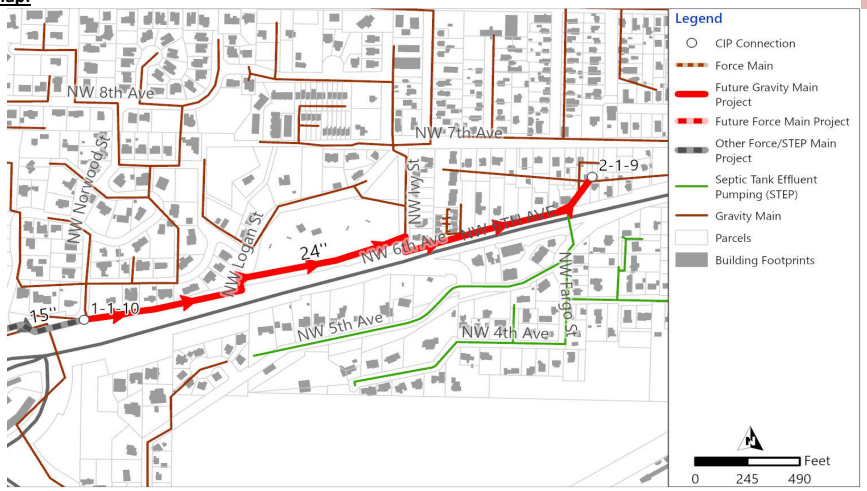
Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 2,869,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 2,869,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2031	$ 2,869,000
Total		$ 2,869,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-04
Project Title: NW 6th Place Avenue East Improvements
Facility Type: Gravity Main
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: Once upstream deficiency areas were improved in NW 6th Place Avenue West Upsize, model surcharging occurred between manholes 2-1-2B and 2-1-2 along NW 6th Avenue. To alleviate surcharging, the proposed pipeline profile between manholes 5-1-5 and 5-1-1 was modified to provide a steeper slope and improve hydraulic conveyance through the relatively flat portion of the existing alignment. The shallow manhole at 5-1-6 should also be evaluated during future project planning and design to determine whether an adjustment to the pipeline profile or manhole invert could provide additional hydraulic benefit. The recommended improvements include upsizing 446 LF of pipe between manhole 3-1-1 and 5-8-1 from 18- to 27-inch, 260 LF of pipe between manhole 5-8-1 and 5-1-12 from 21- to 30-inch, 402 LF of pipe between manhole 2-1-1 and 5-1-12 from 12- to 30-inch, 545 LF between manhole 5-1-12 and manhole 5-1-11 from 21- to 36-inch, 947 LF between manhole 5-1-10 and manhole 5-1-7 from 24- to 36-inch, 1,126 LF of pipe between manhole 5-1-7 and manhole 5-1-2 from 21- to 36-inch, and 34 LF between manhole 5-1-2 and manhole 5-1-1 from 24- to 36-inch. This project is a gravity pipeline along NW 6th Avenue to SE 3rd Avenue upstream of Main Lift Station, at an approximate depth of five feet. Portions of the proposed improvements are located beneath an existing building, and a portion of the proposed alignment crosses an existing railroad. The proposed improvements may also be affected by an existing bridge along the alignment. An alternative alignment analysis was not performed as part of this GSP because future redevelopment and land use changes may affect the presence of the existing building and the feasibility of potential alternative alignments. Additional evaluation should be completed during the future project planning and design phase to determine the feasibility of constructing the proposed pipeline through or adjacent to the existing building, railroad, and bridge. Depending on the condition and structural constraints of the existing bridge, replacement or modification of the bridge may be required to accommodate the proposed improvements. This project is driven by existing capacity deficiency and exacerbated by future growth in the North Shore Area. The cost has been split 50% existing upgrade and 50% future growth similar to Main LS.

Reasoning Capacity Upgrade / Growth

Anticipated Project Cost:

Project Element		Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
27-inch diameter		446	LF	$ 736	$ 328,500	$ 98,500	$ 238,000		$665,000
30-inch diameter		260	LF	$ 896	$ 233,000	$ 70,000	$ 169,000		$472,000
30-inch diameter		402	LF	$ 896	$ 360,000	$ 108,000	$ 261,000		$729,000
36-inch diameter		545	LF	$ 1,204	$ 656,000	$ 197,000	$ 475,000		$1,328,000
36-inch diameter		947	LF	$ 1,204	$ 1,140,000	$ 342,000	$ 826,000		$2,308,000
36-inch diameter		1126	LF	$ 1,204	$ 1,355,500	$ 406,500	$ 982,000		$2,744,000
36-inch diameter		34	LF	$ 1,204	$ 40,900	$ 12,500	$ 29,600		$83,000

Total Anticipated Project Cost	$ 8,329,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	50%	$ 4,164,500
Upgrade:	50%	$ 4,164,500
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 8,329,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 8,329,000
Total		$ 8,329,000

Project Location Map:

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City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-05 **Facility Type:** Gravity Main

Project Title: NW Fargo St, NW 18th Loop, and NW 18th Ave Improvements

Go to CIP Summary Table

Priority: 0-10 years **Project Status (Completed?):** N

Project Description:

Project Description: Model surcharging and manhole flooding between manholes 3-1-33 to 3-1-25 revealed the need for upsizing. To alleviate surcharging, 2,744 LF of pipe between manholes 3-1-26 to 3-1-14 should be upsized from 8- to 15-inch. This project is at a depth of approximately 10 feet.

Reasoning Capacity Upgrades

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
15-inch diameter	2,744	LF	$ 378	$ 1,037,000	$ 311,000	$ 751,000		$2,099,000

Total Anticipated Project Cost	$ 2,099,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 2,099,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 2,099,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2028	$ 2,099,000
Total		$ 2,099,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-06 **Facility Type:** Gravity Main

Project Title: NE Garfield St to NE 15th Ave to NE Franklin St to along the Mill Ditch Improvements

Go to CIP Summary Table

Priority: 10-20 years **Project Status (Completed?):** N

Project Description:

Project Description: There is a deficiency present at manholes 4-2A-1, 4-2-1, 4-1-2, 4-1-1, and 3-2-2, which has revealed the need for upsizing. To alleviate surcharging, 282 LF of pipe between manholes 4-2A-2 to 4-2A-Q should be upsized from 8- to 12-inch, 115 LF of pipe between manholes 4-2A-Q and 4-2A-1 from 8- to 15-inch, 795 LF of pipe between manholes 4-2A-1 and 4-2-2 from 8- to 18-inch, 427 LF of pipe between manhole 4-2-2 and 4-2-1 from 8- to 24-inch, 256 LF of pipe between manholes 4-2-1 and 4-1-2 from 8- to 27-inch, 254 LF of pipe between manholes 4-1-2 and 4-1-1 from 21- to 30-inch, 158 LF of pipe between manholes 4-1-1 and 3-2-6 from 21- to 30-inch, and 347 LF of pipe between manholes 4-1-1 and 3-2-4 from 15- to 36-inch. This project is a gravity pipeline along Division Street between NW 18th and 11th Avenue, at an approximate depth of 10 feet.

Reasoning Capacity Upgrades

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
12-inch diameter	282	LF	$ 300	$ 84,600	$ 25,500	$ 60,900		$171,000
15-inch diameter	115	LF	$ 378	$ 43,500	$ 13,000	$ 31,500		$88,000
18-inch diameter	795	LF	$ 442	$ 351,500	$ 105,500	$ 255,000		$712,000
24-inch diameter	427	LF	$ 576	$ 246,000	$ 74,000	$ 178,000		$498,000
27-inch diameter	256	LF	$ 736	$ 188,500	$ 56,500	$ 137,000		$382,000
30-inch diameter	254	LF	$ 896	$ 227,500	$ 68,500	$ 165,000		$461,000
36-inch diameter	158	LF	$ 1,204	$ 190,000	$ 57,000	$ 138,000		$385,000
Total Anticipated Project Cost								$ 2,697,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 2,697,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 2,697,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2037	$ 2,697,000
Total		$ 2,697,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-07
Project Title: Lower/South Prune Hill Force Main Improvements
Facility Type: Gravity Main
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The Lower/South Prune Hill Lift Station captures flows from the eastern side of the City's gravity collection system. Based on the modeled flows to the Lift Station wet well, the existing force main diameter is unable to convey flows, producing velocities that exceed the 8 feet per second criteria under both existing and 20-year conditions. To address this deficiency, upsizing 925 LF of the force main from South Prune Hill wet well to manhole 10-1-3 must occur to reduce velocity below the criteria. This project is split 25% future growth and 75% existing upgrade similar to the South Prune Hill LS.

Reasoning Capacity Upgrade / Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
18-inch diameter	925	inch-dia	$ 442	$ 409,000	$ 122,500	$ 296,500		$828,000

Total Anticipated Project Cost	$ 828,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	25%	$ 207,000
Upgrade:	75%	$ 621,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 828,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2033	$ 828,000
Total		$ 828,000

Project Location Map:

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City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-08
Project Title: West Camas Lift Station Force Main Improvements
Facility Type: Gravity Main
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The West Camas Force Main faces a deficiency between West Camas Wet Well and manhole 1-1-10. To address this deficiency, approximaely 574 LF of the existing 6-inch asbestos cement force main should be removed and replaced with a 15-inch force main.

Reasoning Capacity Upgrades

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
15-inch diameter	574	inch-dia	$ 478	$ 274,500	$ 82,500	$ 199,000		$556,000

Total Anticipated Project Cost	$ 556,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 556,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 556,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2031	$ 556,000
Total		$ 556,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

carollo

Project ID: P-09 **Facility Type:** Gravity Main

Project Title: Main Lift Station Dual Force Main Improvements

Go to CIP Summary Table

Priority: 0-10 years **Project Status (Completed?):** N

Project Description:

Project Description: The Main Lift Station captures flows from the majority of the system, except the STEP Basin and Flow Meter 8-1-2. Based on the modeled flows to the Lift Station wet well, the existing force main is unable to convey flows under both existing and 20-year conditions, resulting in velocities that exceed the 8 feet per second criterion. To address this deficiency, approximately 2,348 LF of the proposed 21-inch force main should be installed between the Main Lift Station wet well and the WWTF. The replacement force main will require a river crossing as part of the installation. This project is split 50% future growth and 50% existing capacity deficiency to match the Main LS capacity project.

Reasoning Capacity Upgrades / Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
21-inch diameter	448	inch-dia	$ 504	$ 226,000	$ 68,000	$ 164,000		$458,000

Total Anticipated Project	$ 458,000

Notes on Cost Estimation:

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Cost Allocation:

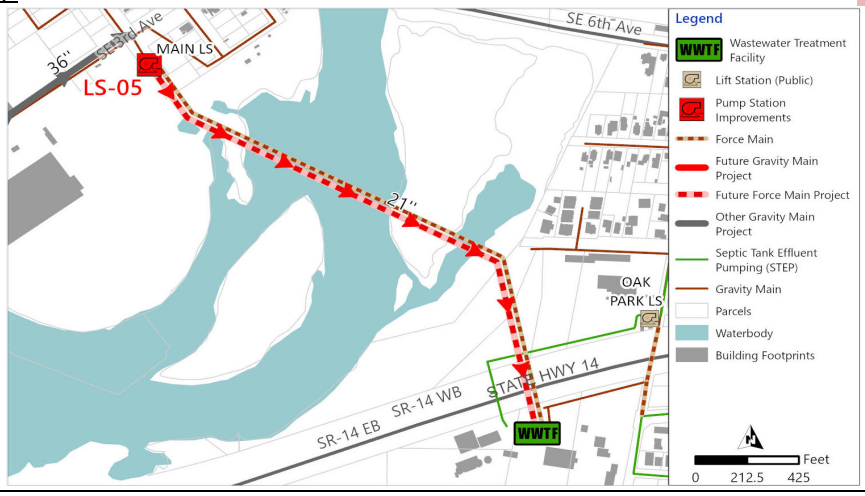
Project Type	Percent	Cost
Growth:	50%	$ 229,000
Upgrade:	50%	$ 229,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 458,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 458,000
Total		$ 458,000

Project Location Map:

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City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-10
Facility Type: Gravity Main
Project Title: Leadbetter Rd Lift Station Dual Force Main Improvements
Priority: 10-20 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The Leadbetter Rd Lift Station captures all the flows from the North Shore area. Based on the modeled flows to the Lift Station wet well, the existing single 8-inch force main diameter is too small to convey these flows, producing velocities that exceed the 8 feet per second criteria under 20-year system conditions. Installing a 6,500 LF parallel 10-inch force main between Node_161 and Node_27 is needed to reduce velocity below the criteria. The proposed force main alignment follows NE Everett St. and will cross an existing bridge along the route. The bridge crossing and existing roadway conditions may present construction challenges and should be further evaluated during the project planning and design phase. The project cost estimate includes the cost associated with installing the proposed force main across the existing bridge.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
10-inch diameter	6,500	inch-dia	$ 268	$ 1,742,000	$ 522,500	$ 1,261,500		$3,526,000

Total Anticipated Project Cost	$ 3,526,000

Notes on Cost Estimation:

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Cost Allocation:

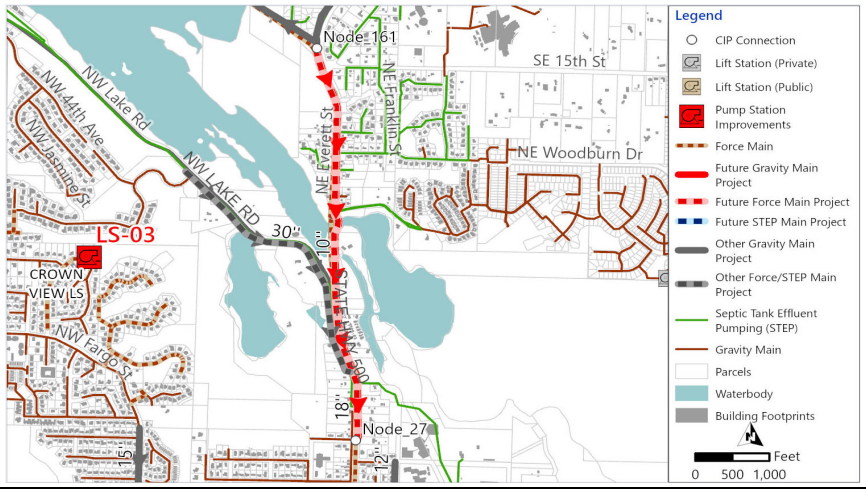
Project Type	Percent	Cost
Growth:	100%	$ 3,526,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 3,526,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2041	$ 3,526,000
Total		$ 3,526,000

Project Location Map:

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City of Camas
General Sewer Plan
Capital Improvement Plan

carollo

Project ID: P-11
Project Title: Division Street Improvements

Facility Type: Gravity Main

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: Model surcharging and manhole flooding between manholes 3-1-11 to 3-1-10, and 3-1-6 revealed the need for upsizing. To alleviate surcharging, 827 LF of pipe between manholes 3-1-14 and 3-1-11 from 8- to 15-inch, 505 LF of pipe between manholes 3-1-11 and 3-1-9 from 8- to 21-inch, and 1,526 LF of pipe between manhole 3-1-9 and 3-1-2 from 8- to 18-inch. This project is at a depth of approximately 10 feet.

Reasoning Capacity Upgrades

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
15-inch diameter	827	LF	$ 378	$ 312,500	$ 94,000	$ 226,500		$633,000
21-inch diameter	505	LF	$ 504	$ 254,500	$ 76,500	$ 184,000		$515,000
18-inch diameter	1,526	LF	$ 442	$ 674,500	$ 202,500	$ 489,000		$1,366,000

Total Anticipated Project	$ 2,514,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 2,514,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 2,514,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2032	$ 2,514,000
Total		$ 2,514,000

Project Location Map:

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City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-12
Project Title: SE Everett Rd to Leadbetter Rd Extension
Facility Type: Gravity Main
Priority: 10-20 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: Extend the existing sanitary sewer system to serve planned development within the project area. The project will provide sewer infrastructure and capacity necessary to accommodate future development and connect the proposed development to the existing public sewer system. Project timing and implementation will be driven by development needs and coordinated with the developer.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
8-inch diameter	2,031	LF	$ 236	$ 479,500	$ 144,000	$ 347,500		$971,000
12-inch diameter	692	LF	$ 300	$ 207,500	$ 62,500	$ 150,000		$420,000
18-inch diameter	6,036	LF	$ 442	$ 2,668,000	$ 800,500	$ 1,932,500		$5,401,000

Total Anticipated Project	$ 6,792,000

Notes on Cost Estimation:

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Cost Allocation:

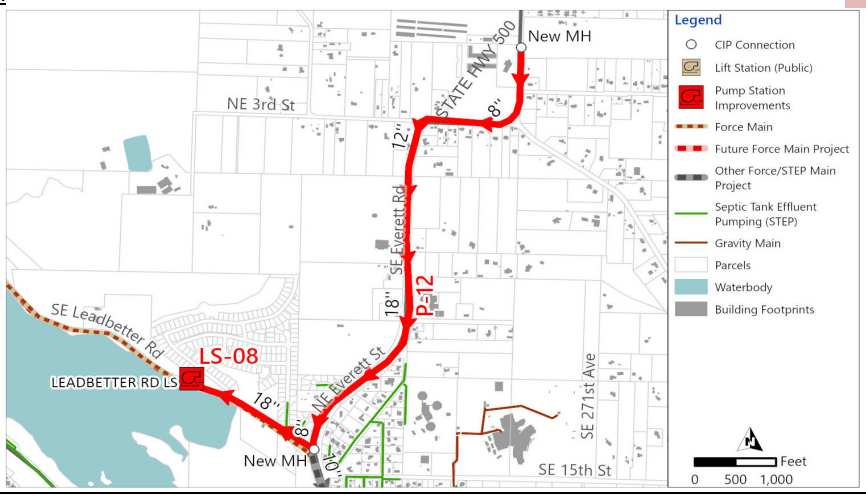
Project Type	Percent	Cost
Growth:	100%	$ 6,792,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 6,792,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2045	$ 6,792,000
Total		$ 6,792,000

Project Location Map:

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City of Camas
General Sewer Plan
Capital Improvement Plan

carollo

Project ID: P-13
Project Title: SE 283rd Ave to NE Woodburn Dr Extension
Facility Type: Gravity Main
Priority: 10-20 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: Extend the existing sanitary sewer system to serve planned development within the project area. The project will provide sewer infrastructure and capacity necessary to accommodate future development and connect the proposed development to the existing public sewer system. Project timing and implementation will be driven by development needs and coordinated with the developer.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
12-inch diameter	6,782	LF	$ 300	$ 2,034,500	$ 610,500	$ 1,474,000		$4,119,000

Total Anticipated Project	$ 4,119,000

Notes on Cost Estimation:

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Cost Allocation:

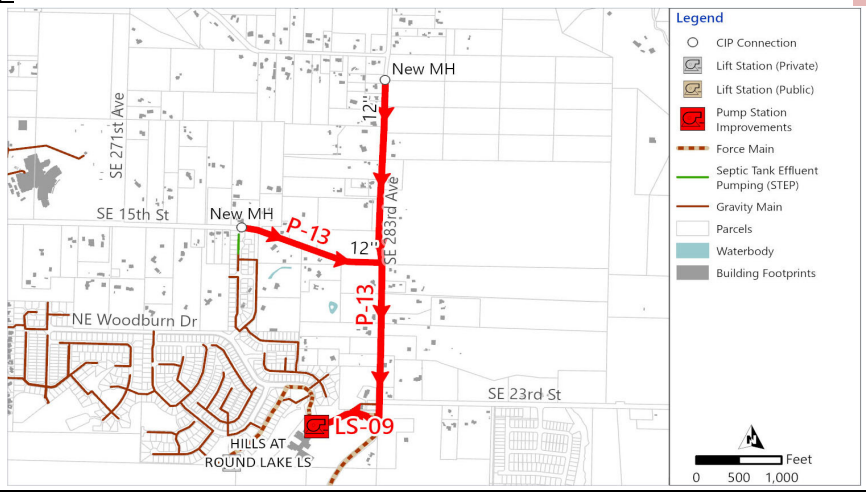
Project Type	Percent	Cost
Growth:	100%	$ 4,119,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 4,119,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2045	$ 4,119,000
Total		$ 4,119,000

Project Location Map:

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City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: S-01 **Facility Type:** STEP Main
Project Title: NW Parker St to NW Lake Rd STEP Main Improvements

Go to CIP Summary Table

Priority: 10-20 years **Project Status (Completed?):** N

Project Description:

Project Description: The NW Parker St to NW Lake Rd STEP Main captures all the flows in STEP Basin areas from NW Parker St and NW Lake Rd . Based on the modeled flows and velocity results, the existing 21- and 24-inch STEP main diameters are unable to convey these flows, producing higher hydraulic grade line under the 20-year system conditions. To address these deficiencies, a parallel STEP main will be installed. The proposed improvement consist of installing approximately 14,002 LF of 30-inch pipe from Node 9 to Node J176 and 4,061 LF of 30-inch pipe from Node 13 to Node 15. The STEP Main is reaching the end of it's useful life and the City is beginning to construct new segments to address age. The new pipe will be sized to accomodate future growth. Therefore, this project is assigned 50% future growth and 50% age and condition based replacement.

Reasoning Growth and Age/Condition

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
30-inch diameter	14,002	LF	$ 896	$ 12,546,000	$ 3,764,000	$ 9,088,000		$25,398,000
30-inch diameter	4,061	LF	$ 896	$ 3,638,500	$ 1,091,500	$ 2,636,000		$7,366,000

Total Anticipated Project	$ 32,764,000

Notes on Cost Estimation:

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Cost Allocation:

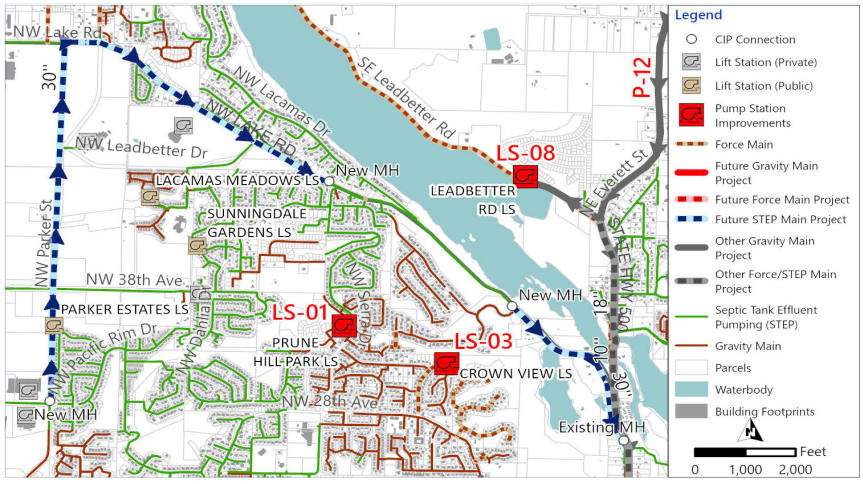
Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 32,764,000
General:		
R&R:	0%	$ -
Total Anticipated Project	100%	$ 32,764,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2038	$ 32,764,000
Total		$ 32,764,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

carollo

Project ID: LS-01 **Facility Type:** Lift Station
Project Title: Lower/South Prune Hill Lift Station Improvements

Go to CIP Summary Table

Priority: 0-10 years **Project Status (Completed?):** N

Project Description:

Project Description: The existing lift station is right off of NW 6th Pl. in a residential area and directly west of the entrance to NW Sierra Ln. The current station connects to a 10-inch force main.The Lower/South Prune Hills Lift Station captures flows from the Southwest portion of the system. Based on the modeled flows to the lift station wet well, the lift station receives more peak wet weather flow (PWWF) than its firm capacity during

Reasoning Capacity Upgrade / Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Lower/South Prune Hill Lift Station	3.00	MGD	$ 2,425,167	$ 2,425,167	$ 727,500	$ 1,914,333		$5,067,000
Odor Control	1.00	EA	$ 150,000	$ 150,000	$ 45,000	$ 119,000		$314,000

Total Anticipated Project	$ 5,381,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	25%	$ 1,345,250
Upgrade:	75%	$ 4,035,750
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 5,381,000

Project Timing:

Project Element	Timing	Cost
Partial Project	2033	$ 2,690,500
Partial Project	2033	$ 2,690,500
Total		$ 5,381,000

Go to Maps Tab

Project Location Map:



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: LS-02
Project Title: West Camas Lift Station Improvements
Facility Type: Lift Station
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The existing lift station is next to a roundabout and sits along NW 6th place. The existing inrastrucutre PWWF's are constricted. The current system connects to a 6-inch force main. The West Camas Lift Station captures flows from the Southwest portion of the system and is just downstream of the Lower/South Prune Hills LS. Based on the modeled flows to the lift station wet well, the lift station receives more PWWF

Reasoning Capacity Upgrade

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
West Camas Lift Station Improvements	3.30	MGD	$ 2,490,700	$ 2,490,700	$ 747,000	$ 1,966,300		$5,204,000

Total Anticipated Project	$ 5,204,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

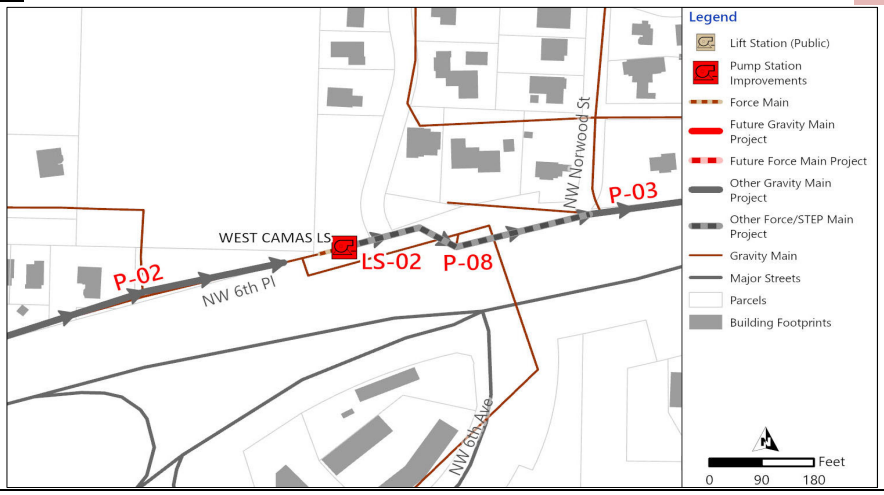
Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 5,204,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 5,204,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2031	$ 5,204,000
Total		$ 5,204,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

carollo

Project ID: LS-03
Project Title: Crown View Lift Station Improvements
Facility Type: Lift Station
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: Crown View Lift Station currently has 2 pumps and connects to a 6-inch force main. It is not able to serve existing system PWWF and will not be able to serve 20-year and buildout PWWF. This system is located right next to intersection of NW 32nd St and NW Kent St at the end of a cul de sac. Based on the modeled flows to the lift station wet well, the lift station receives more PWWF than its firm capacity during existing and 20-

Reasoning Capacity Upgrade

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Crown View Lift Station Improvements	1.00	MGD	$ 2,053,000	$ 2,053,000	$ 616,000	$ 1,621,000		$4,290,000

Total Anticipated Project	$ 4,290,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 4,290,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 4,290,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2034	$ 4,290,000
Total		$ 4,290,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: LS-04 **Facility Type:** Lift Station

Project Title: Lacamas Creek Lift Station Improvements

Priority: 10-20 years **Project Status (Completed?):** N

Go to CIP Summary Table

Project Description:

Project Description: The Lacamas Creek Lift Station captures the flow from the Hills at Round Lake Lift Station and a small portion of the eastern portion of the system. Based on the modeled flows to the Lift Station wet well, the lift station receives more PWWF than its firm capacity during 20-year and build-out conditions. The station's firm capacity needs to convey more than its current firm capacity from 1.37 MGD to 2.13 MGD. Replacing its

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Lacamas Creek Lift Station Improvements	2.1	MGD	$ 584,525	$ 584,525	$ 175,500	$ 461,975		$1,222,000

Total Anticipated Project	$ 1,222,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

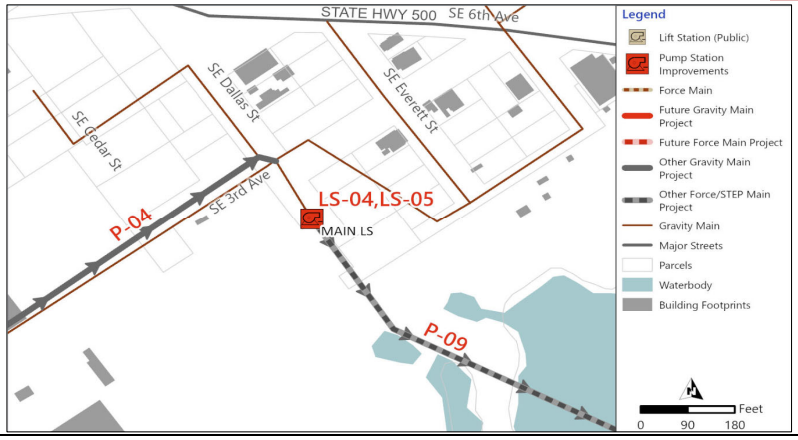
Project Type	Percent	Cost
Growth:	100%	$ 1,222,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 1,222,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2045	$ 1,222,000
Total		$ 1,222,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

carollo

Project ID: LS-05
Project Title: Main Lift Station Improvements
Facility Type: Lift Station
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The existing Main Lift Station has three pumps and is connected to an existing 18-inch force main. The station receives flows from the majority of the system, with the exception of Flow Monitoring Basin 8-1-2 and the STEP/WWTF, and is located immediately upstream of the WWTF. Existing infrastructure PWWF capacity is constrained. While the existing and 20-year PWWF are below the existing firm capacity, the station does not

Reasoning Capacity Upgrade / Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Main Lift Station Improvements	21.0	MGD	$ 4,942,444	$ 4,942,444	$ 1,482,500	$ 3,901,056		$10,326,000

Total Anticipated Project	$ 10,326,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

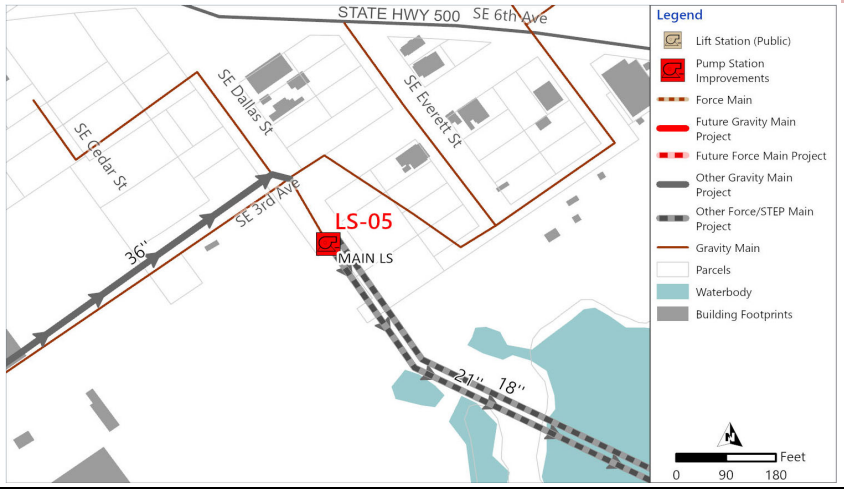
Project Type	Percent	Cost
Growth:	50%	$ 5,163,000
Upgrade:	50%	$ 5,163,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 10,326,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2029	$ 10,326,000
Total		$ 10,326,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

carollo

Project ID: LS-06
Project Title: Goodwin Rd Lift Station Improvements
Facility Type: Lift Station
Priority: 10-20 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The Goodwin Lift Station captures flows from the northern portion of the North Shore area of the system. Based on the modeled flows to the Lift Station wet well, the lift station receives more PWWF than its firm capacity during the 20-year conditions. The station's firm capacity needs to convey more than its current firm capacity from 0.49 MGD to 0.71 MGD. Adding an additional 3rd pump to the station are recommended in the

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Goodwin Rd Lift Station Improvements	0.49	MGD	$ 240,000	$ 240,000	$ 72,000	$ 190,000		$502,000
Total Anticipated Project								$ 502,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

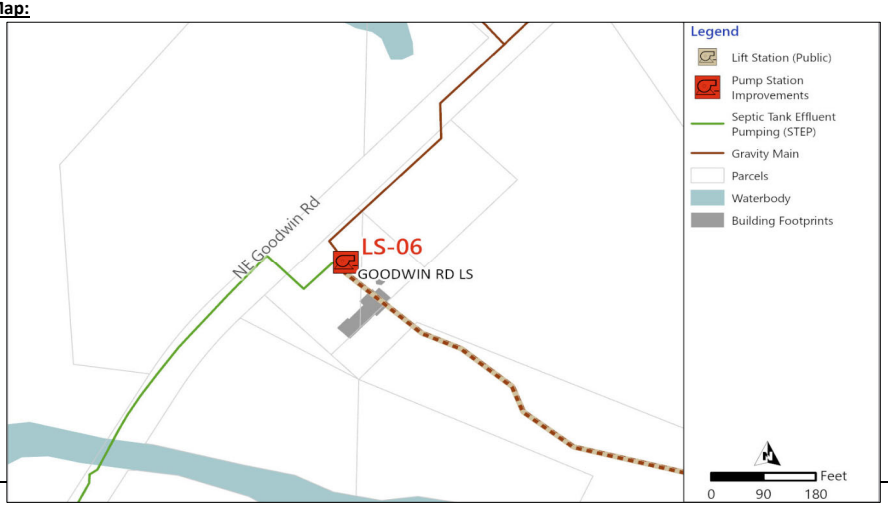
Project Type	Percent	Cost
Growth:	100%	$ 502,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 502,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2043	$ 502,000
Total		$ 502,000

Go to Maps Tab

Project Location Map:



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: LS-07
Project Title: 232nd Ave Lift Station Improvements
Facility Type: Lift Station
Priority: 10-20 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The existing lift station infrastructure is constricted. There are currently two pumps but there is room for a third pump. Demand is expected to grow and Lift Station capacity will need to be increased. The 232nd Ave Lift Station captures flows from the Goodwin Lift Station. Based on the modeled flows to the Lift Station wet well, the Lift Station receives more PWWF than its firm capacity during existing and 20-year conditions. The

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
232nd Ave Lift Station	0.53	MGD	$ 240,000	$ 240,000	$ 72,000	$ 190,000		$502,000

Total Anticipated Project	$ 502,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

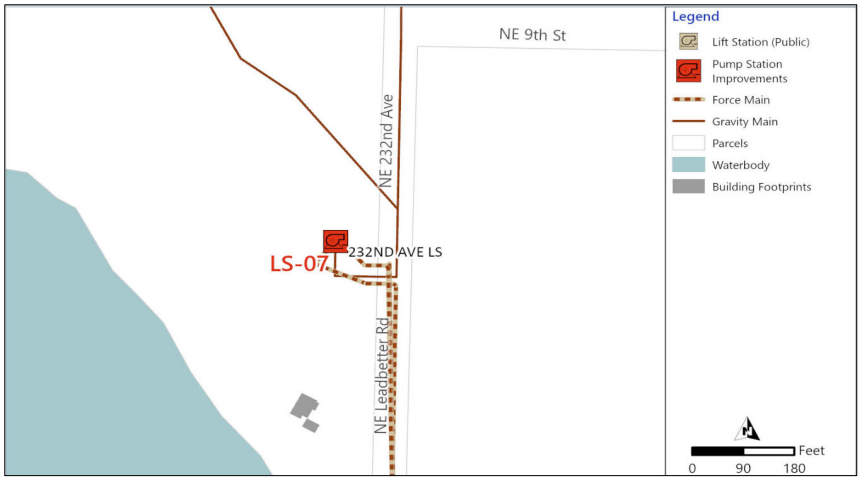
Project Type	Percent	Cost
Growth:	100%	$ 502,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 502,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2042	$ 502,000
Total		$ 502,000

Go to Maps Tab

Project Location Map:



City of Camas
General Sewer Plan
Capital Improvement Plan

carollo

Project ID: LS-08
Project Title: Leadbetter Rd Lift Station Improvements
Facility Type: Lift Station
Priority: 10-20 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The lift station does not have sufficient capacity for existing system PWWF and will remain capacity-constrained under 20-year and buildout PWWF conditions. The current station has two pumps, with space available for a third pump and a dual force main. The Leadbetter Rd Lift Station captures flows from the 232nd Ave Lift Station. Based on modeled flows to the lift station wet well, the station receives more PWWF than its firm

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Leadbetter Rd Lift Station Improvements	0.87	MGD	$ 240,000	$ 240,000	$ 72,000	$ 190,000		$502,000
Leadbetter Rd Lift Station Improvements	1.82	MGD	$ 898,350	$ 898,350	$ 269,500	$ 709,150		$1,877,000

Total Anticipated Project	$ 2,379,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

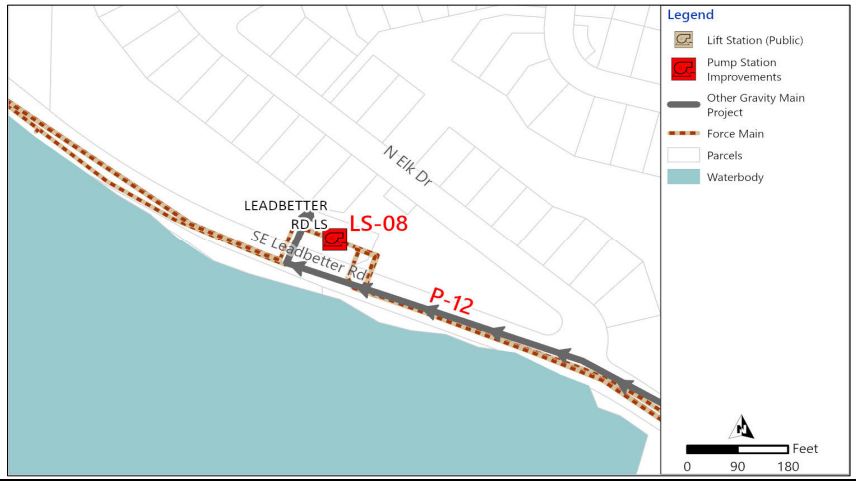
Project Type	Percent	Cost
Growth:	100%	$ 2,379,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 2,379,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2041	$ 2,379,000
Total		$ 2,379,000

Go to Maps Tab

Project Location Map:



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: LS-09 **Facility Type:** Lift Station
Project Title: Hills at Round Lake Lift Station Improvements

Go to CIP Summary Table

Priority: 10-20 years **Project Status (Completed?):** N

Project Description:

Project Description: The Hills at Round Lake Lift Station captures flows from the northeastern portion of the system. Based on the modeled flows to the Lift Station wet well, the lift station receives more PWWF than its firm capacity during 20-year and build-out conditions. The station's firm capacity needs to convey more than its current firm capacity from 0.96 MGD to 1.21 MGD. Replacing its pumps in this station are recommended in the long-term.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Hills at Round Lake Lift Station Improvements	1	MGD	$ 720,000	$ 720,000	$ 216,000	$ 568,000		$1,504,000

Total Anticipated Project	$ 1,504,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

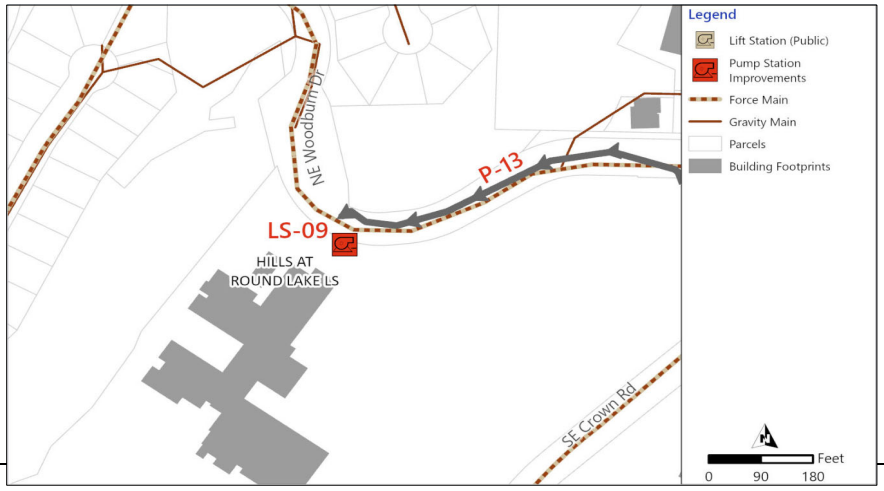
Project Type	Percent	Cost
Growth:	100%	$ 1,504,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 1,504,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2044	$ 1,504,000
Total		$ 1,504,000

Go to Maps Tab

Project Location Map:



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: G-01
Project Title: Basin 4-1-3 Pilot I/I Study
Facility Type: General
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: This program will investigate the source and magnitude of inflow and infiltration (I&I) of storm and groundwater into the wastewater system at locations where suspected high I&I is currently or is forecast to exceed conveyance and/or Lift Station capacity. Identifying and removing non-sewage flow where that would reduce surcharging such that costly capacity improvements might be avoided.

Reasoning Study

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Basin 4-1-3 Pilot I/I Study	1	ea	$ 200,000	$ 200,000	-	-		$200,000

Total Anticipated Project Cost	$ 200,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

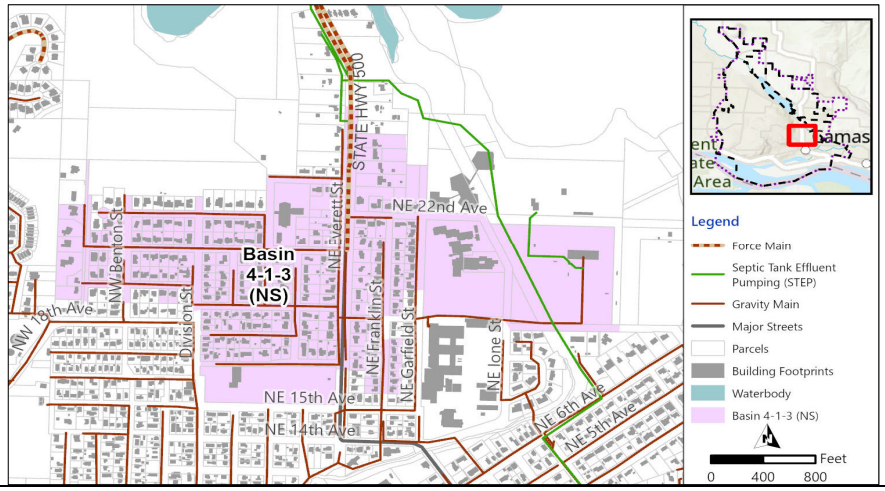
Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	100%	$ 200,000
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 200,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2027	$ 200,000
Total		$ 200,000

Go to Maps Tab

Project Location Map:



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: G-02
Project Title: Basin 5-1-2 Flow Monitoring
Facility Type: General
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: This project is to install temporary flow meters in Basin 5-1-2 to capture flows from the Camas LS and Upper Prune Hill contributing areas separately. Both areas have pipe and LS capacity deficiencies and additional flow monitoring within this basin would help to understand if part of the basin is contributing a greater portion of I&I. This study should evaluate if projects within the basin have the potential to reduce I&I such that projects to increase hydraulic capacity within

Reasoning Study

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Basin 5-1-2 Flow Monitoring	1	ea	$ 250,000	-	-	-		$250,000

Total Anticipated Project Cost	$ 250,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

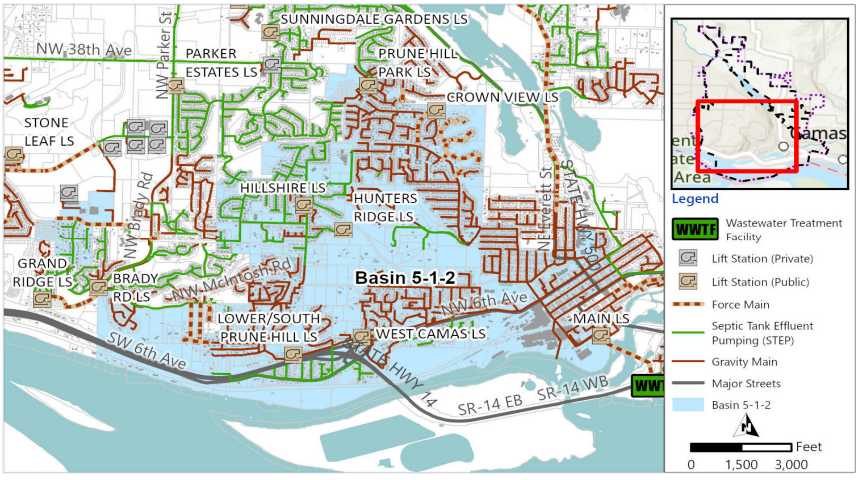
Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	100%	$ 250,000
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 250,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2027	$ 250,000
Total		$ 250,000

Go to Maps Tab

Project Location Map:



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: G-03
Project Title: Geographic Information System (GIS)
Facility Type: General
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: This program will implement ongoing enhancements to the Geographic Information System (GIS), including asset mapping, data collection, database maintenance, and integration with utility management systems. Maintaining accurate and up-to-date spatial information will improve infrastructure planning, field operations, emergency response, and asset management while supporting informed decision-making and efficient delivery of utility services.

Reasoning General

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Geographic Information System (GIS)	1	ea	$ 200,000	$ 200,000	-	-		$200,000

Total Anticipated Project Cost	$ 200,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	100%	$ 200,000
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 200,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2027	$ 200,000
Total		$ 200,000

Go to Maps Tab

Project Location Map:
N/A - Systemwide

City of Camas
General Sewer Plan
Capital Improvement Plan

carollo

Project ID: G-04
Project Title: Hydraulic Modeling
Facility Type: General
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The City's collection system model is heavily skeletonized, only 28 percent of the City's collection system pipes are included. A full pipe or less skeletonized model is needed for a more robust evaluation of the system. In order to expand the model, accurate and updated GIS for the collection system should be developed.

Reasoning Study

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Hydraulic Modeling	1	ea	$ 75,000	$ 75,000	-	-		$75,000

Total Anticipated Project Cost	$ 75,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	100%	$ 75,000
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 75,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2029	$ 75,000
Total		$ 75,000

Go to Maps Tab

Project Location Map:
N/A - Treatment Plant

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: G-05
Project Title: Electrical System Arc Flash Study
Facility Type: General
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: No arc flash labels were found on the plant's distribution equipment, and the owner confirmed that an Electrical System Study is not maintained. Carollo recommends completing this study as soon as possible and applying arc flash labels in accordance with Occupational Safety and Health Administration requirements to ensure worker safety.

Reasoning Study

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Electrical System Arc Flash Study	1	ea	$ 50,000	$ 50,000	-	-		$50,000
Total Anticipated Project Cost								$ 50,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	100%	$ 50,000
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 50,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2027	$ 50,000
Total		$ 50,000

Go to Maps Tab

Project Location Map:
N/A - Treatment Plant

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: G-06
Project Title: Hazardous Area Classification Study
Facility Type: General
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: To ensure regulatory compliance, and safety, Carollo recommends conducting a hazardous area classification study per NFPA 820 and upgrading any areas that do not meet code.

Reasoning Study

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
2034 Hazardous Area Classification Study	-	1	$ 700,000	$ 700,000	-	-		$700,000
2044 Hazardous Area Classification Study	-	1	$ 700,000	$ 700,000	-	-		$700,000

Total Anticipated Project Cost	$ 1,400,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	100%	$ 1,400,000
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 1,400,000

Project Timing:

Project Element	Timing	Cost
First General Sewer Plan	2027	$ 700,000
Second General Sewer Plan	2045	$ 700,000
Total		$ 1,400,000

Go to Maps Tab

Project Location Map:

N/A - Systemwide

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: G-07
Project Title: Flood Risk Assessment
Facility Type: General
Priority: 0-10 years
Project Status (Completed?):

Go to CIP Summary Table

Project Description:

Project Description: This project is a comprehensive flood risk analysis for all major electrical and control systems to assess vulnerabilities and strengthen flood resilience at the WWTF.

Reasoning Study

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
2034 Flood Risk Assessment	-	1	$ 700,000	$ 700,000	-	-		$700,000
2044 Flood Risk Assessment	-	1	$ 700,000	$ 700,000	-	-		$700,000

Total Anticipated Project Cost	$ 1,400,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	100%	$ 1,400,000
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 1,400,000

Project Timing:

Project Element	Timing	Cost
First General Sewer Plan	2027	$ 700,000
Second General Sewer Plan	2045	$ 700,000
Total		$ 1,400,000

Go to Maps Tab

Project Location Map:

N/A - Systemwide

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: G-08
Project Title: General Sewer Plan
Facility Type: General
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: Occurs two times over the 20-year planning horizon, with each occurrence assumed to take place approximately 10 years apart. For the purposes of this GSP, the occurrences are assumed to occur in 2035 and 2045.

Reasoning General

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
2035 General Sewer Plan	-	1	$ 700,000	$ 700,000	-	-		$700,000
2045 General Sewer Plan	-	1	$ 700,000	$ 700,000	-	-		$700,000

Total Anticipated Project Cost	$ 1,400,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	100%	$ 1,400,000
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 1,400,000

Project Timing:

Project Element	Timing	Cost
First General Sewer Plan	2035	$ 700,000
Second General Sewer Plan	2045	$ 700,000
Total		$ 1,400,000

Go to Maps Tab

Project Location Map:
N/A - Systemwide

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-01
Project Title: Parshall Flume Replacement
Facility Type: Treatment Plant
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: Replace existing Parshall Flume with new Parshall Flume (higher capacity) and structural modification to prevent spraying of the influent wastewater during peak flow events. Cost is split between growth and upgrade because the parshall flume needs to be modified to address existing process issues and it needs to be a larger size to accomodate growth-driven future peak wet weather.

Reasoning Existing and future growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Top Slab Demolition	2.1	CY	$ 560.00	$ 1,200.00	$ 400.00	$ 1,000		$2,600
Wall Demolition	9.4	CY	$ 560.00	$ 5,300.00	$ 1,600.00	$ 4,100		$11,000
Foundation Slab	1.7	CY	$ 560.00	$ 1,000.00	$ 300.00	$ 800		$2,100
Influent Channel Wall	2.5	CY	$ 3,000.00	$ 7,500.00	$ 2,300.00	$ 6,200		$16,000
Influent Channel Walls	6.5	CY	$ 1,800.00	$ 11,500.00	$ 3,500.00	$ 9,000		$24,000
Influent Channel	9.5	CY	$ 3,000.00	$ 28,500.00	$ 8,600.00	$ 22,900		$60,000
Excavation and Backfill	95.0	CY	$ 225.00	$ 21,500.00	$ 6,500.00	$ 17,000		$45,000
Guardrail Demolition	8.0	LF	$ 110.00	$ 900.00	$ 300.00	$ 800		$2,000
New Guardrail	8.0	LF	$ 225.00	$ 1,800.00	$ 500.00	$ 1,400		$3,700
Parshall Flume Shoring Elevated Slab	1.0	LS	$ 22,500.00	$ 22,500.00	$ 6,800.00	$ 17,700		$47,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 30,500.00	$ 9,200.00	$ 24,300		$64,000
Total Anticipated Project								$ 277,400

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	50%	$ 138,700
Upgrade:	50%	$ 138,700
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 277,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2029	$ 277,400
Total		$ 277,400

Project Location Map:
N/A

Go to Maps Tab

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-02
Project Title: Primary Clarifier Bypass

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: Add a Bypass around Existing Primary Clarifiers. Add a weir, dropbox, and piping as needed to construct a bypass around the primary clarifiers. This bypass will direct all flows greater than the maximum day flows around the primary clarifiers. The driver for this project is growth, predominantly occuring from development in the North Shore area.

Reasoning Future PWWF driven

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Install a new 30-inch bypass around the Primary Clarifiers No. 1 and 2	220.0	LF	$ 897	$ 200,000	$ 60,000	$ 158,000		$418,000
Structural modifications and installation of weir gates at Plant Headworks Effluent	1.0	LS	$ 112,500	$ 112,500	$ 34,000	$ 88,500		$235,000
Additional Site Work	25.0	%	N/A	$ 78,100	$ 23,500	$ 61,400		$163,000
Total Anticipated Project Cost								$ 816,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 816,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 816,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 816,000
Total		$ 816,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

carollo

Project ID: TP-03
Project Title: Aeration Basin Flow Splitter Box

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: Construct new Aeration Basin Influent Flow Splitter Box.This is a new structure to provide adequate mixing and even split of flow to the aeration basins. It should also be designed to address the issue of very little head available between the primary clarifier and aeration basins. The improvements include an 18-inch foundation slab, 12-inch-thick walls, new guardrails and aluminum grating, and associated excavation and backfill. New 60-inch by 30-inch and 24-inch by 24-inch stainless steel slide gates will be provided to control flows through the splitter box. The project also includes demolition of the existing Aeration Basin Flow Splitter Box, temporary pumping and piping during construction, installation of piping to and from the new splitter box, and additional site work as needed to complete the improvements. This project is timed to align with TP-02.

Reasoning Addresses existing peak event capacity issues and issues with mixing

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
18" Floundation Slab	32.0	CY	$ 975	$ 31,000	$ 9,300	$ 24,700		$ 65,000
12" Thick Wall	61.0	CY	$ 1,800	$ 110,000	$ 33,000	$ 87,000		$ 230,000
New Guardrail	116.0	LF	$ 225	$ 26,000	$ 7,800	$ 20,200		$ 54,000
Aluminum Grating	777.0	SF	$ 113	$ 88,000	$ 26,500	$ 69,500		$ 184,000
Excavation and Backfill	167.0	CY	$ 225	$ 37,500	$ 11,500	$ 30,000		$ 79,000
60" x 30" SS Slide Gate	4.0	LS	$ 32,799	$ 131,000	$ 39,500	$ 103,500		$ 274,000
24" x 24" SS Slide Gate	3.0	LS	$ 16,183	$ 48,500	$ 14,500	$ 39,000		$ 102,000
Demolition of Existing Aeration Basin Flow Splitter Box	1.0	LS	$ 75,000	$ 75,000	$ 22,500	$ 59,500		$ 157,000
Temporary Pumping/Piping during construction	1.0	LS	$ 112,500	$ 112,500	$ 34,000	$ 88,500		$ 235,000
Piping to New Aeration Basin Flow Splitter Box	200.0	LF	$ 897	$ 179,500	$ 54,000	$ 142,500		$ 376,000
Piping From New Aeration Basin Flow Splitter Box	400.0	LF	$ 897	$ 358,500	$ 107,500	$ 283,000		$ 749,000
Installation	25.0	%	N/A	$ 299,400	$ 90,000	$ 236,600		$ 626,000
Additional Site Work	15.0	%	N/A	$ 179,600	$ 54,000	$ 142,400		$ 376,000
Total Anticipated Project Cost								$ 3,507,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 3,507,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 3,507,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 3,507,000
Total		$ 3,507,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-04
Project Title: Replace Screens and Slide Gates

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes replacement of the existing screens and slide gates at the WWTF Headworks to improve the reliability and operation of the screening process. The improvements include replacement of the existing screens/washer compactors with new units and installation of new 66-inch by 48-inch, 66-inch by 36-inch, and 72-inch by 36-inch stainless steel slide gates. The project also includes associated installation, electrical, instrumentation, and controls improvements, as well as additional site work required to complete the improvements. This project is split between growth and R&R becuase componensts of the plant headworks should be replaced because it is near the end of it's useful life and capacity increased to address growth-driven future peak flows to the plant.

Reasoning Growth driven capacity issues and age/condition

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Replace existing screens/washer compactors with new	1.0	LS	$ 568,000	$ 570,000	$ 171,000	$ 450,000		$1,191,000
66" x 48" SS Slide Gate	2.0	LS	$ 26,161	$ 52,300	$ 15,500	$ 41,200		$109,000
66" x 36" SS Slide Gate	2.0	LS	$ 24,652	$ 49,300	$ 15,000	$ 38,700		$103,000
72" x 36" SS Slide Gate	3.0	LS	$ 37,022	$ 111,000	$ 33,500	$ 87,500		$232,000
Installation	25.0	%	N/A	$ 195,700	$ 58,500	$ 153,800		$408,000
Electrical, Instrumentation, and Controls	15.0	%	N/A	$ 117,400	$ 35,000	$ 92,600		$245,000
Additional Site Work	25.0	%	N/A	$ 195,700	$ 58,500	$ 153,800		$408,000

Total Anticipated Project Cost	$ 2,696,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	50%	$ 1,348,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	50%	$ 1,348,000
Total Anticipated Project Cost	100%	$ 2,696,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2029	$ 2,696,000
Total		$ 2,696,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

carollo

Project ID: TP-05
Project Title: Relocate the Internal Recycle Piping

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: Relocate the IR piping to the beginning of the Anoxic Selector. Relocate the internal recycle piping such that the recycle is introduced just upstream of the first of the two anoxic zones and not in the last anerobic zone for the three existing aeration basins. The project also includes associated electrical, instrumentation, and controls improvements, as well as additional site work required to complete the improvements. The City currently has two options for where recycled flow is discharged to: one from the splitter box (currently used) and the other at the end of the selector zone. It is recommended that the City use switch to discharge at the end of the selector zone and to monitor and test before and after the switch to assess improvement in treatment performance from this change to see if it is sufficient. TP-05 could potentially be completed in-house.

Reasoning Existing process upgrade

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Relocate IR piping	1.0	LS	$ -	$ -	$ -	$ -		$0
Electrical, Instrumentation, and Controls	15.0	%	$ -	$ -	$ -	$ -		$0
Additional Site Work	10.0	%	$ -	$ -	$ -	$ -		$0

Total Anticipated Project Cost	$ -

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ -

Project Timing:

Project Element	Timing	Cost
Entire Project	2027	$ -
Total		$ -

Project Location Map:
N/A

Go to Maps Tab

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-06
Project Title: Modifying Anaerobic Selectors Baffle Wall
Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years
Project Status (Completed?): N

Project Description:

Project Description: Modifications to the Baffle wall separating the Anaerobic Selectors. The baffle walls that divide the zones within the existing aeration basins' should be repoured to a smooth level. Plywood baffle walls in the anaerobic selector zone should be removed and replaced with 316 stainless steel baffle plates for rigidity. The project also includes associated electrical, instrumentation, and controls improvements.

Reasoning Existing process upgrade

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Modify baffle walls	1.0	LS	$ 29,000	$ 29,000	$ 8,700	$ 23,300		$61,000
Electrical, Instrumentation, and Controls	15.0	%	N/A	$ 4,400	$ 1,300	$ 3,500		$9,200

Total Anticipated Project Cost	$ 70,200

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 70,200
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 70,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2027	$ 70,200
Total		$ 70,200

Project Location Map:

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N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

carollo

Project ID: TP-07
Project Title: Replace Secondary Clarifier No. 1

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes demolition and replacement of Secondary Clarifier No. 1 to improve the reliability and performance of the secondary treatment process. The new clarifier will be constructed as a 75-foot-diameter clarifier with a 15-foot SWD, matching the size, slope, and other design criteria of Secondary Clarifier No. 3. The improvements include a new concrete foundation slab and walls, sludge collection box, launder and effluent structures, aluminum grating, stairs, platforms, and railings, as well as new internal clarifier mechanisms. New RAS and WAS pumps will also be installed to match the size of those serving Secondary Clarifier No. 3. The project also includes associated demolition, installation, electrical, instrumentation, and controls improvements, and additional site work required to complete the improvements. The City is currently evaluating this project.

Reasoning Existing process upgrade

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
12" Conc Wall, 16'-0" ht.	142.0	CY	$ 1,800	$ 255,500	$ 76,500	$ 202,000		$534,000
18" Fdn Slab	281.0	CY	$ 975	$ 274,000	$ 82,000	$ 216,000		$572,000
Sludge Collection Box	23.0	CY	$ 975	$ 22,500	$ 6,800	$ 17,700		$47,000
Launder Slab	19.0	CY	$ 1,200	$ 23,000	$ 6,900	$ 18,100		$48,000
Launder Wall	9.1	CY	$ 2,400	$ 22,000	$ 6,600	$ 17,400		$46,000
Grout	27.0	CY	$ 750	$ 20,500	$ 6,200	$ 16,300		$43,000
Effluent Box Walls	19.0	CY	$ 1,800	$ 34,000	$ 10,000	$ 27,000		$71,000
Effluent Box Fdn Slab	5.0	CY	$ 975	$ 4,900	$ 1,500	$ 3,600		$10,000
Aluminum Grating	63.0	SF	$ 113	$ 7,100	$ 2,100	$ 5,800		$15,000
Alum. Stairs	12.0	RSR	$ 1,050	$ 12,500	$ 3,800	$ 9,700		$26,000
Small Platform	1.0	LS	$ 7,500	$ 7,500	$ 2,300	$ 6,200		$16,000
Alum. Railing	75.0	LF	$ 150	$ 11,500	$ 3,500	$ 9,000		$24,000
Demolitish existing clarifier	1.0	LS	$ 150,000	$ 150,000	$ 45,000	$ 119,000		$314,000
Construct a new 75-feet diameter, 15-feet SWD Secondary Clarifier No. 1 (Internal Mechanisms)	1.0	LS	$ 536,750	$ 537,000	$ 161,000	$ 424,000		$1,122,000
New RAS and WAS pumps	1.0	LS	$ 75,000	$ 75,000	$ 22,500	$ 59,500		$157,000
Electrical, Instrumentation, and	30.0	%	N/A	$ 437,100	$ 131,000	$ 344,900		$913,000
Installation	25.0	%	N/A	$ 364,300	$ 109,500	$ 288,200		$762,000
Additional Site Work	20.0	%	N/A	$ 291,400	$ 87,500	$ 230,100		$609,000
Total Anticipated Project Cost								$ 5,329,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 5,329,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 5,329,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2027	$ 5,329,000
Total		$ 5,329,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-08
Project Title: Replace RAS Pumps for SC No. 2

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes replacement of the return activated sludge (RAS) pumps serving Secondary Clarifier No. 2 to improve pumping capacity and maintain consistency with the existing Secondary Clarifier No. 3 facilities. Two new non-clog submersible RAS pumps, each rated at 1,400 gpm, will be installed to match the pump capacity serving Secondary Clarifier No. 3. The project also includes associated installation, electrical, instrumentation, and controls improvements. This project is driven by growth, predominantly development in the North Shore area.

Reasoning Aging infrastructure

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
RAS Pumps (2) for SC No. 2 (1,400 gpm, non-clog submersible pumps)	2.0	LS	$ 68,000	$ 136,000	$ 41,000	$ 108,000		$285,000
Installation	25.0	%	N/A	$ 34,000	$ 10,000	$ 27,000		$71,000
Electrical, Instrumentation, and Controls	N/A	30	N/A	$ 40,800	$ 12,000	$ 31,200		$84,000

Total Anticipated Project Cost	$ 440,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	100%	$ 440,000
Total Anticipated Project Cost	100%	$ 440,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 440,000
Total		$ 440,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

carollo

Project ID: TP-09
Project Title: Replace Plant Drain PS No. 1

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: The condition assessment noted signs of concrete corrosion, and its pumps are nearing the end of useful life. As such, it is recommended that Lift Station No. 1 be rehabilitated by:

1. Replacing the pumps (500 gpm each).
2. Installing a liner in the wet well to extend the line of the existing structure.
3. Replacing control panel, pump guide rails, and discharge piping within the wet well.
4. Adding a totalizing flow meter and composite sampler.

The project includes associated demolition and temporary piping, electrical, instrumentation, and controls improvements, installation, and additional site work required to complete the rehabilitation. The City may consider constructing a single Plant Drain Pump Station to replace No. 1 and 2. This project is timed to align with TP-02.

Reasoning Aging infrastructure and condition

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Demolition and Temporary Piping	1.0	LS	$ 60,000	$ 60,000	$ 18,000	$ 47,000		$125,000
Plant Drain Pumps and Piping	1.0	LS	$ 85,000	$ 85,000	$ 25,500	$ 66,500		$177,000
Wet Well Liner	1.0	LS	$ 135,000	$ 135,000	$ 40,500	$ 106,500		$282,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 84,000	$ 25,000	$ 67,000		$176,000
Installation	25.0	%	N/A	$ 70,000	$ 21,000	$ 56,000		$147,000
Additional Site Work	10.0	%	N/A	$ 28,000	$ 8,400	$ 21,600		$58,000
Total Anticipated Project Cost								$ 965,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	100%	$ 965,000
Total Anticipated Project Cost	100%	$ 965,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 965,000
Total		$ 965,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

carollo

Project ID: TP-10
Project Title: Replace Plant Drain PS No. 2

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: The condition assessment noted signs of concrete corrosion, and its pumps are nearing the end of useful life. As such, it is recommended that Lift Station No. 2 be rehabilitated by:

1. Replacing the pumps (500 gpm each).
2. Installing a liner in the wet well to extend the line of the existing structure.
3. Replacing control panel, pump guide rails, and discharge piping within the wet well.
4. Adding a totalizing flow meter and composite sampler.

The project includes associated demolition and temporary piping, electrical, instrumentation, and controls improvements, installation, and additional site work required to complete the rehabilitation. The City may consider constructing a single Plant Drain Pump Station to replace No. 1 and 2. This project is timed to align with TP-02.

Reasoning Aging infrastructure and condition

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Demolition and Temporary Piping	1.0	LS	$ 60,000	$ 60,000	$ 18,000	$ 47,000		$125,000
Plant Drain Pumps and Piping	1.0	LS	$ 85,000	$ 85,000	$ 25,500	$ 66,500		$177,000
Wet Well Liner	1.0	LS	$ 135,000	$ 135,000	$ 40,500	$ 106,500		$282,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 84,000	$ 25,000	$ 67,000		$176,000
Installation	25.0	%	N/A	$ 70,000	$ 21,000	$ 56,000		$147,000
Additional Site Work	10.0	%	N/A	$ 28,000	$ 8,400	$ 21,600		$58,000

Total Anticipated Project Cost	$ 965,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	100%	$ 965,000
Total Anticipated Project Cost	100%	$ 965,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 965,000
Total		$ 965,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-10
Project Title: Replace Plant Drain PS No. 2

Facility Type: Treatment Plant

Go to CIP Summary Table

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General Sewer Plan
Capital Improvement Plan

Project ID: TP-11
Project Title: PLANTWIDE: Electrical Conduit & Stand Replace
Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years
Project Status (Completed?): N

Project Description:

Project Description: The project includes plantwide replacement of existing electrical conduit and support stands to improve the reliability and condition of the plant electrical infrastructure. Existing conduit and support stands will be demolished, with existing conductors protected for reuse where feasible. New electrical conduit and support stands will be installed throughout the plant as needed.

Reasoning Aging infrastructure

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
DEMO Conduit & Support Stand - Protect Conductors for Reuse	1.0	LS	$ 55,000	$ 55,000	$ 16,500	$ 43,500		$115,000
Electrical Conduit & Support Stand Replacement	500.0	Units	$ 204	$ 102,000	$ 30,500	$ 80,500		$213,000
Total Anticipated Project Cost								$ 328,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	100%	$ 328,000
Total Anticipated Project Cost	100%	$ 328,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 328,000
Total		$ 328,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-12 **Facility Type:** Treatment Plant
Project Title: NETWORK: Equipment Enclosure & Cabled Protect Upgrade
Priority: 0-10 years **Project Status (Completed?):** N

Go to CIP Summary Table

Project Description:

Project Description: This project includes plantwide improvements to equipment enclosures and cable protection to improve the reliability and protection of the instrumentation and control system. Improvements include installation of new instrumentation and control cabinets, de-termination and re-termination of existing conductors, and installation of conduit to provide additional protection for cables and conductors. Cost is split between upgrade and R&R becuase it addresses aging infrastructure and upgrades to more modern equipment.

Reasoning Aging infrastructure and upgrade

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Instrumentation and Control Cabinet	2.0	LS	$ 6,000	$ 12,000	$ 3,600	$ 9,400		$25,000
DE-Terminate Conduit (Assumed 30 LF)	1.0	LS	$ 9,000	$ 9,000	$ 2,700	$ 7,300		$19,000

Total Anticipated Project Cost	$ 44,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	50%	$ 22,000
General:	0%	$ -
R&R:	50%	$ 22,000
Total Anticipated Project Cost	100%	$ 44,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 44,000
Total		$ 44,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
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Project ID: TP-13
Project Title: Replace MCC-A & Relocate Electric Equipment
Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years
Project Status (Completed?): N

Project Description:

Project Description: Reference section 7.9.8 of the WWTF Evaluation Report in Appendix I for more information on the current electrical system and background on previous upgrades.
This project includes replacement of MCC-A and relocation of associated electrical equipment to improve the reliability and maintainability of the plant electrical system. MCC-A currently serves two WAS pumps, one general-purpose sludge pump, a compressor, two heaters, and a hoist. MCC-A will be removed from the plant distribution system, and its remaining loads will be re-fed from nearby electrical sources. PLC-A will also be removed from the Old Controls Building, with its current loads transferred to another nearby PLC. This will allow the Old Controls Building to be fully utilized as a maintenance and workshop area, consistent with its current use. The project includes replacement of MCC-A and relocation of electrical equipment from the Old Controls Building, along with associated electrical, instrumentation, and controls work. The City is currently evaluating this project.

Reasoning Upgrade equipment

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
MCC To Replace MCC-A	1.0	LS	$ 63,000	$ 63,000	$ 19,000	$ 50,000		$132,000
Relocate Electrical Equipment from Old Controls Bldg	1.0	LS	$ 172,000	$ 172,000	$ 51,500	$ 135,500		$359,000

Total Anticipated Project Cost	$ 491,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 491,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 491,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 491,000
Total		$ 491,000

Project Location Map:
N/A

Go to Maps Tab

City of Camas
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Project ID: TP-14
Project Title: Replace and Add Diffusers in the Aeration Basins

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes replacement of the existing diffusers in the three aeration basins and installation of additional diffusers in the second of the two anoxic zones within each basin. The additional diffusers will allow the anoxic zones to function as swing zones, providing greater operational flexibility and treatment capacity. New diffuser supports within the swing zones will be designed to withstand the forces exerted by the existing submersible mixers.

Reasoning Process upgrade

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Replace existing diffusers in the Aeration Basins and add diffusers to one of the Anoxic Zones	1.0	LS	$ 425,000	$ 425,000	$ 127,500	$ 335,500		$888,000

Total Anticipated Project Cost	$ 888,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 888,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 888,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2032	$ 888,000
Total		$ 888,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-15
Project Title: Replace Disk Filtration Units

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: Replace the two existing Disk Filtration Units with new Units (6.0 mgd). Plant staff indicated the filters are backwashing 30% of the time, which is higher than the anticipated 20% or less.

This project includes replacement of the two existing disk filtration units with new units to improve filtration performance and operational reliability. The new disk filtration units will be sized for a capacity of 6.0 mgd. Plant staff indicated that the existing filters are currently backwashing approximately 30 percent of the time, which is higher than the anticipated 20 percent or less. The project includes removal of the existing disk filtration units, installation of the new units, and associated electrical, instrumentation, and controls improvements. The City will assess the need for the disk filters, which are currently not run all the time, prior to completing this project. This project is assigned to 75% growth and 25% to upgrade. It is primarily driven by growth but will also address existing issues reported by staff.

Reasoning Growth driven capacity issue and existing process improvement

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Disk Filter Unit	1.0	LS	$ 705,484	$ 705,500	$ 211,500	$ 557,000		$1,474,000
Remove existing Disk Filtration Units	1.0	LS	$ 75,000	$ 75,000	$ 22,500	$ 59,500		$157,000
Installation	25.0	%	N/A	$ 195,100	$ 58,500	$ 154,400		$408,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 234,200	$ 70,500	$ 184,300		$489,000

Total Anticipated Project Cost	$ 2,528,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	75%	$ 1,896,000
Upgrade:	25%	$ 632,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 2,528,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2032	$ 2,528,000
Total		$ 2,528,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-16
Project Title: Second UV Channel

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: This City recently constructed a second UV disinfection channel which will be used going forward while the existing channel will serve as bypass. This project is to rehabilitate the existing channel and put back into service for UV disinfection to provide sufficient disinfection capacity for the entire plant effluent at peak hour flow conditions of 22.2 mgd. The project includes installation of the new UV equipment and associated electrical, instrumentation, and controls improvements will also be included.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
UV Equipment	1.0	LS	$ 1,507,286	$ 1,507,500	$ 452,500	$ 1,190,000		$3,150,000
Aluminum Grating	1.0	LS	$ 113	$ 100	$ -	$ -		$100
Installation	30.0	%	N/A	$ 452,300	$ 135,500	$ 357,200		$945,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 452,300	$ 135,500	$ 357,200		$945,000

Total Anticipated Project Cost	$ 5,040,100

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 5,040,100
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 5,040,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2032	$ 5,040,100
Total		$ 5,040,100

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-16
Project Title: Second UV Channel

Facility Type: Treatment Plant

Go to CIP Summary Table

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-17
Project Title: Replace Effluent Transfer Pumps

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: Replace the existing Effluent Transfer Pumps with larger impeller, motor, and associated VFDs to allow pumping of the entire plant effluent (22.2 mgd). Under high river water level conditions, when the headloss is too great for gravity flow to the Columbia River, the effluent is pumped using three vertical propeller effluent pumps, located in the second compartment of the effluent wet well. Each pump has a capacity of 4,550 gpm (6.54 mgd). The total capacity of the effluent transfer Lift Station is 19.6 mgd with a firm capacity of 13.09 mgd. The process implications of exceeding the effluent pumps' capacity are catastrophic, under the high river level conditions. Such conditions could quickly submerge upstream plant processes.
The replacement pumps will be rated at approximately 4,700 gpm and will include associated structural and mechanical modifications, installation, and electrical, instrumentation, and controls improvements. This project is driven by future growth and is timed to align with TP-18.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
4700 gpm centrfugal pumps	3.0	LS	$ 230,000	$ 690,000	$ 207,000	$ 545,000		$1,442,000
Structural and Mechanical Modifications	1.0	LS	$ 15,500	$ 15,500	$ 4,700	$ 12,800		$33,000
Installation	25.0	%	N/A	$ 176,400	$ 53,000	$ 139,600		$369,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 211,700	$ 63,500	$ 167,800		$443,000

Total Anticipated Project Cost	$ 2,287,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 2,287,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 2,287,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2035	$ 2,287,000
Total		$ 2,287,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-18
Project Title: Construct a New Plant Outfall

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes construction of a second plant outfall to the Columbia River to provide additional discharge capacity and improve the reliability and flexibility of the plant effluent discharge system. The new outfall will consist of approximately 36-inch corrugated metal pipe with a 16-port, 160-foot diffuser. The project includes mobilization, cleanup, and demobilization; erosion control; additional pipe fittings; trench safety; excavation and backfill; and installation of the new outfall. Associated electrical, instrumentation, and controls improvements will also be included. This project is timed to align with TP-17.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
36-in corrugated metal pipe	850.0	LF	$ 3,245	$ 2,758,500	$ 827,500	$ 2,177,000		$5,763,000
16-port, 160 ft diffuser	1.0	LS	$ 500,000	$ 500,000	$ 150,000	$ 395,000		$1,045,000
Mobilization, cleanup, and demobilization	1.0	LS	$ 1,120,000	$ 1,120,000	$ 336,000	$ 884,000		$2,340,000
Erosion control	1.0	LS	$ 133,800	$ 134,000	$ 40,000	$ 106,000		$280,000
Additional pipe fittings	20000.0	LB	$ 16	$ 320,000	$ 96,000	$ 253,000		$669,000
Trench safety programs	1.0	LS	$ 145,000	$ 145,000	$ 43,500	$ 114,500		$303,000
Excavation and Backfill	10000.0	CY	$ 225	$ 2,250,000	$ 675,000	$ 1,777,000		$4,702,000
Installation	30.0	%	N/A	$ 2,168,300	$ 650,500	$ 1,711,200		$4,530,000
Electrical, Instrumentation, and Controls	5.0	%	N/A	$ 361,400	$ 108,500	$ 285,100		$755,000

Total Anticipated Project Cost	$ 20,387,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 20,387,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 20,387,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2035	$ 20,387,000
Total		$ 20,387,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-19
Project Title: Construct a New Electrical Building

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes construction of a new electrical building west of the Digester complex to house electrical equipment serving the digester facilities. The new CMU block electrical building will be designed to meet the hazardous area classification requirements of NFPA 820 and provide a suitable location for electrical equipment serving the digester process. The project includes construction of the new building, electrical equipment and installation, and associated electrical, instrumentation, and controls improvements. This project is timed to align with TP-09 and TP-10. This project is driven by the need to move the existing electrical equipment to make room for the new digester and it will also address code issues, therefore it reiceves a 75%/25% split for future and existing cost, respectively.

Reasoning Code/Growth - secondary gravity thickener driven by growth, which drives electrical upgrade (can do both at same time)

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
CMU Block Electrical Building	1.0	LS	$ 306,000	$ 306,000	$ 92,000	$ 242,000		$640,000
Electrical Equipment and Installation	1.0	LS	$ 300,000	$ 300,000	$ 90,000	$ 237,000		$627,000
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		#N/A

Total Anticipated Project Cost	#N/A

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	75%	#N/A
Upgrade:	25%	#N/A
General:	0%	#N/A
R&R:	0%	#N/A
Total Anticipated Project Cost	100%	#N/A

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	#N/A
Total		#N/A

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-20 **Facility Type:** Treatment Plant
Project Title: Construct a Second Rotary Drum Thickener for WAS Thickening

Go to CIP Summary Table

Priority: 0-10 years **Project Status (Completed?):** N

Project Description:

Project Description: This project includes construction of a second Rotary Drum Thickener (RDT) for waste activated sludge (WAS) thickening to provide redundancy and improve the reliability of the thickening process. The existing RDT has been in service for more than 10 years, and a second unit is recommended to provide additional operational flexibility and backup capacity. The project includes a new RDT, associated polymer blending unit, thickened sludge pump, access platform, stairs, and supporting structures. The project also includes installation, additional site work, and associated electrical, instrumentation, and controls improvements. This project is timed to align with TP-09 and TP-10.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
New RDT (2nd unit) for redundancy	1.0	LS	$ 300,000	$ 300,000	$ 90,000	$ 237,000		$627,000
Associated polymer blending unit	1.0	LS	$ 75,000	$ 75,000	$ 22,500	$ 59,500		$157,000
Thickened Sludge Pump	1.0	LS	$ 75,000	$ 75,000	$ 22,500	$ 59,500		$157,000
Access platform, stairs, supporting structure etc.	10.0	%	N/A	$ 45,000	$ 13,500	$ 35,500		$94,000
Installation	25.0	%	N/A	$ 112,500	$ 34,000	$ 88,500		$235,000
Additional Site Work	15.0	%	N/A	$ 67,500	$ 20,500	$ 53,000		$141,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 135,000	$ 40,500	$ 106,500		$282,000

Total Anticipated Project Cost	$ 1,693,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 1,693,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 1,693,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 1,693,000
Total		$ 1,693,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

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Project ID: TP-21
Project Title: Construct a New Primary Clarifier

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 10-20 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes construction of a new Primary Clarifier No. 3 to improve primary treatment performance and provide additional process capacity. The additional clarifier will help maintain high BOD_5 and TSS removals during normal flow conditions, allow the aeration basins to operate at lower MLSS concentrations during maximum month organic loadings, and reduce oxygen demands in the BNR process while increasing gas production in the digesters. The new clarifier will be approximately 60 feet in diameter with a 10-foot SWD and will include new internal mechanisms, sludge collection box, concrete foundation and walls, launder structure, aluminum stairs, catwalk framing, grating, and railing. The project also includes new LS pumps, excavation and backfill, installation, additional site work, and associated electrical, instrumentation, and controls improvements.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
12" Conc Wall, 12'-6" ht.	89.0	CY	$ 1,800	$ 160,000	$ 48,000	$ 126,000		$334,000
18" Fdn Slab	175.0	CY	$ 975	$ 170,500	$ 51,000	$ 134,500		$356,000
Sludge Collection Box	15.0	CY	$ 975	$ 14,500	$ 4,400	$ 11,100		$30,000
Launder Slab	12.0	CY	$ 1,200	$ 14,500	$ 4,400	$ 11,100		$30,000
Launder Wall	6.6	CY	$ 2,400	$ 16,000	$ 4,800	$ 12,200		$33,000
Grout	17.4	CY	$ 750	$ 13,000	$ 3,900	$ 10,100		$27,000
Alum. Stairs	15.0	RSR	$ 1,050	$ 16,000	$ 4,800	$ 12,200		$33,000
Alum. Catwalk Framing	10306.0	LB	$ 11	$ 108,000	$ 32,500	$ 85,500		$226,000
Alum. Grating	720.0	SF	$ 113	$ 81,500	$ 24,500	$ 64,000		$170,000
Alum. Railing	409.0	LF	$ 150	$ 61,500	$ 18,500	$ 49,000		$129,000
Excavation and Backfill	1902.0	CY	$ 225	$ 428,000	$ 128,500	$ 337,500		$894,000
Construct a new 60-feet diameter, 10-feet SWD Primary Clarifier No. 3 (Internal Mechanisms and other items)	1.0	LS	$ 541,250	$ 541,500	$ 162,500	$ 428,000		$1,132,000
New PS pumps	1.0	LS	$ 58,000	$ 58,000	$ 17,500	$ 46,500		$122,000
Additional Site Work	25.0	%	N/A	$ 420,800	$ 126,000	$ 331,200		$878,000
Installation	25.0	%	N/A	$ 420,800	$ 126,000	$ 331,200		$878,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 504,900	$ 151,500	$ 398,600		$1,055,000

Total Anticipated Project Cost	$ 6,327,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 6,327,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 6,327,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2039	$ 6,327,000
Total		$ 6,327,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-22
Project Title: Construct a New Secondary Clarifier

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 10-20 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes construction of a new Secondary Clarifier No. 4 to provide additional secondary treatment capacity and accommodate future growth. The new clarifier will be approximately 75 feet in diameter with a 15-foot SWD and will include new internal mechanisms, sludge collection box, effluent box, launder structure, concrete foundation and walls, aluminum grating, stairs, platforms, and railings. The project also includes new RAS and WAS pumps and approximately 36-inch piping to connect the new clarifier to the existing system. Associated excavation and backfill, installation, additional site work, and electrical, instrumentation, and controls improvements will also be included.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
12" Conc Wall, 16'-0" ht.	142.0	CY	$ 1,800	$ 255,500	$ 76,500	$ 202,000		$534,000
18" Fdn Slab	281.0	CY	$ 975	$ 274,000	$ 82,000	$ 216,000		$572,000
Sludge Collection Box	23.0	CY	$ 975	$ 22,400	$ 6,700	$ 17,900		$47,000
Launder Slab	18.0	CY	$ 1,200	$ 21,600	$ 6,500	$ 16,900		$45,000
Launder Wall	9.1	CY	$ 2,400	$ 21,800	$ 6,500	$ 16,700		$45,000
Grout	27.0	CY	$ 750	$ 20,300	$ 6,100	$ 15,600		$42,000
Effluent Box Walls	19.0	CY	$ 1,800	$ 34,200	$ 10,500	$ 27,300		$72,000
Effluent Box Fdn Slab	5.0	CY	$ 975	$ 4,900	$ 1,500	$ 3,600		$10,000
Aluminum Grating	63.0	SF	$ 113	$ 7,100	$ 2,100	$ 5,800		$15,000
Alum. Stairs	12.0	RSR	$ 1,050	$ 12,600	$ 3,800	$ 9,600		$26,000
Small Platform	1.0	LS	$ 7,500	$ 7,500	$ 2,300	$ 6,200		$16,000
Alum. Railing	75.0	LF	$ 150	$ 11,300	$ 3,400	$ 8,300		$23,000
Excavation and Backfill	5200.0	CY	$ 225	$ 1,170,000	$ 351,000	$ 924,000		$2,445,000
Construct a new 75-feet diameter, 15-feet SWD Secondary Clarifier No. 4 (Internal Mechanisms)	1.0	LS	$ 536,750	$ 537,000	$ 161,000	$ 424,000		$1,122,000
New RAS and WAS pumps	1.0	LS	$ 75,000	$ 75,000	$ 22,500	$ 59,500		$157,000
New 36-inch pipe to new Secondary Clarifier No. 4	36.0	in	$ 1,203	$ 722,000	$ 216,500	$ 569,500		$1,508,000
Installation	25.0	%	N/A	$ 799,300	$ 240,000	$ 631,700		$1,671,000
Additional Site Work	20.0	%	N/A	$ 639,400	$ 192,000	$ 505,600		$1,337,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 959,200	$ 288,000	$ 757,800		$2,005,000
Total Anticipated Project Cost								$ 11,692,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 11,692,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 11,692,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2039	$ 11,692,000
Total		$ 11,692,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-23
Project Title: Replace Centrifugal Blowers

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes replacement of the two existing 150-hp multistage centrifugal blowers with two new 150-hp HST blowers to provide sufficient aeration capacity for future peak oxygen demands. The existing centrifugal blowers will be removed and replaced with two HST blowers (Model HST 10-3600-1-U150-48). It is assumed that all four blowers will need to operate simultaneously to meet the projected 2045 peak oxygen demand. The project also includes associated installation and electrical, instrumentation, and controls improvements. The City is currently working on a project to increase capacity of blowers 3 and 4.

Reasoning Existing capacity and process upgrade

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Two new HST Blowers (Model - HST 10-3600-1-U150-48)	1.0	LS	$ 416,000	$ 416,000	$ 125,000	$ 329,000		$870,000
Installation	15.0	%	N/A	$ 62,400	$ 18,500	$ 49,100		$130,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 124,800	$ 37,500	$ 98,700		$261,000

Total Anticipated Project Cost	$ 1,261,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 1,261,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 1,261,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2027	$ 1,261,000
Total		$ 1,261,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-24
Project Title: Replace Sludge Dryer

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 10-20 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes replacement of the existing sludge dryer with new sludge drying equipment to maintain reliable biosolids processing as the existing equipment approaches the end of its useful life. The existing sludge dryer was installed in 2014 and is more than 10 years old. Typical sludge drying equipment may require a major overhaul within approximately 10 years, and the City should plan for potential replacement within the next 10 to 15 years. However, a firm recommendation for replacement is not made as part of this 2025 GSP, because regulations related to biosolids, particularly per- and polyfluoroalkyl substances (PFAS), continue to evolve and may affect future biosolids management requirements. The project includes new sludge belt drying equipment (BDS-10) and associated components, partial demolition and expansion of the existing building, additional site work, installation, and associated electrical, instrumentation, and controls improvements. The City has contracted for an evaluation of the dryer and alternatives for solids handling.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
New Sludge Belt Drying equipment (BDS-10) and associated components	1.0	LS	$ 5,883,000	$ 5,883,000	$ 1,765,000	$ 4,644,000		$12,292,000
Demo part of existing building	1.0	LS	$ 20,000	$ 20,000	$ 6,000	$ 16,000		$42,000
Expand existing building Building	2400.0	SF	$ 130.00	$ 312,000	$ 93,500	$ 246,500		$652,000
Additional Site Work	30.0	&	N/A	$ 1,864,500	$ 559,500	$ 1,472,000		$3,896,000
Installation	15.0	%	N/A	$ 932,300	$ 279,500	$ 736,200		$1,948,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 1,864,500	$ 559,500	$ 1,472,000		$3,896,000

Total Anticipated Project Cost	$ 22,726,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 22,726,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 22,726,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2042	$ 22,726,000
Total		$ 22,726,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-25
Project Title: Replace Biofilters

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 10-20 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes replacement of the existing biofilters with new biofilters to maintain reliable odor control as the existing tertiary filters approach the end of their useful life. The new biofilter odor control system will be designed for approximately 10,000 cfm and will include associated ductwork, sump pumps, water panels, and other necessary components. The project also includes construction of a structural pad, installation, and associated electrical, instrumentation, and controls improvements. Prior to completion of this project, the City may consider replacing the biofilters with trickling filters which have a smaller footprint.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
New Biotrickling Filter Odor Control System with Ductwork, sump pumps, water panel etc. (10,000 cfm)	1.0	LS	$ 1,200,000	$ 1,200,000	$ 360,000	$ 947,000		$2,507,000
Structural pad	56.0	CY	$ 975.00	$ 54,500	$ 16,500	$ 44,000		$115,000
Installation	15.0	%	N/A	$ 188,200	$ 56,500	$ 148,300		$393,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 376,400	$ 113,000	$ 297,600		$787,000

Total Anticipated Project Cost	$ 3,802,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 3,802,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 3,802,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2043	$ 3,802,000
Total		$ 3,802,000

Project Location Map:

Go to Maps Tab

N/A

APPENDIX M

FINANCIAL BACKUP

~ To be included in a future submittal. ~



Water System Plan Update

September 2026 / DRAFT

Water System Plan Update

September 2026 / DRAFT

This document is released for the purpose of information exchange review and planning only under the authority of Matthew Huang, September 2026, State of Washington PE No. 54002.

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Abbreviations

µg/L	micrograms per liter
2010 WSP	City of Camas 2010 Water System Plan
2019 WSP	City of Camas 2019 Water System Plan
ADD	average day demand
ADU	accessory dwelling unit
AFY	acre-feet per year
AL	action level
ALE	action level exceedance
AMI	advanced metering infrastructure
Army	United States Army
ASR	Annual Summary Report
AWIA	American Water Infrastructure Act
AWWA	American Water Works Association
BAT	Backflow Assembly Testers
BPS	booster pump station
Carollo	Carollo Engineers
CCC	Cross-connection control
CCL	Contaminant Candidate List
CCR	Consumer Confidence Report
CCS	Cross-Connection Control Specialist
CCT	corrosion control treatment
CDC	Centers for Disease Control and Prevention
CEU	Continuing Education Units
CFR	Code of Federal Regulations
cfs	cubic feet per second
CI	Cast Iron
CIP	Capital Improvement Plan
City	City of Camas
CMC	City of Camas Municipal Code
CMP	coliform monitoring plan
Corps	United States Army Corps of Engineers
CPU	Clark Public Utilities
Cr(VI)	hexavalent chromium
CT	contact time
CWA	Clean Water Act
CWSP	Coordinated Water System Plan
D	Distribution System Improvements

DBP	disinfection byproducts
DBPR	Disinfection Byproducts Rule
DI	ductile iron
DOH	Washington State Department of Health
DSL	distribution system leakage
DSN	determination of non-significance
Ecology	Department of Ecology
EDC	endocrine disrupting compounds
EIS	Environmental Impact Statement
ELA	Engineering, Legal, and Administration
EPS	extended period simulation
ERP	Emergency Response Plan
ERU	equivalent residential unit
ESA	Endangered Species Act
ESWTR	Enhanced Surface Water Treatment Rule
FBRR	Filter Backwash Recycling Rule
FF	fire flow
fps	feet per second
FSS	Fire-suppression storage
FTE	full-time-equivalent
G	General
G&O	Gray & Osborne
GenX or HFPO-DA	hexafluoropropylene oxide dimer acid
GIS	Geographic Information System
GMA	Growth Management Act
GME	Green Mountain Estates
GP	Georgia Pacific
gpd	gallons per day
gpm	gallons per minute
GWI	Groundwater under the Direct Influence of Surface Water
GWR	Groundwater Rule
HAA5	haloacetic acids
HAL	health advisory level
HGL	hydraulic grade line
HI	Hazard Index
HPA	hydraulic project approval
HPC	heterotrophic plate count
IDSE	Initial Distribution System Evaluation
IMT	Industrial Metal Technology

IOC	inorganic contaminants
IRIS	Integrated Risk Information System
LCR	Lead and Copper Rule
LCRI	Lead and Copper Rule Improvements
LF	linear feet
LID	low impact development
LPH	Lower Prune Hill
LRAA	locational running annual average
LSL	Lead Service Line
LT1ESWTR	Long Term 1 Enhanced Surface Water Treatment Rule
LT2ESWTR	Long Term 2 Enhanced Surface Water Treatment Rule
LWWF	Lower Washougal Wellfield
MCC	Motor Control Center
MCLG	maximum contaminant level goals
MDBP	Microbial and Disinfection-by-Products
MDD	maximum day demand
MFR	Multifamily Residential
MG	million gallons
mg/L	milligrams per liter
mgd	million gallons per day
mL	milliliters
MPA	microscopic particulate analysis
MRDL	Maximum Residual Disinfectant Levels
MRDLG	Maximum Residual Disinfectant Level Goals
MWS	municipal water suppliers
N/A	not applicable
NDMA	Nitrosamines/N-nitrosodimethylamine
NEPA	National Environmental Policy Act
ng/L	nanograms per liter
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDWR	National Primary Drinking Water Regulation
NTU	nephelometric turbidity unit
NWPR	Navigable Water Protection Rule
O&M	operations and maintenance
PAA	Project Approval Application
PCB	Polychlorinated biphenyls
pCi/L	picocurie per liter

PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutane sulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctyl sulfonate
PHD	peak hour demand
PNR	Public Notification Rule
PPCP	pharmaceutical and personal care products
ppt	parts per trillion
PRV	pressure reducing valve
PS	pump station
psi	pounds per square inch
PVC	polyvinyl chloride
PWS	public water systems
PZ	pressure zone
Qa	annual water right
Qi	instantaneous water right
R	Annual Repair and Replacement Programs
R&R	Repair and Replacement
RAA	running annual average
RCW	Revised Code of Washington
RRA	risk and resilience assessments
RTCR	Revised Total Coliform Rule
RTL	rule trigger level
RUL	Remaining Useful Life
RWSA	retail water service area
S	Supply and Treatment
SAL	State Action Levels
SCA	Sanitary Control Area
SCADA	supervisory control and data acquisition
SDC	system development charges
SDWA	Safe Drinking Water Act
SEPA	State Environmental Policy Act
SFR	single-family residence
SMA	Satellite Management Agency
SMCL	secondary maximum contaminant levels
SMP	Shoreline Master Program
SOC	synthetic organic chemicals

SRF	State Revolving Fund
SS	Standby storage
SS	Standby storage
SSF Plant	slow sand filtration treatment plant
ST	Storage
SWTR	Surface Water Treatment Rule
T	Transmission Pipe
TAZ	transportation analysis zones
TCR	Total Coliform Rule
TL	trigger level
TNW	traditional navigable waters
TOrC	Toxic Organic Chemicals
TSMC	Taiwan Semiconductor Manufacturing Company
TTHM	trihalomethanes
UCMR	Unregulated Contaminant Monitoring Regulation
UCMR	Unregulated Contaminants Monitoring Rule
UGA	urban growth area
UPH	Upper Prune Hill
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Services
Vancouver	City of Vancouver
VBLM	Vacant Buildable Lands Model
VOC	volatile organic compounds
WAC	Washington Administrative Code
WDM	Water Distribution Manager
WFI	Water Facilities Inventory
WHP	wellhead protection
WHPA	wellhead protection area
WHPP	wellhead protection plans
WLCAP	Water Loss Control Action Plan
WQM	water quality monitoring
WQMS	Water Quality Monitoring Schedule
WQP	water quality parameter
WRIA	Water Resource Inventory Areas
WRIA Plan	Salmon-Washougal and Lewis Watershed Management Plan
WSDM	Water System Design Manual
WSDOT	Washington Department of Transportation
WSP	Water System Plan
WSPU	Water System Plan Update

WTPO	Water Treatment Plant Operator
WUE	Water Use Efficiency
WWTF	wastewater treatment facility
WWTP	wastewater treatment plant

EXECUTIVE SUMMARY

ES.1 Introduction

This Water System Plan Update (WSPU) updates the City of Camas' (City) 2019 WSPU. It was developed collaboratively by City staff, Carollo Engineers (Carollo), Strata Geosciences, and FCS Group. This WSPU documents the water system's current status and evaluates the water City's future needs. The data used for this WSPU was current as of 2024. The WSPU was developed between November 2024 and September 2026 for approval in 2026. This WSPU will be used as a guide for maintaining and improving the water system in the short-term over the next 10 years, while also providing a framework for the 20-year, long-term planning horizon.

The purpose of this WSPU is to document changes to the City's water system, identify required system improvements, and appropriately outline capital improvement projects to meet future water demands. Maintaining a current Water System Plan is required to meet the regulations of the Washington State Department of Health (DOH) and the requirements of the Washington State Growth Management Act. The WSPU complies with the requirements of DOH as set forth in the Washington Administrative Code (WAC) 246-290-100, Water System Plan.

This WSPU contains timeframes, which are the intended framework for future funding decisions and within which future actions and decisions are designed to occur. However, these timeframes are estimates and depending on factors involved in the processing of applications and project work, as well as the availability of funding, the timing may change. The framework presented in this WSPU does not represent actual commitments by the City.

Key points of the WSPU including analysis results and recommendations are summarized below, with more details provided in the specific chapters.

ES.2 Planning Considerations

Chapter 2 summarizes the City's water planning considerations that influence the WSPU, including background on the study area, policies, criteria, and related documents. The City maintains a Duty to Serve customers within the retail water service area (RWSA):

> *The City will exercise reasonable diligence and care to furnish and deliver a continuous and sufficient supply of pure water to the customer, and to avoid any shortage or interruption of delivery of the same. The City will meet all regulatory requirements for management of its water system and provision of water to its customers, including water quality, system pressure, and adequate supply. The City will conserve and protect groundwater resources to provide safe, clean, high-quality drinking water to residents.*

The City's Retail Water Service Area is shown in Figure ES.1. Retail service area is the specific area, defined by the municipal supplier, where the supplier has a duty to provide service to new service connections, as set forth in Revised Code of Washington (RCW) 43.20.260, if:

1. Its service can be available in a timely and reasonable manner;
2. The municipal water supplier has sufficient water rights to provide the service;
3. The municipal water supplier has sufficient capacity to serve the water in a safe and reliable manner as determined by the department of health; and
4. It is consistent with the requirements of any comprehensive plans or development regulations adopted under chapter 36.70A RCW or any other applicable comprehensive plan, land use plan, or development regulation adopted by a city, town, or county for the service area and, for water service by the water utility of a city or town, with the utility service extension ordinances of the city or town.

Water system planning is based on a careful analysis of a water utility's responsibility to comply with applicable regulatory requirements while providing service to existing and future customers. These laws are monitored and enforced by a number of federal, state, and local agencies. The WSPU incorporates several regional and local plans of the southwest region of Washington, such as Clark County, that affect the water utility.

The City has adopted many resolutions regarding water system planning that are included in the City Code. The City manages its water utility in accordance with established water system policies. The policies provide a consistent framework for the design, operation, maintenance, and service of the water system for appropriately implementing programs, designing new infrastructure, and serving additional customers. The Plan summarizes many of these policies and provides criteria needed to evaluate the water system.

ES.3 Existing System

The City owns and operates a multi-source municipal water system- summarized in Chapter 3 - which includes supply, treatment, storage, and distribution of potable water to residential and commercial customers. The City currently obtains its water from 10 groundwater wells and two surface water sources that are treated to provide high quality water to customers. The City owns over 159 miles of pipelines in its water transmission and distribution system. Service is provided to customers across 26 pressure zones, 10 booster pumping stations, and seven storage facilities with a combined total of 9.95 million gallons (MG) to provide storage for normal and emergency conditions, such as fire suppression. Additionally, distribution system includes numerous meters, isolation valves, and hydrants. Major elements of the water system are shown in Figure ES.2.

ES.4 Operations and Maintenance

The water system is operated and maintained (O&M) by the City staff, with contractors providing services that City staff are not trained or equipped to perform. O&M of the water system requires the combined effort of the Public Works Department, Engineering Department, and Finance Department. The City's water system operators are experienced and well trained, exceeding the minimum state requirements (WAC 246-292-050). The City provides opportunities for staff professional growth and training to maintain up-to-date knowledge. The City has a well-operated and maintained system, as documented in Chapter 4. Additionally, the City has updated their system wide O&M manual as part of this WSPU, which describes the assets, operations, and preventative maintenance for each of their major distribution system facilities.

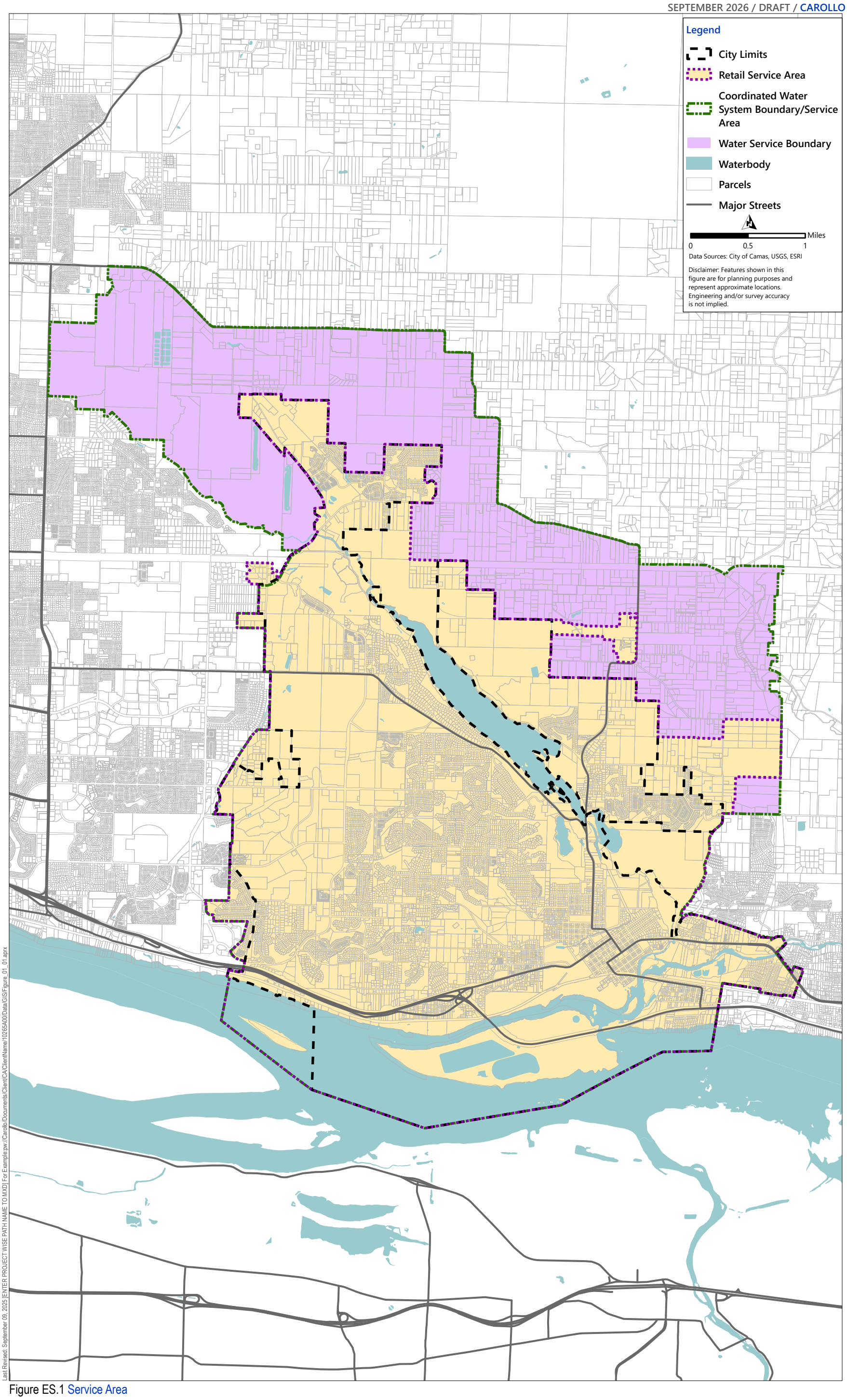


Figure ES.1 Service Area

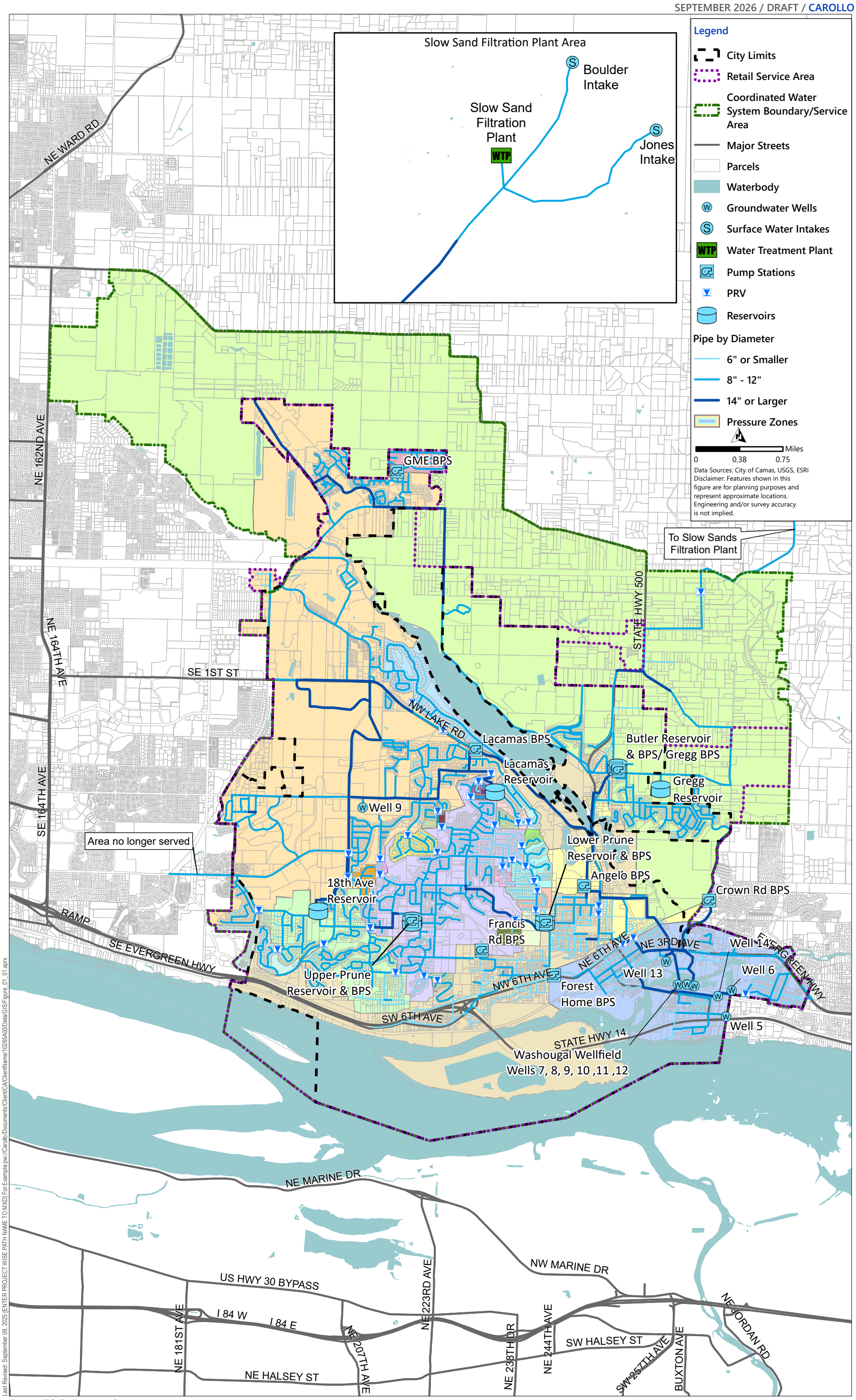


Figure ES.2 Existing System Map

ES.5 Water Requirements

Projecting realistic future water demand is necessary for planning infrastructure projects and securing adequate water supply to meet future growth. Chapter 5 projects the water system requirements, i.e., demand, for the next 20 years. Demographic projections were used to predict where and how much growth will occur in the water system based on the City's comprehensive planning. The resulting future accounts were converted to projected demands using the historical water use patterns and parameters.

Three future water demand scenarios (low, medium, and high) were projected for the planning period between 2026 to 2046 for the City's established RWSA. The medium scenario's predictions most closely resemble the City's future demands, while the low and high demand projection scenarios provide a range within which the City's future water demands are expected to fall. The medium scenario was used for the distribution system analysis in Chapter 9, which identifies future pumping, storage, and distribution system requirements. The high scenario was used for the supply evaluation in Chapter 8, which identifies future water rights and supply capacity requirements. Demand projections were expressed as average day demand (ADD), and maximum day demand (MDD). The ADD is typically used in operational evaluations. The MDD represents the single largest day water demand during the year and is a key parameter for infrastructure sizing.

Figure ES.3 is a chart of the system-wide demand projections for the 20-year planning period. By 2036, the City's ADD is projected to be between 6.2 and 7.4 million gallons per day (mgd) and with MDD projected to be between 11.6 and 15.1 mgd for the low and high scenarios, respectively. By 2046, the City's ADD is projected to be between 7.4 and 9.6 mgd and with MDD projected to be between 14.2 and 20.2 mgd for the low and high scenarios, respectively.

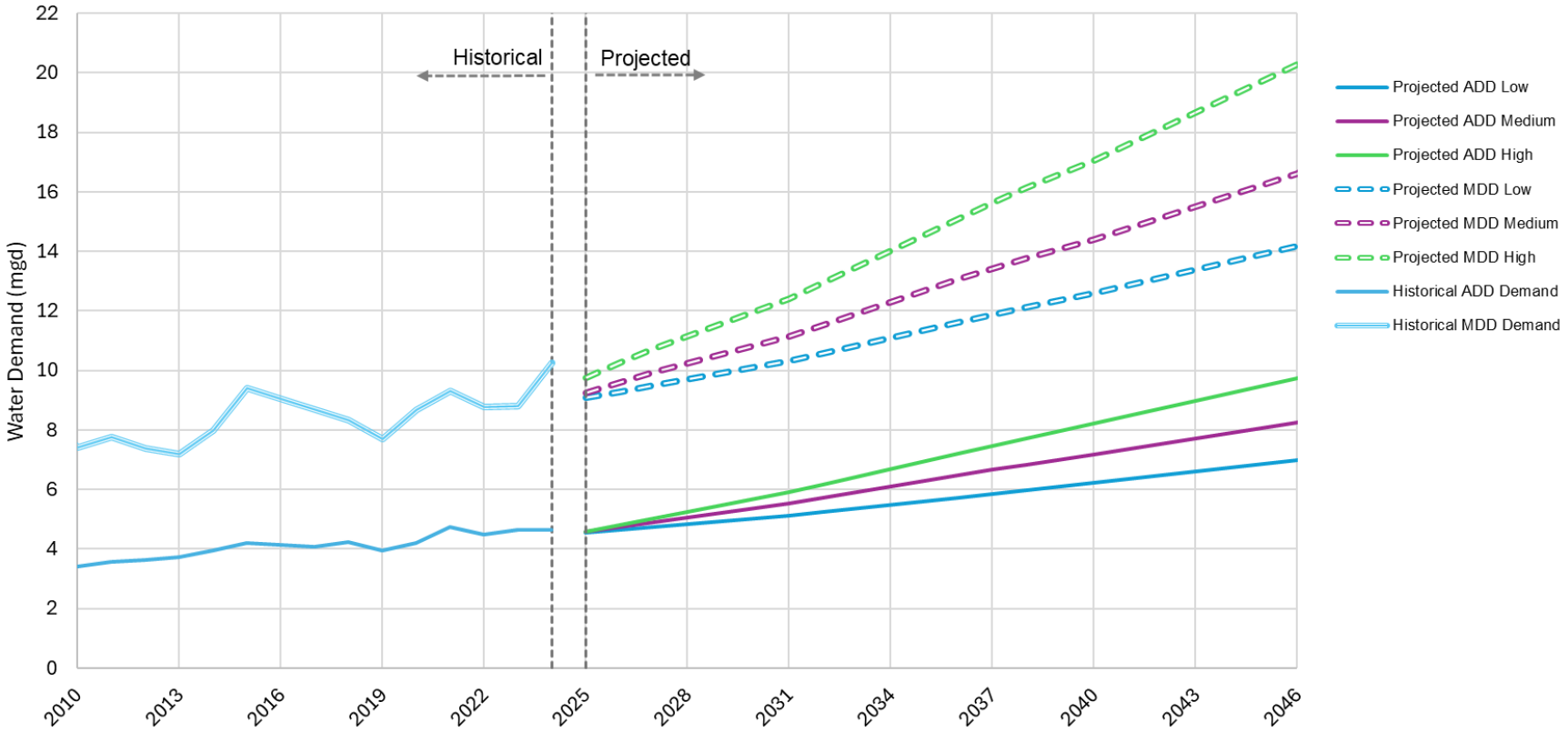


Figure ES.3 Average and Max Day Demand Projections

ES.6 Water Use Efficiency

In 2003, the Washington State Legislature passed the Engrossed Second Substitute House Bill 1338, known as the Municipal Water Law or the Water Use Efficiency (WUE) rule, to address the increasing demand on Washington's water resources. This law established that all municipal water suppliers (MWS) must use water more efficiently in exchange for water right certainty and flexibility to help them meet future demand.

Table ES.1 summarizes the mandatory WUE measures the City completes. As part of this WSPU, the City has completed a Water Loss Control Action Plan (WLCAP) as historical billing data has indicated that distribution system leakage (DSL) is above the DOH standard of 10 percent. Background of the City's current and future WUE programs are detailed in Chapter 6.

Table ES.1 WUE Mandatory Measures

WUE Mandatory Measure	Status
Must implement the following WUE measures:	
Install production (source) meters	Implemented
Install consumption (service) meters	Implemented
Perform meter calibration	Implemented/Ongoing
Implement a WLCAP to control leakage if exceeds 10%	Ongoing
Educate customers about water efficiency at least once per year	Implemented/Ongoing
Must evaluate or implement these WUE measures:	
Evaluate rates that encourage water demand efficiency	Implemented
Evaluate reclamation	Implemented

ES.7 Water Quality

The City is defined as a Group A - Community Water System and must comply with the drinking water standards of the federal Safe Drinking Water Act and its amendments, as regulated by the United States Environmental Protection Agency. The DOH adopted the updated federal standards under WAC 246-290, of which the most recent version became effective June 17, 2025.

The quality of the City's drinking water is of primary concern to the City. As described in Chapter 7, the City is in compliance with all monitoring and reporting requirements. Additionally, the City publishes an annual consumer confidence report that keeps their customers informed of the quality of their water. Based on available water quality, the City has not had issues meeting current regulatory requirements and does not anticipate any issues meeting future regulatory requirements with the exception of per- and polyfluoroalkyl substances (PFAS). Preliminary risk assessments and mitigation screenings indicate uncertainty about PFAS impacts on the City's water supply. As a result, the City will likely need some form of treatment to meet future maximum contaminant levels. To support planning and budgeting, source development and PFAS mitigation will be incorporated into the Capital Improvement Plan (CIP), detailed in Chapters 8 and 10. These projects typically require significant capital investment and will guide the City in securing necessary funding sources.

ES.8 Water Resources

An evaluation was conducted on the City's current water resources to identify deficiencies and propose improvements related to the City's water supply. Chapter 8 outlines the City's sources of supply and existing water rights and makes recommendations for future supply-related improvements. The City expects to have sufficient annual water rights (Qa) and physical capacity to serve projected High scenario ADD over the 20-year planning period. However, to serve project High scenario MDD, the City will need to acquire additional instantaneous water rights (Qi) and increase physical supply capacity as shown in Figure ES.4.

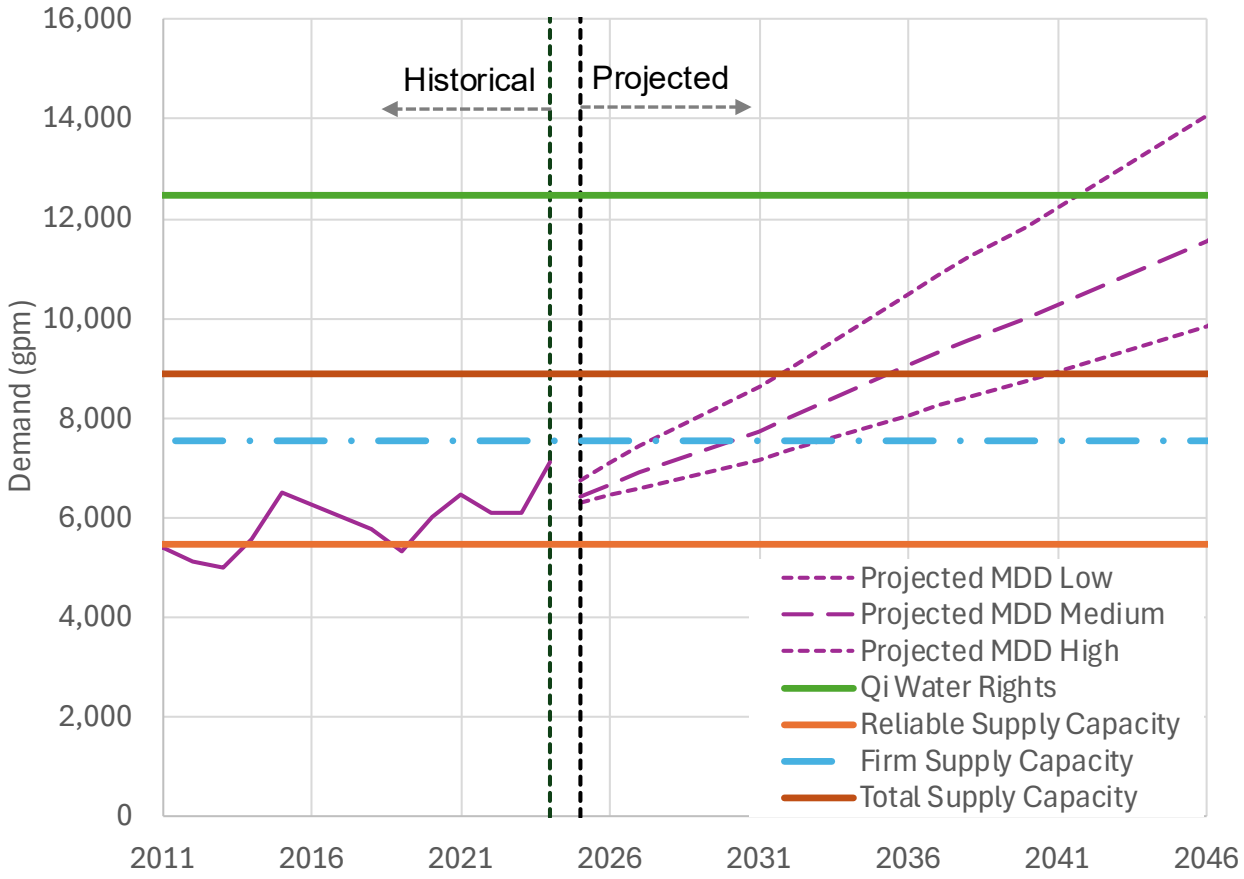


Figure ES.4 MDD Ability to Pump

To address supply related deficiencies, a water supply strategy was developed and is comprised of four parts:

- Lower Washougal Wellfield Expansion.
- Construct Wells for Existing Water Rights.
- Secure Additional Water Rights.
- Continue a WUE Program.

The City anticipates additional supply capacity may be available in the Lower Washougal Wellfield. As such, the water supply strategy focuses efforts on acquiring additional water rights and developing additional physical supply in the Lower Washougal Wellfield (LWWF). However, the development of physical capacity in the LWWF will be dependent on the availability of additional water rights for the wellfield. Should additional water rights in the LWWF be unavailable, a water resources decision making framework summarizes potential next steps to address the City's supply capacity deficits. Both the water supply strategy and water resources decision making framework are further discussed in Chapter 8.

ES.9 System Analysis

The City's water system was evaluated for its ability to meet both DOH and City specific performance criteria under existing, 2031, 2036, and 2046 demand projections. The distribution system analysis identified existing and potential future system deficiencies in the City's water system. Based on the results of the analysis, improvements were recommended to address these deficiencies. Capacity of the pipelines within the distribution system were evaluated under peak hour demands (PHD) and MDD + fire flow (FF) using the City's updated and calibrated hydraulic model. Evaluations of storage reservoirs, booster pump stations and supply sources were conducted in Microsoft Excel. The supply evaluation is discussed previously in Section ES.8. The system analysis identified a number of recommended improvements for pump stations, storage reservoirs, distribution system pipelines and pressure zones, which are shown in Figure ES.5.

ES.9.1 Distribution System Model Analysis

Under projected 2046 demands, several areas of low pressure and fire flow deficiencies were identified. In general, the majority of these deficiencies occurred on dead-end mains or areas of high elevation. These deficient areas will be addressed through distribution pipeline and booster pump station projects, which are outlined in Chapter 9. Additionally, within the planning period the City expects development in their North Shore area. Future pipelines were sized for this development and included in the distribution system model analysis.

ES.9.2 Pumping Analysis

To evaluate pump station capacities, the City's water distribution system was divided into seven different pumping areas containing nine total pump stations. The 343 pumping area is supplied by groundwater wells and although not considered a pump station, was evaluated under both supply specific and pumping criteria. Three pumping areas were flagged as deficient and three different pump station projects are described in Chapter 9 to meet future pumping capacity needs. The 343 pumping area was identified as deficient, however these deficiencies are related to the City's water supply capacity and are described in Chapter 8.

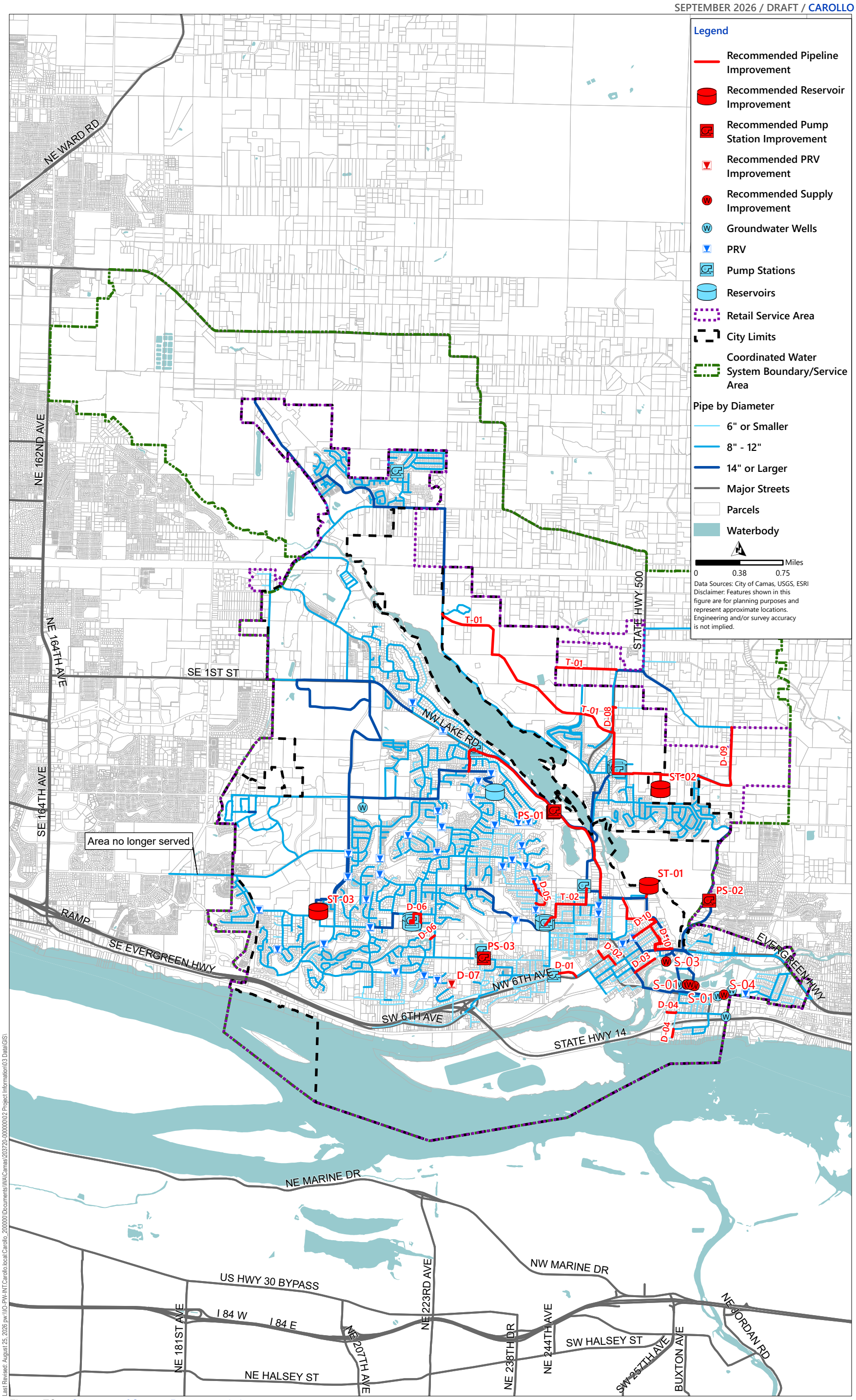


Figure ES.5 Summary of System Recommendations

ES.9.3 Storage Analysis

The City's reservoir storage requirements depend on the water system's configuration, seasonal and daily variations in water-use patterns, and the reliability of various water system components. Water storage volumes are comprised of five components:

- Operational storage.
- Equalizing storage.
- Fire-suppression storage (FSS).
- Standby storage (SS).
- Dead storage.

DOH requires that operational and equalizing storage are available to all customers at a residual pressure of at least 30 pounds per square inch (psi) under PHD flow conditions. The City has an increased level of service goal to provide standby and fire suppression storage to all customers at a residual pressure of at least 30 psi under MDD, which is above the DOH requirement of 20 psi. Therefore, all reservoir volumes above the 30 psi hydraulic grade line are considered available storage. Dead storage is the volume in the reservoir that cannot be used to serve the highest customer in the storage area with a pressure of at least 30 psi. The City also combines fire and standby into a single band for planning (i.e., nesting) and only the larger of the two volumes is used for analysis.

To evaluate storage capacities, the City's distribution system was divided into five different storage areas containing 26 total pressure zones. A summary of existing storage and storage needs in the 5-, 10-, and 20-year planning periods is shown in Table ES.2. Storage deficits were identified in the 343, 542, and 544 storage areas. Additional storage will be needed in these storage areas to address the deficits. All recommended storage projects are summarized in Chapter 9.

Table ES.2 Storage Requirements by Planning Year

Storage Area	Total Available Storage at 30 psi (MG)	2031		2036		2046	
		Required Storage (MG)	Storage Surplus/Deficit (MG)	Required Storage (MG)	Storage Surplus/Deficit (MG)	Required Storage (MG)	Storage Surplus/Deficit (MG)
343	1.20	1.20	0	1.22	-0.02	1.24	-0.04
455	1.50	0.5	1.0	0.51	0.99	0.52	0.98
542	0.05	1.05	-1.0	1.11	-1.06	1.33	-1.28
544	3.46	2.87	0.59	3.25	0.21	4.09	-0.63
852	2.42	1.85	0.57	1.91	0.51	2.06	0.36

Notes:
MG - million gallons.

ES.10 Capital Improvement Plan

The City's CIP summarizes the recommended improvements over the 10- (short-term) and 20-year (long-term) planning period with the purpose of providing the City with a guideline for the planning and budgeting of their water system. The improvements developed in the CIP address the deficiencies identified as part of the supply and distribution analysis described above in Sections ES.8 and ES.9.

The CIP is projected to cost approximately $317 million over the course of the next 20 years. Tables ES.3, ES.4, and ES.5 summarize the CIP projects by project category, priority and allocation, respectively. Figures ES.6, ES.7, and ES.8 summarize the percent of each project identified by project category, priority, and allocation, respectively. Additionally, Figure ES.9 presents a breakdown of annual costs for the City's CIP for each year of the 20-year planning period. Specific project details are discussed further in Chapter 10. The cost allocation designation differentiates how CIP projects may be funded. In general, CIP projects needed to support future growth and development are funded by developers and connection fees while projects needed to support existing infrastructure deficiencies or repair and replacement are funded by existing rate payers.

The WSPU's CIP projects are categorized as follows:

- Distribution System Improvements (D).
- Transmission Pipeline (T).
- Annual Repair and Replacement Programs (R).
- Pump Station (PS).
- Storage (ST).
- Supply and Treatment (S).
- General (G).

The CIP cost estimates presented in this chapter are consistent with American Academy of Cost Engineers Class 5 estimates, which are considered planning level estimates. Actual costs may vary from -50 percent to +100 percent of the estimated cost. These costs were determined based on the City and Carollo's perception of current conditions at the project locations.

Table ES.3 CIP Summary Table by Cost Category

Project Category	Total Cost	Average Annual Cost	Percentage
Distribution System	$4,340,000	$220,000	1.4%
Annual Programs	$87,000,000	$4,350,000	27.4%
Transmission Pipeline	$23,200,000	$1,160,000	7.3%
Pump Station	$42,020,000	$2,100,000	13.3%
Storage	$63,800,000	$3,190,000	20.1%
General	$1,500,000	$80,000	0.5%
Supply and Treatment	$95,130,000	$4,760,000	30.0%
Total Cost	**$317,000,000**	**$15,860,000**	**100.0%**

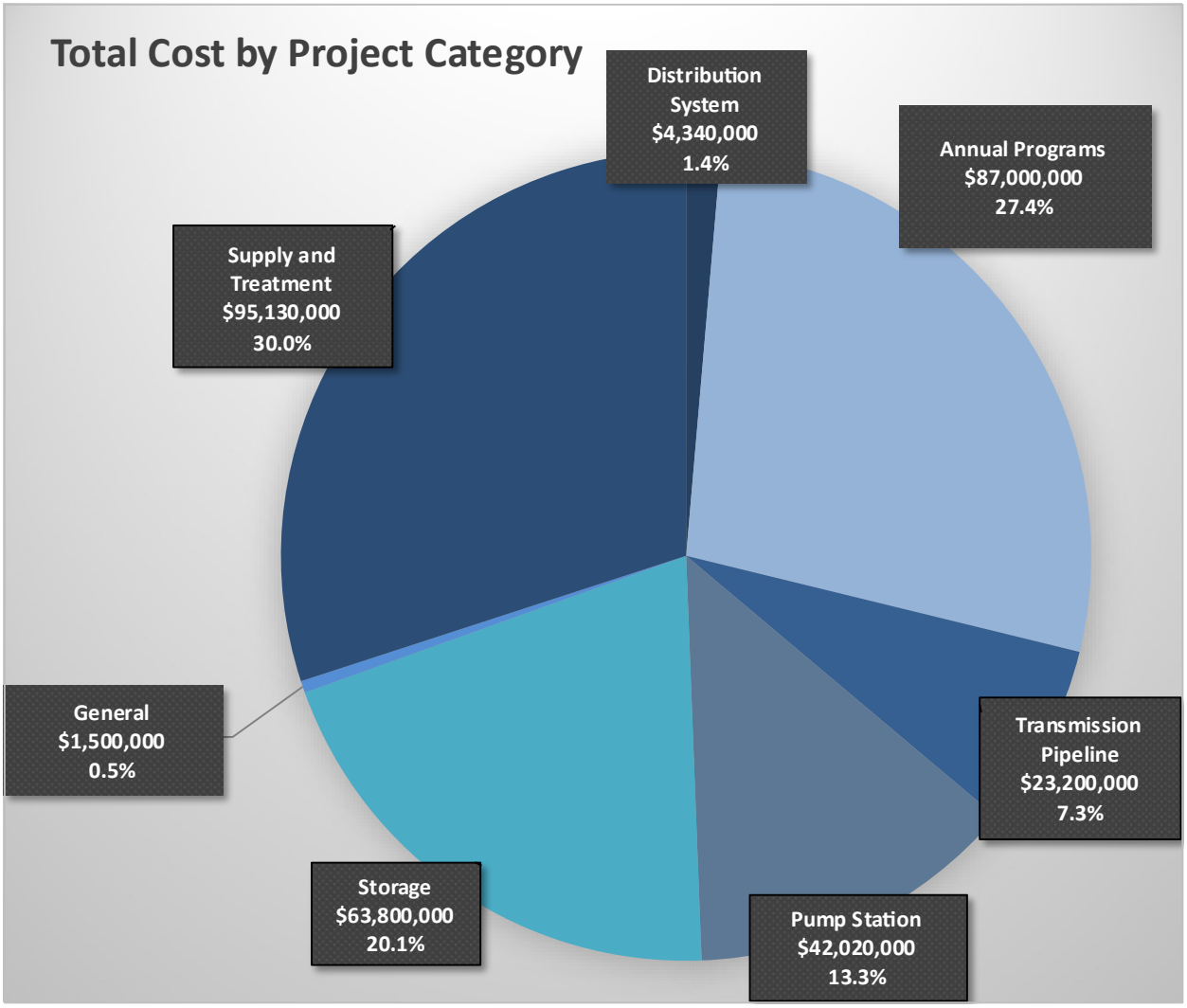


Figure ES.6 CIP Summary Table by Project Category

Table ES.4 CIP Summary Table by Project Priority

Project Priority	Total Cost	Percentage
0-10 years	$177,000,000	55.8%
10-20 years	$53,000,000	16.7%
Annual	$87,000,000	27.4%
Total Cost	**$317,000,000**	**100.0%**

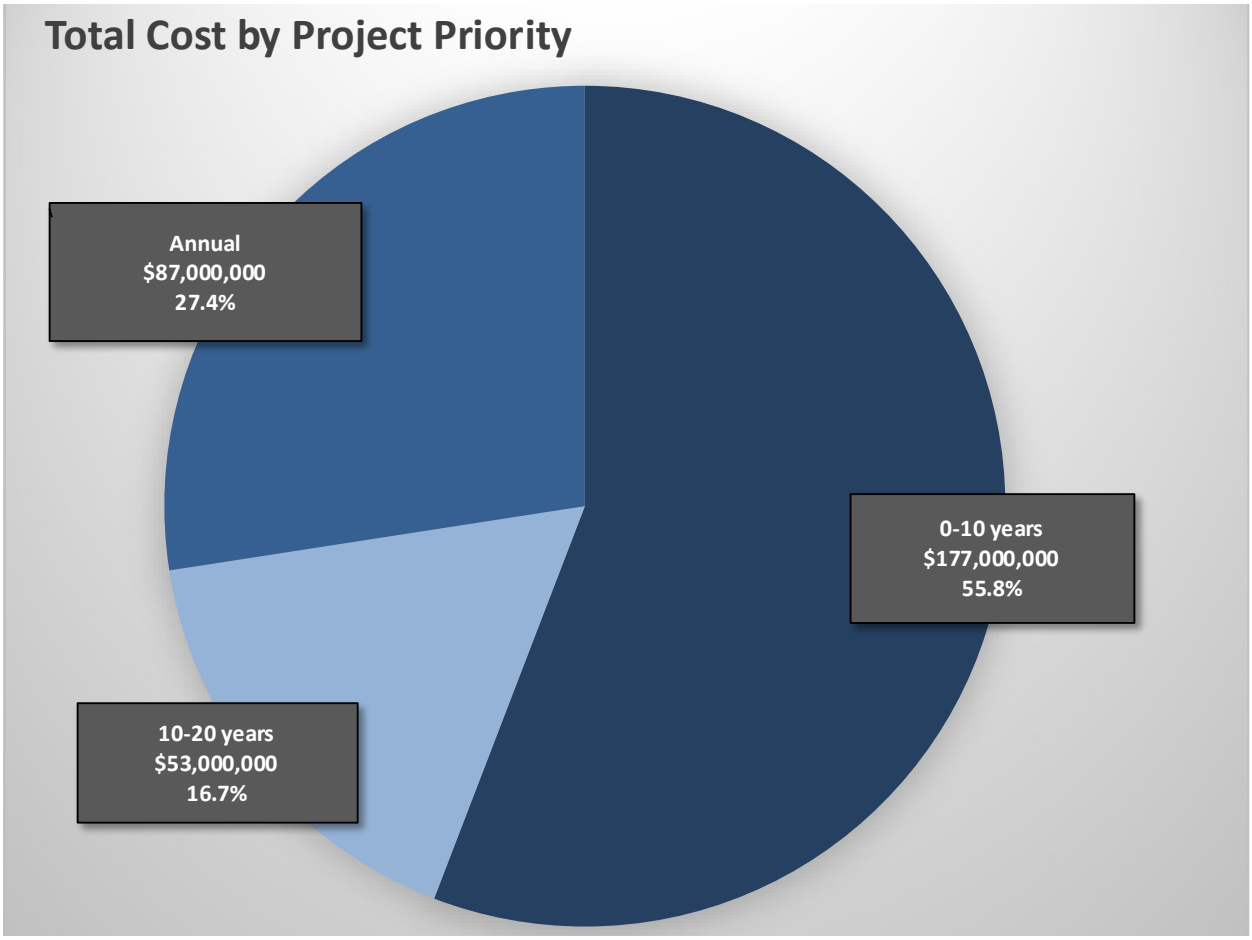


Figure ES.7 CIP Summary Table by Project Priority

Table ES.5 CIP Summary Table by Cost Allocation

Cost Allocation	Total Cost	Percentage
SDC	$148,900,000	47.0%
Rates	$168,100,000	53.0%
Total Cost	**$317,000,000**	**100.0%**

Notes:
SDC - system development charges.

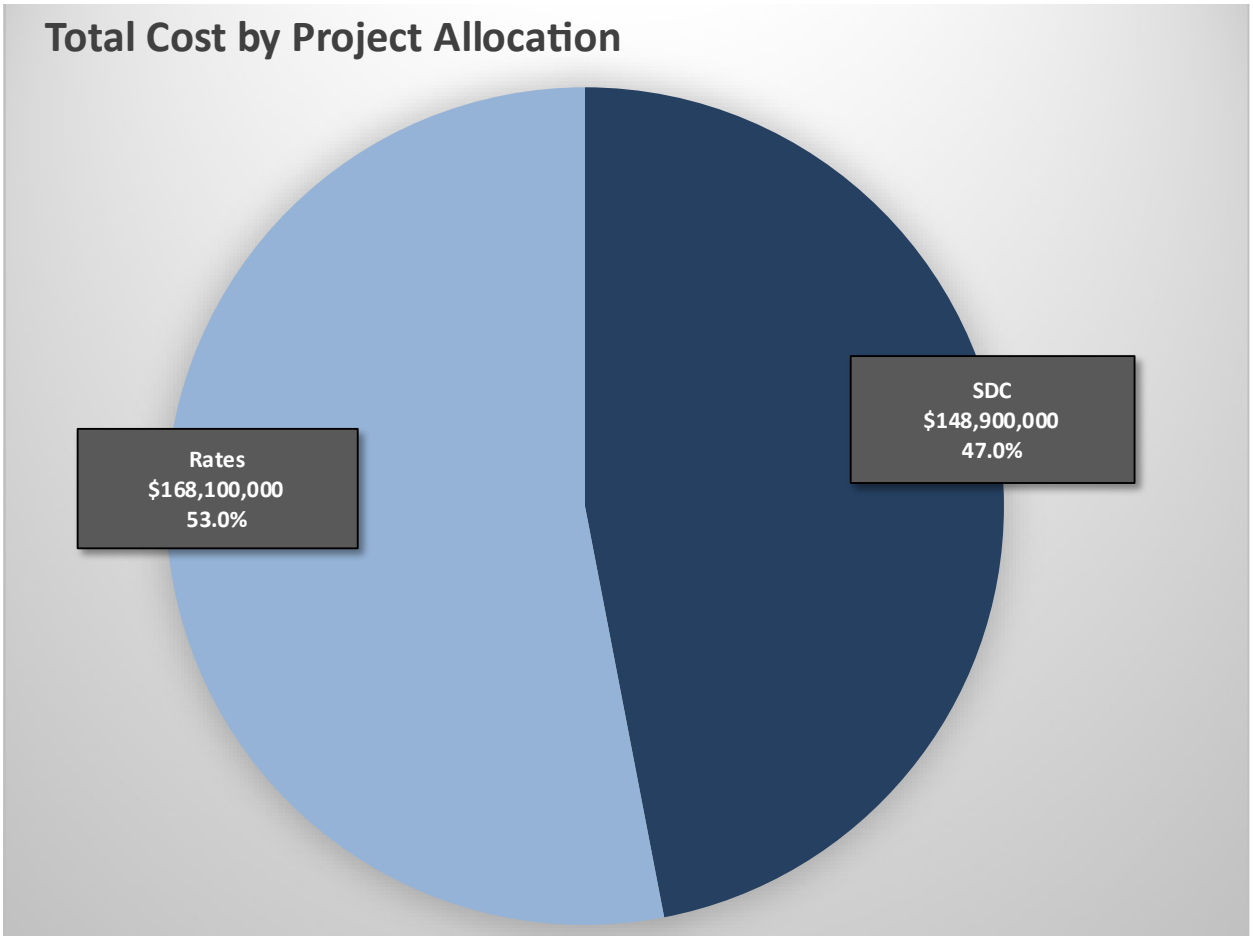


Figure ES.8 CIP Summary Table by Cost Allocation

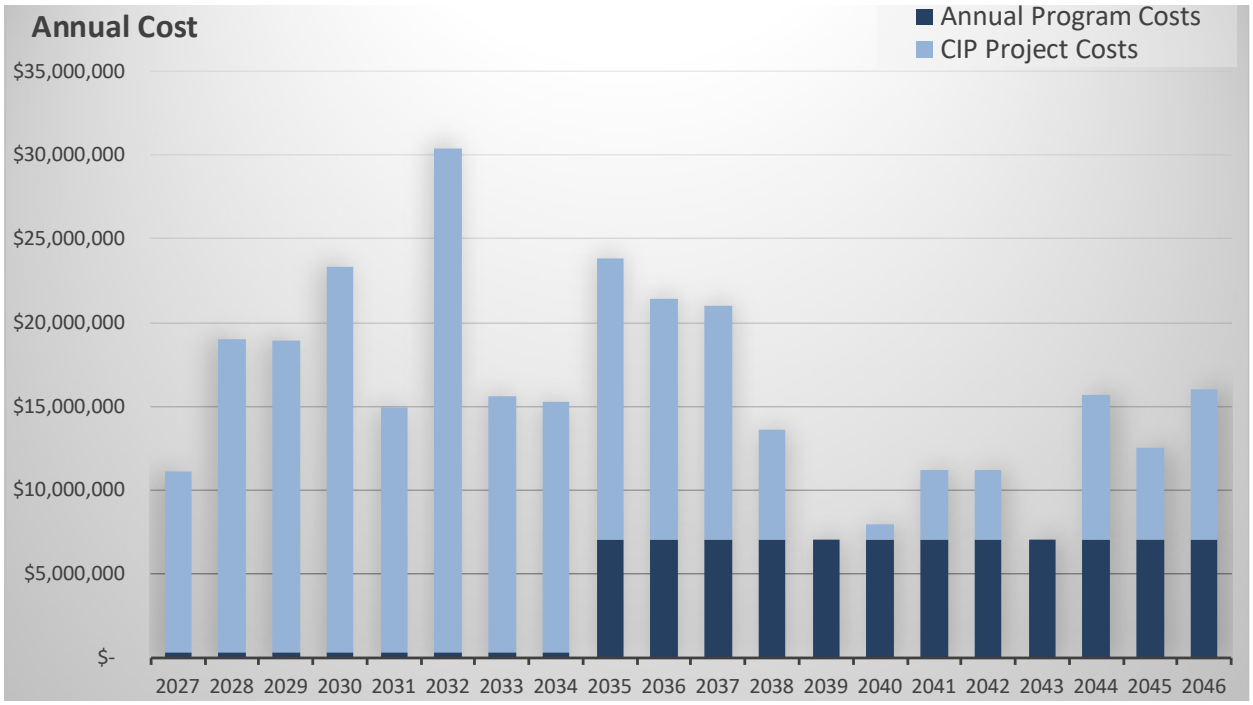


Figure ES.9 CIP Annual Cost

The major projects to be completed in the next several years of this WSPU include the following:

- Well 8, 11, and 12 expansion, and PFAS treatment of LWWF.
- 343 Zone storage improvements.
- 544 Pumping area improvements (with 343 zone transmission pipeline).
- 542 Zone storage improvements (and pipelines).
- North Shore transmission pipeline.

ES.11 Financial Plan

This chapter is still in progress and is not included in this draft of this WSPU.

CHAPTER 1 INTRODUCTION

1.1 Purpose

This Water System Plan Update (WSPU) updates the City of Camas' (City) 2019 WSPU. It was developed collaboratively by City staff, Carollo Engineers (Carollo), Strata Geosciences, and FCS Group. This WSPU documents the water system's current status and evaluates the City's future water needs. The data used for this WSPU was current as of 2024. The WSPU was developed between November 2024 and September 2026 for approval in 2026. This WSPU will be used as a guide for maintaining and improving the water system in the short-term over the next 10 years, while also providing a framework for the 20-year, long-term planning horizon.

The purpose of this WSPU is to document changes to the City's water system, identify required system improvements, and appropriately outline capital improvement projects to meet future water demands. Maintaining a current Water System Plan is required to meet the regulations of the Washington State Department of Health (DOH) and the requirements of the Washington State Growth Management Act. The WSPU complies with the requirements of DOH as set forth in the Washington Administrative Code (WAC) 246-290-100, Water System Plan.

This WSPU contains timeframes, which are the intended framework for future funding decisions and within which future actions and decisions are designed to occur. However, these timeframes are estimates and depending on factors involved in the processing of applications and project work, as well as the availability of funding, the timing may change. The framework presented in this WSPU does not represent actual commitments by the City.

1.2 Authorization

Recognizing the importance of planning, developing, and financing water system facilities to provide reliable service for the existing customers and to serve anticipated growth, the City initiated the preparation of this WSPU. In November 2024, the City selected the Carollo team to assist in the preparation of the WSPU in accordance with applicable rules and regulations governing planning for water utility systems.

1.3 Objectives

This WSPU has been prepared to serve as a guide for the planning and design of future water system facilities. Identified in this WSPU are system improvements intended to meet the needs for expected growth in the City. Specific objectives of this WSPU are addressed within individual chapters presented herein and include the following.

- Develop a document that can be updated periodically as additional information on the water system is obtained.
- Planning Considerations (Chapter 2): Establish the study area, policies and criteria, standards, and documents relating to water service within the City's water system.

- Existing System (Chapter 3): Document the existing water system supply, storage, and distribution facilities.
- Operations and Maintenance (Chapter 4): Provide a comprehensive review of operations and maintenance of the City's water system facilities.
- Water Requirements (Chapter 5): Identify and estimate the effect of future land uses and population trends on the water system. Document historical water use and project future demands based on growth projections.
- Water Use Efficiency (Chapter 6): Determine the City's current and proposed actions to comply with conservation planning requirements and to promote using water efficiently.
- Water Quality (Chapter 7): Summarize water quality regulations, monitoring, and reporting requirements. Evaluate the City's historical water quality against regulatory requirements, summarize violations, and recommend improvements, if necessary to meet anticipated or future water quality regulations.
- Water Resources (Chapter 8): Conduct a water supply evaluation that describes the City's available sources of supply and existing water rights. Develop a water supply strategy with recommendations to develop the supply capacity needed to satisfy the City's future water system demands. Update the wellhead protection plan for the City's groundwater supply sources.
- Distribution System Analysis (Chapter 9): Evaluate the capacity of the distribution system using the City's updated and calibrated hydraulic model. Conduct a desktop analysis to evaluate the capacity of storage reservoirs and booster pump stations against DOH criteria. Summarize existing and potential future system deficiencies in the City's distribution system and offer recommended improvements to the system.
- Capital Improvement Plan (Chapter 10): Develop a program of capital improvements, including priorities for design and construction.
- Financial Analysis (Chapter 11): Develop a plan for financial backing of required system improvements.
- Prepare the WSPU in accordance with the DOH Water System Plan Checklist in Section 1.8 to comply with all requirements of DOH and WAC.

Additionally, the DOH Project Approval Application (PAA) Form for this WSPU is included in Appendix F.

1.4 Location

The City is located in Clark County, WA and is considered part of the greater Portland, OR metropolitan area. The City is bordered to the south by the Columbia River, the west by the City of Vancouver, WA water system, the City of Washougal, WA water system to the east, and unincorporated Clark County to the north.

1.5 Ownership and Management

The City owns and manages its water system for municipal water supply purposes, including a broad range of water uses, including residential, commercial, industrial, irrigation, and government. The DOH water system identification number for the City's system is 108002.

The City is governed by a mayor and seven council members, all of which are elected officials and manages its water system through its Public Works Department. The Public Works Director is hired by the mayor and city administrator and oversees the entire Public Works Department, which is divided into two branches: Engineering and Operations. Daily maintenance and operational responsibilities fall under the Water Division of the Operations branch within the Public Works Department.

Contact information for the City's Public Works Department is provided below:

- Public Works Address: 616 NE 4th Avenue, Camas, WA 98607.
- Operations Center Address: 1620 SE 8th Avenue, Camas, WA 96807.
- Email: publicworks@cityofcamas.us.
- Phone: (360) 817-1563.

1.6 Environmental Assessment

The State Environmental Policy Act (SEPA), chapter 43.21C Revised Codes of Washington (RCW), requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. A SEPA Checklist and determination of non-significance (DNS) have been prepared for this WSPU in Appendix B and C. The City anticipates the WSPU does not have probable significant adverse impacts on the environment in accordance with the DNS under WAC 197-11-340(2). Many of the projects proposed within the WSPU will require subsequent project specific environmental review and SEPA checklists as part of their design process.

1.7 Approval Process

This WSPU is required to meet state, county, and local requirements. The City will submit the WSPU to DOH, Clark County, and adjacent utilities as part of the Agency Review process. See Appendix D for Agency comment letters, responses, and approvals. As required by WAC 246-290-108, a local government consistency review checklist has been prepared and is included in Appendix E. The Adopting Resolution will be included in Appendix A, upon City Council approval of the WSPU.

1.8 DOH Water System Plan Checklist

To assist in review of the WSPU, the DOH Water System Plan checklist from the pre-plan agreement meeting in May 2025 is provided in Table 1.1 with references to the required information. A copy of the checklist will be provided in Appendix G.

Table 1.1 DOH Water System Plan Checklist

Required	Content Description	WSPU Location
(✓)	Project Approval Application (PAA, DOH Pub 331-149 F)	Appendix F
(✓)	Signed and dated stamp from a Professional Engineer licensed in the State of Washington	
Description of Water System		
(✓)	Ownership and management, including Satellite Management Agency (SMA), if applicable	1.5, 2.2.2
(✓)	System history and background	2.2.1
(✓)	Related Plans	2.6
(✓)	Service area and land uses: ▪ Service area map including retail service area, service area, future service area, water rights place of use. ▪ DOH Pub. 331-432 – Service Area Guidance ▪ Existing zoning map(s) for all jurisdictions within future service area ▪ Future land use map(s) for all jurisdictions within future service area (Coordinated Water System Plan [CWSP] Counties Only)	2.2.3
(✓)	Service area and other applicable policies	2.7
(✓)	Duty to serve statement for the retail service area ▪ How does the system define “timely and reasonable”? ▪ Are there appeals processes for when a customer disagrees with a timely and reasonable determination?	Table 2.3
(✓)	Consistency with the watershed plan for Salmon/Washougal Water Resource Inventory Areas (WRIA) No. 28	2.6.8
Basic Planning Data		
(✓)	Existing population, service connections, and equivalent residential units (ERU) ▪ ERUs must be based on full-time residential connections only	Chapter 5
(✓)	Existing production/usage: monthly/annual per source, annual usage by customer class, distribution system leakage (DSL) ▪ Authorized Use and DSL, rather than “unaccounted-for water”. ▪ Additional information is available in our WUE Guidebook, Chapter 6, beginning on page 28 (PDF page 33)	5.1
(✓)	Season variations in use by customer class (1000+ connections)	5.2
(✓)	Water supply characteristics	3.3
(✓)	Water supply reliability evaluation: Include depth-to-water measurements	3.3
(✓)	Interties: agreements, existing/proposed, emergency, metering	3.9
(✓)	Plan approval period and 20-year projections for: Population, service connections, and ERUs (recommend 13- and 23-year)	5.5, 5.6
(✓)	Projections and land use discussion	5.4
(✓)	Future water demand without water use efficiency savings	5.6
(✓)	Water rights self-assessment: Consult with the Department of Ecology (Ecology) prior to plan submittal ▪ Describe water rights and complete water rights self-assessment form for existing, plan approval period, and 20 years.	**Need to complete**
System Analysis		
(✓)	Provide assumptions and basis of analysis:	
(✓)	System design standards	9.2.2
(✓)	Policies on operations and expected level of service (such as standby storage, pumping restrictions and emergency back-up power)	9.3, 9.4
(✓)	Fire flow requirements and if nesting is allowed. May need confirmation from local fire authority.	9.2.2.2, 9.4.1.3, Figure 9.2,
(✓)	Asset Management Inventory: text description and facilities map of major assets, asset management table or spreadsheet	Chapter 3
(✓)	Asset condition assessment and criticality ratings (recommended) – RCAC Template (optional format)	Chapter 3
(✓)	Water quality analysis	Chapter 7
(✓)	Capacity analysis (Must include WSDM Worksheet 4-1, ERU Capacity Summary)	9.5
(✓)	Hydraulic analysis	9.2
(✓)	Summary of system deficiencies	9.6
Water Use Efficiency (WUE)		
(✓)	Metering Program: sources, services, and non-emergency interties	6.1.1.1
(✓)	Distribution System Leakage (DSL) ▪ Summarize DSL and compare to WUE annual reports; discuss DSL calculation methodology, leak detection plan	6.1.2
(✓)	Water Loss Control Action Plan (WLCAP) ▪ If DSL exceeds 10 percent (3-year average), submit the WLCAP per WAC 246-290-820(4) ▪ Include implementation schedule and budget items, as applicable	Appendix O
Water Use Efficiency (WUE) Program		
(✓)	▪ Describe the current WUE program	6.1
(✓)	Updated WUE goal(s). Document public adoption process (include public notice, signed minutes, signed resolution). ▪ Consider doing this after DOH review of first draft	At a later date
(✓)	Describe measure(s) that will be implemented to achieve the goal(s). Include schedule and costs in the budget – 10,000 to 49,999 connections requires 9 additional measures	6.2
(✓)	Describe the process used to evaluate WUE measure(s) you did not implement	6.2
(✓)	Describe or provide an example of yearly consumer education (cannot count as a measure)	6.2
(✓)	Estimate projected water savings from selected WUE measure(s)	6.2.4
(✓)	Describe process that will be used to determine effectiveness of the WUE program	6.2.5
(✓)	Additional WUE for systems with 1000+ Connections ▪ Estimate water saved from implemented WUE measure(s) during the previous plan approval period ▪ Water demand forecast (if all cost-effective WUE measure(s) are implemented) ▪ For WUE measure(s) evaluated but not implemented: » Quantitative evaluation of WUE measure(s) cost-effectiveness, including marginal costs of water production » Evaluate WUE measure(s) for cost-effectiveness if shared with other systems » Quantitative/qualitative evaluation of measure(s) to determine cost-effectiveness from societal perspective ▪ Explore reclaimed water opportunities	Appendix P

Required	Content Description	WSPU Location
Source Water Protection		
(✓)	Sanitary Control Area (SCA): description of physical and legal protections for each groundwater source, including deeds, covenants, easements, restrictions, fencing, signage, etc.	8.4
(✓)	Wellhead protection program/update: must include updated Time-of-Travel map, contaminant source inventory, and notifications ▪ WAC 246-290-135: Source Water Protection ▪ 331-106 Wellhead Protection Requirements	8.4
(✓)*	Watershed control program for all surface water/GWI sources ▪ Include watershed and other information relative to the City's two emergency surface water sources (Boulder and Jones Creek)*	8.4
Operation and Maintenance (O&M) Program		
(✓)	Water system management and personnel, including operator certification and Cross-Connection Control Specialist (CCS)	4.1, 4.2
(✓)	Operations and preventative maintenance schedule	4.5
(✓)	Comprehensive water quality monitoring: ▪ Water Quality Monitoring Schedule (WQMS) ▪ Provide Lead and Copper Rule (LCR) and disinfection byproduct (DBP) monitoring schedule(s), map(s), and letters ▪ Coliform monitoring plan, including addresses and map. Update for Revised Total Coliform Rule (RTCR)	Chapter 7
(✓)	Emergency response program, including Water Shortage Response Plan per WAC 246-290-420 ▪ Consider Tier 1 Public Notification process, and multiple channels for notification	4.8
(✓)	Cross-connection control (CCC) program ▪ Systems with 1000+ connections: provide a copy of your CCC annual summary report form	4.9
(✓)	Sanitary survey findings	4.7
(✓)	Recordkeeping, reporting, and customer complaint program	4.4
(✓)	Water treatment (surface, disinfection, contaminant) operations	4.6
(✓)	Summary of O&M deficiencies; include cost in budget	4.11
Distribution Facilities Design and Construction Standards		
(✓)	Project review procedures	Appendix X
(✓)	Policies and requirements for outside parties	Appendix X
(✓)	Design and construction standards for distribution-related projects	Appendix X
(✓)	Construction certification	Appendix X
Capital Improvement Program (CIP)		
(✓)	CIP summary and schedule for the plan approval period (discuss prioritization, project assessment and value planning) ▪ Include any items that were identified as required for addressing capacity-related deficits	Chapter 10
(✓)	20-year (minimum) CIP for projects beyond the plan approval period	Chapter 10
Financial Program		
(✓)	Financial viability (discuss full cost of service, cost recovery, reserves)	Chapter 11
(✓)	Summary of past income and expenses, sufficient to establish trends (previous plan approval period or minimum 3 years)	Chapter 11
(✓)	Balanced operational and capital budget projections for plan approval period	Chapter 11
(✓)	Show operational, capital, and emergency reserve goals. Describe the revenue requirements to achieve them. Demonstrate annual progress toward goals.	Chapter 11
(✓)	Debt-financed capital improvements	Chapter 11
(✓)	Water rate evaluation: ▪ Describe current rate structure: Block rate based on meter size and rate class. (Not inclining block rate.) ▪ Evaluate the feasibility of implementing a rate structure that encourages water demand efficiency. ▪ Evaluate rate affordability and customer assistance programs. Provide rate that would be unaffordable, income below which current and future rates are unaffordable, and programs available for low income customers.	Chapter 11
Miscellaneous Documents		
(✓)	Updated Water Facilities Inventory (WFI) with authorized signature	Appendix R
(✓)	Local Government Consistency Determination Forms: City and County planning departments.	At a later date
(✓)	Informational meeting for the consumers (include public notice and signed minutes)	At a later date
(✓)	Adjacent utilities notice, review, and comment of draft Water System Plan. Attach notice and comments received.	At a later date
(✓)	SEPA: Signed Environmental Checklist and Threshold Determination. The water system is lead agency.	At a later date
(✓)	Agreements: SMA, intertie, service area, franchise, wheeling, mutual aid, inter-local and other agreements	Appendix H
(✓)	Correspondence	
(✓)	Supporting documents	
Miscellaneous Documents - Post DOH Review		
(✓)	Plan approval by water system governing body. Include signed meeting minutes or signed resolution. NOTE: DO NOT approve the plan until after the draft review is completed and you have received authorization to proceed with approval from the Regional Planner.	At a later date

CHAPTER 2 PLANNING CONSIDERATIONS

2.1 Introduction

The objective of this chapter is to document the City water system planning considerations that influence the WSPU including background on the study area, policies, criteria, and related documents.

2.2 Study Area

The study area for this WSPU encompasses the municipal boundaries of the City covering all residential, commercial, and industrial zones. It also extends to adjacent regions within the retail water service boundary, which are anticipated to be incorporated due to comprehensive land use changes over the next 20 years as shown on Figure 2.1.

2.2.1 Water System History

The first known settler, David Parker, came to the City in 1845. In 1883 the Lacamas Colony Company of Portland purchased 2,600 acres encompassing Lacamas, Round, and Dead Lakes (renamed as Fallen Leaf Lake), the stream connecting them to the Columbia River, and constructed dams for hydropower for new flour and paper mills, a sawmill, and a furniture factory in the area. The City was incorporated in 1906. In 1913, the City's first water system was storing Jones Creek supply in Butler Reservoir. The system has continued to expand and adapt to new challenges and regulations, as described in Table 2.1. This WSPU provides a roadmap to continue to provide high-quality water into the future.

Table 2.1 Water System Historical Timeline

Water System Historical Timeline	
1845	Camas first settled
1913	Jones Creek Intake constructed
1913	0.6 MG Butler Reservoir, South Half
1923	0.6 MG Butler Reservoir, North Half (1.2 MG total)
1931	Boulder Creek Intake constructed
1935	0.5 MG Lower Prune Hill Reservoir
1936	Wells 1 and 2 constructed
1945	Well 3 constructed
1948	Butler BPS - 800 gpm
1949	Forest Home BPS- 450 gpm
1952	Chlorination Plant - injects chlorine into water from Jones Creek and Boulder Creek before it goes to the Filter Plant
1959	Well 4 constructed
1965	Filter Plant - 1,200 gpm - filters water from Jones Creek and Boulder Creek intakes
1965	10th Street BPS

Water System Historical Timeline	
1968	Well 5 constructed
1969	Well 6 constructed
1971	Well 7 constructed
1971	1.5 MG Lower Prune Hill Reservoir
1971	0.75 MG Upper Prune Hill Reservoir
1971	Lower Prune Hill BPS - 500 gpm, 500 gpm, 750 gpm
1977	Well 8 constructed 1,350 gpm
1978	0.1 MG Gregg Reservoir
1978	Old Gregg BPS - 500 gpm
1988	SCADA System installed
1993	2.0 MG La Camas Reservoir
1993	La Camas BPS - 500 gpm, 500 gpm, 1,500 gpm
1998	Forest Home BPS Upgrade - 1,000 gpm
1999	Butler BPS Upgrade
2000	Well No. 9 constructed - 650 gpm
2001	Angelo BPS constructed - 3,000 gpm capacity
2001	Lower Prune Hill BPS Upgrade - 1,000 gpm replacement pump
2002	Upper Prune Hill Reservoir (2.4 MG) and BPS (2,900 gpm capacity) construction
2002	New Gregg Zone BPS Constructed, 1,500 gpm
2002	Lower Prune Hill Upgrade, 2,000 gpm
2002	Jones and Boulder Creek intake metering
2002	Chlorine and CT improvements
2002	Well 1 and 2 abandoned
2003	Well 3 decommissioned
2003	Well 11 (1,200 gpm) and Well 12 (900 gpm) constructed, Washougal Wellfield Chemical Feed Facility installed
2003	New Gregg BPS - 1,500 gpm
2004	Well 10 constructed - 900 gpm
2007	Well 4 decommissioned
2008	Well 13 constructed, 1,325 gpm
2008	Washougal River 24-inch pipe crossing installed
2008	Ostenson Canyon Pipeline installed
2008	City and Ecology sign agreement regarding use of service water sources and increased water rights associated with groundwater
2009	Well 14 constructed - 1,000 gpm
2009	Sodium hypochlorite disinfection system installed at Well 5 and 9
2011	Crown Road BPS installed - 1,600 gpm
2015	Slow Sand Filtration Plant constructed

Water System Historical Timeline	
2021	2.0 MG 18th Avenue Reservoir constructed
2026	Lower Prune Hill Reservoir and BPS replaced and upgraded

Notes:
BPS - Booster Pump Station; CT - contact time; gpm - gallons per minute; MG - million gallons; SCADA - supervisory control and data acquisition.

2.2.2 Ownership and Management

The City's water system is owned and operated by the City. The City is governed by a mayor and seven council members, all of which are elected officials. The Public Works Director is hired by the mayor and city administrator, and oversees the entire Public Works Department, which is divided into two branches: Engineering and Operations. Water system responsibilities fall under the Water Division of the Operations branch within Public Works.

The City has both surface water and groundwater sources. The surface water sources, Boulder and Jones Creeks, are located on the south side of Larch Mountain, northeast of Camas. The ground water sources include nine wells near the Washougal River, and one well in Grass Valley. The City treats all of its water with chlorine for disinfection and fluoride. Water pressure and fire flows are maintained throughout the service area with seven distribution reservoirs, 10 BPS, and over 159 miles of piping to serve their approximately 29,000 and growing customers.

2.2.3 Service Area

In accordance with the Municipal Water Law, the City is required to designate a retail service area within that it has a duty to serve all customers meeting the City's stated conditions of service - the City's service policies are summarized in Table 2.3 - and also designate a service area. The City's retail water service area and service area are shown in Figure 2.1. The City is temporarily serving the area northwest outside of the service area boundary under an agreement with the City of Vancouver (Vancouver), until Vancouver installs its own pipeline. Additional details of this interlocal agreement are provided in Appendix **[X]**. The retail water service area is largely defined by the City's urban growth boundary. The City's service area, defined by the Clark County CWSP, expands the retail service area to the urban growth boundary. The Regional planning does not anticipate the entire service area to develop during the planning period (next 20-years); however, the City reserves the first right of refusal for providing water service to developments in its service area.

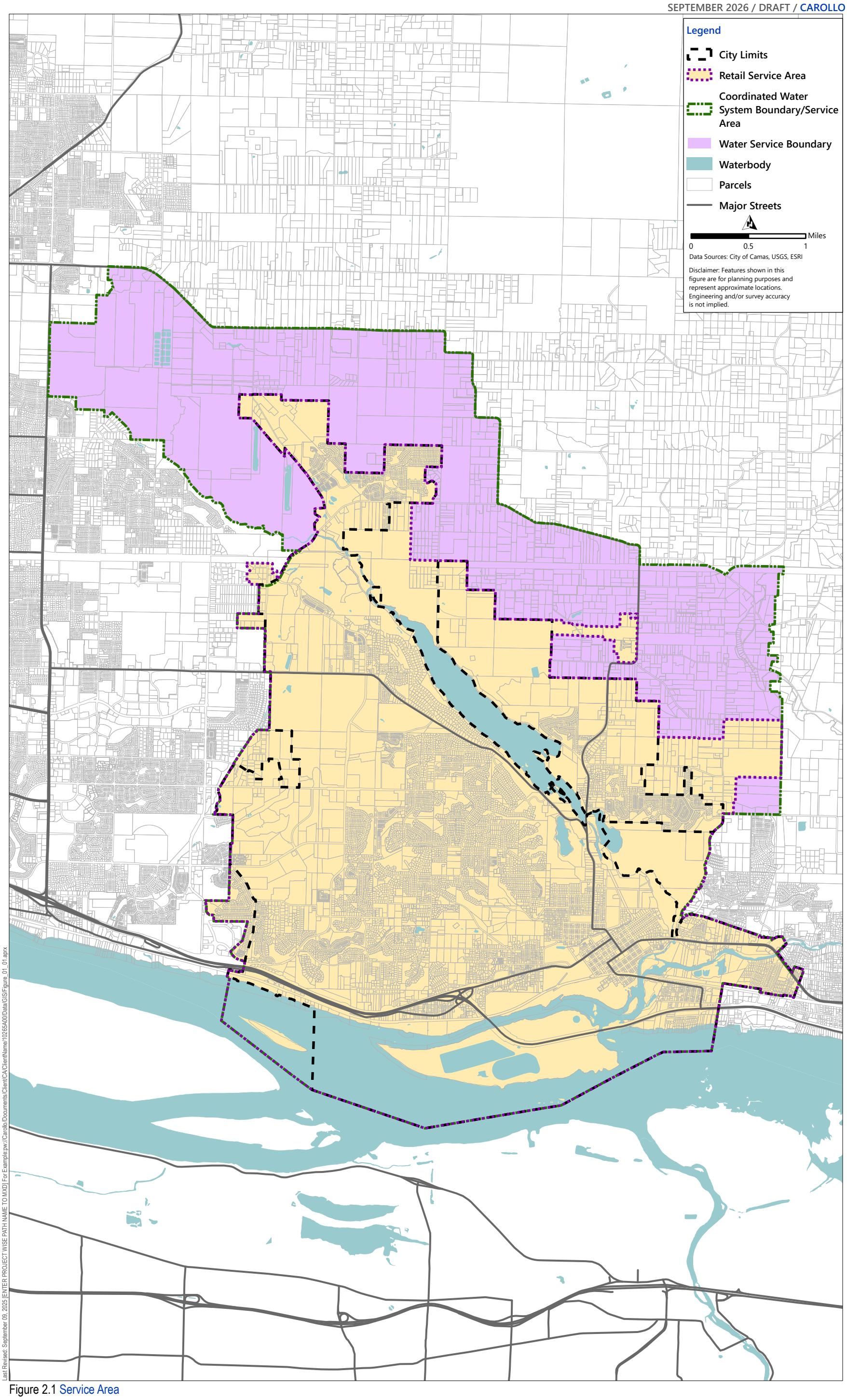


Figure 2.1 Service Area
CITY OF CAMAS
WATER SYSTEM PLAN UPDATE

2.2.4 Regional Environment

2.2.4.1 Climate

The climate in the City and the surrounding greater Clark County area is influenced by the Coast Mountain Range to the west and the Cascade Mountain Range to the east. The Coast Mountain Range provides some limited protection from the direct influence of the Pacific Ocean. Moist heavy air from the Pacific is cooled as it rises over the Coast Mountain Range and releases moisture as rainfall. The air is further cooled as it approaches the Cascade Mountain Range, resulting in moderate rainfall for lower lying area, and heavier precipitation along the west slopes of the Cascades. This results in a large variation of rainfall across the county. The Cascade Mountains also provide a barrier against continental air masses originating over the Columbia Basin to the east.

According to the Weather Atlas, Clark County has wet, mild winters and warm, dry summers. The City of Camas receives an average of about 37 inches of precipitation annually, while the northeastern portion of the county can receive averages approximately 150 inches per year, based on the data from the Washington Department of Transportation (WSDOT). Approximately 80 to 85 percent of the precipitation occurs between the months of October and May, and the City receives 173 days of sunshine per year.

Based on data from National Oceanic and Atmospheric Administration (NOAA), the average January temperature across Clark County between 2000 and 2025 was 40.2 degrees Fahrenheit, increasing to a 78-degree high in July. Winter storms come generally from the southwest, with infrequent snowstorms originating from the Gulf of Alaska. Fall and winter storms can be accompanied by high winds, resulting in power outages.

2.2.4.2 Topography

Clark County is located in the Willamette-Puget Trough, a geographic basin formed by the Cascade and Coast Mountain Ranges. The county is bounded on the south and west by the Columbia River, on the north by the Lewis River, and on the east by the foothills of the Cascades. The City itself resides in the Southeast side of the county, with Vancouver to the west and Washougal to the east.

The ground slope and natural drainage features within the City play a significant role in the planning and design of the water distribution storage facilities. The elevation within the City ranges from about 20 feet above sea level along the shores of the Columbia and Washougal Rivers, to approximately 752 feet (NGVD 29) at the Upper Prune Hill Standpipe located at the top of Prune Hill. The terrain in the City includes a flat plateau in the Downtown area and generally increasing elevations to the North, except where Lacamas Lake forms a valley through the City as shown in Figure 2.2.

2.2.4.3 Surface Water

The surface water features within the City urban growth area (UGA) boundary include the Columbia River, Washougal River, Little Washougal River, Lacamas Creek, Lacamas Lake, Fallen Leaf Lake, and Round Lake. The City also owns the majority of the watershed for the Jones and Boulder Creeks north of the City's intakes for these sources. Jones and Boulder Creek are tributaries of the Little Washougal River, which is a tributary of the Washougal River. The basin characteristics for the creeks, streams, and rivers discussed below were obtained from stream gauging published by the U.S. Geological Survey.

The Columbia River begins in Canada, enters the United States in northeastern Washington, continues traveling southwest through eastern Washington, where it travels over a series of dams until it empties into the Pacific Ocean. The Columbia River forms the border between the states of Washington and Oregon from the point where it crosses the 46th Parallel until it empties into the Pacific Ocean. The Columbia River drainage area is approximately 241,000 square miles, with an average flow of 603,000 cubic feet per second (cfs).

The Washougal River flows southwest from the Cascade Mountains to the City, where it empties into the Columbia River. The Washougal River drainage basin is approximately 108 square miles in size and historical records report average flows at approximately 9,000 cfs.

The Little Washougal River, of which Jones and Boulder Creeks are tributaries, flows to the southwest out of the Cascade Mountains. The Little Washougal turns to the southeast before it crosses into the City UGA and empties into the greater Washougal River. The Little Washougal drainage basin covers approximately 23 square miles with historical average daily peak flows of approximately 1,317 cfs.

Lacamas Lake is over 60 feet deep in places. It receives flow from Lacamas Creek and Dwyer Creek. The Lake then discharges into Lacamas Creek, which flows into the Washougal River. The water level is controlled by dam located at the south end of the lake. Round Lake is a reservoir and is a smaller part of Lacamas Lake, separated from Lacamas Lake by Everett Street.

2.2.4.4 Critical Areas

Critical areas within the City include those classified as Critical Aquifer Recharge Areas, Fish and Wildlife habitat conservation areas, frequently flooded areas, geologically hazardous areas and wetlands. Given its importance to the water system, the City's Critical Aquifer Recharge area map is included as Figure 2.3. Please refer to the City's website for the up-to-date description and mapping of its Critical Areas.

2.2.4.5 Geology

The Clark County area exhibits traces of its geologic history, including repeated inundation by fluctuating sea levels during glacial epochs, the sedimentary processes of repeated flooding of the Columbia River, volcanic activity, periodic earthquakes, and other tectonic activity. The geologic units in Clark County reflect this varied history and can be placed into two general categories: older consolidated rocks and volcanic rocks. These include Columbia River Basalts and Skamania and Goble volcanic series, and sedimentary rocks incorporating unconsolidated gravels, silts, sands, and clays created by glacial and alluvial processes.

The main geological feature of Camas is Prune Hill, which is an extinct volcanic vent that much of the residential area resides on. Prune Hill is at the Northwest end of Camas, and the City elevation drops off to the west and the Columbia River Gorge to the south. Lady Island, in the Columbia River Gorge, is separated from the mainland by the Camas Slough, and is mostly used for industrial purposes.

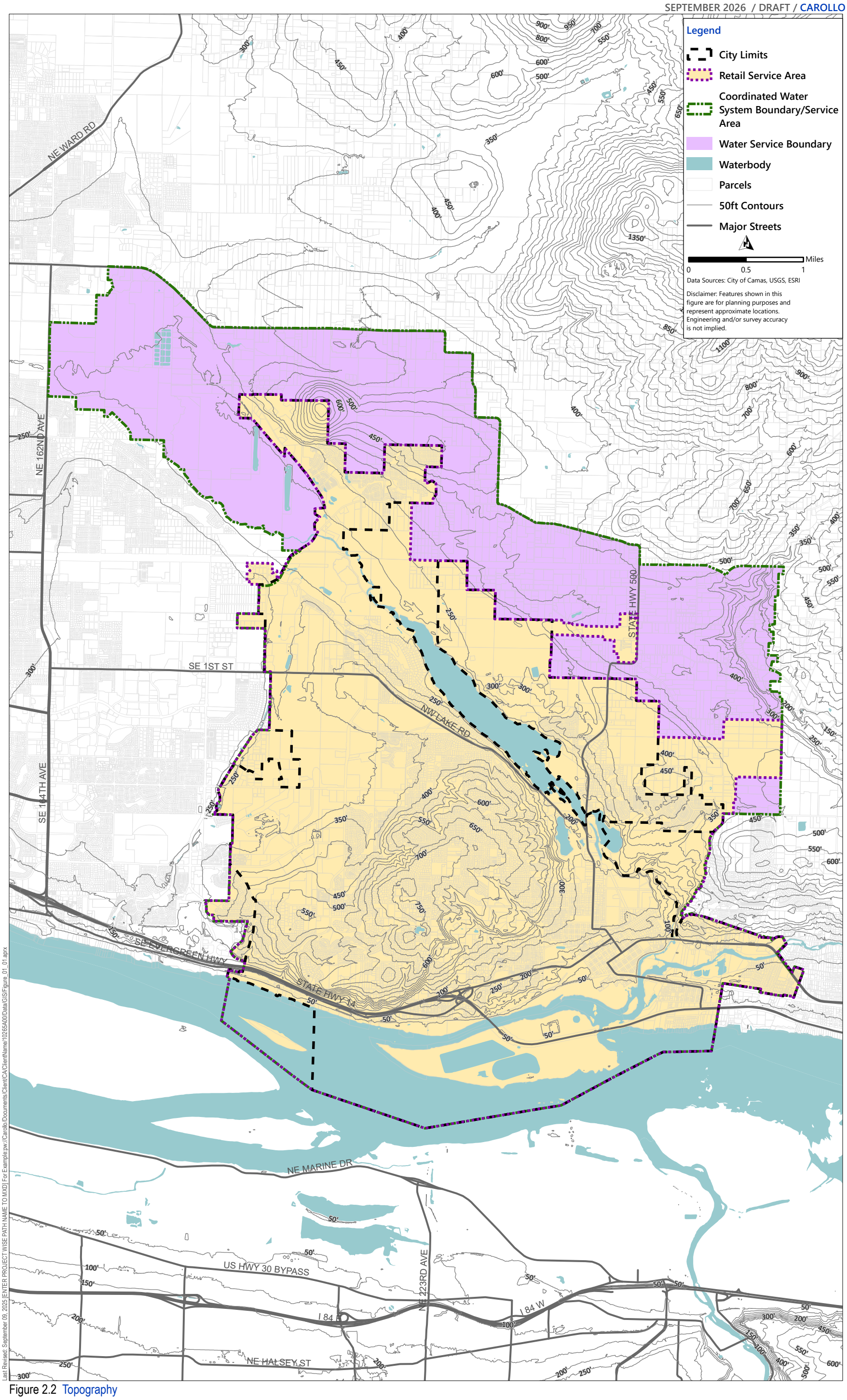
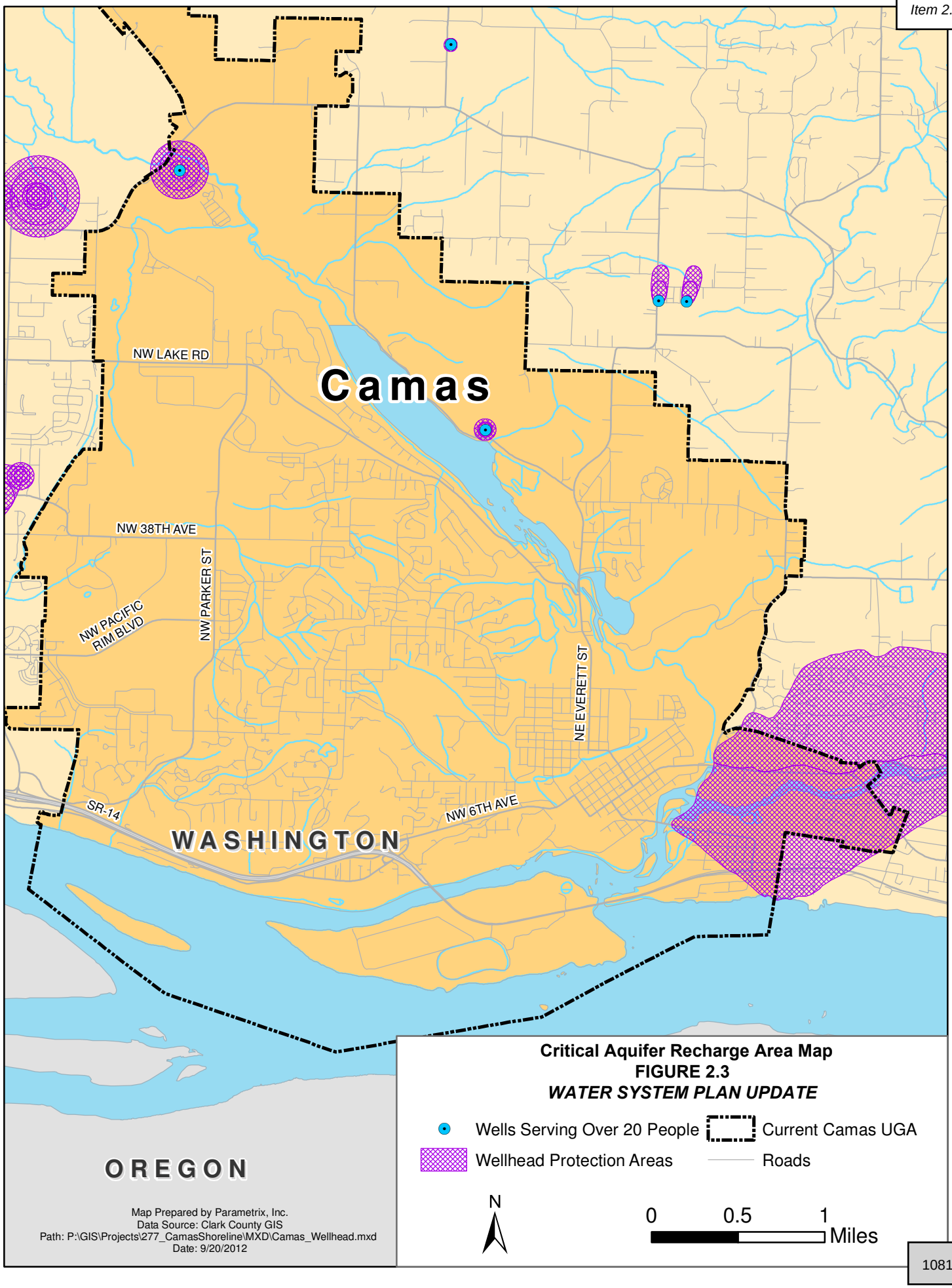


Figure 2.2 Topography


Camas
NW LAKE RD
NW 38TH AVE
NW PACIFIC RIM BLVD
NW PARKER ST
NE EVERETT ST
NW 6TH AVE
SR-14
WASHINGTON
OREGON
Critical Aquifer Recharge Area Map
FIGURE 2.3
WATER SYSTEM PLAN UPDATE
Wells Serving Over 20 People
Current Camas UGA
Wellhead Protection Areas
Roads
N
0
0.5
1
Miles
Map Prepared by Parametrix, Inc.
Data Source: Clark County GIS
Path: P:\GIS\Projects\277_CamasShoreline\MXD\Camas_Wellhead.mxd
Date: 9/20/2012

2.3 Legislation, Regulations, and Permits

Water system planning is based on a careful analysis of a water utility's responsibility to comply with applicable regulatory requirements while providing service to existing and future customers. These regulatory requirements are the result of a number of state and federal laws. These laws are monitored and enforced by a number of federal, state, and local agencies.

In this section, the various state and federal legislation that may affect City operations are discussed, as well as other relevant permits, programs, and regulations.

2.3.1 Federal Clean Water Act

The Federal Water Pollution Control Act is the principal law regulating the water quality of the nation's waterways. Although originally enacted in 1948, it was significantly revised in 1972 and 1977, when it was given the common title of the "Clean Water Act." (CWA) The CWA has been amended several times since 1977. The 1987 amendments replaced the Construction Grants program with the State Revolving Fund (SRF) which provides low-cost financing for a range of water quality infrastructure projects.

A CWA Section 401 Water Quality Certification is required for any activity that may result in discharge to surface waters including excavation activities that occur in streams, wetlands, or other Waters of the United States. In Washington State, CWA Section 401 responsibility has been assumed by Ecology, and is required for projects with CWA Section 404 Permits.

Section 404 of the CWA regulates discharges of fill or dredged materials in wetlands, including any related draining, flooding, and excavation. Pipeline and pump station projects in wetlands will require a Section 404 Permits, in addition to any related local permits. CWA Section 404 Permits require Endangered Species Act (ESA), Section 7 consultation with the United States Fish and Wildlife Services (USFWS) and the National Marine Fisheries Service (NMFS) as a result of recent listings of salmonids. Biological Assessments, Biological Opinions, and their review have significantly lengthened the time required for issuance of CWA Section 404 Permits.

The Navigable Water Protection Rule (NWPR), implemented by the United States Environmental Protection Agency (USEPA) and the United States Department of the Army (Army) recognizes and outlines four clear categories of waters that are considered “waters of the United States”. These four categories protect the nation’s navigable waters and the core perennial and intermittent tributary systems that flow into those waters. These categories are territorial seas and traditional navigable waters (TNW), tributaries, lakes, ponds, and impoundments or jurisdictional waters, and adjacent wetlands.

2.3.2 Safe Drinking Water Act

The Federal 2.3.2Safe Drinking Water Act (SDWA) was passed in 1974 and amended in 1986 and 1996. The DOH adopted the federal standards under WAC 246-290, which became effective April 27, 2003. All public water systems as defined by the USEPA are affected by the SDWA. A public water system is defined as one that serves piped water to at least 25 people, or 15 connections for at least 60 days per year. The SDWA contains regulations regarding water quality, sampling, treatment, and public notification requirements that are applicable to the City. Water quality regulations are discussed further in Chapter 7.

The American Water Infrastructure Act (AWIA) was signed into law on October 23, 2018, and amended sections of the SDWA. Under Section 2013 of the AWIA, water systems serving more than 3,300 people are

required to develop or update risk and resilience assessments (RRA) and emergency response plans (ERP). An RRA looks at risks to a system and a system's resilience to those risks. An ERP covers strategies to improve system resilience as well as plans, actions, and procedures to be implemented to mitigate or lessen the impact of an emergency event. Submission cycles for RRAs and ERPs are every five years, and the deadlines are based on the size of the population served by the water system. The next five-year RRA submission cycle deadline for the City is June 30, 2026, and the ERP update deadline is December 31, 2026. It is important to note that ERP certifications are due six months from the date of the RRA certification.

2.3.3 Endangered Species Act

The purpose of the 1972 ESA is to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved…" In pursuit of this goal, the ESA authorizes USFWS and NMFS to list species as endangered or threatened, and to identify and protect the critical habitat of listed species. USFWS has jurisdiction over terrestrial and freshwater plants and animals such as bull trout and cutthroat trout, while NMFS is responsible for protection of marine species including anadromous salmon. Under the ESA, endangered status is conferred upon "any species within the foreseeable future throughout all or a significant portion of its range." The ESA defined critical habitat as the "geographical area containing physical and biological features essential to the conservation of species."

The Table 2.2 lists the Evolutionarily Significant Units of salmonid species present in the Camas area listed, or proposed for listing, under the authority of the ESA.

Table 2.2 Evolutionarily Significant of Listed Salmonid Species

Species	Listing Status	Date Listed
Columbia River Bull Trout	Threatened	June 1998
Lower Columbia River Chinook	Threatened	March 1999
Lower Columbia River Chum	Threatened	March 1999
Lower Columbia River Coho	Threatened	June 2005
Lower Columbia River Steelhead	Threatened	March 1998

Once a species is listed as endangered or threatened, the ESA makes it illegal for the government or individuals to "take" a listed species. "Take" has been interpreted by the federal courts to include "significant modification or degradation of critical habitat" that impairs essential behavior patterns. For species listed as endangered, the blanket prohibitions against "take" are immediate. However, threatened species may be protected through a more flexible Section 4(d) rule describing specific activities that are likely to result in a "take."

Since 2007, The City has updated its ordinance on critical areas and has adopted the Shoreline Master Program (SMP). These updates helped to clarify the specific activities in Section 4(d) and to increase the focus on migratory species.

2.3.4 Reclaimed Water Standards

The standards for the use of reclaimed water are outlined in the Revised Code of Washington (RCW) Section 90.46 and in a separate document published by Ecology and DOH entitled "Water Reclamation and Reuse Standards." Reclaimed water is "the effluent derived in any part from sewage from a

wastewater treatment system that has been adequately and reliably treated, such that it is no longer considered wastewater and is suitable for a beneficial use or a controlled use that would not otherwise occur" (Water Reclamation and Reuse Standards). The legislature has declared that "the utilization of reclaimed water by local communities for domestic, agricultural, industrial, recreational, and fish and wildlife habitat creation and enhancement purposes (including wetland enhancement) will contribute to the peace, health, safety, and welfare of the people of the State of Washington."

2.3.5 National Environmental Policy Act

The National Environmental Policy Act (NEPA) was established in 1969 and requires federal agencies to conduct environmental review or assessments of projects to determine impacts on all projects requiring federal permits or funding. If the project is determined to be environmentally insignificant, a Finding of No Significant Impact is issued, otherwise an Environmental Impact Statement (EIS) is required. City activities requiring CWA Section 404 permits fall under the jurisdiction of NEPA.

The National Historic Preservation Act (NHPA) regulates federal activities with the potential to impact materials of historic, cultural, or archaeological significance under Section 106, which requires consultation with affected Native American Tribes and the Washington State Department of Archaeology and Historic Preservation. Documentation of this consultation is included in NEPA Environmental Reports and Assessments. Recent decisions by the United States Army Corps of Engineers (Corps) require an independent NHPA Section 106 consultation process for projects permitted by the Corps, which can result in significant delays to project implementation.

The State of Washington regulates state funded projects with the potential to impact material of historic, cultural, or archaeological significance under Governor's Executive Order 05-05, which requires consultation with the Department of Archaeology and Historic Preservation and affected Tribes similar to the NHPA Section 106 process.

2.3.6 State Environmental Policy Act

The SEPA that environmental issues are taken into consideration during the planning and process for Non-Federal projects. An EIS is required if a project will have a significant adverse environmental impact. The EIS looks at potential environmental problems that would be caused by the project; ways the project could be changed to minimize the impact; and mitigation options. The City is currently pursuing alternate source of supply, which may require an EIS depending on the type of projects that are involved. Most projects, including water right applications and transfers, typically do not require an EIS. A SEPA checklist is prepared, and a Determination of Non-significance is issued instead. This WSPU will fall under the SEPA Checklist Non-Project Action requirement. The water system projects listed in the capital improvement plan will each be completed under a separate SEPA checklist. A SEPA checklist and DNS for the WSPU is indicated in Appendix B.

2.3.7 Growth Management Act

The Washington State Growth Management Act (GMA) was enacted in 1990 and requires certain local governments to plan for the population growth that will occur over the next 20 years within an established UGA. The GMA also requires cities to classify critical areas (wetlands, aquifer, recharge areas, fish and wildlife habitat areas, geologically hazardous areas, and frequently flooded areas) and to establish

development regulations to protect these areas. Clark County is updating its current plan, which will be adopted in December 2025, to extend through 2045. The update will include changes regarding population and employment growth for the next 20 years.

2.3.8 Shoreline Management Act Permit

A Shoreline Permit is required on all projects of $8,500 or more that are located on the water or shoreline area. Shorelines are lakes of reservoirs of 20 acres or greater, streams with a mean annual flow of 20 cfs or greater, marine waters, and an area within 200 feet of the ordinary high water mark. Areas within the City that are classified as shoreline are those areas along Lake Lacamas, Washougal River, Little Washougal River, and Columbia River.

2.3.9 Floodplain Development Permit

Local governments that are participating in the National Flood Insurance Program are required to review projects (including water system facilities) in a mapped flood plain and impose conditions to reduce potential damage from flood water. A Floodplain Development Permit is required prior to construction.

2.3.10 Hydraulic Project Approval

Under WAC 220-110, the Washington State Department of Fish and Wildlife requires a hydraulic project approval (HPA) for activities that will "use, divert, obstruct, or change the natural flow or bed" of any waters of the state. For City activities such as pipeline crossings of streams or outfall and intake improvements, an HPA will be required, and must include provisions necessary to minimize project specific and cumulative impacts to fish.

Because of ESA listings throughout Washington, the Washington State Department of Fish and Wildlife and the NMFS revised the Hydraulic Code to protect species listed as threatened or endangered. The revisions to the code specifically aimed to "incorporate up-to-date fish science technology, simplify the permitting of certain types of projects, improve procedural and administrative requirements to better align with statutory changes and, establish a structure for adaptive management that responds to changing science and technology and/or the results of effectiveness monitoring".

If NMFS determines that the revisions are sufficient to protect listed species, the State hopes the revised Code will constitute an accepted Habitat Conservation Plan under Section 10 of the ESA. If the Habitat Conservation Plan is approved, NMFS may issue an Incidental Take Permit allowing incidental take of a listed species if the permittee has complied with the Habitat Conservation Plan. This Incidental Take Permit expires after an agreed upon period of time, and may then be revised by NMFS.

2.3.11 Local Permits

The City has agreements with Clark County for the construction and maintenance of facilities in their respective rights-of-way. Under these agreements, an Encroachment Permit is issued that specifies construction standards such as traffic control, work hours, and safety issues, as well as design and restoration standards.

2.4 Water Rights

A water right is the legal authorization to use a specified amount of public water for a certain beneficial purpose. Washington State law requires that permission in the form of a water right permit or certificate be granted for most appropriations of public water. Water rights are issued by Ecology and are required to ensure proper allocation and management of water resources. The following sections provide definitions of key terms with regards to water rights.

2.4.1 Water Right Claim

A water right claim is a statement of claim to water use that began before the State Water Codes were adopted and is not covered by a permit or certificate. A claim may represent a valid water right if it describes the use of a surface water source that began before 1917 or the use of groundwater source that began before 1945. It can also represent a water right claim that was filed with the State during an open filing period designated under RCW 90.14 or is covered by the groundwater exemption.

2.4.2 Water Right Permit

A water right permit is issued by the State for water right applicants to begin developing their water right. A water right is developed when the applicant follows the provisions outlined in their permit such as using the water for the purposes and limits stated in the permit. A water right permit will remain in effect until the water right certificate is issued, if all terms of the permit are met, or the permit is canceled.

2.4.3 Water Right Certificate

A water right certificate is issued by Ecology to certify that the water user has the authority to withdraw a specific amount of water under certain conditions. The conditions are based on the beneficial use of the water under the water right permit. The water right certificate is a legal document recorded at the county auditor's office. Issuance of the water right certificate is the final step in obtaining a water right.

2.5 Regulatory Agencies

The above regulations, permits, and programs are administered by various local, state, and federal agencies. The history, purpose, and authority of these agencies are discussed below.

2.5.1 United States Environmental Protection Agency

The stated mission of the USEPA is to protect human health and to safeguard the natural environment upon which life depends. The USEPA's purpose includes protecting all Americans from significant human health risks, ensuring that national environmental efforts are based on the best available scientific information, ensuring that federal laws are enforced fairly, and that the environmental protection contributes to making our communities and ecosystems diverse, sustainable, and economically productive. Ecology currently administers the SRF loans for the USEPA.

2.5.2 United States Fish and Wildlife Service

Under the ESA, USFWS is responsible for the protection of all non-marine life including birds, mammals, and non-anadromous fish, including bull trout and sea-run cutthroat. Although USFWS may choose to invoke the blanket prohibitions of Section 9, the "threatened" status of Bull Trout allows more flexibility to establish regulations designed to protect these species. These regulations, known collectively as Section 4(d) rule, online activities likely to result in a "take" of a threatened species, as well as exempted activities.

2.5.3 The National Marine Fisheries Service

Under the ESA, the NMFS is responsible for the protection of marine life, including anadromous salmon such as the Columbia River Chinook, Chum, and Steelhead. When a species is listed as "endangered" the prohibitions against "take" of the species are immediate under Section 9 of the ESA of the Act. Although NMFS may choose to invoke the blanket prohibitions of Section 9, the "threatened" status of the Columbia River Chinook, Coho, Chum, and Steelhead allows more flexibility to establish regulations designed to protect these species. These regulations, known collectively as a Section 4(d) rule, outline activities likely to result in a "take" of a threatened species, as well as exempted activities. The final 4(d) Rule was adopted on June 20, 2000.

2.5.4 United States Army Corps of Engineers

Under Section 404 of the CWA, the Corps is authorized to regulate discharge of fill and dredged material to waters of the United States, including wetlands. A similar review process is employed for projects with the potential to impact navigable waters, including the Columbia River, under Section 10 of the Rivers and Harbors Act of 1899. This process applies to any work on outfalls to the Columbia River. The Corps employs a system of General or Nationwide Permits for blanket authorization of activities such as utility lines that have minimal adverse impact on the environment. In situations where projects are large and complex, or adverse impact is probable, the Corps may issue an Individual Permit after reviewing an alternatives analysis. Enforcement actions may be brought by the Corps or the USEPA. Activities subject to Corps jurisdiction require NEPA and ESA review and consultation.

2.5.5 Washington State Department of Health

DOH has three primary functions: to regularly assess the State's health needs and resources; to develop and implement sound public policy; and to ensure the capacity of public health agencies to manage daily operations and respond to public health emergencies. The DOH was granted full authority and responsibility for the regulation and enforcement of the SDWA by the federal government in 1976. DOH also publishes guidelines for the preparation of water system plans, water conservation programs, design and drinking water quality standards, and watershed control programs. Water system comprehensive plans must be reviewed and approved by DOH. Construction plans and specifications must also be reviewed by DOH unless they are the transmission or distribution improvements included in the Water System Comprehensive Plan, CIP.

2.5.6 Washington State Department of Ecology

The mission of the Ecology Water Quality Program is to protect, preserve, and enhance the State's surface and ground water quality and to promote the wise management of water for the benefit of current and future generations. Ecology performs various functions under State and federal authority and has both local and regional offices. Ecology oversees the allocation of water rights.

2.5.7 Washington State Department of Fish and Wildlife

Under the updated Hydraulic Code Rules WAC 220-660, and RCW 75.20, any form of work that uses, diverts, obstructs, or changes the natural flow or bed of any fresh water of the State requires hydraulic project approval from the Department of Fish and Wildlife. Approval would be required for all City construction projects that cross or otherwise take place in streams or shorelines.

2.5.8 Watershed Resource Inventory Area

Under WAC 173-500-040, Washington State was divided into 62 geographic areas, defined on the basis of surface water resource. These 62 geographic areas are defined as WRIA. The purpose of WRIA is to implement effective planning involving all jurisdictions that fall within WRIA, including county, city, and other local, state, and national agencies.

The City and the Jones and Boulder Creek watersheds reside within WRIA 28. The City owns and controls a majority of the Jones and Boulder Creek watersheds, Figure 1.2, which are both tributaries of the Washougal River. The City is an active participant in regional watershed planning efforts.

2.5.9 Local Health Departments

The Clark County DOH is the local health department governing the City. In general, local health departments may adopt and enforce local regulations when they are consistent with and more stringent than state regulations.

2.5.10 County Planning Policies

City planning policies should be consistent with those of Clark County. Accordingly, this WSPU will require approval by Clark County.

2.6 Related Planning Documents

The City recognizes that planning activities of governmental entities can affect the water utility. These include several regional and local plans of the southwest region of Washington, such as Clark County. Some related plans affect how Camas operates its water system and how it plans to meet future growth. The following section summarizes these related plans.

2.6.1 Clark County Coordinated Water System Plan

Amended and adopted in 2012, the CWSP serves as a primary planning document for water purveyors within Clark County. Since the adoption of the 2012 CWSP, an addendum was incorporated in 2021 to reflect a 2017 interlocal agreement between the Cities of Camas and Vancouver. This agreement adjusted

the water services boundaries and water service shut-offs provisions, as referenced in Exhibit 2 of the 2012 CWSP. The CWSP was developed to fulfill the requirements of the 1977 Public Water System Coordination Act (RCW 70.116) and the 1971 Water Resource Act (RCW 90.54). The plan is in accordance with the Lewis and Salmon-Washougal Water Resources Management Program rules (WAC 173-527 and WAC 173-528). These acts work together to create a framework for water utilities, which allows for coordinated planning and construction programs among adjacent water utilities. Also, these acts allow utilities in a specified geographical area to reserve water rights required to meet projected municipal and industrial needs for a 50 year period. In order for reservation of water rights and coordination of water system planning to occur, a CWSP is required to be developed.

A Clark County Water Utility Coordinating Committee was created in 1977 and requested that the DOH assess the need for a designation of a Critical Water Supply Service Area. Such designation represents the first step toward the development of a CWSP. The assessment, which was completed in 1980, addressed problems within the county related to inadequate water quality, unreliable service, and the lack of coordinated planning by the water utilities. Based on the findings of the assessment, the County Commissioners declared Clark County a Critical Water Supply Service Area. Following that determination, development of the 1983 CWSP was initiated.

The Coordination Act requires that the CWSP be reviewed and updated by the water utility coordinating committee, if the water utility coordinating committee feels it necessary; the last major update occurring in 2012. The update serves as the regional supplement to local water system plans that have been or will be approved by DOH.

The 2012 CWSP:

- Addresses local legislative and CWSP policies.
- Updates water utility service area boundaries.
- Requires consistent water utility design standards.
- Adopts a utility service review procedure.
- Establishes a satellite system management agency.
- Assesses water resources.
- Reviews water supplies.

The 2012 CWSP addressed recent changes to Washington State's satellite system management agency regulations and the Lewis and Salmon-Washougal Water Resources Management Program rules.

2.6.2 Clark County Comprehensive Plan (2015-2035)

In response to rapid growth and growth-related pressures in the late 1980s, the State Legislature enacted the Washington State GMA to establish a framework for comprehensive planning efforts by local governments to accommodate anticipated growth and development. Under the GMA, each county is required to adopt a comprehensive plan and to do so in consultation with its cities.

The intent of the comprehensive plan is to build on the Community Framework Plan and the 20-Year Plan revised in 1997, 2004, 2007, and 2016 to present a clear vision for Clark County's future through 2035. The Clark County Comprehensive Plan Update is anticipated to be completed by December 2025.The plan includes comprehensive planning elements addressing issues of land use, housing, rural and natural

resources, environmental goals, transportation, capital facilities and utilities, parks and open space, historic preservation, economic development, school policies and goals, community design, annexation, SMP goals and policies, and procedures for planning for a twenty-year planning horizon. For each element included there is an introduction, a discussion of that element's relationship to other elements, a description of existing conditions, estimates and projections of future needs, and goals and policies. Additionally, the plan contains strategies for implementation of these goals and policies.

The Vacant Buildable Lands Model (VBLM) is a planning tool developed to analyze residential, commercial, and industrial lands within UGA. The model serves as a tool for evaluating urban area alternatives during Comprehensive Plan updates and for monitoring growth patterns during interim periods. The most recent data available online is from 2023. However, current efforts to update the Clark County Comprehensive Plan in coordination with the cities includes more recent analyses using the VBLM. The demographic analysis and water demand projections, documented in Chapter 5, were developed based on the best available VBLM information at the time (2025).

2.6.3 Clark County Public Utilities Water System Plan

Clark Public Utilities (CPU) 2024 Water System Plan (Consor) evaluates the long-term water supply needs and resources available for CPU. The following studies and investigations are included in the CPU Plan: an inventory of existing wells, water supply systems, and interties in the County; an analysis of the population, history, and water needs to the year 2042; and supplies to serve future water needs. Future supplies are expected to come from CPU's Well 36, Carol J. Curtis and Paradise Point Wellfields.

2.6.4 Metropolitan Transportation Plan for Clark County

The Southwest Washington Regional Transportation Council is the region's principal transportation planning organization. As a means to link transportation and land use, the Council periodically produces a regional transportation plan for the metropolitan area of Clark County. The plan is developed through a coordinated process between local jurisdictions in order to develop regional solutions to transportation needs for the next 20 years and to direct the metropolitan transportation planning process.

In order to establish transportation needs over the 20-year planning period, the Council used a regional travel forecasting model. The model is based on historic and future demographic data allocated by Clark County to 2,162 individual transportation analysis zones (TAZ) within Clark County. Each TAZ was populated with 2020 and future (2040) population, household, and employment demographic data. Historic demographic data was obtained from Census 2020 and future data was based on the results of forecasts performed by the Washington State Office of Financial Management.

2.6.5 City of Vancouver Comprehensive Water System Plan

Vancouver's Comprehensive Water System Plan is updated every 10 years; most recently in 2015. The next updated plan is expected to be adopted in 2026. The purpose of the plan is to develop a planning strategy for the city's retail water service area by evaluating the existing system and its ability to meet the anticipated requirements for water source, quality, transmission, storage, and distribution over a 20-year planning period. Water system improvements were identified to meet changes in regulatory impacts, and population growth, as well as infrastructure repair and replacement. The plan also identified planning level

costs of the improvement projects and provided a financial plan for funding the projects. The plan was prepared in accordance with DOH WAC 246-290 requirements.

2.6.6 City of Washougal Water System Plan Update

The City of Washougal's WSPU was completed in 2021. The Plan states its purpose "is to document key water system information and provides analysis and recommendations that inform infrastructure development and operational decisions by City staff". This plan includes an inventory of existing facilities, establishing criteria for water system analysis and analyzing the hydraulic capacity of the system, developing a CIP based on the hydraulic analysis and developing a financial plan to fund the proposed CIP and assess existing revenue and expenses. This plan also includes an assessment of the City of Washougal's groundwater resources, water rights, and water use efficiency program." The plan was prepared in accordance with DOH WAC 246-290 requirements.

2.6.7 Salmon-Washougal and Lewis Watershed Management Plan (Lower Columbia Fish Recovery Board, July 21, 2006)

The Watershed Management Act (RCW Chapter 90.82) provides a framework to address and resolve water resource issues in each of the state's 62 WRIAs. Planning units created for each WRIA are responsible for developing a watershed plan. The planning units consist of citizens, tribes, interest groups, and government agencies where appropriate. Camas's water system boundaries and the boundaries of surrounding water providers are within the Salmon-Washougal and Lewis watersheds (WRIAs 27 and 28). The Salmon-Washougal and Lewis Watershed Management Plan (WRIA Plan) was adopted in 2006. The WRIA Plan addresses a range of issues related to water resources, including water supply, stream flow management, water quality, and fish habitat. It reviews alternative approaches for managing water resources in the area and recommends select strategies for implementation.

The Salmon-Washougal and Lewis Water Resources Management Program rules were adopted in 2008 (WAC 173-527 and WAC 173-528). These rules were based on the WRIA Plan and had five key elements:

- Setting Instream Flows.
- Closing sub-basins to future withdrawals.
- Designating "regional supply areas" for future water supply.
- Establishing reservations for water for future use, and
- Specifying conditions of use for access to the water reserves.

2.6.8 City of Camas 2019 Water System Plan Update (Carollo Engineers)

Camas' Water System Comprehensive Plan was developed to meet the City's water system needs for a 20-year planning period. The plan was prepared in accordance with DOH WAC 246-290 requirements and includes:

- A water system description.
- Historical and future water use.
- Service area population and water demand projections.
- Water quality and SDWA impacts.

- A water system analysis, including a computer simulation model.
- CIP.

The base 6-year CIP includes pipeline, pumping, control, storage, and source improvements. These improvements include the development of multiple well sites and future sources, developing or replacing storage reservoirs throughout the system, transmission and distribution improvements, and booster station improvements. New water sources will be required by the end of the planning period to provide redundant supply to its customers. The elements and the direction of Camas' plan were consistent with activities and plans of this WSPU.

2.6.9 Jones and Boulder Creek Watershed Forest Management Plan

The City Boulder Creek and Jones Creek watershed consists of roughly 1,700 acres of forest where the City collects its water. There has been minimal work done in the area to keep it managed. The largest work was in 2011 when AKS Engineering and Forestry performed a timber inventory. This document summarizes the work that was done so that the City could periodically receive timber income while still protecting and maintaining water quality. The contents consist of an assessment of existing resources, a timber harvesting plan, an access and road plan, and implementation methods, guidelines and management recommendations.

2.7 Policies, Criteria, and Standards

The City manages its water utility in accordance with established water system policies. The policies provide a consistent framework for the design, operation, maintenance, and service of the water system for appropriately implementing programs, designing new infrastructure, and serving additional customers. The policies and planning considerations set forth herein pertain solely to the water system; the City has additional land use, development, and finance policies that may specify additional requirements for development or extension of a water service.

The following documents were reviewed for this update of the City's water policies:

- The City of Camas Municipal Code (CMC).
- The City of Camas 2010 Water System Plan (2010 WSP).
- The City of Camas 2019 Water System Plan (2019 WSP).
- The City of Camas Design Standards.
- The City Draft Comprehensive Plan 2045.
- Clark County CWSP.
- Clark County Coordinated Water System Minimum Standards and Specifications. (Appendix V-A to the CWSP).
- Clark County Code.
- RCW.
- Uniform Plumbing Code.
- International Fire Code.

2.7.1 Service Policies and Standards

The service policies and standards outlined in Table 2.3 consist of policies relating to the growth, management, and service of the water system. The extension of water service to any future service area would only occur in accordance with the policies and standards detailed in this section.

Table 2.3 Service Policies and Criteria

Subject Name	Policy and Criteria	Reference	Action Items
Duty to Serve	The City will exercise reasonable diligence and care to furnish and deliver a continuous and sufficient supply of pure water to the customer, and to avoid any shortage or interruption of delivery of same The City will meet all regulatory requirements for management of its water system and provision of water to its customers, including water quality, system pressure, and adequate supply. Conserve and protect groundwater resources to provide safe, clean, high quality drinking water to residents. The City will respond to parcels requesting service within 120 days beginning on the date the applicant and water system complete a formal agreement.	CMC 13.16.010, 2025 WSP, Comprehensive Plan 2045 Policy PFS-4.8	
Government Consistency	The City's Water System Comprehensive Plan will be consistent with local, county, and state land use authorities and plans and will comply with the Washington State GMA.	2019 WSP	
Retail Water Service Area	The City will provide water service to all customers within its RWSA meeting the City's requirements.		City to update text to be consistent with Comp Plan.
Future Water Service Area	The City's future water service area shall be determined through the CWSP and adopted through the "Interlocal Agreement for Adjusting or Confirming Future Water Service Area Boundaries Between The Cities of Battle Ground, Camas, Ridgefield, Vancouver, and Washougal, and Clark Public Utilities".	2019 WSP	
Condition of Service	It is unlawful for any person, except duly authorized city employees, to make connections with any water main or water pipe belonging to the municipal water supply system, without first obtaining written permission to do so from the public works director or his designated representative.	CMC 13.32.030	
Annexation	Do not extend utilities without annexation or commitment for annexation. Exceptions may be made in cases where human health is threatened. In areas where utilities presently extend beyond City limits, but are within UGAs, plan development jointly with the County. A joint development must be consistent with City standards.	Comprehensive Plan 2045 Policy PFS-4.4	
Service to customers outside of UGA boundary	The City will continue to provide water service to [existing] customers outside of the City's UGA Boundary but within the established Water Service Area. The City is not required to provide fire flow to such customers. The City reserves the right to deny service to new customers outside the UGA that do not meet City requirements.	2010 WSP	City to review highlighted text.
Water Main Extensions	All extensions shall extend to and across the full width of the property served with water. No property shall be served with City water unless the water main is extended to the extreme boundary limit of the property line extending the full length of the front footage of the property. ▪ Extensions to water mains will be made only upon proper petitions to the City. The City shall have the right to reject such petitions or enter into contract with the petitioners under such conditions as the City may elect. ▪ All water main extensions installed, whether within or without the corporate limits of the City, shall be ~~six~~ [eight] inches in diameter or larger. ▪ All extensions of mains required to serve new customers shall be constructed at the expense of such customers. Ensure water infrastructure is designed to City standards and is in place prior to land development.	CMC 13.48.010, 2016 WSP recommended change, Comprehensive Plan 2045 Policy PFS-4.9	City to review and update "to and through" language
Oversizing	The City Council may enter into a development agreement pursuant to RCW 36.70(b).170 whereby it agrees to set aside and reserve capacity in the municipal water system for a prospective development. Such development agreement shall be permitted only if the city council makes a specific finding that the public good and general welfare will benefit by such agreement.	CMC 13.12.085 (A)	
	If in the judgment of the water department of the city, it is in the best interest of the City and of the general area where a new main is contemplated to install a larger main than that required by the immediate development, the city may install such larger main and shall pay the increased difference in cost between installation of the smaller and of the larger main. ▪ The City may participate to the extent permitted by law, through SDC credits, Local Improvement District, or other payback agreements to assist in the financing of such improvements. ▪ Water system extensions needed to serve new development shall be built prior to or simultaneous with such development, according to the size and configuration identified by the Comprehensive Water Plan as necessary to serve future planned development. ▪ The location and design of these facilities shall give full consideration to the ease of operation and maintenance of these facilities by the City. ▪ Wherever any form of City finance is involved in a water line extension, lines that promote a compact development pattern will be favored over lines traversing large undeveloped areas where future development plans are uncertain.	CMC 13.48.010 (D), 2016 WSP	City to review and update to be consistent with current practices.
Latecomer Agreements	The City may choose to allow reimbursement contracts in exchange for permission to develop and allow for reimbursement to the initial developer by future users in the area who will benefit from the system expansion. The developer must be willing to front the initial expense of system expansion.		

Subject Name	Policy and Criteria	Reference	Action Items
Satellite Management Area	The City may assume the operation of a water district or private water system within the City limit, at the water system's request, if the following conditions are met and subject to approval of the City Council: ▪ The district or private system is adjacent to or within the City's current or future RWSA as identified in the City's comprehensive plan. ▪ The assumption of the district or private system is permitted by State law. ▪ The district's or private system's facilities meet the City's performance criteria and engineering standards, or a plan is in place to assure that they will be brought up to City standards without adversely impacting City's existing customers financially or with regard to level of service. ▪ Any extension of the City's system to connect the newly accepted system will be paid for by the district or private system. ▪ The City shall require the district or private system to transfer the ownership of its water supply sources and associated water rights to the City. Water rights must be successfully transferred to the City and approved for municipal water use by Ecology prior to commitment from the City for water service.	2019 WSP	City to review and update to be consistent with current practices
Developer Extensions outside of City UGA Boundary	The City will provide water service to developer extensions outside the City's existing UGA but within the established RWSA whenever reasonably possible. Developer extensions shall adhere to the established SDC.	2010 WSP	
New Customers with Existing Wells	Developer extensions shall adhere to the established SDC and shall abandon all private wells and relinquish associated water rights to the City as a provision of the SDC. Water rights procured in this manner will be used to accommodate growth in the Retail Water Service Area.	2010 WSP	
Metering	All services to the water system shall be metered.	CMC 13.40.010 (A)	
Source Metering	All supply sources will be metered either at individual wells or at a common flow meter.	2019 WSP	

Notes:
RWSA - Retail Water Service Area.

2.7.2 Coordination with Other Agencies

Table 2.4 summarizes policies regarding the City's coordination with other agencies, which includes but is not limited to Vancouver, City of Washougal, Clark County, federal and state agencies, other public and private utilities.

Table 2.4 Coordination with Other Agencies

Subject	Policy	Reference
Coordination with Other Agencies	Coordinate with Clark County and other purveyors to eliminate private systems in accordance with the Clark County CWSP.	Comprehensive Plan 2045 Policy PFS-4.10
	Coordinate with the County and the cities of Vancouver and Washougal to protect groundwater from contamination.	Comprehensive Plan 2045 Policy PFS-4.11
Intergovernmental Cooperation	To adequately plan for growth and implement policies for the GMA, Clark County has implemented the Coordination Act which provides a legal mechanism for municipalities, special purpose districts and private water utilities to establish future water service areas within unincorporated areas.	Clark County CWSP Update 2011

2.7.3 Environmental Policies and Criteria

Table 2.5 summarizes the City's environmental policies, criteria, and goals that relate to the City's water system.

Table 2.5 Environmental Policies

Subject	Policy/Goal	Reference
SMP	Shorelines are a specifically designated environmental feature and are protected and managed by the City's SMP. Adopted in 2013, the SMP implements the Washington State Shoreline Management Act and its policies. These policies include protecting the ecological function of the state's shorelines and their associated natural resources by identifying areas for preferred uses and economic development, restoring previously impacted shorelines, and providing opportunities for the general public to have access to and enjoy shorelines.	Camas SMP 2021
Goal NE-1 Environmental Stewardship	Preserve Camas' natural environment citywide by developing a sustainable urban environment and protecting natural areas and open space, including critical areas.	Comprehensive Plan 2045
Policy NE-1.1	Support a cleanup of the Camas Mill and other contaminated sites to protect natural resources and the city's water supply.	Comprehensive Plan 2045
Policy NE-1.2	Support programs and regulations that monitor, maintain, conserve and protect water quality in Camas, including watersheds, Lacamas Lake Basin, Columbia River Basin, and Washougal River Basin.	Comprehensive Plan 2045
Policy NE-1.4	Support and implement actions identified in adopted plans, including adaptive management of natural resources that is consistent with best available science and climate guidance to improve climate resiliency.	Comprehensive Plan 2045
Policy NE-1.5	Protect and restore natural resources, valuable historic and cultural areas, climate refugia, habitat areas and corridors to provide biological and hydrological connectivity that fosters resilience to climate impacts.	Comprehensive Plan 2045

Subject	Policy/Goal	Reference
Policy NE-1.6	Create and support natural resource management plans that consider climate change impacts and guide adaptive management.	Comprehensive Plan 2045
Policy NE-1.7	Include immediate and long-term environmental impacts in the policy and regulatory decision-making process. Identify and quantify the ecosystem services benefits of natural systems and include these natural capital assets in cost-benefit assessments for community and development planning.	Comprehensive Plan 2045
Policy NE-1.9	Regulate land use and development to protect natural topographic, geologic, vegetative, and hydrologic features of undeveloped properties.	Comprehensive Plan 2045
Policy NE-1.10	Promote soil stability and minimize and control soil erosion using best management practices, best available science, ecologically sustainable site design, natural drainage systems and protection of existing native vegetation.	Comprehensive Plan 2045
Policy NE-2.1	Use best management practices and best available science to preserve, protect, and restore the biological health and diversity of Camas' critical areas.	Comprehensive Plan 2045
Policy NE-2.2	Preserve and restore aquatic and riparian habitats consistent with applicable regulations.	Comprehensive Plan 2045
Policy NE-2.4	Ensure that development throughout the City meets or exceeds standards and practices for long-term wetland protection and mitigation.	
Policy NE-3.1	Adopt the goals and policies as outlined in the current Camas Shoreline Master Program.	Comprehensive Plan 2045
Goal NE-3 Shorelines	Use the full potential of shoreline in accordance with the opportunities presented by their relationship to the surrounding area, their natural resource values, and their unique aesthetic qualities offered by water, topography, and views. Develop a physical environment that is both ordered and diversified, and which integrates water and shoreline uses while achieving a net gain of ecological function.	Comprehensive Plan 2045

2.7.4 System Reliability and Maintenance Policies and Standards

Table 2.6 outlines the City's maintenance standards and policies, as well as system reliability policies.

Table 2.6 System Reliability and Maintenance Policies and Standards

Subject	Policy/Standard	Reference
Water Shortage Response Plan	The City created a City ordinance CMC Chapter 13.14. This allows the City to promote the public interest by conserving the city's water supply in order to protect the health, welfare and safety of water users. To accomplish this declared purpose, the city reserves the right to exercise its police powers through emergency measures as set forth in this chapter.	2019 Camas WSP
Water System ERP	The City has a Disaster Manual, which identifies the emergency response functions within the City using an "all hazards" approach. Within the City's emergency response framework, the City has developed a Water System ERP which describes alternative operations for the interruption of each major water supply facility (i.e., loss of a well, reservoir, or booster pump station).	2019 Camas WSP
System Maintenance	The City proactively operates and maintains its water system as an effective means of system management. The City has an O&M manual which gets updated regularly and adds material as necessary. The manual provides detailed information on operator certification and training, water quality monitoring, operation and control, cross-connection control, and emergency planning/response.	2019 Camas WSP

Subject	Policy/Standard	Reference
Cross Connection	The control or elimination of cross-connections shall be in accordance with the rules and regulations of the Washington State Board of Health regarding public water supplies, WAC 248-54-285 as it now exists or as it may hereinafter be amended, and with any requirements set forth by the "U.S. EPA" as authorized by the "SDWA" PL 93-523, as it presently exists or as it may hereinafter be amended, and with any manual of standard practice pertaining to cross-connection control approved by the public works director or his designated representative.	CMC Section 13.32.04 Cross Connection Control or elimination
Pump Station Redundancy	With the largest pump in each booster pump station out of service, the remaining pumps should provide MDD whole concurrently replenishing fire suppression storage within 72 hours.	2019 Camas WSP
Pump Station Reliability	Wells and booster pumps with back-up power should be capable of supplying max day demand for the water system while concurrently replenishing fire suppression storage within 72 hours.	2019 Camas WPS
Supply Reliability	Wells should be capable of supplying MDD for the water system while concurrently replenishing fire suppression storage within 72 hours	2019 Camas WPS
Supply Redundancy	Largest source out of service	2019 Camas WSP

Notes:
MDD - max day demand.

2.7.5 Financial Policies

The City's financial policies related to the Water Utility are summarized in Table 2.7

Table 2.7 Financial Policies

Subject	Policy	Reference
Combined residential and commercial uses	Where a single service is provided to a combination of residential and commercial uses, the commercial rates shall be charged for all water and sewer service.	CMC Section 13.36.030
Monthly service charge and rate for automatic sprinkler systems	The monthly flat-rate charge for automatic sprinkler systems with fire hydrants and for standpipes in conjunction with fire protection shall be as provided in CMC Section 13.36.010.	CMC Section 13.36.040
Connection charges	1. Charges for connection to the city water system including setting the meter, installing a service line and tapping the water main shall be computed as follows: a. Except as hereinafter provided, the connection charge shall be the cost of materials, the labor costs for city personnel billed at then existing rates for such personnel, and any fees or charges that were necessary to be paid to third parties in order to make such connection. b. For installing a water meter for services one inch or smaller, the connection charge shall be as per the fee schedule established by the city council per resolution. c. For installing a water meter, service line, and tapping the water main for a service one inch or smaller, the connection charge shall be as per the fee schedule established by the city council per resolution or the actual cost to the city calculated in accordance with subsection (A)(1) of this section, whichever is greater. 2. There shall be no charge for connecting a sprinkler system to a water main for fire protection other than the installation cost of the same, providing that such system shall include a detector to record water usage.	CMC Section 13.36.050
Temporary water service	For temporary irrigation or commercial hydrant use, all connections shall pay a deposit as per the fee schedule established by the city council per resolution, with the nonrefundable amount established as per the fee schedule established by the city council per resolution. Water usage shall be deducted from the deposit of the then current applicable commercial rate per Section 13.36.010 of this chapter. The city reserves the right to remove the meter for nonuse or misuse at its discretion. Any remaining deposit will be returned to the applicant, or the remaining balance will be billed to the applicant. The applicant shall notify the city when use is complete. The applicant will be responsible for any damage to the equipment, and shall be invoiced for repairs or replacement of the equipment.	CMC Section 13.36.060
Utility charge – Governmental Users	The following designated governmental users shall pay for water and sewer utilities as follows: 1. Rental by the Camas fire department of all fire hydrants within the city shall be as per the fee schedule established by the city council per resolution. 2. Rental of fire hydrants, per hydrant, outside the limits of the city by any other municipality or fire district shall be as per the fee schedule established by the city council per resolution. 3. All other utility services for governmental users shall be charged at the regular meter rate.	CMC Section 13.36.070
Meters – Installation – Reading – Accuracy	1. All services to the water system shall be metered. 2. All meters up to and including one inch in size will be owned, installed and maintained by the city water department. Meters larger than one inch shall be paid for by the customer. All services shall have the meter installed before the service is connected. The type and make of all meters purchased and paid for by any customer or applicant must be approved by the water superintendent before being installed. 3. The city will not furnish or read auxiliary or submeters used for the customer's convenience. 4. The city will keep an accurate account on its books of the reading of meters, and such account, so kept, shall be offered at all times, places and courts as prima facie evidence of the use of water service by the customer, and shall be the basis on which all bills are calculated. 5. Should any meter fail to register correctly the use of that part of the water service which the meter should properly register, the service shall be estimated by the city from a corresponding period. 6. The city will, upon written request, test any customer's meter, and where circumstances require, adjust for wrong charges for a period not to exceed three months' previous. 7. When a customer requests a meter test, a deposit as per the fee schedule established by the city council per resolution to cover the cost of the test may be required of the customer. 8. The amount so deposited will be returned to the customer if the meter is found upon test to overregister more than two percent under conditions of normal operation. 9. A customer shall have the right to require the city to conduct the test in his presence, or if he so desires, in the presence of an expert or other representative appointed by him. 10. All meters will be tested before installation, and no meter will be placed in service or allowed to remain in service which is known to have an error in registration in excess of two percent under conditions of normal operation. 11. For the purpose of making charges, all meters serving the customer's premises will be considered separately, and the readings will not be combined, except that where the city, for operating necessity, elects to install two or more meters instead of one at a central location to service the customer's premises, the readings of two or more meters will be combined for the purpose of making charges. 12. The location of the meter or meters used in measuring the customer's use of water must be in a place satisfactory to the city before service will be supplied. Ordinarily, this site shall be the property line and curb. Where meters are at present or may be installed within a building, the city will not be held responsible for damage from water seepage through the wall, nor for damage from leaking meter, pipe or fittings. 13. No rent or other charge whatever shall be made by the customer against the city for placing or maintaining meters upon the customer's premises. 14. If a meter underregisters the amount of water due to tampering with the meter, and/or piping, or in any other way causing underregistration, the service may be discontinued and will not be reconnected until the customer immediately makes the necessary corrections in his own water lines to prevent further damage to the city's meters. 15. Meter readings are to be averaged during any period when it will be impossible or impracticable to read any meter on the regular reading date. 16. It is unlawful to place any material on or to otherwise obstruct any water meter. a. Separate water meters shall be installed for each dwelling unit in a townhouse, condominium or other multifamily dwelling configuration where individual dwelling units are separately owned. Single meters may be installed to serve multifamily residential structures when said structures and the units therein remain under a single ownership. b. Water connection shall be charged beginning on the date of installation. All connections will be billed continuously for the base charge even during periods of non-use, including vacancy and disconnection for nonpayment.	CMC Section 13.40.010
Meter – Reading	1. Meters shall be read as nearly as possible at regular thirty-day intervals or sixty-day intervals, and the bill rendered will be based on consumption to the nearest hundred cubic feet. 2. Other than regularly scheduled reading of water meters, water meters may be read by the city on the day a notice of change of tenancy or ownership is delivered to the city or as close as possible to such day as required in CMC 13.44.040.	CMC Section 13.40.020
Meter – Multiple - Determination	When one customer is served by more than one meter on separate service lines, the minimum for each service or the meter minimums for each meter and the surcharges for water supplied may be calculated and billed separately.	CMC Section 13.40.030

Subject	Policy	Reference
Meter – Shared - Liability	When more than one family, business or other customer receives water through one service line in one building and it is found impractical to separate the water piping for each customer, the owner of the premises shall be responsible for payment of all water served to the premises. In the event of a delinquent bill where several consumers receive water from a common service, the water superintendent shall not cause the service to be shut off until ten days after mailing written notice of such fact to all the joint consumers and owner of the premises.	CMC Section 13.40.040
Meter – Shared – Notice to separate service - Shutoff	When two or more houses, buildings or other premises occupied by separate consumers are supplied from a single-service connection, the owner or owners shall immediately, upon notice from the water superintendent, separate each customer's line and connect up to individual services and if separate services are not established within a reasonable time thereafter, the service shall be shut off and further service refused. The joint service may, however, be continued at the option of the water superintendent, providing one owner is responsible and agrees to pay the total water bill for both premises. Computation of the total bill for the services shall be by adding the total of the separate use classifications of the premises.	CMC Section 13.40.050
Charges – Meter service – Billing intervals	1. All residential and most commercial water services shall be billed at regular intervals and shall be due and payable on the twenty-first day of each month following billing. Such billings shall be delinquent on the twenty-sixth day of the month following billing. 2. All industrial and some commercial services shall be charged monthly and shall be due and payable on the tenth day of each month following billing. Such billing shall be delinquent on the eighteenth day of each month following billing. 3. A customer shall be charged the sum as per the fee schedule established by the city council per resolution for each nonsufficient fund check, or a check written on a closed account and returned by the bank to the city. 4. There shall be a penalty on all delinquent accounts assessed at the rate of five percent of the outstanding balance.	CMC Section 13.44.010
Billing liability – rental properties	1. The record owner of any real property provided utility services by the city shall be and act as the sole customer of the city. All utility services provided to the real property shall be the responsibility of the record owner of the subject property. The city shall not be responsible for unpaid billings resulting from tenants moving in or out without paying charges due, nor the collection thereof, and said charges shall be a lien on the real property until paid. 2. Except as hereinafter provided, all billings for utility services provided by the city shall be mailed to the record owner of the subject property at the record owner's address. In the event that billings are sent to a tenant or agent of the owner, the billing will become the responsibility of the tenant or agent as well as the property owner, and each can be held jointly and severally liable for such billing. 3. In the event a record owner requests billings of non-owner occupied real property be mailed to an address other than that of the record owner, including, but not limited to, any management company or to the premise address, the record owner must complete, sign, and have notarized a form provided by the finance department agreeing to the regulations and provisions associated with the request for an exception. Such form shall provide in part that the record owner agrees to be responsible for any prorating of utility billings between any tenants or lessees, any utility billings which remain unpaid, and any disconnect charges otherwise imposed pursuant to the Camas Municipal Code that may be due in the event of any delinquency associated with any tenancy.	CMC Section 13.44.015
Nonpayment—Shutoff—Hearing—Disconnection fees.	1. Whenever any charge for furnishing water and/or sewer services to any premises is not paid in full by the twenty-sixth day of the month following billing, the finance department shall give notice to the person or persons billed for such services at the address shown in the city's billing records of the city's intent to discontinue service if payment is not made. Such notice shall contain the following information: a. The amount of the charges owing. b. A statement that the person billed may request a hearing to contest the amount or validity of the charges. c. A statement that if the charges are not paid in full or a hearing requested within ten days of the notice, the city will disconnect the service of water to such premises. 2. The notice of intent to disconnect shall also contain a request for hearing form to be utilized by any person desiring to contest the amount or validity of such charges. Any person desiring such a hearing shall file the request for hearing with the finance department within ten days of the date of the notice, and shall accompany such request with a tender of the amount of charges billed. Failure to file a request for hearing and tender the amount of charges owing within such time limit shall be deemed a waiver of the right to a hearing. 3. In the event the charges are not paid, or a hearing requested accompanied with a tender of the amount owing within 10 days of the date of the date of the notice, or if the customer's check is tendered and then is returned unpaid by the bank, then the city shall proceed to disconnect the water service to the premises. 4. In the event a hearing is requested, the amount tendered by the customer shall be deposited into the customer account. If all or a portion of the charges are found not to be owing, such amount shall be refunded to the customer or credited to the customer's account. 5. Whenever a disconnection is made at the owner's request, the sum as per the fee schedule established by the city council per resolution shall be charged for the cost of disconnecting. Whenever a disconnection is made for nonpayment, the sum as per the fee schedule established by the city council per resolution shall be charged for disconnecting. 6. If service personnel is required to go to the premises for the purpose of disconnecting the service for nonpayment, the disconnection fee shall be charged even if the service has not been physically disconnected. 7. There shall be an additional charge as per the fee schedule established by the city council per resolution for each time a service is found wrongfully or illegally reconnected after being disconnected for nonpayment. 8. If a meter or spacer must be removed, padlocked, or other means used to prevent illegal reconnection of a service, then there shall be an additional charge as per the fee schedule established by the city council per resolution for removal of such meter or spacer 9. All disconnection charges and outstanding obligations for water and/or sewer furnished to such premises must be paid in full prior to reconnection. 10. If a customer's meter has been turned off for nonpayment and the customer requests reconnection after the hours of five p.m. or on a weekend or holiday, the customer shall be charged an additional turn-on fee as per the fee schedule established by the city council per resolution.	CMC Section 13.44.020

Subject	Policy	Reference
Adjustments for broken pipes	When a property owner, in any given billing period because of a broker water pipe on the owner's premises, has used, according to the meter, a quantity of water which is more than double the most recent average without leak as set forth in Section 13.64.060(A), a written application may be made to the finance director for a reduction in said billing. If the application states that the main underground service line between the meter and house or inside a crawlspace was broken on the owner's premises which caused the large consumption of water, and it is established that such broken pipe has been repaired and documentation in the form of a bill from a certified plumber or receipt for parts is attached, the finance director shall authorize a credit to such billing as follows: 1. Average water consumption will be determined by the customer's most recent winter average without leak as set forth in Section 13.64.060(A). Customers with no winter average will have the most recent two meter reads without leak used to define an average. Customers with no prior billing, or whose prior reads are zero, will use the city's default as set forth in Section 13.64.060(B). 2. The average consumption will then be deducted from the consumption which occurred at the time of the broken water pipe. 3. A credit shall be permitted only once per customer account in a five-year period. The credit shall apply to a single billing cycle and only up through the day of repair. No additional credit shall be given for a delay in repair of pipes beyond one billing period. 4. The reduction provided for by this section shall not be allowed if such excess water consumption is due to the owner's neglect or failure to repair the water system of the premises. A reduction shall not be permitted if such excess consumption is due to leaking faucets, other plumbing fixtures or irrigation systems.	CMC Section 13.44.030
Service termination	1. Each customer about to vacate any premises supplied with water service by the city shall give notice of their intended removal at least two days prior thereto; specifying the date change-in-ownership or tenancy actually occurred, otherwise, they will be responsible for all water supplied to the premises until the city water department has notice of such removal. 2. At the time specified by the customers of the termination of the service, a reading of the water meter will be made and a bill shall be rendered based on the proportionate days of usage.	CMC Section 13.44.040
Water System Development Charges	13.52.010 - Purpose. Pursuant to the authority conferred upon cities and towns by RCW 35.92.025, the city council of the city finds that property owners who seek to connect their property to the water works system of the city should be assessed a charge in order that such property shall bear its equitable share of the cost of the water works system. The city council further finds that the charge should be based upon the property owners' anticipated use of the water works system as related to the historical cost of the water works system's capacity available to meet their demands. It is the intent of the city council that the charge imposed by this chapter shall be derived from the historical cost of the system as measured by the undepreciated value of the water works system and plant in service at the time the charge is imposed and the projected cost of additions to the system to meet new demands. The charge imposed by this chapter shall be denominated a "water system development charge" and shall be in addition to any water connection, installation, or permit fees imposed by other ordinances of the city. 13.52.020 - Definitions. Unless otherwise specifically defined, the terms used in this chapter shall have the following meanings: 1. "Accessory dwelling unit" means one or more rooms with a private bath and kitchen facilities comprising an independent, self-contained dwelling unit within or attached to a single-family dwelling or in a detached building on the same lot as the primary dwelling unit. An accessory dwelling unit is distinguishable in that it is clearly subordinate to the primary dwelling unit, both in use and appearance. 2. "Industrial or unusual requirement customer" means that use classification of a nonresidential property owner who uses a meter equal to or greater than three inches in size and has a non-standard peak flow, uses a significantly large daily volume of water that is in excess of the City's typical commercial customer, or who otherwise have an unusual water usage pattern. 3. "Water system" means all facilities for collecting, transporting, pumping, treating and providing water. 13.52.030 - Imposition. 1. Except as provided herein, there is imposed on all properties in the city and all properties outside the boundaries of the city that connect to the water system of the city a water system development charge, which charge shall be assessed in accordance with the rates set forth in Section 13.52.070. 2. There shall be no water system development charge imposed for the installation of an additional meter installed to an existing residential customer service line which meter is installed for irrigation purposes. 3. Property owners that install a residential fire sprinkler system, which requires that the water meter size be increased to make the fire sprinkler system operational, shall not be charged the increased system development charge for the larger meter. 13.52.040 - Credits. 1. Development credit: a. A developer (as defined in CMC 3.88.030.K) shall be entitled to a credit against the applicable system development charge for the dedication of land or for the design or engineering or construction of an "eligible improvement". For purposes of this section, an eligible improvement shall mean an improvement or real property that is: required as a condition of development approval; identified in the water system plan or capital improvement plan; and included in the current system development charge calculation as being funded by system development charges. b. The amount of the credit shall be the dollar amount assigned to the improvement or to the land in the system development charge calculation. Where only a portion of the improvement is constructed, or a portion of the land is dedicated, the amount of the credit shall be pro-rated. c. Credits earned for one category of system development charge, e.g. water, may not be applied against a different system development charge, e.g. sewer. d. Approval from the city council shall be required prior to the start of construction or dedication of any eligible improvement. "Approval" in the context of this subsection shall be satisfied if the city requires the construction or dedication of the eligible improvement as a condition of approval for a land use application. If a developer wishes to construct an eligible improvement that is not otherwise a condition to an approved land use application, prior approval must be obtained from the city council. No system development charge credit shall be granted until either the eligible improvements have been designed, engineered, or constructed by the developer, and such work has been accepted by the city; or until the land has been dedicated by the developer and such dedication has been accepted by the city. e. If system development charges become due and payable prior to the developer becoming eligible for the issuance of credits as provided in section (4), the developer may apply to the public works director to defer collection of the charges until construction or dedication is completed. The public works director may condition deferral upon: i. The developer posting a bond or other financial security satisfactory to the city in an amount equal to one hundred twenty-five percent (125%) of the deferred system development charges, which bond or other financial security shall be conditioned upon the developer either paying the deferred system development charges or completing construction or dedication within a specified time, ii. The withholding of an occupancy permit. iii. Such other conditions acceptable to the city. f. If the developer is dissatisfied with the decision of the public works director, the developer may seek to have that decision reviewed by the city council	CMC Chapter 13.52

Subject	Policy	Reference
	2. Upon acceptance of the eligible improvement, the developer may submit an application for the system development charge credit to the public works department. After submission of the application and verification of entitlement thereto, the public works director shall submit to the City Council for concurrence. Upon ratification, the finance department shall issue a credit voucher to the developer specifying the amount of the system development charge credit and the type of credit. 3. The credit may, at the option of the developer, be applied all or in part to the system development charges owing for the developer's project. 4. To the extent the credit exceeds the amount of the system development charges owed by the developer, or the developer chooses not to apply the credit to the developer's project, the unused credit may be applied to a different project of the developer or to the project of a different developer. 5. Before the system development charge can be transferred to a different project or a different developer, the holder of the system development charge credit shall file with the finance department an application to transfer the credit on a form to be created by the finance department. The application shall identify the transferee, and the amount of the system development charge credit being transferred. The transfer application shall be accompanied by an administrative fee in an amount as may be set by resolution of the city council. 6. When credits are to be redeemed, the holder of the system development charge credit shall file an application for redemption on a form to be created by the finance department. Redemption shall be permitted only in increments equal to a whole system development charge, or when redemption will exhaust the entire system development charge credit. The application for redemption shall be accompanied by an administrative fee in such amount as may be set by resolution of the city council. When system development charge credits are being redeemed, such redemption shall not allow for system development charge credits to be pro-rated among more than one residential lot in amounts that are less than the existing system development charge per lot. For example, where system development charges are five thousand dollars per residential lot and a developer wishes to redeem eleven thousand dollars' worth of credits, the developer shall not be allowed to apply one thousand dollars per residential lot over eleven lots. The developer may apply five thousand dollars to two residential lots and the remaining one thousand dollars to one residential lot. 7. The finance department shall be responsible for maintaining appropriate records documenting the issuance, transfer, and redemption of system development charge credits. 8. Expiration of credits. Any credits issued after the effective date of this ordinance shall expire and become null and void ten years from the date of approval of the original credit by the city council. Transfer of credits or partial use of credits shall in no event extend the expiration date of those credits. 13.52.050 - Accessory dwelling units. 1. There shall be no water system development charge for connection of accessory dwelling units to the city water system. 13.52.060 - Application for connection—Use classification of property. 1. Any property owner seeking to connect his property to the water system of the city shall file with the city an application to be on a form provided by the city. The application shall contain the name and address of the property owner, the location of the property to be connected to the water system, the nature of the structure to be constructed on the subject property, the proposed use of the subject property, and any relevant information deemed necessary by the city to process the application. 2. Upon receipt of the completed application, the applicant shall then be informed by the city of the amount of the water system development charge, which shall be based upon the use classification of the property and shall be in accordance with the rates set forth in section 13.52.070. 13.52.070 - Rates. 1. The rates for water system development charges shall be determined based on the meter size installed as set forth in Table 13.52.070. 2. The water system development charge shall be indexed yearly on January 1st to address inflation based on the Engineering News Record Construction Cost Index for the City of Seattle. Effective January 1, 2020, and annually thereafter, the water system development charge shall be adjusted pursuant to the adopted cost index as set forth herein. 3. The water system development charge for properties classified as industrial or unusual requirement customer shall be based on a separate engineering study completed by the applicant and approved by the city. The factors used in the study to determine the system development charge shall include the size of meter, the average and peak volumes of water used by the customer, seasonal variations, the calculated meter customer equivalents as compared to the city's current system development charge calculation and other pertinent factors deemed necessary by the city. 13.52.080 - Payment of water system development charge. 1. The water system development charge owing under the provisions of this chapter shall be paid by the applicant at the time of issuance of the plumbing permit or building permit, whichever shall first occur, or as scheduled by a separate agreement with the city. The amount of the charge shall be based on the system development charge in effect at the time of permit application. 2. No water service shall be furnished to the property of any person seeking to connect to the water system of the city until the water system development charge imposed by this chapter has been paid to the city or until such time as the city and the applicant have entered into a separate agreement providing for the payment of such water system development charge. 13.52.090 - Revenue disposition. 1. All revenues collected pursuant to this chapter shall be paid into the water and sewer capital reserve fund and shall be used for the purpose of financing system improvements. Such revenues shall not be used to offset current operation or maintenance costs. 13.52.100 - Appeals. 1. Any applicant aggrieved by the amount of the water system development charge found by the city to be required under the provisions of this chapter, may appeal to the board of adjustment from such finding by filing a written notice of appeal with the city clerk within twenty days from the time such property owner is given notice of such amount. The chairman of the board of adjustment shall cause a notice of the time and place of hearing to be mailed to the applicant. At such hearing, the applicant shall be entitled to be heard and to introduce evidence on his own behalf. The board of adjustment shall thereupon ascertain the correct amount of the water system development charge, and the city clerk shall immediately notify the appellant thereof, by mail, which amount, together with the costs of appeal, if appellant is unsuccessful therein, must be paid within ten days after such notice is given. 2. The chairman of the board of adjustment may, by subpoena, require him to produce any pertinent books and records. Any person served with such subpoena shall appear at the time and place therein stated, and shall produce the books and records required, if any, and shall testify truthfully under oath administered by the chairman in charge of the hearing on appeal, as to any matter required of him pertinent to the appeal, and it is unlawful for him to fail or refuse to do so.	

2.7.6 Design Standards

Table 2.8 describes the City's general design standards associated with the management of the water utility and design of the water system.

Table 2.8 General Design Standards

Subject Name	Standard	Reference
Pipeline Material	Water mains shall be ductile iron.	City of Camas Water Details Water Construction Notes
Minimum Pipeline Size	Water mains shall be 8-inch diameter minimum line size. Larger line sizes may be required.	City of Camas Water Details Water Construction Notes
Valve Spacing	Valves are to be installed at all branches, for long main runs, inline valve spacing not to exceed 500 feet.	City of Camas Water Detail No. W13
Fire Hydrant Spacing	Fire hydrant spacing number and spacing shall be minimum 500 feet spacing and based on International Fire Code Appendix C, Table C.102.1.	City of Camas Code of Ordinances Chapter 17.19.040, Section C.4.a.
Fire Hydrant Specification	Hydrants shall be designed per standard detail No. W11.	City of Camas Water Detail No. W11
Looping	Water mains shall be looped wherever possible. Keep dead ends to a minimum.	City of Camas Water Details Water Construction Notes and Detail No. W13

2.7.7 Distribution System Criteria and Standards

The City's distribution system criteria and standards are summarized below in Table 2.9.

Table 2.9 Distribution System Criteria and Standards

Subject Name	Standard	Reference
Supply Components and Government Criteria	Following the Washington State DOH storage volume requirements (WAC 246-290-235(3)) and the WSDM, Chapter 9, the five components of storage listed below and illustrated in Figure 9.6 must be considered for any water system: 1. Operational storage. 2. Equalizing storage. 3. Standby storage. 4. Fire Suppression storage. 5. Dead storage.	2019 WSPU
Standby Storage	Following the Washington State DOH storage volume requirements (WAC 246-290-235(3)) and the WSDM, Chapter 9, the five components of storage listed below and illustrated in Figure 9.6 must be considered for any water system: 1. Operational storage. 2. Equalizing storage. 3. Standby storage. 4. Fire Suppression storage. 5. Dead storage.	2019 WSPU

Subject Name	Standard	Reference
Service Pressure and Fire Flow	The distribution system was evaluated for the following criteria, which match the requirements of the DOH WSDM and WAC 246-290. 1. PHD Pressure. a. Minimum allowed pressure is 30 psi during PHD. 2. Available Fire Flow. a. While delivering the required fire flow during MDD conditions, system pressures must remain above 20 psi.	2019 WSPU
Maximum Pipeline Velocities	Water main non-fire condition maximum velocity is limited to 8 feet per second according to the DOH WSDM	DOH WSDM
Minimum System Pressure	In accordance to the DOH WSDM, the City must design a water system to provide PHD while maintaining a minimum pressure of 30 psi throughout the distribution system (WAC 246-290-230(5)).	DOH WSDM
Excess Pressure	Excessive water system pressure can increase the risk of pipe failure and result in increased distribution system leakage. Working pressure in the distribution system should be limited to 80 psi unless the design engineer can justify the need for higher pressure (to reduce capital and/or pumping costs, increase fire flow reliability, or for other reasons), and verify that the pipe material is appropriate for the design working pressure.	DOH WSDM

Notes:
PHD - peak hourly demand; psi – pounds per square inch; WSDM - Water System Design Manual.

CHAPTER 3 EXISTING SYSTEM

3.1 Introduction

The City owns and operates a multi-source municipal water system (DOH) System Number 108002), which includes supply, treatment, storage, and distribution of potable water to residential and non-residential customers. Service is provided to customers across 26 pressure zones (PZ). The locations of PZ and key elements of the water system are shown in Figure 3.1. A detailed hydraulic profile of the City's water system, including each PZ are shown in Figure 3.2A and Figure 3.2B. A simplified hydraulic profile showing only key facilities and PZ is shown in Figure 3.3. This chapter reviews all of the system components incorporated in the water supply system and provides a brief summary of each facility as shown below:

- PZ.
- Sources of Supply.
- Water Treatment.
- Storage Facilities.
- Transmission and Distribution Facilities.
- BPS.
- Interties.
- SCADA.

3.2 Pressure Zones

The City's water system has 26 distinct PZ. The hydraulic profile shown in Figure 3.2A and Figure 3.2B displays how PZ are connected and illustrates water moves throughout the system between each pressure zone. Although the system has 26 distinct PZs, not all of them have separate storage facilities. A PZ that does not have a storage reservoir located in it is classified as a "closed" PZ, while a PZ that does have a storage reservoir is classified as an "open" PZ. Zones that are served by a pressure reducing valve (PRV) from a PZ with gravity storage are also classified as an "open" PZ. Table 3.1 describes each PZ, noting minimum and maximum elevations served within each zone and boundaries for each PZ are delineated in Figure 3.4.

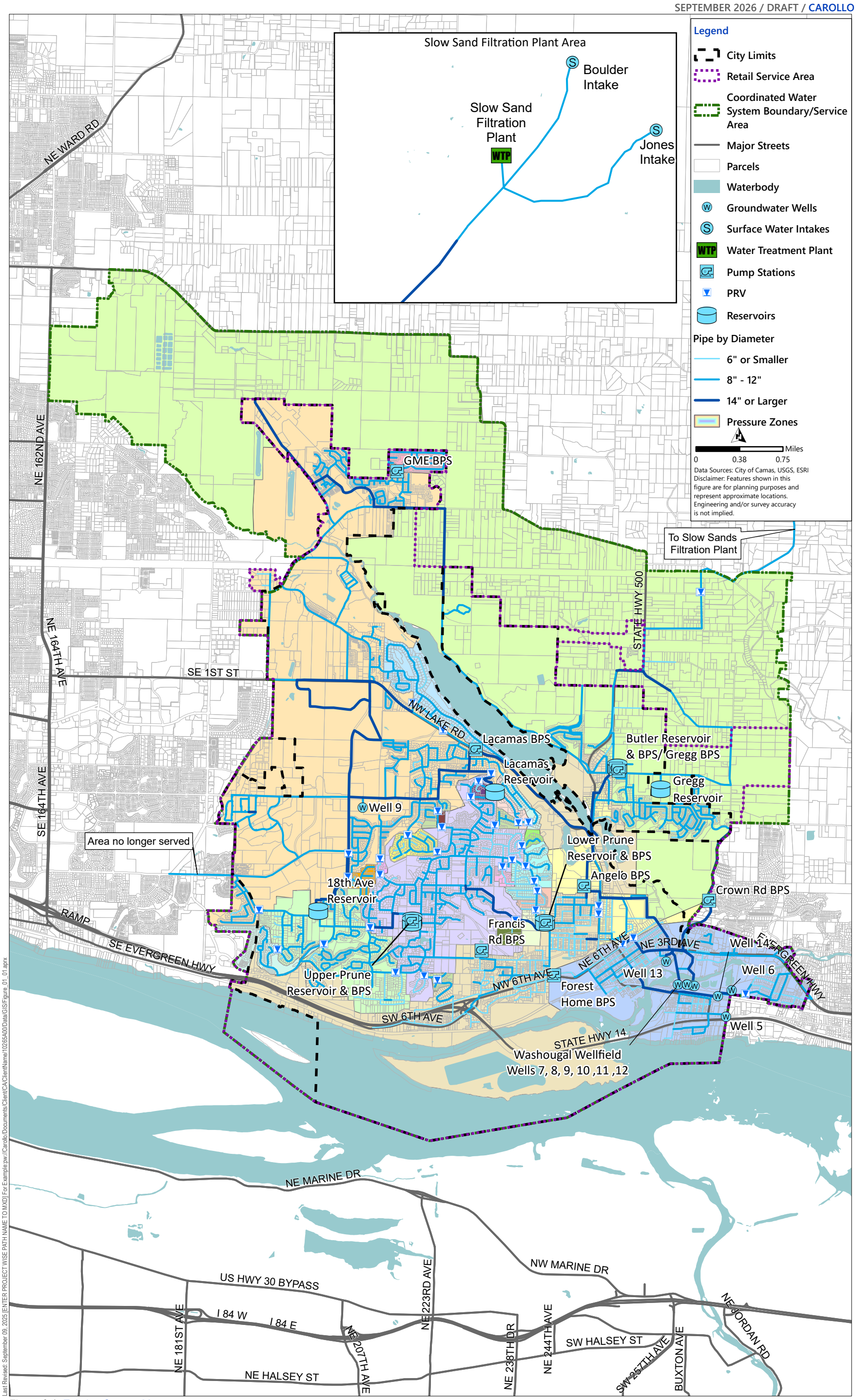
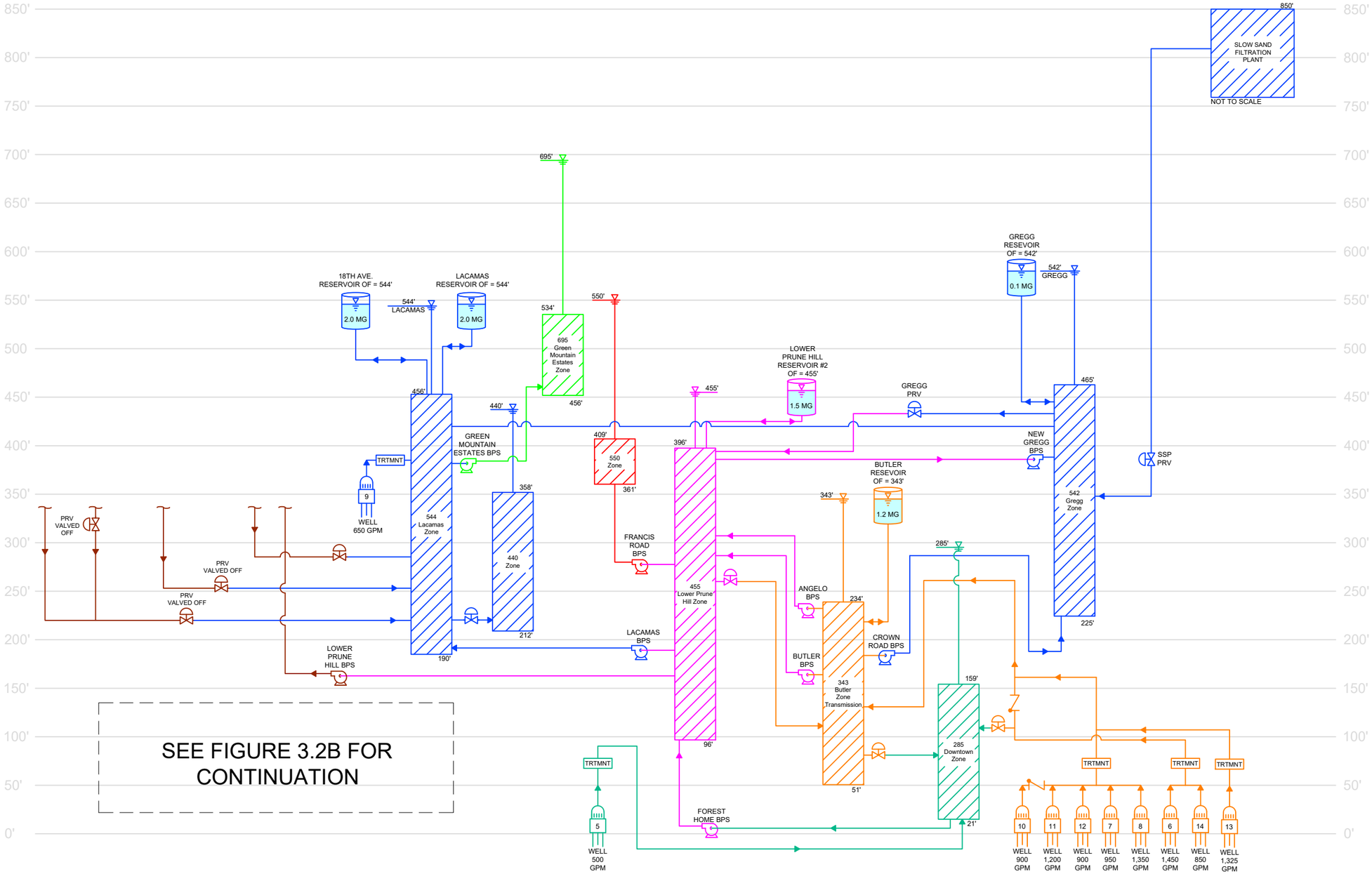


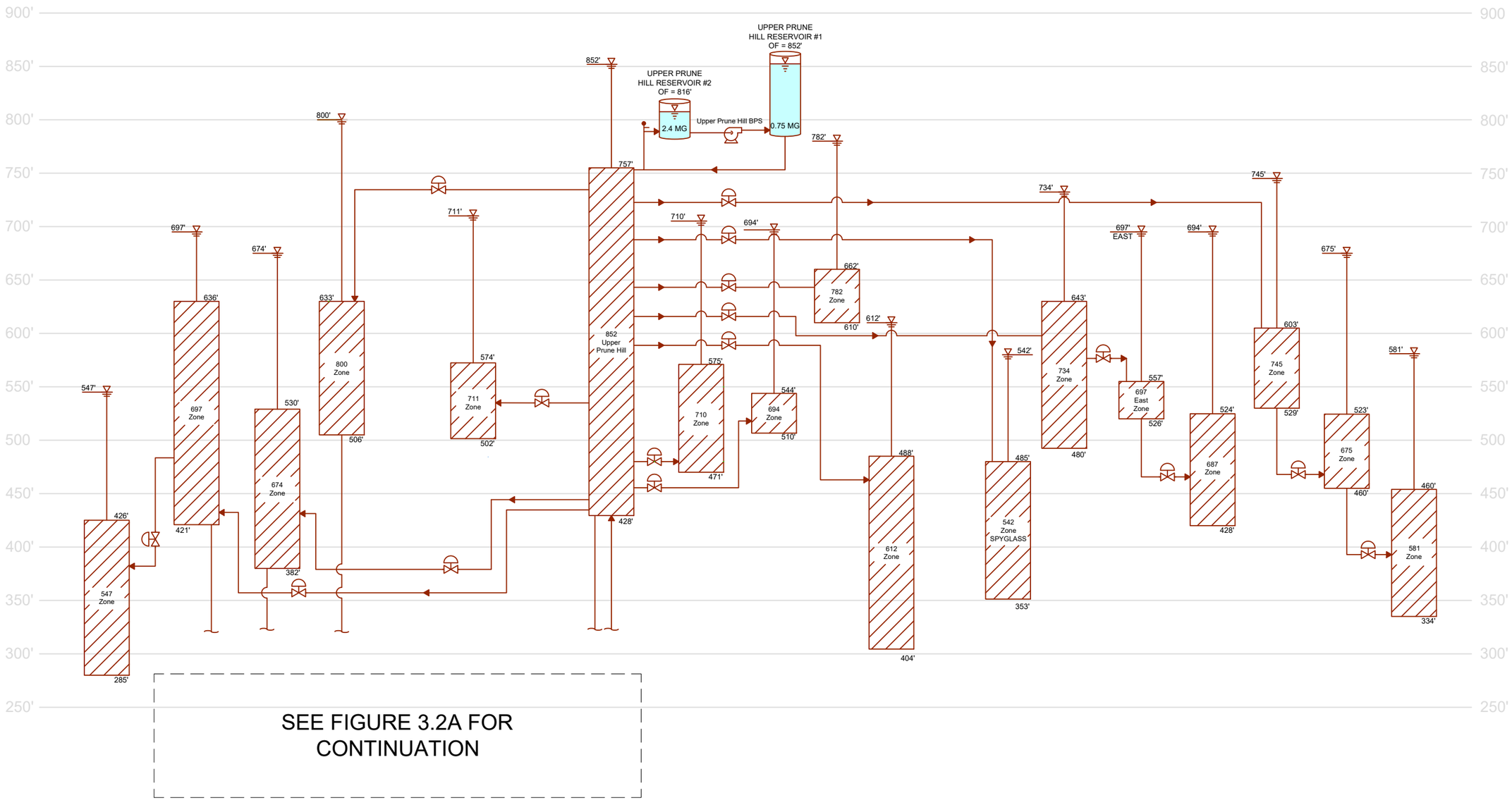
Figure 3.1 Existing System Map



LEGEND

- RESERVOIR (1.0 MG) — VOLUME INSIDE TANK; OVERFLOW (OF) ABOVE TANK
- GROUNDWATER WELL
- BOOSTER PUMPING STATION
- PRESSURE REDUCING VALVE
- PRESSURE ZONE (HGL, HIGH, ZONE, LOW) — HIGH: HIGHEST ELEVATION SERVED IN ZONE; LOW: LOWEST ELEVATION SERVED IN ZONE; HGL: HYDRAULIC GRADE LINE FOR ZONE
- SWING CHECK VALVE
- FILL VALVE
- 285 - DOWNTOWN OPERATIONAL AREA
- 343 - BUTLER (TRANSMISSION) OPERATIONAL AREA
- 455 - LOWER PRUNE HILL OPERATIONAL AREA
- 542 - GREGG/ 544 - LACAMAS OPERATIONAL AREA
- 550 - ZONE
- 695 - GREEN MOUNTAIN ESTATES OPERATIONAL AREA
- 852 - UPPER PRUNE HILL OPERATIONAL AREA

Figure 3.2A
Simplified Hydraulic Profile Schematic
City of Camas

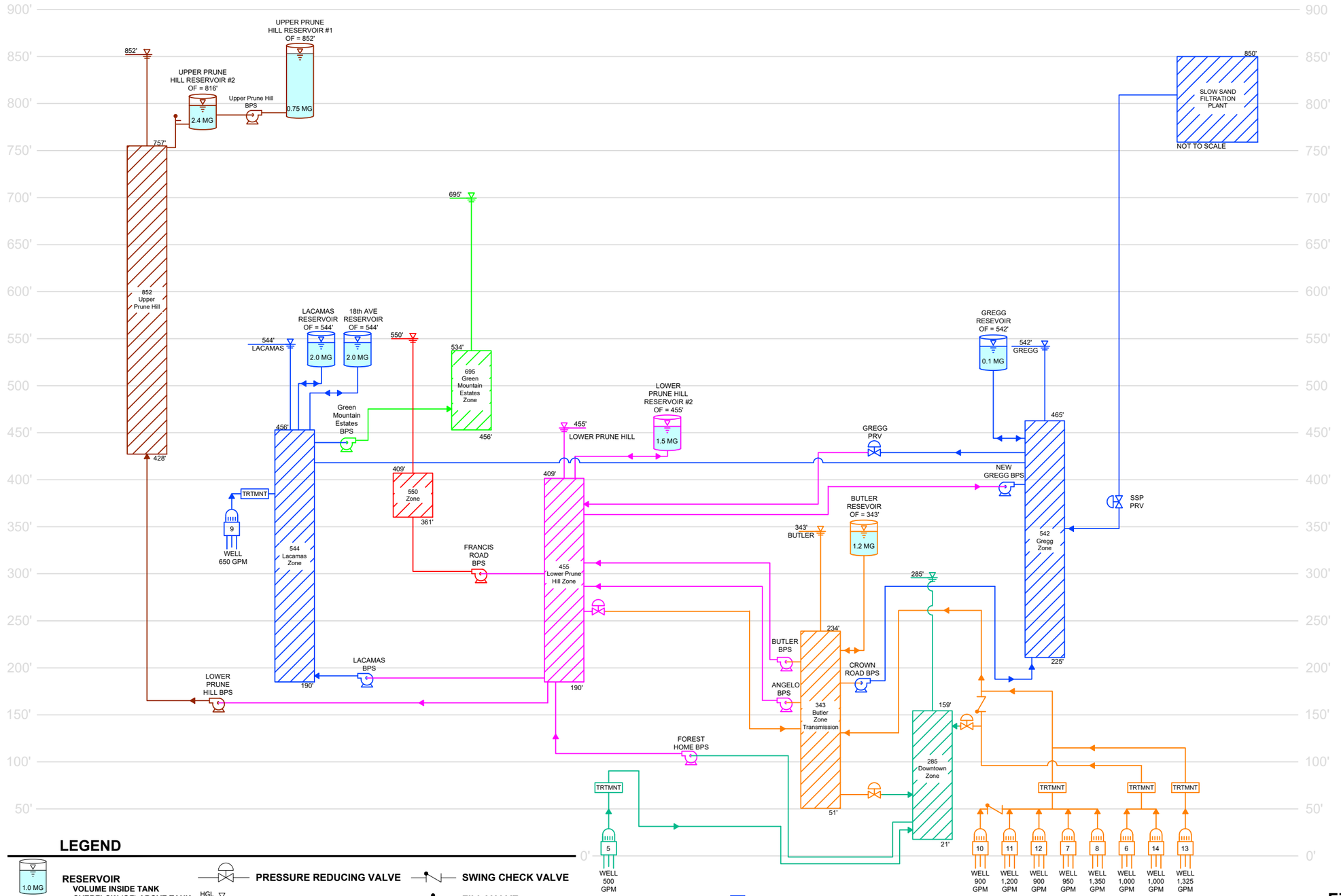


SEE FIGURE 3.2A FOR CONTINUATION

LEGEND

- RESERVOIR — VOLUME INSIDE TANK; OVERFLOW (OF) ABOVE TANK
- GROUNDWATER WELL
- BOOSTER PUMPING STATION
- PRESSURE REDUCING VALVE
- PRESSURE ZONE
  - HIGH: HIGHEST ELEVATION SERVED IN ZONE
  - LOW: LOWEST ELEVATION SERVED IN ZONE
  - HGL: HYDRAULIC GRADE LINE FOR ZONE
- SWING CHECK VALVE
- FILL VALVE
- 852 - UPPER PRUNE HILL OPERATIONAL AREA

Figure 3.2B
Simplified Hydraulic Profile Schematic
City of Camas



LEGEND

- RESERVOIR
  - VOLUME INSIDE TANK
  - OVERFLOW (OF) ABOVE TANK
- GROUNDWATER WELL
- BOOSTER PUMPING STATION
- PRESSURE REDUCING VALVE
- PRESSURE ZONE
  - HIGH: HIGHEST ELEVATION SERVED IN ZONE
  - LOW: LOWEST ELEVATION SERVED IN ZONE
  - HGL: HYDRAULIC GRADE LINE FOR ZONE
- SWING CHECK VALVE
- FILL VALVE
- 285 - DOWNTOWN OPERATIONAL AREA
- 343 - BUTLER (TRANSMISSION) OPERATIONAL AREA
- 455 - LOWER PRUNE HILL OPERATIONAL AREA
- 542 - GREGG/ 544 - LACAMAS OPERATIONAL AREA
- 550 - ZONE
- 695 - GREEN MOUNTAIN ESTATES OPERATIONAL AREA
- 852 - UPPER PRUNE HILL OPERATIONAL AREA

Figure 3.3
Simplified Hydraulic Profile Schematic
City of Camas

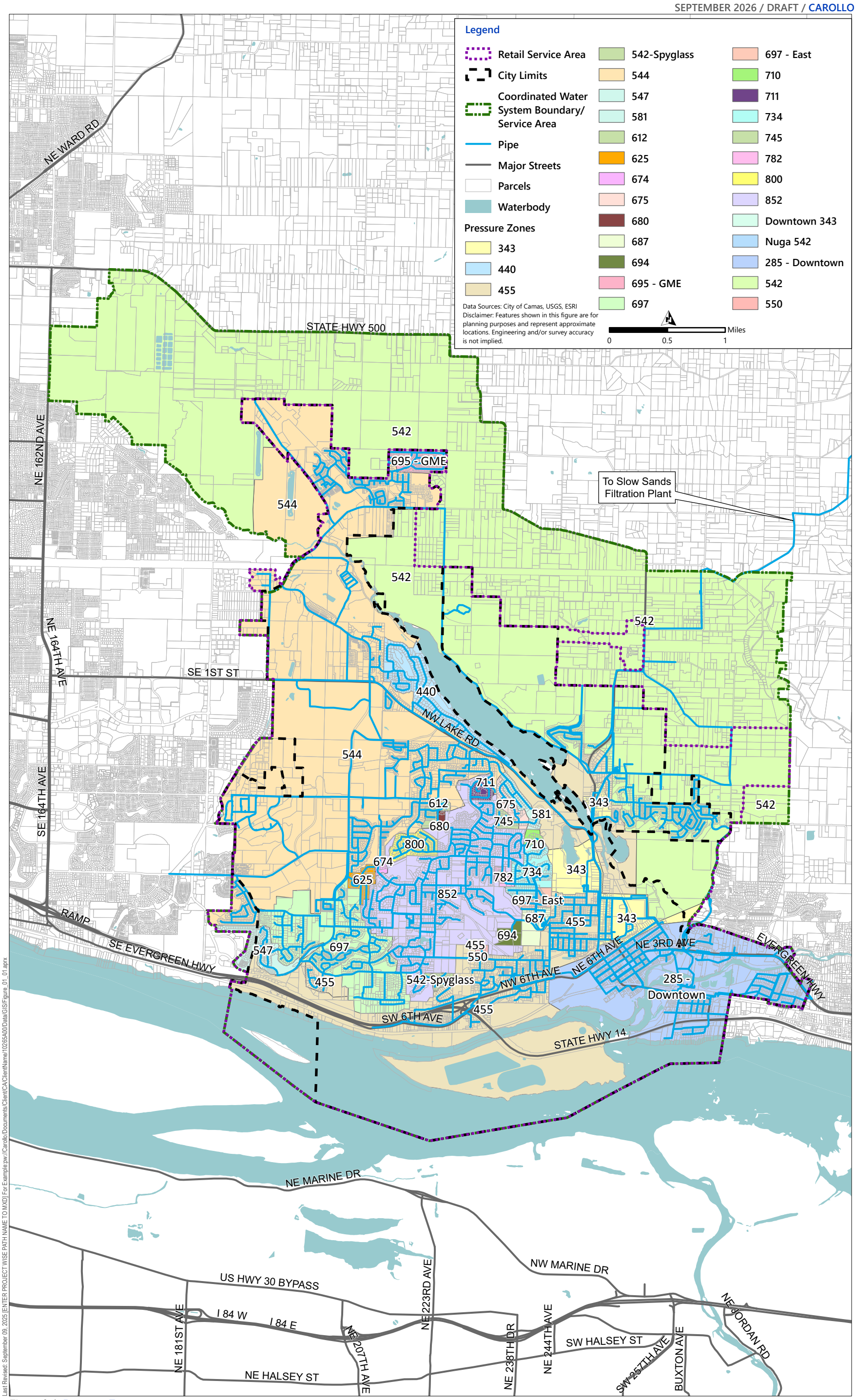


Figure 3.4 Pressure Zones

Table 3.1 Pressure Zones

Zone ID[1] (feet)	Supplying Pressure Zone	Open or Closed?	Minimum Elevation[2][3] (feet)	Maximum Elevation[2][3] (feet)
285 - Downtown	343 – Butler (Transmission)	Open	21	159
343 - Butler (Transmission)	N/A	Open	51	234
455 - LPH	N/A	Open	96	409
542 - Gregg	N/A	Open	225	465
544 - Lacamas	N/A	Open	190	456
440 - Lacamas Shores	544 – Lacamas	Open	212	358
852 - UPH	N/A	Open	428	757
542 - Spyglass	852 - UPH	Open	353	485
547	852 – UPH	Open	285	426
550	455 - LPH	Closed	361	409
581	852 – UPH	Open	334	460
612	852 – UPH	Open	404	488
625	852 – UPH	Open	399	549
674	852 – UPH	Open	382	530
675	852 – UPH	Open	460	523
687	852 – UPH	Open	428	524
694	852 – UPH	Open	510	544
695 - GME	542 – Gregg / 544 - Lacamas	Closed	456	534
697	852 – UPH	Open	421	636
697 - East	852 – UPH	Open	526	557
710	852 – UPH	Open	471	575
711	852 – UPH	Open	502	574
734	852 – UPH	Open	480	634
745	852 – UPH	Open	529	603
782	852 – UPH	Open	610	662
800	852 – UPH	Open	506	633

Notes:
(1) Zone ID is based on HGL.
(2) Elevation data based on interpolation of 3 foot contours.
(3) Location of service connections based on hydraulic model junction location.
GME - Green Mountain Estates; HGL - hydraulic grade line; LPH - Lower Prune Hill; N/A - not applicable; UPH - Upper Prune Hill.

3.3 Sources of Supply

The City currently obtains its water from ten groundwater wells and two surface water sources. Nine of the ten groundwater sources are located in the downtown area, in the Downtown 285 Zone, and Well 9 is

located in the Lacamas 544 Zone. The City's seasonal surface water sources are from Jones and Boulder Creeks to the north of the City as shown in Figure 3.1.

3.3.1 Surface Water Sources

Jones Creek has been providing the City of Camas with water since 1913. The Boulder Creek source was added in 1931. The intakes at Boulder and Jones Creeks consist of small settling basins and screens. Surface water sources may be operated between November 1st and May 15th. Seasonal raw water from the Boulder and Jones Creek intakes is conveyed to the recently constructed slow sand filtration treatment plant (SSF Plant) where the water is filtered prior to chemical treatment and discharge to the distribution system.

The SSF Plant has the capacity to treat the entire permitted flow of 1,570 gpm from the City's surface water sources. The surface water sources have lower operating expenses because they can provide flow toward two PZ without pumping, and have low silica content, which makes these sources more desirable to light industrial customers and their water quality sensitive industrial processes. However, these surface water sources are not available during peak water demand months. The City calls its groundwater sources only after demands cannot be met by production from the SSF Plant.

3.3.2 Groundwater Sources

The City currently operates ten groundwater wells. All of these wells are physically located in the Downtown 285 Zone except for Well 9. Wells 7, 8, 10, 11, and 12 are located on SE 6th Avenue, in the eastern downtown area, and are referred to as the Washougal Wellfield. Wells 6 and 14 are located further east along SE 6th Avenue near the Camas/Washougal border. The wellfield supply is conveyed across the Washougal River via a 14-inch diameter steel line under the river and a 24-inch diameter ductile iron (DI) pipe on a bridge over the river. The two pipes join, and an 18-inch diameter 343 Zone transmission line carries water from the Washougal Wellfield up toward the Angelo BPS. Well 5 is located south of Well 6 on SE 8th Street and pumps directly into the Downtown 285 zone. Well 13 is located in the Downtown 285 Zone on SE Cramer Lane and pumps into the same 18-inch diameter transmission line as the Washougal Wellfield. Well 9 is located in the 544 Zone on NW 38th Avenue near Parker Street. Table 3.2 lists the City's groundwater sources and the typical pumping rates observed in SCADA data. The City is currently investigating additional groundwater sources within its service area in anticipation of future demands.

Several of the City's groundwater sources must be operated with a booster pumping station in service to prevent over pressurization:

- When Well 5 is called into service, the Forest Home BPS must also be called on to prevent over-pressurization of the downtown zone.
- Washougal Wellfield operations are matched by pumping at the Angelo BPS. For each well that is called on at the wellfield, for up to four total wells, a corresponding pump must be called on at the Angelo BPS. The City will be adding a 5th temporary pump as a backup to the four pumps at Angelo while an additional booster station is designed and construction along Lake Road.
- There are currently piping restrictions that prevent the City from operating Well 6 and Well 14 at the same time. A planned waterline project to connect these wells to allow them to operate at the same time will be completed by the summer of 2026.

Table 3.2 Groundwater Sources

	Depth(1) (feet)	Rated Capacity (gpm)	Motor (hp)	Casing (inch)	Control Valve	Auxiliary Power
Well 5	71	675	75	8	3-inch waste valve	No
Well 6	85	1,200	150	16	4-inch waste valve	No
Well 7	84	950	100	14	3-inch waste valve	No
Well 8	87	1,250	150	14	4-inch waste valve	Yes
Well 9	253	575	100	16	4-inch waste valve	No
Well 10	92	900	150	16	8-inch	No
Well 11	106	1,000	150	16	8-inch	Yes
Well 12	106	1,000	150	16	8-inch	Yes
Well 13	103	1,350	200	20	8-inch	Yes
Well 14	75	850	200	20	8-inch	Yes
Total Groundwater Source Capacity				9,750 gpm		

Notes:
(1) Drilled depth of completed well below ground surface.
hp - horsepower.

3.4 Water Treatment

The City currently has approximately 15.5 million gallons per day (mgd) of total source water treatment capacity. A discussion of the treatment facilities is provided in the following sections. A summary of treatment facilities is provided in Table 3.3 and facility locations are shown in Figure 3.1.

3.4.1 Surface Water

The City's surface water is chlorinated and filtered. Chlorination of the surface water occurs at the City's slow sand facility with 0.840 percent sodium hypochlorite. The distance between the slow sand plant and the first customer provides 2.5 hours of CT.

In 2013, the City began construction of the SSF Plant. This plant has a design capacity of 1,570 gpm and filter beds are comprised entirely of sand. The City also treats with sodium fluoride for dental benefits.

3.4.2 Groundwater

Treatment of the City's groundwater sources includes on-site chlorination, fluoridation, and caustic soda addition. A single chemical feed facility provides treatment for Wells 7, 8, 10, 11, and 12 due to their proximity to one another. Water from Wells 6 and 14 are treated at the Well 14 site. The remaining wells each have individual treatment facilities at the well locations. Fluoridation always occurs downstream of the well pump and sodium fluoride is used at all facilities. Sodium hydroxide, also known as caustic soda, is added for corrosion control at each of the treatment facilities except for Well 9 due to natural pH. The existing treatment facilities for the City's sources are shown in Table 3.3. The residual chlorine target for all facilities is 0.8 milligrams per liter (mg/L) with alarms if the concentration is above 2 mg/L or below 0.2 mg/L. The fluoridation target for all facilities is 0.7 mg/L for all facilities with alarms if the concentration is above 2.5 mg/L or below 0.25 mg/L.

Table 3.3 Treatment Facilities

Treatment Facility	Sources Treated	Filtration	Chemical Addition
SSF Plant	Boulder Creek, Jones Creek	Yes	▪ Sodium Hypochlorite ▪ Sodium Hydroxide ▪ Sodium Fluoride
Washougal Wellfield - Site 519	Well 7, Well 8, Well 10, Well 11, and Well 12	No	▪ Sodium Hypochlorite ▪ Sodium Hydroxide ▪ Sodium Fluoride
Well 14 - Site 518	Well 6 and Well 14	No	▪ Sodium Hypochlorite ▪ Sodium Hydroxide ▪ Sodium Fluoride
Well 13 Site	Well 13	No	▪ Sodium Hypochlorite ▪ Sodium Hydroxide ▪ Sodium Fluoride
Well 9 Site	Well 9(1)	No	▪ Sodium Hypochlorite ▪ Sodium Fluoride
Well 5 Site	Well 5	No	▪ Sodium Hypochlorite ▪ Sodium Hydroxide ▪ Sodium Fluoride

Notes:
(1) Well 9 pH is above the treatment limit.

3.4.3 Groundwater Under the Direct Influence of Surface Water

The federal definition of ground water under the direct influence of surface water (GWI) is a groundwater source located near a surface water such that it has significant occurrence of contamination from pathogens such as Giardia lamblia which is not normally found in groundwater. A GWI receives direct surface water recharge and is subject to rapid changes in water characteristics that correlate to surface water conditions. Sources determined as GWI are required to achieve 99.9 percent removal of Giardia lamblia and viruses by filtration and disinfection.

A hydraulic connection to nearby surface water is a potential GWI source. In order to determine if a hydraulic connection exists, a water system may conduct a hydrogeologic investigation or use the water quality monitoring (WQM) method. The WQM method requires monitoring the groundwater and surface water source for 1 year for temperature and conductivity. If a significant correlation is determined from statistical analysis of the data, then the source is determined to be hydraulically connected to surface water. Less demanding requirements are required for hydraulically connected sources. These include eliminating the surface water influence, developing an alternate source, meeting criteria to remain unfiltered, or installing filtration.

A microscopic particulate analysis (MPA) is conducted in order to determine if a groundwater source is a GWI source. The City has completed MPA testing on Wells 6, 7, 8, 10, 11, 12, and 14 which indicate that these sources are hydraulically connected to surface water. Therefore, these sources are required by DOH to achieve a CT of 6. An evaluation by Pacific Groundwater Group in 2006 states that Well 13 is not under the direct influence of surface water but is hydraulically connected to surface water. Wells 5 and 9 are not hydraulically connected to surface water, so no CT is required.

3.5 Storage Facilities

The City currently maintains and operates seven storage facilities with a combined total of 9.95 MG. A discussion of each storage facility is provided in the following sections. A summary of the storage facilities is provided in Table 3.4. A map showing the location of the key elements of the City's water system is provided as Figure 3.1.

Table 3.4 Existing Storage Facilities

Reservoir	Capacity (MG)	Diameter (feet)	Base Elevation (feet)	Overflow Elevation (feet)	Year Constructed and Type
Butler	1.2	100x100	328	343	1913, Concrete
LPH No. 2	1.5	105	432	455	1971, Concrete
UPH No. 1	0.75	36	752	852	1971, Steel
UPH No. 2	2.4	78	748	816	2002, Steel
Gregg	0.1	16	472	542	1978, Steel
Lacamas	2.0	84	496	544	1993, Steel
18th Avenue	2.0	94	504	547	2020, Steel

3.5.1 Butler Reservoir

The Butler Reservoir consists of two adjacent, partially buried concrete reservoirs. The two reservoirs share a common wall, with the north half being constructed in 1913, and the south half being completed in 1923. The reservoirs are covered and have a total storage capacity of 1.2 MG. The base elevation of the reservoir is approximately 328 feet, and the overflow elevation is 343 feet. The entire capacity of the Butler Reservoir is usable storage. Under normal operating conditions, the Butler Reservoir is supplied through 6,420 lineal feet of 12-inch diameter cast iron (CI) transmission main. This transmission main connects with the 18-inch diameter main from Wells 6, 7, 8, 10, 11, 12, 13, and 14 at NE 22nd Avenue and NE Everett Street. The Butler Reservoir is shown in Figure 3.5 and capacity details are summarized in Table 3.4.



Figure 3.5 Butler Reservoir

3.5.2 Gregg Reservoir

The Gregg Reservoir, a 100,000-gallon capacity steel standpipe, was constructed in 1978. It has a base elevation of approximately 472 feet, an overflow elevation of 542 feet, and is the only storage facility for the 542 Zone. The reservoir provides equalization and operational storage for the 542 Zone but does not provide fire suppression storage. Fire flow demand is instead supplied by the two 1,500 gpm fire pumps at the New Gregg BPS. The Gregg Reservoir is typically supplied by a small jockey pump at the New Gregg BPS and the Crown Road BPS. The Gregg Reservoir can also be supplied by the City's SSF Plant, when it is operated during the winter months. The Gregg Reservoir is shown in Figure 3.6 and capacity details are summarized in Table 3.4.



Figure 3.6 Gregg Reservoir

3.5.3 Lacamas Reservoir

The Lacamas Reservoir, constructed in 1993, has a total capacity of 2.0 MG. It has a base elevation of approximately 496 feet, and an overflow elevation of 544 feet. The Lacamas Reservoir is a ground level reservoir. The Lacamas Reservoir is primarily supplied from the LPH Zone via the Lacamas BPS or from Well 9. PRV stations from the UPH zone can also provide fire flow to the Lacamas Zone. The Lacamas Reservoir is shown in Figure 3.7 and capacity details are summarized in Table 3.4.



Figure 3.7 Lacamas Reservoir

3.5.4 18th Avenue Reservoir

The 18th Avenue Reservoir, constructed in 2020, is a ground level steel reservoir that has a total capacity of 2.0 MG. It has a base elevation of approximately 504 feet and an overflow elevation of 547 feet. The 18th Avenue Reservoir is primarily supplied by the Lacamas Reservoir through a fill valve that opens once the Lacamas Reservoir is full. The 18th Avenue Reservoir is shown in Figure 3.8 and capacity details are summarized in Table 3.4.



Figure 3.8 18th Avenue (Anderson) Reservoir

3.5.5 Lower Prune Hill Reservoirs

Storage in the LPH Zone is currently provided by a single concrete ground level reservoir (LPH Reservoir 2) with a base elevation of 423 feet and overflow elevation of 455 feet. LPH reservoir 2 was constructed in 1971 and has a total capacity of 1.5 MG. LPH Reservoir 1, a 0.5 MG concrete ground level reservoir

originally constructed in 1935 was recently taken offline to be replaced. Once construction is completed, the new welded steel reservoir will provide an additional 0.57 MG of storage and will be plumbed together with LPH Reservoir 2 to act as one reservoir, increasing total storage capacity for the LPH Zone to 2.07 MG. Storage in the LPH Reservoir is accessible via gravity to the 455 Zone, or is pumped to the UPH Zone through the LPH BPS. Under normal system operation, water from the SSF Plant supplies the 455 Zone and the reservoirs. The 455 Zone can also be supplied through pumping from the 343 Zone via the Forest Home, Butler, and Angelo BPS. The LPH Reservoirs can also supply the 544 Zone through the Lacamas BPS. When SSF is running the surface water can supply the 544 Zone through Lacamas BPS. The LPH Reservoir 2 is shown in Figure 3.9 and capacity details are summarized in Table 3.4.



Figure 3.9 LPH Reservoirs

3.5.6 Upper Prune Hill Standpipe and Reservoir

The UPH Reservoir 1 and Reservoir 2 were constructed in 1971 and 2001, respectively. Reservoir 1 has an overflow elevation of 852 feet, stands 100-feet tall, and has a total capacity of 0.75 MG. This reservoir sets the HGL for the 852 Zone. The UPH Reservoir 2 is below the HGL of the 852 Zone and serves the zone by pumping through the UPH BPS to the UPH Reservoir 1. It has an overflow elevation of 816 feet, stands 68-feet tall, and has a total capacity of 2.4 MG. The BPS has a total pumping capacity of 2,900 gpm. Including the standpipe and reservoir, the 852 Zone is supplied by the LPH BPS, 12-inch diameter transmission line, and 16-inch diameter Ostenson Canyon transmission line. The UPH Reservoirs are shown in Figure 3.10 and capacity details are summarized in Table 3.4.



Figure 3.10 UPH Reservoirs

3.6 Pipe Network

The City owns over 159 miles of pipe in its distribution system. An inventory of existing pipelines in the system, as reported from the City's hydraulic model, is summarized in Table 3.5. The system is predominately looped and located within public rights-of-way, giving the City access for repair and maintenance. The City replaces aging and undersized pipes to serve the City's growing demands on an ongoing basis. Pipe materials within the City currently include the following:

- CI Pipe.
- Polyvinyl chloride (PVC) Pipe.
- DI Pipe.
- Steel (ST) Pipe.

Table 3.5 Pipe Diameter and Material

Diameter	DI (feet)	CI (feet)	ST (feet)	PVC (feet)	Unknown	Total (feet)	Percent
6-inch	77,204	69,979	20,210	903	9,108	180,065	21%
8-inch	156,044	20,937	7,943	0	7,943	365,424	43%
10-inch	7,560	0	2,014	0	10,690	20,264	2%
12-inch	67,301	21,432	1,922	3,891	63,523	162,810	19%
14-inch	11,923	0	6,934	5,037	7,207	32,881	4%
16-inch	1,170	2,467	0	0	9,641	13,278	2%
18-inch	37,679	0	179	0	12,394	50,251	6%
20-inch	0	0	0	1,859	57	57	< 1%
24-inch	1,817	0	0	0	14,455	16,272	2%
Total	360,697	114,815	39,203	11,612	277,723	841,303	100%
Percent	43%	14%	5%	1%	33%	100%	

3.7 Pressure Reducing Stations

The City maintains numerous pressure reducing stations as shown in Table 3.6 and Figure 3.1 to help maintain pressure in low elevations and minimize potential risks from high pressures. In most cases, there are two PRVs at each station. The smaller valve operates to provide the average daily demand to the zone that it serves. The larger valve, which is generally set 5 psi lower than the small valve, is primarily used for fire protection or large demand situations. The City's PRVs have pressure sustaining features, which are set to ensure that upstream pressures are maintained. The City has a contract with GC Systems to service the 71 PRVs located within the water system. This contract allows GC Systems to perform general maintenance and ensure that the valves are operating correctly, both on an individual and system-wide level.

Table 3.6 PRV

PRV Station	PRV Model ID	Size (inches)	Downstream Zone	Downstream Setting (psi)	Upstream Pressure (psi)
NW McIntosh	PRV-1	6	697	27	120
	PRV-2	2	697	32	120
NW Payne Road. and SE 201st Avenue	PRV-3	8	544	Closed	Closed
	PRV-4	4	544	Closed	Closed
NW 16th Avenue and Klickitat	PRV-5	10	697	12	105
	PRV-6	4	697	22	105
NW Ivy and Fargo	PRV-7	4	734	45	90
NW 22nd and Fargo	PRV-8	4	697E	65	130
NW 19th Avenue and Fargo	PRV-9	6	687	70	157
NE 21st and Everett	PRV-10	8	343	45	110
NE 19th and Everett	PRV-11	6	343	40	110
2349 NW 32nd Circle	PRV-12	8	680	25	120
	PRV-13	2	680	30	120
NW Brady Road and Deer Creek	PRV-14	8	547	25	105
	PRV-15	3	547	30	105
NW Parker Street and Linear	PRV-16	8	544	Closed	Closed
NW Astor and 36th (Applewood)	PRV-17	8	612	55	90
	PRV-18	2	612	65	90
NW 43rd and Sierra	PRV-19	8	544	30	190
NW 23rd Avenue and Fargo	PRV-20	4	734	45	130
2666 NW Logan Street off NW 28th	PRV-21	6	782	50	90
	PRV-22	2	782	55	90
2929 NW 31st and NW Dahlia Drive	PRV-23	6	544	Closed	Closed
	PRV-24	2	544	Closed	Closed
NW 29th Avenue and NW Astor Street	PRV-25	2	800	58	90
	PRV-26	6	800	53	90
NW Sierra Drive and NW 38th Avenue	PRV-27	6	711	35	115
	PRV-28	2	711	40	115
Currawong Court and NW 40th Avenue	PRV-29	6	711	75	145
	PRV-30	2	711	80	145
NW 23rd Avenue and Iris	PRV-31	8	656	58	130
	PRV-32	2	656	63	130
NW Julia Street	PRV-33	8	544	Closed	Closed
	PRV-34	2	544	Closed	Closed
NW Fern Ridge Drive	PRV-35	2	547	40	110
	PRV-36	8	547	35	110
NE 6th and NE Hayes Street	PRV-37	4	343	68	94
	PRV-38	12	343	58	94

PRV Station	PRV Model ID	Size (inches)	Downstream Zone	Downstream Setting (psi)	Upstream Pressure (psi)
East End Walden	PRV-41	2	442	37	84
	PRV-42	6	442	32	84
West End Walden	PRV-43	1.5	442	72	118
	PRV-44	6	442	67	118
NE 6th and Joy	PRV-45	6	343	55	92
Goot Park	PRV-46	3	343	115	138
	PRV-47	10	343	110	138
Lake Ridge Lower	PRV-48	2	581	55	98
	PRV-49	6	581	50	98
Lake Ridge Middle	PRV-50	2	675	63	91
	PRV-51	6	675	58	91
Lake Ridge Upper	PRV-52	2	745	68	123
	PRV-53	6	745	63	123
702 NW View Ridge Strett (Dovehill) Upper	PRV-54	2	542S	30	100
	PRV-55	6	542S	25	100
NW 7th and Valley (Dovehill) View Ridge Lower	PRV-56	2	542S	40	110
	PRV-57	6	542S	35	110
NW Fargo and 27th (Drewf's Farm Upper)	PRV-58	2	734	Open	63
	PRV-59	6	734	Open	63
905 NW 30th Avenue and NW Ivy Lane (Drewf's Farm Lower)	PRV-60	2	710	60	130
	PRV-61	6	710	55	130
NW Ivy and Ostenson Canyon	PRV-62	2	694	65	140
	PRV-63	6	694	60	140
NW 24th Avenue and NW Brady Road	PRV-64	6	625	70	124
	PRV-65	2	625	75	124
2011 NW Larkspur Street	PRV-66	6	625	45	132
	PRV-67	2	625	50	132
Wellfield East	PRV-69	12	343	100	125
	PRV-70	4	343	Closed	Closed
NE 277th and NE 14th Street	PRV_SSP	6	542	78	140
	V9093	3	542	88	140

3.8 Booster Pumping Stations

The City currently maintains and operates ten booster pumping stations to move water between PZ. A description of each BPS is included in the following sections. Table 3.7 provides a summary of each pump station and details the rated capacity of each pump. Locations for each of the City's BPS are shown in Figure 3.1.

Table 3.7 BPS Summary

Name	From Zone	To Zone	Year Constructed	Auxiliary Power	Pump Information		
					Pump No.	Power (hp)	Design Capacity (gpm)
Angelo BPS	343 Transmission	455 - LPH	2001	Yes	1	75	1,000
					2	75	1,000
					3	75	1,000
					4	75	1,000
Butler BPS	343 – Transmission	455 - LPH	1948(2)	No	1	50	800
					2	60	600
Crown Road BPS	343 – Transmission	542 - Gregg	2011	Yes	1	75	800
					2	75	800
					3	75	800
Forest Home BPS	343 - Lower (Downtown)	455 - LPH	1949(3)	No	1	50	1,000
GME BPS	544 - Lacamas	695 - GME	2023	Yes		15	180
					2	15	180
					3	15	180
					4	60	650
					5	60	650
New Gregg BPS	455 - LPH	542 - Gregg	2003	Yes	1	100	1,500
					2	100	1,500
					3	15	500
Lacamas BPS	455 - LPH	544 - Lacamas	1993	Yes	1	25	500
					2	25	500
					3	100	1,500
LPH BPS	455 - LPH	852 - UPH	1971(4)	Yes	1	150	1,000
					2	150	1,000
					3	100	750
UPH BPS	852 - UPH	852 - UPH	2002	Yes	1	20	750
					2	20	750
					3	40	1,400
					4	40	1,400
Francis Road BPS	455 - LPH	550	1942	No	1	7.5	80

Notes:
(1) Source: The City.
(2) Pumps were replaced in 1998.
(3) Pump was replaced in 1999.
(4) Pumps were replaced in 2002 and 2004.

3.8.1 Butler Booster Pump Station

The Butler BPS is located at the Butler Reservoir site and pumps from the 343 Zone to the 455 Zone. The Butler BPS has one end suction centrifugal 50-hp pump and one end suction centrifugal 40-hp pump that are capable of supplying 800 and 600 gpm, respectively. When one of the larger two pumps in the New Gregg BPS is called on, one of the Butler pumps is also turned on to feed the 14-inch diameter suction line of the New Gregg BPS. This station does not have the capacity for an additional pump. Figure 3.11 shows the interior of the Butler BPS and capacity details are summarized in Table 3.7.



Figure 3.11 Butler BPS

3.8.2 New Gregg Booster Pump Station

The New Gregg BPS is also located at the Butler Reservoir site and pumps water from the 455 Zone to the 542 Zone. The New Gregg BPS is equipped with two 100-hp double end suction split case pumps, each with a capacity of 1,500 gpm. In 2013 a third 500 gpm pump was added for domestic service and to maintain the level in the Gregg Reservoir. The two larger pumps are typically only called on when fire flow demands occur. The New Gregg BPS has suction side flow limitations due to insufficient head provided by the Butler Reservoir. When one of the larger two pumps in the New Gregg BPS is called on, a pump in the Butler BPS must also be called on to supply adequate pressure for the Station's 14-inch diameter suction line. Figure 3.12 shows the interior of the New Gregg BPS and capacity details are summarized in Table 3.7.





Figure 3.12 New Gregg BPS

3.8.3 Forest Home Booster Pump Station

The Forest Home BPS, located at 418 NW 10th Avenue, pumps from the Downtown 343 Zone to the 455 Zone. This station contains one pump with a rated capacity of 1,000 gpm. When Well 5 is called into service, this BPS is also called on to prevent over-pressurization of the Downtown 285 Zone. Figure 3.13 shows the Forest Home BPS and capacity details are summarized in Table 3.7.



Figure 3.13 Forest Home BPS

3.8.4 Lower Prune Hill Booster Pump Station

The LPH BPS is located at the LPH Reservoir site and pumps water from the 455 Zone to the 852 Zone. This station has three pumps with two 150-hp split case double end suction pumps capable of providing 1,000 gpm each and a 100-hp vertical turbine pump capable of providing 750 gpm for a total rated station capacity of 2,500 gpm. This station has does not have capacity for an additional pumping unit. With the improvements to LPH Reservoir 1, the City is also replacing the LPH BPS. Construction is expected to be completed in 2026. Once operational, the new LPH BPS will utilize three 250-hp vertical turbine pumps capable of providing 1,600 gpm each to supply the 852 Zone. The upgrades at LPH BPS will increase the total station capacity to 4,800 gpm. The LPH BPS is shown in Figure 3.14 and current capacity details are summarized in Table 3.7.



Figure 3.14 LPH BPS

3.8.5 Lacamas Booster Pump Station

The Lacamas BPS, located at 4620 NW Sierra Street, pumps water from the 455 Zone to the 544 Zone. This station has two 25-hp turbine pumps that are capable of supplying 500 gpm each and one 100-hp turbine pump equipped with a VFD capable of supplying up to 1,500 gpm. The VFD is required for the largest pump due to suction side limitations. The Lacamas BPS is shown in Figure 3.15 and capacity details are summarized in Table 3.7.



Figure 3.15 Lacamas BPS

3.8.6 Angelo Booster Pump Station

The Angelo BPS is located at Fallen Leaf Park and is the primary BPS supplying the 455 Zone. It pumps from the 18-inch diameter transmission main in the 343 Zone to serve the 455 Zone and feeds the suction side of the Lacamas BPS. This station has four 75-hp split case double end suction pumps capable of pumping 1,000 gpm each. A selected well is called on with the first pump of the Angelo BPS to provide adequate suction side supply. If additional wells are called on to meet demand, a corresponding pump is also called on at the station to prevent over pressurization of the 343 Zone. The Angelo BPS is shown in Figure 3.16 and capacity details are summarized in Table 3.7.



Figure 3.16 Angelo BPS

3.8.7 Upper Prune Hill Booster Pump Station

The UPH BPS is located at 2822 NW 18th Avenue and is used to maintain level in the UPH Standpipe, which sets the HGL for the 852 Zone. This station has four pumps with two 20-hp split case double end suction pumps capable of providing 750 gpm each and two 40-hp split case double end suction pumps capable of providing 1,400 gpm each. The UPH BPS suction line is fed from the 2.4 MG reservoir. The 2.4-MG reservoir is fed from the LPH BPS. The UPH BPS is shown in Figure 3.17 and capacity details are summarized in Table 3.7.



Figure 3.17 UPH BPS

3.8.8 Crown Road Booster Pump Station

The Crown Road BPS is located at 3700 SE Crown Road and pumps from the 343 Zone to the 542 Zone. This station has three pumps capable of providing 800 gpm each for a total station capacity of 2,400 gpm. There is one pedestal open for an additional pumping unit within the station. When the station is called into service, a selected well is called on simultaneously to provide sufficient suction side supply. The Crown Road BPS is shown in Figure 3.18 and capacity details are summarized in Table 3.7.



Figure 3.18 Crown Road BPS

3.8.9 Green Mountain Estates Booster Pump Station

The GME BPS is the City's newest BPS and is located at 9046 N Hargrave Street. This station pumps from the 542/544 Zones to the GME Zone through three pumps capable of providing 180 gpm each and two fire pumps each capable of providing 650 gpm for a total station capacity of 1,840 gpm. This station is the sole source of supply for the GME Zone (closed zone), which has no storage instead utilizes a hydropneumatic tank to prevent constant cycling of pumps and maintain a constant discharge pressure downstream of the pumps. The GME BPS is shown in Figure 3.19 and capacity details are summarized in Table 3.7.



Figure 3.19 GME BPS

3.8.10 Francis Road Booster Pump Station

The Francis Road BPS is located at the intersection of 1514 NW 10th Avenue and NW Francis Road. This station was constructed in 1942 and has one 7.5-hp pump capable of supplying 80 gpm to a few customers in the 455 LPH Zone at higher elevations. The Francis Road BPS is shown in Figure 3.20 and capacity details are summarized in Table 3.7.



Figure 3.20 Francis Road BPS

3.9 Interties

The City currently has emergency intertie agreements with the City of Washougal and the City of Vancouver, which are detailed in Table 3.8. The City has two one-way emergency PRV interties with Washougal, located on SE Shepherd Road and at the intersection of SE 3rd Street and Whitney Street. These interties provide water from the City of Camas to the City of Washougal under low pressure conditions. The City's intertie with Vancouver is located at the intersection of SE Columbia Palisades Drive and SE Brady Road. Additionally, the City has an agreement for emergency use of two fire hydrants located at SE 1st and Friberg for firefighting purposes. Intertie locations are shown on Figure 3.21 and interlocal agreements are provided in Appendix C.

Table 3.8 Interties

Location	Other System	Flow Direction	Valve/Meter Size (inches)	Max Flow Rate (gpm)	Type of Service
SE Shepherd Road	City of Washougal	To Washougal	8 1.5	1500 gpm at 100 psi	Emergency
SE 3rd Street and Whitney Street	City of Washougal	To Washougal	8 1.5	1500 gpm at 100 psi	Emergency
SE Columbia Palisades Drive and SE Brady Road	City of Vancouver	To Vancouver			Emergency
SE 1st and Friberg	City of Vancouver	N/A	N/A	N/A	Emergency

Notes:
(1) Not a physical intertie. Agreement is for the emergency use of two fire hydrants owned/maintained by the City of Vancouver.

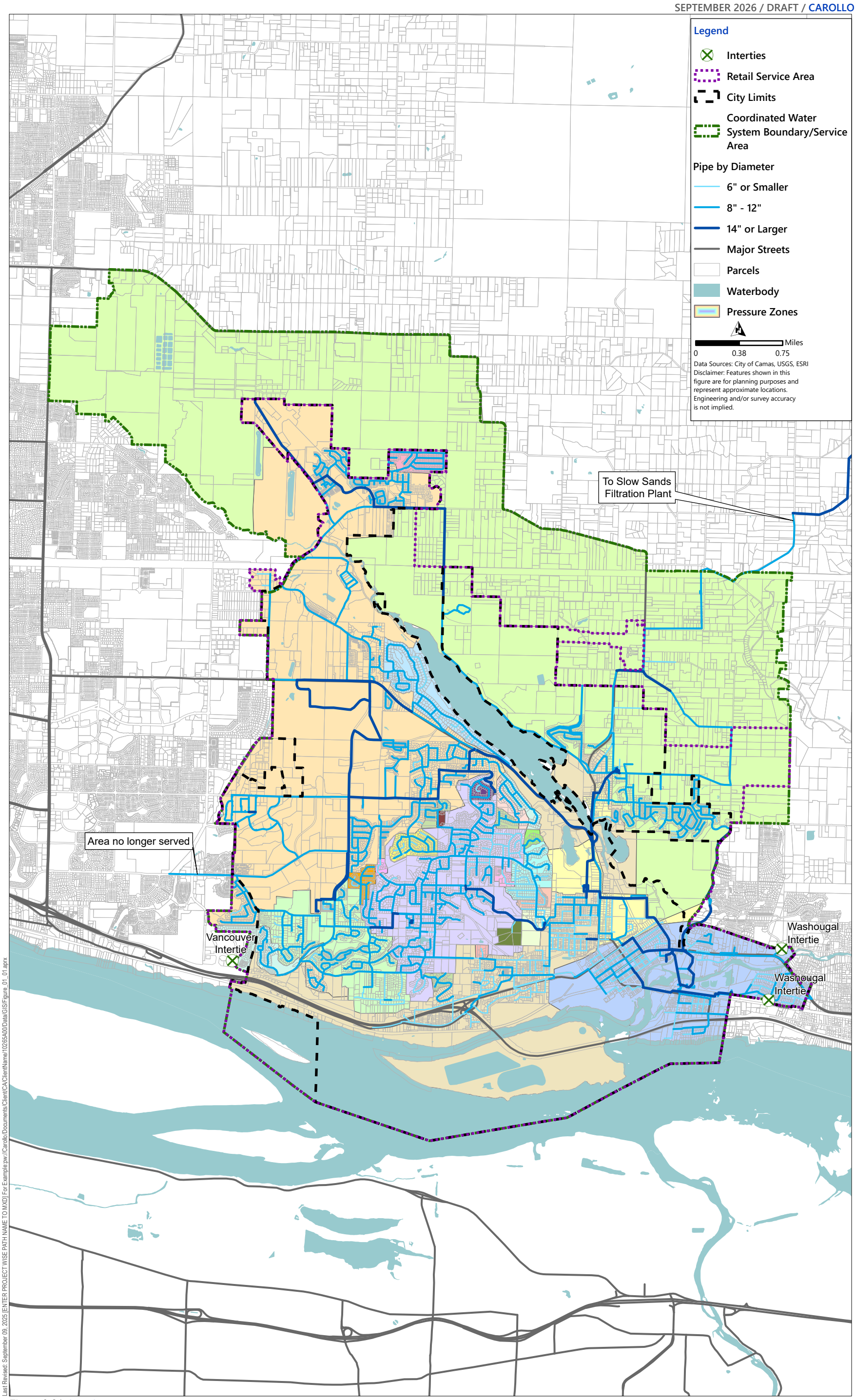


Figure 3.21 Interties

3.10 Supervisory Control and Data Acquisition

The City has a SCADA system with master control located at the City Operations Center. The system uses programmable control software, which can be controlled by a personal computer at the operations center, or from remote by a modem connected to a remote computer. The system monitors reservoir levels, well status, well flow rate, booster pump flow rates, pump status, run time, power usage, and alarm conditions. The system is able to record and display trending data for everything the City monitors. The City continually rotates well and booster pump calls to exercise the pumps and to evenly distribute wear on the pumps.

CHAPTER 4 OPERATION AND MAINTENANCE

4.1 Water System Management and Personnel

The water system is operated and maintained by the City staff, with contractor-provided services that City staff are not trained or equipped to perform. The organization of the City's water utility is shown in Figure 4.1. This section includes a brief discussion of the responsibilities of positions in the Public Works Department.

The City is governed by a mayor and seven council members, all of which are elected officials. The Public Works Director reports to the mayor and council and directs the City's utilities, including water. The City's organization combines water and sewer operation to furnish domestic water and sanitary sewage disposal service to industrial, commercial, and residential areas within the City and surrounding areas. The following subsections discuss the roles and responsibilities of the water system personnel.

4.1.1 Public Works Director

The City's water system is operated by the Public Works Department. The Public Works Director is responsible for overseeing Camas' water, sewer, and solid waste services. The Engineering Manager, Operations Manager, and Utilities Manager all report to the Public Works Director.

4.1.2 Capital Engineering

The City's Capital Engineering Department is lead by the Engineering Manager and is responsible for engineering services, including capital planning, project implementation, development review, construction management, and operational support. Field engineering support is supplied by both City staff and contracted private parties such as engineering consultant firms.

4.1.3 Utility Manager

The water system is one of several utilities within the Public Works Department that is managed by the Utilities Manager, who reports directly to the Public Works Director. The Utilities Manager is responsible for the management of the operation and maintenance of the City's water supply, water treatment, water distribution, wastewater collection, and wastewater treatment systems. For the City's water supply system, the Utility Manager has budgetary responsibility and directs the Lead Water System Operator in carrying out daily operations and maintenance, water quality monitoring, and asset management and facility inspection. The Utilities Manager works with the Engineering Manager to develop the City's Water System Plan (WSP) and supports engineering design review. The Utilities Manager is also responsible for all aspects of the water system during an emergency, including damage assessments, assessing customer impacts, coordinating with jurisdictional public health agencies and adjacent water utilities, keeping the public and media informed through the Director of Communications and Public Affairs, and working with the Public Works Engineering Manager for design and construction services required for repair and recovery operations.

4.1.4 Water System Operators

The Water System Operators perform all field maintenance and operation functions for the City's water utility. The Water System Operator responsibilities include the operation, maintenance, and repair of the following assets:

- Pump stations.
- PRVs.
- Reservoirs.
- Wells.
- Treatment systems.
- SCADA systems.

Further responsibilities include, but are not limited to, the following water system activities:

- Main flushing.
- Tank and reservoir cleaning.
- Valve and hydrant maintenance, repair, and replacement.
- Leak detection and emergency water main repairs.
- Meter reading and repair.

4.1.4.1 Cross-Connection Control Specialist

The CCS performs inspections of construction projects and existing facilities to ensure compliance with specification and standards for cross connection control. They perform recordkeeping to ensure that state regulations are met, and results are compiled to meet the appropriate department's standards. As a secondary focus, the CCS performs construction, maintenance, and repair of the City's water distribution system.

4.1.4.2 Water Quality Specialist

Within the water division a water system operator is assigned responsibility for source and distribution water quality monitoring. The responsibilities for water quality monitoring for routine compliance sampling and testing are outlined in the O&M manual. Other responsibilities include water quality data verification, reporting to the DOH, and conducting sanitary surveys. Positive coliform events of the water system require the water quality monitoring operator to follow procedures as outlined in the Emergency Response Plan in Appendix **[D]**.

4.1.5 Emergency Public Communication

The City's Director of Communications and Public Affairs is the designated media contact. Additional responsibilities include issuing a health advisory as part of a Tier 1 public notice during an emergency.

4.2 Operator Certification

The City's operators are experienced and well trained, exceeding the minimum state requirements (WAC 246-292-050). As a Class 3 system (population between 15,000 and 50,000 people) the City is required to have at a minimum, a Water Treatment Plant Operator (WTPO) Level 3, a Water Distribution Manager (WDM) Level 3, and a CCS. The City certified operators are shown in Table 4.1. As staff changes, the Water Works Certification Board is notified of any changes to the mandatory or supporting certificated personnel.

4.2.1 Professional Growth and Training

Public Works Leads and administrative staff ensure operators receive the necessary training and continuing education to effectively operate the water system. The City provides opportunities for staff professional growth and training; planning for approximately 25 hours per year of professional growth and training for each employee. Through these activities, City staff are able to obtain the required continuing education unit (CEU) requirements for their operators' certifications. City staff are regular attendees of training programs sponsored by both Washington Environmental Training Resources Center and the Pacific Northwest Section of the American Water Works Association (AWWA). The professional growth requirement may also be met by advancement by examination or certification by examination to a different classification.

Table 4.1 Certified Operators

Name	Title	Certification			
		WDM	WTPO	Certificate Number	CCS
Brandon Prather	Lead	3	2	11124	Yes
Derek Engler	Senior	2		11703	No
Allen Nelson	Water Operator	4	3	8187	Yes
Will Weglege	Senior	2	2	12451	No
Henry Erickson	MW2	2		11540	Yes
Nick Mettler	CCS	2		16006	Yes

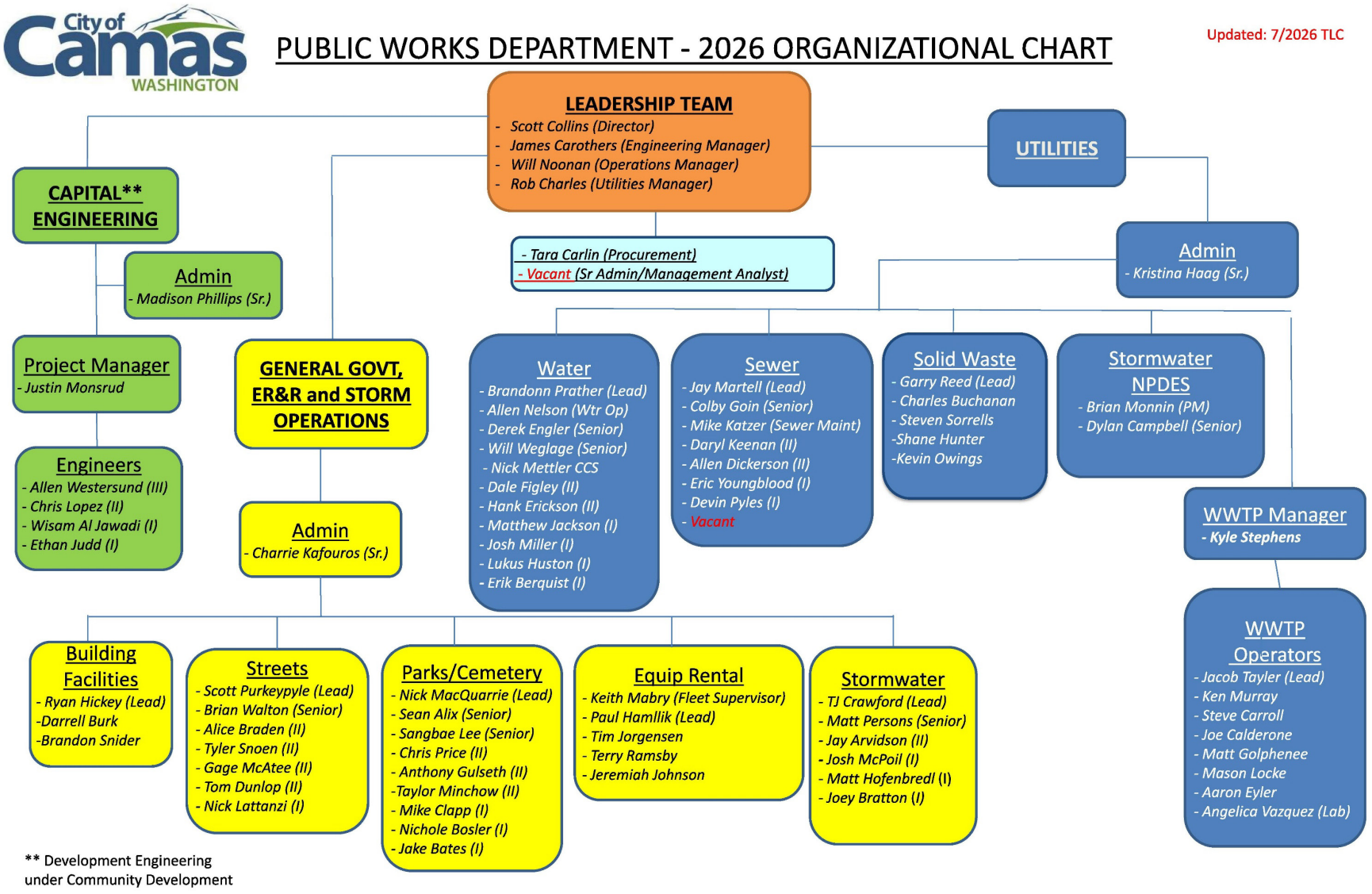


Figure 4.1 2026 Organizational Chart

4.3 Customer Complaint Response Reporting

Customers interact with the City through a variety of methods. Customer service representatives are available by phone and through an online Utility Service Request system on the City's website. Customer service agents are trained to answer typical questions and route service requests (complaints) to the appropriate department (Operations, Finance, Engineering, etc.). Calls are tracked by customer service agents, and the resulting activities are documented in the maintenance management system if a work order is issued. The finance department also tracks billing-related requests.

City operators also routinely interact with customers during maintenance activities. Often, these interactions are directly related to ongoing system maintenance such as hydrant flushing, and customer inquiries or concerns are resolved on the spot. Operators direct additional requests to customer service representatives, as needed. The Utilities Manager is responsible for responding to more complex and time-sensitive customer complaints.

4.4 Record Keeping and Reporting

The City maintains detailed records of the water system. Substantial record keeping activities are required to record and report customer water usage, water production, water quality information, and maintenance activities. All recordkeeping and reporting follows DOH regulations as specified in WAC 426-290-480.

The City's Finance Department is responsible for billing customers for water use. The billing records include customer account data for classes of customers, water use, billing, service, and comments. Water production for the City's surface water sources and wells are tracked in real time via SCADA, which maintains approximately a year of historical data. Operators record production daily and report the production monthly to DOH. Based on these records and water consumption records, the City develops and submits an annual WUE Report to DOH.

The City conducts substantial water quality testing, as summarized in Chapter 7. Hard copies of the water quality laboratory reports from the testing are kept at the City. In addition, analytical laboratories also submit reports directly to DOH. This data is summarized annually in the City's consumer confidence report that is available on its website.

The City maintains a maintenance management system to manage work order requests and document maintenance activities. Historically, the City has recorded work efforts on hard copy maintenance cards that are available for reference to City staff.

The City submits all required construction completion reports to DOH. Construction completion reports for distribution main projects are maintained on file at the City and are available upon request by DOH.

4.5 Routine System Operating Procedures and Preventative Maintenance

Basic system operation and major system components are described in Chapter 3 - Existing System and Chapter 9 - System Analysis. Detailed documentation of the system operation procedures and preventive maintenance can be found in the City's O&M Manual. The manual provides detailed information on operator certification and training, water quality monitoring, operation and control, cross-connection

control, and emergency planning/response. Routine operating procedures and preventative maintenance aspects of the O&M Manual are summarized below.

4.5.1 Routine Operating Procedures

The City is updating its O&M Manual in 2026 to reflect recent changes in the system and capture the institutional knowledge of retiring operators. The O&M Manual provides the following types of operation and control information for wells, reservoirs, pump stations, and pipelines:

- Facility/process components, such as booster pumps, SCADA telemetry, valves, chemical metering pumps, storage tanks, etc.
- Description of facilities/processes, including area served and relationship to other facilities/processes.
- Operation and control, including set points and chemical usage guidelines.
- Guidance on performing maintenance activities such as cleaning, pump isolation, and meter/pump calibration.
- Alarm responses.
- Emergency operation, including use of safety equipment (i.e., emergency showers and eyewash, etc.) and facility operations on auxiliary power.

To aid in accessing the detailed information, the O&M Manual provides annotated pictures identifying all facility equipment.

A hard copy of the O&M Manual is kept at the City's operations center and is available electronically on the City's network. The slow sand filtration plant operations and control are documented in a separate O&M Manual that is kept onsite at the plant and available electronically on the City's network.

4.5.2 Preventative Maintenance

The City staff are responsible for daily operation of the City's surface water sources, wells, treatment facilities, booster stations, PRVs, storage facilities, and distribution system. In addition to daily operation, they also perform preventative maintenance on the system based on City goals. These preventative maintenance goals help the City maintain its assets at an acceptable level of risk, while meeting the City's desired level of service goals. An activity's complexity and level of effort is generally greater the less frequently it is performed. Daily and weekly activities can likely be completed in an hour or less. In general, activities are intended to be grouped (i.e., weekly, semi-weekly, monthly, and quarterly during a single visit) to reduce inefficiencies in travel and site setup (i.e., traffic control at PRVs, etc.). Some activities may take several days and require specialized contractors.

Daily preventative maintenance focuses on inspections of the general condition and function of the facilities and maintaining and recording chemical levels. Frequency of inspections is based on industry practices and professional judgement. Weekly and monthly maintenance activities include more detailed inspections and cleaning of assets, as well as maintenance of the surface water sources. Annual preventative activities include basic maintenance of equipment (i.e., oil and filter changes, exercising infrequently used valves and pumps, cleaning cooling systems on generators, etc.). All activities are completed to the extent possible based on available staff and resources. A more detailed description of the preventative maintenance activities is provided in Appendix **[E]**.

4.6 Facility Maintenance

A high-level condition assessment was prepared for the City's water system facilities in 2016. The assessment included review of information for the existing facilities and inspection of the facilities on January 5 and 6, 2016. The assessment included each supply well and BPS. The City's storage reservoirs, PRV stations, and piping were not included in the assessment.

4.6.1 Booster Pump Stations and Supply Wells

Overall, the City's BPSs and supply wells were found to be in generally good condition. The facilities have been well-maintained with regularly scheduled maintenance and CIP work being performed. Electrical equipment conditions were the most common deficiency observed, primarily due to equipment age.

Table 4.2 lists the projects identified in the 2016 condition assessment that have been completed in the years following.

Table 4.2 Completed CIP Projects from 2016 Condition Assessment

Asset	Project Description	Year Completed
Well No. 6	Replace starter cabinet and RTU	2018
	Well casing, motor, and pump rebuild	2026
Well No. 7	Replace well pedestal grout and install two additional anchor bolts	2024
	Well casing, motor, and pump rebuild	2026
Well No. 8	Replace starter cabinet	2024
	Well casing, motor, and pump rebuild	2024
Well No. 10	Well casing, motor, and pump rebuild	2025
Well No. 11	Well casing, motor, and pump rebuild	2025
Well No. 12	Well casing, motor, and pump rebuild	2025
Well No. 13	Well casing, motor, and pump rebuild	2022
Lower Prune Hill BPS	Replacement	2026
Washougal Wellfield	Chlorine generator replacement	2017
Lacamas BPS	Motor and IR testing	2026

Notes:
RTU - remote terminal unit.

In addition to the improvements noted above, the City constructed the Green Mountain Estates BPS in 2022.

4.6.2 Reservoirs

The City has previously assessed the condition of its reservoirs for the 2010 WSP. The City's reservoirs are generally in good condition. The Butler Reservoir, the City's oldest reservoir, has reached the end of its usable life. The City intends to abandon the Butler Reservoir as soon as a replacement is constructed in the 343 Zone. The City's second oldest reservoir, the 0.5 MG reservoir at the Lower Prune Hill reservoir site was replaced in 2025 per the 2010 WSP's recommendation and is currently in service. Additional upgrades to the City's water storage systems include the new 2.0 MG 18th Avenue Reservoir constructed in 2020 and the implementation of cathodic protection to all steel reservoirs in 2023. Steel reservoirs require regular recoating and is considered routine maintenance.

4.6.3 Recommended CIP Summary

Not all projects identified in the 2016 condition assessment have been planned or completed as of August 2026. A list of the outstanding recommended projects is provided in Table 4.3. Improvement projects have been separated into BPS improvements, which are denoted "RP-" and supply projects, which are denoted "RS-". It should be noted that projects were identified for the Lacamas BPS but seeing as how the City intends to abandon the Lacamas BPS in the next 5-10 years, there does not appear to be much benefit in going through with these upgrades and has therefore be omitted from the CIP summary in Table 4.3. As seen in the table, the remaining condition assessment projects are anticipated to cost approximately $2.1 million. It is anticipated that future project designs will further revise the cost estimates and prioritization of projects. Costs for these projects have been incorporated into the miscellaneous facility projects annual program for reporting in the CIP, which is shown in Chapter 10.

The cost estimates presented in this section are opinions developed from bid tabulations, cost curves, information obtained from previous studies, City estimates, and Carollo's experience on other projects. The cost estimates have been prepared for general planning purposes and for guidance in project evaluation and implementation. Final costs of a project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors.

All costs are escalated from 2016 to 2026 dollars with a 5D Handy Whitman Index factor of 1.89. Cost estimates were developed using a Class 4 budget estimate, as established by the American Association of Cost Estimators. This level of estimate is used for budgeting and feasibility studies and assumes a 1 percent to 15 percent level of project definition. The expected accuracy range is -30 percent to +50 percent, meaning the actual cost should fall in the range of 30 percent below the estimate to 50 percent above the estimate.

Table 4.3 Outstanding Booster Pump Station and Well CIP Summary

Asset	Project ID	Project Type	Estimated Cost	Project Description
Butler BPS	RP - 1	Strategic Replacement	$100,000	Replace or refurbish pumps 1 and 2.
	RP - 2	Condition	$6,000	The motor starter(s) at the Butler BPS were recommended for replacement during the condition assessment.
	RP - 3	Condition	$4,000	The check valve(s) at the Butler BPS were recommended for replacement during the condition assessment.
Angelo BPS	RP - 4	Strategic Replacement	$180,000	Replace or refurbish pumps 1, 2, 3, and 4.
Crown Road BPS	RP - 5	Condition	$9,000	Remove vent caps and install new vent piping for the emergency generator's diesel tank as part of routine maintenance.
	RP - 6	Strategic Replacement	$260,000	Replace or refurbish pumps 1 and 2.
Upper Prune Hill BPS	RP - 7	Condition	$9,000	Add lateral support to the pump discharge header.
	RP - 8	Strategic Replacement	$380,000	Replace or refurbish pumps 1, 2, 3, and 4.
	RP - 9	Condition	$80,000	MCC and RTU require general maintenance.
Gregg BPS	RP - 10	Strategic Replacement	$275,000	Replace or refurbish pumps 1 and 2.
	RP - 11	Strategic Replacement	$105,000	Replace or refurbish pump 3.
Booster Pump Station Projects (RP) Total			**$1,408,000**	
Well 7	RS - 1	Condition	$40,000	Replace panelboard and starter cabinet.
Well No. 9(1)	RS - 2	Strategic Replacement	$100,000	Well casing, motor, and pump rebuild.
	RS - 3	Condition	$45,000	pH, Chlorine, Fluoride.
	RS - 4	Condition	$155,000	Replace Starter cabinet and RTU.
Well 11 and 12(1)	RS - 5	Condition	$12,000	Tie rods across flexible coupling at pump discharge to prevent flexing. Air release is locating on discharge header for wells 11/12 rather than for each well.
	RS - 6	Condition	$12,000	MCC requires general maintenance.
Well No. 14(2)	RS - 7	Strategic Replacement	$100,000	Well casing, motor, and pump rebuild.
Washougal Wellfield Salt Storage Building(1)	RS - 8	Condition	$260,000	Replace existing storage building and provide anchorage for the two NaOH storage tanks.
Supply Projects (RS) Total			**$724,000**	
Total All Projects			$2,132,000	

Notes:
(1) Planned for 2027 or later.
MCC - motor control center.

4.7 Sanitary Survey

A sanitary survey of the City's water system was completed by DOH in January 2025. No significant deficiencies were identified. All recommendations and required submittals by DOH have been completed.

4.8 Emergency Response Program

The City has a Disaster Manual, which identifies the emergency response functions within the City using an "all hazards" approach. Within the City's emergency response framework, the City has developed a Water System ERP following a RRA according to AWIA requirements. The ERP defines risks, water system roles and responsibilities during an emergency, communication procedures, personal safety, alternative water sources, equipment replacement procedures, property protection procedures, and water sampling and monitoring procedures. The ERP also describes alternative system operations for the interruption of each major water supply facility (i.e., loss of a well, reservoir, or booster pump station). Further, it documents an incident specific response plan for major risks, such as drought, earthquake, flood, cyber-attack, etc. The ERP is provided in Appendix **[D]**). The sensitive nature of information included in the RRA necessitated its exclusion from the WSP; however, the RRA is on file with the City and DOH.

4.9 Cross-Connection Control Program

As required by WAC 246-290-490, cross-connection control, utilities have the responsibility to protect customers from water contamination due to cross-connections. A cross-connection is any actual or potential physical connection between a public water system or the consumer's water system and any source of non-potable liquid, solid, or gas that could contaminate the potable water supply by backflow. City Ordinance 10504 addresses cross-connections and their prevention, which can be found as part of the Camas Municipal Code under Water Use Regulations 13.32.

This ordinance and corresponding Municipal Code provide the City's water department the ability to protect the water supply from contamination by prohibiting cross-connections, requiring backflow prevention devices, establishing fees for the inspection of cross-connection assemblies, and adopting State standards for cross-connection regulations. The ordinance and corresponding Municipal Code provides procedures for the abatement of cross-connections and the installation of backflow prevention devices.

The City has four employees certified as cross-connection control specialists. The City's CCC program and records are continually updated and information on each cross-connection device are on file with the City. The Public Works Department and the Building Department coordinate notification to customers who have devices that need to be tested. The City's backflow program management software was upgraded XC2 to SAMS in 2019, which will allow for higher efficiency when entering test report data and sending notifications to water customers regarding their backflow devices.

Per WAC 246-290-490(8), all water systems must complete Annual Summary Report (ASR) forms documenting the status of the water system's CCC program and submit to the DOH upon request. The previous five years of water system ASRs are provided in Appendix **[F]**.

The City maintains the following information on file for its cross-connection control program:

- Date of last inspection.
- Results of inspection.
- Recommended protection.
- List of approved assemblies.
- Test and maintenance reports.
- List of certified testers.
- Customer account number, billing address, service address, phone numbers, device history and maintenance records.

The City's Cross-Connection Control Program requires the inspection of backflow prevention devices at the time of installation. These devices are also scheduled to be inspected annually after installation, after the device is repaired, after the device is relocated or reinstated, and as necessary if tests indicate repeated failure.

Owners of backflow prevention devices are notified by mail that their devices are due for inspection. Three notices are provided, with an example of the first backflow prevention postcard that is sent out to owners being shown in Figure 4.2. However, it is the responsibility of the customer to see that their device is tested. Failure to provide the City with a backflow prevention device inspection report from a certified cross-connection control specialist within 30 days of the third notification will result in the customer's water service being terminated. This termination is then reported to DOH. The City's list of certified backflow testers as of 2025 is provided in Figure 4.3.

The CCS and assistant host an informational backflow booth at the City's annual Camas Days event to educate consumers. They answer questions regarding backflow and provide general knowledge to the public on the issues. Updated informational brochures with current contact information are distributed at the event, online, and at various City facilities. An example brochure is provided in Appendix **[G]**.

ANNUAL BACKFLOW TEST REMINDER

Public Works Department

First Notice: «LTR_Letter_Sent_Date »

Response due by: «LTR_Letter_Response_Date »

«Mailing_Address »

For service address: **«[Facility]Service Address (Full)»**

Camas Water Customer,

Our records indicate that you have a backflow prevention device(s) at the service address above for either lawn sprinkler irrigation or fire suppression. That backflow device listed below is **due or past due** for its annual testing. Please provide the City of Camas with the results of your test no later than **30 days** from the date of this letter.

«LTR_Assembly_List »

Per Washington State Law (WAC 246-290) and Camas Municipal Code (CMC) section 13.32, backflow prevention assemblies are **required to be annually tested** by a Certified Backflow Assembly Tester (BAT). A list of Certified BAT can be found on our website: cityofcamas.us
Please Note: Noncompliance can result in the City taking appropriate actions to protect the drinking water, up to and including terminating your water service to this address, according to Washington State Law, WAC 246-290-490.

City of Camas
1620 SE 8th Ave
Camas, WA 98607
backflow@cityofcamas.us
360-817-1569

City of Camas, 1620 SE 8th Avenue, Camas, Washington 98607 | www.cityofcamas.us | 360.817.1563 | Fax: 360.834.0215

Figure 4.2 Annual Backflow Protection Device Testing First Notification

WASHINGTON STATE CERTIFIED BACKFLOW TESTERS & COMPANIES

The City of Camas makes no representation regarding the abilities, performance, or quality of service of the testers listed below. The City of Camas does not assume of accept any responsibilities for the actions or performances of testers. This list is provided for the convenience of our residents. Customers are to use their own judgement with respect to contracting with these or any other testers.

COMPANY NAME	EMAIL	PHONE
1ST CHOICE BACKFLOWS	office@1stchoicetesting.com	(425)273-3106
A1 BACKFLOWS LLC	a1backflows98601@gmail.com	(360) 907-1519
AAA BACKFLOW NW LLC	aaabackflownw@gmail.com	(360) 263-4840
AC IRRIGATION LLC	acibackflows@gmail.com	(360) 241-9981
ALL PRO BACKFLOW | RON HENDRICKSON, LLC	ron@allprobackflowtesting.com	(360) 448-8285
ASHLAND BROTHERS LANDSCAPING	jordan@ablandscapes.net	(503) 981-6131
BACKFLOWS BY THE BEST	hammrichdale@gmail.com	(360) 606-0870
BACKFLOWS NORTHWEST, INC.	office@backflowsnorthwest.com	(425) 277-2888
BEACON BACKFLOW LLC	beaconbackflow@comcast.net	(360) 694-0587
BRUCE BOYLAN	batbruce57@gmail.com	(360) 993-1772
C & E LAWN SPRINKLERS INC.		(360) 694-2035
CERTIFIED TESTING SERVICES INC.	testing@clarkcobackflow.com	(360) 600-3273
CLARK COUNTY SPRINKLER REPAIR	ccsprinklerrepair@gmail.com	(360) 772-3396
COLUMBIA CROSS-CONNECTION CONTROL	office@columbiacross.com	(503) 235-6141
DRAKE'S 7 DEES, INC.	leads@drakes7dees.com	(503) 292-9121
EMORY SANTACRUZ	emory.santacruz@yahoo.com	(564) 653-1621
FRONTIER LANDSCAPING, INC.	terry@frontierlandscaping.com	(360) 574-8979
JRT MECHANICAL	servicesolutions@jrtmechanical.com	(360) 667-4159
KENNETH EBERT	shaman6891@gmail.com	(562) 673-6741
LANDSCAPE MANAGEMENT & SERVICES INC	irene@landscapemgmt.com	(360) 553-9872
LANDSCAPE MANAGEMENT 2 LLC	andrea@landscapemgmt.com	(360) 256-0706
MATHEWSON'S BACKFLOW	mathewsontgk@gmail.com	(360) 828-8483
PERFORMANCE SYSTEM INTEGRATION	info@psintegrated.com	(877) 857-6174
PNW BACKFLOW	rick.pnwbackflow@gmail.com	(360) 409-3109

Figure 4.3 List of Certified Backflow Testers

4.10 Pipeline Repair and Replacement

The City currently has a modest water main repair and replacement (R&R) program to address O&M and capacity concerns as opportunities arise, such as during redevelopment or in conjunction with other utility projects. While much of the City's distribution system was constructed after 1990, the distribution piping near downtown was constructed in the 1950s and early 1960s and is expected to begin reaching the end of its useful life during the next 20 years.

Useful life is the length of time that a pipe is anticipated to remain in service. Useful life depends largely on the pipe material, but can also depend on soil conditions, water constituents, and installation. When a pipe is in service beyond its useful life, the increasing costs of maintenance associated with a failing pipe typically exceed the cost of replacement. Useful life analyses do not predict exactly when and where failures will occur, rather it is a method to identify the pipes for inclusion in an ongoing R&R program.

Remaining useful life (RUL) is simply the period of time remaining before the end of useful life is reached. A pipeline replacement schedule can be developed by looking at the remaining useful life of all the pipes

in the distribution system. This replacement schedule is often reported in terms of average annual feet of pipe replacement over a ten-year replacement period due to limitations in historical installation records and difficulties in assessing the impact of environmental conditions and other factors limiting useful life. Within a given replacement period, pipes near or exceeding their useful life should be prioritized based on the criticality of the pipe to the system. For example, a large diameter transmission main or pipes that can be included in redevelopment or transportation projects may be a higher priority. By incorporating criticality, the City will be able to address existing priorities and adapt to changing priorities while maintaining an annual replacement program.

4.10.1 Pipe Material and Age

Pipe material was available from the City's records. The information was reviewed by City staff and recent replacement projects were incorporated into the data. The City does not have a reliable pipe age inventory. As a rule of thumb, pipes installed before or during the 1970s were classified as CI pipes installed after the 1970s were classified as DI pipe.

4.10.2 Useful Life

Useful life in combination with pipe age provides the basis for the RUL calculations. The estimated useful life of each pipe material based on industry standards and City staff knowledge, as presented in Table 4.4. The City chose a 75-year useful life for CI pipes, polyvinyl chloride (PVC) and steel pipes. Cast iron and steel useful life were conservatively selected at the lower end of the typical range. The PVC useful life is within industry ranges; however, it has little overall impact given less than 1 percent of the system is PVC. DI pipes were considered to have an 85-year useful life, which was the median of the industry range. It is important to note that the actual useful life of an individual pipe can vary widely due to soil, groundwater, and installation conditions. It is recommended that the condition of pipes being replaced be noted for consideration in future analyses, which will increase the accuracy of the useful life estimates.

Table 4.4 Useful Life of Pipes

Pipe Material	Useful Life (years)
CI	75
DI	85
PVC	75
Steel	75

4.10.3 Remaining Useful Life Analysis

RUL is defined as the length of time left before a pipe's maintenance costs will likely exceed its cost of replacement. The period of time between the end of the useful life and today is the RUL. For example, a DI pipe installed in 2000 has a useful life of 85 years, where it will reach the end of its useful life by 2085. From the current year, 2026, this DI pipe's RUL would be 59 years. Due to the limited pipe age information available, a thorough RUL analysis could not be completed. However, it is understood that much of the City's CI and Steel piping was installed prior to 1960 and therefore, based on the chosen useful life for these materials, are expected to reach the end of their useful life by end of the planning period (2046). It is recommended that all CI and steel piping, approximately 20 percent of the distribution system pipeline,

be replaced over the 20-year planning period. The majority of the City's DI and PVC pipe are not anticipated to reach the end of their useful life until after the planning period.

The pipe recommended for replacement represents the majority of the City's downtown and surrounding areas. Pipes reaching their RUL serve all types of customers, including commercial, industrial, and residential customers. Pipes that exceed their useful life will continue to provide service but are at a greater risk for pipe breaks and may have increased leakage. Therefore, replacement should be prioritized based on criticality to the system to best manage the aging distribution infrastructure within the City's available budget.

4.10.4 Pipeline Repair and Replacement Program

Over the 20-year planning period, the City should replace all the CI and steel piping. This amounts to approximately 20 percent of the entire distribution system, or 1 percent system replacement per year over the 20 years. Further discussion of the pipe replacement CIP is provided in Chapter 10. Additionally, small diameter mains (2-inch to 6-inch) should be upsized to 8-inch to meet current City standards. To gain economies of scale, the City should consider geographically concentrated projects that incorporate other utilities, such as sewer main R&R and roadway resurfacing.

4.11 Operations and Maintenance Improvements

The City has a well operated and maintained system. Condition assessments identified repair and replacement projects for above ground assets (i.e., pump stations, wells, and reservoirs, etc.). The majority of projects were necessary due to aging electrical equipment and normal replacement of pumps and motors. Having recently replaced the Lower Prune Hill reservoir, the Butler reservoir is the only other reservoir built prior to 1940 which has reached the end of its usable life and is due to be replaced. A PRV study conducted in 2024 identified various solutions to fire-flow deficiencies and PRV operational inefficiencies.

It is anticipated that the piping in Downtown and surrounding areas will begin to reach the end of their life in the short-term planning horizon (2026 to 2035). The City's long-term goal is to create a risk prioritized water infrastructure rehabilitation program that addresses above and below ground assets. However, at this time, the City's financial resources are focused on meeting the rapid growth occurring in Camas.

To gain economies of scale during the replacement, the City should consider geographically concentrated projects that incorporate other utilities, such as sewer main R&R and roadway resurfacing.

CHAPTER 5 WATER REQUIREMENTS

Projecting realistic future water requirements, i.e., demand, is necessary for planning infrastructure projects and securing adequate water supply to meet future growth. Future water demands are a key component of the water system analyses presented in this Plan and in the City's CIP. Accurate demand projections require a thorough review of historical water use, predicting where and how much growth will occur, and estimating the future water use for existing and new customers.

Historical data provides the City's unique water use over a long period of time, which captures the range of water use due to weather, economic conditions, conservation practices, and other factors. This Chapter presents an analysis of historical water use from 2017 to 2024 based on customer billing and production records. This data provide information on the City's different types of customers, as well as water use parameters on an average annual basis, seasonally, and for the maximum day. Historical water use patterns and parameters were established from these data to predict future water use for existing and new customers.

The City's draft 2045 Comprehensive Plan was used to predict where and how much demand will occur in the water system. The number and type of future customer accounts were determined based on developable vacant parcels and future land use. The resulting future accounts were converted to projected demands using the historical water use patterns and parameters.

Demand projections were generated for the planning period of 2026 to 2046 for the City's established RWSA. The projections were divided into three planning scenarios:

- Short-term, 5-year (2027-2031).
- Medium-term, 10-year (2032-2036).
- Long-term, 20-year (2037-2046).

Dividing the planning period into three scenarios aids in the development and phasing of improvement projects and the CIP, as well as being consistent with DOH requirements.

Demand projections were expressed as ERU, average day demand (ADD), and MDD. One ERU is defined as the average quantity of water beneficially used by one average, full-time, single-family residence (SFR) per day. The quantity of water used by other customer classes, and by the whole system, can be expressed in terms of ERUs. The ADD is typically used in operational evaluations. It is calculated by dividing the total water produced by the number of days per year (2020 and 2024 were leap years and include 366 days per year). The MDD represents the single largest day water demand during the year and is a key parameter for infrastructure sizing.

Changes in water use, conservation activities, system growth, and other factors may result in higher or lower than projected water use. Planning for the potential changes allows the City to better manage potential risks from these changes. For example, lower than projected water use may be a concern for the City's financial planning, while higher than projected water use may be a concern for water supply planning. Therefore, three demand scenarios were developed: low, medium, and high demand scenarios. The low demand scenario represents future demand with conservation; the high demand scenario generally reflects the highest demands in the last eight years; the medium demand scenario is a

conservative projection between the low and high projections. Details on the historical water use, demographic projections, and demand calculations used to develop these projections are presented in this Chapter.

5.1 Historical Water Use

Historical water use data, i.e., consumption data, was obtained from City records to characterize the demands of the City's customers. Annual water use data for the years 2017 to 2024 were used to develop historical demand patterns and parameters, which represent current and expected future water use. Two key demand parameters were generated from the data: typical water use per customer class, and typical water use per ERU. These parameters were used as the basis of future demand projections.

5.1.1 Historical Accounts

The City customers were divided into seven customer classes. These customer classes are:

- Accessory Dwelling Unit (ADU) Shared.
- City Accounts.
- Commercial.
- Industrial.
- Irrigation.
- Multifamily Residential (MFR).
- SFR.

The number of accounts for each customer class is summarized in Table 5.1. As seen in the table, SFR makes up approximately 91 percent of accounts. The total number of accounts has increased by approximately 21 percent from 2017 to 2024 due to growth and development in the City.

Table 5.1 Historical Number of Accounts by Customer Class

Year	SFR	MFR	Commercial	Industrial	City	Irrigation	ADU Shared	Total
2017	7,539	334	239	30	45	96	8	8,291
2018	7,730	332	249	30	46	109	13	8,509
2019	8,147	337	248	27	46	106	14	8,925
2020	8,489	352	253	24	46	106	15	9,285
2021	8,877	354	264	24	50	121	16	9,706
2022	8,974	356	268	23	48	106	18	9,793
2023	9,031	357	273	22	49	121	22	9,875
2024	9,191	356	272	22	50	122	21	10,034
Average Annual Growth Rate	2.9%	0.9%	1.9%	-4.3%	1.5%	3.5%	14.8%	2.8%
Average Percent per Class	91.3%	3.7%	2.8%	0.3%	0.5%	1.2%	0.2%	100%

5.1.2 Large Users

The City's top 10 water users in 2024, herein termed "large users," were also evaluated in this study. The large users class includes the following customers:

- Taiwan Semiconductor Manufacturing Company (TSMC) Washington (formerly known as "Wafertech Industries").
- Analog Devices (formerly known as "Linear Technologies").
- Georgia Pacific Mill.
- Camas School District No. 117.
- City of Camas.
- Bodycote Industrial Metal Technology (IMT).
- Fisher Creek Investments.
- Hills at Round Lake Homeowner's Associate (HOA).
- Prestige Care and Rehabilitation.
- Clara Street Block Building.

These large users represent 34 percent of the total consumption; therefore, it is typical to separate them (number of accounts and consumption) from the rest of the system as to not skew any system-wide ERU values for these customer classes. Individual demand projections were developed for each large user to provide additional accuracy in the demand projections, as well as the system analyses. The development of the large user demand projections is detailed in Section 5.6.2.

5.1.3 Historical Consumption

The City's historical annual water consumption was provided for each customer class based on City billing data, as presented in Table 5.2 in units of mgd. The table also includes the average, 75th percentile, 3-year average, and maximum statistics on historical consumption. The SFR customer class has the highest water demand and the industrial class has the second highest water demand for all years.

Table 5.2 Historical Water Demand by Customer Class (mgd)

Year	SFR	MFR	Commercial	Industrial	City	Irrigation	ADU Shared	Total(1)
2017	1.85	0.11	0.13	1.21	0.10	0.23	0.003	3.67
2018	1.88	0.10	0.15	1.18	0.07	0.28	0.003	3.69
2019	1.80	0.10	0.15	1.07	0.07	0.24	0.004	3.45
2020	2.00	0.12	0.13	1.06	0.07	0.18	0.005	3.58
2021	2.31	0.14	0.17	1.15	0.10	0.28	0.005	4.17
2022	2.08	0.14	0.17	1.22	0.08	0.22	0.005	3.94
2023	2.29	0.16	0.20	1.16	0.10	0.26	0.007	4.19
2024	2.22	0.14	0.21	1.11	0.19	0.43	0.006	4.33
Average (all years)	**2.06**	**0.13**	**0.16**	**1.15**	**0.10**	**0.26**	**0.005**	**4.25**
75th Percentile	**2.24**	**0.14**	**0.18**	**1.19**	**0.10**	**0.28**	**0.006**	**4.18**
3-Year Average (2022-2024)	**2.20**	**0.15**	**0.19**	**1.16**	**0.12**	**0.30**	**0.006**	**4.16**
Maximum	**2.31**	**0.16**	**0.21**	**1.22**	**0.19**	**0.43**	**0.007**	**4.33**

Notes:
(1) Totals may not equal due to rounding.

The average percentage of accounts and annual water consumption by customer class from 2017 to 2024 are presented in Figure 5.1 and Figure 5.2. Comparing accounts and water consumption illustrates the differences in water use between the customer classes. As seen in these figures, SFR customers represent 91 percent of the accounts yet only comprise 53 percent of the total consumption. By contrast, industrial customers represent less than one percent of the accounts, but account for 30 percent of the total demand. This difference in proportional water use was quantified by comparing the historical water use per account for each customer class (in Table 5.3), as described in Section 5.1.3.

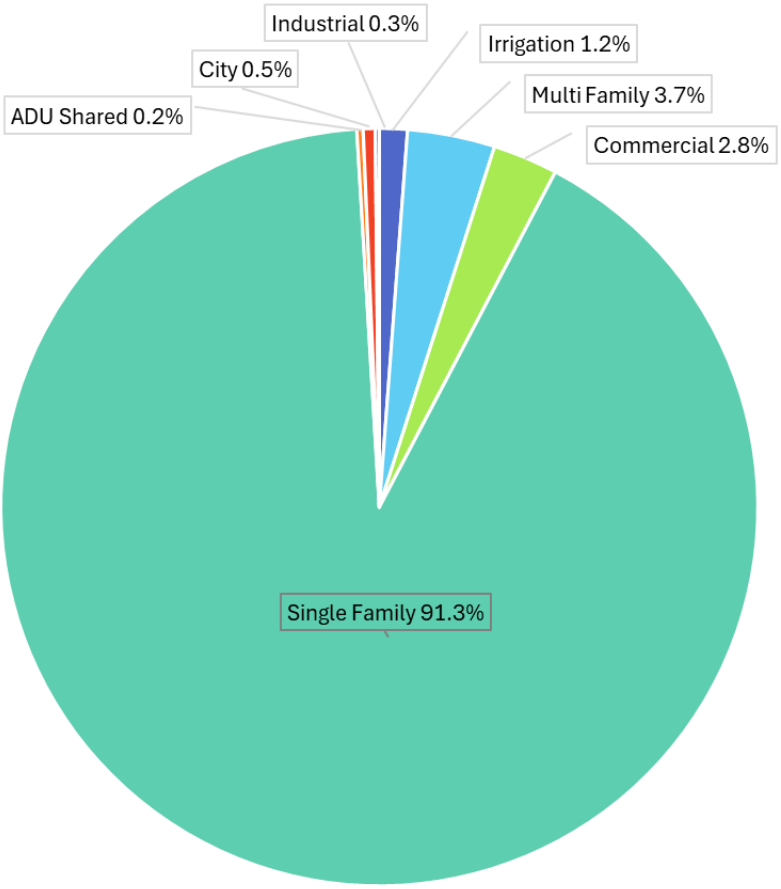


Figure 5.1 Average Number of Accounts by Customer Class

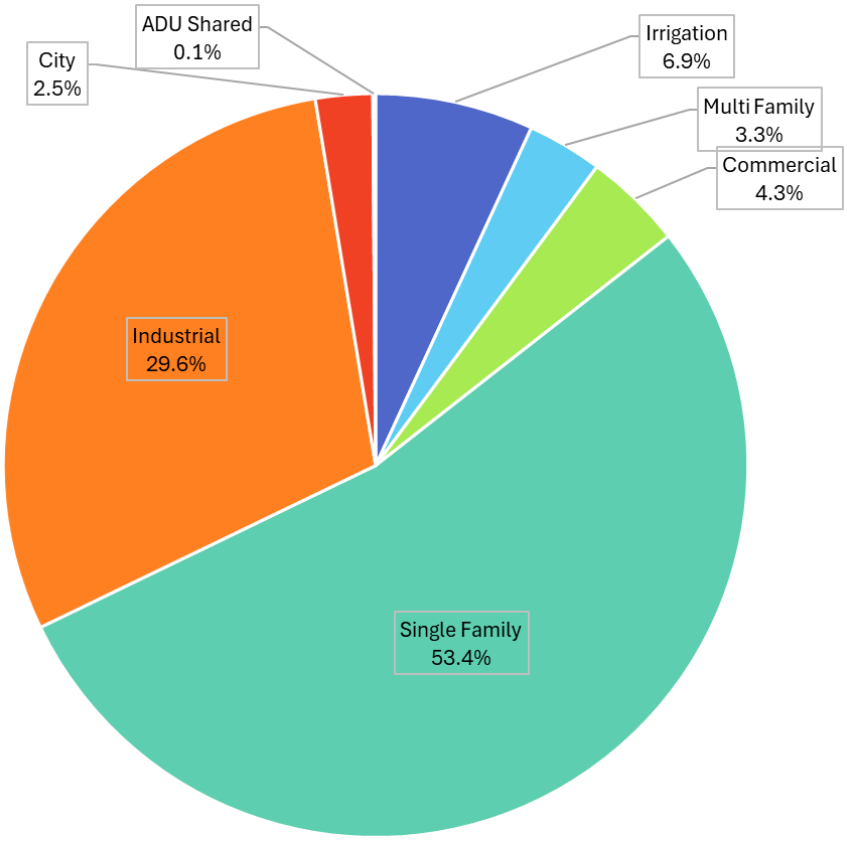


Figure 5.2 Average Amount Consumed by Customer Class

5.1.4 Water Use per Account and Equivalent Residential Units

The demand of each customer class can be expressed in terms of ERUs for forecasting and planning purposes. As discussed previously, one ERU is the amount of water consumed by a typical SFR. According to the Washington Administrative Code 246-290-010, non-residential customer water consumption is expressed as a multiple of SFR ERU. In this case, consumption data from 2017-2024 was used to establish the "single-family residence" ERU. Importantly, the ERU calculation is based on historical consumption (i.e., billing records) and therefore does not include distribution system leakage.

To calculate ADD water use per ERU, the total annual volume of water consumed by SFRs is divided by the total number of active SFR accounts. The resulting value, also called the ERU planning value, is the average SFR's annual water use per account. To determine the number of ERUs in other customer class, the volume of water used by those customer categories is divided by the ERU value.

Table 5.3 shows the historical annual average water consumption by customer class. The table also includes the average, 75th percentile, three-year average, and maximum consumption statistics. The 3-year average (2022 to 2024) quantity of water used by one typical, full-time SFR ERU is equal to 242 gallons per day (gpd). From 2017 through 2024, the 75th percentile of water consumption per ERU was 248 gpd.

Table 5.3 Historical Annual Water Use per Account (gpd/account)

Year	SFR	MFR	Commercial	Industrial	City	Irrigation	ADU Shared
2017	246	315	564	40,338	2,143	2,402	315
2018	244	309	611	39,230	1,459	2,541	198
2019	221	303	624	39,651	1,511	2,247	259
2020	236	338	520	44,258	1,487	1,677	303
2021	260	400	639	48,029	1,988	2,295	332
2022	232	387	628	53,183	1,657	2,082	286
2023	253	437	716	52,933	1,974	2,186	304
2024	242	399	778	50,262	3,711	3,507	297
Average	**242**	**361**	**635**	**45,986**	**1,991**	**2,367**	**287**
75th Percentile	**248**	**400**	**658**	**50,930**	**2,027**	**2,437**	**307**
3-Year Average (2022-2024)	**242**	**408**	**707**	**52,126**	**2,447**	**2,591**	**295**
Maximum	**260**	**437**	**778**	**53,183**	**3,711**	**3,507**	**332**
ERUs per Account(1)	**1.0**	**1.5**	**2.6**	**190.2**	**8.2**	**9.8**	**1.2**

Notes:
(1) ERUs per Account based on average of annual water consumption.

Compared to other Washington utilities evaluated by Carollo, the City's water use per SFR account appears slightly high, possibly indicating larger properties requiring irrigation or lower than usual replacement rates of high-flow appliances and fixtures. Additionally, the City's MFR water use per account appears low, possibly due to a higher percentage of low-density MFR accounts (such as tri-plexes or quad-plexes), or due to monitoring MFR irrigation demands in separate irrigation meters (under the "Irrigation" customer class).

Calculating the City's water use in terms of ERUs provides a means to express water use by non-residential customers as an equivalent number of SFR accounts. The ERUs per account for MFR and all non-residential accounts are obtained by dividing the average water use per account for each customer class by the ERU water use. For example, the average Commercial account uses approximately 2.6 times the water use of an average SFR account; therefore, each Commercial account is equivalent to 2.6 ERUs. Table 5.3 presents the average number of ERUs per account for each customer class based on average historical water use. The number of ERUs per account ranges from 1.2 for ADU accounts to 190.2 for Industrial accounts.

5.2 Seasonal Demands

The pattern of water consumption differs between the customer classes. Figure 5.3 presents average total monthly consumption by customer class from 2017 through 2024. Note that, with exceptions, the City has historically conducted bi-monthly meter reading; therefore, the water consumption was averaged between months to better reflect the actual water consumed in the month. As of June 2025, the City has started monthly reads. SFR and irrigation accounts show a significant peak in total consumption during the summer months. Water use increases significantly during the summer when daylight hours are longer, and lawn and landscape watering is prominent. Other outdoor uses, including car washing and recreation, are also at their highest during summer months. By contrast, industrial users do not demonstrate significant seasonal variation in demand. These monthly variations in demand for each customer class can be used to target water use efficiency efforts and/or to project future water-use patterns for planning purposes.

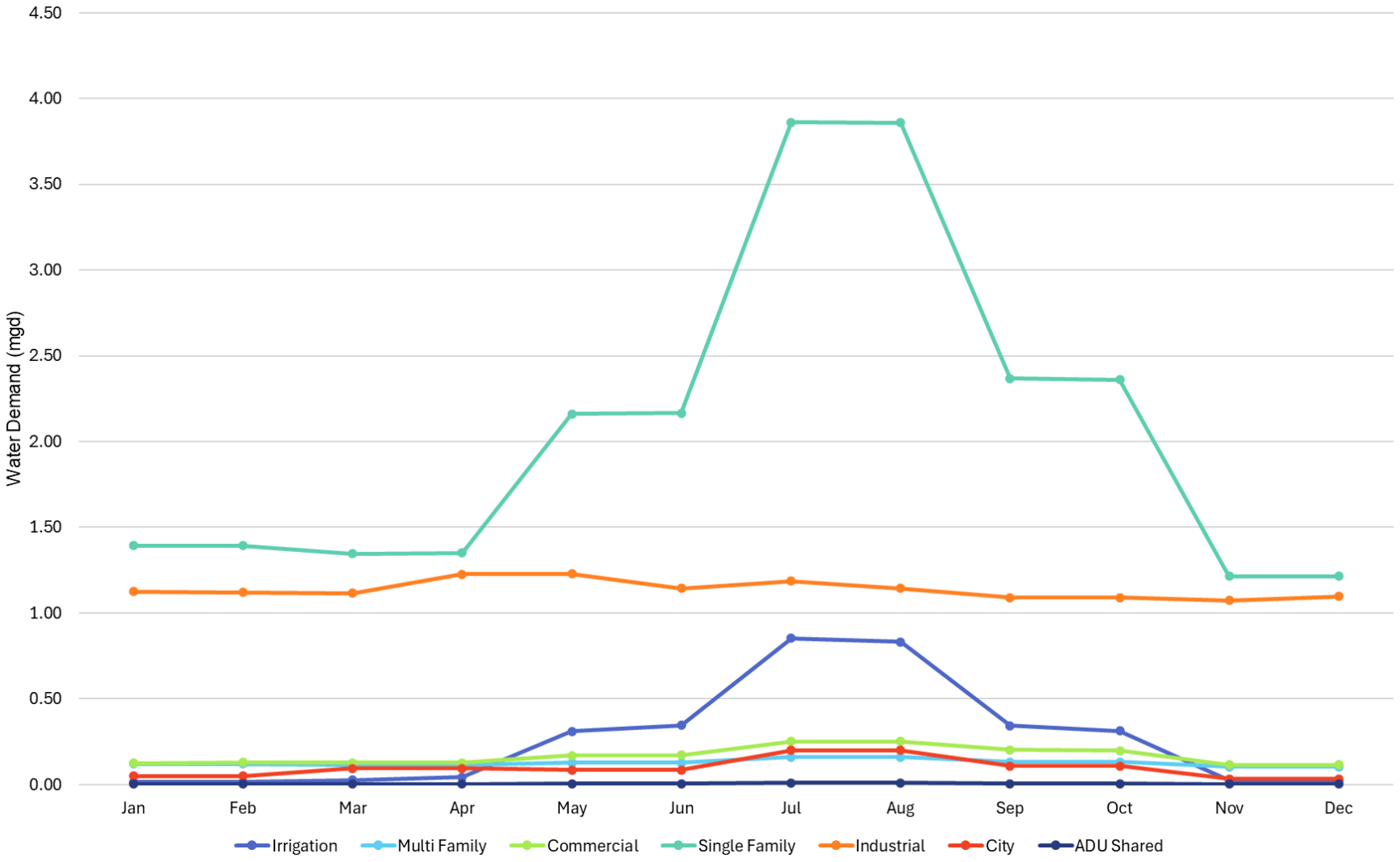


Figure 5.3 Average Seasonal Demand by Customer Class

5.3 Historical Production

The historical average and maximum water demands are important parameters when performing system and supply analyses. The term "water demand" refers to all the water requirements of a system including metered customers, unmetered water use, and unaccounted-for water such as leakage. For this reason, the City's production data, which accounts for all water demand, was used to calculate the ADD and MDD for each year. Additionally, historical production allows the City to track system-wide demands on a daily basis, rather than monthly or bi-monthly as is the case with billing records. Note that as of June 2025, the City has started monthly reads. Table 5.4 lists the historical annual production from 2017 through 2024. As shown, the annual production ranged from 1,448 million gallons (MG) to 1,729 MG.

5.3.1 Distribution System Leakage and Non-Revenue Water

DSL is equal to the total water produced minus the total authorized consumption. Aging water infrastructure leads to real losses such as water main breaks, reservoir leaks or overflows, and general distribution system leakage. It is important to note though that DSL includes apparent losses other than leakage as well, such as data handling errors, water theft, meter inaccuracy or failure, and untracked authorized water use. Authorized Non-Revenue Water that is not metered by the City contributes to the DSL as well.

The City's total water production and consumption in millions of gallons, or MG, as well as estimates of DSL for 2017 through 2024 are shown in Table 5.4 and presented graphically in Figure 5.4. The City's average annual DSL over the three-year period from 2022 to 2024 was 10.3 percent. There is a slight discrepancy in the DSL calculated from the historical billing records and the value reported on the Water Use Efficiency reports submitted annually to DOH. In early 2025, the City transitioned to a new data management and billing software, Tyler Technology's Utilities Pro, to improve data quality, management, and reporting. While the two sources are generally consistent, minor differences are present, which are likely due to errors introduced during the transition of historical data to the new software or to the timing of report preparation and subsequent revisions made to ensure accuracy.

Table 5.4 Historical Distribution System Leakage

Year	Historical Billing Data[1]				Annual Water Used Efficiency Reports[2]			
	Total Production (MG)	Total Consumption (MG)	DSL (MG)[3]	DSL (%)	Total Production (MG)	Total Consumption (MG)	DSL (MG)	DSL (%)
2017	NA	1,338.8	NA	NA	1,493.4	1,339.0	154.4	10.3%
2018	1,541.2	1,346.5	194.7	12.6%	1,545.9	1,348.9	197.1	12.7%
2019	1,447.6	1,259.6	188.1	13.0%	1,447.6	1,253.3	194.3	13.4%
2020	1,537.3	1,309.0	228.3	14.9%	1,537.3	1,314.8	222.5	14.5%
2021	1,729.0	1,522.0	207.0	12.0%	1,733.0	1,478.4	254.6	14.7%
2022	1,639.4	1,439.5	199.9	12.2%	1,639.4	1,406.0	233.4	14.2%
2023	1,699.2	1,530.3	168.9	9.9%	1,699.2	1,524.2	175.0	10.3%
2024	1,697.5	1,547.2	150.3	8.9%	1,697.5	1,540.9	154.6	9.2%
Average				**11.9%[4]**				**12.4%**
3-Year Average (2022-2024)				**10.3%**				**11.2%**

Notes:
(1) Historical production and consumption data were calculated based on the data provided by the City in July 2025.
(2) Historical production and consumption shown are based on the Water Use Efficiency report submitted to Washington's Department of Health (DOH).
(3) Distribution System Loss (DSL) was determined by subtracting total consumption from total production.
(4) 2017 Water Total Production was not provided for this analysis, therefore the DSL's average percentage excluded the year of 2017.

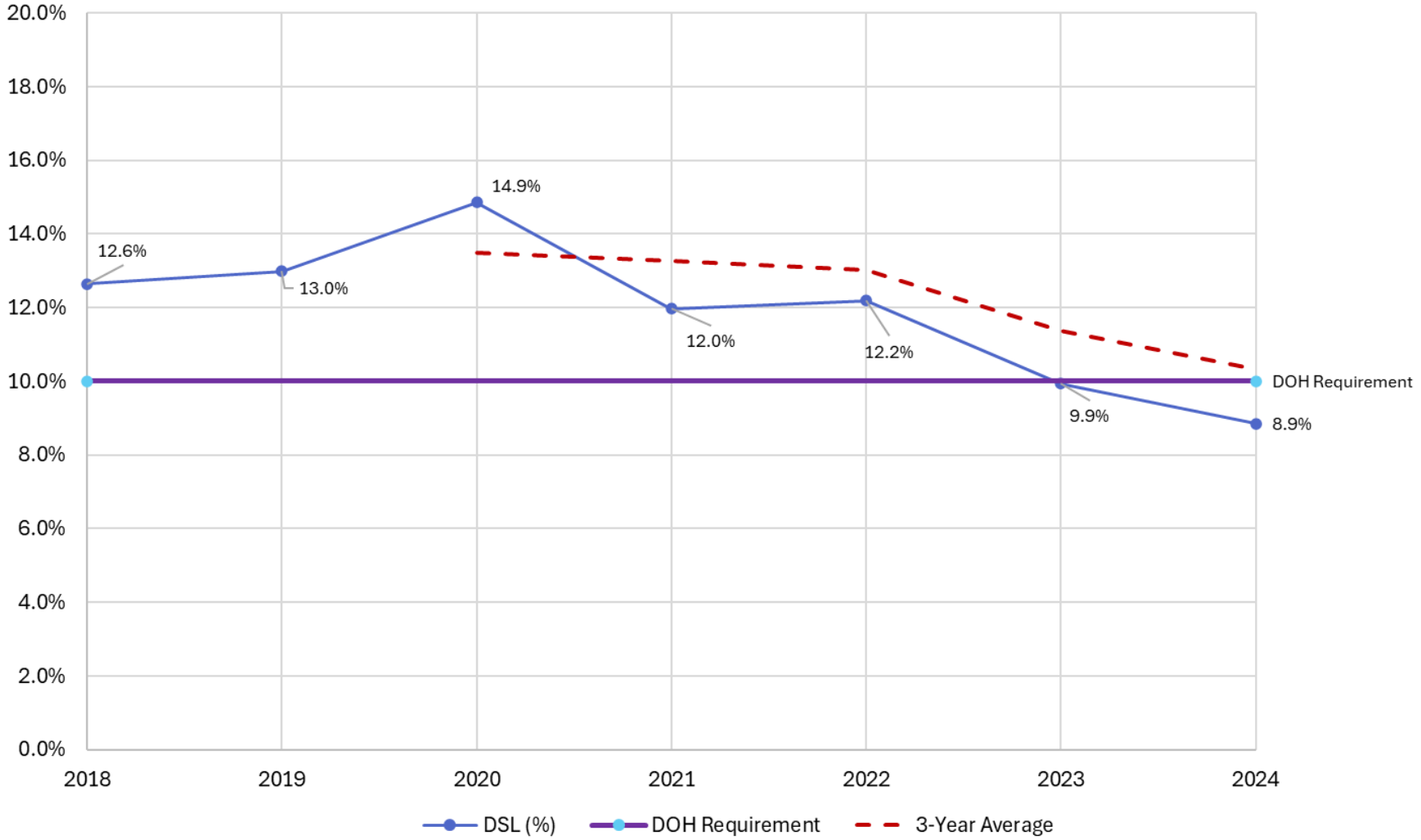


Figure 5.4 Historical Distribution System Leakage Trend

5.3.2 Historical Average and Maximum Demands

The City produces water for its customers through ten wells and two surface water sources. Table 5.5 presents the ADD and MDD (based on production) for the period of 2018 through 2024. The average annual water produced from 2018 through 2024 was 1,613 MG per year. The average ADD over the period was 4.42 mgd. The annual ADD trends increases slightly over this period, reflecting the growing number of City water customers.

Table 5.5 Historical Average Production, Maximum Day Demand, and Peaking Factor

Year	Date of MDD	MDD (mgd)	MDD without Top 2 Large User	ADD (mgd)	ADD without Top 2 Large Users	MDD:ADD Peaking Factor with Top 2 Large Users	MDD:ADD Peaking Factor(1)
2018	July 28	8.3	7.2	4.2	3.3	2.0	2.2
2019	July 15	7.7	6.6	4.0	3.0	1.9	2.2
2020	August 16	8.7	7.5	4.2	3.3	2.1	2.3
2021	July 29	9.3	8.1	4.8	3.8	2.0	2.2
2022	July 29	8.8	7.5	4.5	3.5	2.0	2.2
2023	August 21	8.8	7.6	4.7	3.7	1.9	2.1
2024	July 8	10.2	8.9	4.7	3.6	2.2	2.5
Average		**8.8**	**7.6**	**4.4**	**3.4**	**2.0**	**2.2**
3-Year Average (2022-2024)		**9.3**	**8.0**	**4.6**	**3.6**	**2.0**	**2.2**
75th Percentile		**9.3**	**8.1**	**4.7**	**3.7**	**2.1**	**2.3**
Maximum		**10.2**	**8.9**	**4.7**	**3.8**	**2.2**	**2.5**

Notes:
(1) Peaking factor excludes large user demand. Large user demands were removed from both MDD and ADD values to calculate the peaking factor.
(2) Totals may not equal due to rounding.

The MDD is a key benchmark for supply capability, pump station discharge rates, reservoir capacity, and pump sizes. The MDD is the highest daily production in a given year and typically occurs during the summer when irrigation is prevalent. Table 5.5 presents the historical MDD from 2018 to 2024. MDD is less dependent on indoor water use (which drives the ADD), and more dependent on irrigation. The highest MDD value (10.2 mgd) occurred in 2024, which had record-setting high temperatures and low rainfall. The next highest MDD occurred in 2021, three years earlier during COVID-19, when many individuals were still working from home.

The second to last column of Table 5.5 presents the historical MDD to ADD peaking factor including the top two large users, which reflects systemwide demand patterns. The last column presents the MDD to ADD peaking factor with the top two large users removed, providing a comparison of typical residential and commercial demand trends across different years. Large user demands are excluded from the peaking factor by removing large user demands from both ADD and MDD. This is because large user demands do not typically exhibit the same daily variation and peaks as other customers. Because of their significant demands, including large user demands in peaking factors can skew peaking factors intended to represent the majority of customers. The peaking factor is also a key parameter in developing the future MDD projections, as discussed later in this chapter. The maximum peaking factor of 2.46 occurred in 2024

and the minimum peaking factor of 2.17 occurred in 2021 and 2022. The MDD to ADD peaking factor over the period is shown graphically in Figure 5.5. Figure 5.5 illustrates the variability in the peaking factor over the period. Section 5.6.4 discusses the peaking factor to be used for future projections.

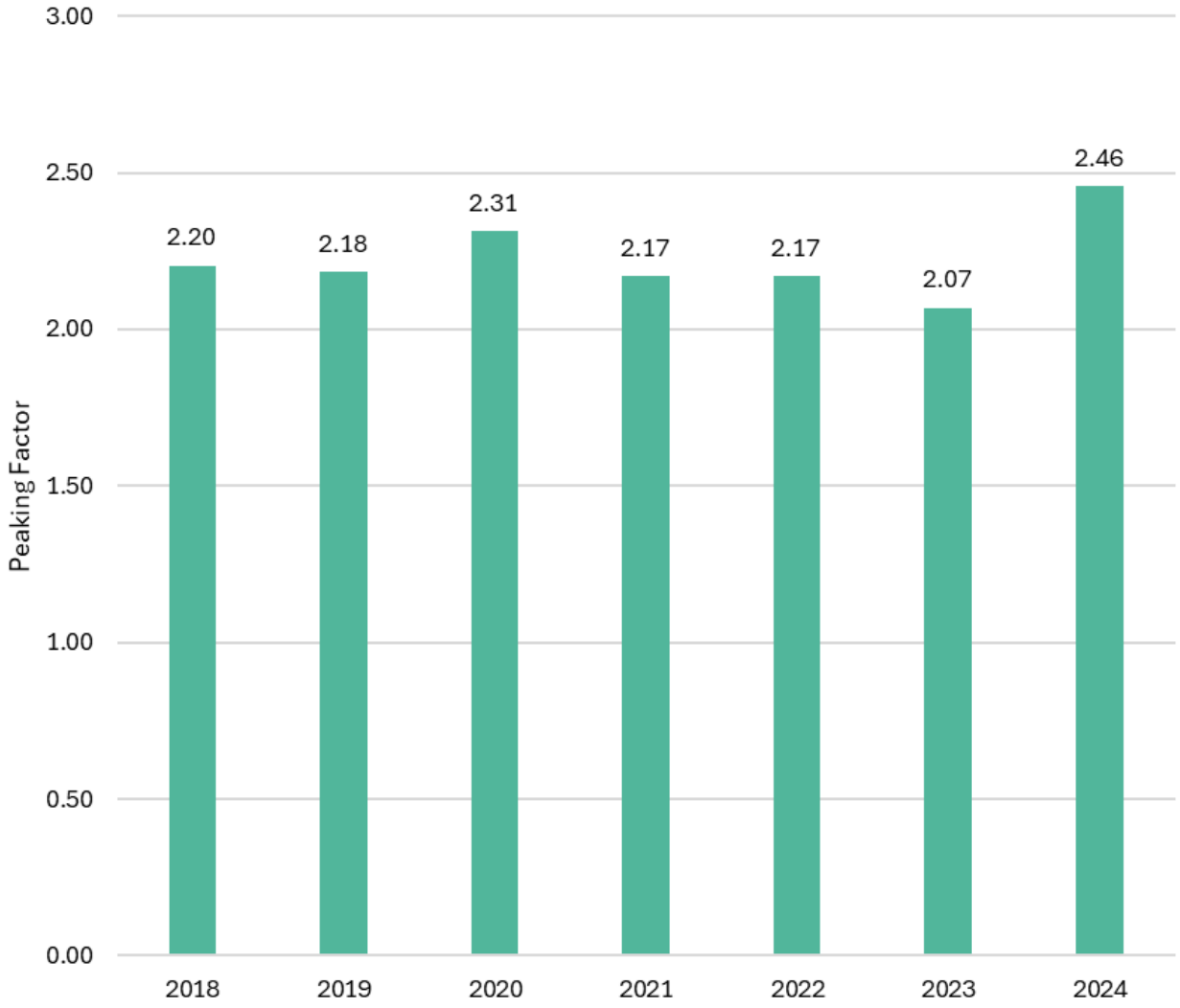


Figure 5.5 MDD/ADD Peaking Factor

5.4 Demographic Forecast

Demand projections depend on the future number of customers to be served by the City's water system. Thus, demographic forecasts of future population and employment must be made to establish an estimate of the future number of customers. A demographic analysis consistent with regional growth planning was performed to estimate the number and type of future customer accounts served by the City's water system. Converting the number of accounts into demand projections is discussed in Section 5.6.

5.4.1 Land Use

Land use designations and regulations provide important information in determining future water requirements. Land use determines the area available for various types of development including both SFR and MFR development, as well as commercial and other types of land use that provide the economic base necessary to support residential development.

5.4.1.1 Existing Land Use

Figure 5.6 depicts the best available data on existing land use based on Clark County Geographic Information System (GIS) data developed for the 1994 GMA and the 2023 VBLM data. While these sources provide the best available information, some parcel records were not up to date. In those cases, a simple check was done to confirm whether the parcels are vacant or developed. Because these GIS data are not up-to-date, existing water customers were derived using the City's billing data and matching it to parcel property IDs thereby providing the geographic location. Each metered account was assigned one of the eight customer classes. Open space, water, agriculture and vacant land uses were also part of the existing land use classes but are not associated with metered accounts.

Figures 5.6 shows the City’s existing land use.

5.4.1.2 Future Land Use

Future land use designations were obtained from the City's 2045 Comprehensive Plan and the Preferred Land Use Alternative Map. (Camas 2025). These future land use designations are depicted in Figure 5.7. The future land use designations are used to evaluate the 20-year development conditions as described below.

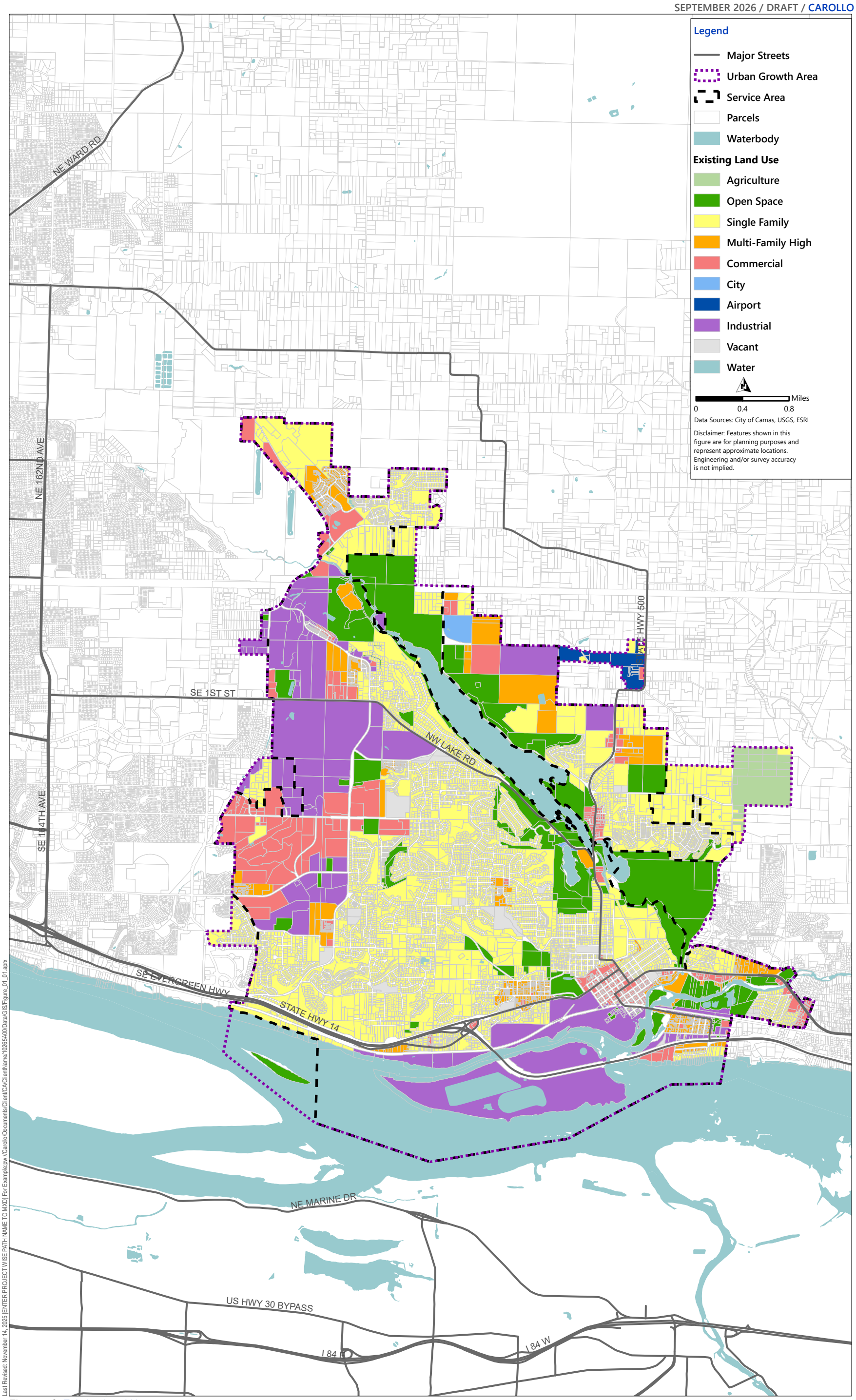


Figure 5.6 Existing Land Use
CITY OF CAMAS
WATER SYSTEM PLAN UPDATE

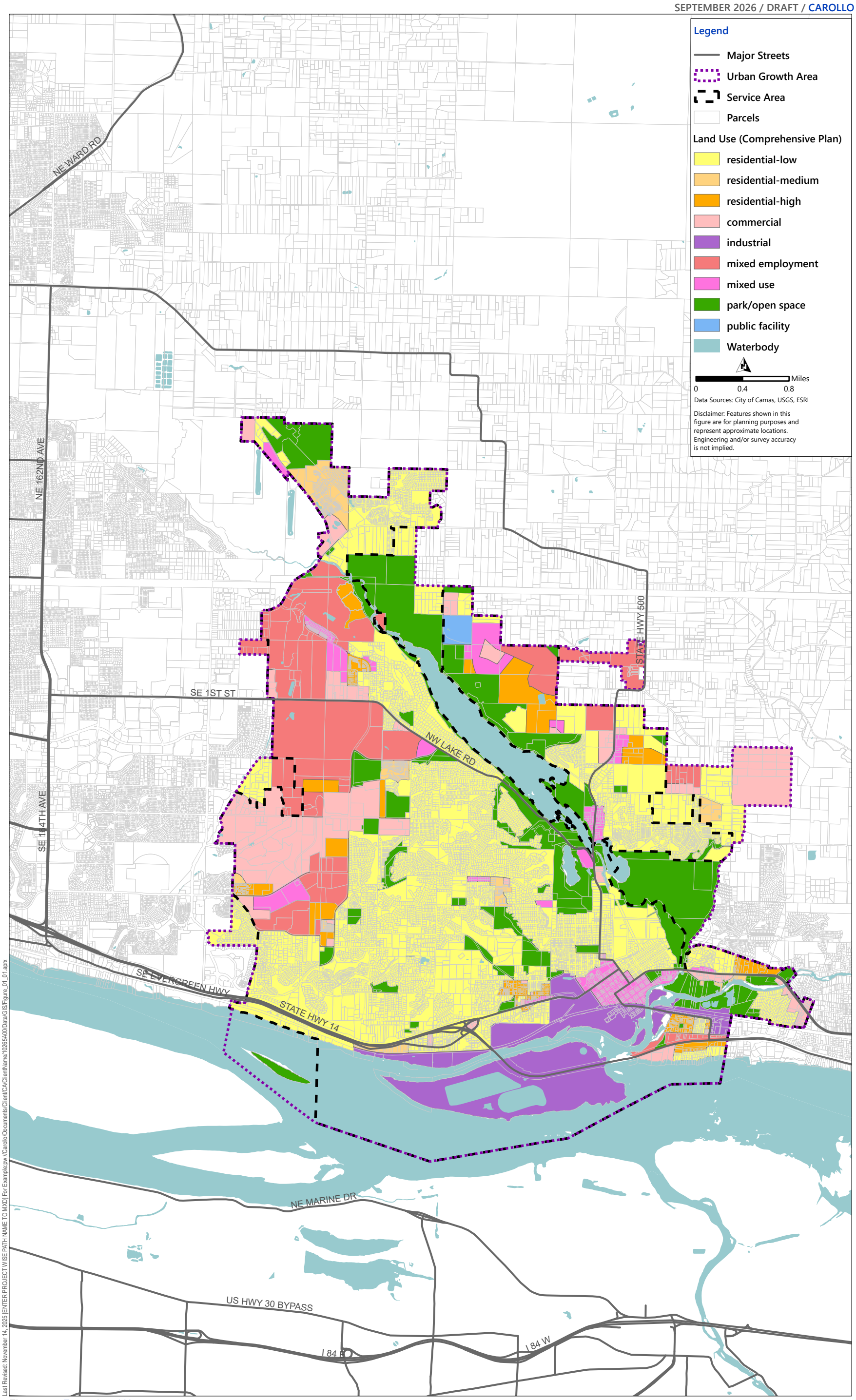


Figure 5.7 Future Land Use
CITY OF CAMAS
WATER SYSTEM PLAN UPDATE

5.4.2 Demographic Projections

To determine future demand for the City's RWSA, current and projected demographic trends provided by the City were used. The number of households in 2025 is based on the number of residential accounts in 2024 provided by the City and an annual growth rate of 2.9 percent. Number of employees in 2025 is from the US Census Bureau data. 2045 projected households and employees were provided by the City's planning department. Years 2036 and 2046 projections are linearly interpolated and extrapolated from the 2031 and 2045 values. Table 5.6 shows the City's household and employment projections.

Table 5.6 System-wide Household and Employment Projections

System-wide Projections	2025	2031(3)	2036(5)	2045(4)	2046(5)
Households	9,824(1)	11,415	12,790	15,443	15,738
Employees	12,600(2)	13,604	18,929	24,098	24,904

Notes:
(1) Existing number of households for 2025 are based on the number of residential accounts in 2024 provided by the City and 2.9% average annual growth rate.
(2) Number of employees in 2025 are estimated based on the U.S. Census Bureau's Data for the 2019-2023 period.
(3) The 2031 Household Projections were based on the City's Current Development Project Dashboard, which identifies parcels currently under review, in construction, on hold, or in the permitting process. Employee projections were estimated based on the anticipated redevelopment of parcels designated for commercial and industrial land uses.
(4) Projections for household and employees for 2045 were provided by the City.
(5) 2036 and 2046 projected values are based on interpolation and extrapolation of the 2031 and 2045 values.

The City's VBLM data does not identify the specific locations where residential and employment growth will occur or when, so projected household and employees were distributed across the service area based on known developments expected to occur within the short term (2031) and using the VBLM parcel constrained/unconstrained classification (2036 and 2046).

- For 2031: Residential units and employments were allocated based on parcels currently under review, in permitting, or under construction per the City's Current Development Project Dashboard, and growth was assigned to these areas.
- For 2036: For residential land uses, approximately 20 percent of each land uses' buildout density was assumed to be added by 2036. 20 percent development of residential demand aligns with the household projections presented in Table 5.6 based on the buildout densities for single family and multifamily parcels obtained from the 2022 Clark County Buildable Lands Report. Buildout densities are 20 dwelling units per acre for MFR and six dwelling units per acre for SFR. For non-residential land uses (commercial, City, and industrial), approximately 50 percent of the 2046 buildout density was assumed to be added by 2035, with commercial and City at 20 employees per acre and industrial at 9 employees per acre. Employment increments for 2036 were calculated as the additional number of employees needed to reach the 2036 total projection, including any employees already accounted for in 2031.
- For 2046: For residential land uses, 95 percent of buildout density was assumed to be added by 2046. Similarly, non-residential land uses were assumed to reach 95 percent of buildout density.

By 2045, the City is expected to have a population of 37,080 people, a 7,729-person increase from the estimated 2023 population of 29,352 (Camas 2045, 2025). This represents an annual average growth rate of 1.2 percent. The 2023 Clark County VBLM information is in Appendix **[X]**. Moreover, projections were prepared specifically for the North Shore area which is expected to add about 1,230 housing units by 2046, which is included in the projected households in 2046. Figure 5.8 shows the City's residential projections for North Shore area.

The City currently serves several accounts located outside the RWSA. These accounts were not grown as expansion of water service in this area is not expected, per the definition of the RWSA. Instead, their 2025 demands were held constant over the entire 20-year planning period.

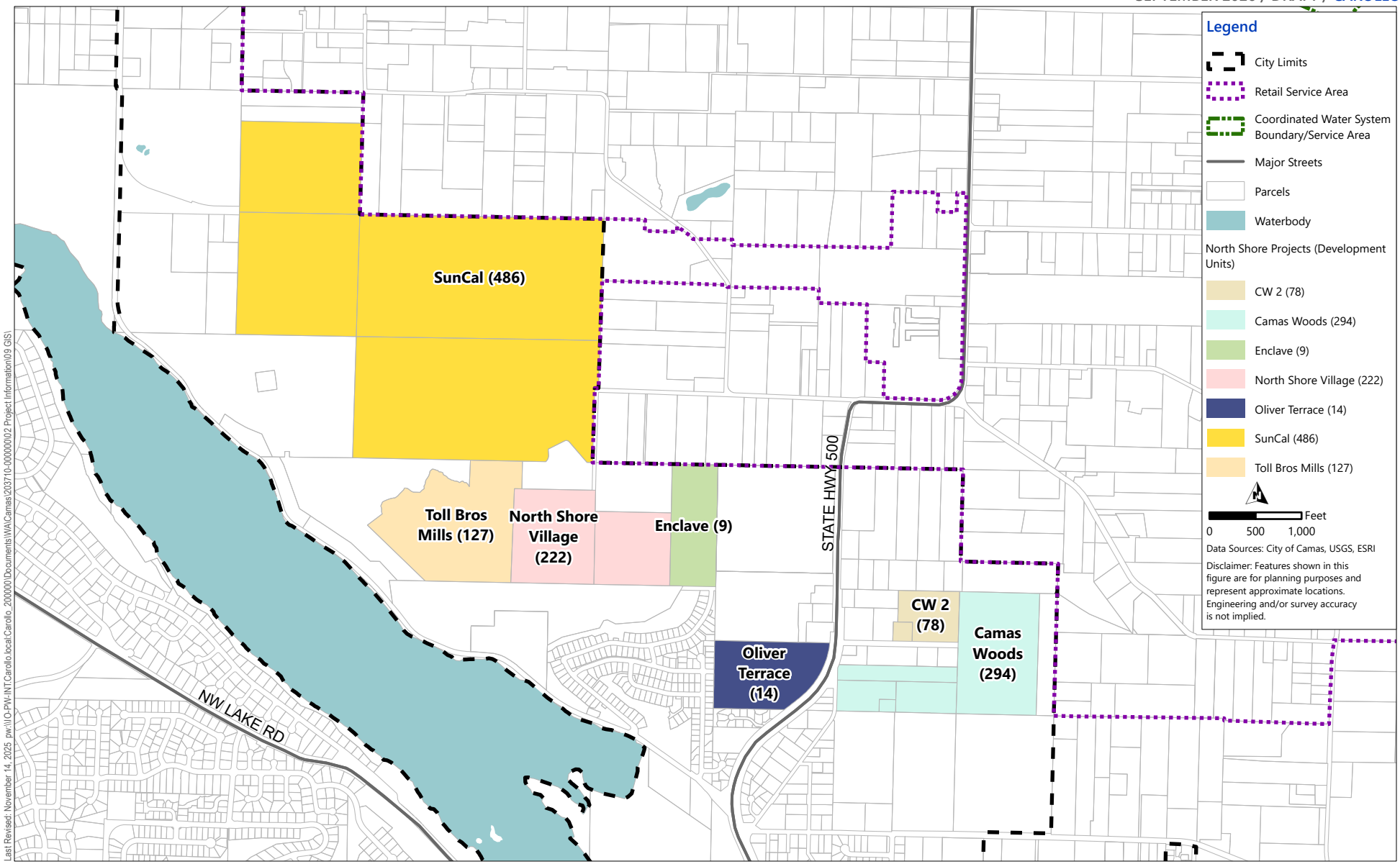


Figure 5.8 Projected Growth in North Shore Area in Number of Units

5.5 Projected Number of Accounts

Water accounts were projected using the GIS data and percent of land developed that meets the household and employee projections presented in Section 5.4. Growth was added to existing accounts to align with the household and employee projections presented in Table 5.6.

Table 5.7 summarizes the projected number of water accounts for each planning year. The projections show increased growth over historical growth in multi-family residential and industrial accounts. These projections form the basis for estimating the City's future water demand. The ERU factors for low, medium, and high demand scenarios were then applied to the account projections to develop the City's future demand estimates.

Table 5.7 Projected Number of Water Accounts

System-wide Projections	2025	2031	2036	2046	Average Annual Growth Rate
Airport	1	1	1	1	0%
SFR(1)	9,350	10,284	11,018	12,808	1.5%
MFR	490	1,303	2,007	3,379	9.6%
Commercial(2)	260	286	347	482	2.9%
Commercial Large Users	12	12	12	12	0%
City	50	50	50	50	0%
Industrial	13	25	68	123	11.5%
Industrial Large Users	10	10	12(3)	12(3)	0.9%
Total of Accounts	10,187	11,971	13,541	16,867	2.4%

Notes:
(1) SFR includes ADU Shared category from historical accounts. ADU Shared are not projected separately from SFR.
(2) Commercial accounts include demand irrigation water demand. The Irrigation category of account from historical accounts are not projected separately.
(3) Two additional large users were assumed to be added, one located in North Shore and one in the STEP Basin.

5.6 Projected Water Demand

Projecting future water demand is one of the key elements of the water system planning process. Identification of system improvements such as supply, pumping, storage, and piping requirements are all related to demand projections. This section summarizes the ERU, ADD, and MDD projections, as well as the potential range in future demands associated with various factors, such as water use per ERU, DSL, and climate change.

5.6.1 Potential Range in Future Water Demand

Numerous factors and assumptions affect the accuracy of projected future water demands. Recognizing that certain assumptions built into the demand projections will vary in the future, the projections were developed for low, medium, and high demand scenarios to provide a range in demands that may be experienced in the future.

The variables considered in developing the range of demand projections are summarized in Table 5.8 and are discussed below.

- **Future Water Accounts:** The future water accounts are shown in Table 5.7 and were projected using VBLM data and planning data from the City. Because the 20-year planning period (2046) of this Water System Plan Update (WSPU) extends beyond the 20-year planning period of the Comprehensive Plan 2045, linear interpolation was used to determine the future water accounts in the planning periods for the WSPU.
- **Water Use per ERU:** Water use per ERU for the low, medium, and high demand projections are based on the City's historical data from 2017 to 2024. The low projection reflects the historical average of 242 gpd/ERU, while the medium projection reflects the 75th percentile value of 248 gpd/ERU. The high demand projection was based on maximum of the historical data presented in Table 5.3, which equals 260 gpd/ERU.
- **ERUs per Account:** The historical ERUs per account by customer class presented in Table 5.3 were used to project the future demands. These ERU per Account values based on the average of the historical data and a water use per ERU value of 242 gpd/ERU.
- **Distribution System Leakage:** The City's three-year running average DSL varied between 10.3 and 13.0 percent of the City's total production between 2022 through 2024, as shown in Table 5.4. For the low demand scenario, a DSL of 9.1 percent was selected to represent the City's conservation goals, based on the most recent 2024 data. For the medium and high demand scenario, 10 percent was used to represent the City's goal of meeting Washington Department of Health threshold.
- **Climate Change Impacts:** Climate models project that the Pacific Northwest will generally experience warmer, wetter winters and hotter, drier summers. To estimate the potential impact on the City's future demands, Carollo evaluated historical and projected maximum temperature data from an ensemble of global climate models under multiple future scenarios.

  A regression analysis was developed between the City's historical consumption and modeled historical climate data. This relationship was then applied to future climate projections. The City elected to assume no change for the low scenario, to use the Shared Socioeconomic Pathway (SSP) 1-2.6 scenario as the basis for the medium demand scenario, and to use the SSP 3-3.7 scenario as the basis for the high demand scenario for its planning assumptions. SSP 1-2.6 represents a sustainably focused future and decreasing rate of change. SSP 3-3.7 represents a world with limited climate policy and higher emissions producing greater warming than SSP 1-2.6 but less than SSP5-8.5. It brackets a plausible upper range of climate stress on demand and supplies for planning.

  Results indicate that by midcentury, climate change may increase overall water demand by approximately 2.93 percent under the SSP 1-2.6 scenario and by approximately 4.49 percent under the SSP 3-3.7 scenario. Seasonal impacts are more pronounced, with the largest increases expected during the spring (February–April) and fall (September–October) shoulder seasons.
- **Maximum Day/Average Day Peaking Factor:** Due to the high projected demands for the City's largest two water users (described in the following section), and the lack of summer peaking in demand, the MDD/ADD peaking factor was not applied to the top two largest users to avoid overly conservative demand projections. Instead, peaking factors for the two largest users were calculated separately and are described in the section below. The MDD/ADD peaking factors developed for all customers excluding the top two large users is based on the historical production data. The MDD/ADD

peaking factors for all customers excluding large users varied from 2.07 to 2.46 between 2018 and 2024 as shown in table 5.5. For the low demand projection, the average peaking factor from 2018 and 2024 of 2.22 was used. For the medium demand projection, the three-year average observed between 2022 and 2024 of 2.23 was used. For the high demand projection, the 75th percentile observed from 2018 and 2024 of 2.31 was used.

- **Large Industrial Users Maximum Day/Average Day Peaking Factor:** The MDD/ADD peaking factor was not applied to large industrial users to avoid overly conservative demand projections. Instead, the two largest users were assigned a peaking factor of 1.25 for the low demand scenarios, which represents a maximum day demand approximately 10 percent above the average day demand. For the medium scenario, a peaking factor of 1.30 was applied to remain consistent with the City's 2022 economic development studies. The high scenario used a conservative peaking factor of 1.50. It is important to note that the remaining eight large users were assigned to the non-large user peaking factor, as their water use pattern aligns more closely with typical business diurnal demands, unlike the top two large industrial users.
- **Future Large Industrial Users:** Additional demand for Future large users was based on individual demand projections that are presented in the following sections.

Table 5.8 Demand Projection Parameters

Demand Scenario	Demographic Growth Scenario	Water Use per ERU (gpd/ERU)	Distribution System Leakage (%)	Maximum Day Peaking Factor	Large Industrial User Peaking Factor(1)
Low	Average	242	9.1%	2.22	1.25
Medium	75th Percentile	248	10.0%	2.23(2)	1.30
High	Maximum	260	10.0%	2.31(3)	1.50

Notes:
(1) The large industrial peaking factors were only applied to the top two large industrial users, as their usage patterns are industrial in nature and do not follow typical business diurnal demand patterns like the other large users.
(2) The three-year average from 2018-2024 was used to determine the maximum day peaking factor for the medium demand scenario.
(3) The 75th percentile from 2018 to 2024 was used to determine the maximum day peaking factor for the high demand scenario.

5.6.2 Large Users Demand Forecast

The City's top 10 water users, or large users, were identified by the City as presented in Section 5.1.1. Low, medium, and high demand forecasts were created for each large user based on historical water use data from 2017 through 2024.

The low demand scenario projections were determined by identifying the lowest projected demand for each large user based on four calculated estimates: the average historical growth rate, the most recent three-year average growth rate, the large users' annual demand with the maximum historic yearly demand held constant, and the current demand. If the current demand is the lowest of these four estimates, it was used as the low demand scenario. The high demand scenario projections were determined by identifying the highest projected demand for each large user based on three calculated estimates: the average historical growth rate, the most recent three-year average growth rate, and the large users' annual demand with the maximum historic yearly demand held constant. The medium demand scenario is an average of the low and high demand projections.

For three large users, however, projections were developed using a different approach. Georgia Pacific demonstrated a decline in average demand from 2017 to 2024 period following a reduction in production and accompanying layoffs in 2018 that eliminated approximately two-thirds of its jobs, according to City staff. Similarly, the City and Camas School District No. 117 have reduced irrigation use due to recent budget cuts. For these three large users, demand projections were conservatively set equal to the maximum observed demand between 2017 and 2024 and applied consistently across all demand scenarios, as increases in demand are not anticipated. Additionally, Clara Street Block Building, LLC presented very limited data with only other data shown in 2021. For planning purposes, it is assumed that its 2024 demand will remain steady over the projection period.

The City has requested future large users demand projections to be included and increase linearly through 2046. Table 5.9 shows the additional future large user demands for 2031, 2036, and 2046.

Table 5.9 Additional Future Large User Demands

Demand Scenario	2031 (mgd)	2036 (mgd)	2046 (mgd)
Low	0.0	0.0	0.25
Medium	0.19	0.375	0.75
High	0.375	0.75	1.50

Additionally, all the existing large users demand projections are presented in Table 5.10. For each of the existing large users, Table 5.10 provides the Service Area, 2025 demand, and the projected 2031, 2036, and 2046 demands.

5.6.3 Projected ERUs

Projected ERUs for single family residential is the projected number of accounts since ERU is defined as water consumption from one single family home. Projected ERUs for all other customer classes is the projected number of accounts multiplied by the number of ERUs per account for that customer class. Table 5.11 presents the projected ERUs for each of the City's Service Areas under different growth scenarios. To spatially allocate demands across the retail water service area, the City's 2023 VBLM data was used to determine whether parcels are constrained or unconstrained, and whether parcels are expected to develop or redevelop by 2045 consistent with the future land use per the Comprehensive Plan 2045.

5.6.4 Projected Average Day and Maximum Day Demands

ADD projections were determined by multiplying the total number of projected ERUs per Service Area by the appropriate water use per ERU for each demand scenario, as listed in Table 5.8. Additionally, the ADD projections incorporate the assumptions for DSL and the unique large users demand projections. To develop MDD projections, the ADD projections for all customers were multiplied by the peaking factors. For the two largest existing users and the future users, the large user peaking factors shown in Table 5.8 were applied depending on the demand scenario.

Tables 5.12 and 5.13 show the projected ADD and MDD, respectively, under the low, medium, and high demand scenarios. These projections, as well as historical ADD and MDD, are visually depicted in Figure 5.8.

Table 5.10 Existing Large Users Demand Projections

Large User	Service Area	Demand - 2025 (mgd)	Demand - 2031 (mgd)			Demand - 2036 (mgd)			Demand - 2046 (mgd)		
			Low	Med	High	Low	Med	High	Low	Med	High
TSMC (formerly "Wafertech Industries")	544	0.74	0.74	0.80	0.87	0.74	0.84	0.94	0.74	0.93	1.12
Analog Devices (formerly "Linear Technologies")	544	0.28	0.28	0.30	0.31	0.28	0.30	0.31	0.28	0.31	0.34
City of Camas	343, 455, 544, 852	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Camas School District No. 117	343, 455, 544, 852	0.10	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Bodycote IMT	544	0.05	0.05	0.07	0.10	0.05	0.09	0.13	0.05	0.12	0.20
Georgia Pacific Mill	343	0.04	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Fisher Creek Investments	544	0.02	0.02	0.02	0.03	0.02	0.03	0.03	0.02	0.03	0.05
Hills at Round Lake Homeowners Association	852	0.02	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.03	0.04
Prestige Care and Rehabilitation	343	0.01	0.01	0.02	0.02	0.01	0.02	0.03	0.01	0.03	0.05
Clara Street Blocking Building, LLC	343	0.04	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Total (Existing Large Users)(1)	-	1.44	1.60	1.70	1.80	1.60	1.77	1.95	1.60	1.93	2.28

Notes:
(1) Totals may not equal due to rounding.

Table 5.11 ERU Projections

Service Area	ERUs – 2025	ERUs – 2031	ERUs - 2036	ERUs - 2046
343 - Butler	2,314	3,017	3,430	3,843
455 - Lower Prune Hill	1,653	1,901	1,942	1,983
542 - Gregg	1,198	1,901	3,182	5,413
544 - Lacamas	9,132	11,570	13,223	16,942
695 - Green Mountain Estates	83	289	289	331
852 - Upper Prune Hill	4,876	5,124	5,372	5,909
Total	19,256	23,802	27,438	34,421

Table 5.12 Average Day Demand Projections

Service Area	2025 ADD (mgd)	ADD - 2031 (mgd)			ADD - 2036 (mgd)			ADD - 2046 (mgd)		
		Low	Med	High	Low	Med	High	Low	Med	High
343 – Butler	0.9	1.1	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.4
455 – Lower Prune Hill	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5
542 – Gregg(1)	0.3	0.5	0.5	0.6	0.8	0.9	1.0	1.2	1.4	1.6
544 – Lacamas(1)	2.0	2.3	2.6	2.8	2.4	2.9	3.4	2.9	3.7	4.6
852 – Upper Prune Hill	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.4
695 – Green Mountain Estates	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total Demand(1)	4.6	5.6	5.9	6.3	6.2	6.8	7.4	7.4	8.4	9.6

Notes:
(1) Service areas 542 and 544 include additional future large user demand.
(2) Totals may not equal due to rounding.

Table 5.13 Maximum Day Demand Projections

Service Area	2025 MDD (mgd)	MDD - 2031 (mgd)			MDD - 2036 (mgd)			MDD - 2046 (mgd)		
		Low	Med	High	Low	Med	High	Low	Med	High
343 – Butler	1.9	2.2	2.3	2.4	2.4	2.5	2.7	2.7	2.9	3.1
455 – Lower Prune Hill	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.1
542 – Gregg(1)	0.7	1.0	1.1	1.3	1.6	1.8	2.2	2.6	3.0	3.6
544 – Lacamas(1)	3.2	3.6	4.2	5.1	4.0	4.9	6.3	4.8	6.5	8.9
852 – Upper Prune Hill	2.4	2.4	2.5	2.6	2.5	2.6	2.7	2.9	3.0	3.2
695 – Green Mountain Estates	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total Demand(2)	9.1	10.3	11.1	12.4	11.6	13.0	15.1	14.2	16.6	20.2

Notes:
(1) Service areas 542 and 544 includes additional future large user demand.
(2) Totals may not sum exactly due to rounding.

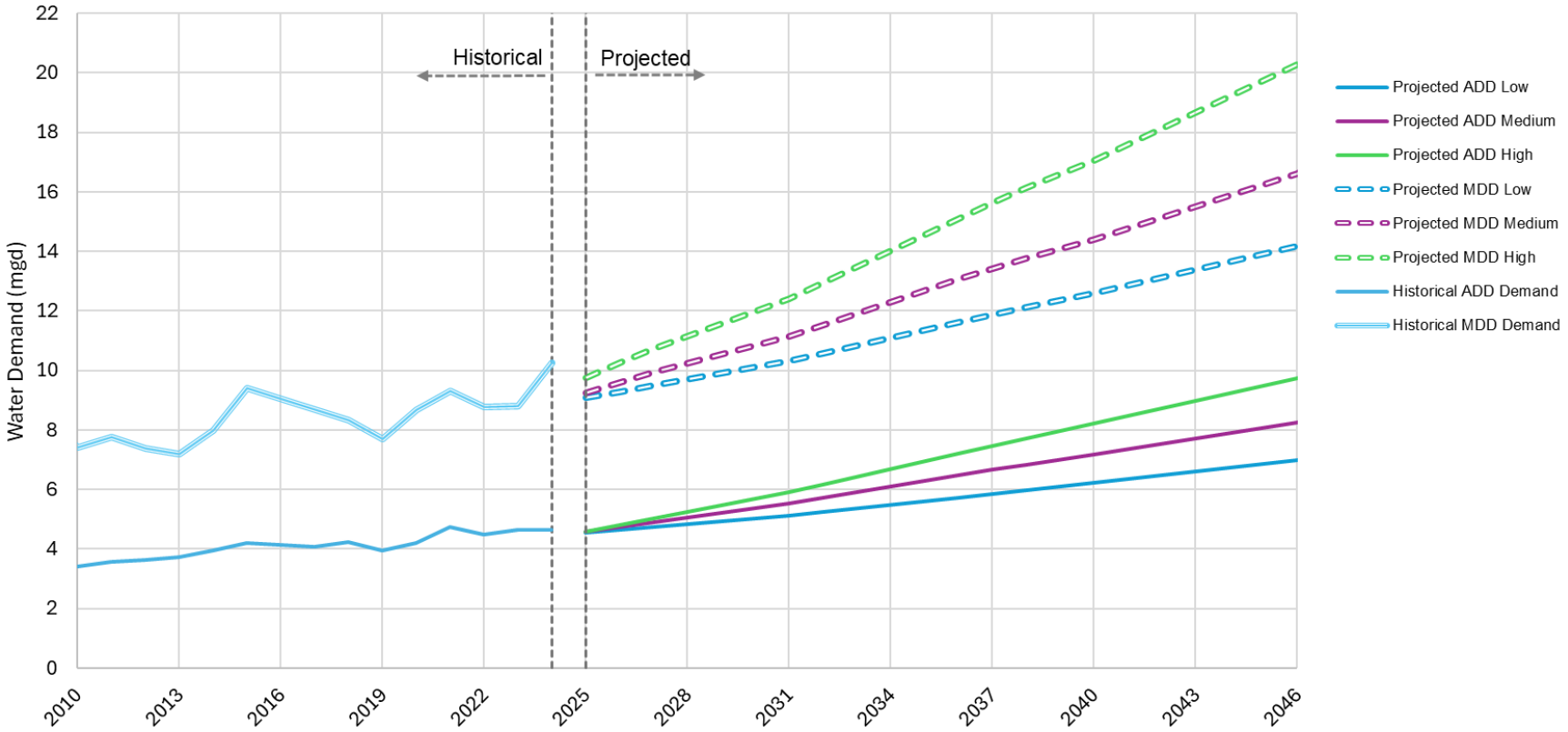


Figure 5.9 Average and Max Day Demand Projections

CHAPTER 6 WATER USE EFFICIENCY

The City promotes efficient water use to conserve and protect their existing water supplies for present and future residents. The City promotes water conservation and efficient use of water through a variety of activities that encompass their WUE Program. The program encourages water conservation and utilizes continued improvements to reduce leakages and water loss in the City's system. This chapter details both the City's existing and future WUE programs.

6.1 WUE Program Background

In 2003, the Washington State Legislature passed the Engrossed Second Substitute House Bill 1338, known as the Municipal Water Law or the WUE rule, to address the increasing demand on Washington's water resources. This law established that all municipal water suppliers (MWS) must use water more efficiently in exchange for water right certainty and flexibility to help them meet future demand.

The WUE rule, which became effective on January 22, 2007, emphasizes the importance of measuring water use and evaluating the effectiveness of the water supplier's WUE program. The intent is to minimize water withdrawals and water use by implementing water saving activities and adopting policies, resolutions, ordinances, or bylaws. This chapter follows the guidelines set forth in the Water Use Efficiency Guidebook, Fourth Edition, (May 2025) as well as the Water System Planning Handbook (June 2025).

6.1.1 Current WUE Program

The City's current WUE Program was established as part of the 2019 WSP. Per the WAC 246-290-830(4)(a), all water purveyors with 1,000 or more connections were required to set efficiency goals through a public process. The established goals promote water use efficiency for internal operations and for water customers. The past WUE Program goals were established in the 2010 WSP and subsequently re-established in 2013 and 2019:

- **Demand-Side Goal:** Reduce customer consumption per ERU by 1 percent or approximately 2 gpd per year over the next six years.
- **Supply-Side Goal:** Continue to reduce distribution loss to or below 10 percent for the next five years.

The following summarizes the current program.

6.1.1.1 Supply-Side Measures

The City implements the following supply-side measures as part of their WUE Program. A number of these measures are mandated by the DOH per the WUE Guidebook. The following summarizes the City's supply-side measures:

1. Record and monitor supply source production (Mandatory).
2. Record and monitor customer demands through customer water meters (Mandatory).
3. Test and calibrate industrial and commercial meters annually (Mandatory).

4. Replace customer water meters with enhanced advanced metering infrastructure (AMI) meters. Once complete, the City will regularly test and repair residential meters per manufacturer recommendations.
5. Perform annual leak detection surveys through a private contractor. Hydrants and valves are checked as part of leak detection surveys (Mandatory).
6. Repair or replace old distribution system piping with defects as budget allows.
7. Reclaimed Water: Treated wastewater is used for washdown and process use and for landscape irrigation at the wastewater treatment plant (WWTP) (Mandatory to evaluate reclaimed water).

6.1.1.2 Demand-Side Measures

The City implements a number of demand-side measures that previously met the DOH requirement for six WUE measures. These measures are similar to many of the example water use efficiency measures presented in Appendix B of the Water Use Efficiency Guidebook. The City provides an overview of their water use efficiency activities on their Water Services website (http://www.ci.camas.wa.us/index.php/pwwater). The City's various public outreach activities meet the DOH requirement for educating customers about water use efficiency. The following provides a summary of the City's demand-side measures:

1. Include water consumption history on customer's utility bills.
2. City staff alert and visit customers where customer leaks are identified.
3. Promote installation of smart controllers and irrigation timers for the school district and industrial users.
4. Educate the public on conservation and water-saving devices at community events and on the City website (http://www.ci.camas.wa.us/images/DOCS/WATER_SEWER/REPORTS/waterconservation.pdf).
5. Distribute water-saving devices such as shower timers at community events.
6. Require xeriscaping and Low Impact Development (LID) to reduce irrigation requirements for new developments.
7. Work with developers to evaluate their irrigation systems to incorporate drip systems or micro sprayers.
8. Promote odd/even day and late night or early morning irrigation for all customers.

The above supply- and demand-side WUE measures are effective in encouraging WUE for the water system. Additional measures have been evaluated since the requirement increased to nine measures due to the City falling in the range of 10,000 to 49,999 service connections. These are discussed further in Section 6.2.3.

6.1.2 Distribution System Leakage

DSL is a significant element of supply-side WUE requirements. DSL above 10 percent on a three year rolling average is considered excessive and necessitates the creation of a WLCAP. DSL is the difference between total water production and metered water use. The estimate of DSL is dependent on the accuracy of meter readings for supply and customer meters. Table 6.1 presents the City's reported three-year rolling average DSL from 2021 through 2025. From 2021 through 2024, the City's three-year rolling DSL average was above their WUE program goal and DOH standard of 10 percent, but the City is making progress in lowering the DSL as seen from 2022 through 2025.

Table 6.1 Distribution System Leakage (Three-year Rolling Average)

Year	3-Year Rolling Average DSL (%)
2021	14.2
2022	14.5
2023	13.1
2024	11.2
2025	6.7

The DSL in Table 6.1 differs from that calculated in Chapter 5 - Water Requirements, where Chapter 5 evaluates historical billing data for consumption. The City cannot account for the differences; however, it is believed to be related to year end meter reading.

Although the 2025 three-year rolling average is below the 10 percent threshold, the City transitioned billing software in 2025, which required consumption data to be compiled from two sources. This may have contributed to higher reported water use. As a result, the City will complete a WLCAP to address its DSL. This can be found in Appendix **[X].**

6.1.3 Historical Effectiveness of Current Water Use Efficiency Program

The City's current WUE Program includes measures for residential, irrigation, commercial, and industrial customers. The effectiveness of the City's program in meeting their WUE goals can be evaluated considering system-wide water use trends.

The 2019 WSP used a planning ERU of 260 gpd based on average residential use from 2013 to 2015. The current planning ERU value of 242 gpd was based on the average of water use from 2022 to 2024. This equates to a decrease of 0.8 percent annually over the nine-year period, close to the City's goal of 1 percent.

Annual water use per account from 2017 to 2024 was detailed previously in Section 5.1.4. Water use across the City's SFR, MFR, commercial, industrial, city, irrigation, and ADU shared accounts have fluctuated since 2017. Overall, SFR and ADU shared water use have decreased from 2017 to 2014 by 2 and 6 percent, respectively. The City believes these decreases were in part from the WUE Program. Some decreases may have been from requirements in the Washington State Plumbing Code, which limits maximum flow rates for faucets, showers, toilets, and urinals. It is acknowledged that other factors may have played a prominent role, such as weather and economic conditions.

The City does not officially track staff time or project costs associated with WUE. The supply-side WUE measures, such as metering and leak detection, are core activities of the Utility and are funded through Utility Capital Improvement and O&M funds. The City estimates that it dedicates approximately 0.5 full-time-equivalents (FTE) of staff time to conduct demand-side measures across its Water Utility, finances department, and development services staff. It is not possible to estimate the cost of each demand-side measure; therefore, a cost-benefit comparison cannot be calculated.

Water consumption in City billing is based on the following most common meter size for SFR and cost per 100 cubic feet:

- Inside City limits:
  - Base rate for 3/4-inch meter: $15.54.
  - Cost per one hundred cubic feet: $2.76 or 0.37 cents per gallon.
- Outside City limits:
  - Base rate for 3/4-inch meter: $23.31.
  - Cost per one hundred cubic feet: $4.15 or 0.55 cents per gallon.

Because the City's water rates are generally comparable to those of neighboring utilities, its WUE Program appears to be implemented in a cost-effective manner.

6.2 Future WUE Program

The City plans to continue its efforts to encourage efficient water use and has updated its WUE Program, which is included in Appendix **[X]**. Going forward, the program will continue to focus on measures targeted at residential customers. The WUE Program goals established in 2026 are:

- **Demand-Side Goal:** Reduce customer consumption per ERU by 1 percent over the next 6 years.
- **Supply-Side Goal:** Continue to reduce distribution loss to 10 percent or less over the next 5 years.

Public comment on the future WUE program was taken at the **[XXXXXX]** City Council Meeting. An agenda and minutes for the meeting are provided in Appendix **[D]**.

6.2.1 Mandatory Measures

The WUE Program requires certain measures to be implemented, some of which can be incorporated as supply-side measures by the utility as described in Supply-Side Measures as well as in Future WUE Program Supply-Side Measures. The City's WUE Program will continue to meet the following mandatory measures in the future:

- Install production (source) meters.
- Install consumption (service) meters.
- Perform meter calibration.
- Implement a water loss control action plan to control leakage if the three year rolling average exceeds 10 percent.
- Educate customers about water use efficiency practices.
- Evaluate rates that encourage water demand efficiency, as discussed in a subsequent section.
- Evaluate reclamation opportunities, as discussed in a subsequent section.

6.2.1.1 Rate Structure

The City's current rate structure bills customers on a uniform volumetric charge. In 2010, the City added a consumption-based element to sewer rates based on average winter water consumption, which was thought to encourage water efficiency. In 2023, a rate study was performed that evaluated a tiered rate structure. Ultimately, it was determined that the current rate structure would remain in place. Future rate studies will continue to reevaluate rate structures to encourage conservation.

6.2.1.2 Reclaimed Water

Per WAC 246-290-100 and WUE requirements, water systems with over 1,000 connections must evaluate reclaimed water opportunities. As mentioned previously, the City currently uses treated wastewater at the WWTP. In addition, the City previously evaluated reclaimed water opportunities in 2006 with costs escalated to 2025 dollars in the concurrent effort of updating the General Sewer Plan, considering a multitude of locations to use the water for irrigation; Figure 6.1 displays locations with irrigation connections. Overall, it was concluded that using reclaimed water as irrigation water was not economically feasible, and therefore, the reclaimed water system will not be expanded at this time.

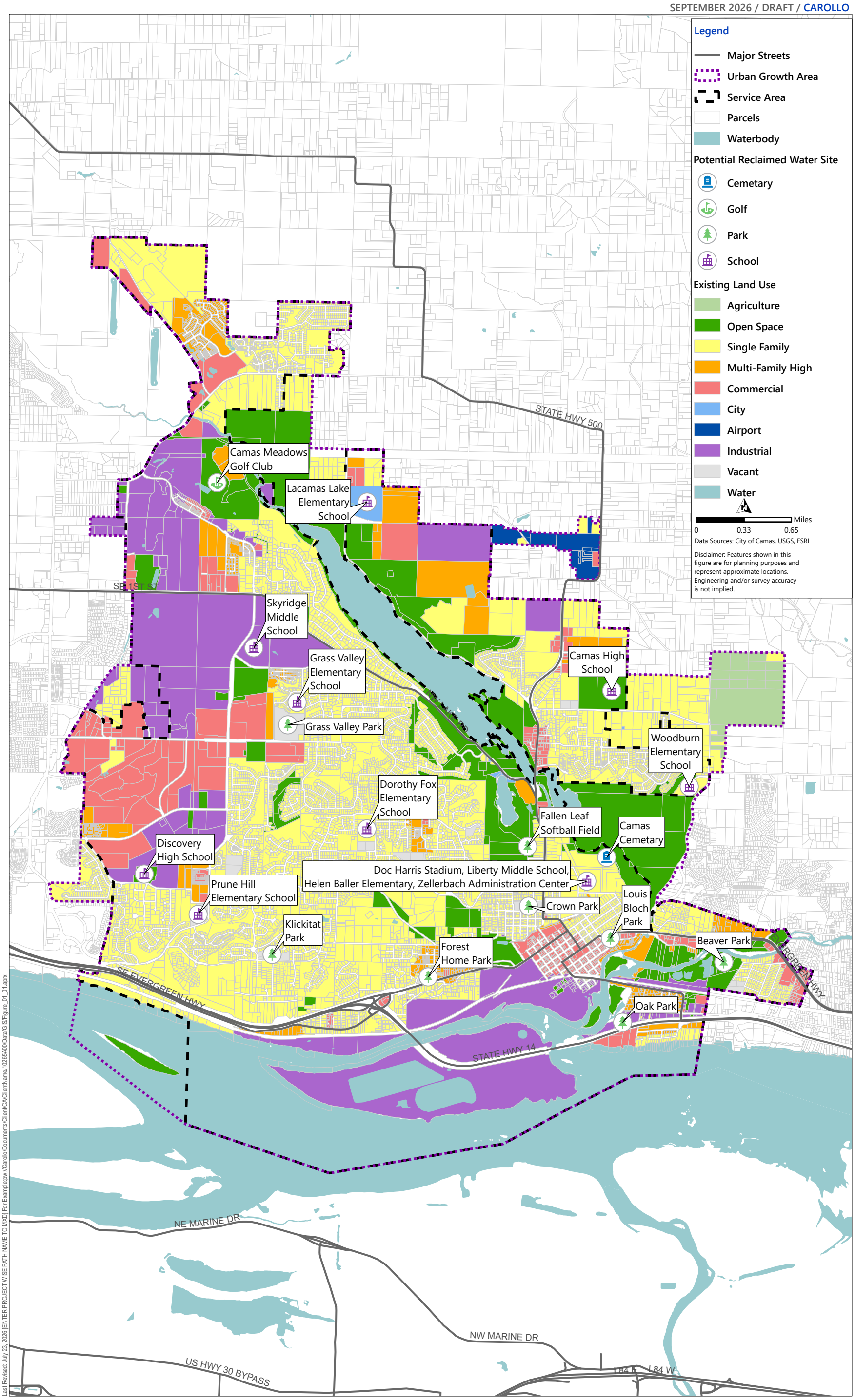


Figure 6.1 Possible Locations for Reclaimed Water Irrigation

6.2.2 Future WUE Program Supply-Side Measures

The City completed replacing 100 percent of customer water meters with AMI meters in 2025. The AMI meters provide operational benefits, reduces data error and helps identify customer-side leaks. Installation of AMI meters is expected to enhance meter accuracy, leak detection and customer education through the detailed water use data and statistics provided by the AMI system. The City will continue the existing supply-side measures as described in Section 6.1.1.1 and updated fourth supply-side measure to be as follows:

- The City will repair and/or replace residential meters per manufacturer recommendations.

6.2.3 Future WUE Program Demand-Side Measures

Due to an increase in connections, the City must have at least nine demand-side measures. Some of the current measures will continue, some are modified, and three new ones were added. The following list provides the new measures:

1. City staff alert and visit customers where customer leaks are identified.
2. Promote installation of smart controllers for City-wide users.
3. Educate the public on conservation and water-saving devices at community events and on the City website (http://www.ci.camas.wa.us/images/DOCS/WATER_SEWER/REPORTS/waterconservation.pdf).
4. Promote xeriscaping and LID to reduce irrigation requirements for new developments.
5. Promote irrigation systems to incorporate drip systems or micro sprayers.
6. Promote odd/even day and late night or early morning irrigation for all customers.
7. Provide monthly billing to all customers.
8. Send water savings tips to customers in the annual water quality report.
9. Onsite irrigation at the WWTP with treated effluent.

6.2.4 Projected Demands with Water Use Efficiency Goals

The projected water demands considering the water savings from the City's WUE Program were represented with the low demand scenario presented in Chapter 5. Projected demands with WUE savings were compared to the medium demand projection. The low demand projection assumes a 2025 demand based on 242 gpd/ERU while the medium demand projections assumes a 2025 demand based on 248 gpd/ERU. The low demand projection also assumes the WUE Program will help to reduce the MDD to ADD peaking factor by approximately 0.45 percent. The low and medium demand projections assume the City's DSL is 9.1 and 10 percent, respectively. Table 6.2 presents the projected ADD and MDD with and without the WUE Program for the 20-year planning period. The projected demands with the WUE Program are also shown in Figure 6.2. For ADD, WUE measures are projected to provide a reduction of 1.0 mgd, or 11.9 percent, by 2046. For MDD, WUE measures are projected to provide a reduction of 2.4 mgd, or 14.6 percent, by 2046.

Table 6.2 WUE Demand Projections

Demand Scenario	2046 Projection with WUE (mgd)	2046 Projection without WUE (mgd)	Water Savings (mgd)	Percent Savings
ADD	7.4	8.4	1.0	11.9
MDD	14.2	16.6	2.4	14.6

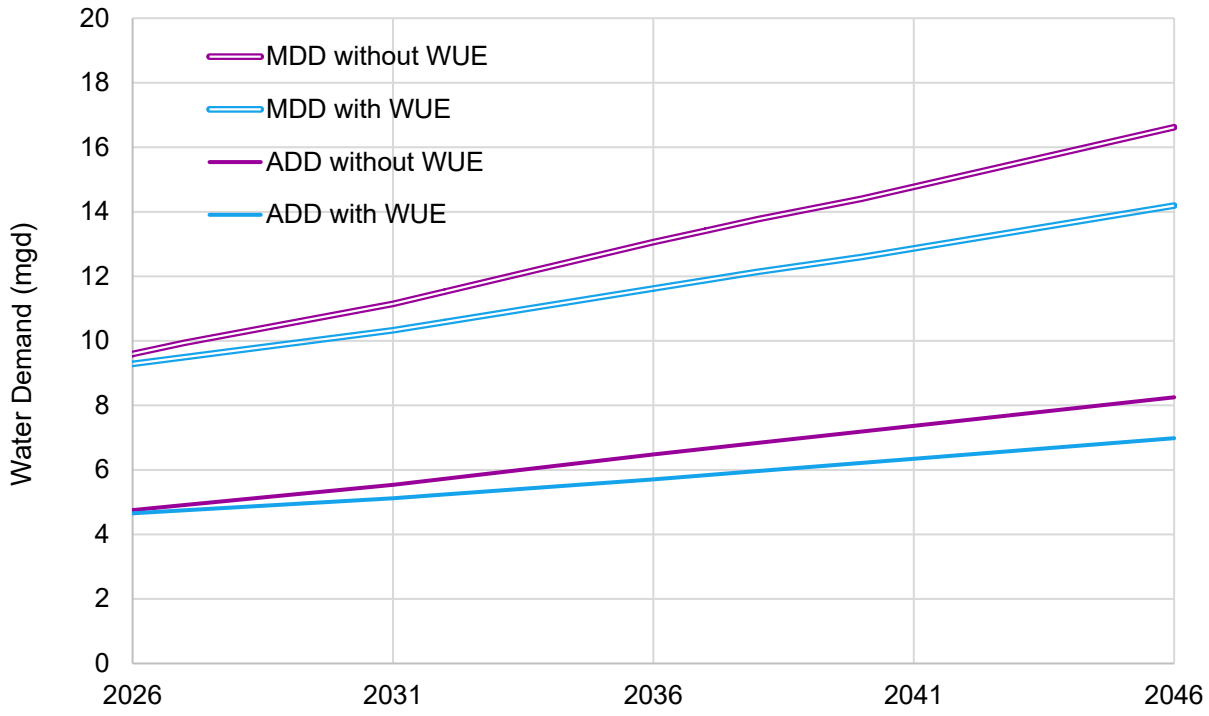


Figure 6.2 Projected Demands With and Without Water Use Efficiency

6.2.5 Future WUE Program Effectiveness

The effectiveness of the existing WUE program was evaluated using system-wide water use data. Measuring the effectiveness of the City's future WUE Program against the established goals could be similarly evaluated using system-wide water use data. Estimating the water savings directly resulting from the City's WUE Program in a single year is difficult. Therefore, long-term trends should be use to more clearly show the impact of the City's WUE Program.

The first step would be to establish a baseline from historical information. The second step is to evaluate the resulting water use after promoting WUE through targeted activities and events to customers. It is recommended that water use be tracked for at least a year to identify trends. Some considerations will need to be given to variations in weather and economic conditions. Another method would be to perform the same before/after water use analysis for WUE Program participants who volunteer and provide their address. The resulting information would be valuable for the City to correlate its WUE Program efforts with direct water savings for its customers.

AMI was implemented in 2025. The City will leverage AMI water usage data in its targeted public education programs to customers in a particular area or user profile, such as heavy irrigators. Using AMI, the City can estimate overall usage, irrigation usage, and peak water use rates.

6.2.6 Budget

The City recognizes the importance of continuing their WUE measures and considers it a core function of the Utility. The WUE program provides cost savings through demand reduction and reduction in DSL. Continuing the WUE Program can assist the City in meeting peak demands and avoiding curtailment periods. The City will continue the following level of effort for demand-side measures: approximately 0.5 FTE of staff time across its Water Utility, finances department, and development services department. Due to AMI capabilities, it is anticipated that the City will further personalize water use communications with customers without increasing staff effort. Future supply-side WUE measures will be funded, as appropriate, through the Capital Improvement and O&M funds. If AMI detects a large number of existing and new leaks, the City will evaluate the need for additional personnel in its meter maintenance group to address leaks.

6.3 Water Shortage Plan

Camas Municipal Code (CMC) Chapter 13.14 has been created to allow the City to impose restrictions during a water shortage. It defines five stages of water emergencies:

- Stage I - Anticipated Water Shortage.
- Stage II - Serious Water Shortage.
- Stage III - Critical Water Shortage.
- Stage IV - Emergency Water Shortage - Mandatory Outdoor Restrictions and Indoor Conservation.
- Stage V - Regional Disaster - Water Rationing.

The Public Works Director is responsible for declaring and implementing the water shortage plans. Stages I or II implement voluntary reductions in water use for customers and some City watering reductions. Stages III and IV further regulate or prohibit nonessential uses of water. Details on the Water Shortage can be found in CMC Chapter 13.14.

CHAPTER 7 WATER QUALITY

7.1 Introduction

The City is defined as a Group A - Community Water System and must comply with the drinking water standards of the federal Safe Drinking Water Act (SDWA) and its amendments, as regulated by the USEPA. The DOH adopted the updated federal standards under WAC 246-290, of which the most recent version became effective June 17, 2025.

The quality of the City's drinking water sources is of primary concern to the City. The City's water is supplied by groundwater aquifers and surface water sources (Jones and Boulder Creeks), which are tested regularly for the presence of contaminants at frequencies prescribed by DOH regulations. The City is in compliance with all DOH reporting requirements, including publication and distribution of an annual Water Quality Report that keeps consumers informed as to the quality of the City's water supply and water delivery systems.

This chapter includes the following components:

- Description of current drinking water quality regulations.
- Summary of anticipated future regulations.
- Summary of current monitoring programs.
- Summary of the City's compliance with USEPA and DOH regulations.
- Recommendations.

This chapter utilizes information from the DOH's website for Drinking Water Regulation and Compliance , the USEPA's website for regulations under the SDWA, the City's annual Water Quality Reports (included in Appendix E), and the City's previous 10 years water quality data.

7.2 Overview of Regulatory Requirements

The SDWA of 1974, amended in 1986 and 1996, established specific roles for the federal government, state government, and water system purveyors, with respect to water quality monitoring. The USEPA is authorized to develop national drinking water regulations and oversee the implementation of the SDWA. State governments are expected to adopt the federal regulations and accept primary responsibility or "primacy" for administration and enforcement of the Act. States can also regulate contaminants and set advisory levels. Public water system purveyors are assigned the day-to-day responsibility of meeting regulations by incorporating monitoring, record-keeping, and sampling procedures into their operation and maintenance programs.

Applicable SDWA regulations are summarized in Table 7.1 and are divided into those that address source water quality, surface water treatment, distribution system water quality, and system-wide requirements, respectively. Monitoring requirements under each rule are noted herein.

Table 7.1 Drinking Water Regulations

Rule	CFR	WAC 246-290	Affected Contaminants	Publication Date of Final Rule
Source Water Quality				
National Primary and Secondary Drinking Water Standards	See below	Part 4, 300, 310, 315 and 320	Bacteriological, IOC, VOC, SOC, Asbestos, Radionuclides, THM, Lead/Copper, Phase II/V	Phases I through V promulgated 1987 through 1992
Radionuclide Rule	40 CFR 141.15 141.25 141.26	Part 4, 300(9) 310(6), and 320	Radionuclides	Promulgated April 4, 1997
Arsenic Rule	40 CFR 141.23 141.24 141.16	Part 4, 300(3) and 310(3)	Arsenic	Promulgated February 2002 Compliance by January 23, 2006
UCMR	N/A		Various contaminants considered for future regulations	UCMR 1 promulgated 1999 UCMR 2 promulgated 2007 UCMR3 promulgated May 2, 2012 UCMR4 promulgated December 20, 2016 UCMR5 promulgated December 27, 2021
Groundwater Rule		Part 4, 300(3) and 320(2)	Fecal indicators in groundwater	Promulgated January 8, 2007
PFAS NPDWR	40 CFR 141.	N/A	PFAS	Promulgated April 10, 2024; features implementation timeline with an initial monitoring phase required by 2027 and compliance with listed MCLs by 2029.
PFAS SAL	N/A	Part 4, 300 (10), 310 (7), 315, 320	PFAS	Promulgated December 8, 2021 Revisions promulgated December 15, 2025.
Surface Water Treatment Rules				
Information Collection Rule	40 CFR, Part 141, Subpart M	Part 6, Subparts A and B	Large Surface Water Systems: Bacteriological, DBP, IOCs	Promulgated June 18, 1996
Interim ESWTR	63 FR 69478	Part 6, Subparts A and B	Large Surface Water Systems: Bacteriological, incorporate *Cryptosporidium* into watershed plans	Promulgated November 1998
LT1ESWTR	40 CFR, Parts 9, 141, 142 67 FR 1812	Part 6, Subparts A and B	Bacteriological, *Cryptosporidium*	Promulgated February 13, 2002, compliance by March 15, 2005

Rule	CFR	WAC 246-290	Affected Contaminants	Publication Date of Final Rule
LT2ESWTR	40 CFR Parts 141, 142 68 FR 47639	Part 6, Subparts A and B	Bacteriological	Promulgated in 2006
Filter Backwash Recycling Rule	40 CFR Parts 9, 141, 142 66 FR 31086	Part 6, Subparts A and B	Bacteriological	Promulgated August 7, 2001, compliance by December 8, 2003
Distribution System Water Quality				
Revised Total Coliform Rule		Part 4, 300, 310(2), 320	Total coliform bacteria	Promulgated February 13, 2013 Compliance by April 2016
Lead and Copper Rule	40 CFR 141.86 141.87 141.88	Part 4, 300(4) and 310(3)	Lead and Copper	Promulgated January 12, 2000 Revised December 4, 2013
Stage 1 Disinfectants/ Disinfection Byproducts Rule	40 CFR, Parts 9, 141, 142 63 FR 69390	Part 4, 300, 310, and 320	THM, HAA5, chlorite, bromate, and disinfectant residuals	Promulgated February 16, 1999
Stage 2 Disinfectants/ Disinfection Byproducts Rule	40 CFR, Parts 9, 141, 142 71 FR 388	Part 4, 300, 310, and 320	THM and HAA5	Promulgated January 4, 2006 Effective March 6, 2006
System-Wide Requirements				
Consumer Confidence Report Rule	40 CFR 141 Part O	Part 7, Subpart B	Reporting only	Published August 19, 1998
Public Notification Rule	40 CFR 141 Part Q	Part 4, 320	Reporting only	Promulgated 2000
Operator Certification Rule		WAC 246-292	N/A	Effective January 4, 2014

Notes:
CFR - Code of Federal Regulations; DBP - disinfection byproducts; ESWTR - Enhanced Surface Water Treatment Rule; HAA5 - haloacetic acids; IOC - inorganic contaminants; LT1ESWTR - Long Term 1 Enhanced Surface Water Treatment Rule; LT2ESWTR - Long Term 2 Enhanced Surface Water Treatment Rule; MCL - maximum contaminant levels; NPDWR - National Primary Drinking Water Regulation; PFAS - per- and polyfluoroalkyl substances; UCMR - Unregulated Contaminants Monitoring Rule; VOC - volatile organic compounds, SAL - State Action Levels; SOC - synthetic organic chemicals; THM - trihalomethanes.

7.3 Source Water Quality

Historically, the City has relied on groundwater supplies from wells and surface water diversions. All of the City's sources are treated with chlorine, fluoride, and sodium hydroxide for pH adjustment (with the exception of Well 9). Surface water is treated via a slow sand filtration plant. Regulations that address source water quality for groundwater and surface water systems are described herein.

7.3.1 National Primary and Secondary Drinking Water Standards

The NPDWRs, established by the USEPA, are legally enforceable primary standards to protect the public from consuming water containing contaminants that present a risk to human health. The current list comprises 87 contaminants, including six microorganisms (two of which are nonpathogenic indictors of potential contamination, total coliform, and Escherichia coli), turbidity, four DBP/byproduct groups, three disinfectants, 16 inorganic contaminants, 53 organic contaminants, and four radionuclides. MCL and maximum contaminant level goals (MCLG) have been set for 73 of these contaminants. Disinfectant MCLs and MCLGs are comprised of Maximum Residual Disinfectant Levels (MRDL) and Maximum Residual Disinfectant Level Goals (MRDLG) have been set for three disinfectants. Ten other contaminants are regulated through treatment technique requirements.

The USEPA has also published secondary regulations which are not legally enforceable and function as guidelines to help utilities provide aesthetically pleasing drinking water (taste, odor, color, etc.). The secondary standards set secondary maximum contaminant levels (SMCL) for 15 compounds. These compounds do not present a health risk at the SMCL. States are not required by the USEPA to enforce any of the secondary standards; however, each state may choose to regulate any or all of the secondary standards. For new community water systems, the DOH requires treatment for secondary MCL exceedances under WAC 246-290-320 (3)(d). For other public water systems, the WAC stipulates that the required follow-up action be determined by the DOH based on the degree of consumer acceptance of the water quality and their willingness to bear the cost of meeting the secondary standard.

Current primary and secondary MCLs for inorganic and organic constituents, respectively, are documented in the following subsections.

7.3.2 Inorganic Chemicals

Regulated IOCs include elemental metals such as mercury, arsenic, and iron. Some non-metallic constituents such as chloride, fluoride, and sulfate are also included in this category. Physical properties of IOCs that affect water quality in this category include turbidity, specific conductivity, total dissolved solids, and color. WAC 246-290-310 specifies primary and secondary MCLs for IOCs, which are summarized in Table 7.2 and Table 7.3, respectively.

Table 7.2 Primary MCLs for Inorganic Chemicals

Chemical	Primary MCL (mg/L)(1)
Antimony (Sb)	0.006
Arsenic (As)	0.01
Asbestos	7 million fibers/liter (length > 10 microns)
Barium (Ba)	2.0

Chemical	Primary MCL (mg/L)(1)
Beryllium (Be)	0.004
Cadmium (Cd)	0.005
Chromium (Cr)	0.1
Copper (Cu)	1.3(2)
Cyanide (HCN)	0.2
Fluoride (F)	4.0
Lead (Pb)	0.015(2)
Mercury (Hg)	0.002
Nickel (Ni)	0.1
Nitrate (as N)	10.0
Nitrite (as N)	1.0
Selenium (Se)	0.05
Sodium (Na)	20(3)
Thallium (Tl)	0.002

Notes:
(1) Source: State DOH Drinking Water Regulations (246-290-310), effective June 2025.
(2) Lead and copper have established Action Levels (AL), rather than MCLs. These are discussed further in the LCR, under the Distribution System Water Quality section.
(3) USEPA has established a recommended level of 20 mg/L for individuals that have restrictions on daily sodium intake. This is not an enforceable standard.

Table 7.3 Secondary MCLs for Inorganic Chemicals

Chemical	Primary MCL (mg/L)(1)
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1.0 mg/L
Corrosivity	Non-corrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Specific Conductivity	700 (umhos/cm)
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

Notes:
(1) Source: State DOH Drinking Water Regulations (246-290-310), effective June 2025.

7.3.2.1 Monitoring Requirements

The City has a waiver for IOC testing that reduces the frequency to once every nine years for all its wells. The next IOC samples are required in 2028.

7.3.2.2 Compliance

The City complies with the requirements for monitoring IOCs and has not exceeded any water quality requirements. Water quality data for inorganic chemicals from 2021-2024 is presented in Table 7.4.

Table 7.4 Inorganic Chemicals Monitoring Results

Contaminant	MCL Goal	MCL	2021	2022	2023	2024
Fluoride (mg/L)	1	4	0.34-1.03	0.16-1.1	0.13-1.11	0.12-1.24
Nitrates (mg/L)	10	10	ND-2.9	ND-2.1	ND-1.7	ND-2.0

7.3.3 Volatile Organic and Synthetic Organic Compounds

VOCs are manufactured, carbon-based chemicals that vaporize quickly at normal temperatures and pressures. VOCs include many hydrocarbons associated with fuels, paint thinners, and solvents. This group does not include organic pesticides, which are regulated separately as SOCs. VOCs are divided into the following two groups:

- Regulated VOCs that have been determined to pose a significant risk to human health.
- Unregulated VOCs for which the level of risk to human health has not been established.

There are currently 21 regulated VOCs and 33 regulated SOCs (excluding PFAS). A list of these compounds and their MCLs is included in Table 7.5.

Table 7.5 Regulated Volatile and Synthetic Organic Chemicals

Organic Chemical	Federal Regulation	Primary MCL (mg/L)(1)	Organic Chemical	Federal Regulation	Primary MCL (mg/L)(1)
Volatile Organic Chemicals					
Vinyl chloride	Phase I	0.002	Monochlorobenzene	Phase II	0.1
Benzene	Phase I	0.005	Ortho-Dichlorobenzene	Phase II	0.6
Carbon Tetrachloride	Phase I	0.005	Styrene	Phase II	0.1
1,2-Dichloroethane	Phase I	0.005	Tetrachloroethylene	Phase II	0.005
Trichloroethylene	Phase I	0.005	Toluene	Phase II	1
Para-Dichlorobenzene	Phase I	0.075	Trans-1,2-Dichloroethylene	Phase II	0.1
1,1-Dichloroethylene	Phase I	0.007	Xylenes (total)	Phase II	10
1,1,1-Trichloroethane	Phase I	0.2	Dichloromethane	Phase V	0.005
Cis-1,2-Dichloroethylene	Phase II	0.07	1,2,4-Trichloro-benzene	Phase V	0.07
1,2-Dichloropropane	Phase II	0.005	1,1,2-Trichloroethane	Phase V	0.005
Ethylbenzene	Phase II	0.7			

Organic Chemical	Federal Regulation	Primary MCL (mg/L)(1)	Organic Chemical	Federal Regulation	Primary MCL (mg/L)(1)
Synthetic Organic Chemicals					
Arochlor	Phase II	0.002	Benzo(a)pyrene	Phase V	0.0002
Atrazine	Phase II	0.003	Dalapon	Phase V	0.2
Carbofuran	Phase II	0.04	Di(2-ethylhexyl) adipate	Phase V	0.4
Chlordane	Phase II	0.002	Di(2-ethylhexyl) phthalate	Phase V	0.006
Dibromochloro-propane	Phase II	0.0002	Dinoseb	Phase V	0.007
2,4-D	Phase II	0.07	Diquat	Phase V	0.02
Ethylene dibromide	Phase II	0.00005	Endothall	Phase V	0.1
Heptachlor	Phase II	0.0004	Endrin	Phase V	0.002
Heptachlor epoxide	Phase II	0.0002	Glyphosate	Phase V	0.7
Lindane	Phase II	0.0002	Hexachlorobenzene	Phase V	0.001
Methoxychlor	Phase II	0.04	Hexachloro Cyclopentadiene	Phase V	0.05
PCBs	Phase II	0.0005	Oxamyl (vydate)	Phase V	0.2
Pentachlorophenol	Phase II	0.001	Picloram	Phase V	0.5
Toxaphene	Phase II	0.003	Simazine	Phase V	0.004
2,4,5-TP	Phase II	0.05	2,3,7,8-TCDD (dioxin)	Phase V	$3x10^{-8}$

Notes:
(1) 40 CFR 141.61(a) and (c); adopted by State DOH, effective April 1999.
PCB - Polychlorinated biphenyls.

7.3.3.1 Monitoring Requirements

Per DOH requirements, VOCs and SOCs must be sampled once every three years, unless a waiver is in place. State waivers requiring no monitoring have been issued for dioxin, endothal, diquat, glyphosate, and insecticides. Additionally, the state grants a waiver if a chemical is not in use or previous monitoring indicates contamination would not occur. The City must apply for waivers through DOH. There are two types of waivers, risk-based or area-wide. The risk-based waiver requires a susceptibility analysis and DOH charges a fee for these waivers (purchased waivers). Area-wide waivers are issued if a chemical is not used within a region, thus DOH does not charge for these waivers. While the state issues both types of waivers, an area-wide waiver is referred to as a "State waiver." A waiver is in place for two years, during which time there are no requirements for monitoring. However, once a waiver expires, monitoring frequency for VOCs and SOCs is one sample every three years.

The City is required to sample for VOCs to once every three years at the eastern wellfield (Well 6 and 14) and has waivers at the remaining wells reducing frequency to every six years. The City also has issued waivers reducing sampling frequency for herbicides and pesticides to nine and three years, respectively.

7.3.3.2 Compliance

A review of the City's previous 10 years of water quality data shows that all the City's source wells test below VOC and SOC MCLs or are not detected at all.

7.3.4 Radionuclides

In December 2000, the USEPA announced updated standards for radionuclides. This rule became effective in December 2003. All community water systems are required to meet the MCLs listed in Table 7.6 and requirements for monitoring and reporting. All systems were required to complete initial monitoring and phase in the monitoring requirements between December 8, 2003, and December 30, 2007. Initially, utilities were required to undergo four consecutive quarters of monitoring for gross alpha, combined radium-226/-228, and uranium. Only systems that were considered "vulnerable" were required to monitor for gross beta (quarterly samples), tritium, and strontium-90 (annual samples). The initial monitoring was used to determine if the system would have to perform reduced or increased monitoring.

Table 7.6 Regulated Radionuclides

Radionuclide	MCL(1)
Radium – 226	3 pCi/L
Combined Radium – 226 and 228	5 pCi/L
Uranium	30 µg/L
Gross Alpha (excluding Uranium)	15 pCi/L
Beta Particle and Photon Radioactivity	4 millirem/year(2)
Tritium	20,000 pCi/L(2)
Strontium-90	8 pCi/L(2)

Notes:
(1) Environmental Protection Agency, 40 CFR 141.66.
(2) According to USEPA 40 CFR 141.66, "average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water must not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year." The MCLs for tritium and strontium-90 are assumed to produce body organ doses equivalent to 4 millirem/year.
pCi /L - picocurie per liter.

7.3.4.1 Monitoring Requirements

The WAC states "The purveyor may omit analysis for radium-226 and radium-228 if the gross alpha particle is less than 5 pCi/L." The City is required to sample for radium-228 and monitor gross alpha at all wells every six years. The USEPA has adopted a new schedule of sampling once every three years that has not yet been adopted by DOH. In Washington State, natural occurrence levels of the regulated radionuclides have generally been quite low.

7.3.4.2 Compliance

The City is in full compliance with the monitoring requirements and has no exceedances to date.

7.3.5 Arsenic Rule

In January 2001, USEPA promulgated a new standard that requires public water systems to reduce arsenic levels in drinking water. The final rule became effective in 2002 and required compliance by 2006. The rule applies to all community water systems and non-transient, non-community water systems, regardless of size. The rule not only establishes an MCL for arsenic (0.010 mg/L), based on a running annual average (RAA) of quarterly results and an MCLG for arsenic (zero), but also lists feasible and affordable

technologies for small systems that can be used to comply with the MCL. However, systems are not required to use the listed technologies in order to meet the MCL.

Initial monitoring of arsenic required groundwater systems to take one sample between 2005 and 2007. Monitoring requirements decreased to one sample every three years (for groundwater systems) if the initial result is less than the MCL. Monitoring requirements increased to quarterly samples if the initial results were greater than the MCL. Each entry point to the distribution system should have been tested, unless otherwise specified by the State.

The arsenic rule has been adopted by the Washington DOH as a revision to the arsenic MCL under WAC 249-290-310.

7.3.5.1 Monitoring Requirements

Monitoring requirements are once every three years, per requirements for IOCs. Arsenic must be monitored at each entry point to the distribution system as part of the IOC monitoring framework. If any sampling point is in violation of an MCL, the system is in violation.

7.3.5.2 Compliance

The City is in full compliance with the monitoring requirements and has no exceedances to date.

7.3.6 PFAS NPDWR

The USEPA initially announced a finalized National Primary Drinking Water Regulation (NPDWR) for six PFAS in drinking water on April 10, 2024. The final regulations set MCLs for five PFAS as individual components: Perfluorooctanoic acid (PFOA), perfluorooctyl sulfonate (PFOS), perfluorohexanesulfonic acid (PFHxS), perfluorononanoic acid (PFNA), and hexafluoropropylene oxide dimer acid (HFPO-DA commonly known as GenX). Additionally, an MCL was set for PFAS mixtures containing at least two or more of the following: PFHxS, PFNA, GenX, and perfluorobutane sulfonic acid (PFBS). The Hazard Index (HI) is used for the PFAS mixture MCL to account for combined and co-occurring levels of these PFAS compounds in drinking water. MCLGs were also established for these six PFAS compounds.

On May 14, 2025, USEPA announced its intent to modify the already promulgated NPDWR. This change would keep MCLs for PFOA and PFOS but rescind MCLs for the other PFAS under the existing NPDWR. Additionally, the intended changes included an extended timeline for compliance from 2029 to 2031. However, it is unclear at this time if these proposed changes will take effect, as these changes must undergo full rulemaking process under the Administrative Procedure Act, legal review, and potential judicial review. While the USEPA expects to finalize their proposed revision in the spring of 2026, it is unclear if it will ever take effect. The City should plan to operate on the assumption to comply with MCLs by 2029. For the purposes of this document, it is assumed that the currently promulgated NPDWR will remain in effect as it is the more conservative approach to managing the regulations and maintaining compliance.

Prior to issuance of UCMR 5, USEPA concluded there was enough data on the health effects of PFAS to begin the process of regulating certain PFAS compounds. The following describes the sequence of key actions taken by USEPA related to PFAS:

- In February 2021, USEPA issued notice for its intent to enforce limits on PFAS in drinking water to safeguard communities from PFAS contamination, specifically PFOA and PFOS.
- In June 2022, USEPA announced new health advisory levels (HAL) for four PFAS: PFOA, PFOS, GenX, and PFBS. This was the first time HALs had been issued for PFBS and GenX. For PFOA and PFOS, these new HALs are several orders of magnitude below the HAL announced in 2016 (i.e., 70 nanograms per liter [ng/L] for PFOA and PFOS combined). The new HALs for PFOA and PFOS were labelled "interim" because the USEPA's draft analysis of health studies for PFOA and PFOS were still undergoing review by the Science Advisory Board at the time of the announcement.
- On March 14, 2023, USEPA announced a proposed NPDWR to establish legally enforceable levels for not only PFOA and PFOS but also PFNA, GenX, PFHxS, and PFBS.
- On April 10, 2024, USEPA announced the final NPDWR for six PFAS. Under the NPDWR, the USEPA established MCLs for six PFAS in drinking water: PFOA, PFOS, PFHxS, PFNA, and GenX as contaminants with individual MCLs, and PFAS mixtures containing at least two or more of PFHxS, PFNA, GenX, and PFBS using a Hazard Index MCL to account for the combined and co-occurring levels of these PFAS in drinking water. USEPA also finalized health-based, non-enforceable MCLG for these PFAS. A summary of these levels is provided in Table 7.7. An explanation of the HI approach follows the table.

Table 7.7 MCLs and MCLGs for Specific PFAS Compounds in Drinking Water

Compound	Final MCLG	Final MCL (Enforceable Levels)
PFOA	Zero	4.0 ppt(1)
PFOS	Zero	4.0 ppt(1)
PFNA	10 ppt	10 ppt
PFHxS	10 ppt	10 ppt
HFPO-DA (GenX)	10 ppt	10 ppt
Mixtures containing two or more of PFHxS, PFNA, HFPO-DA (GenX), and PFBS	HI of 1.0 (unitless).	HI of 1.0 (unitless).

Notes:
(1) In aqueous matrixes, ppt can also be expressed as ng/L.
ppt - parts per trillion.

While PFOA, PFOS, PFNA, PFHxS, and GenX have their own individual MCLs and MCLGs under the NPDWR, a HI of less than 1.0 must also be met to comply with the rule. The HI is used to reduce the risk of health impacts from a chemical mixture. The HI is calculated via a sum of fractions. Each fraction compares the level of each PFAS measured in the water to the health-based water concentration. The equation below summarizes the HI calculation. It includes indexes for PFHxS, PFNA, and GenX (all of which have their own individual limits as MCLs) and PFBS (which does not have its own individual limit as an MCL).

With the HI approach, the concentration of each of these four PFAS would be divided by a corresponding health-based value (10ppt for PFHxS, PFNA, and GenX; 2000 ppt for PFBS). The sum of these fractions needs to be below 1.0 to comply with the NPDWR. Note, however, that an exceedance must be triggered

by two or more chemicals. For example, a GenX concentration of 11 ppt alone would not cause a HI exceedance, but it would cause an MCL exceedance. A PFBS concentration of over 2,000 ppt alone would not cause a HI exceedance unless another chemical within the calculation exceeded 10 ppt.

$$HI = \frac{[PFHxS]}{10ppt} + \frac{[GenX]}{10ppt} + \frac{[PFNA]}{10ppt} + \frac{[PFBS]}{2000\ ppt}$$ Hazard Index Calculation

7.3.6.1 Monitoring Requirements

Under the NPDWR, public water systems (PWS) will be required to take initial monitoring samples at all entry points to the distribution system based on the frequency outlined in Table 7.8. This initial monitoring must be completed by 2027. The City has already completed this initial monitoring requirement through sampling efforts under the SAL requirements for PFAS, which are discussed more in the following section.

Systems with appropriate, previously acquired monitoring data from UCMR 5, state-led, or other applicable monitoring programs using USEPA Methods 533 or 537.1, will not be required to conduct separate initial monitoring for regulated PFAS.

Table 7.8 PWS Sampling Requirements under USEPA's Proposed PFAS Rule

PWS Type	Monitoring Frequency
Groundwater Systems serving >10,000 persons	Monitor regulated PFAS quarterly within a 12-month period.
Groundwater Systems serving ≤ 10,000 persons	Monitor regulated PFAS twice within a 12-month period, with sampling events conducted at least 90 days apart.
Surface Water Systems	Quarterly within a 12- month period. Samples are required to be collected 2 to 4 months apart.

After initial monitoring, PWS must monitor for rule compliance on a quarterly basis at each entry point to the distribution system. However, based on the initial monitoring results, agencies may reduce compliance monitoring frequency if the monitoring results are below the rule trigger level (RTL). The RTL is half of the MCLs or HI (i.e., 2 ng/L for specific PFAS with an MCL, or an HI of 0.5). Primacy agencies (states) have the flexibility to reduce monitoring to annually or triennially for systems that are consistently below RTLs. Any results above the RTL automatically require a reversion back to quarterly sampling.

For systems required to monitor quarterly, compliance will be determined by running annual averages at the sampling point. When calculating the running annual averages, if a sample result is less than the practical quantitation level for the monitored PFAS, the PWS may use zero as the result on that sample to calculate the average for compliance purposes.

7.3.6.2 Compliance

The PFAS NPDWR has a 5-year compliance window from its year of inception (2024) with specific requirements throughout this timeframe:

- Within three years of rule promulgation (2024-2027):
  - » Initial monitoring must be complete.

- Starting three years following rule promulgation (2027-2029):
  - Results of initial monitoring must be included in Consumer Confidence Reports (i.e., Annual Water Quality Report).
  - Regular monitoring for compliance must begin, and results of compliance monitoring must be included in Consumer Confidence Reports.
  - Public notification for monitoring and testing violations.
- Starting five years following rule promulgation (starting 2029):
  - Public notification for MCL violations.
  - Comply with all MCLs (including performing mitigation measures or installing PFAS treatment as required to comply with the MCLs).

All requirements described in this section will supersede current DOH SALs related to PFAS as per the WAC 246-290-315 Subsection (8) unless the State of Washington enacts more stringent or additional requirements beyond those listed in the PFAS NPDWR.

Due to the timeframe in which the PFAS NPDWR requirements are rolled out, the WAC 246-290-315 is temporarily more stringent than the PFAS NPDWR until 2027. Currently in Washington, PWS must report exceedances of certain PFAS above SALs (summarized previously in Table 7.6.1 and Section 7.3.9.1.). The City of Camas has conducted its required initial monitoring as required by the PFAS NPDWR, but will also continue to comply with monitoring and reporting requirements under WAC 246-290-315 and 246-290-320 until 2027, when the reporting requirements under the PFAS NPDWR become more stringent (unless the State of Washington enacts more stringent requirements).

The City is in full compliance with PFAS monitoring requirements, however sampling data collected have indicated certain wells within the City's water supply exceed MCLs. To comply with the PFAS NPDWR by 2029 some form of PFAS mitigation will be needed at these wells. Additionally, the City has taken action to mitigate PFAS by constructing a treatment facility at Well 13 and evaluate mitigation alternatives at other wells of concern.

7.3.7 Washington State Action Levels for PFAS

The State of Washington's DOH has primacy to establish SALs and state MCLs that set more stringent or more encompassing requirements for public water systems than federal requirements. The basis on which SALs or State MCLs may be established is described in WAC 246-290-315.

DOH set SALs for certain PFAS in December of 2021. DOH considers establishment of SALs when human exposure to the contaminant in question can occur through drinking water, and when the contaminant is known or likely to occur in public water systems at levels of public health concern.

DOH may develop a SAL based on the following:

- Evaluation of available peer-reviewed scientific literature and government publications on fate, transport, exposure, toxicity, and health impacts of the contaminant and relevant metabolites;

- An assessment based on the most sensitive adverse effect deemed relevant to humans and considering susceptibility and unique exposures of the most sensitive subgroup such as pregnant women, fetuses, young children, or overburdened and underserved communities; and
- Technical limitations to achieving the SAL such as insufficient analytical detection limit achievable at certified drinking water laboratories.

SAL exceedance requires follow-up action as described in WAC 246-290-320.

- A State MCL may be established by DOH in specific cases where:
- Regulating the contaminant in question presents a meaningful opportunity to reduce exposures of public health concern for persons served by public water systems.
- Where there is a need for an enforceable limit to achieve uniform public health protection in Group A public water systems.
- The need for an enforceable limit to support source water investigation and clean-up of a contaminant in drinking water supplies by responsible parties.

State MCLs would require treatment for the contaminant in question, whereas SALs require specific follow-up actions as described in WAC 246-290-320. DOH has not yet established any State MCLs but has established a series of SALs that were enacted in late 2021 and became effective in 2022. These specific SALs are described further in the Compliance section below. Note that DOH modified the SALs in December of 2025 to more closely align with the federal USEPA MCLs.

7.3.7.1 Monitoring Requirements

The City is in compliance with all monitoring rules associated with constituents subject to SALs. WAC 246 290-300 describes the monitoring requirements for contaminants subject to DOH SALs. These requirements are summarized in Table 7.9.

Table 7.9 Sampling Requirements for WA SALs

Contaminant or Group of Contaminants	Initial Sampling	Routine Sampling Frequency	Sampling Location
PFAS with prescribed SALs (see compliance section below)	One sample on or before December 31, 2025	Once every three years	Per the locations described in WAC 246-290-300.7b.

While one sample is required before the end of 2025, sampling requirements for UCMR 5 will generally fulfill this requirement for large public water systems, as is the case for Camas. UCMR 5 sampling requirements (described in Sections 7.3.8 and 7.3.8.1) include the five PFAS that are subject of the Washington SALs. However, sampling for contaminants with SALs may bring specific follow-up actions. These follow up actions generally include notification of the result to DOH, and public notification. There are also follow-up requirements for samples that do not exceed the SALs but result in a certain percentage of the SAL.

7.3.7.2 Compliance

The City is currently in compliance with existing state regulations regarding PFAS sampling and public notification requirements under WAC 246-290-320. Some sampling efforts at Well 13 showed PFAS levels above the SALs. As a result, the City has taken follow-up actions, including follow up monitoring and

public notification, in accordance with WAC 246-290-320. Although a SAL exceedance does not trigger the need for treatment, the City is also currently constructing a PFAS treatment system for Well 13.

Washington's SALs for PFAS have been in effect since 2022 and currently govern monitoring and follow-up actions for five PFAS. Utilities must complete initial SAL sampling by December 31, 2025, and continue routine monitoring every three years thereafter. In contrast, the USEPA's PFAS NPDWR was finalized in April 2024, with initial monitoring required by 2027 and enforceable MCLs beginning in 2029. This creates an overlap period where SAL requirements remain in force until federal MCLs become effective. Washington's emergency rulemaking in 2024–2025 clarified that SAL protections will continue through this transition to avoid any regulatory gap.

Washington has indicated through emergency rules and recent updates that SALs will effectively transition to match the federal MCLs when they become enforceable in 2029. However, in December 2025, DOH updated the SALs to align with the MCL values. They are effective January 15, 2026.

The following table shows the SAL values that existed from 2022 through 2025, as well as what the updated SAL values are.

Table 7.10 Washington State Action Levels

Compound	Old SAL – Previously Effective 2022 through 2025 (ppt)	Updated SAL - Effective Jan 15, 2026 (ppt)
PFOA	10	4
PFOS	15	4
PFNA	9	10
PFHxS	65	10
PFBS	345	N/A (part of HI)
HFPO-DA (GenX)	N/A	10
Mixtures containing two or more of PFHxS, PFNA, HFPO-DA (GenX), and PFBS	N/A	HI of 1.0 (unitless).

Notes:
(1) Old SAL exceedances were based on a single sample exceedance (with second sample averaging allowed). Updated SAL exceedances are based on annual running averages to be in alignment with federal MCL rules.
(2) The hazard index calculation is the same as the MCL hazard index calculation.

The City does not anticipate any compliance issues with the updated SALs. The Tier 2 notification requirements remain in place, they are just now required for exceedances of the updated SAL values. The City is actively implementing PFAS treatment at Well 13 and is developing a plan for treatment at other well sites in order to maintain compliance with drinking water regulations when the federal MCL enforcement begins in 2029.

7.3.8 Manganese

The USEPA included manganese, a naturally occurring ion, in UCMR4 to help assess if a primary MCL, in addition to the existing secondary MCL, should be established. Manganese is currently regulated by DOH as a secondary standard; any exceedances trigger follow-up actions as directed by DOH. Elsewhere, in 2019, Canada established two new values regulating manganese in drinking water: A health-based

maximum allowable concentration (analogous to the US's primary contaminant MCL) of 0.12 mg/L and an aesthetic objective (analogous to the US's secondary contaminant MCL) of 0.02 mg/L. The aesthetic objective for manganese is below the USEPA's current secondary MCL of 0.05 mg/L.

Manganese was included in sampling for UCMR4 to help assess if it should be moved from a secondary MCL to a primary MCL. As of March 10, 2020, the USEPA determined there was not enough information to proceed to the regulatory determination assessment phase. Manganese was included in Contaminant Candidate List 5, finalized in 2022.

However, USEPA has established HALs for manganese. HALs establish a specific duration and threshold concentration of exposure below which no health effects are anticipated to occur. For all persons, USEPA has a one-day and 10-day HAL of 1 mg/L and a lifetime HAL of 0.3 mg/L. For bottle-fed infants younger than six months, the USEPA also has a 10-day HAL of 0.3 mg/L.

In December 2023, DOH published updated recommendations pertaining to manganese, which included the following:

- Manganese treatment should be installed if levels exceed the 0.05 mg/L secondary MCL.
- Treatment should reduce manganese levels to below 0.02 mg/L.
- Public notification should be provided if manganese levels exceed 0.3 mg/L, consistent with USEPA HALs discussed above.

7.3.8.1 Monitoring Requirements

The City monitors for manganese as part of its complete inorganic chemical test panel which is required once every nine years.

7.3.8.2 Compliance

The City is in full compliance with the monitoring requirements and has no exceedances to date.

7.3.9 Surface Water Treatment Rules

7.3.9.1 Surface Water Treatment Rule

On December 31, 1990, USEPA promulgated the Surface Water Treatment Rule (SWTR) to establish filtration and disinfection as a drinking water treatment technique in lieu of MCLs for Giardia lamblia, viruses, HPC bacteria, Legionella, and turbidity. The SWTR is based on the premise that all surface water and GWI are at risk of microbiological contamination, and the previous requirements were inadequate to prevent waterborne disease outbreaks. The SWTR requires 99.9 percent (3 log) removal and/or inactivation of *Giardia* cysts, and 99.99 percent (4 log) removal and/or inactivation of viruses. To meet these requirements, surface water systems must disinfect according to strict requirements, must filter water unless certain source water-quality and site-specific conditions are met, and must be operated by qualified personnel. To avoid the filtration requirement, the following criteria must be met:

1. 90 percent of the samples taken from the source water must have fewer than 100 total coliform bacteria per 100 milliliters (mL) and fewer than 20 fecal coliform bacteria per 100 mL.
2. The turbidity level prior to disinfection must not exceed 5.0 nephelometric turbidity unit (NTU).

3. *Giardia* and virus inactivation requirements must be met, providing redundant disinfection components and maintaining required disinfection residuals.
4. An approved watershed control program must be implemented with annual onsite inspections.
5. Total Coliform Rule (TCR) requirements in the distribution system and THM requirements must be met.
6. The water system must be free of waterborne disease outbreaks.
7. The purveyor must have alternative operating plans to address high turbidity levels and other water quality issues.

Utilities that use unfiltered water must maintain a disinfectant residual throughout the water distribution system. At entry points to the distribution system, residual disinfectant concentrations cannot be <0.2 mg/L for more than four hours. At distribution system sample locations, residual disinfectant concentrations cannot be undetectable in greater than 5 percent of samples in a month, for any two consecutive months. Heterotrophic plate count (HPC) ≤ 500/mL is deemed to have detectable residual disinfectant.

GWI is regulated by the SWTR. The intent is to provide the same level of treatment for groundwater sources that are at risk for contamination by pathogens as surface water supplies. Examples of water sources that may be classified as GWI are shallow wells, springs, infiltration galleries, and Ranney wells.

7.3.9.2 Long Term 2 Enhanced Surface Water Treatment Rule

The LT2ESWTR is intended to address a number of deficiencies in the original 1990 SWTR, including the following:

1. Cryptosporidium is not addressed in the SWTR.
2. Pathogen reduction may not be adequate in poorer quality waters.
3. Virus disinfection requirements may be greater than indicated in the SWTR.
4. Disinfectants and Disinfection Byproducts Rule (DBPR) may undermine the SWTR by causing utilities to reduce disinfectant residuals.

USEPA developed the ESWTR in two stages. The proposed Interim ESWTR was published in the Federal Register on 29 July 1994. USEPA finalized the Interim ESWTR and Stage 1 DBPR in November 1998, as required by the 1996 Amendments to the SDWA, Section 1412(b)(2)(C). The final rules resulted from formal regulatory negotiations with a wide range of stakeholders that took place in 1992-93 and 1997. On January 16, 2001, USEPA published final revisions to the Interim ESWTR and Stage 1 DBPR. The LT1ESWTR was promulgated in February 2002 and builds on the requirements of the SWTR. The LT1ESWTR specifies treatment requirements to address *Cryptosporidium* and other microbial contaminants in public water systems serving less than 10,000 persons.

The LT2ESWTR proposed rule was promulgated in August 2003 and published in the Federal Register on January 5, 2006. The LT2ESWTR requires PWSs that use surface water or groundwater under the direct influence of surface water to monitor their source water (influent water prior to treatment) for *cryptosporidium*, *E. coli*, and turbidity for a period of two years starting six months after the rule is finalized. Based on the results of this monitoring, water systems will be classified in one of four risk bins. Systems classified in higher risk bins must provide 90 to 99.7 percent (1.0 to 2.5 log) additional reduction

of *Cryptosporidium* levels. The regulation specifies a range of treatment and management strategies, collectively termed the "microbial toolbox," that systems may select to meet their additional treatment requirements. All unfiltered systems must provide at least 99 or 99.9 percent (2 or 3-log) inactivation of *Cryptosporidium*, depending on the results of their monitoring.

7.3.9.3 Monitoring requirements

Monitoring requirements are dictated by source water quality and the selected treatment processes. The City has recently completed construction of a new SSF Plant for its surface water sources. The City's surface water sources have been listed as Bin 1 sources for *Cryptosporidium* removal and do not require additional treatment beyond slow sand filtration. Specific treatment objectives and monitoring for the slow sand facility include:

- Turbidity reduction as required for slow sand filtration processes, providing finished water turbidity less than 1 NTU in 95 percent of samples each month and no turbidity samples greater than 5 NTU.
- Provide 3-log giardia removal and inactivation through a combination of 2-log removal by filtration and 1-log inactivation by chlorine disinfection.
- Provide a total 4-log virus inactivation and removal through filtration and disinfection.
- Provide a continuous free chlorine residual of not less than 1.0 mg/L entering the distribution system at the water quality station and pressure reducing valve vault at NE 277th Avenue and NE 14th Street.
- Provide treated water pH of 7.5 plus or minus 0.2 units (if the optional caustic feed system is installed and used for pH adjustment).
- Provide a fluoride residual of 0.7 mg/L.

7.3.9.4 Compliance

The City has constructed a new slow sand filtration treatment plant that is in full compliance with all surface water treatment rules.

7.3.9.5 Filter Backwash Recycling Rule

The Filter Backwash Recycling Rule (FBRR) regulates the recycling of filter backwash water within the treatment process of public water systems. The purpose of the rule is to require systems to review their recycle practices and, where appropriate, work with the DOH to make any necessary changes to recycle practices that may compromise microbial control. The City's slow sand filter backwash water is wasted to a detention pond rather than recycled to the head of the plant and thus the FBRR does not apply.

7.3.10 Groundwater Rule

The USEPA enacted the final Groundwater Rule (GWR) January 8, 2007, for the purpose of providing increased protection against microbial pathogens in public water systems that use untreated groundwater. The GWR will apply to public water systems that serve groundwater as well as to any system that mixes surface and groundwater, if the groundwater is added directly to the distribution system and is provided to customers without providing disinfection contact time.

To implement the GWR, USEPA is taking a risk-based approach to protect drinking water from groundwater sources that have been identified as being at the greatest risk of fecal contamination. This strategy includes four primary components:

1. **Sanitary Surveys**. Sanitary surveys must be conducted every three years and meet the provisions of the 1998 Interim ESWTR as it relates to populations served. In addition, the sanitary survey shall implement the eight elements of the USEPA/State Joint Guidance on Sanitary Surveys. These elements relate to source protection; identification of the physical components and their condition; and description and implementation of programs for treatment, distribution, storage, pumping, monitoring, operation and maintenance; and operator certification.
2. **Source Water Monitoring**. Source water monitoring is triggered when a system does not sufficiently disinfect drinking water to achieve 4-log (99.99 percent) virus removal and identifies a positive routine sample during its TCR monitoring and hydrogeologic sensitivity assessment monitoring (at the State's discretion) targeted at high-risk systems. Once a total coliform-positive sample is found within a distribution system, the system is required to collect one source water sample per source and monitor for a fecal indicator. Washington State may choose to issue a waiver if the groundwater source has a hydrogeologic barrier.
3. **Corrective Action**. Corrective action is required for any system with a significant deficiency or evidence of source water fecal contamination. Corrective actions must be taken by "groundwater systems that have a significant deficiency or have detected a fecal indicator in their source water." USEPA guidelines recommend that corrective actions take place within 90 days, or longer if approved by the State. The problem should be solved by eliminating the contamination source, correcting the significant deficiencies, or providing an alternate source of water supply.
4. **Compliance Monitoring**. Compliance monitoring ensures that treatment technology installed to treat drinking water reliably achieves 4-log virus inactivation. Compliance monitoring applies to all groundwater systems that disinfect as a corrective action. Systems serving greater than 3,300 individuals must continuously monitor their disinfection treatment process. If disinfection concentrations are below the required level, the system must restore disinfection concentration within fours hours.

The compliance date for triggered source water monitoring and the associated corrective actions, as well as compliance monitoring, was December 1, 2009. Initial sanitary surveys should have been completed by December 31, 2012. However, for community water systems that have been identified by the State as outstanding performers (generally those that have treatment that provides 4-log virus inactivation or removal at all sources), the initial sanitary survey must be completed by December 31, 2014.

Many of the requirements of the GWR are determined by the individual state agencies. The requirements of the GWR were adopted by the Washington DOH into WAC 246-290 in November 2010. In addition, DOH has provided a Fact Sheet for Group A utilities with recommended actions to prepare for the GWR. These actions include the following:

- Correct deficiencies from the last sanitary survey.
- Install a sample tap at each wellhead.
- Know specifically where each well's water goes. Triggered source water monitoring will require monitoring of all sources, unless it can be shown that the area of concern in the distribution system is only served by a limited number of sources.

- Update the emergency response plan, to be ready to provide alternate water, if needed.
- If currently treating groundwater from a well, contact the regional office engineer to confirm whether you currently achieve 4-log virus inactivation. Systems that treat to this level will not be required to conduct triggered source water monitoring but instead will be required to meet treatment technique monitoring requirements.

7.3.10.1 Monitoring Requirements

The DOH is not requiring all systems to perform assessment monitoring. In addition, DOH has indicated that the sanitary surveys completed under the GWR will not differ significantly from those currently required.

Triggered source water monitoring is required at all sources if a distribution system sample tests positive for total coliform (as collected under the total coliform regulations). The federal GWR includes a provision that positive coliform samples attributed to a distribution system source will not trigger source water monitoring. The DOH has not yet decided on the criteria for determining whether a sample can be attributed to the distribution system but may not require triggered source monitoring if they document in writing that the coliform positive sample was attributed to a distribution system deficiency. Source water monitoring will be required at fewer sources if systems can demonstrate the sources impacting each TCR sample site. However, such a plan would need to be pre-approved by the DOH.

The federal GWR also allowed for reduced source water monitoring after 12 non-detect samples. The DOH has not yet established a reduced monitoring standard.

7.3.10.2 Compliance

The City completed its sanitary survey in 2024. No reduction in monitoring resulted from the survey. The City is in full compliance at this time.

7.3.11 Unregulated Contaminant Monitoring Rule

The primary source of occurrence data used to identify emerging contaminants is collected via UCMR. This data is used to support regulatory decision-making regarding contaminants. The SWDA Amendments of 1996 established the following protocols for the UCMR:

- Monitor no more than 30 contaminants every five years.
- Monitor only a representative sample of public water systems serving fewer than 10,000 people (all public water systems serving more than 10,000 people are required to monitor for the selected contaminants).
- Store analytical results in a National Contaminant Occurrence Database.

The Unregulated Contaminant program requires that every five years, the USEPA issues a list of unregulated contaminants for monitoring. Monitoring under this program is conducted using a tiered approach based on the level of development of the selected analytical method. Large water systems (serving more than 100,000 people) are required to monitor for both List 1 and List 2 chemicals:

- Assessment Monitoring (List 1): is conducted for contaminants that have analytical method technologies that are well established.

- Screening Survey (List 2): is conducted for contaminants with more recently developed analytical methods, which employ technologies that are not as widely used, or for which laboratory capacity required to conduct larger-scale Assessment Monitoring may be insufficient.
- Pre-Screen Testing (List 3): is conducted for contaminants that have very new or specialized analytical methods.

The USEPA identified and published unregulated contaminants for the first direct implementation of the UCMR (UCMR1) in 1999, which required some public water systems to monitor for unregulated contaminants from 2001 to 2005. To date, there have been five UCMRs published by the USEPA. The most recent implementation of this rule (UCMR5) was published on December 27, 2021. The implementation period for UCMR5 is 2022 to 2026 with sampling taking place from 2023 through 2025. The final list of 30 contaminants includes 29 PFAS and lithium.

The 1986 amendments to the SDWA require public water systems to monitor for unregulated contaminants every five years and submit these data to the states. The intent of this program is to gather scientific information on unregulated contaminants to determine if regulations are required to protect human health. Both the 1993 and 1996 amendments to the act added new lists of contaminants, which led the USEPA to develop a revised program for monitoring. The new program became known as the Unregulated Contaminant Monitoring Regulations (UCMR 1999). The new UCMR program began in 2001 and produces a new list of unregulated contaminants for monitoring every five years.

Under the UCMR program, USEPA asks large systems to take two sets of samples for unregulated contaminants at six-month intervals. There are two tiers of contaminants in UCMR 1: List 1 - Assessment Monitoring, and List 2 - Survey Screening. List 1 contaminants are sampled by all water systems serving over 10,000 people. There are 10 List 1 contaminants, consisting of flame-retardants and other priority contaminants (USEPA Method 527), and some explosives (USEPA Method 529). List 2 contaminants are analyzed using less common analytical techniques, and only a portion of the purveyors required to test for List 1 contaminants are required to test for List 2. List 2 contaminants include Acetanilide pesticides and degraded products (USEPA Methods 525.2 and 535), and Nitrosamines/N-nitrosodimethylamine (NDMA) (USEPA Method 521).

The UCMR is used as a tool for the USEPA to collect data, and ultimately establish regulations for contaminants that are suspected to be present in drinking water but do not have health-based standards set under the SDWA.

The second cycle (UCMR 2) of monitoring was published in the Federal Register on January 4, 2007. UCMR 2 required monitoring for 25 contaminants using five analytical methods during 2008- 2010. The third cycle (UCMR 3) of monitoring was published on May 2, 2012. UCMR 3 required monitoring for 30 contaminants: 28 chemicals, and 2 viruses. Monitoring occurred during 2012 to 2015. The fourth cycle (UCMR 4) of monitoring was published on December 20, 2016. UCMR 4 required monitoring for 30 chemicals, which included nine cyanotoxins and one cyanotoxin group; two metals; nine pesticides; three brominated HAA5 DBP groups, three alcohols, and three semi-volatile organic chemicals. Monitoring occurred during 2018 to 2020. The fifth cycle (UCMR 5) was published on December 27, 2021, and is currently ongoing, requiring monitoring for applicable systems between 2023 and 2025. UCMR 5 requires monitoring for 29 different PFAS and lithium.

From 2013 to 2015, USEPA's third installment of UCMR sampling efforts measured for six PFAS. These included PFOS and PFOA, two of the most notable and prevalent PFAS compounds. At the time, there

were limited detections nationwide, but laboratory analysis methods could not measure levels low enough to reflect the presence at very low concentrations of these compounds across the US. For the 2023 to 2025 period, the 29 different PFAS compounds can now be measured at relatively low levels through advancements in laboratory analysis methods.

Results from UCMR 5 are currently being reported and compiled as of the date of this report. As of August 2023, around 20 percent of systems have reported results so far and around 8 percent of those systems have seen detections of PFOA and PFOS. However, these results are from Quarter 1 of four quarterly reporting requirements, so some public water systems with no detections may show detections in later reports.

7.3.11.1 Monitoring Requirements

The City has conducted monitoring as required for the previous UCMRs. For systems required to sample under UCMR 5 with a groundwater source (including the City), sampling must occur two times during a consecutive 12-month monitoring period, where sampling events occur 5-7 months apart. For systems with a surface water source, a groundwater source under the direct influence of surface water, or a mixed-source system, sampling must occur four times during a consecutive 12-month monitoring period. Sampling events must occur 3 months apart (quarterly sampling). The City's efforts for UCMR 5 sampling efforts are currently ongoing.

7.3.11.2 Compliance

The City is in compliance with the UCMR 1 through 4 testing requirements and expects to comply with all monitoring requirements of UCMR 5.

7.4 Distribution System Water Quality

Regulations that address distribution system water quality are described herein.

7.4.1 Total Coliform Rule

Coliform bacteria describe a broad category of organisms routinely monitored in potable water supplies. Though not all coliform bacteria are pathogenic in nature, they are relatively easy to identify in laboratory analysis. If coliform bacteria are detected, then pathogenic organisms may also be present. Bacterial contamination in a water supply can cause a number of waterborne diseases; therefore, these tests are strictly monitored and regulated by DOH.

The TCR specifies two types of MCL violations, "monthly" and "acute." A purveyor is required to notify both DOH and system consumers if either a monthly or acute MCL violation occurs. The TCR also requires secondary disinfection in accordance with the following:

- A minimum disinfectant residual of 0.2 mg/L free chlorine or 0.5 mg/L chloramines measured as total chlorine must be continually present at the entrance of the distribution system, with a detectable chlorine residual maintained throughout the distribution system.
- A sample with HPCs less than 500 colony forming units per 100 mL is assumed to carry the required minimum residual.

The original 1989 TCR rule was revised on February 13, 2013. Water systems must comply with the requirements of the Revised Total Coliform Rule (RTCR) by April 1, 2016. The revision requires public water systems that are vulnerable to microbial contamination to identify and fix problems; and establishes criteria for systems to qualify for and stay on reduced monitoring, which could reduce water system burden and provide incentives for better system operation. The rule changes associated with the RTCR are summarized below:

- Monitoring Changes: The RTCR links monitoring frequency to water quality and system performance.
- Public Notification Changes: The RTCR requires public notification when an *E. coli* MCL violation occurs, or when a utility fails to conduct the required assessment and corrective action.
- MCL Changes and Treatment Technique Violation: The RTCR replaces the MCL and MCLG for total coliforms with a MCL and MCLG for *E. coli*, as well as a treatment technique for coliforms.
- New Assessment Requirements: As part of the new treatment technique requirements, all utilities must conduct an assessment to find and fix any vulnerabilities when a treatment technique trigger occurs. Systems must conduct a Level 1 assessment or a more complex Level 2 assessment depending on the level of concern raised by the results of total coliform sampling.
- Corrective Action Requirements: Utilities are responsible for correcting any sanitary defects found through Level 1 or Level 2 assessments within 30 days or on a schedule approved by the DOH if this timeframe is not possible.

7.4.1.1 Monitoring Requirements

Monitoring requirements are described in the City's coliform monitoring plan (CMP). The City currently collects 30 samples per month from 26 locations based on a residential population of 31,794 as provided by the DOH Water Quality Monitoring Schedule as of October 2025.

7.4.1.2 Compliance

Within the last 10 years the City has had three total coliform exceedances; one total coliform exceedance in 2018, 2020, and 2023. All follow-up tests were negative, and no public notification was required. The City is currently in full compliance with the TCR and its RTCR compliant CMP can be found in Appendix E.

7.4.2 Stage 1 Disinfectants and Disinfection Byproducts Rule

The Stage 1 DBPR was promulgated in December 1998 and regulates the concentration of disinfectants such as chlorine, chlorine dioxide, and chloramines, which are oxidants used to control waterborne disease. The DBPR also regulates DBPs such as TTHMs and HAAs, bromate, and chlorite. DBPs are formed when disinfectants used to control microorganisms react with natural organic matter in water.

The MCLs for THMs and HAAs are 0.080 and 0.060 mg/L, respectively. The four regulated trihalomethanes are chloroform, bromodichloromethane, dibromochloromethane, and bromoform. The five regulated HAAs are monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid. Compliance with the TTHM and HAA MCLs is based on a system-wide RAA of quarterly samples taken in the distribution system. The Stage 1 DBPR also introduced MRDL of 4 mg/L for free chlorine and chloramines, and 0.8 mg/L for chlorine dioxide based on an RAA of samples collected concurrent with TCR monitoring.

7.4.2.1 Monitoring Requirements

Monitoring locations under the Stage 1 DBPR were initially identified in an Initial Distribution System Evaluation (IDSE) prepared by the City in 2004. The City's IDSE explains that chlorine and chloramines are monitored as part of the CMP, which currently tests at 40 sites system wide. The City monitors quarterly for disinfectant residuals at each of these locations. Additionally, the IDSE identifies nine locations representing the longest detention time corresponding to each water treatment plant. The IDSE notes that because the City does not use ozone or chlorine dioxide, monitoring for bromate or chlorite is not necessary. Monitoring for DBPs included a TTHM and HAA sample from each site quarterly.

7.4.2.2 Compliance

The City meets the requirements of the Stage 1 DBPR.

7.4.3 Stage 2 Disinfectants and Disinfection Byproducts Rule

The Stage 2 DBPR was promulgated by the USEPA on January 4, 2006. The key provisions of the Stage 2 DBPR consist of:

- An IDSE to identify distribution system locations with high DBP concentrations. Further information is provided below.
- Site-specific locational running annual average (LRAA) instead of system-wide RAAs to calculate compliance data. LRAAs will strengthen public health protection by eliminating the potential for groups of customers to receive elevated levels of DBPs on a consistent basis.

The MCLs for TTHMs and HAA5 remain unchanged from the Stage 1 DBPR at 0.080 and 0.060 mg/L, respectively, although they will now be calculated as LRAAs.

The IDSE is the first step in Stage 2 DBPR compliance. Its intent is to identify sampling locations for Stage 2 DBPR compliance monitoring that represents distribution system sites with high TTHM and HAA levels. For systems serving more than 500 people, three options were available for the IDSE:

- 40/30 Waiver, which allows systems with no samples exceeding TTHM and HAA concentrations of 40 and 30 micrograms per liter (µg/L), respectively, during eight consecutive quarters to apply to waive the IDSE requirements.
- Standard Monitoring Program, which involves a one-year distribution system monitoring effort to determine locations that routinely show high TTHMs and HAA5 concentrations.
- System-Specific Study, based on historical data and a system model.

The Washington DOH adopted the Stage 2 DBPR on January 4, 2010.

7.4.3.1 Monitoring Requirements

The City was approved for a 40/30 waiver in 2006 and is currently required to collect two samples per year for THM and HAA5.

7.4.3.2 Compliance

The City is in compliance with monitoring requirements for the Stage 2 DBPR. Since April 2021, there have been no samples exceeding the MCL for THM or HAA5 as shown in Table 7.9. The results represent the range of samples from all sources sampled in a particular year.

Table 7.11 Disinfection Byproducts Rule Monitoring Results

Contaminant	MCL Goal	MCL	2021	2022	2023	2024
Haloacetic Acids (µg/L)	48	60	ND-1.4	ND	0.87-1.0	ND
Total Trihalomethanes (µg/L)	60	80	2.5-6.5	5.7-7.6	0.5-4.1	–2.9-3.5

7.4.4 Lead and Copper

The USEPA first promulgated the LCR to control lead and copper levels in drinking water in 1991. The LCR was revised in 2000 and 2007. The LCR sets an AL of 0.015 mg/L for lead and 1.3 mg/L for copper. The AL is exceeded if the concentration in more than 10 percent of tap water samples collected during any monitoring period is greater than the action level. If the 90th percentile value for tap water samples is above the action level, it does not signal a violation but may trigger other requirements that include water quality parameter monitoring, corrosion control treatment, source water monitoring/treatment, public education, and/or lead service line replacement. In 2018, the Centers for Disease Control and Prevention (CDC) revised the blood lead reference value for children to 3.5 micrograms per deciliter.

A revised definition of “lead free” was issued and became effective on January 4, 2014. This defines “lead-free” as <0.25 percent lead, and any new meters, pipe fittings, etc., that are installed will have to meet this new definition as well as any parts that are used in repairs.

In January 2021, the LCR was revised again with the effective date postponed to December 16, 2021, and a compliance deadline of October 16, 2024. In 2021, the revised LCR defined a trigger level of 0.01 mg/L for the system's 90th percentile level, additional actions upon system-wide action level exceedance (ALE), and additional actions upon individual tap sample ALE. Now, when the 90th percentile exceeds the trigger level, systems are required to implement additional planning, monitoring, and reevaluation of current treatment. When the 90th percentile exceeds the AL, systems are now required to notify all customers within 24 hours, begin semi-annual sampling, and either install corrosion control treatment (CCT) or reoptimize their system. Lastly, individual tap sample ALE will require 72-hour notice and "find-and-fix" efforts including identifying the lead source and taking action to reduce lead levels. Under the revised LCR, a Lead Service Line Inventory is required of all service lines on both the system and homeowner side of the meter. At a minimum, service lines must be classified as one of the following:

- Lead, where the line is made of lead.
- Non-lead evidence is required to support this determination.
- Galvanized requiring replacement:
  - Replacement is required where a galvanized service line is determined to be downstream of a current or former lead service line.
- Status unknown, where there is no documentation or evidence of the service line material type.

A Lead Service Line (LSL) Replacement Plan is required for systems with lead service lines, galvanized lines requiring replacement, or service lines where the material is unknown. Additionally, partial lead service

line replacement is no longer allowed. Public-side line replacement is now required when a private-side line is replaced. Table 7.10 summarizes the LCRR.

Table 7.12 Comparison of the Major Provisions of the TCR and the RTCR Rule Requirements

Focus Area	Rule Requirement
Identifying Areas Most Impacted	▪ Complete an LSL inventory. ▪ Systems without LSLs must demonstrate their absence.
Strengthening Treatment Requirements	▪ 10 µg/L TL in addition to the current 15 µg/L AL. ▪ If the TL is exceeded based on 90th percentile lead concentrations, systems must re-optimize CCT or conduct a study if CCT is not currently in place. ▪ Calcium hardness adjustment is no longer a lead CCT option and phosphate inhibitors must be orthophosphate. ▪ Calcium, conductivity, and temperature analyses are no longer required as part of the WQP sampling. ▪ If an individual tap sample exceeds 15 µg/L, systems must collect a follow-up sample, conduct WQP monitoring at or near the site (0.5-mile radius, similar pressure zone), and perform a corrective action. This is termed a "find-and-fix" approach.
Systematically Replacing LSL	▪ Systems with lead above the TL must develop a goal for LSL replacement; 3 percent LSL replaced per year with systems above the AL. ▪ No partial LSLs can be conducted. ▪ Utilities must replace their portion of an LSL within 45 days if the customer replaces their portion.
Increasing Sample Reliability	▪ Prioritize sample collection from sites served by LSLs. ▪ For sites with LSLs, the fifth liter should be collected. ▪ Collect samples in wide-mouth bottles with no cleaning, flushing, etc. prior to sample collection.
Improving Risk Communication	▪ Utilities must notify individual tap sample consumers within 3 days of a 15 µg/L sample detection. ▪ Utilities must inform customers served by an LSL or lead status unknown service line. ▪ Consumer Confidence Report must provide updated health effects language and information regarding LSL replacement programs. ▪ Utilities must notify system-wide customers of lead AL exceedance within 24 hours. ▪ Systems must improve public access to lead information, including LSL locations, and respond to requests for LSL information, deliver educational materials to customers during water-related work that could disturb LSLs, and provide increased information to health care providers.
Protecting Children in Schools and Childcare Facilities	▪ Develop a list of schools and childcare facilities by the 2024 compliance deadline. ▪ Test 20 percent of licensed childcare facilities and elementary schools each year. ▪ Provide testing to secondary schools on request. ▪ Provide information and communicate results to users of the facility, parents, Primacy Agency, and the local or state health department.

Notes:
TL - trigger level; WQP - water quality parameter.

On October 8, 2024, the USEPA issued the final Lead and Copper Rule Improvements (LCRI) that requires the identification and replacement of lead service lines within 10 years. In limited situations, systems with high proportion of lead service lines will be allowed additional time to complete service line replacements.

Additionally, under the LCRI water systems are required to regularly update the LSL Inventory that was required under the revised LCR. This rule also changes tap sampling requirements and lowers the lead action level from 15 µg/L to 10 µg/L.

7.4.4.1 Monitoring Requirements

The City must collect 30 samples every three years, based on the standard monitoring schedule. The most recent set of customer tap samples were collected in 2024.

7.4.4.2 Compliance

The City's monitoring results indicate that the City is in compliance with the requirements of the LCR. The City's LCR monitoring results for 2021 and 2024are presented in Table 7.11. Results represent the 90th percentile of all samples taken within a given period.

Table 7.13 Lead and Copper Rule Monitoring Results

Contaminant	MCL Goal (mg/L)	Action Level (mg/L)	2021 Result (mg/L)	2024 Result (mg/L)
Lead	0	0.015	ND	0.014
Copper	0	1.3	0.93	0.73

7.5 Water Quality Monitoring Program

Federal regulations related to system-wide requirements are discussed herein.

7.5.1 Consumer Confidence Report

The Consumer Confidence Report (CCR) Rule was finalized on September 19, 1998. Each July, community water systems must provide an annual report to customers providing information as to the quality of their drinking water supply. These reports are referred to as "Consumer Confidence Reports" or CCRs. These reports let customers know whether their water meets state and federal drinking water standards. The CCR includes information on the water source, the regulated and unregulated contaminants that have been detected during the year, and their concentrations. The report also provides information on DBPs or microbial contaminants and the potential health effects of the contaminants at concentrations greater than the MCL. The likely source of the contaminants is identified, and a summary of any violations in monitoring, reporting, or record-keeping is included. The reports can assist customers with special health needs to make informed decisions regarding their drinking water. CCRs provide references and telephone numbers as to health effects data and available information about the water system in general.

7.5.1.1 Compliance

The City issues an annual Water Quality Report, which includes a basic description of drinking water contaminants, source description, and annual water quality results. The annual Water Quality Reports for 2021 through 2024 are included in Appendix E.

7.5.2 Public Notification Rule

The Public Notification Rule (PNR) requires that public water systems notify their customers when they violate USEPA or State regulations (including monitoring requirements) or otherwise provide drinking

water that may pose a risk to consumers' health. The original public notification requirements were established in the SDWA; the revised PNR was promulgated in 2000 as required by the 1996 SDWA amendments.

The PNR establishes three notification levels:

- Immediate Notice (Tier 1): In a situation where there is the potential for human health to be immediately impacted, notification is required within 24 hours.
- Notice as Soon as Possible (Tier 2). In a situation where an MCL is exceeded or water has not been treated properly, but there is no threat to human health, notification is required as soon as possible and within 30 days.
- Annual Notice (Tier 3). In a situation where a standard is violated that does not directly impact human health, notice must be provided within one year, likely within the system's CCR.

Notification requirements are described in the City's Emergency Response Plan (ERP), available through City Staff. The ERP includes protocol for notifying the DOH and the public when a positive detection of VOCs/SOCs, IOCs, physical characteristics, or bacteriological presence is determined. The ERP maintains current phone numbers and contact information to all relevant utilities, contractors, government agencies, and local cable and radio stations.

7.5.2.1 Compliance

Since the last WSP update, PFAS has been the City's only violation of the PNR. Proper action was taken to notify the public, and the City is currently undergoing efforts to mitigate PFAS in its sources and distribution system.

7.5.3 Operator Certification

The 1996 SDWA amendments require that states develop and implement an operator certification program. Final guidelines were published in February 1999. The regulations set out minimum guidelines for such a certification program including operator classification and qualifications. These sections of the regulation require that:

- Each treatment facility and/or distribution system is placed under the direct supervision of a certified operator.
- Operator certification must be equal to or greater than the system classification being operated.
- At least one certified operator is available on every shift.
- Operators must sit for, and pass, a validated exam demonstrating skills, knowledge, ability, and judgment necessary for the system classification.
- Each operator must have a high school diploma, GED, or state-approved experience and training.

While the responsibility for developing the program lies with DOH, individual systems must bring all operators up to the level of certification as required. The "grandparenting" clause of the regulation will address existing operators; however, new operators will be required to meet the guidelines of the legislation. Washington State issued revised operator certification guidelines in December 2000 (WAC 246-292). A grandparenting clause is also present in this regulation. However, because this clause expired in 2002, full compliance was required by that date.

On December 4, 2013, the DOH adopted the proposed rule changes for the Waterworks Operator Certification rule. The changes of the rule include strengthening the state's authority to enforce regulations, clarify authority to certify Backflow Assembly Testers (BAT) and Cross Connection Control Specialists (CCSs), and other updates to reflect current program practices, move requirements from guidelines into rules, and improve language and readability. Adopted changes pertinent to PWSs include the following:

- Requires purveyors to designate an operator in responsible charge for each operating shift and each major segment of the system, if applicable.
- Requires purveyors to designate and report all mandatory positions to the department within 30 days of starting operations or when a position is vacated.
- Purveyors shall not require operators to perform work that is beyond their skills, abilities, or level of certification.
- Additional requirements for operators, CCSs, and BATs are included.

7.5.3.1 Compliance

Operation, maintenance, cross-connection control, and water quality monitoring functions for the City are accomplished under the direction of the Water/Sewer Superintendent. As a Group A water system, the City presently meets minimum staff certification requirements. To ensure compliance in the future, all certified staff are provided the necessary expenses and leave time to attend classes and seminars in order to meet requirements for certification renewal. Further details on operator certifications are described in Chapter 4.

7.6 Future Regulatory Requirements

The SDWA and its amendments require that the USEPA reevaluate existing drinking water regulations on a periodic basis and develop and promulgate new standards and regulations as necessary to protect public health. At any given time, there may be many contaminants at various stages of the rulemaking and revision process, such as information gathering, regulation development, public comment, or periodic review. Anticipated future regulatory requirements are summarized in Table 7.12. This table includes ongoing programs to introduce new regulatory requirements, under the UCMR and the Contaminant Candidate List (CCL), as well as specific rules and regulations currently under consideration.

The City does not anticipate issues with meeting the other future regulatory requirements listed in the table based on the limited available information. The City will revisit each proposed rule when specific requirements are published. A brief description of anticipated requirements under each rule is provided herein.

Table 7.14 Future Regulatory Requirements

Proposed Rule	Affected Contaminants	Proposed Publication Date[1]
Unregulated Contaminant Monitoring Rule	▪ Unregulated Contaminants	▪ UCMR 6 – 2026
Fifth Regulatory Determination	▪ Fifth Regulatory Determination	▪ Reg-Det 5 - unknown
Contaminant Candidate List	▪ Unregulated Contaminants	▪ CCL4 - unknown
Hexavalent Chromium	▪ Hexavalent Chromium	▪ August 2027
Nitrosamines	▪ Nitrosamines	▪ Unknown

Proposed Rule	Affected Contaminants	Proposed Publication Date(1)
TOrC	▪ Toxic Organic Chemicals	▪ Unknown
1,4-dioxane	▪ 1,4-dioxane	▪ Unknown
DBPs	▪ DBPs	▪ Unknown
MDBP	▪ MDBP	▪ Summer 2027

Notes:
(1) Effective and compliance dates were obtained from the Federal Register and USEPA's Drinking Water Hotline and represent the best information available as of the date of this report.
MDBP - Microbial and Disinfection-by-Products; TOrC - toxic organic chemicals.

7.6.1 Unregulated Contaminant Monitoring Rule (UCMR 6)

The SDWA requires USEPA to issue a list of no more than 30 priority unregulated contaminants in drinking water once every five years. This requires public water systems to monitor for the selected contaminants. The results of current and previous UCMR As of April 2024, the USEPA has identified 68 potential contaminants that may be included in UCMR 6 sampling, which include chlorinated acids, pesticides and degradates, volatile/semivolatile organics, flame retardants, phenols, organic compounds, and pharmaceuticals. The final rule is expected in 2026 with sampling between 2028 and 2030 to follow.

7.6.2 Fifth Regulatory Determination

Under the SDWA, the USEPA must make regulatory determinations (whether to promulgate a new regulation or remove it from consideration) on at least five contaminants every five years. In the first three Regulatory Determinations (Reg-Det 1, Reg-Det 2, and Reg-Det 3 respectively), the USEPA decided not to regulate contaminants under consideration. In the Fourth Regulatory Determination, the USEPA made final determinations to regulate PFOS and PFOS and to not regulate six other contaminants. The USEPA can make "off-cycle" determinations, such as the positive determination to consider a new perchlorate MCL in 2011. The preliminary fifth regulatory determination was announced in January of 2025 and proposes not regulate nine contaminants on CCL 5. The final determination will be released by the USEPA upon review of the input received during the public comment period.

7.6.3 Sixth Contaminant Candidate List

The SDWA requires the USEPA to review its drinking water regulations every six years in light of advances in the fields of health effects, analytical methodologies, treatment, and occurrence data to determine whether any revisions are needed. Any contaminants provided on the CCL are not subject to any proposed or promulgated regulations but are known to occur in public water systems. The USEPA requested nominations of chemicals, microbes, or other substances for consideration on the draft CCL 6 and is currently evaluating nominations and other contaminant data for inclusion on the draft list.

7.6.4 Contaminants of Emerging Concern

Contaminants of emerging concern are a group of priority pollutants that are not typically regulated by the USEPA. This group includes VOCs, 1,4-dioxane, nitrosamines such as NDMA, hexavalent chromium, and perchlorate. Also, among these contaminants are endocrine disrupting compounds (EDC) and pharmaceutical and personal care products (PPCP).

7.6.4.1 Hexavalent Chromium

Total chromium was regulated in 1991 at 100 µg/L. The USEPA has been working over the past several years to develop a draft risk assessment for hexavalent chromium (Cr(VI)). This assessment was extended from its initial 2012 completion date to incorporate the latest health effects research. Total and Cr(VI) monitoring were also included in UCMR3. The USEPA recently finished conducting an Integrated Risk Information System (IRIS) toxicological assessment of Cr-VI and released the final Cr(VI) IRIS on August 1 2024. As the final risk assessment is now published, USEPA will move forward with determining whether or not to promulgate a Cr(VI) MCL. USEPA is required to make this regulatory determination within three years of the release of the final risk assessment, by August 2027.

7.6.4.2 Nitrosamines

Nitrosamines meet the first two of the three SDWA criteria for regulating a new contaminant:

1. NDMA and other nitrosamines are carcinogens.
2. UCMR2 data showed that NDMA and other nitrosamines occur frequently enough to warrant considering regulatory action.

There is still significant debate as to whether this suite of chemicals meets the third criterion, whether their regulation would provide a meaningful opportunity for risk reduction. The contribution of drinking water to the typical person's nitrosamine exposure is small (<0.1 percent) compared to exposure from foods and from what is produced inside the body (endogenous exposure).

Whether or not nitrosamines are regulated will depend largely upon how the USEPA evaluates if regulation would provide a "meaningful opportunity for risk reduction." The agency has adopted a new "life-stages" approach to risk assessment, which focuses more on at risk populations, like infants and toddlers, who drink more water per body weight.

A total of six nitrosamines, including NDMA, were monitored as part of UCMR2. As of March 2011, UCMR2 data indicate that NDMA is the predominant nitrosamine occurring in drinking water. Further, NDMA was detected three times more frequently in surface waters than ground waters and 10 times more frequently in surface water plants using chloramines versus chlorine alone. NDMA was also detected at higher concentrations at maximum residence time locations in the distribution system as compared to entry points. Six nitrosamines, including NDMA, were listed within CCL4.

Current regulatory discussions have focused around regulating nitrosamines as a group; NDMA would almost certainly be included. More than half of the systems that would be impacted by a nitrosamine rule are chloraminated systems. There are many potential treatment options, but many conflict with other regulations. Also, new treatment research at pilot- or full-scale is needed before the risk assessment can be completed. More information on this topic is anticipated to become available over the next few years, but no regulations are anticipated in the near future.

7.6.4.3 Toxic Organic Chemicals

Whether TOrC like PPCPs and EDCs in the environment pose a significant exposure risk to humans or wildlife is still not well understood and the subject of much investigation and debate. Research on these compounds began in the 1990s and the magnitude of the issue is still not fully defined. The use and subsequent release of antibiotics and natural/synthetic steroids to the environment has generated

controversy to date regarding pharmaceuticals as pollutants. However, a plethora of other drug classes, bioactive metabolites, and transformation products, as well as PPCPs have yet to be examined. Certain physiologically active compounds (for example, caffeine, aspirin, and sex steroids) have been known for over 20 years to enter the environment by a variety of routes, primarily via treated and untreated sewage effluents. Available UCMR3 data indicates endocrine disrupting compounds are largely absent in drinking water sources at even very low levels.

Currently, PPCPs are not regulated by USEPA. The USEPA is studying the effect of PPCPs and has not publicly discussed proposing any regulations. A significant portion of on-going research concerns where and how TOrCs should be treated. Options include drug take back programs, treatment at wastewater treatment plants, and treatment at drinking water plants, with the first option being the most practical and cost-effective.

7.6.4.4 1,4-dioxane

1,4-dioxane is a synthetic organic compound commonly used in a variety of commercial and industrial processes such as stabilization of chlorinated solvents and pharmaceutical manufacturing as well as found as a by-product in goods such as paint strippers, dyes, and greases. The USEPA has classified 1,4-dioxane as likely to be carcinogenic to humans, and the compound has been listed in CCL3, CCL4, and CCL5 as well as monitored under UCMR3. USEPA has no established MCL for 1,4-dioxane however, the latest Drinking Water Specific Risk Level Concentration from USEPA is 0.35 µg/L for the 10^{-6} cancer level (one in a million lifetime cancer risk). The USEPA's health advisory level for noncancer toxicity effects is 0.2 mg/L, so the 0.35 µg/L level for cancer effects is the more conservative level. The notable removal difficulty of 1,4-dioxane is one of the key concerns. While no conventional drinking water treatment technologies can reliably remove it at drinking water levels, ultraviolet light-hydrogen peroxide advanced oxidation process (UV AOP) is effective at treating 1,4-dioxane to below the method reporting limit of 0.1 µg/L.

7.6.4.5 Emerging Disinfection Byproducts

The USEPA continually considers whether additional regulation of DBPs is warranted, as illustrated by the inclusion of several unregulated DBPs on the fourth CCL, the decision to consider revisions to the Stage 1 and 2 D/DBPRs based on the Third Six-Year Review cycle, and inclusion of several classes of unregulated DBPs through the UCMR. A number of potentially significant disinfection by-products continue to be the subject of on-going research. For example, both iodo-substituted HAAs and THMs have been shown to form under certain conditions when drinking water is chloraminated. Nitrosamine is under consideration for inclusion in any new DBP regulations. Bromate has been the subject of scrutiny as well. Since more brominated DBPs can be more toxic, the USEPA required monitoring for HAA9 under UCRM4. No regulations have been proposed as of yet, but as more information emerges, the USEPA may regulate some of these emerging DBPs.

7.6.5 Microbial and Disinfection-by-Products

The National Drinking Water Advisory Council presented recommendations to USEPA in December 2023 on additional MDBP regulations, which may lead to potential rules being promulgated. These rules are expected from USEPA in summer 2025. Items that may be covered in these new rules include:

- Adoption of a positive numeric minimum disinfectant residual requirement, with minimum specific values for free chlorine and chloramines.

- Data and analysis requirements associated with DBPs of emerging concern.
- Source water evaluation screening requirement, plus additional mandatory treatment to reduce DBP formation and disinfectant demand.
- Finished water storage tank inspection and cleaning requirements.
- Improvement of chloramination practices to promote microbial control and DBP formation potential with guidance, monitoring, and nitrification control plan requirements.
- Improvement of water quality and regulatory compliance for consecutive systems (wholesale connections), requiring disinfectant sampling at wholesale and consecutive system connections and processes for addressing DBP control in these systems.

7.7 Summary and Recommendations

The City seeks to maintain high-quality water for its customers from source to tap. While the City currently complies with all DOH monitoring and reporting requirements, the PFAS MCLs described in Section 7.3.6 compel the City to develop and implement a compliance framework by 2029. This section summarizes actions taken to date and outlines a roadmap for future efforts.

Preliminary risk assessments and mitigation screenings indicate uncertainty about PFAS impacts on the City's water supply. As a result, the City will likely need some form of treatment to meet future MCLs. To support planning and budgeting, source development and PFAS mitigation will be incorporated into the Capital Improvement Plan, detailed in Chapters 8 and 10. These projects typically require significant capital investment and will guide the City in securing necessary funding sources.

7.7.1 Recommendations for Compliance with PFAS MCLs

The actions presented in this section summarize framework to assist the City in planning PFAS mitigation measures and compliance with the PFAS NPDWR. The City has taken early action on multiple items described below, though it is recommended that the City continue to implement this framework for system wide PFAS compliance and mitigation.

Based on PFAS sampling data as of the date of this report, Wells 5, 6, 11, 13, and 14 have reported PFAS levels that exceed the PFAS NPDWR MCLs. Well 5 and 13 are individual wells. Wells 6 and 14 combine before their EPTDS, comprising Wellfield East. Wells 7, 8, 10, 11, and 12 combine before their EPTDS, comprising Oak Park Wellfield. For the purposes of developing planning-level estimates for PFAS mitigation, it was assumed that Well 13, Oak Park Wellfield, and Wellfield East would require treatment to achieve PFAS levels below the proposed MCLs. Because only certain wells within Oak Park Wellfield have shown PFAS levels above the MCLs, treatment may not be required for the full flow of Oak Park Wellfield. However, due to the uncertainty around PFAS fate and transport within the aquifer below the wells, the remaining wells at Oak Park may become impacted. For the purposes of cost planning, mitigation costs for Oak Park are presented as a range to cover the mitigation costs that may be required given what the City currently knows about the PFAS levels, and to cover the mitigation costs that may be required if all wells in Oak Park become impacted.

The City is currently under contract to design and construct PFAS treatment at Well 13, given it has shown the highest levels of PFAS throughout the wellfield.

It is recommended that an adaptive PFAS response plan be adopted by the City to strategically plan for PFAS mitigation. The goal of a PFAS response plan will be to develop a roadmap to compliance with the MCLs by USEPA's proposed deadline of 2029. The table below summarizes the major elements of the response plan. The following sections describe these elements in more detail.

Table 7.15 PFAS Response Plan Components

Actions		2024 - 2026	2026 - 2029	
1.	Risk Assessment	Confirm and fast track priority risks, build treatment at Well 13.	Continue to develop and modify risk assessment as PFAS mitigation progresses.	
2.	PFAS Mitigation Screening	Evaluation of alternatives to mitigate PFAS system wide by 2026.	Act on mitigation efforts and adapt plan accordingly based on results from PFAS Monitoring efforts.	
3.	Treatment design and construction	Ongoing efforts for treatment, including design, construction, and operations optimization as needed based on results from Risk Assessment and PFAS Mitigation Screening efforts.		
4.	PFAS Monitoring	Develop PFAS Monitoring Plan, continue sampling.	Continued monitoring.	
5.	Source Management	Source Identification Plan.	Identify Sources.	Source Control (if needed).
6.	Capital Needs Planning	Track funding and financing opportunities.		
7.	Communications	Develop and build upon a communications strategy that conveys efforts and progress to obtain and maintain stakeholder support, including from the public and City Council.		
8.	Advocacy	Partner with other agencies when available to advocate for science-based decisions, funding, and innovative treatment solutions. Help support regional efforts to reduce PFAS treatment costs.		

7.7.1.1 Risk Assessment

It is recommended that the City develop a risk assessment that will serve to identify immediate and near-term actions that can be taken to mitigate PFAS and maintain the City's commitment to providing high-quality water by ranking the highest risks facing the City with respect to PFAS. The risk assessment will incorporate system PFAS goals, infrastructure evaluations from all City wells, and latest hydrogeological information, and PFAS sampling results. The resulting risk register will serve to guide and prioritize efforts moving forward but will be adjustable over time to accommodate new information and the rapidly-changing landscape associated with PFAS.

This effort will work concurrently with design of treatment at Well 13, while establishing actions that could be done in tandem to increase system resiliency against PFAS. It is intended that this risk assessment be updated by the City over time to adapt to changes in PFAS concentration and build upon progress from mitigating the highest risks identified.

7.7.1.2 PFAS Mitigation Screening

This effort includes ongoing evaluations to find the best alternative for PFAS mitigation system wide in a manner that will ensure compliance by USEPA's proposed deadline of 2029. Screening options will generally be divided into the categories of treatment-based mitigation or operational-based mitigation. An evaluation of treatment-based mitigation efforts should include a technology evaluation, comparing the efficacy of typical treatment technologies for PFAS: granular activated carbon (GAC), ion exchange (IX), and reverse osmosis (RO). Treatment efficacy depends on many site-specific factors, including water

quality, system hydraulics, and site constraints. Depending on water quality, pre- or post-treatment may be needed, for example. Operational-based mitigation efforts may include source identification, alternative sources of supply, or upgrading the capacity at well stations if PFAS results are below the USEPA's reporting limit at those well stations. Any impacts to operations will need to consider the impacts to the overall system and allow the City to maintain its high level of service to its customers.

The optimal solution for the City will likely be a combination of both technological and operational-based mitigation measures. The plan to screen alternatives and implement recommendations will likely need support from design services, hydrogeological services, and other support. It is intended that this effort be adaptive and updated over time based on latest PFAS sampling results and successful implementation of fast-track measures described in the Risk Assessment section.

Evaluations that involve changes to the hydraulics of a well (introducing treatment may increase headloss and lower pump yield, for example) should consider impacts and changes to the overall system. These considerations may include upgrading well pumps to maintain capacity with higher headloss, or a change of well operational strategies to maintain the same overall yield.

7.7.1.3 Treatment Design and Construction

This effort plans for and executes tasks necessary for the construction of PFAS treatment systems. Should the Risk Assessment or Mitigation Screening efforts identify treatment to be the optimal solution at a well station, this task will be utilized. The design process may vary depending on the well site, procurement approach, and treatment goals, but will generally include some similar elements.

- Site evaluation efforts will review site hydraulic, electrical, and infrastructure capacities.
- Basis of design reports will develop a treatment plan for the site, including any pre- or post-treatment (corrosion control) requirements based on water quality data.
- Design deliverables, such as 30 percent, 60 percent, 90 percent, and final design packages, including drawings and specifications (deliverables may look different if the procurement approach allows for a fast-track delivery).
- Permitting and regulatory support.
- Engineering services during construction, including supporting startup, commissioning, and operations optimization.
- Ongoing systems integration support. This effort will monitor treatment performance and overall PFAS reduction systemwide to help guide next steps for the system.

7.7.1.4 PFAS Monitoring

The City's existing PFAS Monitoring Plan should be continued and built upon so it allows the City to continue to build insight on the fate and transport of PFAS in the aquifers, while also allowing the City to track progress from mitigation measures that have been implemented. This allows for the overall PFAS response plan to adapt to any changes in PFAS concentration. The monitoring program will also ensure compliance with monitoring requirements listed under the PFAS NPDWR.

7.7.1.5 Source Management

A PFAS source identification plan should be developed to gain insight into any potential sources of PFAS. This plan may include additional sampling efforts and can be modified as needed to the needs of the City. The City can follow guidance provided in the Water Research Foundation Report 5082, "Investigation of Alternative Management Strategies to Prevent PFAS from Entering Drinking Water Supplies and Wastewater" to support source identification or source management measures.

7.7.1.6 Capital Planning Needs

Efforts to track funding opportunities will be important to minimize impacts on ratepayers. These efforts should track all available opportunities and ensure the City is in compliance with funding requirements.

7.7.1.7 Communications

Stakeholder engagement and community outreach will be important throughout these PFAS mitigation efforts to obtain and maintain support. This may include continuing upon the City's public outreach efforts or providing updates to City Council on current PFAS status.

7.7.1.8 Advocacy

The PFAS response plan should also include an advocacy component. Actions under this effort could include developing partnerships with neighboring utilities to coordinate sampling efforts or supporting regional efforts within the industry to advocate for utility support and funding for PFAS.

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CHAPTER 8 WATER RESOURCES

The City has a diverse water portfolio, which includes groundwater wells and surface water supplies. To meet future demands, the City will need to fully utilize existing water resources and develop new sources to continue to provide high levels of service. The City currently receives its water from 10 groundwater wells and two surface water diversions. This chapter presents an evaluation of these supplies to identify future deficiencies in the City's water rights or in the ability of its supplies to produce reliable water at the levels needed to meet future demands. These deficiencies are addressed by the City's water supply strategy summarized in this chapter.

The City obtains its water from two surface water sources and 10 wells. Eight of the groundwater sources (Wells 5, 6, 7, 8, 10, 11, 12, 14) are located in the City's Lower Washougal Wellfield (LWWF), in the lower Washougal floodplain near downtown Camas. Wells 7, 8, 10, 11 and 12 are often referred to as the City's "Oak Park" wellfield. Well 13 is north and west of the Oak Park wells and is effectively part of the same wellfield pumping center but is not typically referenced as being part of the LWWF. The remaining well (Well 9) is located in the uplands about two miles north of the Columbia River and 1.5 miles west of Lacamas Lake. The City's Boulder and Jones Creek surface water diversions are located in the headwaters of the Washougal River drainage.

8.1 Water Right Analysis

The City relies upon its groundwater wells and surface water sources to meet its current supply needs. Water rights for these sources are administered by Ecology. The DOH regulates source water protection. This section summarizes the City's existing water rights and analyzes the ability of the rights to meet the City's projected demand.

The City has diverted water from Jones Creek since 1913 and Boulder Creek since 1931. Historically, the surface water sources were the City's primary water supply and operated continuously for 24 hours per day with wells being used to meet higher summer peaks. In evaluating options to meet future demands, the City determined that the expansion of existing surface water diversions was not feasible. The City then began expansion of its groundwater supplies, focusing on the productive aquifers in the Lower Washougal River floodplain.

With the issuance of four new groundwater permits in 2008, came the requirement the City cease their surface water operations between May 15 and October 31 of each year. The requirement further stated "At the State's discretion, the water rights associated with these diversions will be placed into the State's Trust Water Program as permanent, seasonal donations." In 2015, the City attempted to place the rights into the Trust Program but was advised by Ecology that the action was not strictly necessary provided they agreed to operate the surface water supply consistent with the intent of the agreement.

Today, the City's focus is on developing new groundwater sources under its existing water right permits. Additional water rights are also being pursued.

8.1.1 Water Rights Summary

The City's water system (DOH ID 108002) currently has two water right claims which have been modified by Certificates of Change, eleven certificated water rights, and five water right permits. A summary of the City's water rights is provided in Table 8.1. Copies of the water right certificates for each well are included in Appendix G. The City's 2023 Water Facility Inventory is provided in Appendix F. Note, in September 2025, the City requested that Ecology extend the development schedule on each of the City's four water right permits to 2031. These extensions were granted by Ecology in May 2026. The City's current plan for developing the wells is presented in Section 8.4.

The City has limitations on its water rights that complicate the calculation of total instantaneous water right (Qi) and annual water right (Qa) as described below:

- Jones and Boulder Creek surface water sources may only be operated seasonally from October 31 through May 15, as directed by Permit G2-30144. The Qa for periods outside of the operating time window are used to maintain instream flow in the Creeks (not for City use).
- Historically, water right permits and certificates with priority dates before 1979 were limited by Ecology to a "total combined maximum Qa of 5,750 acre-feet per year (AFY)". However, modifications to the City's water right claims resulted in the recognition of an additional 550 AFY which increased the total Qa to 6,300 acre-feet/year with priority dates before 1979.
- Withdrawals from Well 9 are considered non-additive. The certificate does not increase the cumulative annual total of all rights but does increase the Qi.
- Certificate CG2-20938 (an irrigation water right allocating 330 gpm and 106 AFY for use between May 1 to October 1) was acquired by the City in 2015 and transferred into permanent trust as instream baseflow support for Lacamas Creek. The City retains the option to request to apply the consumptive use portion of the right (90.3 AFY) as potential mitigation for future water use within the Lacamas Creek drainage downstream of the water right location.

The City's resulting water rights equate to a Qi of 14,045 gpm (20.2 mgd), an additive Qa of 11,090 AFY (9.9 mgd), and a non-additive Qa of 210 AFY (0.3 mgd) as described by Permit G2-30756 (see Page 2) and Certificate G2-27384 (Well 9).

Table 8.1 Water Right Summary

Source	Water Right Number	Priority Date	Instantaneous Qi (gpm)	Annual Qa (AFY)(1)
Claims				
Well 1	Claim 121022 transferred to Well 10(2)			
Well 3	Claim 121023 transferred to Well 11(2)			
Certificates				
Boulder Creek(3)	C-712	08/22/1923	1,120 (2.5 cfs)	977 (A)
	CS2-SWC 712			843 A (Instream Flow)
Jones Creek(4)	C-711	09/05/1930	450 (1.0 cfs)	393 (A)
	CS2-SWC 711			337 A (Instream Flow)
Well 5	G 6636-A G2-*09325C	03/22/1968	600	920(5) (A)
Well 6	G 6635-A G2-*09325C	03/22/1968	1,500	2,400(5) (A)
Well 7	G2-00501	03/22/1971	1,000	530(6) (A)
Well 8	G2-24400	02/04/1977	900	530(6) (A)
Well 9	G2-27384	08/13/1986	650	210 (N)
Well 10(2) (Well 1)	G2-CV1-2P159	06/11/1974	900	320 (A)
Well 12(2) (Well 2)	G2-CV1-2P160	06/11/1974	1,200	230(6) (A)
Well 11(2) (Well 3)	C-85-A G2-*0004C	07/21/1945	900	118 (A)
Well 13(2) (Well 4)	G2-GWC4079 G2-*05130C	02/12/1959	1,325	1,208(6) (A)
Permits				
Lower Washougal Wellfield	G2-30144	08/21/1986(7)	500 (At Well 8)	2,150 (A) (All 8 wells)
Well 14 (Anderson Site)	G2-30145	08/21/1986(7)	1,000	880 (A)
Parkers Landing	G2-30146	08/21/1986(7)	1,000	880 (A)
Treatment Plant Well	G2-30147	08/21/1986(7)	1,000	880 (A)
Umbrella Wellfield(8)	G2-30756	01/08/2020	6,700	11,090 (All 8 wells)
Total			**14,045(9)**	**11,090 (A)(9)** **210 (N)**
Pending Applications				
Steigerwald Regional Supply(10)	G2-30528		17,213	13,555

Notes:
(1) (A) = Additive water right, additive to other rights. (N) = Non-additive water right, not included when summing a cumulative total of all rights.
(2) Original water rights for Wells 1 through 4 have each been re-assigned to their respective replacement Wells 10 through 13. Well 10, 11, and 12 were installed to replace Well 1, 2 and 3, which have failed due to collapsed well casings; see Pacific Groundwater Group report dated June 9, 2003. Well 13 replaced Well 4 after Well 4 was determined to be groundwater under the influence of surface water; see Pacific Groundwater Group report dated August 14, 2006. G2-CV1-2P160 which is now associated with Well 10 allowed for seasonal between May 1st and August 31st. Year-round operation of Well 10 is authorized under Permit G2-30144 for the LWWF.
(3) This source was formerly known as the Little Washougal River. The certificate refers to an instantaneous quantity (Qi) and does not specify an annual withdrawal. An Ecology Report of Examination for Well 7 (G2-00501) summarizes existing water rights, including 1,820 AFY for Boulder Creek (C-712), based on continuous withdrawal at the instantaneous right specified. The withdrawal from surface water sources is limited to May 15 through October 31.
(4) The certificate refers to an instantaneous quantity (Qi) and does not specify an annual withdrawal. An Ecology Report of Examination for Well 7 (G2-00501) summarizes existing water rights, including 730 AFY for Jones Creek (C-711), based on continuous withdrawal at the instantaneous right specified. The withdrawal from surface water sources is limited to May 15 through October 31.
(5) The Permit and Report of Examination preceding this certificate limited water rights to “the total quantity withdrawn or diverted from all sources is not to exceed 3,300 AFY.
(6) The Permit and Report of Examination preceding this certificate limited water rights to “the total quantity withdrawn or diverted from all sources is not to exceed 5,750 AFY.
(7) The original Ecology Report of Examination for these permits indicated a priority date of 08/21/2003. However, Ecology assigned a priority date of 08/13/1986 via amended permits to match with the date of the Clark County Reservation identified by watershed planning for WRIAs 27/28.
(8) Installation of one future well in the LWWF is included under this permit.
(9) Due to permit and certificate restrictions, the total Qi and Qa do not equal the sum of quantities for each column.
(10) Joint application with City of Camas and City of Washougal.

8.1.2 Water Rights Analysis

The City's water rights were compared to existing, 5-year (2031), 10-year (2036) and 20-year (2046) demand projections to establish water right surplus or deficiency. Both Qi and Qa were considered and are summarized in Table 8.2 and Table 8.3, respectively. The City's Water Rights Self-Assessment is provided in Appendix H.

The City currently has surplus water rights based on the actual well pumping in 2024, which was considered to be the existing condition. Note, the reported values reflect the pumping over the entire year, where not all wells were pumped at the same time.

Table 8.2 Instantaneous Water Rights (Qi) Summary

Year	MDD – High Scenario(1) (gpm)	Instantaneous Water Right (Qi) (gpm)	Surplus/Deficiency (gpm)
Existing	6,765(2)	12,475(3)	5,710
2031	8,620	12,475 (3)	3,855
2036	10,490	12,475 (3)	1,985
2046	14,080	12,475 (3)	-1,605

Notes:
(1) Future values based on high MDD demand projection scenario.
(2) Based on actual 2024 maximum day production data.
(3) Instantaneous water rights of 14,045 gpm shown in Table 8.1 minus 1,570 gpm of surface water rights not available during the summer months.
MDD - maximum day demand.

Table 8.3 Annual Water Rights (Qa) Summary

Year	ADD - High Scenario(1) (AFY)	Annual Water Right (Qa) (AFY)	Surplus/Deficiency (AFY)
Existing	5,230(2)	11,090	5,860
2031	6,610	11,090	4,480
2036	8,070	11,090	3,020
2046	10,910	11,090	180

Notes:
(1) Future values based on high ADD demand projection scenario.
(2) Based on actual 2024 annual production data.

For the future water rights evaluation, the forecasted source production was based on the high demand projection scenario. The high demand scenario generally reflects the water use rates from the period of highest demands in the last eight years, as presented in Chapter 5. Use of the highest projected demands is intended to support the City in planning for sufficient physical supplies to meet demands and provide sufficient time for phasing in new supplies, which is typically a multi-year process.

The City is expected to have sufficient Qa through the next 20 years; however, the City is expected to have a Qi deficiency of 1,605 gpm by 2046. As described in the water supply strategy later in this chapter, the City plans to meet this deficiency by a combination of improving pumping yields from existing well facilities, developing all of its existing water rights, and securing water rights for additional supply sources.

Additionally, the City will continue to encourage water use efficiency including the reduction of irrigation use, which is a major driver for the relatively high projected MDD.

8.2 Ability to Pump

In addition to water rights, each of the City's supply sources physical capacity or "Ability to Pump" was evaluated. The resulting Ability to Pump was compared to demands to determine supply surplus or deficiency. The supply evaluation considered both high scenario projections for ADD and MDD conditions. Further, the Ability to Pump was evaluated for three supply scenarios:

- Standard (all supplies) represents the City's ability to meet demands with all sources pumping continuously (24 hours per day).
- Reliability (only supplies with backup power) represents the City's ability to meet demands during a widespread power outage where only supplies with auxiliary power are available.
- Redundancy (largest source out-of-service) represents the City's ability to meet MDD with the single largest source out of service. For the purposes of this analysis, Well 13 is assumed to be the largest source with a capacity of approximately 1,350 gpm.

Table 8.4 shows the supply sources contributing to ability to pump totals for each supply scenario under MDD and ADD demand conditions. Supply improvements to address all identified deficiencies are summarized in Section 8.4.

Table 8.4 Ability to Pump – Supply Summary

Source	Capacity (gpm)	MDD Standard	MDD Redundancy	MDD Reliability(3)	ADD Standard	ADD Redundancy	ADD Reliability(3)
Boulder Creek(1)	1,120	0	0	0	1,120	1,120	1,120
Jones Creek(1)	450	0	0	0	450	450	450
Well 5	675	675	675	0	675	675	0
Well 6(2)	1,200	1,200	1,200	0	1,200	1,200	0
Well 7	950	950	950	0	950	950	0
Well 8	1,250	1,250	1,250	1,250	1,250	1,250	1,250
Well 9	575	575	575	0	575	575	0
Well 10	900	900	900	0	900	900	0
Well 11	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Well 12	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Well 13	1,350	1,350	0	1,350	1,350	0	1,350
Well 14(2)	850	0	0	850	0	0	850
Total	**11,320**	**8,900**	**7,550**	**5,450**	**10,470**	**9,120**	**7,020**

Notes:
(1) The City's surface water sources are unavailable between May 15 and October 31. MDD typically occurs during these months, therefore capacity is assumed to be zero.
(2) A hydraulic restriction prevents the simultaneous operation of Well 6 and 14. The well with the larger capacity (Well 6 at 1,200 gpm) is considered in the existing and redundancy ability to pump scenario, while the well with the smaller capacity (Well 14 at 850 gpm) is assumed to be zero.
(3) Only supplies with backup power are assumed to have reliable capacity.

8.2.1 MDD Ability to Pump

The MDD ability to pump represents the City's ability to pump under maximum day demand periods, typically during summer months. Demands above the MDD (such as peak hour demands or fire flow) are served by storage and evaluated in Chapter 9. The MDD Ability to Pump was compared with the high scenario projected MDD for the planning period to evaluate supply capacity, as shown in Figure 8.1 and Table 8.5. Note, due to water right restrictions, the City's surface water sources are unavailable during the summer; therefore, are not included in the MDD ability to pump analysis.

Table 8.5 MDD Ability to Pump Analysis

Year	MDD (gpm)(1)	Standard Available Supply (gpm)	Standard Surplus/ Deficiency (gpm)	Redundancy Available Supply (gpm)	Redundancy Surplus/ Deficiency (gpm)	Reliability Available Supply (gpm)	Reliability Surplus/ Deficiency (gpm)
Existing	6,765(2)	8,900	2,135	7,550	785	5,450	-1,315
2031	8,620	8,900	280	7,550	-1,070	5,450	-3,170
2036	10,490	8,900	-1,590	7,550	-2,940	5,450	-5,040
2046	14,080	8,900	-5,180	7,550	-6,530	5,450	-8,630

Notes:
(1) Future values based on high MDD demand projection scenario.
(2) Based on actual 2024 annual production data.

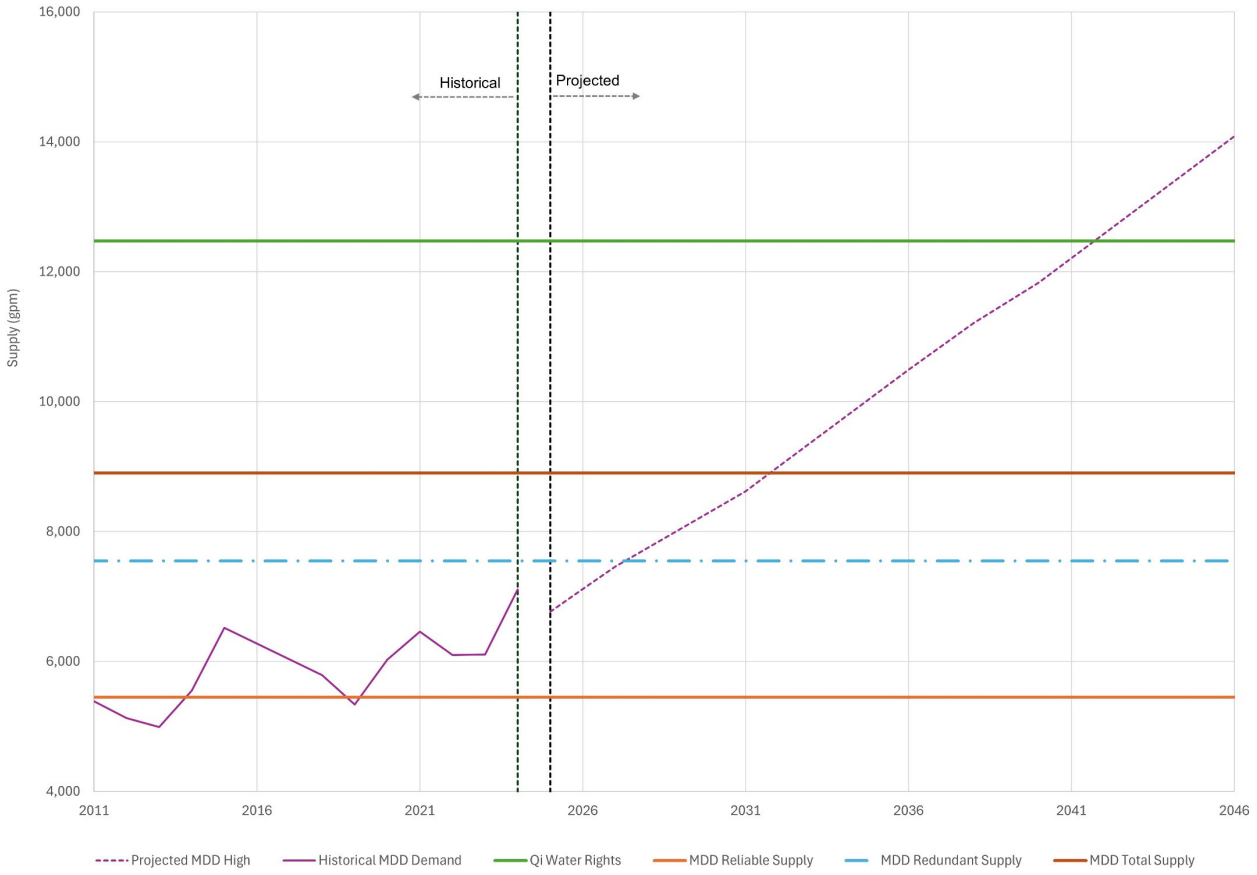


Figure 8.1 MDD Ability to Pump

The City's existing MDD ability to pump is approximately 8,900 gpm (12.8 mgd) in the standard scenario, approximately 7,550 gpm (10.9 mgd) in the redundancy scenario, and approximately 5,450 gpm (7.8 mgd) in the reliability scenario. The MDD Ability to Pump analysis shows a deficiency under the existing reliability scenario and increasing to all scenarios by 2031.

The City needs approximately 5,180 gpm of supply in the standard scenario, approximately 6,530 gpm of supply in the redundancy scenario, and approximately 8,630 gpm of supply in the reliability scenario by the end of the 2046 planning year. Improvements to existing well capacity may increase supply by 3,850 gpm to approximately 12,750 gpm by resolving physical capacity issues in Well 6 and 14 and increasing capacity of Wells 8, 11, and 12. The future construction of Well 18, 19, and 13B add an additional 4,000 gpm of MDD Ability to Pump capacity, allowing the City to meet projected MDD under all scenarios. Additionally, backup power is needed for Wells 5, 6, 7, 9, and 10 to increase reliable MDD Ability to Pump. Recommendations to address MDD supply deficiencies are further detailed in Section 8.4.

8.2.2 ADD Ability to Pump

The ADD Ability to Pump evaluation confirms the City's ability to supply average demand throughout the year. High scenario ADD projections were used to represent typical conditions expected to occur. ADD Ability to Pump was compared with the projected high ADD scenario for the planning period to evaluate supply capacity, as shown in Figure 8.2 and Table 8.7. The City's surface water sources, Jones and Boulder Creek, are included in the ADD Ability to Pump analysis.

Table 8.6 ADD Ability to Pump Analysis

Year	ADD (gpm)(1)	Standard Available Supply (gpm)	Standard Surplus/ Deficiency (gpm)	Redundancy Available Supply (gpm)	Redundancy Surplus/ Deficiency (gpm)	Reliability Available Supply (gpm)	Reliability Surplus/ Deficiency (gpm)
Existing	3,245(2)	10,470	7,225	9,120	5,875	7,020	3,775
2031	4,095	10,470	6,375	9,120	5,025	7,020	2,925
2036	5,005	10,470	5,465	9,120	4,115	7,020	2,015
2046	6,765	10,470	3,705	9,120	2,355	7,020	255

Notes:
(1) Future values based on high ADD demand projection scenario.
(2) Based on actual 2024 annual production data.

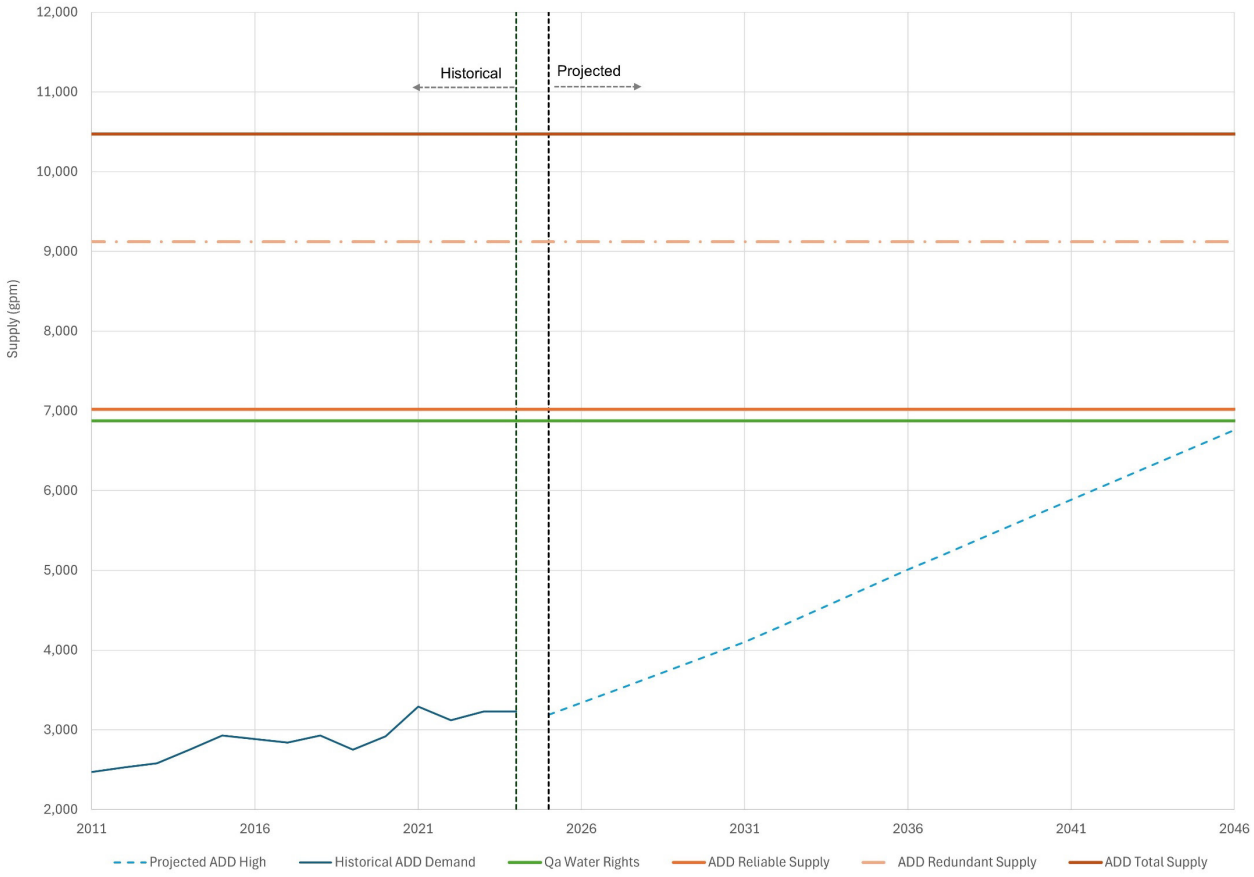


Figure 8.2 ADD Ability to Pump

The City's existing ADD Ability to Pump is approximately 10,470 gpm (15.1 mgd) in the standard scenario, approximately 9,120 gpm (13.1 mgd) in the redundancy scenario, and approximately 7,020 gpm (10.1 mgd) in the reliability scenario. All supply sources have adequate physical capacity under all scenarios and planning years to meet projected ADD.

No additional physical capacity recommendations are necessary to meet future ADD. It is anticipated that projects to address the MDD Ability to Pump deficiencies will concurrently increase ADD Ability to Pump capabilities.

8.3 Water Supply Strategy

The City requires additional supplies or improvements to existing facilities to provide the sought level of service during the planning period, where deficiencies already exist for the MDD ability to pump reliability scenario. To serve the projected 2046 MDD, the City needs a minimum additional supply of 5,180 gpm in the standard scenario, 6,530 gpm in the redundancy scenario, and backup power at all supply facilities to meet reliability level of service goals By the end of the planning period, the City will also need an additional 1,605 gpm of instantaneous water rights (Qi). The City's water supply strategy is comprised of four parts:

- Lower Washougal Wellfield Expansion.
- Construct Wells for Existing Water Rights.

- Secure Additional Water Rights.
- Continue a WUE Program.

The improvements are grouped into either the short-term (2027-2036) or long-term (2037-2046) planning horizons.

8.3.1 Lower Washougal Wellfield Expansion

Improved pumping from existing well facilities to achieve their full water right can provide additional future supply. The Ability to Pump analysis identified 3,850 gpm (5.5 mgd) of MDD supply can be obtained through addressing hydraulic limitations at Well 6 and 14 and increasing pumping capacities through upgrades at Wells 8, 11, and 12. While the pumping capacity will increase, the improved wells will not increase the ADD Ability to Pump due to water right restrictions. The LWWF expansion delays the need for developing additional supply sources.

Potential improvements to existing supply facilities include the following and should be completed by the 2031 planning year:

- The City is currently upsizing the pipeline between Well 6 and Well 14, which resolves an existing transmission deficiency that restricts the wells from operating simultaneously. This project is not included in existing analysis but is assumed to be completed soon as the project is currently in construction.
- Increase the yield of Well 8 to 2,250 gpm (an additional 1,000 gpm) by upgrading existing well screen and pump assemblies. Hydrogeologic investigations indicate additional capacity is available with well redevelopment and upgrades.
- Increase the yield of Wells 11 and 12 to 2,000 gpm each (an additional 1,000 gpm at each well) by upgrading existing pump assemblies. Hydrogeologic investigations indicate additional capacity is available with well upgrades.
- Install backup power for Wells 5, 6, 7, and 10 to increase reliability of the wellfield. It is assumed all new supplies will have backup power available.
- Install per- and polyfluoroalkyl substances (PFAS) treatment for all wells nearing or exceeding federal maximum contaminant levels, with provisions to add wells that may require treatment in the future. Recommendations for projects to address water quality concerns due to PFAS are summarized in Chapter 7.

The City's ongoing O&M program have kept supply facilities in good condition. R&R activities will be triggered by components reaching the end of their usable life. Additional information on the City's O&M and R&R programs is presented in Chapter 4.

8.3.2 Secure Additional Water Rights

The City is actively pursuing new water sources to meet future deficiencies and to improve supply redundancy. A water rights investigation is recommended to evaluate the transfer or acquisition of additional water rights detailed in this section.

8.3.2.1 Transfer or Acquisition of Additional LWWF Water Rights

On January 8, 2020, the City filed application G2-30756 for a new water right permit with Ecology. The application requested authority to withdraw 6,700 gpm and an unspecified annual quantity from the City's LWWF, non-additive to existing rights. The City also requested authorization for an additional point of withdrawal (well) in the LWWF; however, the requested new well (Well 18) will be authorized by adding a point of withdrawal to one or more existing water rights (e.g., G2-0004C and G2-CV1-2P160) through a showing of compliance with RCW 90.44.100(3).

Additionally, a preliminary hydrogeologic analysis indicated the Washougal River and LWWF aquifer may possibly not be in hydraulic connection during the summer. This could potentially allow for the City to transfer surface water rights for use in the LWWF during the summer months to increase available Qi. However, to verify these conditions additional groundwater modeling and monitoring will be required. Since this approach could be speculative, it is recommended the City complete a water rights investigation and discuss feasibility with Ecology.

8.3.2.2 Use of Lacamas Creek Water Rights

In 2015, water right CG2-20938 was placed into the water rights trust program by the City. The water right is a seasonal irrigation right used for past farming of a property located north of the City between NE Ward Road and NE 172nd Avenue. The donated portion is for 330 gpm and 106 acre-feet, of which 90.3 acre-feet is considered the consumptive quantity. The City requested that they be allowed to apply this consumptive quantity as mitigation for future water right requests in the Lacamas Creek basin. New water resource projects that might have impacts to Lacamas Creek or Lacamas Lake could potentially utilize this water right to help offset in-stream impacts to the Lacamas Creek drainage. Utilizing this water right would require site selection and development of a new groundwater well. Additional discussions with Ecology will be needed to verify the applicability to a given project.

8.3.2.3 Steigerwald Regional Supply Source

In the long-term, the City anticipates obtaining supply from the future Steigerwald Regional Supply Source (Water Right Application G2-30528), as discussed in the Detailed Implementation Plan (Lower Columbia Fish Recovery Board 2008) for the Salmon-Washougal and Lewis Watershed WRIAs. Under (WAC) 173-500-040, WRIAs were formalized and the Ecology was given responsibility for the development and management of these planning boundaries. The Salmon-Washougal and Lewis Watershed Management Plan WRIAs 27 and 28 (Lower Columbia Fish Recovery Board 2006) and subsequent Detailed Implementation Plan were created to address a range of issues related to water resources, including water supply, stream flow management, water quality, and fish habitat. The City and the Jones and Boulder Creek surface water supply watersheds reside within WRIA 28.

The completion of WRIA 27 and 28 watershed plans in 2008 eliminated the water rights reservation established by WAC 173-592 and replaced them with regional water supply areas and some stream allocations in WAC 173-527 for the Lewis River Basin (WRIA 27) and WAC 173-528 for the Salmon Creek-Washougal River Basin (WRIA 28).

The Watershed Management Plan discusses the regional water supply areas for Camas, which was designated as the Steigerwald area near Washougal. Ecology has designated water supplies near the City as "Instream Flow with Closures and Reserves." This designation limits the ability of the City to obtain new water rights outside of the regional water source.

The Steigerwald Regional Supply Source will be jointly developed with the City of Washougal. The Cities have applied for a joint water right (Water Right Application G2-30528) for 17,213 gpm of instantaneous water rights and 13,555 AFY of annual water right. The Place of Use has been designated as the water service area for both cities (as defined by each City's most recent water system plan approved by DOH). It is anticipated that the supply source will include up to 10, 20-inch diameter wells with individual well yields of 2,000 gpm or more. As an entirely new supply source, the Cities will need to permit, design, and construction the proposed wells and related facilities, such as disinfection, auxiliary power, and potentially treatment. To convey the water, the City will need several miles of transmission main.

8.3.2.4 Georgia Pacific Water Rights Acquisition

Additionally, the City may consider purchasing or leasing water rights and wells from Georgia Pacific (GP), if available, to develop an additional future water source closer to the City's water system. If production from the GP site proves problematic (due to the costs of treatment for contaminants for example), the water rights could still represent a value to the City as a mitigative offset for a new water right request. However, GP has expressed the desire to keep their water rights and wells for the entirety of the planning period.

8.3.2.5 Columbia River Surface Water Supply

Should the water sources described above not be available or sufficient to meet future needs, the City should explore development of a surface water supply on the Columbia River. Conversations with Ecology indicate water rights for this source are open to appropriation. The feasibility of this alternative should be further evaluated in the next WSP due to the extensive permitting and planning requirements. Development of a surface water supply also requires surface water treatment, leading to significant capital investments.

8.3.3 Develop Wells for Existing Water Rights

The City has existing water rights that allow for the development of additional wells. Hydrogeologic investigations indicate the Lower Washougal Wellfield is recommended site to develop new wells. To meet projected customer demand under this planning period, three wells are recommended for development. By the end of the long-term planning horizon, development of Wells 18, 13B, and 19 should be completed to increase the ability to pump under MDD conditions by approximately 4,000 gpm if the City has obtained sufficient and/or additional water rights prior to the development of these sources.

8.3.4 Continue Water Use Efficiency Program

The final element of the City's supply strategy is to continue to reduce demand through its water use efficiency program. The City has observed declining per account water use for over a decade. The observed drop in the water use and MDD peaking factor can be attributed in part to the City's water use

efficiency program, which is summarized in Chapter 6. WUE gains, including reductions in distribution system leakage, may delay the need for new supplies presented below.

8.3.5 Summary of Improvements

The City water supply strategy outlines the necessary steps to increasing capacity to meet future demands. The focal point of the strategy is to maximize production from existing supply facilities and fully utilizing available water rights before shifting to developing new facilities and pursuing additional water rights. The identified projects to increase the City's supply capacity are summarized below and incorporated in the CIP in Chapter 10. Desktop calculations indicate these projects will address identified physical supply capacity deficiencies under this planning period if sufficient water rights can be obtained; it is recommended the City reevaluate supply needs again in the next WSP. The City's water supply strategy is comprised of the recommended projects summarized below:

1. Well 6 and 14 Transmission Pipeline (in progress).
2. LWWF Expansion and PFAS Treatment (CIP Project S-01).
3. Water Rights Investigation (CIP Project G-03).
4. Well 18 Development (CIP Project S-02).
5. Well 13B Development (CIP Project S-03).
6. Well 19 Development (CIP Project S-04).

Table 8.9 describes each improvement, timing, increase in supply, and resulting MDD Ability to Pump after project completion. By the end of the planning period, the LWWF Expansion project and proposed new wells are expected to effectively make full use of the City's existing and assume proposed LWWF water rights applications are approved. The completion of the LWWF Expansion project delays the City's need for new supplies until the long-term planning horizon (post 2036). It is anticipated remaining supplies will be developed in phases to meet expected demand growth and distribute capital costs.

Table 8.7 Supply Improvements - MDD Ability to Pump

Improvement	Timing	Additional Supply (gpm)	MDD Ability to Pump (gpm)	Reliable MDD Ability to Pump (gpm)	Redundant MDD Ability to Pump (gpm)
	Existing		8,900	5,450	7,550
Well 6 and 14 Transmission Pipeline(1)	Short-term	850	9,750	5,450	8,400
LWWF Expansion	Short-term	3,000	12,750	12,750	10,500(2)
Well 18 Development	Long-term	2,000	14,750	14,750	12,500
Well 13B Development	Long-term	1,000	15,750	15,750	13,500
Well 19 Development	Long-term	1,000	16,750	16,750	14,500

Notes:
(1) The Well 6 and 14 Transmission Pipeline is in progress and is not included in the City's CIP.
(2) Well 8 capacity will be increased to 2,250 gpm during the LWWF Expansion, becoming the largest source out of service in the redundancy scenarios.

The increase in MDD Ability to Pump for these improvements is shown in Figure 8.4. To maintain redundant MDD Ability to Pump, the City will need to complete all recommended supply projects by the end of the planning period. Therefore, well development and PFAS treatment are anticipated to be a

major element of the City's CIP. Since ADD Ability to Pump is sufficient with existing supply facilities, it is assumed supply improvements to address MDD Ability to Pump will provide additional redundancy for the City's system.

If the City cannot obtain sufficient water rights in LWWF to meet the projected need, the City will need to consider additional water sources. Figure 8.3 outlines the water resources decision making framework and the recommended order of prioritization for pursuing water supply outside of the LWWF. A description for each option is provided in Section 8.3.2.2 through Section 8.3.2.5. It is recommended that the City complete an evaluation to determine the feasibility of each water supply option.

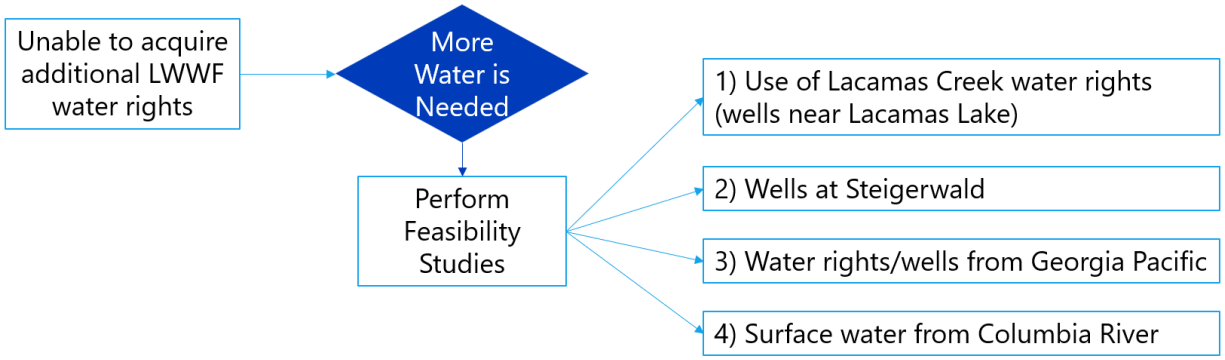


Figure 8.3 Water Resources Decision Making Framework

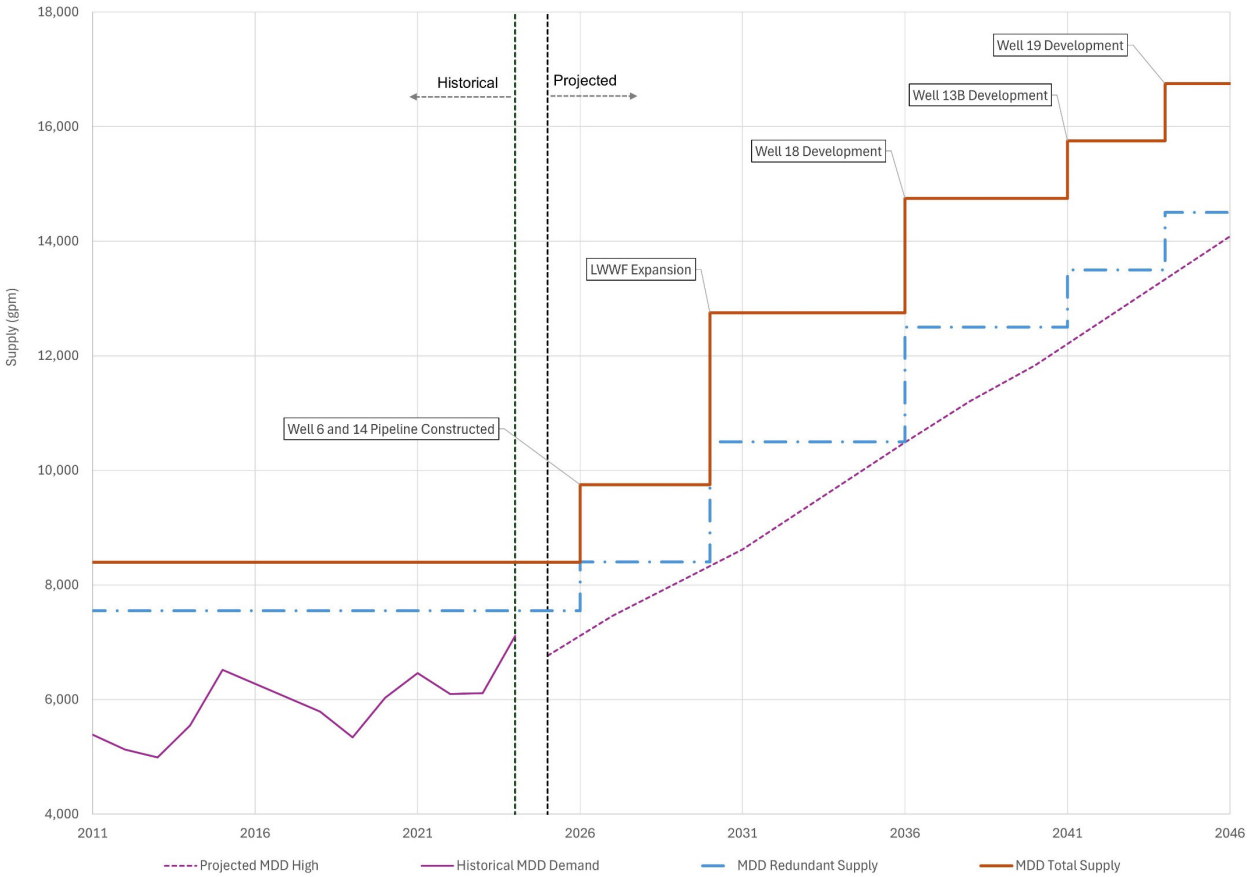


Figure 8.4 MDD Ability to Pump with Improvements

8.4 Groundwater Management

The City's wellhead protection plan was updated as part of the Plan. Section 1428 of the 1986 Amendments to the Federal Safe Drinking Water Act mandates that each state develop a wellhead protection program and that all federally defined public water systems (in Washington, Group A systems) using groundwater as its source implement a wellhead protection plan. In July 1994, the WAC addressed requirements for Group A public water systems (WAC 246-290) and was modified to include mandatory wellhead protection measures. The legislative authority to require wellhead protection (WHP) planning can be found in the RCW Chapters 43.20.050, 70.119A.060, and 70.119A.080.

8.4.1 Wellhead Protection Program

The overall goal of the state WHP program is to prevent the contamination of groundwater used by Group A public water systems. This is to be accomplished by providing management zones around public wells, identifying existing groundwater contamination sources, and managing potential sources of groundwater contamination prior to their entry into the drinking water system. Under the WAC, local public water systems have the primary responsibility for developing and implementing local wellhead protection plans (WHPP). However, due to the limited jurisdictional and regulatory authority afforded most purveyors, coordination with other local, State, and Federal agencies is essential to the successful implementation of a WHPP.

The DOH has developed regulations that require Group A water systems using groundwater sources to develop and implement the WHPP (WAC 246-290-135). The objective is to prevent releases of contaminants to groundwater in areas that contribute water to the public supply systems. The City's Wellhead Protection Report is included in Appendix I.

The basic elements of a WHPP include:

- Assessment of initial groundwater susceptibility for each water supply source.
- Delineation of the wellhead protection area (WHPA) that directly contributes groundwater to each water supply well.
- Inventory of land uses and identification of potential sources of contamination within each WHPA. These include time-of-travel zones (capture zones) representing 6-month, 1-, 5-, and 10-year periods to assess how quickly a potential contaminant might reach a source well.
- Documentation of notification to owner/operators of known or potential hazards.
- Documentation to regulatory agencies and local governments with the known or potential hazards.
- Development of spill prevention plans and water contingency plans that minimize or eliminate the possibility of contamination to the groundwater supply and also development of options for maintaining water supply in the event the aquifer contributing to a source is contaminated.
- Documentation of coordination with local emergency incident responders including notification of WHPA boundaries, susceptibility and inventory findings, and contingency plan.

The State of Washington WHPP applies to the City's wells.

8.4.2 Wellhead Protection Area

The updated WHPP used the WHPA developed in 2016 (PGG 2016). Capture zones for the Lower Washougal Wellfield were estimated using a calibrated MODFLOW groundwater flow model. This included Well 14 and the planned Parkers Landing and Treatment Plant wells. However, these later two wells were not constructed. The model simulations assumed that the City would exercise all of their existing and the two planned future wells. This assumption provides for a fairly conservative assessment of the capture zone extent. In addition, high-range pumping was assumed for the nearby Georgia Pacific Wellfield. Groundwater withdrawals from Georgia Pacific have likely decreased since the 2016 WHPA development due to reduced operations so the interaction between the GP and Camas wellfields may be overstated. In order not to rule out possible contaminant sources to the west of the LWWF, a 'Western Search Area' expansion of the WHPAs was added from the west side of the Washougal River as far west as the Crown Zellerbach Power Ditch (Appendix I). New modeling of the City's WHPAs is underway and may revise some of the assumptions above (Strata Geosciences, in press).

8.4.3 Existing and Potential Contamination Hazard Identification

The City performed a risk assessment within the existing WHPAs and immediate surrounding areas (buffer zone). The inventory of potential contamination sources within the WHPA was performed according to the DOH publication: "Inventory of Potential Contaminant Sources in Washington's Wellhead Protection Areas (1993)." Potential contaminant risks that lie within the vicinity of the LWWF were investigated and mapped using data from multiple sources. The primary source contains data from Ecology's Facility/Site database, including state cleanup sites, federal superfund sites, hazardous waste generators, solid waste facilities, and underground storage tanks. Additional information was gathered from Clark County's (2025) parcel database; septic system and infiltration facilities data on file with Clark County, the City of Camas, and the City of Washougal; Ecology's Environmental Information Management database; DOH's Sentry database; USEPA Enforcement and Compliance History Online PFAS industry sectors analytical tool; and a custom records request from Lightbox Environmental Data Resources. The information from these sources were classified and plotted on GIS coverages to assess whether existing and potential contaminant sources were located within the vicinity of Camas' production wells and WHPA delineations.

Table 7-1a in Appendix A of the WHPP summarizes known environmental sites of potential concern within the LWWF capture zones. Forty-seven contaminant sources of potential concern to the water supply were identified within the wellfield capture zones, and an additional 22 sites of potential concern were identified within the Western Search Area. A previously developed PFAS historic site list (Mott MacDonald 2025) was reviewed in tandem with Table 7-1a and USEPA's PFAS Industry Sectors Analytical tool (USEPA 2025a) to develop a PFAS industry site risk ranking (Table 7-8 in Appendix A). Thirty-six sources of potential PFAS concern to the water supply were identified within the wellfield capture zone, and an additional 18 sites of potential PFAS concern were identified within the Western Search Area.

8.4.4 Contingency Planning Tasks

As described in the WHPP, the nine shallow wells within the LWWF are most susceptible to contaminant risks given the hydrogeology and land surface activities. The capacity of the most productive wells in the Lower Washougal wellfield is about 1,300 gpm. If the supply from one of these wells was lost or compromised, the City would have to rely on a combination of the other sources to meet summertime peak demands (other wells, interties, and emergency use of surface water sources).

Additional risks to the City's supply arise from the fact that five of the City's wells (Wells 7, 8, 10, 11, and 12) are clustered in close proximity to each other. Several, if not all, of these wells could be impacted by a single contaminant release, such as a major railroad spill. Depending on the nature of impact to the wells, the City could perform immediate mitigation with changes in well pumping, treatment, blending of waters between wells, and other operational changes to meet demands; however, should multiple wells become impacted, the City may not be able to support the City's entire water demand on a sustainable basis, particularly during the high demand summer months. If multiple wells are impacted, the City may need to institute short-term rationing and pursue expedited drilling of additional wells.

8.4.5 Management Strategies and Implementation Tasks

[To be added upon completion of the Wellhead Protection Plan.]

CHAPTER 9 DISTRIBUTION SYSTEM ANALYSIS

9.1 Introduction

This chapter summarizes potential future system deficiencies in the City's water distribution system and offers recommended system improvements. Carollo evaluated the capacity of the pipeline system using the City's updated and calibrated hydraulic model. Carollo's hydraulic model development and calibration technical memorandum in Appendix **[X]**, summarizes all model updates made during this plan. Desktop evaluations of storage reservoir and pump station capacities were conducted in Microsoft Excel. Improvements identified in this chapter are summarized in the CIP in Chapter 10.

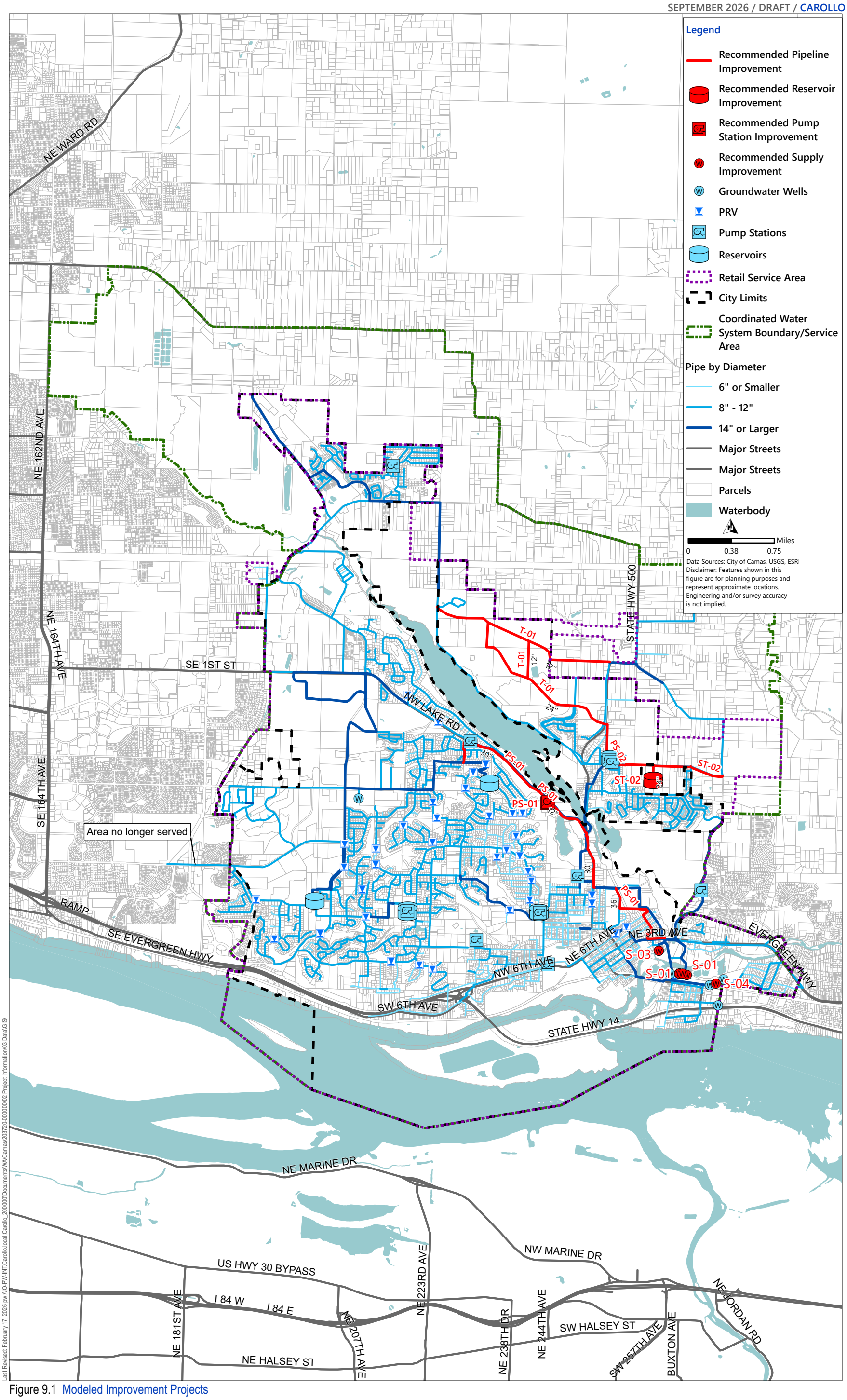
The analysis presented in this chapter is organized by first identifying high velocity and low-pressure deficiencies through the hydraulic model analysis for PHD and fire flow conditions in Sections 9.2.3 and 9.2.4. Recommendations are then provided to address deficiencies under both conditions. Next, Section 9.3 outlines deficiencies in pumping areas via desktop analysis then discusses pump station recommendations. Then, Section 9.4 outlines the storage deficits determined through desktop analysis. A multi-phased approach to addressing storage deficits is subsequently described, assuming all pumping and low-pressure/dead storage deficiencies have been fixed. The chapter finishes with a summary of all distribution system recommendations that will be included in the CIP.

9.2 Distribution System Model Analysis

The calibrated InfoWater Pro model of the City's distribution system was used to analyze the system for future planning years. Projected system demands (from the medium demand scenario) were added for the 2031, 2036 and 2046 planning years. Projected system demands for 2026 were also added to establish the baseline for existing system deficiencies. The hydraulic model was used to evaluate typical system conditions under MDD with diurnal operations (PHD) and for fire flow availability under MDD conditions.

9.2.1 Modeled Improvement Projects

Since the City expects significant growth, existing supplies do not adequate capacity to meet future projected demands. The hydraulic model will not run under conditions where demand exceeds supply. Therefore, it was necessary to add future supply improvements to the model before the distribution system analysis could be conducted. All supply and booster pumping improvement projects identified in the water supply strategy in Chapter 8 and storage and pumping analysis, including required transmission pipeline improvements associated with these projects were also added to the model. The improvement projects added to the model and used for the distribution system analysis are shown in Figure 9.1.



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Figure 9.1 Modeled Improvement Projects

9.2.2 System Criteria

9.2.2.1 Peak Hour Flow Criteria

Chapter 2 discussed system policies and criteria in detail. Key parameters evaluated by the model included system pressure criteria during normal operations and fire flow testing of the system.

During normal operations, the minimum pressure as set by the Washington State Department of Health (DOH) during MDD at PHD is 30 psi at the service meter. DOH velocity criterion is to keep pipeline velocities below 8 feet per second (fps).

9.2.2.2 Fire Flow Criteria

Fire flows are typically the largest flows system's experience and often a major factor in pipeline sizing and network configurations. Using the InfoWater Pro fire flow test feature, the hydraulic model evaluated the fire flow capabilities at all hydrants in the system. Specifically, it systematically simulated a fire at each model node representing a fire hydrant for each of the planning years under MDD conditions. All fire hydrant nodes in the model were simulated with a minimum pressure of 20 psi during the point fire demands, meaning once the node reaches 20 psi, no additional fire flow can be provided. Fire flow demands were allocated based on the land use nearest the hydrant and the following assumptions per land use class:

- Residential with Sprinklers: 500 gpm.
- Residential without Sprinklers: 1,000 gpm.
- Non-Residential: 1,500 gpm.
- The City does not have a record of which houses have sprinklers and which do not. Therefore, for system analysis purposes all existing residential areas are assumed to require 1,000 gpm of fire flow. Recently developed neighborhoods such as Green Mountain Estates were assigned a fire flow of 500 gpm because these homes were confirmed to have sprinklers. Additionally, two neighborhoods not receiving required fire flow were confirmed by City staff to have sprinklers and therefore assigned a fire flow of 500 gpm.
- For specific facilities and customers such as schools, industrial campuses, and churches within the City's service area, the local fire marshal requires fire flow up to 5,000 gpm. These site-specific fire flows were assigned to the respective hydrants neighboring these sites in addition to the required fire flow by land use. Figure 9.2 shows the fire flow requirements within the City's service area.

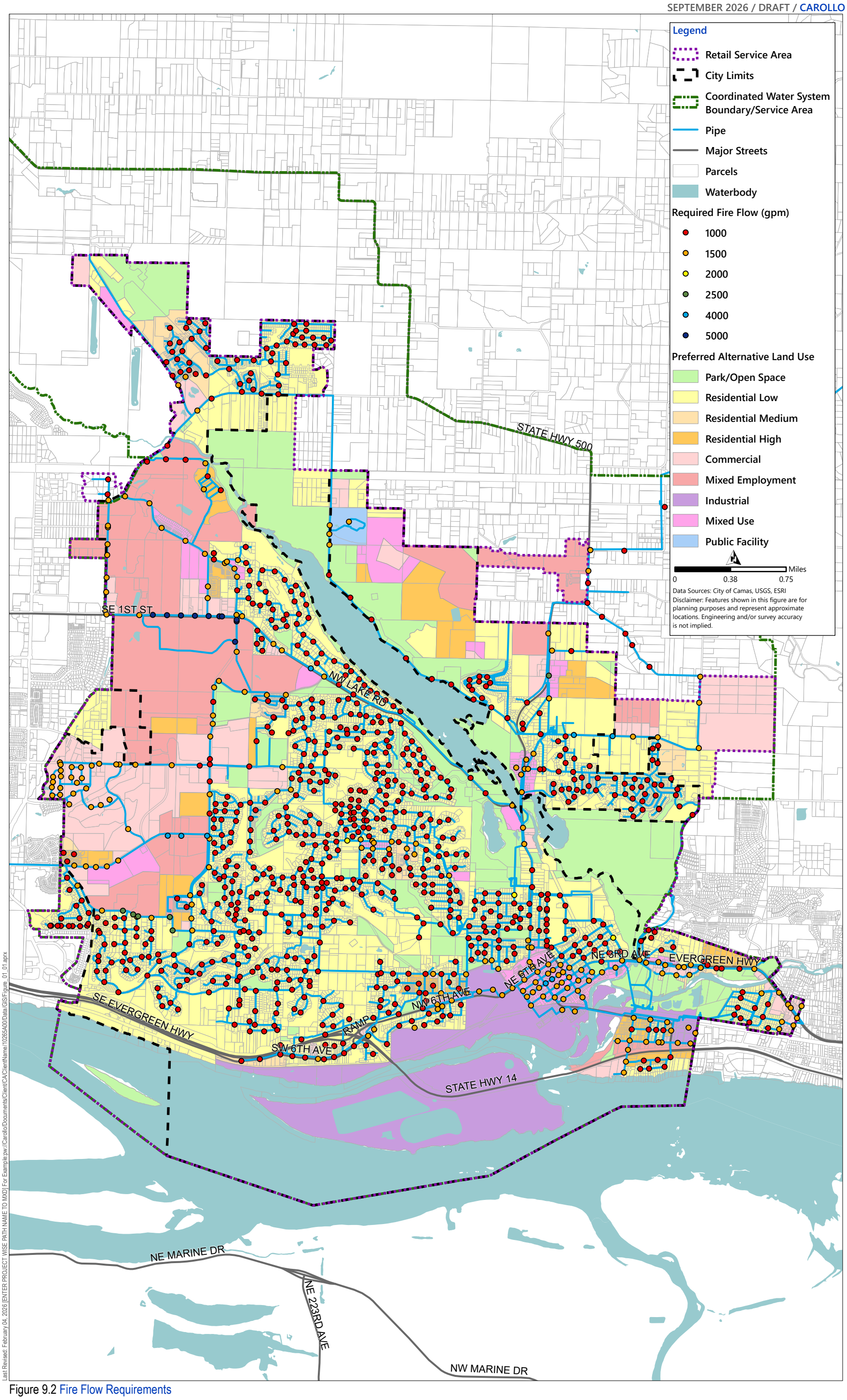


Figure 9.2 Fire Flow Requirements

9.2.3 Peak Hour Flow Evaluation

9.2.3.1 Velocity Results

The model was run in extended period simulation (EPS) for 72 hours at MDD with diurnal operations to evaluate general system velocity conditions for the 2031, 2036 and 2046 planning years. This approach allows the sources, pumps, and reservoirs to operate as their SCADA and controls were set.

Maximum modeled pipeline velocities are shown in Figure 9.3. Note, this figure only shows maximum pipeline velocities for 2046, where existing infrastructure would be most stressed to serve higher demands. Although no pipelines having maximum velocities exceeding DOH minimum criterion of 8 fps were identified, there were multiple transmission pipeline projects needed to serve areas of future development or areas where existing pipelines are undersized causing concerns with high head loss. These pipelines are not shown on Figure 9.3, as they are not deficiencies but are summarized below as recommendations and will be incorporated into the CIP in Chapter 10.

9.2.3.2 North Shore Transmission Pipeline (T-01)

The City expects large development to occur in its North Shore which is located just north of SE Leadbetter Road in the coming years. The development will be a mix of industrial and commercial larger users, as well as single family residences. To serve the projected demands of the area, approximately 6,300 linear feet (LF) of 12-inch diameter pipeline and 12,400 LF of 24-inch diameter pipeline (North Shore Transmission Pipeline) are needed to connect to the existing distribution system. Additionally, to convey water to the development area approximately 4,200 LF of existing pipeline between Gregg Reservoir and the proposed North Shore roundabout needs to be upsized to 24-inch diameter pipeline (Phase 2 Pipeline). The City expects a developer to construct the North Shore Transmission Pipeline by 2030. Since the Phase 2 portion of the pipeline requires upsizing of existing infrastructure, it is recommended for completion in 2033 to evenly distribute CIP funds and further discussed in Chapter 10.

9.2.3.3 Angelo Pump Station Discharge Pipeline (T-02)

Angelo Pump Station is a key facility supplying water to the 455-LPH and 852-UPH pressure zones. The current discharge piping in the distribution system network for this facility consists of various sized pipelines ranging from 6-inch to 14-inch in diameter. These pipelines have been identified as aging, undersized infrastructure causing high head loss and discharge pressures from Angelo Pump Station when demands increase in future planning scenarios. To mitigate these issues, it is recommended to upsize approximately 3,350 LF of various diameter pipeline to 16-inch diameter pipeline. This project is expected to allow more efficient operation at Angelo Pump Station, maximizing available pumping capacity.

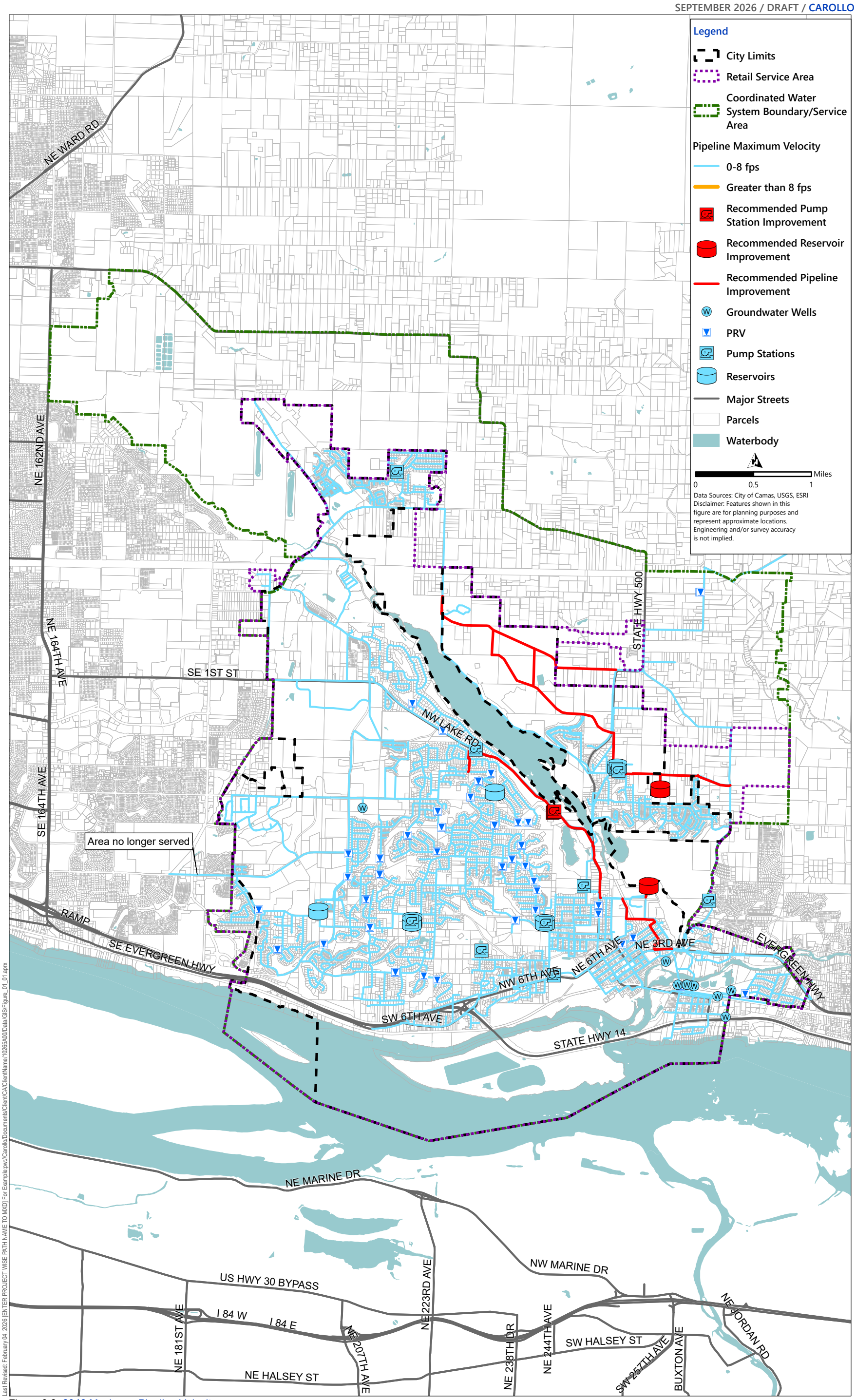


Figure 9.3 2046 Maximum Pipeline Velocity

9.2.3.4 Pressure Results

The same model run described in Section 9.2.3.1 was run to evaluate pressure results. Using the criteria presented in the preceding section, the hydraulic model provides minimum pressures under PHD conditions.

Figures 9.4, 9.5 and 9.6 show the minimum pressures for 2031, 2036 and 2046 PHD conditions respectively.

As seen in Figure 9.6, the system has a few low pressures below 30 psi. Some of the pressure zones cover large elevation ranges, leading to low pressures at high elevations. The City identified some locations where high elevation customers were served from a higher zone. No projects are recommended for such areas and the hydraulic model was updated accordingly to match these conditions. Customers experiencing lower pressures in the 455 – LPH zone are being served from reservoirs that are not at a high enough elevation, which results in low pressures and large amounts of dead storage within the reservoirs. This is further detailed in the storage analysis section below and a recommendation was made to rezone these customers.

9.2.3.5 High Elevation Customer and Low Pressure Recommendations

This section offers recommendations to address the areas where pressures drop below the minimum criteria of 30 psi identified in the previous Section, 9.2.3.4. The improvement for high elevation customers in the Francis Road area of the 455-LPH zone involves modifying pressure zone boundaries to be served by the new pump station recommended in PS-03. To address low pressures near the UPH Reservoirs, pipeline upsizing is recommended to reduce head loss in the area. Each of the recommended improvements requires further site-specific and project-level engineering analysis before implementation. Figure 9.7 outlines the projects necessary to address these deficiencies and projects are summarized in Table 9.1.

Table 9.1 Low Pressure Area Improvement Projects

Low Pressure Area	CIP Name	Original PZ	Revised PZ	Improvement Type
Area 1	D-06	852	-	Upsize pipeline to reduce head loss.
Area 2	PS-03	455	Francis Road	Increase pump station service area.

Notes:
PS - pump station.

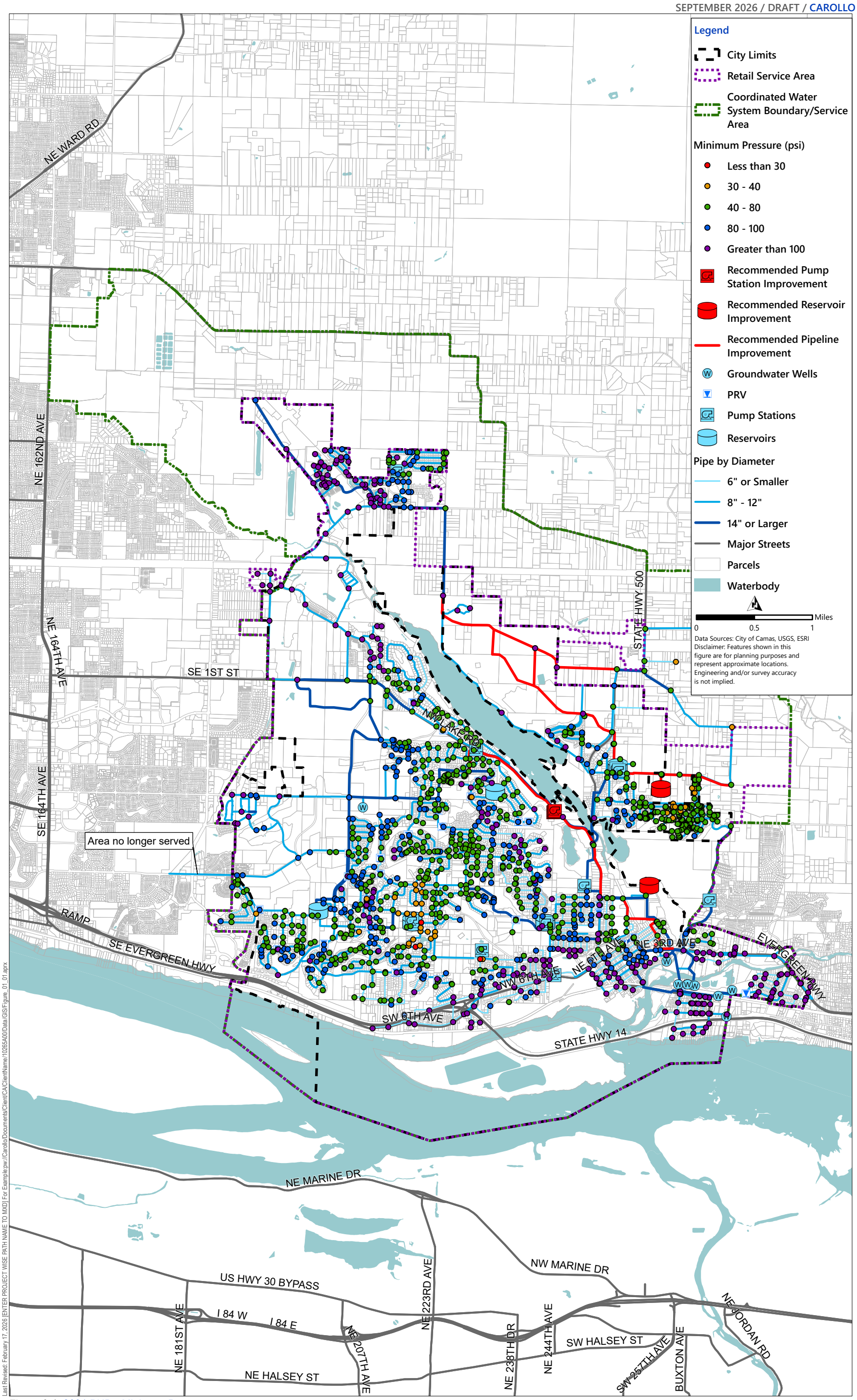


Figure 9.4 2031 PHD - Minimum Pressures

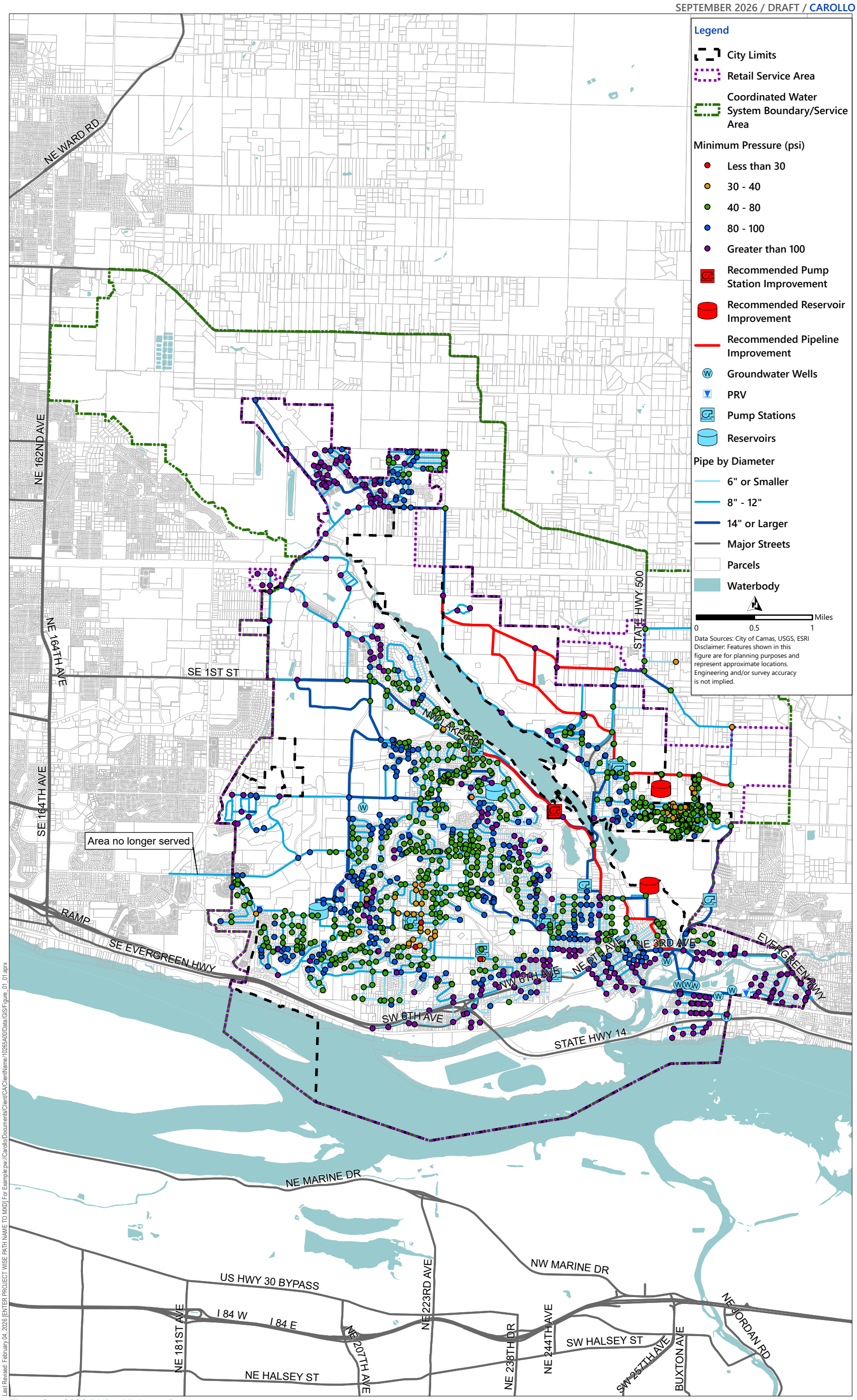


Figure 9.5 2036 PHD - Minimum Pressures

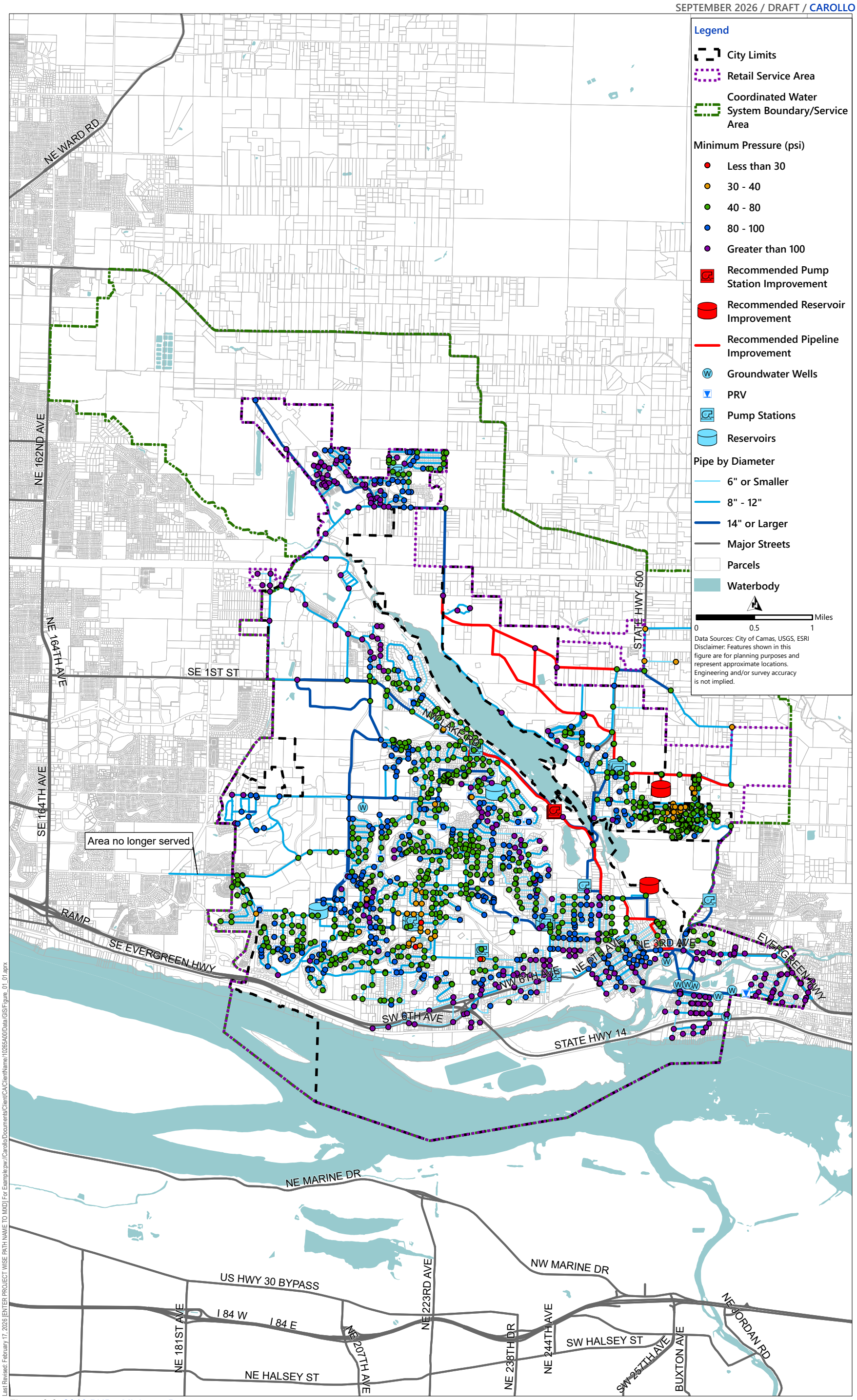


Figure 9.6 2046 PHD - Minimum Pressures

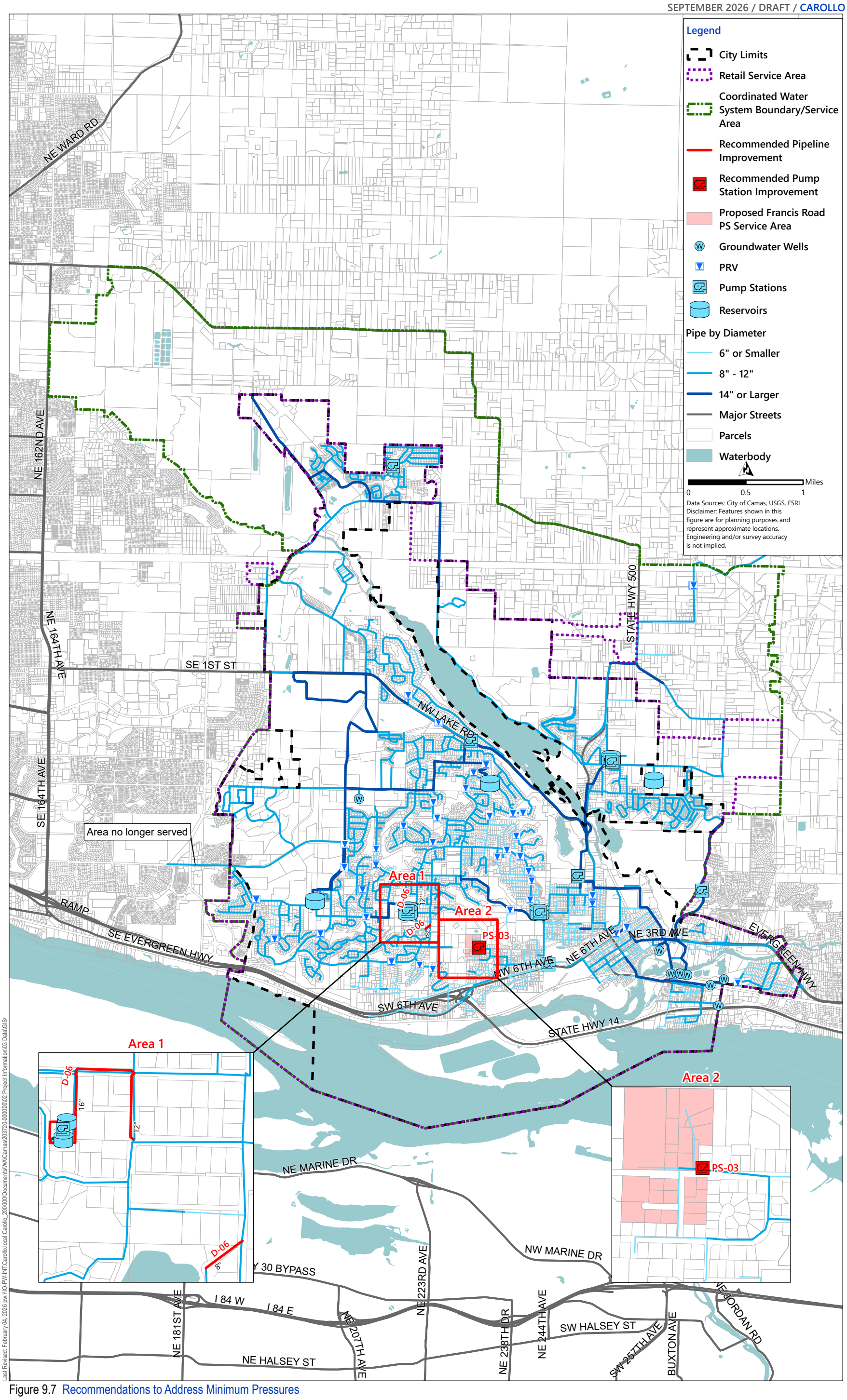


Figure 9.7 Recommendations to Address Minimum Pressures

9.2.4 Fire Flow Evaluation

9.2.4.1 Fire Flow Results

Figures 9.8, 9.9, and 9.10 show the model nodes that do and do not meet the criteria from the fire flow analysis conducted under MDD conditions for the 2031, 2036, and 2046 planning years, respectively.

9.2.4.2 Fire Flow Recommendations

This section outlines the recommendations to address all the fire flow deficiencies predicted in the hydraulic model. Fire flow deficiencies are junctions where the pressure dropped below 20 psi when simulating a fire at their location. Fire flow recommendations are either distribution pipeline upsizing or pump station projects.

- D-01 through D-10: individual distribution system projects upsizing pipeline to address fire flow deficiencies.
- PS-03: pump station project aimed to address fire flow deficiencies and meet the City's level of service goals. This pump station would include the addition of a fire pump with capacity to serve the required fire flow. Additionally, this pump station would have domestic pumps to serve typical demands. More details regarding this project are provided in Section 9.3.

Figure 9.11 outlines all projects recommended to address fire flow deficiencies, showing extent and location for each pipeline upsizing project. Figure 9.12 shows all fire nodes after recommended projects were implemented.

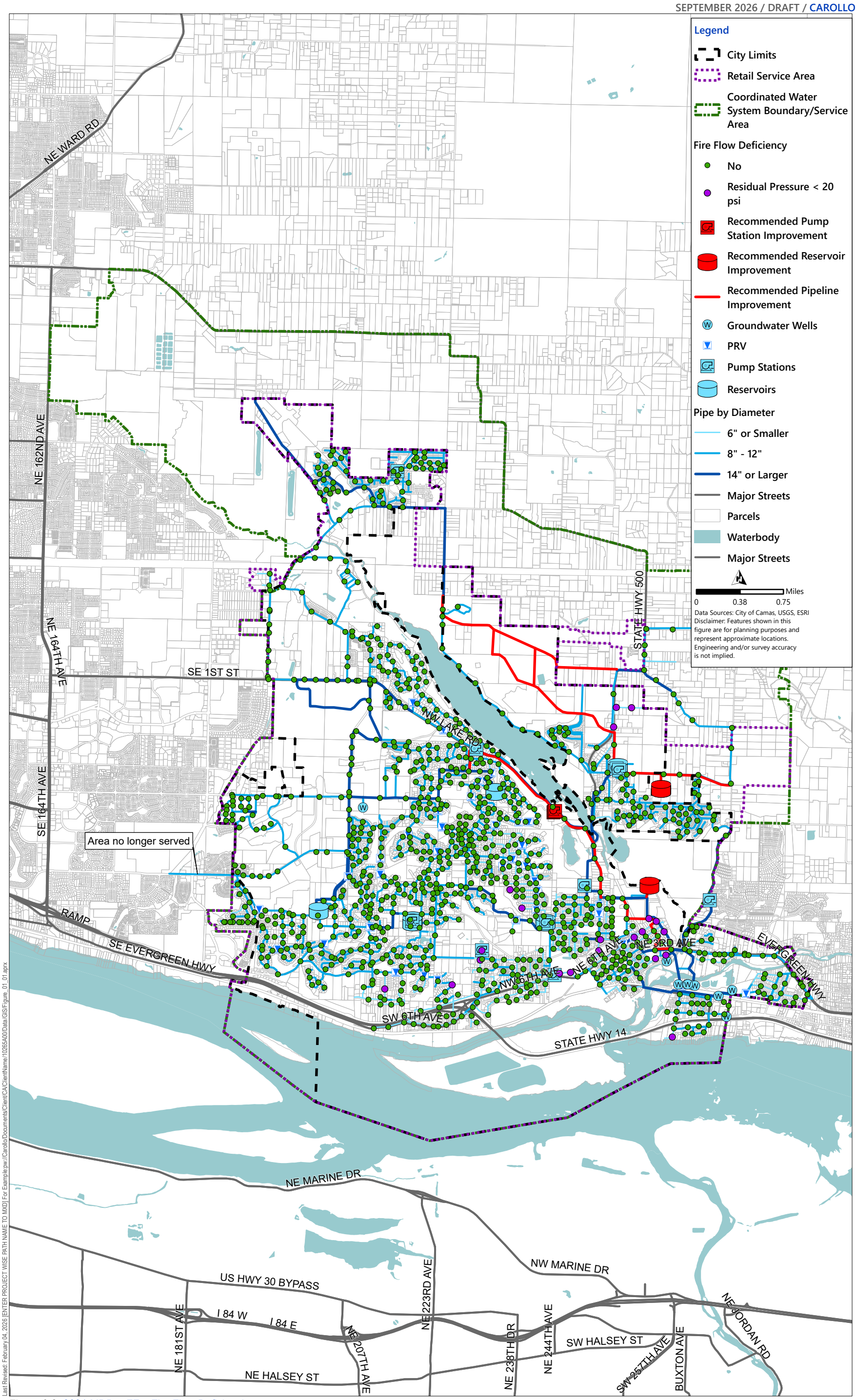


Figure 9.8 2031 MDD + FF – Fire Flow Deficiencies

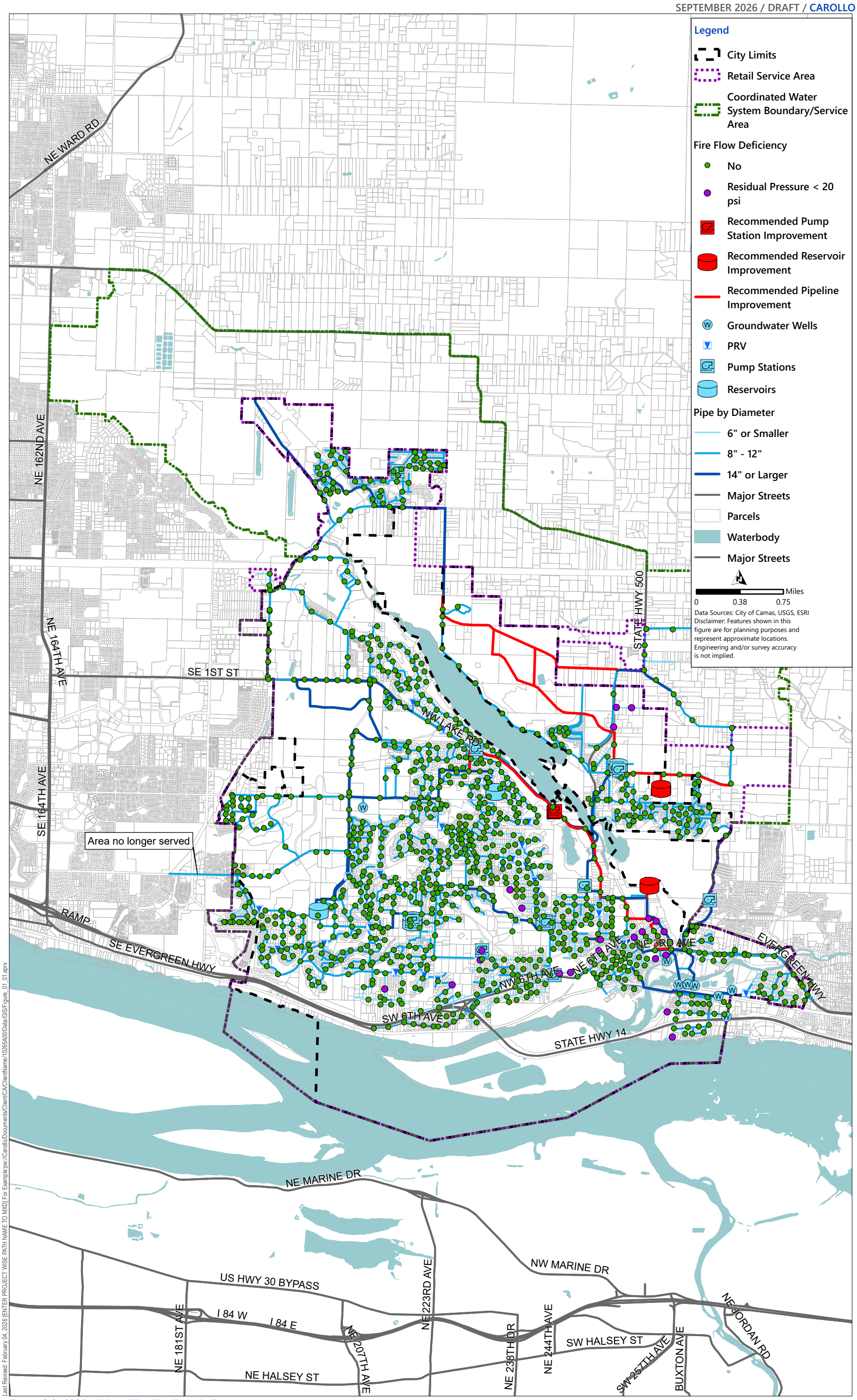


Figure 9.9 2036 MDD + FF – Fire Flow Deficiencies

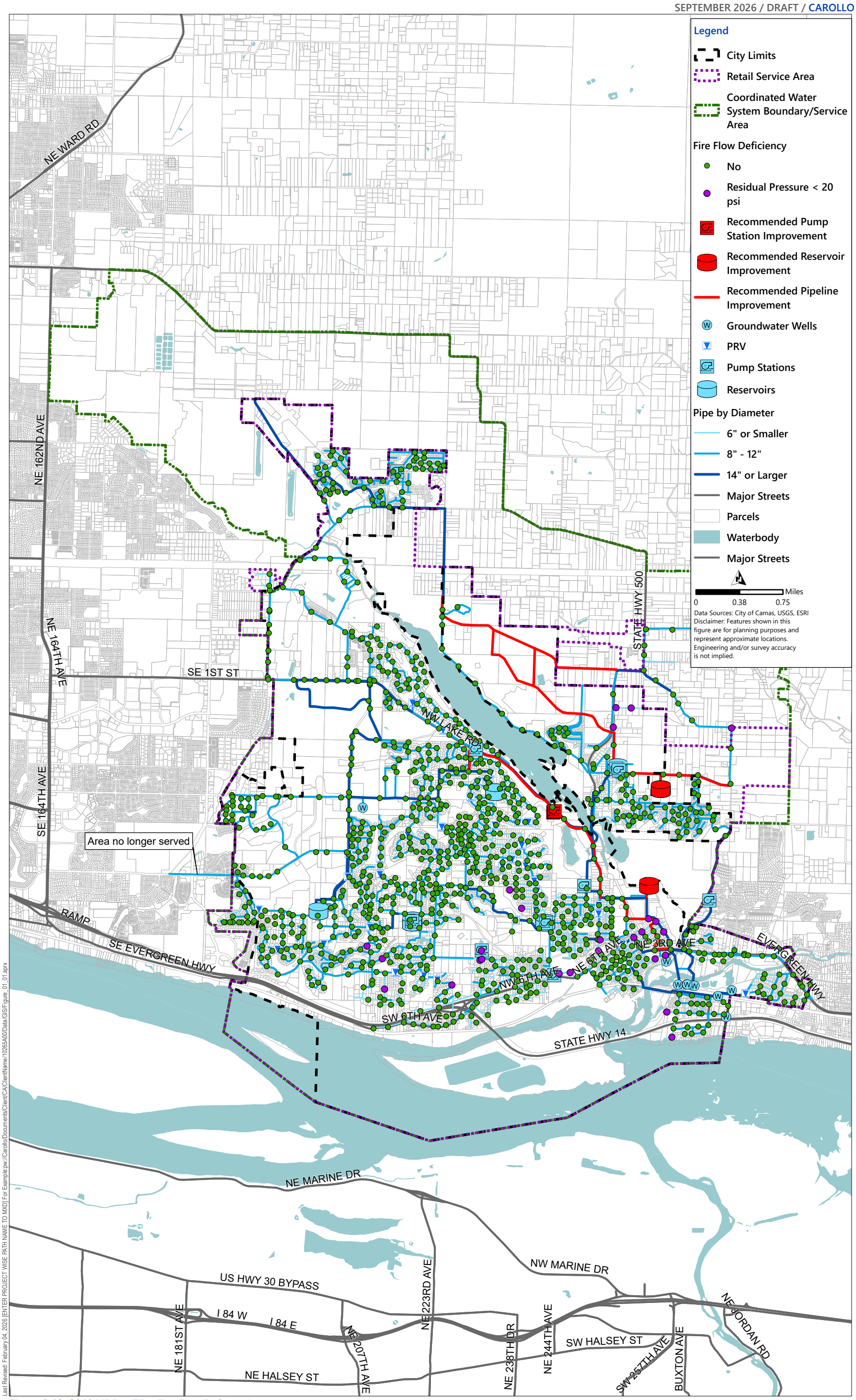
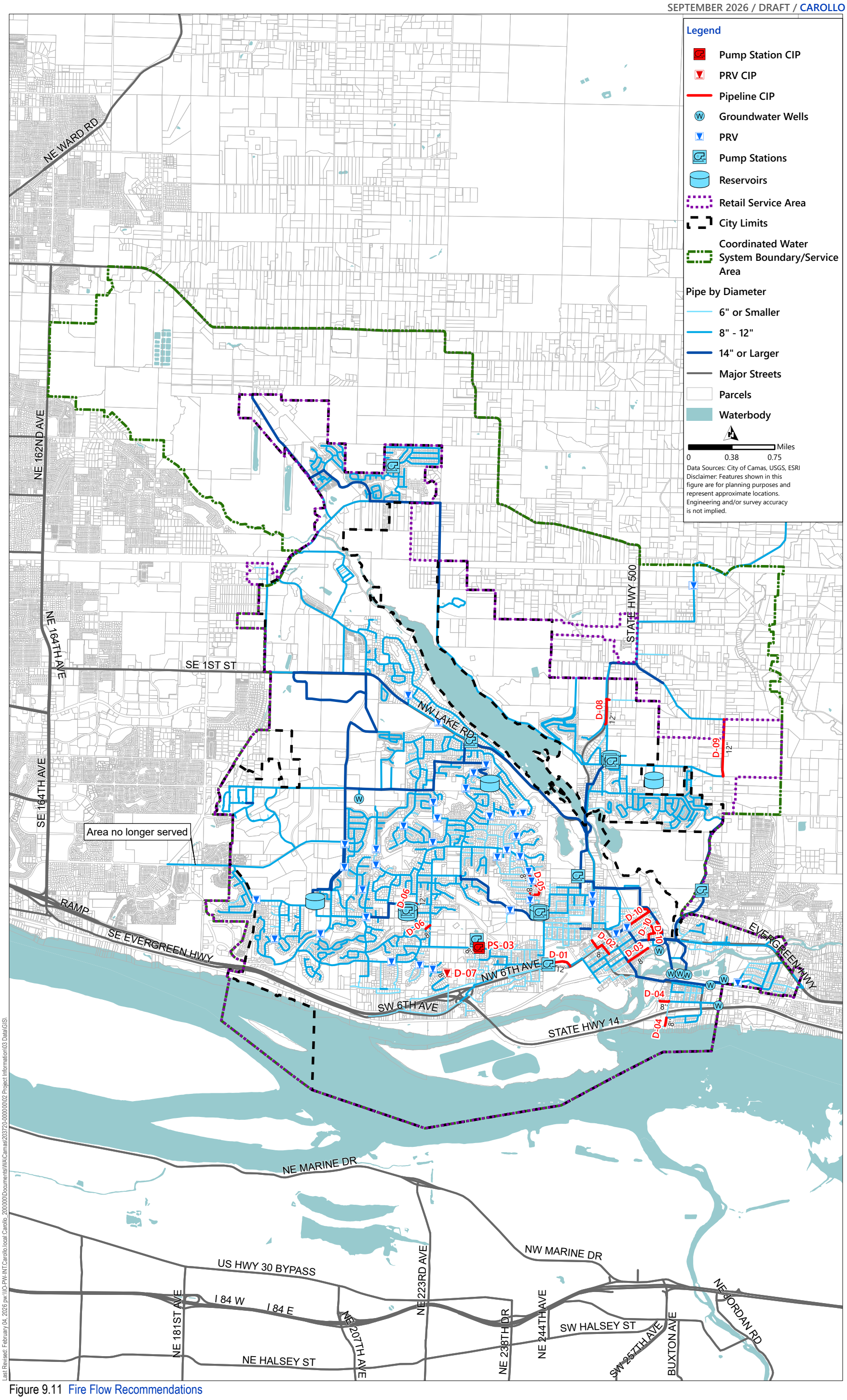


Figure 9.10 2046 MDD + FF – Fire Flow Deficiencies



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Figure 9.11 Fire Flow Recommendations

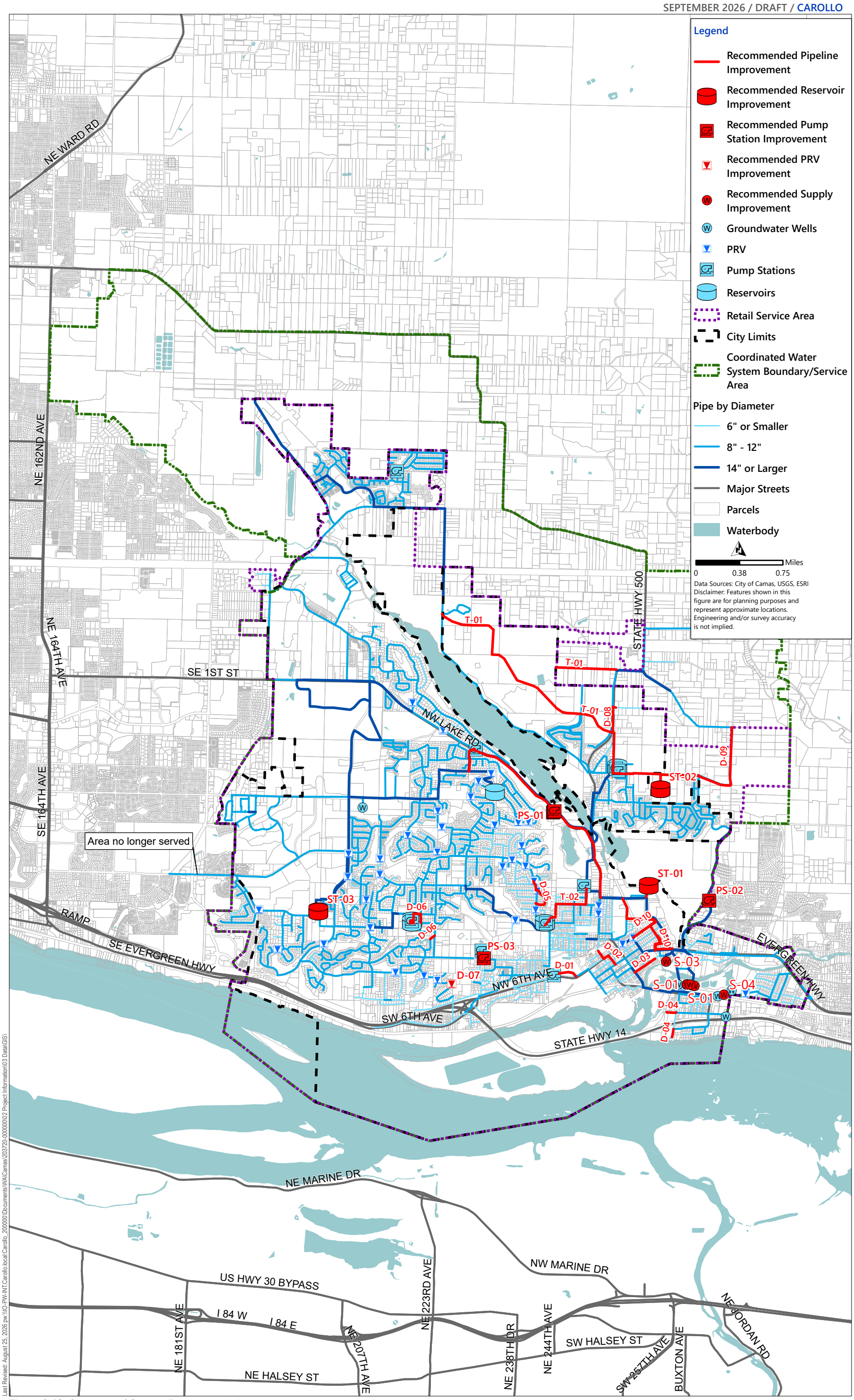


Figure 9.12 Summary of System Recommendations

9.3 Pumping Analysis

To evaluate pump station capacities, the City's water distribution system was divided into seven different pumping areas containing nine total pump stations. The 343 pumping area is supplied by groundwater wells and although not considered a pump station, was evaluated under both supply specific criteria in Chapter 8 and pumping criteria defined herein. For this water system plan update, the City utilized pumping reliability and redundancy criteria described below. A third criterion was added to evaluate wells and/or pump stations supplying closed zones against minimum DOH requirements.

1. Pumping Reliability. Wells and booster pumps with back-up power should be capable of supplying MDD for the water system while concurrently replenishing fire suppression storage within 72 hours.
2. Pumping Redundancy. With the largest pump supplying each service area out of service, the remaining pumps should provide MDD while concurrently replenishing fire suppression storage within 72 hours.
3. For wells or booster pump stations serving closed zones/systems:
    a. Supply MDD + Fire Flow.

Supply PHD with the largest pumping unit out of service. City specific pumping criteria only address MDD conditions. It is assumed if the City meets their MDD pumping reliability and redundancy goals, they will by default also be able to supply ADD reliably and redundantly.

Table 9.2 describes the relationship between pumping areas and pump stations. Pumping areas are defined as open or closed zones. Open zones are ones with adequate equalizing storage, so the pump stations are only required to supply the MDD and replenish fire suppression storage of the pumping area. Closed zones are areas that are supplied solely through a pump station; therefore, the pump station is required to supply PHD and fire flow.

Table 9.2 Pumping Area Summary

Pumping Area	Pump Stations Included	Open or Closed?
343	Lower Washougal Wellfield	Open
455	Forest Home and Angelo	Open
542	Crown Road, Butler, and New Gregg	Open
544	Lacamas	Open
852	Lower Prune Hill	Open
695 – GME	GME	Closed
Francis Road	Francis Road	Closed

9.3.1 343 Pumping Area

The 343 pumping area is an open zone that includes eight production wells: Well 5 (675 gpm), Well 6 (1,200 gpm), Well 7 (950 gpm), Well 8 (1,250 gpm), Well 10 (900 gpm), Well 11 (1,000 gpm), Well 12 (1,000 gpm), Well 13 (1,350 gpm), and Well 14 (850 gpm) with a total pumping capacity of 9,175 gpm. Total firm capacity is reflective of all total pumping capacity less the capacity of Well 13, the largest pump considered offline and Well 14, which was excluded because of a hydraulic limitation restricting the simultaneous operation of Well 6 and Well 14. Since Well 6 has the larger capacity of the two, its production capacity was used in the evaluation. Total reliable capacity is reflective of Well 8, 11, 12, 13, and 14 capacities, which are the facilities with backup power on-site. This pumping area serves the entire

distribution system. Table 9.3 shows the projected demands for the 2031, 2036, and 2046 scenarios compared to the total reliable capacity, with generators, and the total firm pumping capacity, with the largest pump offline. The 343 pumping area supplies show deficiencies for all planning year scenarios. Recommendations to address deficiencies related to the City's water supply are previously detailed in Chapter 8.

Table 9.3 343 Pumping Area Evaluation

343	2031	2036	2046
MDD (gpm)	7,995	9,195	11,685
Fire Replenishment Flow (gpm)	220	220	220
Total Demand(1) (gpm)	8,215	9,415	11,905
Total Firm Capacity (gpm)	6,975	6,975	6,975
Total Reliable Capacity(2) (gpm)	5,450	5,450	5,450
Pumping Redundancy - Surplus/Deficit (gpm)	-1,240	-2,440	-4,930
Pumping Reliability - Surplus/Deficit (gpm)	-2,765	-3,965	-6,455

Notes:
(1) Sum of MDD and Fire Replenishment Flow.
(2) Pumps with backup power. Currently, only Wells 8, 11, 12, 13, and 14 have backup power.

9.3.2 455 Pumping Area

The 455 pumping area is an open zone that includes three pump stations: Angelo, which houses four pumps each with a capacity of 1,000 gpm, Butler, which houses two pumps, one with a capacity of 600 gpm and the other with 800 gpm, and Forest Home, which houses a single 1,000 gpm pump. This pumping area directly serves the 455 pumping area and provides suction to the pump stations serving the 542, 544, 695, and 852 pumping areas. Table 9.4 shows the projected demands for the 2031, 2036, and 2046 scenarios compared to the total reliable capacity, with generators, and the total firm pumping capacity, with the largest pump offline. The 455 area pump stations currently have insufficient capacity for all planning scenarios. Sections 9.3.3.1 and 9.3.4.1 describe the recommended projects and system reconfigurations in the 542 and 544 pumping areas which will eliminate the intermediate pumping demands on this area, therefore, there are no recommendations for the 455 pumping area. Discharge pipeline upsizing described in Section 9.2.3.3 will also increase available pumping capacity at Angelo.

Table 9.4 455 Pumping Area Evaluation

455	2031	2036	2046
MDD (gpm)	6,850	7,890	10,220
Fire Replenishment Flow (gpm)	55	55	55
Total Demand(1) (gpm)	6,905	7,945	10,275
Total Firm Capacity (gpm)	5,400	5,400	5,400
Total Reliable Capacity(2) (gpm)	3,000	3,000	3,000
Pumping Redundancy - Surplus/Deficit (gpm)	-1,505	-2,545	-4,875
Pumping Reliability - Surplus/Deficit (gpm)	-3,905	-4,945	-7,275

Notes:
(1) Sum of MDD and Fire Replenishment Flow.
(2) Angelo PS has backup power to operate at firm capacity (3,000 gpm) and is the only facility in the pumping area with a backup power source.

9.3.3 542 Pumping Area

The 542 pumping area is an open zone including two pump stations: Crown Road and New Gregg, with each containing a total of three pumps. Crown Road has three pumps, each with a capacity of 800 gpm. New Gregg has two fire pumps with a capacity of 1,500 gpm each and a jockey pump with a capacity of 500 gpm. This pumping area serves the 542 pressure zone. Table 9.5 shows the projected demands for the 2031, 2036, and 2046 scenarios compared to the total reliable capacity, with generators, and the total firm pumping capacity, with the largest pump offline. The pump capacities for New Gregg were not considered in this evaluation due to concerns with intermediate pumping from the 455 zone discussed in the previous section. The 542 pumping area shows insufficient capacity for the 2046 redundancy scenario.

Table 9.5 542 Pumping Area Evaluation

542	2031	2036	2046
MDD (gpm)	665	1,130	1,930
Fire Replenishment Flow (gpm)	220	220	220
Total Demand(1) (gpm)	885	1,350	2,150
Total Firm Capacity (gpm)	1,600	1,600	1,600
Total Reliable Capacity(2) (gpm)	2,400	2,400	2,400
Pumping Redundancy - Surplus/Deficit (gpm)	715	250	-550
Pumping Reliability - Surplus/Deficit (gpm)	1,515	1,050	250

Notes:
(1) Sum of MDD and Fire Replenishment Flow.
(2) All pumps at Crown Road have backup power.

9.3.3.1 542 Pumping Area Recommendations - Project PS-02

The 542 pumping area shows insufficient pumping capacity under redundancy criteria in the 2046 scenario. Under normal operating conditions, this area is typically served by the jockey pump at New Gregg PS, which takes suction from the 455 pumping area. As a result, the added demand from the 542 pressure zone creates large deficiencies for the 455 area pump stations.

Additionally, the City has indicated that hydraulic limitations due to undersized pipelines on the discharge side of Crown Road pump station, preventing more than one pump operating at any given time. To reduce the reliance on intermediate pumping from the 455 pumping area and better utilize the available capacity at Crown Road pump station, it is recommended to add an 800 gpm pump in the remaining empty can at Crown Road pump station by 2046 and construct approximately 3,200 LF of 24-inch diameter transmission pipeline from the intersection of SE 283rd Avenue and SE Nourse Road to the new Gregg Reservoir (Phase 1 Pipeline). Phase 1 of the pipeline is recommended for completion in 2031 before the construction of the new storage reservoir in the 542 storage area..

These improvements will address the pumping deficiencies of the 542 area and the 455 area by eliminating intermediate pumping (Crown Road pump station pumps from the 343 zone directly to the 542 zone) and provide capacity for projected growth in the area.

9.3.4 544 Pumping Area

The 544 pumping area is an open zone that includes one pump station, Lacamas, which has three pumps. One pump has a 1,500 gpm capacity while the other two pumps have capacities of 500 gpm each. This pumping area directly serves the 544 pumping area and provides suction to the pump station for the 695 – GME pressure zone. Table 9.6 shows the projected demands for the 2031, 2036, and 2046 scenarios compared to the total reliable capacity, with generators, and the total firm pumping capacity, with the largest pump offline. Lacamas pump station has insufficient capacity for all planning year scenarios.

Table 9.6 544 Pumping Area Evaluation

544	2031	2036	2046
MDD (gpm)	3,530	3,985	5,260
Fire Replenishment Flow (gpm)	280	280	280
Total Demand(1) (gpm)	3,810	4,265	5,540
Total Firm Capacity (gpm)	1,000	1,000	1,000
Total Reliable Capacity(2) (gpm)	2,500	2,500	2,500
Pumping Redundancy - Surplus/Deficit (gpm)	-2,810	-3,265	-4,540
Pumping Reliability - Surplus/Deficit (gpm)	-1,310	-1,765	-3,040

Notes:
(1) Sum of MDD and Fire Replenishment Flow.
(2) All pumps have backup power.

9.3.4.1 544 Pumping Area Recommendation - Project PS-01

The 544 pumping area has insufficient pumping capacity under redundancy and reliability criteria for all planning year scenarios. Like the 542 pumping area, the 544 pumping area relies on intermediate pumping from the 455 pumping area. The City is currently under contract to design a new pump station that will pump directly from the 343 zone to the 544 zone. This project will also include transmission pipeline upgrades needed to increase conveyance capacity for future growth in the area.

9.3.5 695 - Green Mountain Estates Pumping Area

The 695 - GME pumping area is a closed zone that includes one pump station, GME, which contains five pumps. Three pumps are for domestic service and have capacity of 180 gpm each and the remaining two pumps are for fire service and have capacity of 650 gpm each. This pumping area serves the 695 - GME pressure zone. Table 9.7 shows the projected demands for the 2031, 2036, and 2046 scenarios compared to the total pumping capacity and firm capacity, with the largest pump offline. This table shows the GME pump station has adequate capacity for all planning year scenarios.

Table 9.7 695 - Green Mountain Estates Pumping Area Evaluation

695 - GME	2031	2036	2046
MDD + FF Demand (gpm)	1,605	1,610	1,620
PHD Demand (gpm)	520	545	595
Total Capacity (gpm)	1,840	1,840	1,840
Firm Capacity (gpm)	1,190	1,190	1,190
MDD + FF Surplus/Deficit (gpm)	235	230	220
PHD Surplus/Deficit (gpm)	670	645	595

9.3.6 Francis Road Pumping Area

The Francis Road pumping area is a closed zone that includes one pump station, Francis Road, housing a single 80 gpm pump in a small below grade vault. This pumping area serves a few homes along Francis Road. Table 9.8 shows the projected demands for the 2031, 2036, and 2046 scenarios compared to the total pumping capacity and firm capacity, with the largest pump offline. There is a fire hydrant within this pump station's service area therefore fire flow must be provided. Francis Road pump station has insufficient total and firm capacity for all planning year scenarios.

Table 9.8 Francis Road Pumping Area Evaluation

Francis Road	2031	2036	2046
MDD + FF Demand (gpm)	1,001	1,002	1,003
PHD Demand (gpm)	2	3	5
Total Capacity (gpm)	80	80	80
Firm Capacity (gpm)	0	0	0
MDD + FF Surplus/Deficit (gpm)	-921	-922	-923
PHD Surplus/Deficit (gpm)	-2	-3	-5

9.3.6.1 Francis Road Pumping Area Recommendation - Project PS-03

The Francis Road pumping area has insufficient pumping capacity and fire flow capacity for each planning year scenario. Discussion with the City indicated their preference to replace the existing Francis Road pump station with a new above grade pump station. The service area of the new pump station will be expanded to serve nearby customers with low pressures. To meet DOH criteria and the City's level of service goals, the new Francis Road pump station will be equipped with two 75 gpm capacity domestic pumps, two 1,000 gpm capacity fire pumps and a backup generator. These improvements will resolve the current fire flow and pressure deficiencies in this area.

9.4 Storage Analysis

The City's storage facilities were evaluated based on their criteria. To evaluate storage capacities, the City's distribution system was divided into five different storage areas containing 26 total pressure zones. Table 9.9 describes the relationship between pressure zones and storage areas.

Table 9.9 Storage Area

Storage Areas	Pressure Zones
343	285 - Downtown and 343 - Butler
455	455 – LPH and 550 – Francis Road
542	542 - Gregg
544	544 - Lacamas, 695 - GME, and one PRV subzone
852	852 - UPH and 17 PRV Subzones

The City's reservoir storage requirements depend on the water system's configuration, seasonal and daily variations in water-use patterns, and the reliability of various water system components. The following section describes the components of storage, summarizes the existing system's capacity to meet the storage needs of each operational area, and makes recommendations to address any identified storage deficits.

9.4.1 Components of Storage

Following the DOH storage volume requirements (WAC 246-290-235(3)) and the Water System Design Manual, Chapter 7, the five components of storage listed below must be evaluated for all water systems:

- Operational storage.
- Equalizing storage.
- Fire-suppression storage (FSS).
- Standby storage (SS).
- Dead storage.

DOH requires that operational and equalizing storage are available to all customers at a residual pressure of at least 30 psi under PHD flow conditions. The City has an increased level of service goal to provide standby and fire suppression storage to all customers at a residual pressure of at least 30 psi under MDD, which is above the DOH requirement of 20 psi. Therefore, all reservoir volumes above the 30 psi hydraulic grade line (HGL) are considered available storage. Dead storage is the volume in the reservoir that cannot be used to serve the highest customer in the water system with a pressure of at least 30 psi. The City also combines fire and standby into a single band for planning (i.e., nesting) and only the larger of the two volumes is used for analysis. Figure 9.13 schematically shows these components.

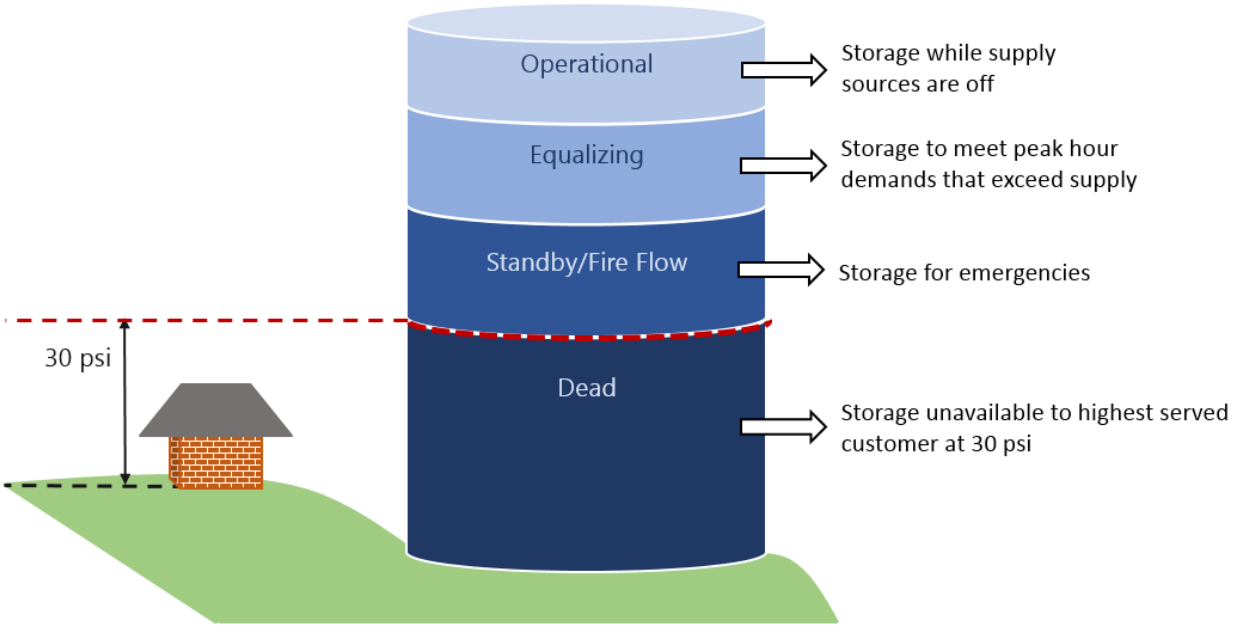


Figure 9.13 Illustration of Storage Components

9.4.1.1 Operational Storage

Operational storage is the volume of water used on a day-to-day basis to supply the water system while the sources of supply are in the "off" position. This volume is dependent on the settings of the water level sensors controlling the pumps and is designed to prevent the pump motors from excessive starts and stops (cycling).

Summarized in Table 9.10, the operational storage volume for reservoirs was determined from SCADA data and pump settings provided by the City and set up within the hydraulic model.

Table 9.10 Operational Storage Volumes

Reservoir	Storage Area	Total Volume (MG)	Operational Band (feet)	Operational Storage (MG)	Percent of Total Storage
Butler	343	1.2	1.3	0.10	9%
Lower Prune Hill #2	455	1.5	0.5	0.03	2%
Gregg	542	0.1	8	0.01	11%
Lacamas	544	2.0	4	0.17	8%
18th Avenue	544	2.0	1.2	0.06	3%
Upper Prune Hill #1	852	0.75	4	0.03	4%
Upper Prune Hill #2	852	2.4	6	0.21	9%
Total		**9.95**		**0.61**	**6%**

9.4.1.2 Equalizing Storage

Equalizing storage is the total volume needed to satisfy the peak hourly demands (PHD) that exceed the supply system's capacity. The WAC 236-290-235 requires that equalizing storage be provided for peak demands.

Equalizing volume requirements were calculated for each reservoir using the following equation using the storage area demands and are summarized in Table 9.11.

ES = (PHD – MDD) x 150 min, but in no case less than zero

Where:

- ES = Equalizing Storage component, in gallons.
- PHD = Peak hourly demand, in gpm.
- MDD = Sum of all installed and active source of supply capacities, except emergency sources of supply, in gpm.

PHD was calculated using the individual pressure zone peaking factors determined from the diurnal patterns used in system analysis.

Table 9.11 Equalizing Storage Volumes

Storage Area	2031 Equalizing Volume (MG)	2036 Equalizing Volume (MG)	2046 Equalizing Volume (MG)
343	0.14	0.16	0.18
455	0.09	0.09	0.09
542	0.08	0.14	0.24
544	0.33	0.37	0.47
852	0.37	0.39	0.43
Total	**1.01**	**1.15**	**1.41**

9.4.1.3 Standby Storage and Fire-Suppression Storage

Standby Storage volumes are required to supply reasonable system demands during a system emergency, such as the disruption of the water supply caused by a transmission pipeline or equipment failure, power outage, valve failure, or other system interruptions (as discussed in Chapter 2). The computation of emergency/standby storage requirements includes consideration of reasonable system disruptions that can be expected to occur within normal planning contingencies, and does not consider major system emergencies, such as earthquakes, which result in shutdown of water supplies and multiple distribution system breaks. These types of emergencies should be covered under emergency system operation planning. Table 9.12 shows the required standby storage capacity for each operational area.

The DOH Water System Design Manual recommends a minimum standby storage volume of no less than 200 gallons per ERU, which is the criteria adopted into City policy. However, as noted above, City policy states that standby storage should be available to the highest customer in the storage area at 30 psi.

Table 9.12 Standby Storage Volumes

Storage Area	2031 Standby Storage Volume (MG)	2036 Standby Storage Volume (MG)	2046 Standby Storage Volume (MG)
343	0.60	0.69	0.77
455	0.38	0.39	0.40
542	0.38	0.64	1.08
544	2.31	2.65	3.39
852	1.03	1.07	1.18
Total	**4.70**	**5.44**	**6.82**

Fire suppression storage is the quantity of water required for firefighting as defined by applicable water system criteria and fire codes. Firefighting often places the largest demand on a water system because a high volume of water must be supplied over a short time period. Such demands require each component of the system to operate at optimal condition.

DOH requires water systems to have storage reservoirs that can meet fire flow requirements while maintaining a level of 20 psi throughout the distribution system. However, City policy states storage reservoirs should have adequate capacity to supply required fire flow while maintaining a minimum of 30 psi at the highest customer. Table 9.13 outlines the required maximum fire flow, duration, and FSS volume for each operational area.

Table 9.13 Required Maximum Fire Flow

Storage Area	Required Fire Flow (gpm)	Required Duration (hours)	Required FSS (MG)
343	4,000	4	0.96
455	2,000	2	0.24
542	4,000	4	0.96
544	5,000	4	1.20
852	2,500	2	0.30

The City plans for single emergency at time per storage area. Either standby storage or fire-suppression storage, whichever volume is smaller, can be excluded from each zone's total storage requirement (this is also known as "nested" storage). Table 9.14 outlines the nested standby storage and fire-suppression storage requirements for each operational area.

Table 9.14 Nested Standby Storage and Fire-Suppression Storage

Storage Area	Volume (MG)			Controlling Factor (FSS or SS)		
	2031	2036	2046	2031	2036	2046
343	0.96	0.96	0.96	FSS	FSS	FSS
455	0.38	0.39	0.40	SS	SS	SS
542	0.96	0.96	1.08	FSS	FSS	SS
544	2.31	2.65	3.39	SS	SS	SS
852	1.03	1.07	1.18	SS	SS	SS

9.4.1.4 Dead Storage

Dead storage is the volume at the bottom of the storage reservoir that cannot reliably be used because it is physically too low to be withdrawn from the reservoir or, if withdrawn from the reservoir, would result in

water pressures in the distribution system below the acceptable criteria of 30 psi. Storage volume is considered dead if it is located below the outlet pipeline and cannot be used because of system's hydraulic limitations or if high elevations cause low pressures at customer connections.

Table 9.15 summarizes the dead volume calculations for each reservoir. Section 9.4.2 outlines the recommendations to mitigate these low pressure and dead storage issues for high elevation customers.

Table 9.15 Reservoir Dead Storage(1)

Reservoir	Storage Area	Storage Volume (MG)	Maximum Elevation Served (feet)	Available Storage at 20 psi (MG)	Percent Available at 20 psi %)	Available Storage at 30 psi (MG)	Percent Available at 30 psi (%)
Butler	343	1.20	234	1.20	100%	1.20	100%
LPH No. 2	455	1.50	392	1.10	73%	0.00	0%
Gregg	542	0.10	440	0.08	80%	0.05	47%
Lacamas	544	2.0	437	2.0	100	1.57	79%
18th Avenue	544	2.0	437	2.0	100%	1.84	95%
UPH No.1	852	0.75	757	0.37	49%	0.19	26%
UPH No. 2(1)	852	2.40	757	2.22	93%	2.22	93%

Notes:
(1) UPH Reservoir No. 2 has pump station to make all storage usable. The City maintains a minimum of 5 feet in the reservoir.

9.4.2 Storage Recommendations

A summary of the existing storage and storage needs in 2046 is shown in Table 9.16. This table assumes the recommended projects to address low pressures identified in Section 9.2.1 have been completed. Storage deficits were identified in the following storage areas: 343, 542, and 544. The identified storage deficits can be mitigated by constructing additional storage space. While adjustments in operational strategy could mitigate some storage requirements, additional storage construction would still be needed to address deficits in all zones.

All recommended projects are summarized in the sections below.

Table 9.16 2046 Storage Summary

Storage Area	Total Storage Volume (MG)	Available Storage at 20 psi (MG)	Available Storage at 30 psi (MG)	Operational Storage (MG)	Equalizing Storage (MG)	Fire-Suppression Storage (MG)	Standby Storage (MG)	Required Storage (MG)	Storage Volume to Add by 2046 (MG)
343	1.20	1.20	1.20	0.10	0.18	0.96	0.77	1.24	0.04
455(1)	1.50	1.50	1.50	0.03	0.09	0.24	0.40	0.52	0
542	0.10	0.08	0.05	0.01	0.24	0.96	1.08	1.33	1.28
544	4.00	4.00	3.46	0.23	0.47	1.20	3.39	4.09	0.63
852(1)	3.15	2.59	2.42	0.45	0.43	0.30	1.18	2.06	0
Total	**9.95**	**9.37**	**8.45**	**1.08**	**1.41**	**3.63**	**6.82**	**9.24**	**1.92**

Notes:
(1) Assumes projects to address low pressures and high elevation customers causing dead storage have been completed.

Table 9.17 outlines the storage requirements and deficits for each planning year, 2031, 2036, and 2046. The sections to follow outline storage recommendations for each storage area to alleviate identified storage deficits.

Table 9.17 Storage Requirements by Planning Year

Storage Area	Total Available Storage at 30 psi(1) (MG)	2031		2036		2046	
		Required Storage (MG)	Storage Surplus/Deficit (MG)	Required Storage (MG)	Storage Surplus/Deficit (MG)	Required Storage (MG)	Storage Surplus/Deficit (MG)
343	1.20	1.20	0	1.22	-0.02	1.24	-0.04
455	1.50	0.5	1.0	0.51	0.99	0.52	0.98
542	0.05	1.05	-1.0	1.11	-1.06	1.33	-1.28
544	3.46	2.87	0.59	3.25	0.21	4.09	-0.63
852	2.42	1.85	0.57	1.91	0.51	2.06	0.36

Notes:
(1) Assumes projects to address low pressures and high elevation customers causing dead storage have been completed.

9.4.2.1 343 Storage Area Recommendations - Project ST-01

By the 2036 and 2046 planning years there are slight storage deficits of 0.02 and 0.04 MG in the 343 area. The storage in this area is currently provided by Butler Reservoir, which is a 1.2 MG partially buried reservoir originally constructed in the early 1900s. The City has indicated Butler Reservoir is reaching the end of its useful life and will be decommissioned once a new 343 zone reservoir is constructed. The replacement reservoir project is currently in preliminary design phase. An alternatives analysis completed by the City's consultant Gray & Osborne (G&O) indicated the preferred alternative would be an elevated reservoir near the Camas Cemetery. The new reservoir would be sized for buildout and provide a minimum of 1.84 MG of usable storage for the 343 area alleviating deficits identified under this planning period. G&O provided preliminary costs for the project in their September 2025 alternatives analysis, which will be included in the City's CIP.

9.4.2.2 542 Storage Area Recommendations - Project ST-02

In 2031, there is a 1.0 MG deficit in the 542 storage area, increasing to a 1.28 MG deficit in 2046. To alleviate deficits in the area, an additional storage reservoir will need to be constructed. There are multiple alternatives for increasing storage capacity in this area. For planning purposes, an elevated reservoir with a nominal capacity of 1.5 MG was recommended and will be incorporated into the CIP as it was the costliest alternative. The City should complete an alternatives analysis before beginning the design phase of this project to identify the most feasible, cost-effective solution. Due to topography the new reservoir will likely need to be located at the existing Gregg Standpipe site which is the highest point in the area. Additionally, Phase 1 of the transmission pipeline project described in Section 9.3.3.1 should be completed with this storage project to mitigate potential hydraulic bottlenecks associated with filling the new reservoir. Phase 1 would include approximately 3,200 LF of 24-inch diameter transmission pipeline from the intersection SE 283rd Avenue and SE Nourse Road to the new Gregg Reservoir.

9.4.2.3 544 Storage Area Recommendations - Project ST-03

At the end of the planning period in 2046, there will be a deficit of approximately 0.63 MG in the 544 storage area. To address this deficit an additional reservoir with a nominal capacity of 0.75 MG is recommended at the 18th Avenue site, which has space on-site to accommodate the additional reservoir.

9.5 Limiting Capacity Analysis

The limiting capacity of the City's physical water system was determined for the 2031, 2036, and 2046 planning years with existing conditions and infrastructure. The limiting capacity was then calculated for the 2046 planning year with the assumption that all recommended improvement projects will be online. The limiting capacity analysis uses the methodology described in DOH Water System Design Manual (2009) Worksheet 6-1 and Table 6-1. Table 9.18 describes the method used to calculate capacity for each component.

Table 9.18 Limiting Capacity Calculations

Water System Component	Equation / Notes
Sources (ADD)	N = $\frac{Firm\ Source\ Capacity}{ADD\ ERU\ value}$ where: Firm source capacity = source capacity with largest source (Well 13) offline.
Sources (MDD)	N = $\frac{Firm\ Source\ Capacity}{MDD\ ERU\ value}$ where: Firm source capacity = source capacity with largest source (Well 13) offline.
Treatment	The City has designed treatment capacity with sufficient capacity to serve its sources.
Equalizing Storage (ES)	N = $\frac{1}{C}[\left(\frac{1440}{MDD}\right)\left(\frac{ES}{150}+Q_s-18\right)-F]$ where: MDD = MDD, gpd/ERUs. C = Coefficient associated with ranges of ERUs. F - Factor associated with ranges of ERUs. Q_s = Total source pumping capacity, gpm.
Standby Storage (SB)	N = $\frac{SB_t}{(SB_i)(t_d)}$ where: SB_t = total volume of water in standby storage component (gallons). SB_i = Design level of standby storage to meet reliability considerations per ERU (gpd/ERU). t_d = time that storage is to be used (days).
Distribution	Not considered capacity limited because the City has planned projects to address all identified deficiencies and design standards confirm all new development meets City standards.
Transmission	Assumed to be addressed as part of source and pumping capacity.

The capacity of many water system components can be expressed as the number of ERUs that can be served. As described in Chapter 5, an ERU for the City's system is one that consumes 242 gpd on an average demand day. On a maximum day, an ERU consumes 490 gpd.

To determine how many ERUs the City's sources can serve on a maximum demand day, the supply to each operational area was divided by the MDD ERU value of 490 gpd. The MDD ERU value was also used to calculate the capacity of the City's equalizing storage in ERUs. The ERU capacity of standby storage was calculated by subtracting out each reservoir's equalizing storage and operational storage under 2046 demand conditions from its total available storage capacity.

The capacity of each operational area is either limited by source supply or standby storage. None of the service areas are limited by the amount of equalizing storage available. In total, based on sources, equalizing storage, and standby storage, the City's water system has a limiting capacity of approximately 18,830 ERUs. This is shown in Table 9.19.

As presented in Chapter 5, the City predicts serving approximately 34,420 ERUs in 2046. Considering sources, equalizing storage, and standby storage, the City's water system is anticipated to have insufficient capacity to meet expected growth within the 20-year planning period due to standby storage and supply source capacity. This confirms the storage recommendations presented in Section 9.4.2 and the supply recommendations presented in Chapter 8.

Fire-suppression storage is not a function of ERUs and therefore is not represented in Table 9.19.

Table 9.19 Calculated Capacity in ERUs for Each Water System Component

Water System Component	2031 System-wide ERUs	2036 System-wide ERUs	2046 System-wide ERUs	2046 System-wide ERUs with Improvements
Projected ERUs	23,800	27,440	34,420	34,420
Sources(1) (ADD)	44,495	44,495	44,495	71,720
Sources (MDD)	24,705	24,705	24,705	42,645
Equalizing Storage	81,670	81,670	81,670	161,425
Standby Storage	20,055	19,665	18,830	49,910
Limiting Capacity	Standby/Sources (MDD)	Standby/Sources (MDD)	Standby/Sources (MDD)	None

Notes:
(1) Average day source capacity assumes supply facilities are operated 18 hours per day.

9.6 Summary of Recommendations

The system analysis yielded a number of recommended improvements for pump stations, storage reservoirs, and pipelines which are summarized in Table 9.20 and Figure 9.14. Supply projects identified in Chapter 8 are also shown on this figure. These recommendations are organized into a CIP with associated costs in Chapter 10.

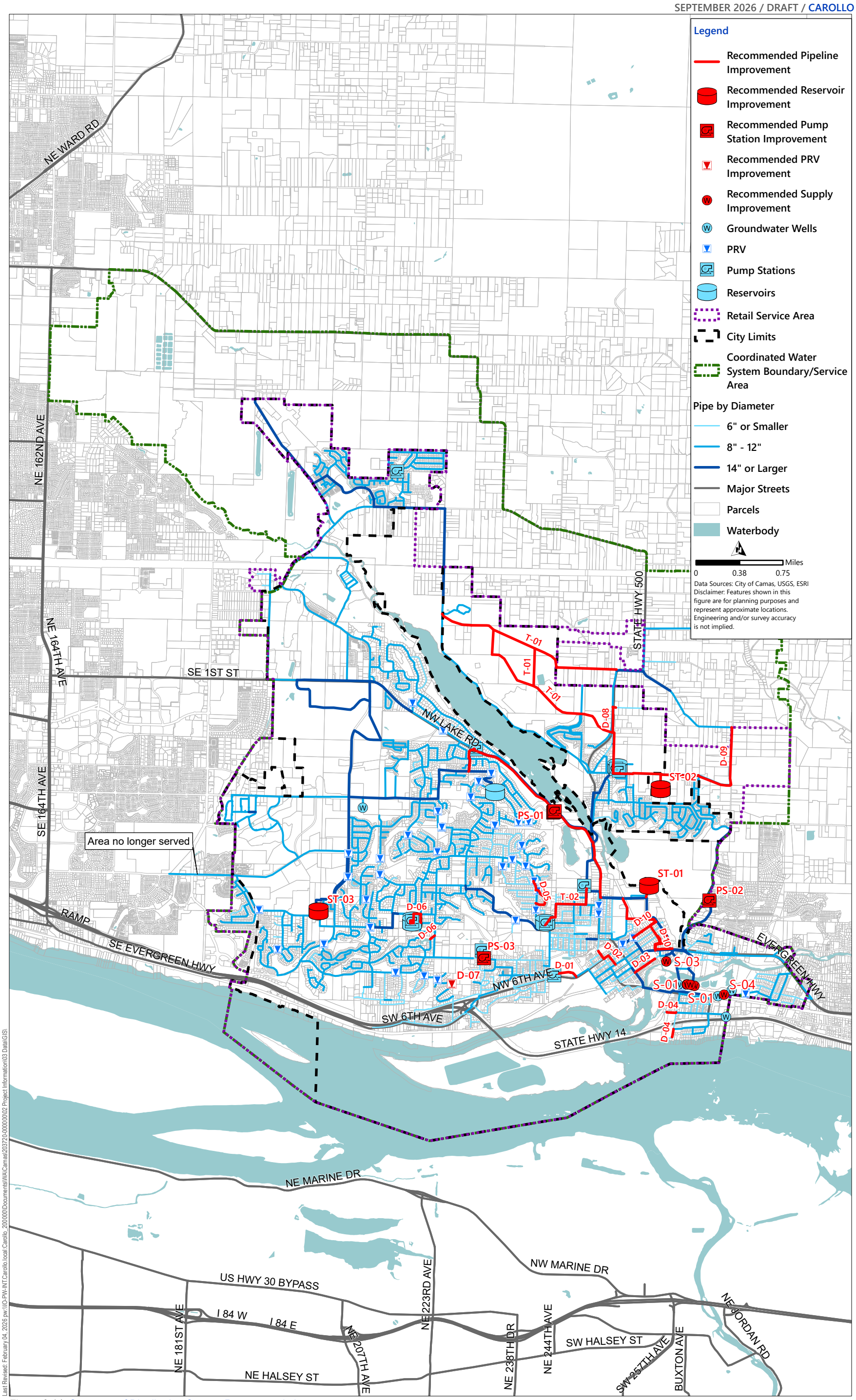


Figure 9.14 Summary of Distribution System Recommendations

Table 9.20 Summary of Recommended Improvement Projects

Project ID	Project Name	Improvement Type	Existing Diameter (inches)	Proposed Diameter (inches)	Description/Purpose
PS-01	544 Pumping Area Improvements	Pump Station and Transmission Pipeline			Construct Lake Road Pump Station, 30-inch suction and discharge pipeline, and 36-inch 343 zone transmission pipeline.
PS-02	542 Pumping Area Improvements	Pump Station Upsize and Transmission Pipeline			Add an additional 800 gpm pump at Crown Road pump station and construct 3,200 LF of 24-inch transmission pipeline.
PS-03	Francis Road Pumping Area Improvements	Pump Station Upsize			Replace Francis Road pump station with a new, above ground pump station sized to serve domestic connections and fire flow.
ST-01	343 Zone Storage Improvements	Storage			A 1.84 MG elevated reservoir in the 343 zone is recommended to address storage deficits in all planning years and replace the aging Butler Reservoir.
ST-02	542 Zone Storage Improvements	Storage			A 1.5 MG elevated reservoir in the 542 zone is recommended to address storage deficits in all planning years.
ST-03	544 Zone Storage Improvements	Storage			A 0.75 MG reservoir in the 544 zone is recommended to address the storage deficit in the 2046 planning year.
D-01	NW 7th Avenue Fire Flow Improvements	Pipeline Upsize	8	12	Upsize approximately 1,300 LF of pipeline from 6-inch to 12-inch to address fire flow deficiencies in the area.
D-02	NE Dallas Street Fire Flow Improvements	Pipeline Upsize	6	12	Upsize approximately 1,150 LF of pipeline from 6-inch to 8-inch to address fire flow deficiencies in the area.
D-03	E 1st Avenue Fire Flow Improvements	Pipeline Upsize	8	12	Upsize approximately 1,150 LF of pipeline from 6-inch to 8-inch to address fire flow deficiencies in the area.
D-04	Operations Center/WWTF Fire Flow Improvements	Pipeline Upsize	6	8	Upsize approximately 850 LF of pipeline from 6-inch to 8-inch to address fire flow deficiencies in the area.
D-05	NW Fargo Street Fire Flow Improvements	Pipeline Upsize	6, 8	12	1,700 LF of pipeline is being upgraded from 6-inch to 8-inch to address fire flow deficiencies in the area.
D-06	Upper Prune Hill Fire Flow Improvements	Pipeline Upsize	4	8	Upsize approximately 750 LF of pipeline from 12-inch to 16-inch and 450 LF of 8-inch pipeline to 12-inch to address fire flow and low-pressure deficiencies in the area.
D-07	Sierra Lane PRV Station	PRV Station	4	8	New PRV station to allow fire flow from the 542_S zone to the 455 zone.
D-08	SE 5th Street and SE Everett Road Fire Flow Improvements	Pipeline Upsize	4	8	Upsize approximately 1,200 LF of pipeline from 10-inch to 12-inch and 50 LF of 8-inch pipeline is recommended to address fire flow deficiencies in the area.
D-09	SE 283rd Avenue Fire Flow Improvements	Pipeline Upsize	16	20	2,700 LF of pipeline is being upgraded from 8-inch to 12-inch to address fire flow deficiencies in the area.
D-10	NE 6th Avenue and NE Nevada Street Fire Flow Improvements	Pipeline Upsize		8	Upsize approximately 3,600 LF of pipeline from 6-inch to 8-inch to address fire flow deficiencies in the area.
T-01	North Shore Transmission Pipeline	Transmission Pipeline		12,24	Construct approximately 6,300 LF of 12-inch pipeline and 16,600 LF of 24-inch pipeline to serve future North Shore development.
T-02	Angelo Pump Station Discharge Pipeline	Transmission Pipeline	Various	16	Upsize approximately 3,350 LF of various diameter pipeline to 16-inch pipeline to address high head loss and discharge pressures at Angelo PS.

CHAPTER 10 CAPITAL IMPROVEMENT PLAN

10.1 Introduction

This chapter combines the various projects recommended in the WSPU for the City's distribution system and presents them as a comprehensive CIP. With this CIP, the City will have guidelines to plan and budget for the distribution system over the next 20 years, along with the recommended timing and cost estimates for each identified project. Project phasing is described as either short-term (0 to 10 years, which corresponds to 2027 through 2036) or long-term (11 to 20 years, which corresponds to 2037 through 2046).

Appendix **[X]** lists each project with cost estimates in 2025 dollars and detailed implementation timing and prioritization.

10.1.1 Capital Project Categories

The WSPU's CIP projects are categorized as follows:

- Distribution System Improvements (D).
- Transmission Pipeline (T).
- Annual Repair and Replacement Programs (R).
- Pump Station (PS).
- Storage (ST).
- Supply and Treatment (S).
- General (G).

The abbreviations presented above were used during project identification to delineate each project category.

10.1.2 Capital Project Types

To support the City's financial evaluation, CIP projects were assigned need based on four types:

- **Growth:** Projects that add system capacity to meet future demand growth. These projects are typically funded with connection fees and are recommended to meet the analysis criteria detailed in Chapter 2.
- **Upgrade**: Projects necessary to improve the level of service (e.g., redundant pumping, backup power, pipe upsizing, fire flow, system reliability) of existing infrastructure. These projects are typically funded with rates and are needed whether demand increases or stays the same.
- **Replace and Repair (R&R)**: Projects that replace or maintain existing infrastructure without increasing capacity or level of service. These projects are typically funded with rates and are meant to renew aging infrastructure that is in poor condition.
- **General/Programmatic**: Projects that are intended to be studies, consisting of future water system plans and water supply feasibility studies.

Individual projects may include elements of multiple capital project types, meaning each project was defined as one or more of the four types and assigned a percentage of the total project cost to each type. The allocations between multiple types were made using professional judgment.

10.1.3 Capital Planning Periods

CIP projects were allocated into the planning periods referenced in previous chapters:

1. Short-term (2027-2036).
2. Long-term (2037-2046).

Projects recommended under this planning period have all been allocated to individual years. To better distribute costs, some larger projects have been spread across multiple years to account for longer design and construction periods. The project timing in this Chapter is subject to change, as the City regularly reviews and updates its CIP based on changing conditions and priorities.

10.1.4 Capital Project Cost Allocation

Discussed in Section 10.1.2, each CIP project was assigned to a capital project type. The allocated project type will help support the City in the development of rates and standard development charges. Each CIP project type was assigned a cost allocation. In general, CIP projects needed to support future growth and development are funded by developers and connection fees while projects needed to support existing infrastructure deficiencies or repair and replacement are funded by existing rate payers.

- Growth: Projects will be funded by developers and SDCs (connection charges).
- Upgrade: Projects will be funded by rates.
- R&R: Projects will be funded by rates.
- General: Projects will typically be funded by rates.

10.2 Cost Estimating Assumptions

10.2.1 Cost Estimate Level

The CIP cost estimates in this chapter are Class 5 (budget-level estimates from a -50 percent to +100 percent range). These costs were determined using both Carollo Engineers' (Carollo) understanding of project locations and current conditions and the City's costs for similar and recently constructed capital projects. Note actual costs may vary by -50 percent to +100 percent from these estimates.

All costs are given in 2025 dollars. The Handy-Whitman Index for Water Utility Construction in the Pacific Region for January 2025 is 1,401. As previously stated, the estimates are subject to change as the project design matures and because costs for labor, materials, and equipment may vary in the future.

10.2.2 Baseline Unit Cost

Baseline construction costs were estimated using unit costs with the assumptions presented in the following subsections.

10.2.3 Cost Estimates Elements

The total CIP cost estimates are based on construction costs that are inflated using cost factors to account for non-construction project elements. The cost factors for the WSPU are shown in Table 10.1. Note for pump station and supply projects, which typically rely heavily on mechanical components, a 25 percent factor for engineering and planning were allocated to account for project complexity. For pipeline and storage projects, 20 percent was allocated for engineering and planning. For pipeline and storage projects, the cost factors would increase the baseline construction costs by 80 percent to represent the total project cost. For pump station and supply projects, the cost factors would increase the baseline construction costs by 85 percent to represent the total project cost, respectively.

Table 10.1 Cost Factors

Adjustment Factors	Description	Factor
Contingency	Costs that may occur due to uncertainty in project scope and conditions.	30%
General Conditions and Overhead	Contractor costs indirectly related to construction.	25%
Engineering/Planning(1)	Cost for planning and design of project.	20%/25%
City Admin	Cost to administer the project.	5%

Note:
(1) Pump station and supply projects were assigned an engineering/planning factor of 25 percent to account for project complexity.

The costs presented in this CIP are high-level planning costs that will help the City make financial decisions.

The sample capital improvement project cost calculation shown below demonstrates how construction contingency as well as design and administrative costs were added to the baseline construction cost to determine the total project cost. The construction contingency plus design and administration costs make up just over 50 percent ($1,015,000/$2,015,000) of the total project cost estimate.

Example, assuming engineering/planning factors for pump stations and supply/treatment:

Baseline Construction Cost	**$1,000,000**
Construction Contingency (30%)	$300,000
Estimated Construction Cost	**$1,300,000**
General Conditions & Overhead (25%)	$325,000
Engineering/Planning (25%)	$325,000
City Admin (5%)	$65,000
Total Capital Improvement Cost	**$2,015,000**

10.2.4 Pipeline Unit Costs

Table 10.2 shows unit cost assumptions for pipelines. These costs were developed using Carollo's understanding of project locations and current conditions and the City's costs of similar and recently constructed capital projects. For planning purposes, these unit costs assume open-trench construction in improved areas. If trenchless construction is possible for some projects, the cost estimates may need to be modified. Costs include pavement cutting, excavation, hauling, shoring, ductile iron pipe, materials (i.e.,

valves, fittings, restraints, etc.) and installation, hydrant assemblies, backfill material and installation, and pavement replacement. The unit costs are for construction in stable soil at standard excavation depths for each pipe size. Additionally, costs reflect increased effort to construct on shallow bedrock that overlays large areas of the City and its Urban Growth Area. Steep slopes, extensive permitting, or acquisition of right of way may result in additional costs. These costs are construction costs only and do not reflect Contingency, General Conditions and Overhead, Engineering/Planning, and City Admin.

Table 10.2 Pipeline Unit Costs

Pipe Size (Inches)	Pipe Unit Cost(1) ($/Linear Foot)
8	$236
10	$268
12	$300
16	$404
20	$481
24	$575
30	$897
36	$1,203

Notes:
(1) Costs represent baseline construction costs and do not include additional cost factors for contingency, general conditions and overhead, engineering/planning, and City admin.

10.2.5 Pump Station Costs

Pump station projects costs were developed based on both site and project specific requirements. The costs account for Carollo's understanding of project locations and current conditions, as well as costs from recently completed Carollo projects.

10.2.6 Well Costs

Well drilling project costs were developed based on typical costs from past Strata Geosciences projects. Costs do not include mechanical equipping of well. Well equipping costs were site specific and developed based on Carollo's understanding of estimated well yields, project location, and the City's ongoing Well 13 construction project. Cost estimates for new well drilling is approximately $150,000.

10.2.7 Reservoir Costs

New reservoir project costs were developed based on typical costs from past Carollo projects. Conceptual costs for reservoirs vary by type: ground and elevated. Costs are estimates based on reservoir volume in gallons, as presented in Table 10.3. Reservoir costs are sensitive to site-specific geotechnical and seismic considerations; therefore, it is recommended that a reservoir siting study that addresses these issues be conducted at the initiation of a new reservoir project.

Table 10.3 Reservoir Unit Costs

Reservoir Type	Cost per gallon(1) ($/gallon)
Ground(2)	$3
Elevated	$10

Notes:
(1) Costs represent baseline construction costs and do not include additional cost factors for contingency, general conditions and overhead, engineering/planning, and City admin.
(2) Unit costs for ground reservoirs are based on welded steel construction.

10.2.8 Additional Costs

Other common costs for the CIP include those associated with onsite generators and PRV stations. Conceptual costs were estimated based on recent Carollo projects and presented in Table 10.4.

Table 10.4 Additional Costs

Reservoir Type	Cost(1)(Lump Sum)
Onsite Generator	$500,000 per generator installation
PRV Station	$400,000 per station

Notes
(1) Costs represent baseline construction costs and do not include additional cost factors for contingency, general conditions and overhead, engineering/planning, and City admin.

10.3 CIP Development and Implementation

The capital improvement implementation was separated into three priorities:

- Short-term: 0 to 10 years.
- Long-term: 10 to 20 years.
- Annual.

Table 10.5 summarizes the priorities associated with all projects and recommendations from this WSPU, based on the City's water system needs.

Table 10.5 CIP Prioritization Summary

Project Types	0-10 years	10-20 years
Pipeline upsize for fire flow only.	X	
Pipeline upsize for fire flow and low pressure.	X	
Pipeline repair and replacement.	Annual	
Transmission pipeline projects	X	X
Pump station projects.	X	X
Storage projects.	X	X
Supply and treatment projects.	X	X
General projects.	X	X

The following sections summarize recommended projects identified in previous chapters and incorporated in the summary in Section 10.5.

10.3.1 Recommended Distribution Projects

Distribution system projects (D) were developed using the hydraulic model and were identified for areas not meeting velocity and pressure criteria, as detailed in Chapter 9. These projects also took City staff input into account during development.

10.3.1.1 D-01 through D-10 - Fire Flow Recommendation Projects

To address the fire flow deficiencies identified in Chapter 9, the projects and recommendations presented in that chapter should be implemented. Namely, projects will upsize pipelines or add piping to create looped piping. Once implemented, these projects will address the identified deficiencies. Appendix **[X]** details each fire flow project and references it according to its respective project identification. In the CIP, these are projects D-01 through D-10.

In summary, these projects will replace or upsize approximately 15,500 LF of pipelines. Projects D-01 through D-05 and project D-10 include replacing aging cast iron or steel pipe to address fire flow deficiencies. Costs for these projects have been incorporated into the pipeline replacement program. The remaining projects, D-06 through D-09 are estimated to be a total of $4.4 million (including all applicable cost factors) and are recommended for completion in 2034 as part of the short-term planning period.

10.3.1.2 Distribution System Recommendations Summary

Table 10.6 summarizes recommended distribution system projects along with their respective priorities and costs. As discussed in the previous section, costs for projects D-01 through D-05 and project D-10 have been incorporated into the pipeline replacement program and therefore are not presented in Table 10.6.

Table 10.6 Distribution System Recommendations

Project Number	Project Name	Timing(2)	Priority	Cost(1)(2)
D-01	NW 7th Avenue Fire Flow Improvements	-	0-10 years	$-
D-02	NE Dallas Street Fire Flow Improvements	-	0-10 years	$-
D-03	E 1st Avenue Fire Flow Improvements	-	0-10 years	$-
D-04	Operations Center/WWTF Fire Flow Improvements	-	0-10 years	$-
D-05	NW Fargo Street Fire Flow Improvements	-	0-10 years	$-
D-06	Upper Prune Hill Fire Flow Improvements	2034	0-10 years	$1.3 million
D-07	Sierra Lane PRV Station	2034	0-10 years	$0.8 million
D-08	SE 5th Street and SE Everett Road Fire Flow Improvements	2034	0-10 years	$0.74 million
D-09	SE 283rd Avenue Fire Flow Improvements	2034	0-10 years	$1.6 million
D-10	NE 6th Avenue and NE Nevada Street Fire Flow Improvements	-	0-10 years	$-

Notes:
(1) The cost includes 30 percent construction contingency and 20 percent Engineering, Legal, and Administration (ELA) contingency.
(2) Costs and timings for projects D-01 through D-05 and D-10 are incorporated into the pipe replacement program and not reported in this table.
WWTF - wastewater treatment facility.

10.3.2 Recommended Transmission Pipeline

Transmission pipe projects (T) were developed using the hydraulic model and input from City staff. Table 10.7 summarizes transmission pipeline projects identified for this planning period.

Table 10.7 Transmission Pipe Recommendations

Project Number	Project Name	Timing	Priority	Cost(1)
T-01	North Shore Transmission Pipeline	2032	0-10 years	$20.5 million
T-02	Angelo Pump Station Discharge Pipeline	2037-2038	10-20 years	$2.7 million

Notes:
(1) The cost includes 30% construction contingency and 20% ELA contingency.

10.3.2.1 T-01 - North Shore Transmission Pipeline

Large development, both residential and commercial, is expected in the City's North Shore area. Geographically located in the area north of Leadbetter Road, the development will be connected to the existing distribution system via transmission pipeline. Detailed in Chapter 9, approximately 1,600 LF of 12-inch diameter pipe and 13,200 LF of 24-inch diameter pipeline will be needed to connect the area to the existing system. Additionally, to convey water to the development area approximately 4,200 LF of existing pipeline between Gregg Reservoir and the proposed North Shore roundabout needs to be upsized to 24-inch diameter pipeline (Phase 2 Pipeline).

The estimated cost for the North Shore transmission pipeline is approximately $20.5 million and recommended for completion when needed to support development in the area. This is expected to be in approximately 2032 as part of the short-term planning period.

10.3.2.2 T-02 - Angelo Discharge Pipeline

Discharge piping for Angelo Pump Station in the distribution system network is undersized for future demands causing concerns with high head loss and discharge pressures. Detailed in Chapter 9, approximately 3,350 LF of 16-inch diameter pipeline will be needed to address these concerns.

The estimated total project cost for the Angelo discharge pipeline is approximately $2.7 million and recommended in the long-term. As this project is due to an existing system deficiency, this project can be completed as soon as funds are available, however, this is a lower priority project. Therefore, to distribute costs for this project across multiple planning years, design is recommended for 2037 and is assumed to be approximately $0.3 million, which is 10 percent of the total project costs. Construction was assumed to be the remaining $2.4 million and would occur the following year in 2038.

10.3.3 Recommended Annual Repair and Replacement Programs

Table 10.8 summarizes the two annual program projects (R) being recommended: pipeline replacement program and miscellaneous facility projects.

Table 10.8 Annual Repair and Replacement Program Recommendations

Project Number	Project Name	Priority	Cost(1)
R-01	Pipeline Replacement Program	Annual	$84 million
R-02	Miscellaneous Facility Projects	Annual	$3 million

Notes:
(1) The cost includes 30% construction contingency and 20 percent ELA contingency.

10.3.3.1 R-01 - Pipeline Replacement Program

The City has approximately 165,000 LF (31.3 miles) of cast iron and steel pipe in their distribution system. These pipes are reaching the end of their useful life and deteriorating conditions have caused the City's distribution system leakage to increase. It is recommended the City implement a pipeline replacement program aimed at replacing these pipes to reduce the risk of failure. Overall, the total estimated cost to replace all cast iron and steel pipe is approximately $84 million. Over the 20 year period of this WSPU, it is recommended the City replace approximately 1.5 miles of pipe and budget approximately $4.2 million per year. However, it was determined that budgeting this amount in the short-term would be difficult given the City's expected short-term CIP project list. To better align the pipeline replacement program with these projects, it is recommended that the City budget $0.2 million for the program per year through 2034. From 2035 through 2046, the City can budget the remaining costs for the program which equates to approximately $6.9 million per year over this twelve year period.

10.3.3.2 R-02 - Miscellaneous Facility Projects

Discussions with the City indicated they complete two R&R type projects annually at major distribution system facilities (wells, reservoirs, pump stations, etc.). On average each of these projects typically cost the City approximately $75,000. The overall CIP allocated $150,000 per year for the completion of two miscellaneous facility "improvement type" projects in each planning year. Over the 20-year period, miscellaneous facility projects are estimated to cost approximately $3 million.

10.3.4 Recommended Pump Station Projects

This section summarizes the recommended pump station projects (PS), identified through the desktop pumping analysis detailed in Chapter 9. Table 10.9 summarizes three PS projects, all of which are prioritized in the short-term.

Table 10.9 Pump Station Recommendations

Project Number	Project Name	Timing	Priority	Cost(1)
PS-01	544 Pumping Area Improvements	Segment 1: 2027-2028 Segment 2: 2031-2033 PS: 2032-2034	0-10 years	$37.9 million
PS-02	542 Pumping Area Improvements	2045	10-20 years	$0.72 million
PS-03	Francis Road Pumping Area Improvements	2035	0-10 years	$3.4 million

Notes:
(1) The cost includes 30% construction contingency and 25% ELA contingency.

10.3.4.1 PS-01 - 544 Pumping Improvements

The 544 pumping area has insufficient pumping capacity for all planning years and scenarios. To address this deficiency, the Lake Road pump station is recommended to pump directly from the 343 Zone to the 544 Zone. Currently in the preliminary design phases, the new pump station will have a firm capacity of 9,000 gpm and include approximately 1,250 LF of 24-inch, 9,850 LF of 30-inch, and 6,000 LF of 36-inch diameter transmission pipeline.

A cost estimate developed by Carollo in summer 2025 for the pump station portion of the project estimated construction costs at $7.3 million. The estimated cost of the transmission pipeline is approximately $31.8 million. Both portions of the project are recommended to be completed in the short-term. Given the City's short-term CIP project list, it will be difficult to construct the entirety of this project in a single phase. Therefore, it was recommended that the pipeline portion of this project be divided into multiple segments to be constructed across various years. Additionally, it was determined that some segments of the pipeline and the pump station could be delayed to allow for other projects to be prioritized. Segment 1 of the pipeline is the highest priority and includes approximately 6,000 LF of 36-inch pipeline between the intersections of NE 3rd Avenue/E 1st Avenue and NE Everett Street/ NE 22nd Avenue. Funds have already been allocated for the design of this pipeline, which is currently in progress. Construction of this segment of pipeline is recommended to start in 2027 and cost approximately $13.7 million with completion in 2028. While the City initially planned on constructing this project in the 2027 and 2028 timeframe, due to other budget priorities, it is recommended that the City considered delaying segments 2 through 4 and the pump station. For purposes of this WSP, approximately $1.8 million has been allocated in 2031 for design of Segments 2 through 4 of the pipeline, which is 10 percent of the cost for these segments. Construction for these segments would occur in 2032 and 2033 and cost approximately $15.7 million. For the pump station portion of the project, approximately $0.7 million would occur in 2032 for design with construction in 2033 and 2034 making up the remaining $6.6 million.

10.3.4.2 PS-02 - 542 Pumping Improvements

The 542 pumping area has insufficient pumping capacity under redundancy criteria in the 2046 scenario. To address this deficiency, an additional 800 gpm pump is recommended at Crown Road pump station.

The total estimated cost of the project is approximately $0.72 million and is recommended for completion in 2045 as part of the long-term planning period.

10.3.4.3 PS-03 - Francis Road Pumping Improvements

The Francis Road pumping area has insufficient pumping capacity and fire flow capacity for each planning year scenario. Discussion with the City indicated their preference to replace the existing Francis Road pump station with a new above grade pump station. The service area of the new pump station will be expanded to serve nearby customers with low pressures. To meet DOH criteria and the City's level of service goals, the new Francis Road pump station will be equipped with two 75 gpm capacity domestic pumps, two 1,000 gpm capacity fire pumps and a backup generator. These improvements will resolve the current fire flow and pressure deficiencies in this area.

As this is an existing deficiency, it is recommended that the City perform this project as budget allows. The estimated cost for the Francis Road pump station replacement is approximately $3.4 million, and for purposes of this WSP is schedule for 2035 as part of the short-term planning period.

10.3.5 Recommended Storage Projects

This section summarizes the recommended storage projects (ST), identified through the desktop storage analysis detailed in Chapter 9. Table 10.10 shows the three recommended storage capacity projects, two of which are prioritized for the short-term and one in the long-term.

Table 10.10 Storage Recommendations

Project Number	Project Name	Timing	Priority	Cost(1)
ST-01	343 Zone Storage Improvements(2)	2030-2031	0-10 years	$25.7 million
ST-02	542 Zone Storage Improvements	Pipeline:2029-2030 Reservoir: 2034-2036	0-10 years	$33.6 million
ST-03	544 Zone Storage Improvements	2045	10-20 years	$4.5 million

Notes:
(1) The cost includes 30% construction contingency and 20% ELA contingency.
(2) The cost was provided in Gray and Osborne's, New 343 Reservoir Alternatives Analysis, September 2025.

10.3.5.1 ST-01 - 343 Zone Storage Improvements

By the 2036 and 2046 planning years there are slight storage deficits of 0.02 and 0.04 MG in the 343 area. The storage in this area is currently provided by Butler Reservoir, which is a 1.2 MG partially buried reservoir originally constructed in the early 1900s. The City has indicated Butler Reservoir is reaching the end of its useful life and will be decommissioned once a new 343 zone reservoir is constructed. The replacement reservoir project is currently in preliminary design phase. An alternatives analysis completed by the City's consultant Gray & Osborne indicated the preferred alternative would be an elevated reservoir near Camas Cemetery. The new reservoir, being sized for buildout conditions, would provide a minimum of 1.84 MG of usable storage for the 343 area alleviating deficits identified under this planning period.

The estimated total project cost for the elevated reservoir (ST-01) is approximately $25.7 million and is expected to be completed in the short-term. Costs for this project were provided in Gray and Osborne's, New 343 Reservoir Alternatives Analysis, completed in September 2025. While the City was planning to construct this project immediately, due to budgetary limitations, this project is scheduled for construction to occur in 2030 and 2031 to balance out the City's CIP, equaling approximately $12.9 million per year. Funds for the design of this project have already been allocated and therefore were not considered in the cost distribution.

10.3.5.2 ST-02 - 542 Zone Storage Improvements

In 2031, there is a 1.0 MG deficit in the 542 storage area, increasing to a 1.28 MG deficit in 2046. To alleviate deficits in the area, an additional storage reservoir will need to be constructed. There are multiple alternatives for increasing storage capacity in this area. For planning purposes, an elevated reservoir with a nominal capacity of 1.5 MG was recommended and will be incorporated into the CIP as it was the

costliest alternative. Additionally, 3,800 LF of 24-inch diameter transmission pipeline is recommended between Crown Road pump station and the new reservoir. This will address the hydraulic limitation and allow for multiple pumps at Crown Road to operate simultaneously to fill the new reservoir.

The estimated cost for the reservoir portion of the project is approximately $29.3 million and approximately $4.3 million for the pipeline. Both elements of the project are recommended for completion in the short-term. However, the pipeline should be prioritized before the reservoir to address the existing hydraulic limitation as previously noted. Since this is an existing deficiency, design of the pipeline is recommended for 2029 and is assumed to be approximately $0.4 million, which is 10 percent of the pipeline cost. Construction was assumed to be the remaining $3.9 million and would occur the following year in 2030. To distribute the total project costs, it is recommended that the design and construction of the reservoir should be delayed, allowing for the completion of other higher priority projects. Under this timeline, design of the reservoir is slated for 2034 and is assumed to be approximately $2.9 million, which is 10 percent of the reservoir cost. Construction of the reservoir is expected to take multiple years, so the remaining reservoir costs are divided across 2035 and 2036, equating to approximately $13.2 million per year.

10.3.5.3 ST-03 - 544 Zone Storage Improvements

At the end of the planning period in 2046, there will be a deficit of approximately 0.63 MG in the 544 storage area. To address this deficit, an additional reservoir with a nominal capacity of 0.75 MG is recommended at the 18th Avenue site, which has space on-site to accommodate the additional reservoir.

The estimated cost for the 544 zone storage improvements (ST-03) is approximately $4.5 million and is recommended in 2045 as part of the long-term planning period.

10.3.6 Recommended Supply and Treatment Projects

This section summarizes the recommended supply and treatment projects that were identified through the supply analysis detailed in Chapter 8 and Chapter 9. Table 10.11 shows the four recommended projects with detailed descriptions in the sections to follow.

Table 10.11 Supply and Treatment Recommendations

Project Number	Project Name	Timing	Priority	Cost(1)
S-01	Well 8, 11, and 12 Expansion and PFAS Treatment	2027-2030	0-10 years	$40.3 million
S-02	Well 18 Development	2037	10-20 years	$9.5 million
S-03	Well 13B Development	2044	10-20 years	$8.7 million
S-04	Well 19 Development	2046	10-20 years	$8.7 million
S-05	LWWF PFAS Treatment Facility Expansion Phase 1	2032-2034	0-10 years	$9.3 million
S-06	LWWF PFAS Treatment Facility Expansion Phase 2	2036-2038	10-20 years	$9.3 million
S-07	LWWF PFAS Treatment Facility Expansion Phase 3	2040-2042	10-20 years	$9.3 million

Notes:
(1) The cost includes 30% construction contingency and 25% ELA contingency.

10.3.6.1 S-01 - Well 8, 11, and 12 Expansion and PFAS Treatment

By 2030, the City will need additional supply capacity to meet projected maximum day demands (MDD). From the water supply strategy detailed in Chapter 8, hydrogeologic investigation identified expansions at Wells 8, 11, and 12 would be capable of providing sufficient capacity and have lower associated risks than developing a new well in the short-term. Additionally, treatment is recommended for wells with the highest PFAS detections. This project is expected to consist of well upgrades, PFAS treatment with an initial capacity of 2,725 gpm, an intermediate reservoir/pump station, chemical facility upgrades, and standby power improvements.

The estimated cost for this project is approximately $40.3 million and recommended for completion in the short-term. This project is expected to be one of the largest projects undertaken by the City to date, and implementation of the project is expected to take multiple years. Due to the need for additional water supply by 2030 and an imminent MCL for PFAS, design is recommended for completion in 2027 and is assumed to be approximately $4 million, which is 10 percent of the total project cost. Construction for this project is expected to occur between 2028 and 2030, making up the remaining $36.3 million. In 2028, it is expected that well upgrades, intermediate reservoir/PS, and chemical facility upgrade components will be in construction, therefore a cost of approximately $11.9 million is expected. In 2029, the well upgrades, intermediate reservoir/PS, and chemical facilities would be completed, and construction would begin on the PFAS treatment and standby power components. Approximately $18.1 million is expected for construction in 2029. In 2030, it is assumed that PFAS treatment and standby power improvements would be completed and therefore the remaining $6.3 million is expected for construction.

10.3.6.2 S-02 - Well 18 Development

By 2037, the City will need an additional supply capacity to meet projected MDD. It is recommended to drill and develop Well 18 in the Lower Washougal Wellfield to increase capacity by approximately 2,000 gpm. This project will include well drilling, mechanical equipping, PFAS treatment, and a generator for backup power.

The estimated cost for this project is approximately $9.5 million and recommended for completion in 2037 as part of the long-term planning period.

10.3.6.3 S-03 - Well 13B Development

By 2044, the City will need additional supply capacity to meet projected MDD. It is recommended to drill and develop Well 13B assumed to be located at the existing Well 13 site or Louis Bloch Park. This project is estimated to increase capacity by 1,000 gpm and will include well drilling, mechanical equipping, PFAS treatment, and a generator for backup power.

The estimated cost for this project is approximately $8.7 million and recommended for completion in 2044 as part of the long-term planning period.

10.3.6.4 S-04 - Well 19 Development

By 2046, the City will need additional supply capacity to meet projected MDD. It is recommended to drill and develop Well 19 assumed to be located near Well 6 and 14, in the City's eastern wellfield. This project

is estimated to increase capacity by 1,000 gpm and will include well drilling, mechanical equipping, PFAS treatment, and a generator for backup power.

The estimated cost for this project is approximately $8.7 million and recommended for completion in 2046 as part of the long-term planning period.

10.3.6.5 S-05 through S-07 - LWWF PFAS Treatment Facility Expansion Phase 1-3

To reduce the initial project cost of the well expansions and PFAS treatment (Project S-01), it was recommended PFAS treatment facility capacity be sized to only treat wells with the highest PFAS detections. Due to the uncertainty around future PFAS detections, the LWWF PFAS treatment facility will be designed to accommodate expansion to an initial buildout capacity of 9,925 gpm. To reach this capacity, expansions to the treatment facility are recommended in three phases, with each phase increasing capacity by approximately 2,400 gpm. Further expansion to ultimate buildout may occur when Well 18 (Project S-02) and Well 19 (Project S-04) are drilled and developed, depending on PFAS concentrations of new wells.

The estimated cost for each phase of expansion is approximately $9.3 million, resulting in a total cost for all three phases of approximately $27.9 million. The implementation for each phase is assumed to take three years, allowing one year for design and two years for construction. For budgetary purposes, design is approximately $0.9 million, which is 10 percent of the cost per phase. Construction for each phase will make up the remaining $8.4 million with $4.2 million allocated per year. For purposes of this CIP, it is assumed that design for Phases 1, 2, and 3 would occur in 2032, 2036, and 2040, with construction occurring in 2033-2034, 2037-2038, and 2040-2041.

10.3.7 Recommended General Projects

Four general projects (G) were recommended for this CIP and are summarized in Table 10.12.

Table 10.12 Recommended General Projects Summary

Project Number	Project Name	Timing	Priority	20-year Total Cost(1)
G-01	2036 WSP	2035-2036	0-10 years	$0.53 million
G-02	2046 WSP	2045-2046	10-20 years	$0.53 million
G-03	Water Rights Investigation	2027-2028	0-10 years	$0.29 million
G-04	Pipe Replacement Prioritization Study	2034	0-10 years	$0.16 million

Notes:
(1) All general project costs include an additional 10% for City costs to administer the project.

10.3.7.1 G-01 and G-02 - Water System Plan Updates

The City's WSP will need to be updated every 10 years to comply with WAC 246-290-100. It is expected an update will occur by 2036 and 2046, respectively. The estimated cost for each WSP update is approximately $0.53 million. These projects are expected to be two year projects, which result in a cost of approximately $0.27 million per year.

10.3.7.2 G-03 - Water Rights Investigation

To fully utilize potential yields from the LWWF, it was recommended the City complete a water rights investigation. The investigation would target acquiring additional groundwater rights for the LWWF or transferring surface water rights to the LWWF for use during the period where surface water withdrawals are prohibited. The estimated cost for the water rights investigation is approximately $0.29 million. This project was recommended to start in 2027 and is expected to be completed by 2028, resulting in cost of $0.15 million per year.

10.3.7.3 G-04 - Pipeline Replacement Prioritization Study

To assist the City in developing a schedule of prioritization of the pipeline replacement program discussed in Section 10.4.3.1, it is recommended a pipeline replacement prioritization study be conducted. The estimated cost for the pipeline replacement prioritization study is approximately $0.16 million and recommended for completion in 2034 under the short-term planning period.

10.4 CIP Program Summary

This section summarizes the City's CIP program described in the previous sections. Tables 10.13 and 10.14 summarize the CIP projects by project category and priority, respectively. Figures 10.1 and 10.2 summarize the percentage of each project identified by project category and project type, respectively.

When considering CIP costs by project category as shown in Table 10.13 and Figure 10.1, the majority of CIP costs are accrued from supply and treatment projects (30 percent) and annual programs (27 percent). Pump station projects and storage projects comprise the other high-cost categories and account for 13 percent and 20 percent of the CIP, respectively.

When considering CIP costs by priority as shown in Table 10.14 and Figure 10.2, approximately 29 percent of the CIP costs are annual programs, as previously stated. The total water CIP cost over the next 20 years is approximately $317 million, which equates to approximately $15.9 million per year for the planning period. Of the total cost, approximately $177 million is budgeted for the short-term, approximately $53 million is budgeted for the long-term, and approximately $87 million is budgeted for the annual category.

When considering CIP costs by cost allocation as shown in Table 10.15 and Figure 10.3, approximately 53 percent of total CIP costs are allocated to existing rate payers. Annual programs account for a large portion of this percentage.

Table 10.13 CIP Summary Table by Cost Category

Project Category	Total Cost	Average Annual Cost	Percentage
Distribution System	$4,340,000	$220,000	1.4%
Annual Programs	$87,000,000	$4,350,000	27.4%
Transmission Pipeline	$23,200,000	$1,160,000	7.3%
Pump Station	$42,020,000	$2,100,000	13.3%
Storage	$63,800,000	$3,190,000	20.1%
General	$1,500,000	$80,000	0.5%
Supply and Treatment	$95,130,000	$4,760,000	30.0%
Total Cost	**$317,000,000**	**$15,860,000**	**100.0%**

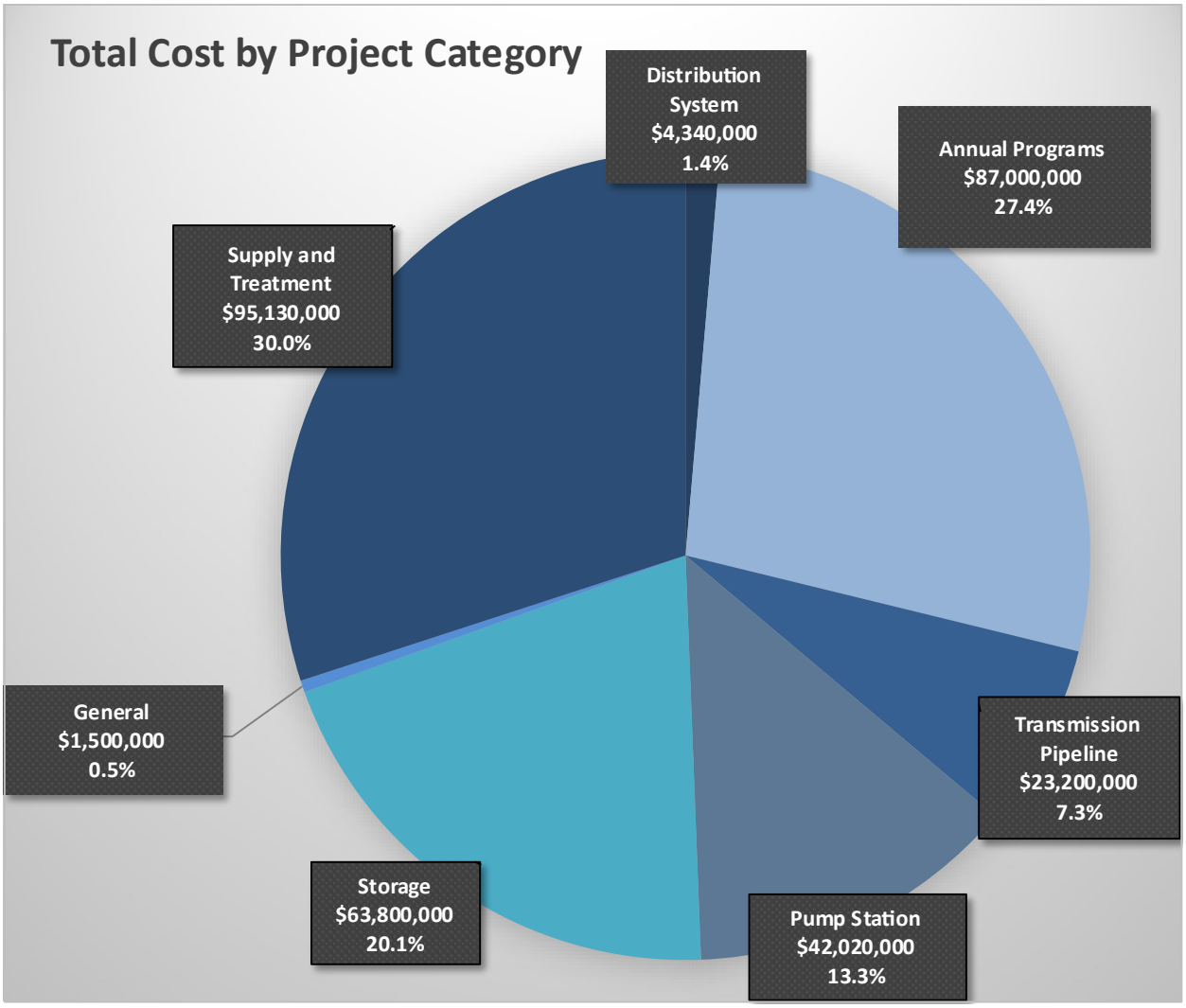


Figure 10.1 CIP Summary Table by Project Category

Table 10.14 CIP Summary Table by Project Priority

Project Priority	Total Cost	Percentage
0-10 years	$177,000,000	55.8%
10-20 years	$53,000,000	16.7%
Annual	$87,000,000	27.4%
Total Cost	**$317,000,000**	**100.0%**

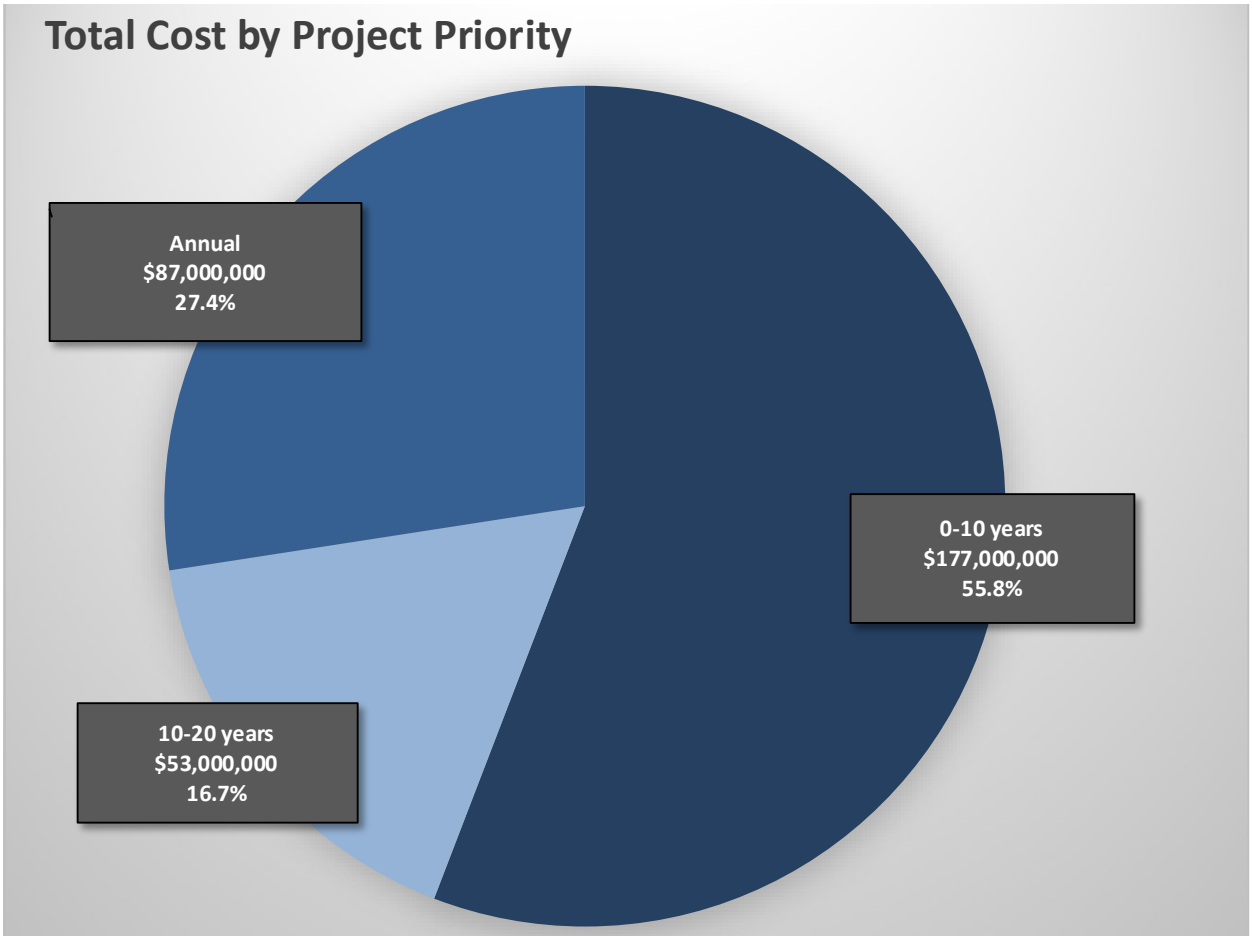


Figure 10.2 CIP Summary Table by Project Priority

Table 10.15 CIP Summary Table by Cost Allocation

Project Priority	Total Cost	Percentage
SDC	$148,900,000	47.0%
Rates	$168,100,000	53.0%
Total Cost		

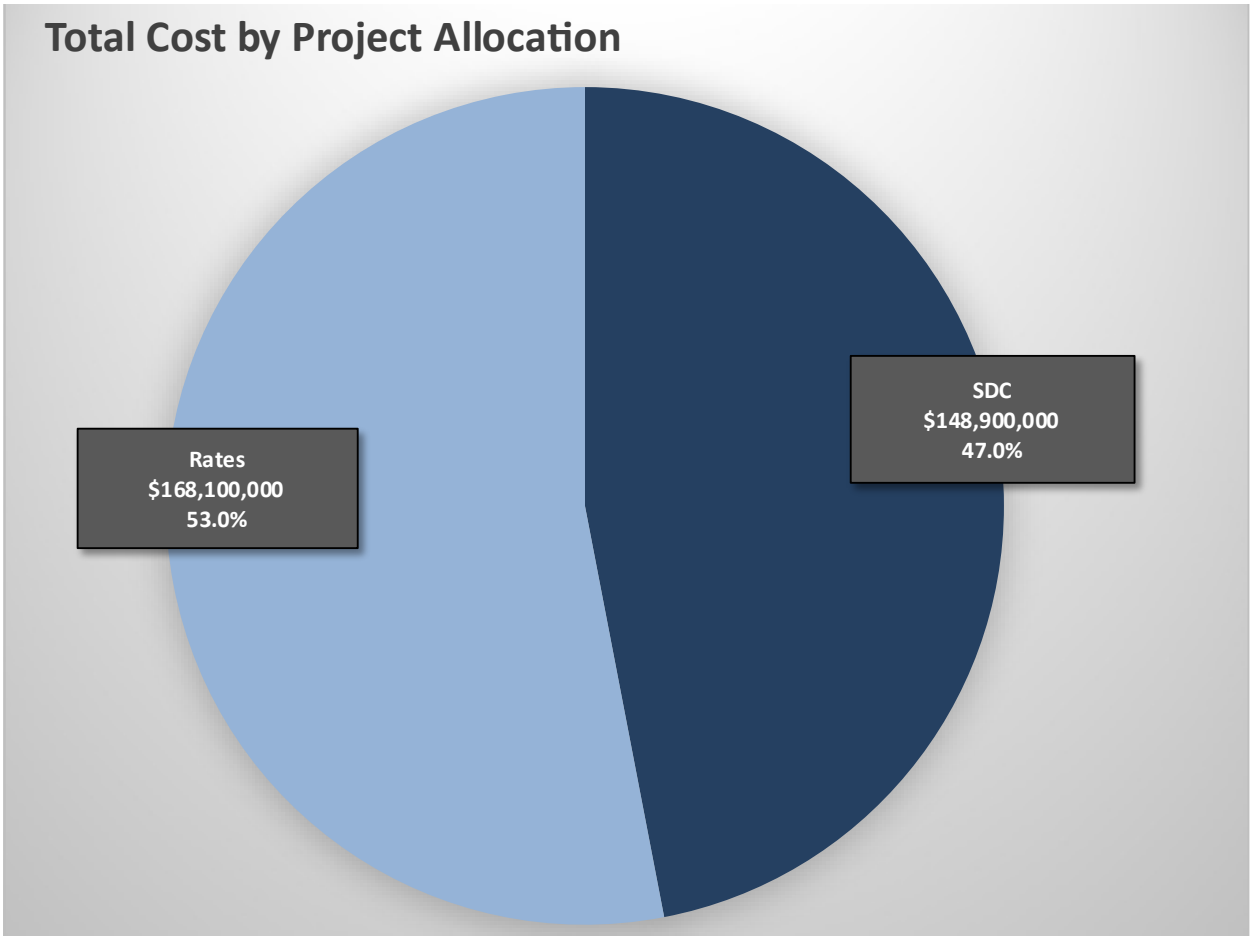


Figure 10.3 CIP Summary Table by Cost Allocation

10.4.1 CIP Project Summary

Section 10.1 summarizes the CIP projects and labels them as D, T, R, PS, ST, S, or G with each project assigned a unique CIP Identification. Table 10.16 shows all CIP projects developed for this WSPU along with associated costs and priority. Figure 10.4 presents annual costs for the City's CIP for each year of this WSPU, while Figure 10.5 illustrates annual cost breakdowns for projects funded by rates and SDCs.

An individual project sheet was generated for each CIP project and includes project identifier, description, costs, project type, timeline, and comments to help with future implementation. To help the City identify individual projects, project sheets are separated by project category. Appendix **[X]** includes all the project sheets.

Table 10.16 CIP Project Summary

Project Number	Project Name	Timing(1)	Priority	20-year Total Cost(1)
D-01	NW 7th Avenue Fire Flow Improvements	-	0-10 years	$-
D-02	NE Dallas Street Fire Flow Improvements	-	0-10 years	$-
D-03	E 1st Avenue Fire Flow Improvements	-	0-10 years	$-
D-04	Operations Center/WWTF Fire Flow Improvements	-	0-10 years	$-
D-05	NW Fargo Street Fire Flow Improvements	-	0-10 years	$-
D-06	Upper Prune Hill Fire Flow Improvements	2034	0-10 years	$1.3 million
D-07	Sierra Lane PRV Station	2034	0-10 years	$0.80 million
D-08	SE 5th Street and SE Everett Road Fire Flow Improvements	2034	0-10 years	$0.74 million
D-09	SE 283rd Avenue Fire Flow Improvements	2034	0-10 years	$1.6 million
D-10	NE 6th Avenue and NE Nevada Street Fire Flow Improvements	-	0-10 years	$-
T-01	North Shore Transmission Pipeline	2032	0-10 years	$20.5 million
T-02	Angelo Discharge Pipeline	2037-2038	10-20 years	$2.7 million
R-01	Pipe Replacement Program	-	Annual	$84 million
R-02	Miscellaneous Facility Projects	-	Annual	$3 million
PS-01	544 Pumping Area Improvements		0-10 years	$37.9 million
PS-02	542 Pumping Area Improvements	2045	10-20 years	$0.72 million
PS-03	Francis Road Pumping Area Improvements	2035	0-10 years	$3.4 million
ST-01	343 Zone Storage Improvements	2030-2031	0-10 years	$25.7 million
ST-02	542 Zone Storage Improvements	Pipeline:2029-2030 Reservoir: 2034-2036	0-10 years	$33.6 million
ST-03	544 Zone Storage Improvements	2045	10-20 years	$4.5 million
S-01	Well 8, 11, and 12 Expansion and PFAS Treatment	2027-2030	0-10 years	$40.3 million
S-02	Well 18 Development	2037	10-20 years	$9.5 million
S-03	Well 13B Development	2044	10-20 years	$8.7 million
S-04	Well 19 Development	2046	10-20 years	$8.7 million
S-05	LWWF PFAS Treatment Facility Expansion Phase 1	2032-2034	0-10 years	$9.3 million
S-06	LWWF PFAS Treatment Facility Expansion Phase 2	2036-2038	10-20 years	$9.3 million
S-07	LWWF PFAS Treatment Facility Expansion Phase 3	2040-2042	10-20 years	$9.3 million
G-01	2036 WSP	2035-2036	0-10 years	$0.53 million
G-02	2046 WSP	2045-2046	10-20 years	$0.53 million
G-03	Water Rights Investigation	2027-2028	0-10 years	$0.29 million
G-04	Pipe Replacement Prioritization Study	2034	0-10 years	$0.16 million

Notes:
(1) Costs and timings for projects D-01 through D-05 and D-10 are incorporated into the pipe replacement program and not reported in this table.

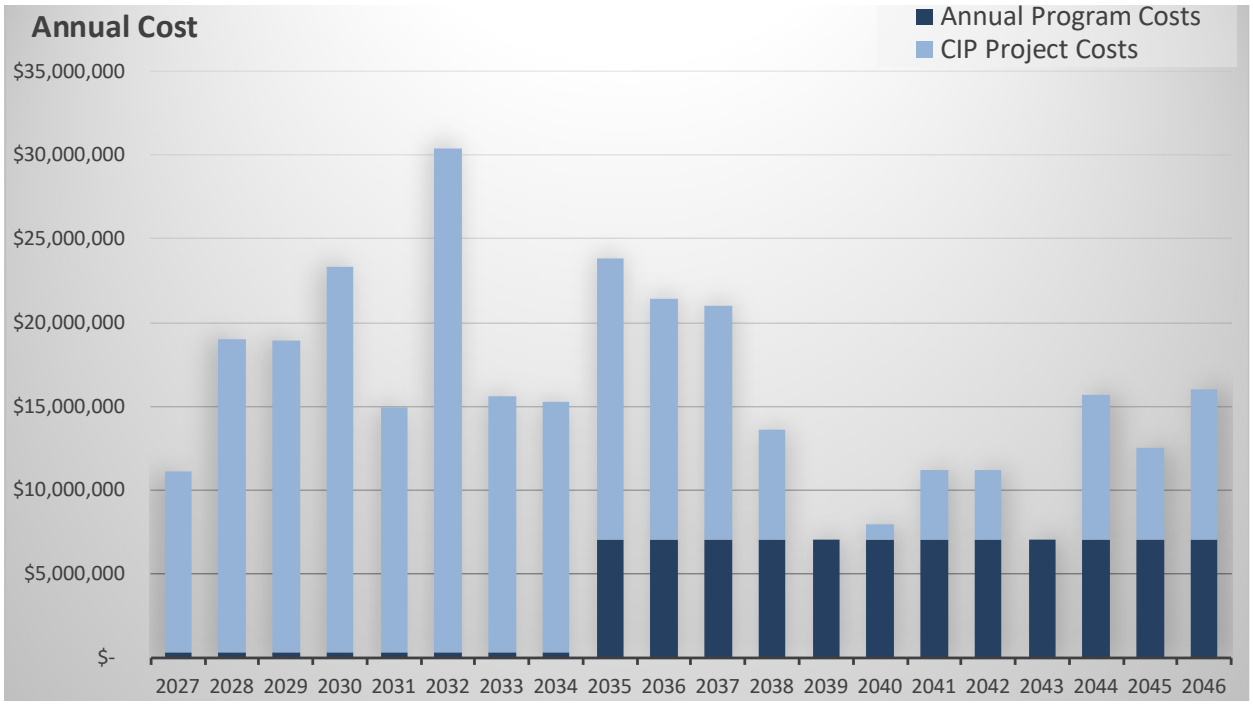


Figure 10.4 CIP Annual Cost

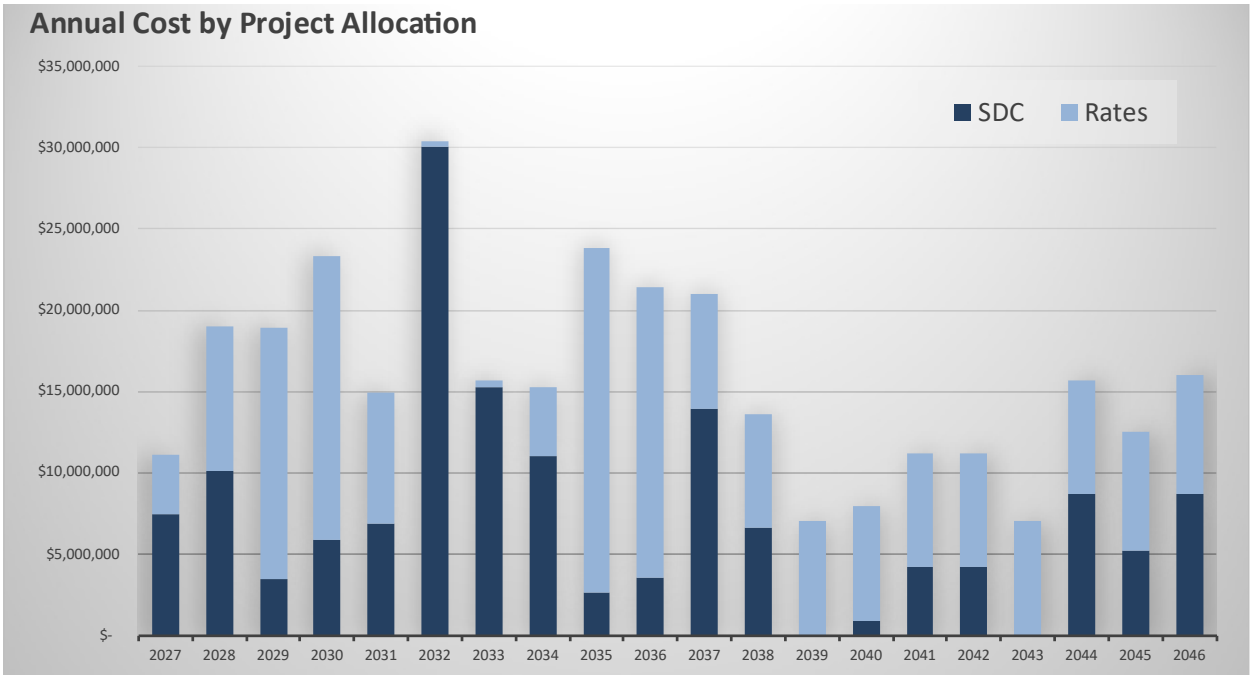


Figure 10.5 CIP Annual Cost by Project Allocation

APPENDIX A

ADOPTING RESOLUTION

~ To be included in a future submittal. ~

APPENDIX B

SEPA - AGENCY COMMENTS

~ To be included in a future submittal. ~

APPENDIX C

NOTICE OF DETERMINATION OF NON SIGNIFICANCE

~ To be included in a future submittal. ~

APPENDIX D

AGENCY COMMENT LETTERS AND RESPONSES

~ To be included in a future submittal. ~

APPENDIX E

LOCAL GOVERNMENT CONSISTENCY DETERMINATION

~ To be included in a future submittal. ~

APPENDIX F

PROJECT APPROVAL APPLICATION (PAA) FORM

Drinking Water

Project Approval Application (PAA) Form

331-149 F • Revised 3/24/2026

Instructions

Please complete all appropriate sections of this application form and include them with your project. You must submit them electronically. Before submitting your documents and the PAA form, please check with your Drinking Water staff contact. An administrative staff member will set up a free Box.com folder to transfer your project documents to us electronically.

Use the interactive map on our Drinking Water Contacts and Office Location webpage to find program staff assigned to your county. Email ODWOperations@doh.wa.gov Phone 360-236-3100

Water System Information

CAMAS MUNICIPAL WATER SEWER SYSTEM	108002
Water System Name	PWS ID #
2026 Water System Plan Update	Clark
Submittal Description	County
A-Community	10,000 or more
Classification	# of Service Connections

Owner Information

City of Camas			108002
Name			Owner ID #
publicworks@cityofcamas.us			360-817-1563
E-mail address			Phone
616 NE 4th Ave.	Camas	WA	98607
Mailing address	City	State	Zip

Project Contact Information

Rob Charles		Utilities Manager	
Name/Position			
RCharles@cityofcamas.us		360-817-7003	
E-mail address		Phone	
1620 SE 8th Ave.	Camas	WA	98607
Mailing address	City	State	Zip

Consulting/Design Engineer Information

Enter text		Carollo Engineers, Inc.	
Name/Firm			
Enter text		Enter text	
E-mail address		Phone	
760 SW 9th Ave., Ste 2000	Portland	OR	97205
Mailing address	City	State	Zip

Satellite Management Agency Information

Enter text		Enter text	
Name/SMA		SMA #	
Enter text		Enter text	
E-mail address		Phone	
Enter text	Enter text	WA	Enter Zip
Mailing address	City	State	Zip

Billing Information*

Rob Charles			
Name			
RCharles@cityofcamas.us		360-817-7003	
E-mail address		Phone	
1620 SE 8th Ave.	Camas	WA	98607
Mailing address	City	State	Zip

General Submittal Information

Does this water system or owner have other projects currently under review with unpaid invoices? ☐ Yes ☒ No

Is this a new water system? *(If so, include a completed Water Facilities Inventory Report Form with your project).* ☐ Yes ☒ No

If submitting an engineering project, is it included in an approved plan? (as applicable) ☐ Yes ☐ No ☒ N/A

Select Submittal General Category

(Complete the corresponding section of this form. Planning and engineering submittals must be submitted separately.)

☐ Engineering Submittal for Group A System

☐ Group B Workbook

☒ Water System Plan (WSP)

☐ Small Water System Management Program (SWSMP)

☐ Satellite Management Agency Plan

Is the submittal DWSRF funding related?

☐ Intention to apply for DWSRF Construction Loan (*Contact a regional planner on the timing for review/approval for funding applications.)*

☐ Existing DWSRF Application ..... Enter Application Number

☐ Existing DWSRF Loan ..... Enter Loan Number

Is the submittal related to formal enforcement?

☐ Enforcement Docket #:..... Enter Docket Number

Engineering Submittal Information

Select Type of Engineering Submittal (select one):

☐ Design Project Report
☐ Pre-Design Project Report
☐ Construction Documents
☐ Bid Documents (for SRF funding)
☐ Combined Design Project Report and Construction Documents
☐ Combined Design Project Report and Bid Documents (for SRF Funding)
☐ Non-Design Submittal (i.e. operations plan, pilot study protocol, or watershed plan)

Select Subject Matter (choose all that apply):

☐ Annual Unfiltered Surface Water Report
☐ Blending Plan
☐ Booster Station
☐ Capacity Analysis
☐ Chemical Addition Only (for groundwater)
☐ Corrosion Control Recommendation
☐ Corrosion Control Study
☐ Distribution Mains
☐ Other (Please Describe): _____
☐ Groundwater Filtration Treatment
☐ Group B System Approval
☐ GWI Determination
☐ Major System Modification
☐ Monitoring Plan (DBP, LCR, Coliform)
☐ Operations Plan
☐ Pilot Study Protocol
☐ Pilot Study Report
☐ Sanitary Control Area Mitigation
☐ Source Approval
☐ Storage Reservoir/Tank
☐ Surface Water/GWI Treatment – New
☐ Surface Water/GWI Treatment – Modified
☐ Tracer Study Plan
☐ Watershed Plan
☐ Well Site Inspection
☐ Wellfield Designation

Planning Submittal Information *(Water System Plans and Small Water System Management Programs)*

Date of DOH preplan meeting 5/6/2025. Does your plan follow the preplan checklist?	☒ Yes ☐ No
Is the system regulated by the Utilities and Trade Commission (UTC)?	☐ Yes ☒ No
Is the system proposing to do any of the following:	
• Increase in the number of approved connections?	☒ Yes ☐ No
• Expand the service area or water rights place of use?	☒ Yes ☐ No
(If yes, the plan must include completed Local Government Consistency Determination Forms from all local governments within the proposed water rights place of use, including Coordinated Water System Plan (CWSP) responsible agency, if located within a CWSSA).	
• Add a new intertie to a wholesale customer?	☐ Yes ☒ No
• Request approval for distribution main submittal exception?	☐ Yes ☒ No
• Request an "Unspecified" approval designation?	☐ Yes ☒ No
Has the WSP or SWSMP been sent to the following organizations for review/comment:	
• Adjacent utilities for review or a letter notifying them that a copy is available for their review?	☐ Yes ☐ No
• All local governments within the service area?	☐ Yes ☐ No
• County and/or city planning department (as applicable)?	☐ Yes ☐ No
• Federal governments, including tribes (as applicable)?	☐ Yes ☐ No
Is the system located in a Critical Water Supply Service Area with a Coordinated Water System Plan (CWSP)?	☐ Yes ☒ No
• If yes, have you sent a copy of the WSP or SWSMP to the county or agency responsible for the CWSP?	☐ Yes ☐ No
What year are the important projections in the plan dated to (water demands, CIP, and budget)? *(WSPs can be approved for up to 10 years from date of approval [not date of submittal], but approval will be limited to the projections provided in the plan. This does not apply to SWSMPs.)*	2046

Satellite Management Agency Plan Information

☐ Ownership only ☐ Management and Operations only ☐ Ownership, Management & Operations

Are you requesting approval as a new SMA?	☐ Yes ☐ No
If the SMA plan is combined with a water system plan submittal, where is the SMA Notice of Intent Form located in the plan? *SMA Notice of Intent* 331-590	Enter Location in Plan

List the counties the SMA is requesting approval to serve: Enter Counties

To request this document in another format, call 1-800-525-0127. Deaf or hard of hearing customers, please call 711 (Washington Relay) or email doh.information@doh.wa.gov. If in need of translation services, call 1-800-525-0127.

APPENDIX G

DOH WATER SYSTEM PLAN CHECKLIST

Department of Health, Office of Drinking Water
Southwestern Regional Office
Pre-Plan Agreement

Water system name:	Camas Municipal Water Sewer System	**Preplan date:**	May 6, 2025
PWS ID#/County:	108002	**WSP submittal due date:**	May 6, 2026
Planning Purpose:	Large System WAC 246-290-100(2)(a)	**Target year of approval:**	2026-2027
Operating Permit Color:	Green	**Existing WSP expiration date:**	August 1, 2030
Initial/Update/Amend:	Update	**End of "plan approval period":**	up to 2038 (last year of all projections)
Number of Connections:	11842		

WAC 246-290-100 requires purveyors of new water systems, systems in a water coordination act area, systems serving 1,000 or more service connections, systems with an unspecified number of approved connections and systems that are growing or experiencing capacity problems to gain approval for a Water System Plan (WSP). The purpose of this preplan is to determine the level of detail of the WSP and establish an approval schedule. This agreement is valid until the WSP submittal due date above. After that date, the agreement will need to be renegotiated. The operating permit color may change to yellow if the WSP is not approved by the existing WSP expiration date noted above.

Planning forms and other resources, including the current Water System Planning Guidebook and additional information can be found HERE.

Water System Representatives:	Consultants	ODW SW Regional Staff:	External Agency Representatives
Rob Charles, Camas Utilities Manager	Jill Kjellsson, Carollo Engineers	Scott Pollock, Regional Engineer	Matthew Kogle, Dept. Of Ecology
	Max Mozer, Carollo Engineers	Meredith Jones, Regional Planner	
	Matt Huang, Carollo Engineers		

Include in plan	Content Description	*WSP Page #*
Y	Project Approval Application (PAA, DOH Pub 331-149 F)	
Y	Signed and dated stamp from a Professional Engineer licensed in the State of Washington	
Chapter 1 – Description of Water System		
Y	Ownership and management, including Satellite Management Agency (SMA), if applicable	
Y	System history and background	
Y	Related plans	
Y	Service area and land uses: • Service area map including retail service area, service area, future service area, water rights place of use • DOH Pub. 331-432 – Service Area Guidance • Existing zoning map(s) for all jurisdictions within future service area • Future land use map(s) for all jurisdictions within future service area (CWSP Counties Only)	
Y	Service area and other applicable policies	
Y	Duty to serve statement for the retail service area • How does the system define "timely and reasonable"? • Are there appeals processes for when a customer disagrees with a timely and reasonable determination?	
Y	Consistency with the watershed plan for Salmon/Washougal WRIA #28.	

Chapter 2 – Basic Planning Data		
Y	Existing population, service connections & equivalent residential units (ERUs) • ERUs must be based on full-time residential connections only.	
Y	Existing production/usage: monthly/annual per source, annual usage by customer class, distribution system leakage (DSL) • Authorized Use and DSL, rather than "unaccounted-for water". • Additional information is available in our WUE Guidebook, Chapter 6, beginning on page 28 (PDF page 33).	
Y	Seasonal variations in use by customer class (1000+ connections)	
Y	Water supply characteristics	
Y	Water supply reliability evaluation: Include depth-to-water measurements	
Y	Interties: agreements, existing/proposed, emergency, metering	
Y	**Plan approval period & 20-year projections for:** Population, service connections, & ERUs (Recommend 13- and 23-year)	
Y	Projections and land use discussion	
Y	Future water demand without water use efficiency savings	
Y	**Water rights self-assessment: Consult with Ecology prior to plan submittal** Describe water rights and complete water rights self-assessment form for existing, plan approval period, and 20 years.	
Chapter 3 – System Analysis		
Y	Asset Management Inventory: text description and facilities map of major assets, asset management table or spreadsheet	
Y	Asset condition assessment and criticality ratings (recommended)—RCAC Template (optional format)	
Y	Water quality analysis	
Y	System design standards	
Y	Capacity analysis (Must include WSDM Worksheet 4-1, ERU Capacity Summary)	
Y	Hydraulic analysis	
Y	Summary of system deficiencies	
Chapter 4 – Water Use Efficiency (WUE)		
Y	**Metering Program:** sources, services, and non-emergency interties	
Y	**Distribution System Leakage (DSL)** Summarize DSL and compare to WUE annual reports; discuss DSL calculation methodology, leak detection plan	
Y	**Water Loss Control Action Plan (WLCAP) – 3-year average 13.1% (2021, 2022, 2023)** If DSL exceeds 10 percent (3-year average), submit the WLCAP per WAC 246-290-820(4) • Include implementation schedule and budget items, as applicable.	
Y	**Water Use Efficiency WUE Program**	
Y	Describe the current (WUE) program	
Y	Updated WUE goal(s). Document public adoption process (include public notice, signed minutes, signed resolution). • Consider doing this after our review of your first draft.	
Y	Describe measure(s) that will be implemented to achieve the goal(s). Include schedule & costs in the budget – 10,000 to 49,999 connections: 9 additional measures.	
Y	Describe the process used to evaluate WUE measure(s) you did not implement	
Y	Describe or provide an example of yearly consumer education (cannot count as a measure)	
Y	Estimate projected water savings from selected WUE measure(s)	

Y	Describe process that will be used to determine effectiveness of the WUE program	
Y	Plan approval period and 20-year water demand projection with WUE savings (recommend 13- and 23-year)	

Y	**Additional WUE for systems with 1000+ Connections**
	• Estimate water saved from implemented WUE measure(s) during the previous plan approval period
	• Water demand forecast (if all cost-effective WUE measure(s) are implemented)
	• For WUE measure(s) evaluated, but not implemented:
	  ○ Quantitative evaluation of WUE measure(s) cost-effectiveness, including marginal costs of water production
	  ○ Evaluate WUE measure(s) for cost-effectiveness if shared with other systems
	  ○ Quantitative/qualitative evaluation of measure(s) to determine cost-effectiveness from societal perspective
	• Explore reclaimed water opportunities	

Chapter 5 – Source Water Protection		
Y	Sanitary Control Area (SCA): description of physical and legal protections for each groundwater source, including deeds, covenants, easements, restrictions, fencing, signage, etc.	
Y	Wellhead protection program/update: must include updated TOT map, contaminant source inventory, and notifications • WAC 246-290-135: Source Water Protection • 331-106 Wellhead Protection Requirements	
***N**	Watershed control program for all surface water/GWI sources— *Please include watershed and other information relative to your two emergency surface water sources.	
Chapter 6 – Operation and Maintenance Program		
Y	Water system management and personnel, including operator certification and CCS	
Y	Operations and preventative maintenance schedule	
Y	Comprehensive water quality monitoring: • Water Quality Monitoring Schedule (WQMS) • Provide LCR and DBP monitoring schedule(s), map(s), and letters. • Coliform monitoring plan, including addresses and map. Update for RTCR. DOH Guidance and Template	
Y	Emergency response program, including Water Shortage Response Plan per WAC 246-290-420. • Consider Tier 1 Public Notification process, and multiple channels for notification.	
Y	Cross-connection control (CCC) program • Systems with 1000+ connections: provide a copy of your CCC annual summary report form	
Y	Sanitary survey findings	
Y	Recordkeeping, reporting, and customer complaint program	
Y	Water treatment (surface, disinfection, contaminant) operations	
Y	Summary of O&M deficiencies; include cost in budget	
Chapter 7 – Distribution Facilities Design and Construction Standards (optional)		
Y	Project review procedures	
Y	Policies and requirements for outside parties	
Y	Design and construction standards for distribution-related projects.	
Y	Construction certification	

Chapter 8 – Capital Improvement Program (CIP) (Recommend 13- and 23-year CIP info.)		
Y	CIP summary and schedule for the plan approval period (discuss prioritization, project assessment and value planning) • Include any items that were identified as required for addressing capacity-related deficits.	
Y	20-year (minimum) CIP for projects beyond the plan approval period	
Chapter 9 – Financial Program (Recommend 13- and 23-year financial info.)		
Y	Financial viability (discuss full cost of service, cost recovery, reserves)	
Y	Summary of past income and expenses, sufficient to establish trends (previous plan approval period or minimum 3 years)	
Y	Balanced operational and capital budget projections for plan approval period	
Y	Show operational, capital, and emergency reserve goals. Describe the revenue requirements to achieve them. Demonstrate annual progress toward goals.	
Y	Debt-financed capital improvements	
Y	Water rate evaluation: • Describe current rate structure: **Block rate based on meter size and rate class**. (Not inclining block rate.) • Evaluate the feasibility of implementing a rate structure that encourages water demand efficiency. • Evaluate rate affordability and customer assistance programs. Provide rate that would be unaffordable, income below which current and future rates are unaffordable, and programs available for low income customers.	
N	~~Water system regulated by the Utilities and Transportation Commission (UTC)?~~	
Chapter 10 – Miscellaneous Documents		
Y	Updated Water Facilities Inventory (WFI) with authorized signature	
Y	Local Government Consistency Determination Forms: City and County planning departments.	
Y	Informational meeting for the consumers (include public notice and signed minutes)	
Y	Adjacent utilities notice, review, and comment of draft WSP. Attach notice and comments received.	
Y	SEPA: Signed Environmental Checklist and Threshold Determination. The water system is lead agency.	
Y	Agreements: SMA, intertie, service area, franchise, wheeling, mutual aid, inter-local and other agreements	
Y	Correspondence	
Y	Supporting documents	
Miscellaneous Documents – Post review		
	Plan approval by water system governing body. Include signed meeting minutes or signed resolution. NOTE: DO NOT approve the plan until after the draft review is completed and you have received authorization to proceed with approval from the Regional Planner.	

GENERAL INFORMATION AND REQUIREMENTS:

- **Copies – Provide an electronic copy of the WSP. DOH will send to Ecology. Contact DOH SWRO admin for box.com login swro.admin@doh.wa.gov**
- **Provide this document with first draft.** Use the right side column of the checklist to provide page numbers for required content.
- **Fee – The total review fee for the first and second drafts for 10,000 or more connections is $5,484. Additional drafts are an additional $1,371. Fees are subject to change.**
- **REVIEW TIMELINE – Plans are reviewed in the order received.** DOH will respond within ninety (90) days of receiving draft plans (i.e. 90 days after the first draft, and again, 90 days after the second draft). Dept. of Ecology has 60 days to review, and that is concurrent with the DOH 90-day period.

WAC 246-290-100 – Water System Plans
DOH Pub. 331-432 – Service Area Guidance
DOH Pub. 331-438 – Service Area Policies
DOH Pub. 331-366 – Duty to Provide Service
DOH Pub. 331-568 – Local Government Consistency Determination Form
DOH Pub. 331-370 – Water Right Self-Assessment
WAC 246-290-221 – Water Demand Design Criteria
DOH Pub. 331-123 – Water System Design Manual
DOH Pub. 331-375 – Water Use Efficiency Guidebook
DOH Pub. 331-036 – Preparing a Coliform Monitoring Plan
DOH Pub. 331-211 – Emergency Response Planning Guide
DOH Pub. 331-234 – Cross Connection Control Planning Guide
DOH Pub. 331-355 – Cross Connection Control Rules and Definitions

RCAC Asset Management Interactive Spreadsheet
Customer Assistance Programs website
DOH Pub. 331-134 – Small Water System Management Program
DOH Pub. 331-453 -- SCA Fact Sheet
DOH Pub. 331-048 -- SCA Legal Protections
DOH Pub. 331-106 -- Source Water Protection Requirements
DOH Pub. 331-018 -- Wellhead Protection Program Guide
DOH Pub. 331-368 -- Approval Requirement for Water System Plans
DOH Pub. 331-368 -- Timely and Reasonable Water Service
DOH Pub. 331-445 -- Asset Management for Small Water Systems
DOH Pub. 331-634 -- Wellhead Protection Areas: Protecting Drinking Water
DOH Pub. 331-301—Guide for Preparing Water Shortage Response Plans
DOH Pub. 331-327 -- Water Rates Paying for drinking water

Additional Notes:

- What are 3 things the City has accomplished in this past planning period that you're proud of or that have made a positive impact on the system and/or customers?
  - Wrapping up reservoir reconstruction, with booster station.
  - Working on interconnection between wells 6 and 14, which will enable more water going into distribution system.
  - PFAS treatment system. Project has been approved and going to bid soon.
- What are 3 things the City would like to accomplish in the next planning period?
  - Address water rights issues.
    - New source in existing wellfields.
    - Well 13 or Well 13B.
    - Steigerwald.
- What are your top concerns for this upcoming planning period?
  - Other wellfields that will need PFAS treatment.

APPENDIX H

INTERTIE AGREEMENTS

INTERLOCAL AGREEMENT: EMERGENCY INTERTIE BETWEEN WATER SYSTEM OPERATIONS OF THE CITY OF VANCOUVER AND THE CITY OF CAMAS

THIS AGREEMENT is made and entered into this 2nd day of October, 2017, by and between the City of Camas, a municipal corporation of the State of Washington, and the City of Vancouver, a municipal corporation of the State of Washington, hereinafter referred to as the "Parties".

IN CONSIDERATION of the mutual promises, agreements, and covenants contained herein, it is hereby agreed, by and between the Parties, as follows:

RECITALS

WHEREAS, the Parties have developed a Coordinated Water System Plan ("CWSP") pursuant to the Public Water System Coordination Act of 1977, RCW Chapter 70.116; and

WHEREAS, the CWSP designates individual water service areas to avoid unnecessary duplication; and

WHEREAS, the CWSP anticipates the development of physical interconnection of those water systems at points known as interties; and

WHEREAS, water system interties provide mutual benefits to water system operators by creating water supply redundancies; and

WHEREAS, the City of Vancouver and the City of Camas are authorized by Chapter 39.34 RCW, the Interlocal Cooperation Act, to enter into cooperative agreements to jointly exercise their powers, privileges and authorities; and

WHEREAS, the Parties are entering into this Agreement to provide water service to each other during emergency conditions.

NOW THEREFORE, the City of Vancouver and the City of Camas having entered into this Agreement by their signature, agree with the following:

Section 1. PURPOSE

The purpose of this Agreement is to provide emergency water service to the requesting Party at a mutually acceptable intertie location. The intertie location is identified on Exhibit 'A.'

Section 2. CONDITIONS OF SERVICE

A. Metering

A water meter that can serve water flowing in both directions will be installed at the intertie location. The City of Vancouver will set, own and maintain the water meter.

B. Other Infrastructure

Each purveyor will own and maintain the intertie infrastructure on its respective side up to the intertie meter, including all fittings, valves, pressure reducing valves, booster pumps, piping, electrical connections, and pressure gauges. The City of Vancouver will own and maintain the meter and the meter vault and all other associated appurtenances within the vault.

C. Cost of Service

The cost of the water supplied though an intertie shall be based on the supplying Party's then current service rates, as follows:

1. When the City of Camas supplies water to the City of Vancouver, the usage charge will be based on the most current schedule of rates for the size of the meter installed based on the Inside City Commercial rate.

2. When the City of Vancouver supplies water to the City of Camas, the usage charge will be based on the inside city limits commercial rate.

Charges will be limited to water usage. There will be no monthly or system development charges.

D. Service Limitations

The Parties will use the intertie only for emergency water service. Emergency water service is defined as service during any event that requires either Party's water supply to be augmented on a temporary emergency basis and is not intended to supply base or peak supply. Because this Agreement covers only emergency water service, there is no specific time period in which water will be provided; emergency water service may be requested at any time.

Either Party can refuse to provide emergency water service if such use could result in a degradation of water quality. The City of Vancouver and the City of Camas will monitor water quality at the intertie and each water purveyor will continue to be responsible for water quality monitoring within their system. Each Party shall immediately notify the other in the event of any failed coliform bacteria sample within the system and shall discuss any potential necessary actions.

Either Party can refuse to provide emergency water service if the water is needed for their own system.

Each Party shall use reasonable efforts to provide an uninterrupted supply of water. However, neither Party guarantees the availability of water through the intertie at all times because of each Party's respective needs and water demands. Further, either Party may close the intertie until sufficient water supply exists to make water available for use by the other Party.

The volume of water made available by the supplying utility will be dependent on the size of the intertie meter and the capacity available from the supplying water system.

Neither Party will be liable for any loss or damage attributed to their failure to provide water through the intertie.

Either Party can choose to abandon the intertie if the cost to alter, maintain or replace the connection exceeds the benefit to either Party.

The City of Vancouver and the City of Camas will work together to design, construct and maintain future interties where financially feasible.

Operation of the intertie shall be under the mutual consent of the City of Vancouver Water Operations Superintendent and City of Camas Utilities Manager. Each Party shall notify the other Party in writing at least twelve (12) hours in advance of the time either party desires to receive water through the intertie. Such notice shall be delivered in person to ensure it is timely received. If an emergency requires immediate use of the intertie, verbal notification and approval will be permitted, with follow-up written notification to occur as soon as practicable under the circumstances. Follow-up written notification of such emergency request shall be made by each Party to the other party within not more than three (3) days after the initiation of such emergency water usage. Upon receiving a request, the responding Party will provide available water service within a reasonable amount of time.

Section 4. GENERAL TERMS

A. Force Majeure

Notwithstanding anything contained in this Agreement to the contrary, neither Party will be deemed liable or to be in default for any delay or failure in performance under this Agreement deemed to result from acts of God, acts of civil and military authority, acts of public enemy, war, or any like cause beyond the Parties reasonable control.

B. Parties' Interests

Neither Party shall by virtue of this Agreement acquire any proprietary or governmental interest in the water system of the other Party. Each Party shall be solely responsible for the operation and maintenance of its own system of water distribution.

C. Water Use Efficiency Programs

Water use efficiency programs, data collection, water demand forecasting and other operational matters will be coordinated between the City of Vancouver and the City of Camas through the CWSP. Additional coordination activities are not necessary for emergency interties.

D. Severability

Should any provision of this Agreement be held by a tribunal of competent jurisdiction to be invalid or unenforceable, the remainder of the Agreement will remain in full force and effect.

E. Assignment

Neither Party shall assign this Agreement, or any rights under it, or delegate any obligations under it, without first obtaining the written consent of the other Party.

F. Amendments

This Agreement may only be changed, modified, or amended upon the unanimous written approval of both parties.

G. Third Parties

The terms of this Agreement are not intended to establish or create any rights in any persons or entities other than the Parties to this Agreement.

H. Employment Status

In providing services under this Agreement, none of the officers, officials, agents or employees of the parties hereto are employees of the other party to this Agreement for any purpose, including responsibility for any Federal or State tax, industrial insurance, or Social Security liability.

I. Administration

No new or separate legal or administrative entity is created to administer the provisions of this Agreement. This Agreement shall be administered by the respective parties to this

Agreement, which shall each be individually responsible for financing its own actions pursuant to this Agreement.

J. Choice of Law

This Agreement is made and entered in the State of Washington. Any dispute concerning its terms shall be determined by the courts of competent jurisdiction in and for Clark County, Washington.

K. Effective Date and Duration

This Agreement shall become effective upon the occurrence of the approval of this Agreement by the Parties' respective governing bodies, execution of this document by their authorized representatives, and recording with the County auditor. This Agreement shall remain in effect until terminated by either Party in accordance with this Agreement.

L. Termination

Either party may terminate this Agreement by providing sixty (60) days prior written notice to the other party. Upon termination, each party continues to own, is responsible for, and may dispose of the intertie infrastructure for which they are the designated owner through this Agreement.

M. Notices

Any notice to be given or any documents to be delivered by any party to the other shall be delivered in person or, if not urgent, sent by regular U.S. mail and addressed to the parties to this Agreement at the following addresses:

For the City of Vancouver:

Director of Public Works
City of Vancouver
415 W. 6th Street
P.O. Box 1995
Vancouver, WA 98668-1995

For the City of Camas:

Public Works Director
City of Camas
616 NE 4th Avenue
Camas, WA 98607

N. Entire Agreement

This Agreement comprises the entire understanding between the City of Vancouver and the City of Camas with respect to the subject matter hereof, and there are no representations, inducements, promises, or agreements, oral or otherwise, not embodied herein. Any and all prior negotiations, discussions, commitments, and understandings relating hereto are merged herein.

O. Counterparts

This Interlocal Agreement may be executed simultaneously in several counterparts, each of which shall be deemed an original, and all of which together shall constitute one and the same instrument.

P. Filing

The Parties agree that there shall be two (2) duplicate originals of this Interlocal Agreement procured and distributed for signature by the necessary officials of the parties. Upon execution, one executed original of this Interlocal Agreement shall be retained by each Party. Within five (5) days from the date of execution of this Interlocal Agreement, the Parties will cause a copy of this Agreement to be filed with the County auditor in accordance with Chapter 32, Laws of Washington 2006 (RCW 39.34.040). Upon execution of the originals and filing of a copy with the County auditor, each such duplicate original shall constitute an agreement binding upon all Parties.

IN WITNESS WHEREOF, the parties have executed this agreement at Vancouver, Washington this 2nd day of September, 2017. October 3

CITY OF VANCOUVER

By: _____
City Manager

CITY OF CAMAS

By: _____
Mayor

Approved as to form:

_____
City Attorney

Attest:

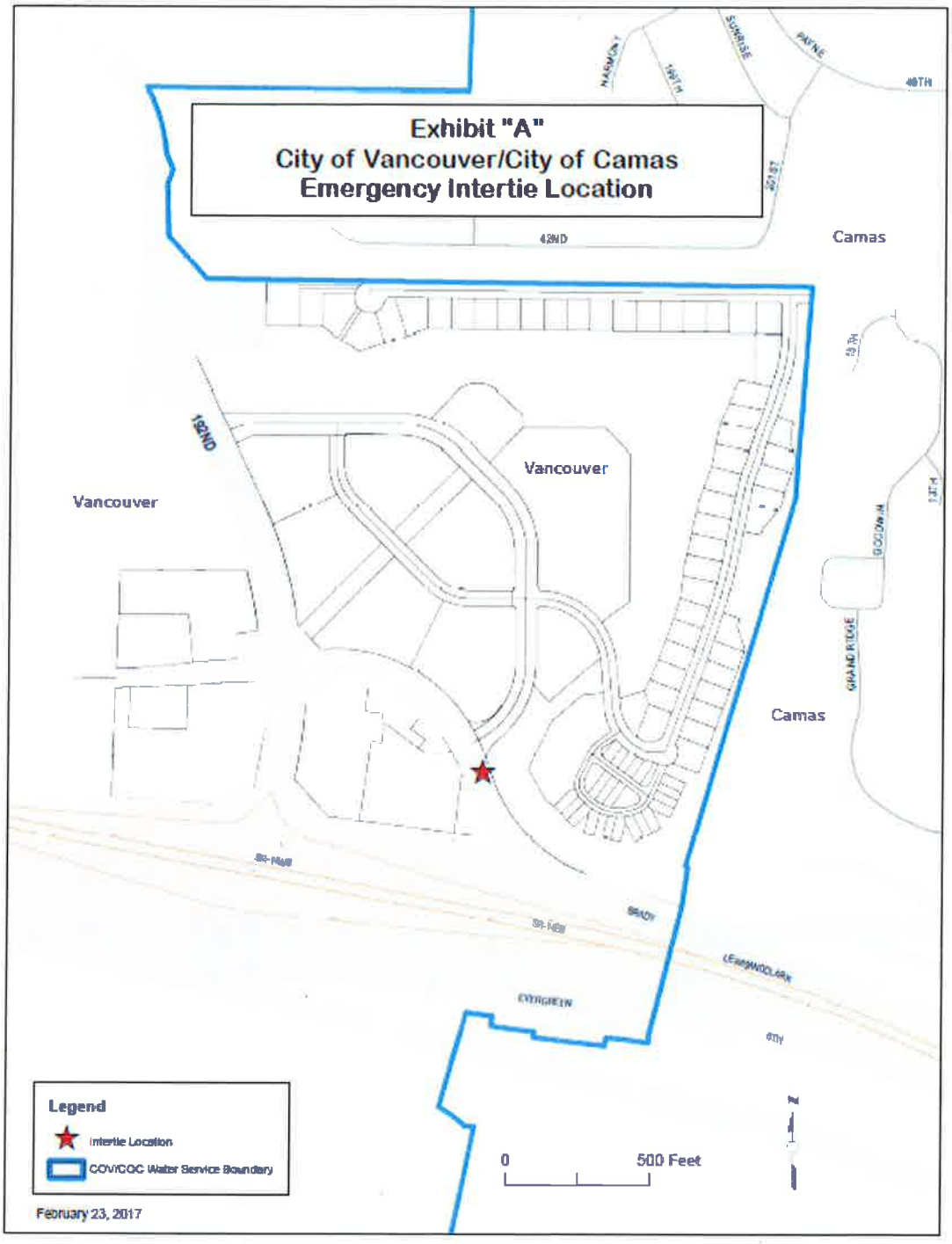
_____
City Clerk

Approved as to form:

_____
City Attorney

Attest:

_____
City Clerk


Exhibit "A"
City of Vancouver/City of Camas
Emergency Intertie Location
Camas
Vancouver
Vancouver
Camas
192ND
43RD
48TH
Legend
Intertie Location
COV/CGC Water Service Boundary
0
500 Feet
February 23, 2017

INTERLOCAL AGREEMENT FOR ADJUSTING WATER UTILITY SERVICE BOUNDARIES AND WATER SERVICE SHUT OFF

BETWEEN

City of Vancouver and City of Camas

THIS AGREEMENT, entered into by and between City of Vancouver ("Vancouver") and City of Camas ("Camas"), (hereinafter referred to collectively as the Water Purveyors), WITNESS THAT:

WHEREAS, Clark County and the Water Purveyors conduct capital facilities and land use planning under the Growth Management Act as adopted by the State of Washington and subsequently amended; and

WHEREAS, RCW 70.116, *Public Water System Coordination Act*, and WAC 246-293-250 require development of a Coordinated Water System Plan, including establishment of service area boundaries by written agreement among purveyors; and

WHEREAS, the designation of water service area boundaries helps facilitate efficient planning and delivering of water services within Clark County, avoid unnecessary duplication of water services, and provide water operation predictability to the water purveyors, Clark County, and the residents served by the public water system; and

WHEREAS, the designation of water service area boundaries helps assure that available water supply sources of the Water Purveyors will be utilized in an efficient manner; and

WHEREAS, Vancouver and Camas entered an Interlocal Agreement for Adjusting or Confirming Future Water Utility Service Boundaries, effective January 10, 2012, which designated service area boundaries for the east boundary for Vancouver and the west boundary for Camas; and which was reviewed and approved by the Clark County Board of Commissioners pursuant to RCW 70.116.040; WAC 246-293-250; and 246-293-290; and

WHEREAS, without the installation of additional tanks and pumps, Vancouver cannot provide reliable water service at an adequate pressure to a portion of land currently located within Vancouver's water service area boundary, which is shown as the "Area Proposed to be Transferred to Camas" in Exhibit 'A' (hereinafter "Affected Area"); and

WHEREAS, Camas's water system has water supply at adequate pressure to provide the Affected Area with reliable water service; and

WHEREAS, it is in the best interests of Vancouver and Camas to make adjustments to the water service area boundaries such that Camas will now provide water service to the Affected Area; and

WHEREAS, Vancouver will provide sewer, stormwater and other municipal services within the Affected Area; and

WHEREAS, Vancouver engages in a lengthy process including multiple steps and actions to collect delinquent sewer and stormwater service charges. This process consists of the following, (1) past due reminder sent 25 days after the bill date to both the service address and the property owner of record, (2) past due final notice is sent 37 days after the bill date to both the service address and the property owner of record to notify that water service will be shut-off if payment is not received, (3) after the 45th day the account is past due, water service is shut-off, (4) after 12 months of non-payment, a notice of intent to file lien is mailed, (5) 30 days after the intent to file lien is sent, lien is filed with the Clark County Auditor and property owner notified, (8) after 24 months of non-payment, foreclosure process commences; and

WHEREAS, almost all of the delinquent sewer and stormwater service charges are paid during this lengthy collection process, and prior to the filing of a foreclosure action; and

WHEREAS, when other efforts fail, a cost effective mechanism for collecting payment of delinquent sewer and stormwater service charges is Vancouver's ability to shut off (terminate) water service to a property; and

NOW THEREFORE, in consideration of covenants, conditions, performances, and promises hereinafter contained the undersigned Water Purveyors hereto agree as follows:

I. Purpose

The purpose of this Agreement is to adjust Water Service Area boundaries of the Water Purveyors that are parties to this Agreement and to provide a mechanism for shut off of water service by Camas at the request of Vancouver for delinquent sewer and/or stormwater service charges.

II. Effective Date

This Agreement shall become effective upon the occurrence of the approval of this Agreement by the individual Water Purveyors' governing bodies, execution of this document by their authorized representatives, the approval of this Agreement by the Clark County Board of County Council, and recording with the County auditor.

III. Duration

This Agreement shall remain in effect with regard to the individual Water Purveyors until terminated. Such termination shall occur through the establishment of future water service boundaries with the next update of the Coordinated Water System Plan.

IV. Property

Nothing in this Agreement shall create or transfer any interest in real or personal property among Water Purveyors. In the event any adjustment of a Future Water Service Area boundary requires transfer of water facility assets from one Water Purveyor to another Water Purveyor, a separate written agreement shall address the transfer of such assets.

V. Administration

No new or separate legal or administrative entity is created to administer the provisions of this Agreement. This Agreement shall be individually administered by the respective Water Purveyors, which shall each be individually responsible for financing its own actions under this Agreement.

VI. Scope

1. **Service Area Boundaries**. The undersigned acknowledge that the map attached to this agreement identified as Exhibit 'A" clearly identifies the current western water service boundary for Camas and eastern water service boundary for Vancouver as well as the proposed water service boundary to be established through this Agreement. In addition, Exhibits B and C identify the final service boundaries for Vancouver and Camas, respectively, which will become effective upon execution of this Agreement. This signed Interlocal Agreement verifies that there are no service area conflicts with adjacent water utilities.

2. **Boundary Adjustments.** If, at some time in the future, it is in the best interests of the undersigned parties to make service area boundary adjustments, such modifications must have the written concurrence of all involved parties and the proper legislative authority/authorities, and must be noted and filed with Clark County and Washington State Department of Health.

3. **Water Service Shut Off.** After Vancouver has completed its delinquent sewer and/or stormwater service charge collection process for property that has delinquent charges, Vancouver's Public Works Director or designee may file a written request with the Camas Public Works Director or designee to shut off water service for such property. Upon receipt of the request, the Camas Public Works Director or designee will shut off the water service following the Camas procedure and requirements for shutting off water service for nonpayment of Camas water service charges. The water service shall remain shut off until the delinquent sewer and/or stormwater service charges, plus penalties, interest and fees, have been paid in full or the property owner and Vancouver have entered into a payment arrangement. The Vancouver Public Works Director or designee shall notify the Camas Public Works Director or designee when the charges have been

paid in full or the payment arrangement has been entered into. Vancouver estimates that requests to shut off water service will be infrequent.

VII. Interpretation

This Agreement has been and shall be construed as having been made and delivered in the State of Washington and it is mutually agreed and understood by the Water Purveyors that this Agreement shall be governed by the laws of the State of Washington. Venue for any lawsuit arising from or related to this Agreement shall be the Superior Court of Clark County, Washington.

VIII. Amendments/Modification

The provisions of this Agreement may be amended only upon the mutual consent of the Water Purveyors. No amendments to the terms of this Agreement shall be valid unless made in writing and formally approved and executed by the duly authorized agents of the Water Purveyors and Clark County, and recorded with the Clark County Auditor.

IX. Severability

If any section or part of this Agreement is held by a court to be invalid, such action shall not affect the validity of any other part of this Agreement.

X. Entire Agreement

This Agreement contains all of the agreements of the Water Purveyors with respect to the subject matter covered or mentioned herein, and no prior Agreement shall be effective to the contrary.

XI. Counterparts

This Interlocal Agreement may be executed simultaneously in several counterparts, each of which shall be deemed an original, and all of which together shall constitute one and the same instrument.

XII. Document Filing

The Water Purveyors agree that there shall be one (1) original of this Agreement procured and distributed for signature by the necessary officials of the Water Purveyors. Upon execution, this Agreement shall be retained by the Clark County Community Planning and each Water Purveyor shall retain one (1) copy. The Parties shall cause a copy of this Agreement to be recorded with the Clark County Auditor.

As specified in WAC 246-293-250, Service Area Agreements-Requirements, this Agreement shall become effective once this document is approved by the Clark County

Board of County Council. The Parties will ensure this Agreement is filed with the County auditor within five (5) days of approval by the Clark County Board of County Council.

This Interlocal Agreement for Adjusting Water Utility Service Boundaries and Water Service Shut Off is hereby approved.

CITY OF VANCOUVER

By: _____
City Manager

CITY OF CAMAS

By: _____
Mayor

Approved as to form:

_____
City Attorney

Approved as to form:

_____
City Attorney

Attest:

_____
City Clerk

Attest:

_____
City Clerk

APPROVED BY CLARK COUNTY BOARD OF COUNTY COUNCIL, CLARK COUNTY, WASHINGTON

_____
Marc Boldt, Chair

_____
John Blom, Councilor

_____
Jeanne E. Stewart, Councilor

_____
Eileen Quiring, Councilor

_____
Julie Olson, Councilor

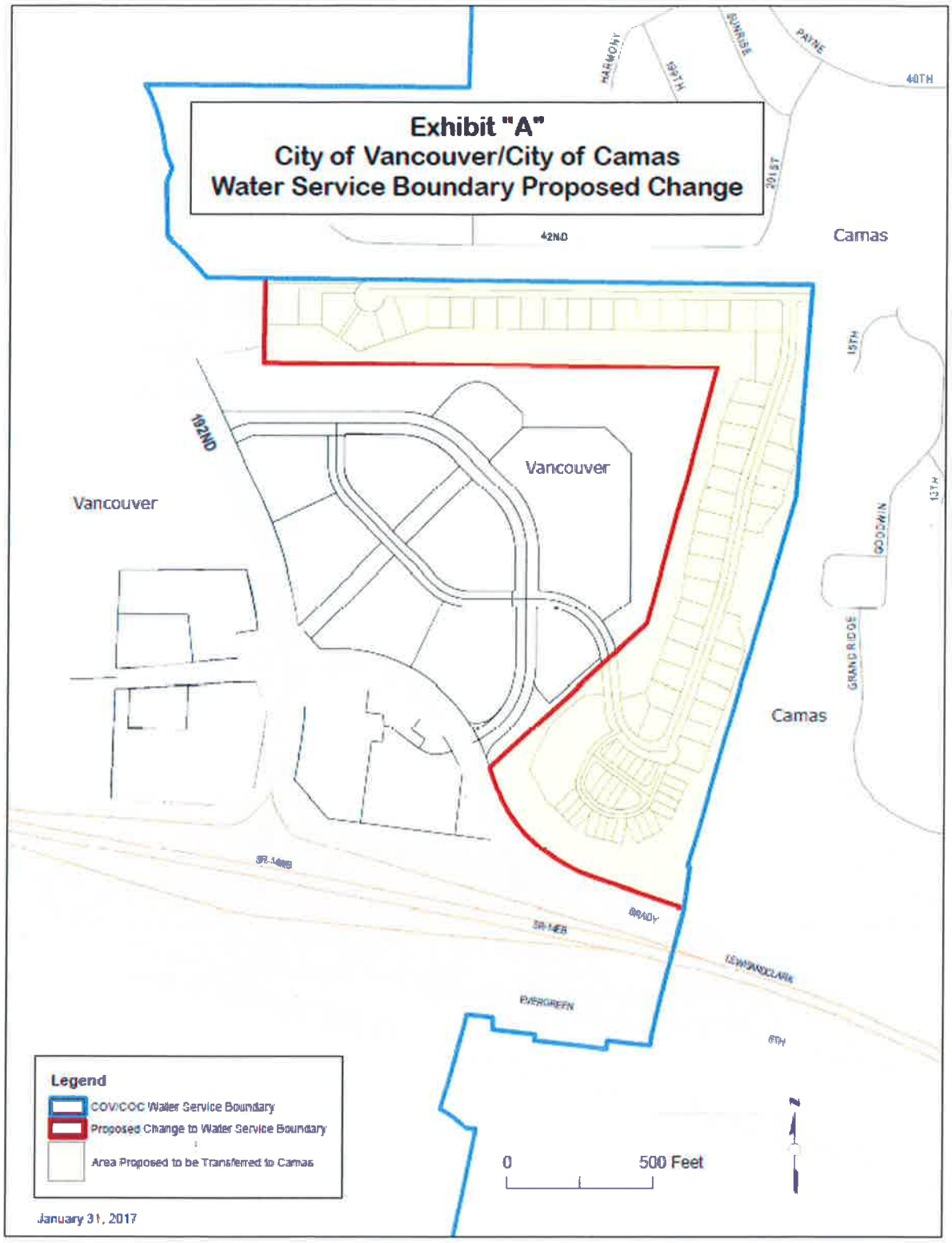
Resolution No. —

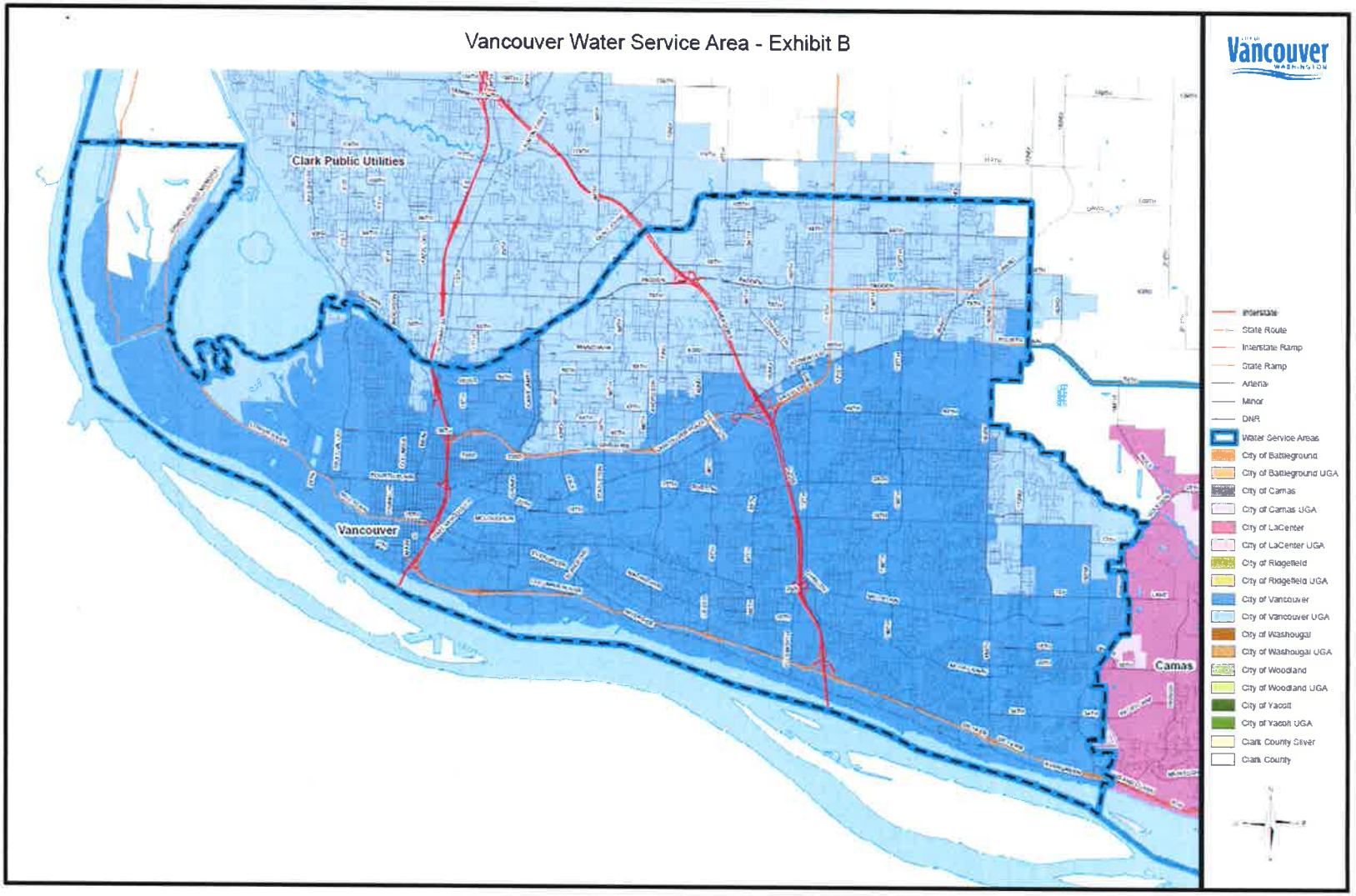
Date: 10-24-17

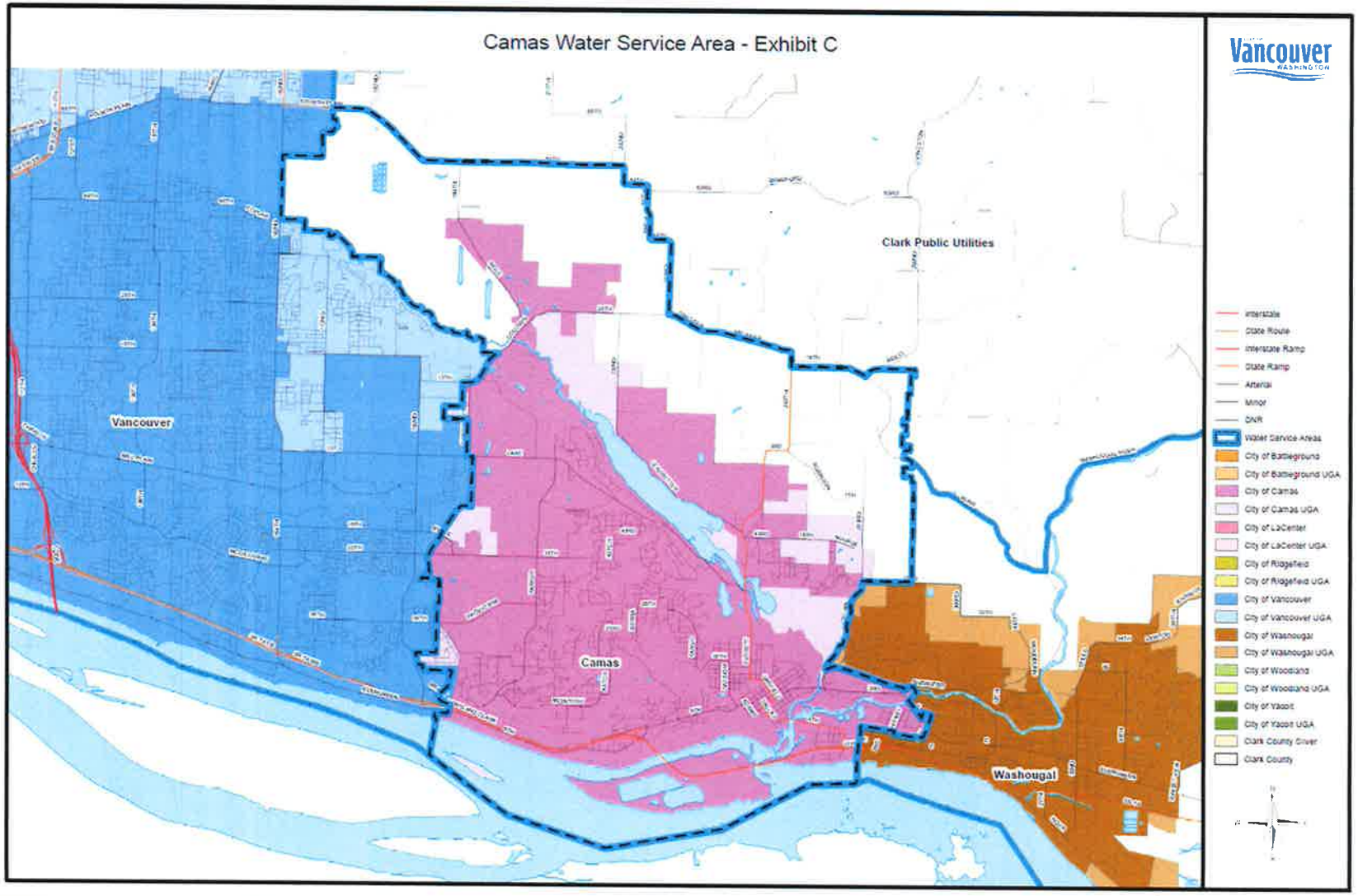
APPROVED AS TO FORM ONLY:
Anthony F. Golik, Clark County Prosecutor

By: _____
Christine Cook, Senior Deputy Prosecuting Attorney

CLARK COUNTY, WASHINGTON 1844


Exhibit "A"
City of Vancouver/City of Camas
Water Service Boundary Proposed Change
Camas
Vancouver
Vancouver
Camas
192ND
42ND
40TH
PAYNE
SUNRISE
HARMONY
199TH
201ST
15TH
137TH
GOODWIN
GRANGRIDGE
BRADY
EVERGREEN
6TH
Legend
COV/COC Water Service Boundary
Proposed Change to Water Service Boundary
Area Proposed to be Transferred to Camas
0
500 Feet
January 31, 2017


Vancouver Water Service Area - Exhibit B
Clark Public Utilities
Vancouver
Camas
Vancouver
Interstate
State Route
Interstate Ramp
State Ramp
Arterial
Minor
DNR
Water Service Areas
City of Battleground
City of Battleground UGA
City of Camas
City of Camas UGA
City of LaCenter
City of LaCenter UGA
City of Ridgefield
City of Ridgefield UGA
City of Vancouver
City of Vancouver UGA
City of Washougal
City of Washougal UGA
City of Woodland
City of Woodland UGA
City of Yacolt
City of Yacolt UGA
Clark County Sewer
Clark County


Camas Water Service Area - Exhibit C
Vancouver
WASHINGTON
Clark Public Utilities
Vancouver
Camas
Washougal
Interstate
State Route
Interstate Ramp
State Ramp
Arterial
Minor
DNR
Water Service Areas
City of Battleground
City of Battleground UGA
City of Camas
City of Camas UGA
City of LaCenter
City of LaCenter UGA
City of Ridgefield
City of Ridgefield UGA
City of Vancouver
City of Vancouver UGA
City of Washougal
City of Washougal UGA
City of Woodland
City of Woodland UGA
City of Yacolt
City of Yacolt UGA
Clark County Other
Clark County

INTER-LOCAL COOPERATION AGREEMENT

THIS AGREEMENT made this day by and between the CITY OF CAMAS, a municipal corporation organized under the laws of the State of Washington, hereinafter referred to as "Camas", and the CITY OF WASHOUGAL, a municipal corporation organized under the laws of the State of Washington, hereinafter referred to as "Washougal",

In accordance with the Inter-Local Cooperation Act (RCW Chapter 39.34), Camas and Washougal, in consideration of the payments, covenants and agreements hereinafter mentioned, to be made and performed by the parties, do covenant and agree as follows:

Section 1. **PURPOSE:** The purpose of this agreement is to allow Camas and Washougal to sell water to the other due to the occurrence of an emergency situation where either city is unable to meet their service demands within internal water sources. The designation of an emergency shall be made by the respective Public Works Directors of each city and shall include, but not be limited to, drought conditions or a break in a water main. The delivery of water upon the designation of an emergency shall be through Inter-Ties between the respective water systems of Camas and Washougal at locations approved by the Public Works Directors of each city.

Section 2. **DURATION:** This agreement shall be for an indefinite duration.

Section 3. **ADMINISTRATION:** No new or separate legal or administrative entity is created to administer the provisions of this agreement. This agreement shall be administered jointly by Camas and Washougal by and through the Public Works Directors of both cities, who shall jointly administer this undertaking in accordance with the terms and conditions of this agreement.

Section 4. **FINANCING:** In the event either Camas or Washougal receives water

pursuant the provisions of this agreement then the receiving city shall remit payment in full for the water received at a rate equivalent to the receiving city's residential, inside city, water volume rate at the time of provision of the water. Invoicing shall be on a monthly basis.

Section 5. **WATER QUALITY:** The water supplied by either Camas or Washougal, in accordance with the terms of this agreement, shall be deemed "finished and treated" drinking water at the point of delivery. The city providing water shall have no responsibility to maintain drinking water quality standards once the water has been provided to the receiving city's distribution system. The receiving city shall be solely responsible to maintain drinking water quality standards upon receipt.

Section 6. **INDEMNIFICATION:** Camas and Washougal shall indemnify and hold harmless the other, its officers, agents, and employees, or any of them, from any and all claims, actions, suits, liability, loss, costs, expenses and damage of any nature whatsoever, by reason of or arising out of any action or omission of the respective employees, officers and agents, in the execution and administration of this agreement.

Section 7. **INSURANCE:** Each city shall obtain and keep in full force and effect liability insurance protecting itself and its employees, officers and agents, and the party, its employees, officers and agents, for claims of any persons for injuries to life, person or property by reason of anything done or permitted to be done or suffered or admitted to be done by the parties in the administration of the project. If either party withdraws from the Washington Cities Insurance Authority, that party shall deliver a certificate of insurance showing compliance with this section.

Section 8. **TERMINATION:** Each party shall have the right to terminate this entire agreement, with or without cause, upon 180 days written notice to the other party. Such notice shall be sufficient if it is in writing and deposited in the United States mail, certified mail, return receipt requested, with postage fully prepaid and addressed to the parties at their last known addresses as follows:

City of Camas
P.O. Box 1055
Camas, WA 98607

City of Washougal
1701 "C" Street
Washougal, WA 98671

Section 9. **FILING:** This agreement shall be filed with the city clerks of Camas and Washougal and with the Clark County Auditor and the Washington Secretary of State.

Section 10. **EFFECTIVE DATE:** This agreement shall be effective upon signing by the respective parties hereto.

DATED this 7 day of August, 2006.

CITY OF CAMAS

By: _____
Mayor

Attest: _____
Clerk

Approved as to form:
_____
City Attorney

CITY OF WASHOUGAL

By: _____
Mayor

Attest: _____
Clerk

Approved as to form:
_____
City Attorney

CITY OF CAMAS
616 Northeast Fourth Avenue
P.O. Box 1055
Camas, Washington 98607

RECEIVED
OCT 09 1997

October 8, 1997

Mike Conway, Director
Department of Public Works
City of Washougal
1701 C Street
Washougal WA 98671

Gentlemen/Mike

Enclosed please find an executed copy of the *INTERLOCAL AGREEMENT BETWEEN the CITY OF WASHOUGAL and the CITY OF CAMAS.* Said agreement designates the City of Washougal as the utility service (water and sewer) provider to the land located north of the intersection of Shepherd Road and 3rd Avenue.

Any questions pertaining to this agreement may be directed to Eric Levison, our Assistant City Engineer, at 834-3451.

Sincerely,

Douglas A. Quinn, P.E.
Director

enclosure

RECEIVED
OCT 09 1997

Administration (360) 834-6864 | Building (360) 834-8860 | Finance (360) 834-2462 | Fire (360) 834-2262 | Library (360) 834-4692 | Police (360) 834-4151 | Public Works (360) 834-3451 | Parks Recreation (360) 834-7092

INTERLOCAL AGREEMENT BETWEEN
the
CITY OF WASHOUGAL and the CITY OF CAMAS

The corporate limits of the cities of Camas and Washougal are irregular along their common boundary. In particular, an area within the Camas corporate limits (herein referred to as "subject area", as described in attached Exhibit "A") located north of the intersection of Shepherd Road and 3rd Avenue is currently surrounded on approximately eighty-four (84) percent of its perimeter by Washougal's corporate limits.

Further, the cities have mutually entered into an Interlocal Agreement which designates the City of Washougal as the utility service (water and sewer) provider to the land located within the subject area.

The City of Washougal is in the process of preparing a Comprehensive Subarea Plan for an area lying north of the subject area, including the land surrounding the subject area. The Subarea Plan will address land uses, environmental protection, storm water drainage and infrastructure impacts for the area. Including the subject area would assure the orderly and logical progression of land development under the jurisdiction of the City of Washougal.

The purpose of this agreement is to establish the City of Washougal as the presiding jurisdiction with respect to land use planning and implementation, including, but not limited to the following:

1. Implementation of land division regulations.
2. Imposition and implementation of zoning regulations
3. Implementation of development standards, including streets, storm and sanitary sewer, water and other utility provision.

Pursuant to this, the City of Washougal and the City of Camas hereby agree to the following:

1. Presiding Jurisdiction. The City of Washougal shall be the presiding jurisdiction in all planning programs, land use designations and land use application processing for land within the subject area.

2. Land Use Planning and Implementation. All land use actions shall be processed under the rules and regulations of the City of Washougal, including but not limited to Titles 15 (Building), 16 (Environmental), 17 (Land Divisions) and 18 (Zoning) of the Washougal Municipal Code, the City of Washougal Engineering Standards for Public Works Construction and any and all provisions of the Woodburn Hill Comprehensive Subarea Plan. No provision of this agreement shall preclude future revisions, amendments or addenda to these regulations from being implemented by the City of Washougal within the subject area without prior written consent of the City of Camas.

3. Annexation. Both the City of Camas and the City of Washougal agree to pursue the necessary routes to transfer true corporate jurisdiction for the subject area from the City of Camas to the City of Washougal.

4. Effective Date and Duration. This agreement shall be effective upon signature by the presiding officer of both the City of Camas and the City of Washougal, and shall be in effect until terminated by one of the following methods:

   a. Ninety (90) day written notice of termination by either party subject to the agreement.
   b. Termination of agreement upon formal annexation of the subject area by the City of Washougal, said termination being effective concurrent with the effective date of the annexation.

5. Application Processing Upon Termination. Upon termination of this agreement, the city of Washougal shall complete processing of any technically complete land use application filed with the City of Washougal pursuant to the provisions of this agreement.

APPROVED this 4th day of August, 1997 by:

City of Washougal

Mayor Charles Crumpacker

City of Camas

Mayor Dean Dossett

Approved as to form:

City of Washougal

Don English, City Attorney

City of Camas

Roger Knapp, City Attorney

f:\eric\woodburn\intrlocl

AFTER RECORDING RETURN TO:

City of Washougal
1701 "C" Street
Washougal, WA 98671

CITIES OF CAMAS AND WASHOUGAL, WASHINGTON

UTILITIES COOPERATION AGREEMENT FOR WATER SYSTEM DEVELOPMENT – PHASE 2

2015

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CITIES OF CAMAS AND WASHOUGAL, WASHINGTON
UTILITIES COOPERATION AGREEMENT
FOR WATER SYSTEM DEVELOPMENT
PHASE 2

1. AGREEMENT

This Utilities Cooperation Agreement for Water System Development ("Agreement") is made by and between the CITY OF CAMAS, a Washington municipal corporation ("Camas"), and the CITY OF WASHOUGAL, a Washington municipal corporation ("Washougal"). Camas and Washougal are each a "Party" and collectively the "Parties" (or "Cities") to this Agreement. The Parties agree as follows.

2. RECITALS

2.1 This Agreement is entered by the Parties under their authority to contract, including but not limited to RCW 35A.11.010 and RCW 35.21.210.

2.2 For a number of years, Camas and Washougal have been jointly addressing the Parties' ongoing water supply needs. The Cities participated in Water Resource Inventory Area (WRIA) planning in the Salmon-Washougal (WRIA 28) and Lewis (WRIA 27) watersheds. Clark, Cowlitz and Skamania Counties adopted the Salmon-Washougal & Lewis Watershed Management Plan on July 21, 2006. The Salmon-Washougal & Lewis Watershed Management Plan guides future water rights development in the community, and identifies the Steigerwald area in Clark County as a regional water source.

2.3 Washougal identifies current average daily water demand of approximately 2.0 million gallons per day, with an estimated 50-year need of 10 million gallons per day. Camas identifies current average daily water demand of approximately 3.7 million gallons per day, with an estimated 50-year need of 15 million gallons per day. To meet these needs, the Parties initiated efforts to develop and operate water system wells and well fields near the Steigerwald Wildlife Refuge to be supplied by the Pleistocene Alluvial Aquifer (the "Project").

2.4 The Parties began Project development efforts at Phase 1, in part, by entering into an Option to Purchase Exclusive Easement for Well Site with the Port of Camas-Washougal ("Port," July 17, 2006 (now expired)), and Inter-Local Cooperation Agreement (July 17, 2006) between the Parties to provide for drilling, testing, and evaluation of drinking water wells in the Steigerwald Lake area. The testing revealed sufficient water supplies for the Project. The 2011 Clark County Coordinated Water System Plan Update identifies the Steigerwald well field as a regional water source and further identifies it as a capital project (SR-11).

2.5 As components of the Project, the Parties now are (i) jointly seeking new water rights sufficient for the Project under an Application for Water Right Permit (Washington Ecology No. G2-30528, August 2009); (ii) acquiring from Port the property rights necessary for the Project; (iii) updating their comprehensive water plans; and, (iv) planning to acquire, develop

and operate necessary water system facilities and improvements. Collectively, these efforts and this Agreement are Phase 2 of the Project.

2.6 The Camas 2010 Water System Plan identifies the Steigerwald well field as a regional water source and further identifies it as a capital project (SR-11). The Washougal Water System Plan identifies the Steigerwald well field as a regional water source and further identifies it as a capital project. Camas intends to update its Water System Plan by 2016. Washougal intends to update its Water System Plan, beginning in 2017.

2.7 The Steigerwald well field site is to be acquired and developed by the Parties, with Washougal acting as lead agency and title holder. The general allocation of rights and responsibility for the Project is 60% to Camas and 40% to Washougal.

2.8 In accordance with their history of cooperation and consistent with the 2006 Inter-Local Agreement for good faith negotiations toward a revised agreement to allocate the costs and distribution of Project water resources, the Parties enter into this Agreement to terminate the 2006 Inter-Local Agreement, except as it relates to unreimbursed costs otherwise allocated thereto which shall be subject to further negotiations, and to set forth the rights and obligations of the Parties for the next phase of the Project. This is another in a series of agreements, and the Parties will consider in the future Phase 3 and other forms of management and/or governance of water systems, including the potential of forming a joint municipal services authority under Chapter 39.106 RCW. This Agreement also provides a protocol in the event future agreements are not reached.

3. DEFINITIONS

3.1 "Capacity Allocation" means the percentage of the Steigerwald Water System's design capacity that a Party is authorized by this Agreement to use. A Capacity Allocation does not convey ownership interest in any of the Steigerwald Water System.

3.2 "Steigerwald Water System" or "Project" means the Real Property and System Facilities subject to this Agreement.

3.3 "Real Property" means that certain real property located in Clark County, Washington, identified as Clark County Tax parcel No. 135307000, consisting of approximately 19.65 acres of land, which is legally described and generally depicted in Exhibit A.

3.4 "System Facilities" means all water system facilities and improvements located on the Real Property and, to the extent agreed upon by the Parties in the future, any other facilities that Camas or Washougal may construct for joint use by the Parties, including without limitation facilities not located on the Real Property.

4. OWNERSHIP OF THE STEIGERWALD WATER SYSTEM

4.1 Capacity Interest and Allocation. Each Party owns a capacity interest in the Steigerwald Water System. The Camas capacity interest and Capacity Allocation is 60% and the Washougal capacity interest and Capacity Allocation is 40%.

4.2 Title to Property. Title to the Real Property shall be held in the name of the City of Washougal. Each Party's interest in the Real Property is defined in this Agreement by its Capacity Allocation.

4.3 Sale of Property. The Real Property, the Steigerwald Water System or any part of either the Property or System may be sold or transferred upon the written approval of both Parties, subject to any rights held by the Port of Camas-Washougal, if then applicable.

5. ALLOCATION OF COSTS, SYSTEM CAPACITY, AND WATER RIGHTS

5.1 Purchase Price. Each Party is obligated to pay its portion of the total purchase price for the Real Property (estimated to be $667,619.90 plus costs), divided as follows: Camas – 60% / Washougal – 40%. The allocable share of the Purchase Price shall be included in each Party's capital contributions if the Real Property is purchased over a term of years. Camas shall pay its share to Washougal under Agreement Section 7. Camas' payments for the real property are an obligation of Camas' water system and shall be considered as junior debt for the water utility.

5.2 Capacity Allocation. Subject to modification in future agreement, each Party's Capacity Allocation is divided as follows: Camas – 60% / Washougal – 40%.

5.3 Water Rights. Subject to modification in future agreement, each Party's interest in the water rights associated with the Steigerwald Water System is divided as follows: Camas – 60% / Washougal – 40%.

6. ADMINISTRATION

6.1 Administration.

6.1.1 Lead Agency. No new or separate legal or administrative entity is created by this Agreement. Washougal serves as lead agency for Project. As lead agency, Washougal shall be responsible for continued process for the Application for Water Right Permit, Real Property acquisition, Project design and Development and other Project related actions, all upon consultation with Camas.

6.1.2 Meetings/System Planning. The Public Works Director of each City shall meet regularly, generally monthly, regarding the Project. Additionally, the Parties shall hold regular meetings, to direct planning related to the Steigerwald Water System and to develop and review future actions, including relevant comprehensive plans, other planning documents and budgets. Each Party shall cooperate with the other Party's water comprehensive planning.

6.1.3 Phase 3. Following the adoption by each Party of the Party's updated water comprehensive plan, or earlier as the Parties determine, the Parties shall begin negotiations for development of a Phase 3 agreement. A Phase 3 agreement is to address the next phase of the water resource development and System Facilities, and System management. A Phase 3 agreement is expected to address such issues as organization and governance; budget and finance; water interties and wheeling; System Facilities planning and development; management and operation; repair and replacement of System Facilities; termination of this

Agreement; and related matters. The Parties intend to enter a Phase 3 Agreement no later than eighteen (18) months following the commencement of negotiations. Each Party commits to good faith and diligent effort to reach a Phase 3 agreement.

6.2 Other Uses. The Real Property is acquired by the Parties for development and operation of well fields and other utility purposes. The Parties may, however, agree to make the Real Property available for either or both Parties' general municipal purposes.

6.3 Water Rights Approval Process. In the event the Parties determine to request accelerated review of their Application for Water Right Permit, all costs of such process shall be allocated between the Parties based on Capacity Allocation.

7. BUDGETING AND INVOICING

7.1 Invoicing and Payment. Monthly, as expenses are incurred, Washougal will invoice Camas for its pro rata share of costs for the Project in accordance with Washougal's standard invoicing procedures for public works projects. Camas must remit payment in full for each invoice no later than thirty (30) days after the receipt of the invoice from Washougal.

7.2 Reimbursement. It is the intent of the Parties that Washougal be reimbursed for (and Camas pay for) only Camas' pro rata share of costs reasonably incurred by Washougal in performing its duties under this Agreement.

7.3 Taxes. Washougal shall not assess its utility tax on revenues from any service to Camas under this Agreement. Other taxes such as state, county and those imposed by other third parties related to the Project shall apply. Each Party retains all rights and authority to levy and collect utility taxes associated with retail or contract water service.

8. DISPUTE RESOLUTION

8.1 Negotiations. The Parties agree to make all reasonable efforts to resolve through informal, good faith negotiations any disputes concerning the terms and conditions or performance of this Agreement. In the event of a dispute, including a claimed breach of this Agreement, notice of the dispute shall be provided in writing and shall be delivered in the manner set forth in Section 12.4. The notice shall set forth with reasonable specificity the factual basis for the claimed dispute. Both Parties shall jointly cooperate to informally resolve any disputes as quickly and efficiently as possible, but in any event not more than sixty (60) days from the date of the notice unless extended by mutual agreement of the Parties.

8.2 Voluntary Mediation. If a dispute cannot be resolved through direct discussions, mediation may, by mutual consent, be initiated. In the event the Parties determine to initiate mediation, a mutually acceptable mediator shall be selected by the Parties for the purpose of facilitating the mediation process. The mediator shall be selected based on his or her expertise with the nature of the matter in dispute and their ability to facilitate a settlement. The Parties agree to provide all documentation and information requested by the mediator and in all other regards to cooperate fully with the mediator. The costs of mediation shall be shared equally between the Parties.

8.3 Other Relief. In the event the dispute is not resolved in mediation, or the Parties do not agree to mediation, the Parties may pursue any other form of relief provided by this Agreement.

8.4 Specific Performance. If a Party continues in default in the performance of any material and substantial covenant or agreement herein contained for a period of thirty (30) days after written notice specifying such default, and following such reasonable time under Agreement Sections 8.1 and 8.2; or as is necessary to cure such default or a Party's failure to commence a cure within sixty (60) days of notice, a Party may, at its option, immediately commence an action for specific performance to compel performance or take any other action available at law or in equity, including an action for damages. The Parties agree that the continued delivery of water from the Steigerwald Water System cannot be terminated without jeopardizing the public health and safety. As a result, termination of the Agreement is not an adequate remedy; and an action for specific performance, in addition to other remedies, is authorized to compel performance under this Agreement.

8.5 Compliance with Order. The Parties shall be bound by the outcome of litigation (or other process) under Agreement Section 8, including all appeals, at the conclusion of the litigation (the "Order"). The first remedy available to a Party under an Order shall be specific performance. If a Party does not comply with the Order within the time specified for compliance in the Order, the prevailing Party may elect to terminate the Agreement without further process under this Agreement. If a Party chooses to not terminate the Agreement, the Party may pursue such other remedies as are available under law or this Agreement.

8.6 Force Majeure. No period of performance required by this Agreement shall run during periods of force majeure.

8.7 No Waiver; Prevailing Party Costs. If a Party incurs attorney fees, costs, or other legal expenses to enforce the provisions of this Agreement against another Party, all fees, costs, and expenses are recoverable by the prevailing Party as against the offending Party. The failure of a Party to exercise any right or enforce any provision of this Agreement is not a waiver of that right or enforcement remedy.

8.8 Jurisdiction and Venue. This Agreement must be interpreted in accordance with the laws of the state of Washington. As against the other Party, Camas and Washougal may file suit to enforce this Agreement only in the Superior Court for Clark County, Washington.

9. ASSETS

9.1 Existing Assets. Subject to Agreement Section 4, this Agreement does not transfer any existing assets between the Parties. The Parties retain all rights, title, and interest in their separate municipal water systems, including without limitation all real and personal property, investments, cash accounts and reserves, and contract and intangible rights.

9.2 Steigerwald Water System Assets. The Parties each have an ownership interest in the assets of the Steigerwald Water System based on Capacity Allocation. Upon termination or dissolution of this Agreement, the Parties will work in good faith toward an asset allocation plan for the Steigerwald Water System and to administer the approved plan. In the event the Parties

cannot reach agreement, then Washougal shall pay to Camas the full amount of prior Camas payments to Washougal for the Real Property and any System Facilities constructed prior to Agreement termination. After payment by Washougal, Camas shall have no interest in the Steigerwald Water System.

10. INSURANCE

10.1 Property Insurance. Washougal must insure, at replacement cost value, any Steigerwald Water System Facilities.

10.2 Liability Insurance. Each Party shall obtain and keep in full force and effect liability insurance protecting itself and its employees, officers and agents, and the party, its employees, officers and agents, for claims of any persons for injuries to life, person or property by reason of anything done or permitted to be done or suffered or admitted to be done by the parties in the administration of the project. If either party withdraws from the Washington Cities Insurance Authority, that party shall deliver a certificate of insurance showing compliance with this section.

10.3 Cost. Any additional cost for liability, property or other insurance required for the System will be included as an operating cost and payable by each Party under Capacity Allocation.

11. UTILITY TAXES

The Parties recognize that the Steigerwald Water System is being developed to provide wholesale water supplies to the Parties. Accordingly, revenues generated by the Steigerwald Water System, if characterized as such, are exempt from certain taxes. Each Party will therefore pay its own share of utility taxes, when owed, for revenue generated by their separate municipal water utilities.

12. GENERAL

12.1 Execution of Documents. The Parties will cooperate fully in executing documents that are necessary to develop and implement the Steigerwald Water System.

12.2 Filing. Prior to or on the Effective Date, the City Clerks of Camas and Washougal must list this Agreement by subject on that city's website or other electronically retrievable public sources. Washougal shall record this Agreement with the deed or other documents transferring title to the Real Property.

12.3 Records.

12.3.1 Washougal must maintain accounts and records that sufficiently and properly document its services and costs under this Agreement.

12.3.2 Upon reasonable notice, each Party may inspect and copy, without charge, all non-privileged records held by any other Party relating to this Agreement.

12.4 Notices. All notices required by this Agreement must be in writing by hand delivery, email, regular U.S. mail, or certified mail, return receipt requested.

If to Camas, notice must be sent to:

City Administrator
City of Camas
616 N.E. 4th Avenue
Camas, WA 98607

If to Washougal, notice must be sent to:

City Administrator
City of Washougal
1701 "C" Street
Washougal, WA 98671

Notice is considered given upon delivery or, if mailed, upon the earlier of actual receipt or three (3) business days after the date of mailing.

12.5 Indemnification. To the maximum extent permitted by law, Camas and Washougal indemnify and hold harmless the other Party and all of its officers, officials, employees, and volunteers from any and all claims, demands, injuries, losses, suits, actions, fines, penalties, and liability of any kind, including attorney fees, to the extent they arise out of or are related to the performance of this Agreement by the indemnifying Party or its officers, officials, employees, volunteers, agents, representatives, consultants, contractors, or subcontractors. This indemnity is not limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the indemnifying Party under workers' compensation acts, disability benefit acts, or other employee benefit acts. This indemnity is specifically and expressly intended to constitute a waiver of the indemnifying Party's immunity under Washington Industrial Insurance (Title 51 RCW) with respect to only the other Party, and only to the extent allowable by law and necessary to provide the indemnified Party with a full and complete indemnity of claims made by the indemnifying Party's employees. This waiver has been mutually negotiated. The provisions of this Subsection 12.5 survive the expiration or termination of this Agreement.

12.6 Non-Waiver. The failure on the part of any Party to enforce its right as to any provision of the Agreement shall not be construed as a waiver of its rights to enforce such provision in the future.

12.7 Force Majeure. If a Party is rendered unable by Force Majeure, to carry out, in whole or part, its obligations under this Agreement and such Party gives notice and full details of the event to the other Party as soon as practicable after such occurrence, the obligations of the Party affected by the event (other than the obligation to make payments due for performance prior to the event) shall be suspended to the extent required. Under this Agreement, "force majeure" shall mean acts of God, wars, strikes, lockouts, labor disputes, civil disorder, acts of terrorism, fires, floods, volcanic eruptions, earthquakes or other causes beyond the reasonable control of the affected Party.

terrorism, fires, floods, volcanic eruptions, earthquakes or other causes beyond the reasonable control of the affected Party.

12.8 Entire Agreement; Amendment. This Agreement contains the entire written agreement among the Parties and supersedes all prior discussions and agreements. This Agreement may be amended only in writing, signed by all Parties.

12.9 Termination of Existing Agreement. On the Effective Date, that 2006 Inter-Local Cooperation Agreement between the City of Camas and the City of Washougal (July 17, 2006) terminates. All cost and responsibility allocations with respect to the Steigerwald Water System are governed by this Agreement.

12.10 Authorship. This Agreement reflects the Parties' joint drafting efforts. In the event any dispute, disagreement, or controversy arises regarding this Agreement, the Parties will consider each other as joint authors and no provision may be interpreted against any Party because of authorship.

12.11 Successors and Assigns. All of the provisions contained in this Agreement are binding upon the successors and assigns of the Parties.

12.12 No Third Party Rights. This Agreement is solely for the benefit of the Parties and does not confer rights to any other individual or person.

12.13 No Joint Venture. This Agreement does not form any joint venture, partnership, administrative entity, or separate municipal corporation between the Parties. Washougal's officers, officials, employees, volunteers, agents, representatives, consultants, contractors, and subcontractors will not be deemed, and may not represent themselves as, employees of Camas.

12.14 Severability. If any section or part of this Agreement is held by a court of competent jurisdiction to be invalid or unenforceable, that action will not affect the validity or enforceability of any other section or part of this Agreement.

13. TERM AND TERMINATION

13.1 Effective Date. This agreement shall be effective upon last signature by the respective Parties hereto.

13.2 Term. The term of this Agreement is ten (10) years plus the remainder of the calendar year in which it becomes effective, ending on December 31, 2025. The term will automatically extend for two (2) consecutive terms of ten (10) years unless at least one Party gives the other Party notice of intent to terminate the Agreement on or before December 31 of the year prior to the year in which the Agreement will expire. Upon expiration of the second extension of ten (10) years, this Agreement will automatically extend for additional calendar-year terms until at least one Party gives the other Party notice of intent to terminate the Agreement on or before December 31 of the year prior to the year in which the Agreement will expire.

13.3 Termination. Either Party may terminate this Agreement for a default by the other Party if the defaulting Party has not cured the default or complied with the Order as provided in Agreement Section 8. Prior to termination, the Public Works Directors of the Parties will propose for approval by the governing bodies of each Party a plan to wind up the Project affairs, allocate assets of the Steigerwald Water System and administer the approved plan. Failure to agree on a plan is governed by Agreement Section 9.2. All applicable costs generated up to and including the date of termination shall be and remain the responsibility of the terminated Party to pay.

13.4 Withdrawal. Either Party may elect to withdraw from this Agreement as follows. The withdrawing Party shall provide at least five (5) years' advance written notice of its intent to withdraw. Such notice shall be delivered consistent with Section 14.4. The effective date of withdrawal shall be 11:59 PM on December 31 of the year following the five (5) years' notice is issued. Withdrawal has the same effect as termination and shall be governed by Agreement Sections and 9.2 and 13.3.

CITY OF CAMAS

By:_____
Mayor

Date: 9-8-2015

Attest:_____
Clerk

Approved as to form:

_____
City Attorney

CITY OF WASHOUGAL

By:_____
Mayor

Date: 8-24-2015

Attest:_____
Clerk

Approved as to form:

_____
City Attorney

EXHIBIT A:
REAL PROPERTY

A tract of land together with an easement for access and transmission main located in portions of Sections 17, 20 and 21, Township 1 North, Range 4 East, Willamette Meridian, Clark County, Washington; said tract is a portion of that particular parcel shown on the official record of survey recorded in Book 43 at Page 9, Records of Clark County, Washington, being more particularly described as follows:

Beginning at the Northwest corner of said Section 21 per said record of survey in Book 43 at Page 9;
Thence South 62°02'18" East a distance of 3,104 . 73 feet to the northerly right of way line of the dike road as shown in said survey and the point of beginning of this description;
Thence along the following described courses:
North 10°34'45" East a distance of 461 . 58 feet;
South 88°36'01" East a distance of 347 . 39 feet;
South 68°07'52" East a distance of 343.29 feet;
South 73°19'26" East a distance of 198.86 feet;
South 73°26'56" East a distance of 160.51 feet;
North 17°28'45" East a distance of 102.65 feet;
South 67°16'49" East a distance of 31. 65 feet;
South 65°33'04" East a distance of 376.31 feet;
North 63°42 ' 19" East a distance of 112.43 feet;
South 01°23'59" West a distance of 292.78 feet to a point here and after referred to as Point "A" said point also being located on the northerly dike road right of way line; Thence following along said northerly line the following described courses:
North 88°35'14" West a distance of 850.42 feet to the beginning of a curve concave to the north having a radius of 2,782.47 feet;
Thence northwesterly 113.96 feet along said curve through a central angle of 2°20'10";
Thence North 86°15'03" West a distance of 141.48 feet;
Thence North 03°44'56" East a distance of 30.00 feet;
Thence North 86°15'03" West a distance of 516.09 feet to the TRUE POINT OF BEGINNING.

Together with an easement beginning at said Point "A"; Thence South a distance of 35.00 feet to the centerline of said dike road and the beginning of this easement description; being 20 feet in width and lying 10 feet on each side of the following described centerline: Following westerly and northwesterly on and along the centerline of said dike road to a point due South of said Northwest corner of Section 21; Thence North 38°03'10" West leaving said dike road centerline a distance of 432 . 82 feet to a concrete monument with brass cap located in the centerline of Index Street as shown on Record of Survey recorded in Book 14 at Page 50, Records of Clark County, Washington, and the terminus of this easement description.

APPENDIX I

EMERGENCY RESPONSE PLAN

OCTOBER 2019

WATER SYSTEM EMERGENCY RESPONSE PLAN

FEDERAL AND STATE REQUIREMENTS

FEDERAL REQUIREMENTS

Under the Public Health Security and Bioterrorism Preparedness and Response Act (Bioterrorism Act), Public Law 107-122 of June 12, 2002, drinking water systems serving more than 3,300 but less than 50,000 customers must complete a vulnerability assessment by June 30, 2004 and an emergency response plan (ERP) by December 30, 2004.

The U.S. Environmental Protection Agency (EPA) considers completion to mean the date on which the vulnerability assessment and certification were sent to EPA. The City submitted its vulnerability assessment on June 30, 2004, and the City completed its ERP certification by December 30, 2004.

The Bioterrorism Act requires the ERP to incorporate the results of the vulnerability assessment and include the following:

- Plans, procedures and equipment that can be implemented or utilized in the event of a terrorist or other intentional attack on the public water system.

- Actions, procedures and identification of equipment that can obviate or significantly lessen the impact of terrorist attacks or other intentional actions on the public health and the safety and supply of drinking water provided to communities and individuals.

STATE REQUIREMENTS

The operations and maintenance section of Chapter 246-290-415 (2)(b) WAC requires public water systems in Washington to have an emergency response plan as part of a water system plan. It also requires that systems employ reasonable security measures to protect the raw water intake facilities, water treatment processes, storage facilities, pump houses, and distribution systems from possible damage or intruders. The State requirements for emergency response must address all applicable hazards that could lead to abnormal operating conditions, such as flood, fire, unscheduled power outages, facility failure and system maintenance.

WATER SYSTEM EMERGENCY RESPONSE PLAN OUTLINE

Both the EPA and Washington State Department of Health (DOH) have prepared guides to develop emergency response plans that will comply with the Bioterrorism Act.

- *Emergency Response Guidance for Small and Medium Community Water Systems to Comply with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002*, EPA 816-R-04-002, April 2004.

- *Emergency Response Planning Guide for Public Drinking Water Systems*, DOH Publication 331-211, May 2003.

The City's water system emergency response plan is based primarily upon the EPA guidance document, which establishes eight basic elements for an ERP:

1. System Specific Information
2. Community Water System Roles and Responsibilities
3. Water System Communication Procedures
4. Personal Safety
5. Identification of Alternative Water Sources
6. Replacement of Equipment and Chemicals
7. Property Protection
8. Water Sampling and Monitoring

The DOH planning guidance has been utilized to develop the eight elements of this ERP. Whenever possible, terminology used by the Department of Homeland Security and its sub-agency, the Federal Emergency Management Agency (FEMA) as well as the Occupational Safety and Health Administration (OSHA) and the National Fire Protection Association (NFPA) has been used relative to emergency management principles, hazardous materials response, mass casualty response and emergency medical response.

The following documents from EPA Water Security website were a technical resource for this ERP as well:

(Reference: http://cfpub.epa.gov/safewater/watersecurity/index.cfm)

Planning for and Responding to Drinking Water Contamination Threats and Incidents Response Protocol Toolbox (December 2003)

- Overview and Application
- Module 1: Water Utility Planning Guide
- Module 2: Contamination Threat Management Guide
- Module 3: Site Characterization and Sampling Guide
- Module 4: Analytical Guide
- Module 5: Public Health Response Guide

- Module 6: Remediation and Recovery Guide

EMERGENCY PLANNING AND OPERATION PRECEPTS

To be effective in a resource-constrained environment where multiple response agencies are involved, emergency planning for a water system must be considered in the context of the community's overall planning for emergency operations. The following sections identify and discuss the various plans that the City utilizes in its "all hazards" emergency management program.

CITY OF CAMAS DISASTER MANUAL

The City's Disaster Manual identifies the Emergency Response functions within the City based on a modified Incident Command System. The City Fire Chief is designated as the Incident Commander. The five functions coordinated by the incident commander are as follows:

- Police
- Public Information Officer
- Resource Officer (includes Public Works)
- Communications
- Disaster Control Officer

Emergency Operations Center (EOC)

The EOC is located at the City Police Department Headquarters building and provides overall direction, control and coordination of an incident. The EOC is primarily concerned with resource management and coordination between City Departments and other County/Regional, State and Federal emergency response and management agencies.

On-Scene Emergency Management

On scene management of emergencies is the responsibility of the Disaster Control Officer, who has a number of functions to coordinate, including:

- Suppression (includes rescue and control)
- Safety
- Triage

The City does not have its own hazardous materials response capability. This response capability is available from the City of Vancouver and the Georgia Pacific paper mill through a coordinated response plan that was development by the County Regional Emergency Services Agency.

CLARK COUNTY REGIONAL EMERGENCY SERVICES AGENCY (CRESA)

The City utilizes the Clark County Regional Emergency Services Agency (CRESA) as its emergency management agency. CRESA also serves as the Local Emergency Planning Authority under the Superfund Amendments and Reauthorization Act (SARA) Title III (also known as the Emergency Planning and Community Right to Know Act – EPCRA) for communities in Clark County, including the City of Camas, the City of Washougal and the City of Vancouver. The CRESA website is:

http://www.cresa911.org/

RELATED COUNTY AND REGIONAL PLANS

In the event local capabilities to manage an incident are exceeded, the City will utilize mutual aid partners through the following plans and guidance documents:

- Clark County Regional Hazardous Materials Response Plan
- Washington State Department of Transportation Public Works Emergency Response Mutual Aid Agreement
- Interlocal Agreement between the City of Camas and the City of Washougal for Equipment Acquisition
- Reimbursable Services Agreement between Clark County Department of Public Works and the City of Camas

HAZARD IDENTIFICATION AND VULNERABILITY ANALYSIS

The City of Camas utilizes the Clark County Hazard Identification and Vulnerability Analysis as the primary means for identifying hazards and vulnerabilities. The Clark County HIVA was last updated in 2003.

To comply with the Bioterrorism Act, the City completed a water system vulnerability assessment (WSVA) in June 2004. The results of the WSVA are considered confidential and will not be addressed as to their specific finding and recommendations in the ERP. However, the ERP must incorporate the WSVA results in terms of providing response plans that address the general categories of vulnerabilities identified in the WSVA.

Table 5-1 summarizes all hazards identified in the County HIVA and the City's WSVA that have been considered in the development of the City's ERP; the final column identifies those hazards considered significant enough to address in the City's water system ERP. Clark County has assigned probability, vulnerability and risk levels to each hazard. Each of these parameters is discussed in greater detail below.

Probability

An adjective description (High, Moderate, or Low) of the probability of a hazard impacting Clark County within the next 25 years is assigned to each hazard. Probability is based on an assessment of a hazard's frequency using information provided by relevant sources, observations and trends.

- HIGH: There is great likelihood that a hazardous event will occur within the next 25 years.

- MODERATE: There is moderate likelihood that a hazardous event will occur within the next 25 years.

- LOW: There is little likelihood that a hazardous event will occur within the next 25 years.

Vulnerability

An adjective description (High, Moderate, or Low) of the potential impact a hazard could have on Clark County is assigned to each hazard. It is the ratio of population, property, commerce, infrastructure and services at risk relative to the entire County.

- HIGH: The total population, property, commerce, infrastructure and services of the county are uniformly exposed to the effects of a hazard of potentially great magnitude. In a worst case scenario there could be a disaster of major to catastrophic proportions.

- MODERATE**:** The total population, property, commerce, infrastructure and services of the county are exposed to the effects of a hazard of moderate influence;

  or

  The total population, property, commerce, infrastructure, and services of the county are exposed to the effects of a hazard, but not all to the same degree;

  or

  An important segment of population, property, commerce, infrastructure, or service is exposed to the effects of a hazard. In a worse case scenario there could be a disaster of moderate to major, though not catastrophic proportions.

- LOW: A limited area or segment of population, property, commerce, infrastructure, or service is exposed to the effects of a hazard. In a worse case scenario there could be a disaster of minor or moderate proportions.

Risk Rating

An adjective description (High, Moderate, or Low) of the overall threat posed by a hazard over the next 25 years. It is a subjective estimate of the combination of probability of occurrence and vulnerability.

- HIGH: There is strong potential for a disaster of major proportions during the next 25 years;

  or

  History suggests the occurrence of multiple disasters of moderate proportions during the next 25 years. The threat is significant enough to warrant major program effort to prepare for, respond to, recover from, and mitigate against this hazard. This hazard should be a major focus of the emergency management training and exercise program.

- MODERATE: There is moderate potential for a disaster of less than major proportions during the next 25 years. The threat is great enough to warrant modest effort to prepare for, respond to, recover from, and mitigate against hazard. This hazard should be included in an emergency management training and exercise program.

- LOW: There is little potential for a disaster during the next 25 years. The threat is such as to warrant no special effort to prepare for, respond to, recover from, or mitigate against this hazard. This hazard need not be specifically addressed in the county's emergency management training and exercise program except as generally dealt with during hazard awareness training.

TABLE 5-1

Hazard Identification and Vulnerability Assessment Summary City of Camas

Hazard Classification	Hazard	Probability	Vulnerability	Risk	Applies to City of Camas Water System
Drinking Water Unique	Bacteriological Contamination	MODERATE	MODERATE	MODERATE	X
Natural Disaster	Drought	HIGH	MODERATE	MODERATE	X
	Earthquake	HIGH	HIGH	HIGH	X
	Flood	HIGH	MODERATE	HIGH	X
	Forest/Wildland Fire	MODERATE	MODERATE	MODERATE	X
	Landslide	HIGH	LOW	MODERATE	X
	Severe Local Storm	HIGH	HIGH	HIGH	X
	Tornado	HIGH	LOW	LOW	X
	Volcano	LOW	MODERATE	LOW	X
Technological Hazards	Airplane Crash	MODERATE	LOW	MODERATE	X
	Dam Failure	LOW	LOW	LOW	X
	Hazardous Materials	HIGH	MODERATE	HIGH	X
	Energy Emergency	MODERATE	MODERATE	MODERATE	X
	Transportation Accident	MODERATE	LOW	MODERATE	X
	Urban Fire	MODERATE	MODERATE	MODERATE	X
Criminal Activity	Terrorist Use of Chemical, Biological, Radiological, Nuclear Agents and Explosives	LOW	MODERATE	MODERATE	X
	Cyber Attack	LOW	MODERATE	MODERATE	X
	Vandalism	LOW	MODERATE	MODERATE	X

SYSTEM SPECIFIC INFORMATION

Chapter 3 of this manual provides a complete description of the City's water system facilities.

Interties

The City currently has an emergency intertie agreement with the City of Washougal to the east. The City has two one-way PRV interties with Washougal, located on SE Shepherd Street and at the intersection of SE 3rd Street and Whitney Street. These interties provide water from the City of Camas to the City of Washougal under low pressure conditions. The City also has an intertie agreement with the City of Vancouver located east of SE 192nd Ave just north of Brady Road in the Columbia Palisades development.

Telemetry and Control System

The City's telemetry system monitors levels in the storage facilities and the status of the booster pump stations and groundwater wells. Installed in 1988 and continually upgraded, the system allows the City to record various systems such as pump runs, reservoir drain and fill and other metering information. The system also has the capability of reading instantaneous flow from individual pumps. The system allows the City to monitor and control the operation of these facilities from the office and over the Internet from home. The chemical feed system for the Washougal wellfield and can be remotely monitored in its operations in the same manner as the wells, reservoirs and booster stations.

Supervisory Control and Data Acquisition (SCADA) System

The City has a SCADA system with master control located at the City Operations Center. The system uses programmable control software, which can be controlled by a personal computer at the operations center or remotely by a modem connected to a remote computer. The system monitors reservoir levels, well status, well flow rate, booster pump flow rate when metered, pump status, run time and alarm conditions. Reservoir levels are recorded on circular charts on a continual basis. The City also has the ability to monitor the drawdown level in the aquifer at Washougal Well field.

WATER SYSTEM ROLES AND RESPONSIBILITIES

PUBLIC WORKS DIRECTOR

The City water system is operated by the Public Works Department. In the event of an emergency sufficient to activate the EOC, the City's Public Works Director or designated representative will locate to the EOC at the Police Department. The Public Works EOC representative is responsible for coordinating all public works functions with other

members of the EOC Operations Group. The Public Works Director also serves as the Public Information Officer for all Public Works matters.

UTILITIES MANAGER

The water system is one of several utilities within the Public Works Department that is managed by the Utilities Manager, who reports directly to the Public Works Director. In the event of an emergency involving the water system, the Utilities Manager will serve as the on-scene Incident Commander until properly relieved by an appropriate Police or Fire Department representative. The Utilities Manager is responsible for all aspects of the water system during an emergency, including damage assessments, assessing customer impacts, coordinating with jurisdictional public health agencies and adjacent water utilities, keeping the public and media informed through the City's Public Information Officer, and working with the Public Works Engineering Manager for design and construction services required for repair and recovery operations.

OPERATIONS LEAD

The water utility has a Lead operator reporting to the Utilities Manager, who is responsible for operating the water system during an emergency. The Lead Operator assists the Utilities Manager in damage assessments and coordinating repair and recovery operations.

WATER QUALITY MONITOR

Within the water division a water system operator is assigned responsibility for water quality monitoring. The responsibilities for water quality monitoring for routine compliance sampling and testing are outlined in the Operations and Maintenance manual. Positive coliform events of the water system require the water quality monitoring operator to follow procedures as outlined in the water sampling and monitoring section within this plan. Intentional contamination of the water system is covered in a separate incident specific plan at the end of this plan.

WATER SYSTEM COMMUNICATION PROCEDURES

The City Disaster Manual establishes communications procedures during an emergency. The City utilizes a 911 call service operated by CRESA, which provides dispatch services for fire police and emergency medical services.

The City maintains emergency phone number lists for use by City personnel. The list contains City staff home phone numbers, addresses and cell phone numbers. The second list includes the numbers for emergency services, generator rentals, adjacent utilities, fuel suppliers, parts supplies, safety equipment, pumper trucks, and contractors. The emergency phone numbers are updated frequently as phone numbers change. These lists are provided in the Appendix G.

The employee on-call will be the first person notified in the event of an emergency, disaster, or incident. The responding party shall report to the command center for a briefing and further instructions. The on-call employee shall be in charge of all Public Works functions until relieved by a higher-ranking Public Works employee.

At the command center, the on-call employee will receive a "Public Works Department Duty Checklist." A copy of this form is provided in the Appendix H. The employee is to fill out the checklist. The employee is to determine if it is within the employee's capabilities to handle the incident requirements of the Public Works Department. If the employee is unable to fill the needs of the incident, the employee shall notify the Water/Sewer Supervisor. The Water/Sewer Lead Operator shall notify the Public Works Utilities Manager of the incident.

The City of Camas Disaster Manual provides additional procedures for Public Works response. A copy of this document can be found in the offices of the Public Works Director and the Public Works Operations Manager. It is an orange manual and all Public Works employees should be familiar with the contents and procedures.

In the event that public notification is required during a water system emergency, the Public Works Director provides information to the media for this purpose.

Liaison with the Washington State Department of Health (DOH) is normally the responsibility of the Public Works Director. An emergency contact list for DOH is presented in Table 5-2.

TABLE 5-2

Emergency Contact List for DOH

Agency/Contact	Contact Telephone Number	Purpose
DOH Hot Line DOH SWRO After Hours	(877) 481-4901 (360) 236-3030	After Hours Emergencies.
DOH/Regional Engineer	(360) 236-3018	Regulatory Assistance
DOH/Coliform Program Manager - SWRO	(360) 236-3044	Coliform Monitoring

The City has entered into a mutual aid agreement with the City of Vancouver and several other public works organizations. The contact names and phone numbers for the responsible individuals for those purveyors are presented in Table 5-3.

TABLE 5-3

Mutual Aid Water Utility and Public Works Contacts

Utility	Contact Person	Contact Number	
		Phone	FAX
City of Vancouver	Tyler Clary	(360) 487-7169 (360) 989-6381	(360) 696-8002
City of Washougal	Trevor Evans	(360) 835-2662 (360) 835-8501	(360) 835-8808
Clark County	Ahmad Quayomi	(564) 397-4358	(360) 397-6051
Clark Public Utilities	Doug Quinn	(360) 992-8022 (360) 992-3000(1)	(360) 992-8027
Washington State Department of Transportation	Bob Kofstad	(360) 905-2007 (360) 921-9119(1)	(360) 905-2075

(1) After hours

PERSONAL SAFETY

EVACUATION PLANS

The City's Disaster Manual provides limited guidance for evacuation operations. The Police Department has overall responsibility for evacuation operations. Each City Department and Division is responsible for developing emergency evacuation plans for its department/division.

The on-scene incident commander will normally direct evacuation operations. The Incident Commander at the scene will initially be the senior City employee at the scene; the on-scene incident commander duties will eventually be assumed by a Police or Fire Department representative depending upon the nature of the emergency.

The Occupational Safety and Health Administration (OSHA) provides guidance on developing evacuation plans for terrorist incidents:

http://www.osha.gov/dep/evacmatrix/index.html

Per the City's Disaster Manual, the Fire Department will be responsible for incident command during a hazardous materials (HAZMAT) release as this duty requires specific training and certification under federal regulations. City and Regional Emergency Plans for terrorist incident response also require that HAZMAT protocols and procedures be followed for incidents involving the intentional release of chemical and biological agents.

EVACUATION ROUTES AND EXITS

Evacuation routes and exits for City facilities are to be posted at each facility. In the event of an evacuation from an area that encompasses more than one facility, the City Police or Fire Department will identify additional evacuation routes as needed. During an incident involving the release of hazardous materials, the Fire Department is responsible for identifying evacuation routes that mitigate hazards to evacuees. In the absence of direction from the Fire Department, the general rule for evacuation during a hazardous materials release is to travel uphill and upwind of the release.

ASSEMBLY AREAS AND ACCOUNTABILITY

Assembly areas for evacuation from City facilities are posted along with evacuation routes and exits at City facilities. In the event of an evacuation from an area that encompasses more than one facility, the City Police or Fire Department will identify additional assembly areas as needed. The senior water division employee is responsible for ensuring that all personnel are accounted for at the assembly area after an evacuation has been conducted.

SHELTER

Sheltering is not addressed in the City's Disaster Manual. The City defers to CRESA for emergency sheltering operations. The City is responsible for sheltering of City employees; this responsibility includes identifying City facilities that may be used for sheltering during a emergency.

TRAINING AND INFORMATION

All water utility employees are provided with the following training:

- Blood borne pathogens
- Cardiopulmonary resuscitation (CPR)
- Defensive driving
- Emergency first aid
- Emergency response awareness (including FEMA ICS - IS195)
- Equipment lock-out/tag-out procedures
- Fall protection
- Fire extinguishers/evacuation
- Hazard communication
- Hearing conservation and testing
- Protection from water borne pathogens

When appropriate for their duties, water utility employees are provided training in:

- Bucket truck
- Confined space (aerial platform)

- Forklift operation
- Respiratory protection and fit testing
- Trenching and shoring

Water utility employees are issued protective equipment appropriate to their job responsibilities including hard hats, safety goggles, work gloves and safety boots.

Recommended training: The water quality monitor should be trained in hazardous materials awareness (reference: 29 CFR 1910.120). This training is available from the City Fire Department.

Emergency Equipment

The water utility has a hoist, harness and gas detection equipment for confined space entry. All employees are issued hard hats and reflective safety vests. All trucks are equipped with emergency first aid kits.

FIRST AID

Water utility employees are trained in emergency first aid that includes the following:

- How to determine the safe response to an emergency situation.
- Recognizing and caring for life-threatening emergencies in adults, such as respiratory, choking, and cardiac problems.
- Caring for injuries including severe cuts and burns, sprains and strains.
- Caring for sudden illnesses such as poisonings, bites, and stings.
- Recognizing and caring for heat- and cold-related emergencies.
- Workplace emergency procedures, including notifications for medical emergencies.

The Fire Department provides emergency medical services for trauma victims whose injuries exceed emergency first aid treatment.

IDENTIFICATION OF ALTERNATIVE WATER SOURCES

INTERTIES

The City has interties with the City of Washougal and the City of Vancouver that would normally be used to supply water to either City. The City has no other interties and therefore, must generally be self-sufficient in the event of a water shortage or water system failure. If necessary, the City would consider attempting to pump (boost) water from either Washougal or Vancouver into the City's system.

REDUNDANCY IN CITY WATER SYSTEM

The City has several wells and a surface water source that provide some redundancy in the event certain elements of the water system fail. For example, if the Washougal Wellfield is flooded, the surface water source may serve as a backup, with water conservation measures in place to offset the loss of the wellfield.

Emergency Water Supplies

Under the County's CEMP, citizens are urged to keep a 72-hour supply of food and water in the event of an emergency. The City will endeavor to supply potable water to support emergency operations within its capabilities.

TRANSPORT OF POTABLE WATER DURING EMERGENCIES

If the City obtains potable water by transporting from another source, DOH has issued guidelines for water system utilities that deliver potable water to the public during emergencies. This guidance is found at the following website and are summarized below:

http://www.doh.wa.gov/ehp/dw/Publications/Truck_Transport.htm

General

- DOH recommends that someone with water treatment expertise be responsible for the operation and management of trucked potable water.
- The City should contact the regional office of the DOH Division of Drinking Water (DOH-DDW) or local health department to discuss current requirements and approve the proposed operation. [see WAC 246-290-415(2)(d) and 246-290-451(4)]. Northwest Regional Office (Kent) – (253) 395-6750.

Truck Container

- The truck container must be contaminant-free and capable of being maintained so that water contamination is prevented.
- If a truck container has been previously used only for potable water and has been protected from possible contamination, it may be used without disinfection and testing for bacteria.
- Truck containers that cannot pass the initial testing criteria after disinfection (i.e. absence of coliforms) shall not be used.
- Trucks previously used for substances other than potable water will be evaluated on an individual basis. Consult with DOH before using trucks that may have previously carried toxic or other non-potable liquids.
- All truck containers must be filled or emptied through an air gap or approved double-check valve assembly, in accordance with WAC 246-290-490.

Initial Truck Disinfection

- The tank and all hoses, pumps, and other equipment used in handling water should disinfected by filling with water containing at least 50 to 60 parts per million (ppm) of chlorine and then held in the tank for at least 24 hours.
- One gallon of liquid bleach is required in every 1,000 gallons of water to produce 50 to 60 ppm. Bleach should be 5.25 to 6 percent hypochorite with no additives. Bleach should be added in proportion to the water as the tank is being filled, e.g., add approximately one-half gallon of bleach with each 500 gallons of water.
- The chlorine solution must be flushed from the tank after 24 hours.
- Once the tank is emptied, refill it with the water to be transported, and test for coliform bacteria. If coliforms are present, repeat the process. If the tank cannot be disinfected to eliminate coliforms, it must not be used.
- Water to be transported by tank trucks should contain a free chlorine residual of about one part per million (1 ppm or 1 mg/L) at the beginning of the haul.

Source of Water

- The source for emergency trucked water must come from an approved public water supply, unless otherwise approved by DOH.

- Every precaution should be taken to ensure that the water remains potable once it is collected and transported.

Receiving Tank

- The water system's receiving tanks must be inspected to assure that water quality issues will not occur during filling and later distribution to consumers.

- Receiving tanks must be cleaned and disinfected using the procedures for truck containers (see "Initial Truck Disinfection" guidelines).

- The receiving tanks must be kept secure and protected from contamination throughout the emergency response.

- The customer's receiving tank must be filled through an air gap or an approved double-check valve assembly in accordance with WAC 246-290-490.

Documentation and Record Keeping

- The receiving water system is responsible for documenting and keeping proper records of the emergency trucked water operation.

- Records should be retained for at least 6 months for review upon request by health agencies, haulers, or the supplying water system.

REPLACEMENT OF EQUIPMENT AND CHEMICALS

EQUIPMENT AND SUPPLIES

A list of equipment suppliers that the City has access to for emergencies is provided in Appendix I.

CHEMICALS

Table 5-4 lists chemicals used by the City in its water treatment processes. Appendix J provides a list of chemical suppliers.

To assist the City in identifying chemicals with emergency planning implications, threshold quantities under EPCRA, the Comprehensive Environmental Response

Compensation and Liability Act (CERCLA), and the Clean Air Act (CAA) are also shown in Table 5-4, where applicable.

The applicability of each regulation is briefly discussed below.

Use and Storage – EPCRA governs reporting requirements for chemicals, either in use or in storage, that pose a significant environmental or health hazard.

Liquid Spill – In the event of a spill where the quantity exceeds the CERCLA threshold, certain reporting requirements will be in effect.

Risk of Air Release – Gaseous chemicals will require a risk management plan if they exceed threshold quantities.

Explanatory notes following Table 5-4 provide greater detail regarding reporting requirements.

The City should coordinate all EPCRA, CERCLA and CAA planning and reporting requirements with CRESA.

Hazardous substance releases should be reported to the Washington State Department of Ecology (Ecology) and responses coordinated with CRESA through the City Fire Department.

CRESA Phone: (360) 737-1911

Ecology 24-Hour Spill Response Phone: (800) 258-5990
National Response Center (800) 424-8802

TABLE 5-4

Water Treatment Chemicals used by the City of Camas

Name[1]	Use[2]	CAS/EPCRA Section 313 Category Codes[3]	EPCRA Section 302 EHS TPQ[4] (pounds)	EPCRA Section 304 EHS RQ[5] (pounds)	CERCLA RQ[6] (pounds)	EPCRA Section 313[7]	CAA 112(r) TQ[8] (pounds)
Sodium fluoride (> 99%)	F	7681-49-4	N/A	N/A	**1,000**	N/A	N/A
Sodium hydroxide (20 – 30%)	CO/pH	1310-73-2	N/A	N/A	**1,000**	N/A	N/A
Sodium hypochlorite (5-12.5%)	DI	7681-52-9	N/A	N/A	**100**	N/A	N/A

All reporting quantities noted in **bold** font n/a = not applicable.

(1) The chemicals listed above were taken from an extensive inventory of chemicals provided in a document titled *List of Lists, Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112(r) of the Clean Air Act (consolidated list), EPA,550-B-01-003, October 2001.* EPA put the list together to help chemical handling firms determine what reporting requirements apply under sections 302, 304, or 313 of EPCRA and if they are subject to the accident prevention regulations under CAA section 112(r). The chemical names are those that are generally used in the regulatory programs developed under EPCRA, CERCLA, and CAA section 112(r)

(2) Use Definitions: Coagulant (CG); Corrosion Control (CO); Disinfection (DI); Fluoridation (F); pH Adjustment (pH).

(3) The chemicals above are organized under the Chemical Abstracts Service (CAS) registry number and the EPCRA Section 313 category codes.

(4) EPCRA Section 302 includes a list of *Extremely Hazardous Substances* (EHSs). The presence of EHSs in quantities at or above the Threshold Planning Quantity (TPQ) require local emergency planning committees to develop emergency response plans and notify State emergency response committees. Facilities with a listed EHS are subject to the reporting requirements of EPCRA section 311. The facility must provide a material safety data sheet or a list of covered chemicals to State and local emergency response committees and the local fire department. The minimum TPQ for section 311 reporting is 500 pounds or the TPQ, whichever is less. EHS TPQ and RQ are represented in pounds.

(5) Under EPCRA Section 304, releases of reportable quantities (RQ) of EHSs are subject to State and local reporting.

(6) Under Section 304 of EPCRA, releases of hazardous substances listed in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) are to be reported to the National Response Center, as well as to the State and local emergency response committees. The CERCLA RQ column shows the reportable quantities (in pounds) for chemicals that are CERCLA hazardous substances as listed in 40 CFR Part 302, Table 302.4. Solid metals listed under CERCLA, with mean diameters greater than 100 micrometers, are not reported. The CERCLA RQs listed above apply to smaller particles.

(7) Under the column titled Section 313, the notation "313" means that the chemical is required to report under section 313 and 6607 of the Pollution Prevention Act. An "X" indicates that this chemical may have a second name or that the same chemical may have the same CAS number listed under a different name. The lower case "c" indicates that a chemical must report under one or more of the EPCRA section 313 chemical categories even though it has no CAS number.

(8) Under CAA section 112(r) EPA identified 77 toxic substances and 63 flammable substances, including their threshold quantities (TQs), which are subject to accident prevention provisions. The requirements for risk management programs for accidental release prevention are found in 40 CFR Part 68. CAA section 112(r) lists several substances in solution that are covered only in concentrations above a specific level. Most of these chemicals are listed above and include ammonia CAS #7664-41-7 (concentrations 20 percent or greater); hydrochloric acid CAS #7647-01-0 (concentrations 37 percent or greater); hydrogen fluoride/hydrofluoric acid CAS #7664-39-3 (concentrations 50 percent or greater); and nitric acid CAS #76997-37-2 (concentrations 80 percent or greater). CAA section 112(r) TQs are in pounds and apply to those quantities within a process and not at the facility as a whole.

PROPERTY PROTECTION

The City controls access to its water facilities using barriers and locks. Reservoirs are fenced, with access controlled by locked gates. Utility vaults are covered and locked. The City maintains strict control over its keys. Employees are issued keys only to those facilities they are required to access to perform their duties. The City has also partnered with residential customers to be vigilant of the areas around its well and reservoir sites to alert the City if they notice any suspicious activity.

WATER SAMPLING AND MONITORING

Water sampling for routine compliance is described in Chapter 2 of this manual.

Water sampling and monitoring for a coliform incident is described below under incident specific plans (bacteriological contamination).

Water sampling and testing for a suspected intentional contamination incident is described below under incident specific plans.

MAJOR WATER SUPPLY INTERRUPTIONS

WATER MAIN BREAKS

Depending on the location where the main break occurs, if susceptible populations are impacted, use contact list in Appendix B (Coliform Monitoring Plan) for notification. City will provide bottled water for lengthy outages. Depending on circumstances, portable toilets may be supplied as well. Trucked potable water may be provided. If the City uses trucked potable water, the guidelines in DOH Publication #331-063 will be followed.

The City maintains an inventory of piping and fittings to address most emergency repair requirements and has a list of vendor telephone numbers to obtain supplies when existing material stocks are inadequate for emergencies. When repairs are too large for City crews to manage, the City will contact contractors from its small works roster.

When water supply interruptions for a pressure zone are expected to be lengthy, the City will consider instituting measures to allow customers to come to a reservoir and obtain water directly from a reservoir. Any water dispensed in this manner will be done under the supervision of a City employee.

BOOSTER STATIONS

The City has developed detailed written procedures for operating the water system when booster stations are not in service and has figures showing locations of pumps, piping, meters, shut off valves and other key features of each facility, such as valve size/type, motor manufacturer/type/hp and pump capacity/type. Copies of these procedures, technical details and figures are kept at each facility.

A brief summary of the booster station emergency procedures follows.

Butler Booster Station

Auxiliary Power

The Butler Booster Station does not have an auxiliary power system.

HOA Setting

Emergency operation of the booster station may require the pump to be operated in the HAND mode to compensate for distribution system problems in other areas of the system during a power outage.

Backup Operations

Angelo Booster Station serves as a backup for feeding the Lower Prune Hill (455) Zone if the Butler Booster Station is out of service. The City has a standby pump for the 455 Zone at the Angelo Booster Station in the event that a pump is out of service. There is sufficient pumping capacity to the 455 Zone to operate with the largest pump out of service under normal system demands, including fire flow.

Gregg Booster Station

Auxiliary Power

The New Gregg Booster Station has a diesel powered 300-kW generator with automatic transfer switch capable of operating the New Gregg Booster Station pumps during a power outage.

HOA Setting

Emergency operation of the booster station may require the pump to be operated in HAND mode to compensate for distribution system problems in other areas.

Backup Operations

There is no back up in the event Gregg Booster Stations are out of service; however, there is sufficient pumping capacity at the Gregg Booster Stations to operate with the largest pump out of service under normal system demands, including fire flow.

Angelo Booster Station

Auxiliary Power

The Angelo Booster Station is equipped with a 200-kW diesel generator with an automatic transfer switch. This generator is capable of providing power to three of the pumps, the lighting, and the HVAC system.

Backup Operations

If Angelo Booster Station is out of service, Butler Booster Station and Forest Home Booster Station serve as back up to feed the upper zones (Lower Prune Hill, Lacamas, Upper Prune Hill) from the lower zone (Butler). The City has a standby pump at the Angelo Booster Station in the event that a pump is out of service. There is sufficient pumping capacity to the 455 Zone to operate with the largest pump out of service under normal system demands, including fire flow.

Lower Prune Hill Reservoir Out of Service

If the Lower Prune Hill Reservoir is out of service, one pump at the station will be placed into hand mode and operated with the reservoir isolated. The pressure relief valve at the station will bleed excess pressure to the inlet piping. This will allow the system to maintain a constant pressure in the zone. During this operation, the pump and pressure need to be monitored every two hours.

Forest Home Booster Station

Auxiliary Power

Auxiliary power is not available for the Forest Home Booster Station.

HOA Settings

During emergencies the booster station may need to be operated in the HAND mode to compensate for distribution system problems in other areas of the system.

Backup Operations

If the Forest Home Booster Station is out of service, Butler Booster Station and Angelo Booster Station serve as back up to feed the upper zones (Lower Prune Hill, Lacamas, Upper Prune Hill) from the lower zone (Butler). The City has a standby pump at the Angelo Booster Station in the event that a pump is out of service. There is sufficient pumping capacity to the 455 Zone to operate with the largest pump out of service under normal system demands, including fire flow.

Lacamas Booster Station

Auxiliary Power

The Lacamas Booster Station has an auxiliary generator with automatic transfer switch available to provide power. This generator is a 60 kW natural gas generator and is capable of running the two 500-gpm pumps, the building lights and ventilation system. This generator is able to provide the Lacamas Booster Station with power as long as natural gas service is not interrupted. If the generator fails during a power outage, water service can be maintained through the pressure reducing valve (PRV) stations that that connected to the system that feeds down from the Upper PruneHill Reservoir. Well No. 9 also serves the area supplied by Lacamas Booster Station, but since it does not have auxiliary power, it is more than likely unavailable during a power outage.

Lacamas Reservoir Out of Service

When the Lacamas Reservoir is out of service, pressure to the Lacamas (544) Zone can be maintained by operating one of the pumps in the Lacamas Booster Station. The pressure relief valve will return excess pressure to the inlet piping while maintaining the downstream pressure. Under this operating condition, the pump operation and pressure need to be checked every 2 hours. The 544 Zone can also be served from Upper Prune Hill through PRV stations.

Backup Operations

When the Lacamas Booster Station is out of service Well No. 9 and the Lower Prune Hill Booster Station can be used to feed the Lacamas (544) Zone.

Lower Prune Hill Booster Station

Auxiliary Power

This facility is equipped with a 300-kW diesel powered generator with an automatic transfer switch to operate the three pumps in the event of a power failure.

Temporary Pump

During high seasonal demands a mobile skid mounted pump is rented by the City to supplement the LPH Booster Station. This pump is installed via connections constructed for this purpose near the entrance to the pump station. It is operated in a manual mode and has a capacity between 600 and 700 gpm. This pump is not powered by the auxiliary power generator. The City also has pumping capacity available at the Upper Prune Hill Booster Station to serve the Upper Prune Hill area for temporary losses of service at the Lower Prune Hill Booster Station, but this is limited and cannot provide supply for extended interruptions in service or extended periods of high demands.

Upper Prune Hill Booster Station

Auxiliary Power

The Upper Prune Hill Booster Station is equipped with a manual transfer switch to allow the City to bring in a portable generator to supply power to the booster station. The portable generator used by the City can operate two of the 20-hp pumps.

RESERVOIR EMERGENCY PROCEDURES

General

The City has developed detailed written procedures for operating the water system when reservoirs are not in service. These procedures are kept at each facility. If a reservoir must be taken off line isolation valves are used to prevent water from being pumped into the reservoirs and the reservoirs are allowed to empty into the distribution system.

A brief summary of the reservoir emergency procedures follows.

Butler Reservoir

Water service is maintained to the system during cleaning / draining / disinfection of the reservoir with the following procedures.

- Connect 6-inch overflow piping to the 12-inch main in the Butler Yard.
- Open the 6-inch overflow valve.
- Open the 4-inch main connecting line valve between the 12-inch and 14-inch mains until water comes out of the 6-inch overflow.
- Close the two 12-inch valves in the reservoir valve pit to take the Butler Reservoir offline.

- Adjust the 4-inch connecting valve to maintain a small amount of water flow from the 6-inch overflow. As long as water flows from the overflow, water service will be maintained to the 343 Zone.

- Depending on the season and the demand, a well may need to be in operation to maintain system pressure in the 343 Zone.

- The pressure reducers on NE 22nd Avenue and NE Everett Street regulate pressure and keep the 343 Zone served.

Reverse the order to place the reservoir back online.

Gregg Reservoir

Water service can be maintained to the Gregg area by running a pump in the HAND position in the Gregg Booster Station. The pressure relief/bypass valve at the Gregg Booster Station will maintain pressure in the service area and also keep it from over pressurizing the zone. The Gregg Reservoir can be isolated after the pump in the Booster Station is placed into operation. Close attention will be paid to the system pressure and the pump to provide uninterrupted service.

Lacamas Reservoir

The Lacamas Reservoir is supplied from the Upper Prune Hill Zone via PRVs, from the Lower Prune Hill Zone via the Lacamas Booster Station, or from Well No. 9. As long as one of these facilities is in operation, the reservoir can be filled.

Water service can be maintained to the Lacamas area (544 Zone) by running a pump in the HAND position in the Lacamas Booster Station or Well No. 9. The pressure relief/bypass valve at the Lacamas Booster Station will maintain pressure in the service area and also keep it from over pressurizing the zone. The Lacamas Reservoir can be isolated after the pump in the Booster Station is placed into operation. Close attention must be paid to the system pressure and the pump to provide uninterrupted service.

Lower Prune Hill (LPH) Reservoirs

Emergency operation of the reservoir would be required if a problem were to occur with one of the reservoirs. If a reservoir were to experience a physical or water quality problem, one reservoir could be taken out of service and the remaining one could be used to supply water until the problem is solved. If the smaller of the two tanks was used alone, the start levels for the Butler, Forest Home, and the Angelo Booster will be raised to keep the reservoir full at all times.

Upper Prune Hill (UPH) Reservoirs

UPH 2.4-MG Reservoir

The 2.4-MG reservoir inlet has an altitude valve that closes to allow the UPH standpipe to fill when the reservoir is full (63-foot level). The UPH 2.4-MG reservoir outlet valve is normally opened, but is seismically controlled and will close in a seismic event. The UPH booster pumps will also be turned off in a seismic event.

If both the Lower Prune Hill and Upper Prune Hill Booster Stations are out of service and the Upper Prune Hill Standpipe level drops low enough, site valves can be opened to allow both the standpipe and the 2.4-MG Reservoir to float on the system.

Two of the booster pumps (No. 2 and No. 3) are equipped with modified pump control valves that employ two valves that are adjusted to drain the UPH 2.4-MG reservoir. Detailed procedures for using these pump control valves are provided at the UPH booster station.

UPH Standpipe

The UPH standpipe inlet valve is a spring-activated altitude valve that is designed to shut off when the standpipe is full. This valve is not controlled by the telemetry system. When the UPH standpipe altitude valve is closed, the UPH booster pumps operate based on the pump discharge pressure.

If the Upper Prune Hill Standpipe is out of service, the UPH area can be supplied by the UPH Booster Station and the LPH Booster Station. The LPH Booster Station operates based on reservoir level in the 2.4 MG UPH Reservoir. If the LPH Booster Station flows exceed system demands, the 2.4 MG UPH Reservoir will fill. If the 2.4 MG UPH Reservoir is full, the LPH Booster Station will shut off and the UPH Booster Station will be called in pressure mode and will supply the system. If system demands exceed the supply of the LPH Booster Station while it is in operation, the UPH Booster Station will be called in pressure mode to provide additional supply. Pressure mode for the UPH Booster Station is discussed below.

At the Upper Prune Hill Pump Control Panel Screen, the operator selects this setting at the pump control panel, which is a six step operating sequence (numbered 0 to 5) that is based satisfying a minimum pressure of the pump discharge. The operator sets the pressure at 40 psi, which simulates a full standpipe.

- Step 0 – no pumps on (40 psi is satisfied)
- Step 1 – pump 1 on and runs till 40 psi is satisfied
- Step 2 – pump 1 and 2 on if 40 psi is not satisfied after Step 1
- Step 3 – pump 1 and 3 on if 40 psi is not satisfied after Step 2
- Step 4 – pump 1, 2 and 3 on if 40 psi is not satisfied after Step 3
- Step 5 – all pumps on if 40 psi not satisfied after step 4

There is a 15 second delay built in between each step. Pumps turn off sequentially in 15 second intervals once 40 psi is satisfied.

WELLS

Detailed written operating instructions are maintained at each well. These instructions cover normal operations as well as response to pump and power failure. For wells with treatment facilities, written descriptions of shutdown and start up of treatment equipment is included with the written procedures. A brief summary of emergency operations at each well is provided below.

Well No. 5

There is neither a generator nor an angle drive to operate Well No. 5 during a power outage. Well No. 5 can be used to maintain pressure in the lower grid when the Butler Reservoir is out of service. Under these conditions, Well No. 5 has to be run from the HAND position from the pump house or the Operation Center master telemetry unit.

Well No. 6

There is neither a generator nor an angle drive to operate Well No. 6 during a power outage. Well No. 6 can be used to maintain pressure in the lower grid when the Butler Reservoir is out of service. Well No. 6 has to be run from the HAND position from the pump house or the Operation Center master telemetry unit.

Well No. 7

There is not a generator or an angle drive to operate Well No. 7 during a power outage. Well No. 7 can be used to maintain pressure in the lower grid when the Butler Reservoir is out of service. Well No. 7 has to be run from the HAND position from the well facility or the Operations Center master telemetry unit.

Well No. 8

During a power outage, Well No. 8 has an auxiliary engine and angle drive. Well No. 8 can be used to maintain pressure in the lower grid when the Butler Reservoir is out of service. Well No. 8 has to be run from the HAND position from the pump house or the Operation Center master telemetry unit during a power outage. The backup chlorination system is also run by the generator.

Well No. 9

There is neither a generator nor angle drive to operate Well No. 9 during a power outage.

Well No. 10

There is neither a generator nor angle drive to operate Well No. 10 during a power outage.

Well Nos. 11 and 12

The Washougal Wellfield Facility has its own diesel powered auxiliary generator with an automatic transfer switch. This generator is 350 kW and is designed to serve the Washougal Wellfield Treatment Facility during a power outage, to include the two well pumps, chemical feed pumps, controls for the well pumps and chemical feed system, HVAC system and lighting.

Well No. 13

The Well No. 13 Facility has its own diesel powered auxiliary generator with an automatic transfer switch and acoustical enclosure. This generator is 250 kW and is designed to serve the Well 13 Facility during a power outage, to include the well pump, chemical feed pumps, controls for the well pump and chemical feed system, HVAC system and lighting.

Well 14

The Well No. 14 Facility has its own diesel powered auxiliary generator with an automatic transfer switch and acoustical enclosure. This generator is 250 kW and is designed to serve the Well 14 Facility during a power outage, to include the well pump, chemical feed pumps, controls for the well pump and chemical feed system, HVAC system and lighting.

SURFACE WATER FILTRATION PLANT

Detailed written operating instructions are maintained at the Slow Sand Water Treatment Facility. These instructions cover normal operations as well as start up and shut down procedures. The plant is equipped with a 45 kW propane powered auxiliary generator in event of a power outage.

INCIDENT SPECIFIC RESPONSE PLANS

Per the hazard assessment summarized in Table 5-1, the following incident specific response plans are outlined below:

- Drinking Water Unique: bacteriological contamination

- Natural Disasters: drought, earthquake, flood, landslide/mudflow/debris flow, severe snow storm, tsunami, volcano

- Technological Hazards: power failure, dam failure, hazardous materials, urban fire, transportation accident

- Criminal Acts: Terrorism, cyber attack, vandalism

BACTERIOLOGICAL CONTAMINATION

WAC 246-290-320 establishes specific procedures for water utilities to follow should bacteriological contamination be detected in the water system. These procedures are outlined in Figure 5-1. If the chlorine disinfection residual in the distribution system is lost, it may be necessary to batch chlorinate the reservoirs and flush distribution piping.

For every 1.0 million gallons of storage, approximately 17 lbs. of 70 percent calcium hypochlorite (HTH) is necessary to provide a 1.0 mg/L chlorine residual. As an alternative, 18 gallons of 5.25 percent sodium hypochlorite, available as household bleach in the supermarket, can be added to 1.0 million gallons to provide a dose of 1.0 mg/L.

In the event of a suspected intentional contamination with a microbial agent, the protocols for intentional contamination shall be followed in addition to the procedures outlined here. Law enforcement authorities will need to be consulted prior to making public notifications as discussed further in the intentional contamination incident plan.

Boil Water Notification

Emergencies such as floods, earthquakes, and other disasters can result in damage to water system infrastructure, thereby warranting a boil water notice as a cautionary measure. A suggested boil water notification form is presented in Appendix K. The City would issue the order through radio, television and newspapers serving the local area. Prior to the issuance of a boil water notice, the City should consider the experience gained by other communities in the past. A summary of pertinent information follows:

- An initial press conference should be held following issuance of the boil water notice to advise the public of the situation. All press releases will go the City's Public Information Officer.

- Consolidated press releases, announced on morning and evening television and radio news broadcasts, can also be used to keep the public informed.

- A 24-hour telephone hotline will be established to respond to public and media inquiries regarding the notice. The hotline should be staffed with knowledgeable representatives from the City and other governmental

agencies. In order to maintain the consistency of information released, hotline operators should be provided with standard question and answer sheets and briefed as new information becomes available. The hotline should remain available for 24 hours after the boil water notice has been rescinded to provide relevant information and reassurance for concerned customers. All media inquiries shall be directed to the Public Information Officer.

- Other State, County, and City agencies will be consulted prior to release of information to the public, including DOH and the Clark County Health Agency. A consensus will be reached among the jurisdictional agencies regarding information to be released and actions to be taken. It is important not to release conflicting information so as not to confuse the public.

- Agencies and hot line phone operators should be aware of difficult questions that could be asked by the public or the press. A few examples follow:

    1. What other utilities are affected?

    2. What should be done about coffee and ice machines that use water directly from the system?

    3. How did the system get contaminated and what is being done about it?

- Protocol should be developed for rescinding the boil water notice. One example includes two consecutive days of no detection of Cryptosporidium, Giardia, or coliform bacteria in the system.

- Once the boil water notice is rescinded, a notice should be developed to inform the public regarding appropriate measures for use of the water supply including flushing of pipes and fixtures as required.

A thorough investigation of the contamination source should be conducted and strategies developed to avoid similar future occurrences. The public should be informed and given updates regarding investigation findings in order to restore confidence in the quality of water provided by the water system.

DROUGHT

The Clark County Hazard Identification and Vulnerability Analysis states that nearly all areas of the county are vulnerable to drought.

History suggests a high probability of occurrence in Clark County. Although the entire population of the county is considered vulnerable to the effects of drought, severity has historically been low. Actual drought conditions have been limited to a few days, even during extended dry periods.

The hazard of a short-term drought will be addressed through water conservation measures outlined in the Water Conservation Chapter of the Water System Plan. The City will need to coordinate with adjacent water users in developing an effective drought response. This type of coordination will become essential with longer drought periods when more stringent water conservation measures may become necessary. Additionally, extended droughts may also increase fire hazards, particularly in the heavily wooded areas of the City.

EARTHQUAKE

The County's assessment indicates that of all potential disasters, the City is most vulnerable to a severe earthquake. However, the ability of the City's water system facilities to withstand a major earthquake has not been fully characterized.

The Northridge earthquake, which struck on January 17, 1994, left the Metropolitan Water District of Southern California (MWDSC) facing a major disaster. Fortunately, the MWDSC had established emergency planning procedures that proved to be essential to restoring water service to its customers. Two essential components were an Emergency Response Center and pre-established reconnaissance patrols that were able to quickly conduct damage inspections. The MWDSC had also stockpiled considerable repair parts and materials in order to be virtually self-sufficient in an emergency. Following the Northridge earthquake, however, the MWDSC found that most parts and equipment were readily available via overnight shipping from around the nation, indicating that stockpiling does not need to be wholly relied on for effecting repairs.

The Pacific Northwest is a very seismically active area. The Clark County HIVA states that potential earthquake sources in Clark County are not well characterized because of their infrequent occurrence compared to California. Estimations of possible earthquake sources are limited to studies of many small earthquakes, investigations of known faults, and other geological surveys.

CRESA indicates that earthquakes in Clark County are most likely to originate from three sources: (1) the Mt. St. Helens seismic Zone; (2) the Portland/Vancouver Seismic Zone; and (3) the Cascadia Subduction Zone. Descriptions of each of these seismic zones are summarized from the Clark County HIVA below.

1. Mt. St. Helens Seismic Zone – This seismic zone is most commonly a source of several small earthquakes (<4 M). The strongest earthquake associated with this zone was the Elk Lake earthquake of February 13, 1981. This was approximately 5.5 M magnitude earthquake. While this

was just a moderate earthquake it was felt over an area of about 104,000 km^2 that ran as far north as Ferndale, Washington and as far South as Salem, Oregon. Geologists suggest that the possibility exist for an earthquake as great as 6.5 M originating from this zone.

2. Portland/Vancouver – The Portland metropolitan area is the most seismically active region in Oregon in historic times. In the past 150 years there have been six earthquakes of magnitude 5 or greater. The Washington side of the seismic area is the second most seismically active area in Washington (the Puget Sound area is the most seismically active area in the state). The area between the Lacamas Creek Fault and the Portland Hills Fault borders this seismic region. The existence of the Portland Hills fault was only recently confirmed by the digging of the light rail tunnel through the West Hills of Portland. This discovery, matched with other geophysical studies suggest that earthquakes as large as 6 M or larger should occur in the Portland region every 300 to 350 years and an event of M 6.5 or larger about every 800 to 900 years. Earthquakes in this area present what may be the worst-case scenario for Clark County because the epicenters may be quite close. Geologists theorize there may be faults directly underneath the cities of Portland and Vancouver. Recent studies suggest that the epicenter for the 5.5 M earthquake in November 5, 1962, was located underneath the City of Vancouver.

3. Cascadia Subduction Zone – The Cascadia Subduction Zone lies about 50 miles offshore, extending from near Vancouver Island to northern California. The zone is where the oceanic Juan de Fuca plate dives beneath the continental North American plate. These plates are converging at a rate of 1 to 1.5 inches per year.

CRESA considers the entire county population, property, commerce, infrastructure and services as vulnerable to an earthquake. The scope of damage will be a function of earthquake magnitude and level of preparedness. Damage could range from minimal to extreme loss of life and destruction of property.

Most injury, death, and property damage in an earthquake result from seismic impacts on structural and non-structural materials. The vulnerability of certain areas partially depends on the types of structures in that area. A wood frame residential structure that is adequately secured to the foundation is relatively safe. An un-reinforced masonry building is at greatest risk from seismic impacts. Most injuries in earthquakes result from non-structural materials such as light fixtures, equipment, and furniture, falling on people and causing injury.

Another factor in earthquake vulnerability is soil type. Water-saturated loose sand and silt lose their ability to support structures in an earthquake. Areas in Clark County that

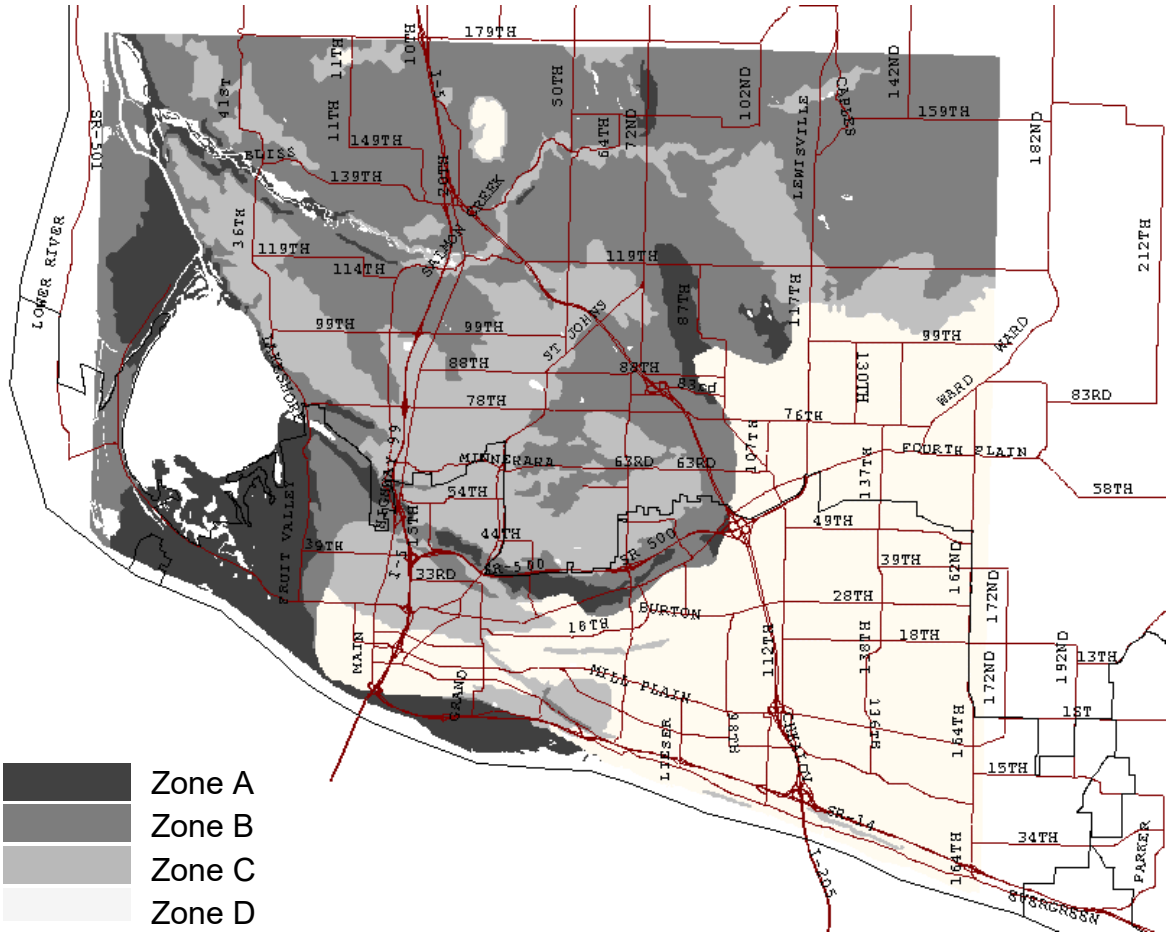
are near flood plains or areas with silt deposits are at the greatest risk during an earthquake.

Within the limits of predictability, CRESA assigns a high probability of occurrence for a damaging earthquake during the next 25 years. A large earthquake could have a catastrophic impact on Clark County suggesting high vulnerability. Accordingly, a high-risk rating is assigned.

Figure 5-2 shows a map of Clark County with zones of relative hazards for earthquakes. Based on evaluation of soil liquifaction, ground amplification, and earthquake induced landsliding hazards. Zone A is area of greatest relative hazard. Zone D is area of least relative hazard. The City of Camas is primarily in Zone D.

FIGURE 5-2

Relative Earthquake Hazard Map, Clark County, Washington



Earthquake response measures for the City's water system are shown in Table 5-5.

TABLE 5-5

Earthquake Response City of Camas Water System

Water System Component	Potential Effects	Recommended Actions
Transmission and Distribution System	Transmission and distribution system mains may be broken and the City's ability to monitor and respond to these incidents may be limited.	Isolate the major broken sections of piping throughout the system as they are located and repair as necessary and possible. Contact DOH.
Storage Facilities	Reservoirs may be leaking or structurally damaged	Inspect each reservoir for structural damage or cracks and leaks. Seal or drain these reservoirs as required. Contact DOH.
Booster Stations	Booster stations may be structurally damaged or mechanical damage to pumps and piping may have occurred.	Check booster stations and shut down pumps as required. If zones can be fed by alternate methods, implement those procedures. Contact DOH.
Wells	Unable to supply additional water to system. Well casings may be broken. Pumping capacity may be lost.	Investigate situation. Determine which wells can be utilized. Determine if surface water source still available. Contact DOH.
Treatment Facilities	Damage may have occurred to the treatment building, piping, or filters at the Slow Sand filter plant. May be unable to supply water from surface water source.	Shut down the equipment at the treatment facility. Attempt to repair. Check possibility of supplying City with groundwater sources. Contact DOH.

FLOOD

The Clark County HIVA states that floods are the most common disaster in Washington State and Clark County. The County's climate, topography, and geology are conducive to flooding. Normal annual precipitation ranges from 38 inches on the western floodplains to over 114 inches in the mountainous northeastern part of the county.

History of Flooding in Clark County and Adjacent Areas

- **December 1933** – The largest flood of record on the Lewis River.

- **May 30, 1948** – Columbia River crested at 34.4 ft. Flood stage at that time was 15 ft. This is the flood that destroyed the City of Vanport. Vanport, with a population at the time of the disaster of 18,500, was the second largest City in Oregon. The destruction of the town occurred when a 600-foot section of dike protecting the settlement from the rising Columbia River broke. Unfortunately, few people evacuated Vanport prior to the dam rupture. Evacuation was hampered by the fact that there were very few good evacuation routes. Fifteen people died in the flood.

- **June 1956** – Columbia River flooded due to snowmelt runoff.

- **January 1972** – A combination of intense rainfall and snowmelt caused major East Fork of the Lewis River floods.

- **December 1977** – Heavy rainfall and snowmelt caused flooding on the East Fork of the Lewis River. Salmon Creek had largest flood since gages were placed on Salmon Creek. The Washougal River also received its largest flood since gages were placed in 1944. This flood was an extremely rare event, greater than a 500-year flood.

- **February 8, 1996** – The Columbia River crested at 27.1 feet on February 9. This flood produced some of the worst flooding seen in the County since 1948. Approximately 1,500 people were evacuated, and 177 homes were destroyed. This flood occurred because of the confluence of several factors. The winter of 1995/96 was extremely rainy. Prior to the flooding period, the region experienced a cold snap with low elevation freezing, ice, and snow. This was followed by a strong warming trend with heavy precipitation.

In Clark County, the weather that produces the most serious flooding events are extensive wet conditions that follow a period of mid and high elevation ice and snow pack development. Many rivers in Clark County historically flood every few years. These include the East Fork of the Lewis River, Washougal River, Salmon Creek, and the Columbia River. Flooding on these rivers usually occurs between October and February. Long periods of heavy rainfall and mild temperatures coupled with snowmelt contribute to flooding.

There are three types of flood threats:

- Riverine
- Tidal
- Flash and Surface

The greatest threat of flooding in the City will be flash and surface flooding due to inundation of stormwater collection and conveyance systems. This may impact the water system operation through a number of mechanisms, including:

- Restricting access to water system facilities due to flooded streets
- Flooded valve and meter vaults
- Flooded City facilities
- Increasing groundwater levels that threaten contamination of leaking underground water lines

Actions the City will consider depending on the extent of flooding and the risks that might be mitigated include:

Pre-Flood

- Sandbagging around City facilities, such as the Public Works Operations Center
- Securing large pieces of equipment and materials that could be carried off by floodwaters
- Raising electronic equipment and computers off the floor
- Moving valuable records to locations expected to remain dry

Post-Flood

- Checking coliform levels in the water system for contamination (see incident specific plan for bacteriological contamination)
- Inspecting meters and PRV stations to ensure proper operation
- Cleaning debris from around reservoirs

Figure 5-3 includes a flood map of the City of Camas. As the flood map indicates areas susceptible to flooding include the Washougal Wellfield (Well Nos. 5, 6, 7, 8, 10 and 12 as well as the new chemical feed building).

Historically, flooding occurs along one or more of the County's waterways every few years, suggesting a high probability of occurrence. Because of the relative land area and population affected, the County is exposed to moderate vulnerability. Although the vulnerability is moderate, the frequency of flooding, the potential for simultaneous flooding events, plus the historical record of recurrent flooding and cumulative costs, all suggest the assignment of a high risk rating.

Table 5-6 lists flood response measures specific to the City's water system.

TABLE 5-6

Flood Response City of Camas Water System

Water System Component	Potential Effects	Recommended Actions
Transmission and Distribution System	Transmission and distribution mains could be affected by landslides or high water levels. City staff transportation for monitoring the system and making repairs may be limited.	Monitor possible areas of concern for waterline conditions. Monitor waterline bridge crossings for possible damage. Prepare to valve off any washed out or damaged waterlines. Contact DOH.
Storage Facilities	Minimum physical/structural impact due to locations. Flooding could cause elevated coliform levels in water system.	Monitor coliform levels. Contact DOH to advise of acute of non-acute coliform violations.
Booster Stations	Minimal operational impact.	None.
Wells	Facilities could be overwhelmed by flood waters.	Prepare to disconnect any well affected by flood waters. Contact DOH.
Treatment Facilities	Heavy rainfall or snow melt may overwhelm the capacity of the water treatment facility. Flooding in the vicinity of the plant is a risk.	Allow the water to bypass the filtration plant by closing intake facilities. Use wells as source of water for City. Contact DOH.

LANDSLIDE/MUDFLOW/DEBRIS FLOW

The term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Landslides commonly occur on water-saturated slopes when the base of the slope can no longer support the weight of the soil above it, thus their frequency increases during or after periods of heavy rain and flooding. Though commonly associated with heavy rain and flooding conditions, landslides may also be associated with earthquakes (the 1994 Northridge Earthquake caused an estimated 11,000 landslides) and volcanic activity.

CRESA indicates that Clark County experienced the greatest number of landslides from 1996 to 1997. One of the largest landslides in the area occurred just outside of Clark

County, two miles north of Woodland on February 8 and 9 when 32,000 yd^3 of earth fell across all lanes of I-5 and the adjacent railroad tracks, disrupting traffic until February 19. In the same flooding period there were also several landslides that disrupted railroad operations in the area adjacent to Vancouver Lake. The following year, which was marked by heavy rains but no significant flooding, there were several landslides. Clark County has several areas where landslides have taken place and several areas that are susceptible to landslides. The hills north of La Center and the slopes north of Camas and Washougal are particularly susceptible.

Slides in Clark County generally range in size from thin masses of soil of a few yards wide to deep-seated bedrock slides more than six miles across. Travel rate may range in velocity from a few inches per month to many feet per second, depending largely on slope, material, and water content. The recognition of ancient dormant slide masses is important as they can be reactivated by earthquakes or unusually wet winters. Also, because they consist of broken materials and disrupted ground water, they are more susceptible to construction-triggered sliding than adjacent undisturbed material.

CRESA states that typical effects of landslides include damage or destruction of portions of roads and railroads, sewer lines, pipelines, and water lines, electrical and communications distribution lines, and destroyed homes and public buildings, but the most significant effect of landslides is the disruption of transportation and the destruction of private and public property.

The Clark County HIVA indicates the County has a history of landslides and their numbers are increasing, suggesting a high probability of occurrence. Landslides tend to occur in isolated, sparsely developed areas threatening individual structures and remote sections of the transportation, energy and communications infrastructure suggesting low vulnerability. Because of the high probability of occurrence and the trend to more frequent landslides, a moderate risk rating is assigned.

The risk to the water system is considered low because of the lack of steep slopes in the Camas area. Flooding and Earthquakes will increase the risk of landslides. Refer to Tables 5-5 and 5-6 for response measures that may be appropriate for landslides induced by those event categories.

SEVERE SNOWSTORM

The most significant anticipated impact of a severe snowstorm is limiting access to the City's facilities. City personnel may not be able to access water mains, reservoirs or valves for maintenance and/or manual operation of system components. During a severe snowstorm the City will rely on the telemetry system for information on the major system components. Additional hazards to be considered with severe winter storms include:

- Freezing in City Reservoirs – Mitigated by ensuring continuous turnover.

- Water service line breaks – Mitigated by asking customers to be vigilant for flooding around homes and businesses.
- Roof Collapse on City buildings and reservoirs – Mitigated by observing snow levels and having City crews remove when snow load may be exceeded.

Table 5-7 lists water system response measures associated with winter storms.

TABLE 5-7

Severe Snowstorm Response City of Camas Water System

Water System Component	Potential Effects	Recommended Actions
Transmission and Distribution System	City staff transportation for monitoring system and making repairs will be limited.	Contact City street department to expedite plowing of critical water system component access. Maintain chains and other snow gear for maintenance equipment on hand. Be able to provide accurate locations of valving for maintenance purposes.
Storage Facilities	Snow may prevent access.	Clear snow from access roads. Three 4 x 4 vehicles are available for water department use to access critical sites.
Booster Stations	Snow may prevent access.	Clear snow from access roads. Three 4 x 4 vehicles are available for water department use to access critical sites.
Wells	Snow may prevent access.	Clear snow from access roads. Three 4 x 4 vehicles are available for water department use to access critical sites.
Treatment Facilities	Snow may prevent access.	Clear snow from access roads. Three 4 x 4 vehicles are available for water department use to access critical sites.

TORNADO

Tornadoes are characterized by funnel clouds of varying sizes that generate winds as fast as 500 miles per hour. They can affect an area of 1/4 to 3/4 of a mile and seldom more than 16 miles long. Tornadoes normally descend from the large cumulonimbus clouds that characterize severe thunderstorms. They form when a strong crosswind (sheer) intersects with strong warm updrafts in these clouds causing a slowly spinning vortex to

form within a cloud. Eventually, this vortex may develop intensity and then descend to form a funnel cloud. When this funnel cloud touches the ground or gets close enough to the ground to affect the surface it becomes a tornado. Tornadoes can come from lines of cumulonimbus clouds or from a single storm cloud. Tornado hazards are measured using the Fujita Scale ranging from F0 to F6.

A history of tornadoes in Clark County follows:

- October 1951 – Battle Ground (F0 on the Fujita Scale). 8-miles long and 25-yards wide, which uprooted trees and destroyed a two-story barn.

- August 26, 1953 – Ridgefield (F0 on the Fujita Scale). Lasted 3 minutes and severely damaged a farm.

- April 5, 1972 – Vancouver (F3 on the Fujita Scale). This was the most disaster to occur in Clark County and the most serious tornado in Washington State. Six people died and 300 were injured when a tornado cut a swath of destruction through East Vancouver. The tornado's path was 9-miles long, from the Columbia River, just east of Andresen Road up to Fourth Plain Blvd. Peter S. Ogden Elementary, a shopping center, and a bowling alley were severely damaged.

- December 1974 – Camas (F0 on the Fujita Scale). Windows were broken and walls collapsed but there was no serious damage.

- October 1984 – Woodland (F1 on the Fujita Scale). A funnel cloud touched down several times, snapping and overturning trees, and ripping up fence lines. A barn roof was torn off, corrals flattened and a pump house lifted and exploded.

- June 29, 1989 – La Center (F1 on the Fujita Scale). Uprooted several trees and tossed one car off the road causing minor injuries to the driver.

- May 31, 1997 – Vancouver (F0 on the Fujita Scale). Caused $10,000 in property damage.

- September 15, 1997 – Yacolt (F0 on the Fujita Scale). No reported damage.

- May 11, 2000 – Battleground (F0 on the Fujita Scale). Caused $10,000 in property damage.

- May 27, 2004 – La Center (F0 on the Fujita Scale). No reported damage.

- September 2004 – Ridgefield (F0 on the Fujita Scale). No reported damage.

- January 10, 2008 – Vancouver, (F1 on the Fujita Scale). Damage reports showed widespread downed power lines, malfunctioning traffic lights, and roofing that had been ripped off. Although the majority of damage was light in nature, in at least one case a home was completely demolished. At least 2,500 homes and businesses had lost power because of the storm. Property damage estimated to total $525,000.

- December 2015 – Battle Ground (F1 on the Fujita Scale). Damage reports showed downed power lines, malfunctioning traffic lights, damaged fences and roofing that had been ripped off. Although the majority of damage was light in nature, two businesses were damaged and deemed to be unsafe. No injuries were reported.

Table 5-8 provides definitions of tornado hazards.

TABLE 5-8

Tornado Hazard Scale

F-Scale Number	Intensity Phase	Wind Speed	Type of Damage Done
F0	Gale Tornado	40-72 mph	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.
F1	Moderate Tornado	73-112 mph	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant Tornado	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	Severe Tornado	158-206 mph	Roof and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted.

Tornadoes are not normal occurrence in the Northwest as they require a confluence of warm surface temperatures and warm fronts coming from the south with cold fronts coming from the north. Northwest climates do not normally generate the temperature variations conducive to tornado formation. Washington is ranked 43 in the US for total number of tornadoes. Nonetheless, CRESA states that the tornado threat should be taken very seriously. The conditions conducive to tornado formation may develop in Southwest Washington and it is common for funnel clouds to be reported in this region. During severe thunderstorms it is possible for tornadoes to occur.

With the exception of the April 1972 disaster, tornadoes in Washington and Oregon tend to be light or moderate, with winds ranging from 40 to 112 mph. There are a notable

minority of tornadoes that cause significant to severe damage with winds going as high as 200 mph. The peak season for tornadoes is April through July. However, in Washington tornadoes may occur in the late summer months and, in a few rare cases, may occur in the winter months. While tornadoes are sometimes formed in association with large Pacific storms, most of them are caused by intense local thunderstorms. Tornadoes almost exclusively occur in the late afternoon and early evening.

It is possible for a tornado to occur anywhere in the lower elevations of Clark County. Normally, Pacific Northwest tornadoes are moderate but it is possible for serious tornadoes to develop, causing death and serious injury as well as property damage.

Water systems most vulnerable to tornadoes will be reservoirs, booster stations and treatment facilities. Reservoirs are not designed to withstand the high winds possible with tornadoes and buildings that house well pumps, booster pumps and treatment facilities may be damaged or destroyed by a severe tornado.

VOLCANO

According to the Clark County HIVA, the most likely scenarios for volcanic eruptions that will impact the County are as follows:

- Ashfall and *tephra* (the ash, rock and boulder-sized debris from an exploding volcano) from Mt. St. Helens.

- Ashfall and the generation of *lahars* (volcanic mud/debris flows) from the Sandy River in Oregon due to volcanic activity at Mt. Hood.

The most severe impacts in Southwest Washington from another major eruption from Mt. St. Helens eruption would be in Cowlitz County. In this event, Clark County emergency managers and responders may support Cowlitz County agencies and the Forest Service in assisting in evacuation, perimeter control, search and rescue and other operations. Drawing from these resources may leave the City of Camas potentially vulnerable to an inability to respond should emergencies arise that require local response assets.

The vulnerability to damage from lahars is greatest in southern Clark County, due to potential impacts from lahars in the Sandy River. Since the Sandy River empties into the Columbia across from Camas, lahar deposits could influence the flow of the Columbia River and possibly affect low lying areas of Camas near the Columbia. However, the potential exists for ashfall from volcanic activity to impact the entire county by creating a respiratory hazard and potentially adding weight to the roofs of City facilities (including the water reservoirs) that will increase significantly if it becomes wet. Wet ash also creates a slipping hazard and will create traffic problems and make water system maintenance hazardous.

URBAN FIRE

In the 2019 Water System Plan, a hydraulic analysis was conducted in several areas throughout the system to determine if the water system had adequate capacity to provide fire flow. Deficiencies were noted in the following areas:

- PRV Systems – Lacking pressure-sustaining features to prevent fire flows in lower pressure zones from causing unacceptable service pressures in upper pressure zones.
- West of Fargo (19th thru 22 Ave) – Fire flow limitations.
- Various pockets in Downtown – Fire flow limitations.
- Pacific Rim Blvd near Parker Street – Fire Flow limitations

The modeling of the water system is generally based on single event structural fires. In addition to the areas with fire flow deficiencies noted above, multiple structural fires occurring simultaneously in the same pressure zone could conceivably overwhelm the water system's capacity. If mutual aid agreements are invoked, the City would need to consider the potential for a water shortage in a coordinated fire response.

However, in the event of a fire City personnel monitor reservoir levels and system performance with the telemetry system, which allows the Fire Department to understand the limitations of water supplies available for fire suppression and to operate accordingly. It is also important to note that the City's Municipal Code also requires that all buildings, including residential structures, are required to be sprinklered, which significantly reduces the potential for large structure fires.

Other issues to consider with fires include:

- Creating a vacuum on waterlines due to high fire demand; this may create a cross-contamination hazard.
- Water quality complaints from customers due to high pipe velocities scouring inner pipe surfaces.

Table 5-9 lists water system response measures for urban fires.

TABLE 5-9

Urban Fire Response City of Camas Water System

Water System Component	Potential Effects	Recommended Actions
Transmission and Distribution System	Low pressure may result in the extremities of the system depending on the extent of the fire incident.	Monitor system and adjust pumps if applicable.
Storage Facilities	Draw down will occur in the reservoirs with increased demand.	Monitor reservoir levels.
Booster Stations	Additional pumps called on.	Monitor pump station to ensure proper operation.
Treatment Facilities	Fire in watershed could cause increased sediment in the surface water source. Turbidity levels may exceed acceptable levels.	Use groundwater sources until surface water sources available. Provide silt fences along areas that have lost vegetation due to fire. Contact DOH.

POWER FAILURE

Various types of severe weather can cause loss of electrical power. In order to alleviate the effects of a power outage, the City has installed auxiliary generators at the Chlorination Plant, the Filter Plant, Butler/Gregg Booster Stations, Angelo Booster Station, Lacamas Booster Station and the Lower Prune Hill Pump Station. Well Nos. 8, 11 and 12 also have an auxiliary power source to allow the wells to operate during an electrical outage. The Washougal Wellfield Treatment Facility obtains auxiliary power from the generator for Wells 11 and 12.

Table 5-10 presents the potential effects of a lengthy power failure on the water system components.

TABLE 5-10

Power Failure Response City of Camas Water System

Water System Component	Potential Effects	Recommended Actions
Transmission and Distribution System	No effect	None.
Storage Facilities	Telemetry system may be inoperable.	Manually check reservoir levels. Some reservoirs can provide water to lower areas.
Booster Stations	Booster stations inoperable without auxiliary power.	Operate booster station with auxiliary power.
Wells	Unable to supply additional water to system.	Well Nos. 8, 11 and 12 Auxiliary Power
Treatment Facilities		Auxiliary generator.

DAM FAILURE

Dam failures are the release of impounded water due to structural deficiencies, which can affect lives and property downstream. Dam failures are caused by flooding, earthquakes, lack of maintenance and repair, misoperation, poor construction, vandalism, or terrorism.

According to the Clark County HIVA, several dam failures have occurred in Washington State over the last 40 years, some of which been catastrophic, but none have occurred in or has impacted Clark County.

There are 36 dams in Clark County. These dams are used for hydroelectric power generation, irrigation, and recreation. Table 5-11 shows dams that could potentially impact the City of Camas.

TABLE 5-11

Clark County Dams Upstream of the City of Camas

Name of Dam	Year Built	Type	Nearest City Downstream	Distance in Miles	River	Downstream Hazard Category
Clark Reservoir Dam	1948	RE	Camas	4	Robinson Creek	3
Lacamas and Round Lakes, Lower Dam	1936	BU	Camas	1	Lacamas Creek	2
Lacamas and Round Lakes, Upper Dam	1936	BU	Camas	1	Lacamas Creek	2
Price Reservoir Dam	1950	RE	Camas	3	Tributary - Lacamas Creek	3

Dam Type: BU – Buttressed Dam, RE – Reinforced Earth Dam.
Hazard Category:
1 = High; 2 = Significant; 3 = Low
(reference: Washington State Department of Ecology Dam Safety Guidelines, July 1992, revised Sept 2004)
2 = 1 to 6 lives at risk, appreciable economic loss, limited or short term water quality degradation
3 = No lives at risk, minimal economic losses, no significant water quality impacts

Washington State uses a Downstream Hazard Classification system for dams, which assigns a Low, Significant or High rating for populations at risk of economic loss and environmental damage should the dam fail. In Clark County, most dams are rated low, three are significant and three high. (The three potential high hazard dams are the Merwin Dam on the Lewis River, Erickson on Rock Creek and Tsugawa Brothers Reservoir Dam on Mason Creek.) The three potential significant hazard dams are the Elmer Dam on Mason Creek and the Lacamas and Round Lakes, upper and lower dams on Lacamas Creek; these latter two dams pose a downstream hazard to the City of Camas.

In addition to the dams located in Clark County, the county can also be affected by dam failures of dams on the Columbia River upstream from Clark County. CRESA considers these dams to be well maintained, operated with 24-hour staffing and inspected on a regular basis.

CRESA states that Washington experiences a dam failure on a frequency of approximately once every two years. The majorities of failures were in whole or part the result of a failure to perform adequate maintenance and monitoring of the facilities. Dam failure can have many effects such as loss of life, damage to structures, roads, utilities, and crops. Economic losses can also result from a lowered tax base and lack of power profits.

History suggests a low probability of occurrence. The failure of a high hazard dam would threaten a small segment of the County suggesting low vulnerability. Because there has not been a major dam failure in Clark County, and the three high hazard dams are well maintained and operated providing no reason to suspect a compromise in

structural integrity baring a natural disaster or terrorist action, a low risk rating is assigned.

For response measures in the event of a dam failure, refer to Table 5-7 (flood response).

TRANSPORTATION ACCIDENT (AIRPLANE CRASH)

Although there have been no major airplane crashes in Clark County, the scope of the impact of such an event and the potential complexities of the response require the City to consider how such an incident could impact the water system operation.

The City of Vancouver is across the river from Portland International Airport. The airspace over the Columbia River and Vancouver is heavily used by all types of aircraft flying into Pearson Airpark, Portland Air National Guard Base and Portland International Airport. Most airplane accidents occur during arrival and departure so the City of Vancouver is at a greater risk than any other area in the County. Considering the flight paths of aircraft into and out of Portland International Airport, Vancouver has the potential for a major airplane crash with mass casualties, hazardous materials incidents, and fires. Accordingly, response assets from the City of Camas may be drawn to a crash site and leave the City potentially vulnerable if another emergency arises that requires those assets. Additionally, an airplane crash could cause major transportation routes to be closed for significant periods of time, resulting in significant delays for contractors, equipment and chemical suppliers to access the City of Camas.

TRANSPORTATION ACCIDENT (HIGHWAY OR RAIL)

City water lines cross a number of well-trafficked thoroughfares through the City, including SR 14 and the railroad that runs parallel to SR14. It is conceivable that a major accident on one of these thoroughfares would damage a water line. The Public Works component of the response to a transportation incident includes the following:

- Coordinate damage assessments, emergency road clearing and road repair activities
- Provide contracts for repair and recover work, including damaged utilities
- Provide maps for transportation route planning

The water utility will need to be assessed rapidly in the event of a major transportation incident to determine if water lines have either been damaged or are at risk of being damaged due to the incident. It may become necessary to isolate damaged or at-risk water lines until the incident has been cleared and emergency repairs have been made to allow recovery efforts to proceed.

HAZARDOUS MATERIALS (HAZMAT) INCIDENT

According to the Clark County HIVA, as of 1998, Clark County had approximately 77 entities, at 117 facility locations, which filed an Emergency and Hazardous Chemical Inventory Form (known as a Tier Two Form) with Washington State Department of Ecology. Of these 117 facilities about 58 of them use chemicals on the Environmental Protection Agencies list of Extremely Hazardous Substances.

The City may obtain Clark County Tier Two Hazardous Chemical Inventories from CRESA:

Phone: (360) 737-1911 Email: cresa@clark.wa.gov

Statistics show that nearly half of all hazardous materials incidents occur during transit. Large quantities of HAZMAT are transported through and in the close vicinity of the City via the interstate highway and by rail. In the event of a HAZMAT spill, the Fire Department will be the City's lead department for incident response within the City limits. A large spill will trigger the need for mutual response under the Regional HAZMAT response agreement.

The City of Camas Fire Department has no HAZMAT response capability. A HAZMAT response capability permits offensive operations necessary to perform the following operations:

- Preliminary hazard characterization
- Safely enter the hazardous area
- Mitigate the effects of the release prior to recovery operations
- Exit the hazard area employing a deliberate and thorough decontamination process

The above capabilities can only be provided by HAZMAT teams that are equipped and trained to Occupational Safety and Health Agency regulations (29 CFR 1910.120) and National Fire Protection Association competency levels (NFPA 471 and 472). The City of Vancouver and the Georgia Pacific Mill have such response capabilities. The City Fire Department will coordinate all HAZMAT support with this units working with CRESA under the regional HAZMAT response plan. Telephone numbers for the City of Vancouver and Georgia Pacific HAZMAT teams leaders are as follows:

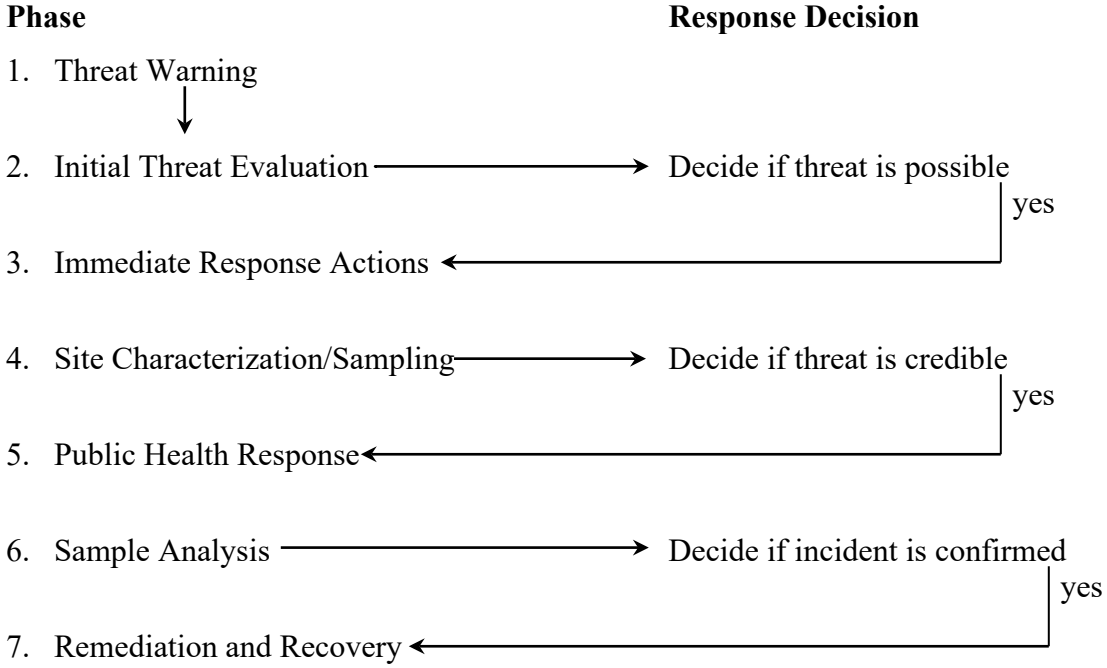
City of Vancouver (360) 619-4165
Georgia Pacific (360) 834-8465

The Public Works and Fire Departments will communicate during a HAZMAT spill to determine if the incident poses a hazard to water system personnel and facilities. It may become necessary to isolate water lines that are at risk of contamination due to a HAZMAT spill in order to prevent contamination of the water system.

INTENTIONAL CONTAMINATION

This type of incident could accompany a terrorist incident involving chemical, biological or radiological agents as well as vandalism. It is treated as a unique class of incident due to the complexities of the response from an operational, public health, law enforcement and physical recovery standpoint.

The EPA recommended protocols for managing a suspected intentional contamination incident are summarized in Figure 5-4. The EPA protocol has seven phases with three response decision points:

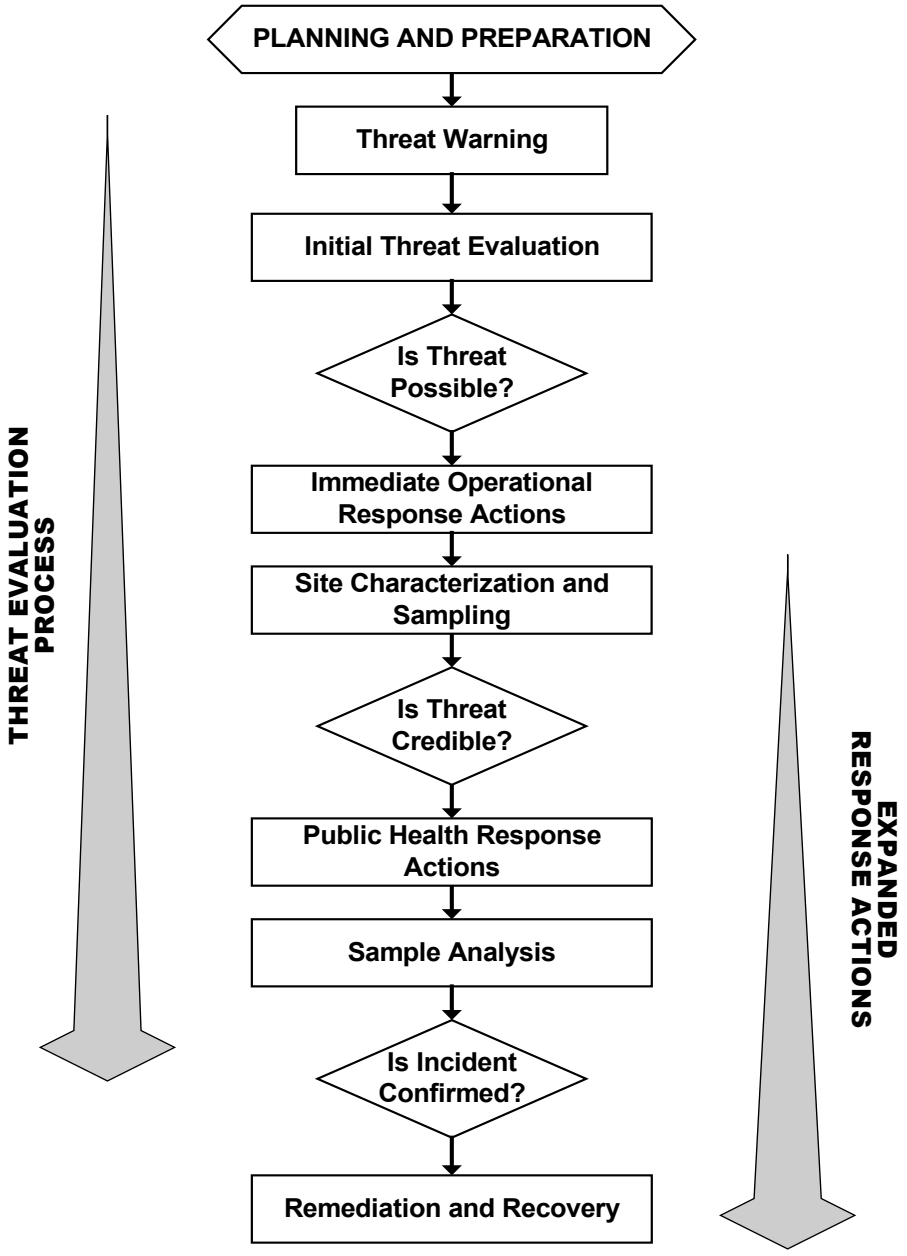


In no case should the utility pursue these actions unilaterally. Jurisdictional law enforcement agencies and public health agencies must be involved in each phase of the process. There are legal and practical requirements for this involvement, including rules of evidence for criminal investigations, balancing the need to protect law-enforcement sensitive information with public-right-to-know provisions in the Safe Drinking Water Act, obtaining specialized technical advice for sampling procedures and protecting the safety and health of water system personnel when taking water samples to test for suspected contamination.

Terrorism is a Federal crime and will require the involvement of federal law enforcement (Federal Bureau of Investigation).

FIGURE 5-4

Protocol for Managing an Intentional Contamination Incident



Reference: Planning for and Responding to Drinking Water Contamination Threats and Incidents Response Protocol Toolbox, USEPA, December 12, 2003.

Additionally, it is always recommended that the water utility consult with the HAZMAT team leader during the characterization and sampling process since, depending on the exposure hazard, it may become necessary for HAZMAT technician trained personnel to perform the site assessment and collect samples wearing OSHA compliant personal protective equipment.

Threat Warning

This is any unusual occurrence, observation, or discovery that indicates a potential contamination incident and initiates actions to address this concern. Such a warning would typically come in the form of an apparent security breach in the water system. Evidence of a security breach could come in the form of a telephone call threatening contamination or stating that intentional contamination has occurred; statements by witnesses who have seen water facilities being tampered with or broken into; physical evidence at a water facility indicating water facilities have been intentionally damaged or tampered with; and reports of increased illnesses from local hospitals or the Clark County Health Department.

Initial Threat Evaluation

This is the part of the threat management process in which all available and relevant information about the threat is evaluated to determine if the threat is possible. This is an iterative process in which the threat evaluation is revised as additional information becomes available. The conclusions from the threat evaluation are considered when making *response decisions*.

Immediate Response Actions

These are actions taken in response to a possible contamination threat in an attempt to minimize the potential for exposure to the potentially contaminated water. Immediate operational response actions will generally have a negligible impact on consumers. These actions will include estimating the potential area(s) within the water system that may have been subject to contamination and isolating these areas from the system to contain the contamination. This process must be performed quickly and generally will not allow modeling tools to be used unless the scenarios have been developed and modeled prior to the suspected contamination event.

Immediate Characterization and Sampling

This is the process of collecting information from an *investigation site* in order to support the evaluation of a drinking water contamination threat. Site characterization activities include the site investigation, *field safety screening*, *rapid field testing* of the water, and sample collection.

Field Safety Screening

Screening performed to detect any environmental hazards (i.e., in the air and on surfaces) that might pose a threat to the *site characterization* team. Monitoring for radioactivity as the team approaches the site is an example of field safety screening.

Rapid Field Testing

Analysis of water during *site characterization* using rapid field water testing technology in an attempt to tentatively identify contaminants or unusual water quality.

Public Health Response

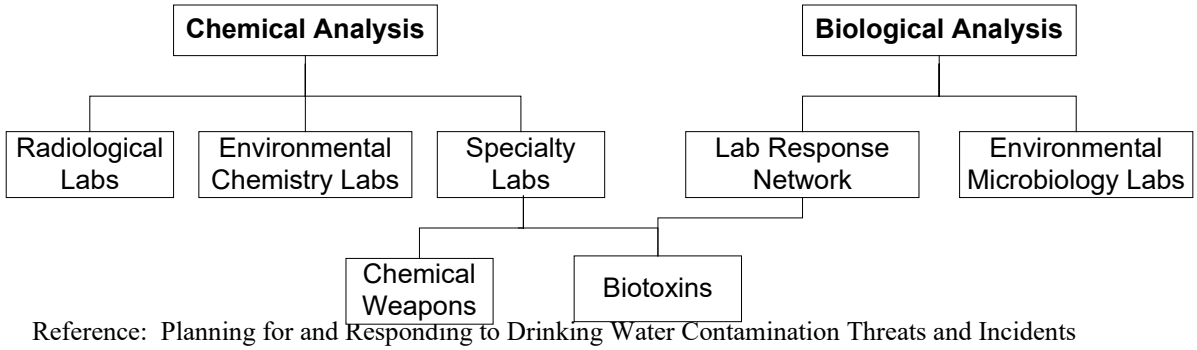
This encompasses all actions taken to mitigate consequences resulting from threats or incidents involving biological, chemical, or radiological contaminants. These actions include public notification, using an alternative water supply, boil water notices and chemical sterilization.

Sample Analysis

This step involves laboratory analysis that is undertaken to confirm the presence/absence of contamination such that specific decisions can be made by law enforcement and public health officials and allow the water utility to proceed with definitive response and recovery actions. It is important to keep in mind that not all labs can definitively confirm a potential contamination agent. Figure 5-5 shows the types of laboratories and their general capabilities.

FIGURE 5-5

Types of Laboratories by Contaminant Class



Reference: Planning for and Responding to Drinking Water Contamination Threats and Incidents Response Protocol Toolbox, Module 4: Analytical Guide, USEPA, December 12, 2003

Definitions for terms used in Figure 5-5 are provided below. The EPA Environmental Laboratory Compendium provides a national listing of laboratories and their capabilities. The City may sign up for this list by going to the EPA's water security website:

http://cfpub.epa.gov/safewater/watersecurity/index.cfm

Environmental Chemistry Laboratory

This is any laboratory, either commercial or government-operated that is able to perform analysis of water samples for compliance with the Safe Drinking Water, Clean Water Acts, or other applicable environmental regulation, as well as other chemical parameters that are important to system operation and overall water quality. These laboratories have the instrumentation necessary to implement methods for chemical analysis of a water sample.

Environmental chemistry laboratories perform water analyses to support regulatory compliance and they are familiar with the need to treat samples with precautions necessary for legal defensibility. Analysis for regulatory compliance purposes, however, may proceed differently than analysis of emergency samples in response to a contamination threat, which has the dual role of both providing an emergency response to protect public health and also providing legally defensible evidence to support a criminal investigation. Additionally, no commercial environmental chemistry laboratories can analyze chemical warfare agents (e.g., nerve, mustard and blood/choking agents); this latter type of analysis can only be performed by a small number of government-operated laboratories in the United States whose access is restricted to law enforcement and military agencies.

Environmental Microbiological Labs

These labs include those of EPA, state environmental agencies, and the commercial sector, that typically perform analyses for waterborne pathogens. Most of these laboratories have the equipment and staff necessary to analyze for indicators of fecal contamination such as fecal and total coliforms and *E. coli*. Culture techniques are available for many of the more common waterborne pathogens such as *Vibrio cholerae, Salmonella enteriditis,* Typhi, and *Shigella* spp.; however, analyses for these pathogens are not routinely performed in most environmental microbiological laboratories. While some environmental microbiological laboratories have expanded capabilities to analyze for parasites such as *Cryptosporidium* and *Giardia* or to perform molecular assays for some organisms, these capabilities are not widespread.

Only laboratories registered for the analysis of select agents are legally permitted to analyze for those agents, and currently most registered labs reside in the LRN. Thus, even if environmental microbiological laboratories develop additional capabilities for pathogen analysis, they could not perform such analyses without registering for select agents.

Laboratory Response Network (LRN)

This is a network of laboratories developed by the Centers for Disease Control (CDC), Association of Public Health Laboratories (APHL), and the Federal Bureau of Investigation (FBI) for the express purpose of dealing with bioterrorism threats, including pathogens and some biotoxins.

Radiological Labs

These laboratories specialize in the analysis and handling of radiological materials. For radionuclides, analytical confirmation may be viewed differently than most chemicals because radionuclide analysis can take the form of screens for gross alpha, beta, or gamma radiation, and/or it can take the form of analysis for the specific radionuclides themselves, such as strontium-90. Thus, analytical confirmation may involve the process of confirming quantity of gross radiation or identifying the radionuclide. The type of analysis that is performed will be based on the analytical goals. For example, radionuclides in drinking water regulation are often characterized by their gross alpha and gross beta emissions.

For the purpose of emergency analysis of water contaminants, a tiered approach is suggested, with screening for gross radiation in the field or upon receipt by the laboratory followed by identification of the radionuclide, which may be important for a more complete understanding of risks to public health as well as potential criminal actions against perpetrators.

Specialty Labs

These are laboratories that are capable of analyzing samples for chemical, biological and radiological agents that cannot be analyzed by commercial laboratories. These labs require special safety certifications for operation and their access is controlled by law enforcement agencies and the military.

Remediation and Recovery

The remediation process involves: system characterization; selection of remedy options; provision of an alternate drinking water supply during remediation; and monitoring to demonstrate that the system has been remediated. This process will follow a process similar to the US EPA's Superfund program's approach to hazardous waste site cleanup to include *risk assessment*, *system characterization*, *feasibility study*, analysis of alternatives, *remedy* selection, *remedial design*, *remedial action*, and post-remedial monitoring and operations.

EXPLOSIVES INCIDENT

A bomb threat will be handled by the City Police Department. If the call is received at the CRESA 911 call center, the call center staff is trained regarding information to be obtained and questioning techniques. If the call is received by a City employee they will follow procedures as shown in Appendix L.

In the event of an attack on the water system with explosive devices, the response will, like a contamination incident, be complex and multidisciplinary (police, fire, public works, emergency medical services (EMS), public information, etc.). Important issues to be considered in the response include:

- Assignment of the Incident Commander (will depend on the situation/risks) – the incident commander is responsible for overall command and control at the incident scene and the health and safety of all response personnel.

- Presence of casualties and proper procedures for casualty extraction and emergency medical treatment at the incident site.

- The risk of fire/explosion presented by flammable materials in the vicinity of the explosion.

- Threat of a secondary device (a device that is placed at the scene to kill or injure emergency responders after their arrival).

- Physical hazards associated with collapsed structures.

- Evidence preservation requirements.

- Respiratory, ocular and skin hazards associated with vapors and fine particulate matter generated by the explosion and subsequent fires and what personal protective equipment (PPE) levels are appropriate for the hazards – note that "escape" respirators (e.g., Quickmask 2000), are not designed for prolonged exposures necessary for intentional entry into a hazardous area, they are designed solely to allow movement away from the incident site to a safer location. Additionally, as of late 2004, no escape masks have received federal certification (the approval agency is NIOSH – National Institute of Occupational Safety and Health) for an independently recognized and tested level of performance.

- The need to maintain communication between all response units (especially police, fire, public works and EMS) to ensure different response units all have the same hazard assessment and understand which response units are being allowed at the incident site, their locations and

basic tasks; this becomes even more critical as mutual aid from other agencies and jurisdictions arrive at the site.

- The need to isolate damaged elements of the water system to make emergency repairs and minimize impact to undamaged elements of the water system.

- The need to maintain a single spokesperson for the City to release information to the public and the news media.

CYBER ATTACK

The City maintains an IT network separate from the water system SCADA network. The network is used for intracity business and is password protected. Firewall protection is used and no outside access for third parties is allowed.

If a cyber attack is successful, the response will require the IT-System Administrator to assess the extent of impact and develop a plan to restore damaged or compromised files and attempt to recover lost files.

If the SCADA system is compromised it will become necessary to monitor the water facilities by periodic and direct visual contact until the system is restored to normal operations.

DOCUMENTATION PROCEDURES

During an emergency, precise documentation of actions taken and materials used will greatly increase the efficiency with which the City handles the situation. Detailed recording and reporting of events, such as shut downs, valve isolations, sampling events and reservoir operations, enables repairs to be made quickly keeping down time to a minimum. The detailed reports are invaluable in making certain that the system is quickly and efficiently returned to pre-emergency operating status. To aid employees, an Operating and Damage Report form is included in Appendix M.

The Federal Emergency Management Agency (FEMA) requires proper documentation of damage for the City to file claims in the event the City is covered by a Presidential Disaster Declaration. Photographic evidence of “before” and “after” an event as well as equipment purchase records will strengthen any justification for compensation from the Federal government.

The FEMA disaster assistance website for public agencies can be consulted for further information:

http://www.disasterassistance.gov/daip_en.portal

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Federal Requirements 1
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APPENDIX J

MAINTENANCE ACTIVITIES

Daily Maintenance Activities

Well No. 5, 6, 9, 13, 14, and Washougal Wellfield (Wells 7, 8, 10, 11, 12)

- Check motor oil level at each well.
- Verify proper pumping operations.
    - Read upstream and downstream pressure gauges to see if pressures are in normal operating range.
    - Read flow meters for instantaneous and totalized flow to verify flow.
    - Observe well pump and motor while operating for abnormal vibrations.
    - Check for signs of loose fittings (water on floor).
- Record sodium hypochlorite level in drum (Well 5, and 9 only).
- Test chlorine residual and record. Chlorine residual should be between 0.7 and 1.0 mg/L at the sample point.
- Check fluoride level in the saturator and fill as necessary.
- Test fluoride concentration and record. Fluoride concentration shall be between 0.5 and 0.9 mg/L at well sample point and in the distribution system.
- Record totalized flow meter reading from fluoride saturator.
- Check for proper operation of surge valves at each well. Inspect blow off discharge points to check if standing water is accumulating anywhere in the surge discharge system.
- Check for proper operation of chlorinator for each well.
- Check for proper operation of the fluoride system for each well.

Diesel Powered Auxiliary Generators (Washougal Wellfield Facility, Well No. 13, Well No. 14, Crown Road Booster Station, New Gregg Booster Station, Angelo Booster Station, Lower Prune Hill Pump Station)

- Perform general inspection.
- Perform Coolant heater inspection.
- Check oil level.
- Check coolant level.
- Check fuel level.
- Record hour meter.

Weekly Maintenance Activities

Jones and Boulder Creek Surface Water Sources

Twice per week (when in operation)

- Check impoundment structure for stability at both surface water intakes.
- Check for debris accumulation at intake screens at both sources.
- Read and record totalized flow on flowmeter.

Weekly

- Perform security check of facilities.

Reservoirs: Butler, Gregg, Upper & Lower Prune Hill, 18th Avenue, & Lacamas

- Perform full security check.
- Perform full structural check.

Booster Pump Stations: Butler, Old & New Gregg, Upper & Lower Prune Hill, Angelo Forest Home, Green Mountain Estates, Lacamas, & Francis Rd

- Perform full security check.
- Verify proper pumping operations.

- Read upstream and downstream pressure gauges to see if pressures are in normal operating range.
- Read flow meters for instantaneous and totalized flow to verify flow.
- Observe well pump and motor while operating for abnormal vibrations.
- Check for signs of loose fittings (water on floor).

Diesel Powered Auxiliary Generators (Washougal Wellfield Facility, Well No. 13, New Gregg Booster Station, Angelo Booster Station, Lower Prune Hill Pump Station)

- Air cleaner inspection.
- Air pipe inspection.
- Battery charger inspection.
- Drain fuel filters.
- Check block heater connections.

Monthly Maintenance Activities

Well No. 5, 6, 9, Washougal Wellfield (7, 8, 10, 11, 12) and Well 13

- Inspect property for security purposes.
- Check fluoride pump gear oil.
- Inspect pump packing lubrication for proper operation.
- Inspect cooling screens on Vertical Turbine pumps for blockage.

On-Site Sodium Hypochlorite Generation System (Washougal Wellfield and Well 13)

- Clean blower inlet screen.
- Check hardness of water from water softener – should be less than 10 mg/L.

Diesel Powered Auxiliary Generators (Washougal Wellfield Facility, Well No. 13, New Gregg Booster Station, Angelo Booster Station, Lower Prune Hill Pump Station)

- Drain exhaust condensate trap.
- Check starting batteries.
- Check antifreeze and DCA concentration.
- Drive belt inspection.
- Check block heater connections.

Semi-Annual Maintenance Activities

On-Site Sodium Hypochlorite Generation System (Washougal Wellfield and Well 13)

- Level switch – remove and clean calcification.
- Clean cells if needed.

Annual Maintenance Activities

Jones and Boulder Creek Surface Water Sources

- Jones Creek - close inlet valve to screen house so that no water is diverted to surface water filtration plant from May 15th to November 1.
- Boulder Creek - close outlet valve from screen house so no water is diverted to surface water filtration plant from May 15th to November 1.

Well No. 5, 6, 9, Washougal Wellfield (Wells 7, 8, 10, 11, 12) and Well 13

- Change oil on all oil lubricated equipment.
- Clean out fluoride saturator.
- Clean filter bags on ventilation fan.
- Infrared scan electrical panels.

- Exercise pump.
- Sample water.
- Inspect roof and building for maintenance requirements.
- Check control valves and piping for proper operation.

On-Site Sodium Hypochlorite Generation System (Washougal Wellfield and Well 13)

- Temperature switch – confirmation that the bi metal opens at 60º C when immersed in hot water.
- Replace bellows and poppets on water pump.
- Inspect water heater and perform the following as needed:
    - Descale the heating element
    - Change anode rod
    - Change heating element
    - Change thermostat
    - Reset high limit switch

Reservoirs: Butler, Gregg, Upper & Lower Prune Hill, 18th Avenue, & Lacamas

- Visually inspect inside of reservoir using Liquivision and/or Tank Divers.
- Inspect and remove sediment.

Booster Pump Stations: Butler, Old & New Gregg, Upper & Lower Prune Hill, Angelo Forest Home, Green Mountain Estates, Lacamas, & Francis Rd

- Pump and motor maintained per manufacturer's instructions.
- Check control valves for proper operation.
- Check Operations Center files for each of the booster stations for instructions concerning equipment at pump station.

Diesel Powered Auxiliary Generators (Washougal Wellfield Facility, Well No. 13, New Gregg Booster Station, Angelo Booster Station, Lower Prune Hill Pump Station)

- Inspect radiator hoses.
- Change air cleaner element.
- Change crankcase oil and filter.
- Change coolant filter.
- Change fuel filters.
- Clean cooling system.
- Check block heater connections.

Distribution System

- Leak detection survey (as determined by maintenance staff).

Five Year Maintenance Activities

Pressure Reducing Valves

- Perform a comprehensive evaluation of the PRVs in the system. This is contracted through GC Systems.
- Quarterly inspect each station.

The City of Camas has two sources that require disinfection with a CT of 6 per the Washington State Department of Health. These are the Washougal Wellfield, Well No. 13, and the Slow Sand Filtration Treatment Plant. A summary of the CT calculations for each source is provided below.

Wells 7, 8, 10, 11 and 12

The Washougal Wellfield disinfection system must be capable of treating all flows from Wells 7, 8, 10, 11 and 12, which totals 5,300 gpm if all wells are operated at their full capacity simultaneously. In reality the total capacity of these five wells is approximately 4,700 gpm, when Well 6 and 13 are not in operation, due to wellfield and transmission main limitations. For the Washougal Wellfield Treatment Facility, a CT of 6 is obtained from a chlorine residual of not less than 1.0 mg/L and a minimum CT volume of 31,800 gallons in the transmission pipeline up to the connection to the distribution system at NE 22nd Avenue and Everett Street.

$$1.0 \text{ mg/L} \times 31{,}800 \text{ gal} \div 5{,}300 \text{ gal/min} = 6 \text{ mg-min/L}$$

CT Volume from the Washougal Wellfield Treatment Facility to NE 22nd Avenue and Everett Street is calculated as follows:

From Washougal Wellfield Treatment Facility toward Well No. 10:

$$(24\text{-inch}/(2 \times 12 \text{ inch/ft}))^2 \times \pi \times 286.6 \text{ feet} \times 7.48 \text{ gal/ft}^3 = 900 \text{ gallons}$$

North under/across Washougal river to connection with the 12-in line going east to connect to new 24-inch river crossing:

$$(14\text{-inch}/(2 \times 12 \text{ inch/ft}))^2 \times \pi \times 1{,}566.9 \text{ feet} \times 7.48 \text{ gal/ft}^3 = 12{,}512 \text{ gallons}$$

North to the intersection of NE 3rd Ave and E 1st Ave

$$(14\text{-inch}/(2 \times 12 \text{ inch/ft}))^2 \times \pi \times 820.3 \text{ feet} \times 7.48 \text{ gal/ft}^3 = 6{,}550 \text{ gallons}$$

North from NE 3rd Ave and E 1st Ave, to intersection of NE 22nd Ave and NE Everett Street:

$$(18\text{-inch}/(2 \times 12 \text{ inch/ft}))^2 \times \pi \times 5{,}111.7 \text{ feet} \times 7.48 \text{ gal/ft}^3 = 67{,}472 \text{ gallons}$$

$$\text{Total} = 87{,}434 \text{ gallons}$$

Thus the pipeline between the Washougal Wellfield and the first connection at NE 22nd Avenue and Everett Street provides adequate CT volume.

Well No. 13

Water from Well No. 13 and all other groundwater sources from the Washougal wellfield will first enter the distribution system either at the pressure reducing valve on NE 21st and Everett.

$$1.0 \text{ mg/L} \times 7{,}950 \text{ gal} \div 1{,}325 \text{ gal/min} = 6 \text{ mg-min/L}$$

CT Volume from Well 13 to 3rd Avenue is calculated as follows:

12-inch DI line from Well No. 13 injection point to existing 18-inch water line on SE Cramer:

$$(12\text{-inch}/(2 \times 12 \text{ inch/ft}))^2 \times \pi \times 50 \text{ ft} \times 7.48 \text{ gal/ft}^3 = 330 \text{ gal}$$

18-inch DI water line from SE Cramer connection to 18-inch water transmission line on 3rd Avenue:

$$(18\text{-inch}/(2 \times 12 \text{ inch/ft}))^2 \times \pi \times (140 \text{ ft} + 500 \text{ ft}) \times 7.48 \text{ gal}/\text{ft}^3 = 9{,}386 \text{ gal}$$

Total = 9,716 gallons

The total CT volume between the injection point inside the Well No. 13 facility to the connection at the 18-inch transmission line in 3rd Avenue is 9,716 gallons, therefore, the required CT volume of 7,950 gallons is provided prior to the 14-inch transmission line connection when a chlorine dose of 1.0 mg/L is provided.

Slow Sand Filtration Treatment Plant

The transmission mains connecting the new Slow Sand Filtration Treatment Plant to the distribution system will provide a CT of 60. The transmission pipeline will comprise approximately 15,500 feet of existing 10-inch transmission pipeline and approximately 7,300 feet of new 12-inch transmission pipeline. The point of connection to the distribution system will be at the intersection of NE 14th street and NE 277th Avenue. At 1,570 gpm, the transmission pipelines will provide a total of approximately 66 minutes of contact time for disinfection. The required CT is based on a chlorine residual of 1 mg/L at the point of connection to the distribution system.

$$1.0 \text{ mg/L} \times 106{,}122 \text{ gal} \div 1{,}570 \text{ gal/min} = 67 \text{ mg-min/L}$$

CT Volume from the Washougal Wellfield Treatment Facility to NE 22nd Avenue and Everett Street is calculated as follows:

From Slow Sand Filtration Treatment Plant to new 12-inch transmission pipeline:

$$(10\text{-inch}/(2 \times 12 \text{ inch/ft}))^2 \times \pi \times 15{,}500 \text{ feet} \times 7.48 \text{ gal}/\text{ft}^3 = 63{,}236 \text{ gallons}$$

North under/across Washougal river to connection with the 12-in line going east to connect to new 24-inch river crossing:

$$(12\text{-inch}/(2 \times 12 \text{ inch/ft}))^2 \times \pi \times 7{,}300 \text{ feet} \times 7.48 \text{ gal}/\text{ft}^3 = 42{,}886 \text{ gallons}$$

Total = 106,122 gallons

APPENDIX K

ANNUAL SUMMARY REPORTS (2021-2025)

Cross-Connection Control Activities (Blue)
Annual Summary Report (ASR) for 2021

PWS ID: **108002** PWS Name: **CAMAS MUNICIPAL WATER SEWER SYSTEM** County: **CLARK**

Part 1: Designated Cross-Connection Control Specialist (CCS) Information

CCS Name	Allen Nelson	**CCS Phone**	360-817-7287	**CCS Cert. #**	8187	**BAT Cert. #**	
CCS is: PWS owner or employee							

Part 2: Status of Cross-Connection Control (CCC) Program at End of 2021

Provide information about the status of your CCC Program at the end of the reporting year.

PWS has:	**A written CCC Program Plan**[1] ◉ Yes ○ No **CCC implementation activities**[2] ◉ Yes ○ No	**Program Plan Last Updated**[3] 10/04/2019

[1] Enter "Yes" if PWS has **any** type of written CCC Program Plan, policies, or procedures. Written CCC Program Plan must be part of a Water System Plan (WSP) or Small Water System Management Program (SWSMP).

[2] Enter "Yes" if PWS implemented **any** CCC Program activities during the reporting year, such as establishing legal authority, conducting hazard evaluations, requiring installation of backflow assemblies to protect the PWS, requiring assembly testing, maintaining CCC records, or enforcing the PWS's or CCC Program requirements.

[3] PWS can update the CCC Program Plan at any time (independent of WSP or SWSMP update).

Provide information regarding PWS's specific CCC Program Elements

Program Element Number	Description of Element [See WAC 246-290-490(3)]	This Program Element is:	
		Included in Written Program Plan	Being Implemented or Is Completed
1	**Legal Authority Established**	◉ Yes ○ No	◉ Yes ○ No
2	**Hazard Evaluation Procedures and Schedules**	◉ Yes ○ No	◉ Yes ○ No
3	**Procedures/Schedules for Ensuring Installation of Backflow Preventers**	◉ Yes ○ No	◉ Yes ○ No
4	**Certified CCS Provided**	◉ Yes ○ No	◉ Yes ○ No
5	**Backflow Preventer Inspection and Testing**	◉ Yes ○ No	◉ Yes ○ No

6	**Assembly Testing Quality Assurance/Quality Control (QA/QC) Program**	◉ Yes ○ No	◉ Yes ○ No
7	**Backflow Incident Response Procedures**	◉ Yes ○ No	◉ Yes ○ No
8	**Public Education Program**	◉ Yes ○ No	◉ Yes ○ No
9	**CCC Records**	◉ Yes ○ No	◉ Yes ○ No
10	**Reclaimed Water Permit**	○ Yes ○ No ◉ N/A	○ Yes ○ No ◉ N/A

Part 3A: PWS Characteristics at End of 2021

Enter the number of connections (new and existing) served by the PWS by type.

Type of Service Connection	Number
Residential (As defined by PWS)	9722
All Other (include dedicated fire lines, dedicated irrigation lines, and PWS-owned facilities such as water and wastewater treatment plants and pumping stations, parks, piers, and docks)	228
Total Number of Connections	9950

Part 3B: Cross-Connection Control for Severe and High-Hazard Premises and High-Hazard Dedicated Lines Served by the PWS

Item 2.

Answer the following questions carefully. These answers control your access to pages 2 and 3 for data entry.

1. Does your PWS serve any severe or high-hazard premises or any high-hazard dedicated fire or irrigation lines? (●) Yes ( ) No

2. Does PWS serve any high-hazard medical premises? (●) Yes ( ) No

- If you answer Yes to both questions, you must enter data in at least one row on page 2 and one row on page 3.
- If you answer Yes to Question 1 and No to Question 2, you must enter data on page 2 only.
- If you answer No to both questions, pages 2 and 3 will be grayed out to prevent data entry.

- Count only premises PWS serves water to.
- Report data as accurately as possible. **DOH currently bases CCC compliance actions on this information.**

Type of Severe or High-Hazard Premises or Dedicated Lines [WAC 246-290-490(4)(b)]	Number of Connections at end of 2021			
	A. Being Served Water by PWS[1]	B. With Premises Isolation by AG/RP[2]	C. With Column B AG Inspected or RP Tested[3]	D. Granted Exception from Premises Isolation
Agricultural (farms and dairies)				
Beverage bottling plants (including breweries)				
Car washes	2	2	2	0
Chemical plants				
Commercial laundries and dry cleaners	2	2	2	0
Both reclaimed water and potable water provided				
Film processing facilities				
Dedicated fire lines with chemical addition or using unapproved auxiliary supplies				
Food processing plants (including canneries, slaughter houses, rendering plants)				
Hospitals, medical centers, medical, dental and veterinary clinics, mortuaries, nursing homes, etc., reported on Part 3C page 3 (totals imported from page 3)	20	6	6	0
Dedicated irrigation systems using purveyor's water supply and chemical addition[4]				

Laboratories	1	1	1	0
Metal plating industries				
Petroleum processing or storage plants	4	4	4	0
Piers and docks				
Radioactive material processing plants or nuclear reactors				
Survey access denied or restricted				
Wastewater lift/pump stations (non-residential only)	9	9	9	0
Wastewater treatment plants	1	1	1	
Unapproved auxiliary water supply interconnected with potable water supply				
Other				
Commercial	26	26	26	0
Manufacturing	75	75	75	0
Totals	140	126	126	0

[1] Count multiple connections or parallel installations to the same premises as **separate** connections.

[2]Count only connections with premises isolation AGs or RPs. Don't include connections with in-premises preventers only or connections with DCVAs or DCDAs installed for premises isolation. The number in Column B can't be larger than the number in Column A in the same row.

[3] Count only connections whose premises isolation preventers were inspected (AGs) or tested (RPs) during the reporting year.

[4] For example, dedicated irrigation lines to parks, playgrounds, golf courses, cemeteries, estates, etc.

[5] Premises with hazardous materials or processes (requiring isolation by AG or RP), such as aircraft and automotive manufacturers, pulp and paper mills, metal manufacturers, military bases, and wholesale customers that pose a high hazard to the PWS. May be grouped together in categories, for example:"Other manufacturing" or "Other commercial".

Part 3C: Cross-Connection Control for High-Hazard Medical Premises Served by the PWS

- Count only medical premises PWS serves water to.
- Don't count the same premises more than once. If you serve different medical category premises through a single connection, count the connection under the medical category you consider to pose the highest hazard to PWS.
- Report data as accurately as possible. **DOH currently bases CCC compliance actions on this information**

Type of High-Hazard Medical Premises [WAC 246-290-490(4)(b)]	Number of Connections at end of 2021			
	A. Being Served Water by PWS[1]	B. With Premises Isolation by AG/RP[2]	C. With Column B AG Inspected or RP Tested[3]	D. Granted Exception from Premises Isolation
Hospitals				
Hospitals (include psychiatric hospitals and alcohol and drug treatment centers)				
Facilities for Treatment and Care of Patients Not Located in Hospitals Counted Above				
Same day surgery centers				
Out-patient clinics and offices				
Alternative health out-patient clinics and offices				
Psychiatric out-patient clinics and offices				
Chiropractors with water-connected X-ray equipment	6	0	0	0
Hospice care centers				
Childbirth centers				
Kidney dialysis centers				
Blood centers				
Dental clinics and offices	6	1	1	0
Facilities for Housing Patients				
Nursing homes	2	2	2	0
Assisted Living Facilities (formerly Boarding Homes)	3	0	0	0
Residential treatment centers				
Other Medical-Related Facilities				
Mortuaries with embalming equipment	2	2	2	0
Morgues and autopsy facilities (not in hospitals)				

Veterinarian offices, clinics and hospitals	1	1	1	0
Totals	20	6	6	0

[1] Count multiple connections or parallel installations to the same premises as **separate** connections.

[2]Count only connections with premises isolation AGs or RPs. Don’t include connections with in-premises preventers only or connections with DCVAs or DCDAs installed for premises isolation. The number in Column B can’t be larger than the number in Column A in the same row.

[3]Count only connections with premises isolation AGs or RPs. Don't include connections with in-premises backflow preventers only or connections with premises isolation DCVAs or DCDAs isolation.

Part 4A: Backflow Preventer Inventory and Testing Information for 2021

- Complete all fields. Enter **zero (0)**, if no backflow preventers in a specific category.
- Count only backflow preventers relied on to protect the PWS.
- Count AVBs on *irrigation systems only*. Select No to AVB question above Table 2 if PWS doesn't track AVBs.
- Count multiple tests (or failures) for the same backflow preventer as one test (or failure) for that backflow preventer.
- For multiple service connections or parallel installations, count each assembly separately.
- Count RPDAs and DCDAs as ***single*** assemblies. Count the tests of the mainline assembly and bypass assembly as ***one test***. Count the failure of either the mainline or bypass assembly (or the failure of both) as ***one failure***. Count an entire detector assembly taken out of service as ***one assembly removed from service***.
- Count assemblies installed on dedicated fire or irrigation lines as **Premises Isolation Assemblies** in Table 1.

	Backflow Preventer Category and Inspection/Testing Information	Air Gap	RPBA	RPDA	DCVA	DCDA	PVBA	SVBA	AVB
Table 1: Premises Isolation Preventers (include preventers isolating PWS-owned facilities)									
Existing Premises Isolation Backflow Preventers									
1	In service at beginning of 2021	0	63	1	2201	23			
2	Inspected and/or tested in 2021[1]	0	44	0	1557	18			
3	Failed inspection or test in 2021	0	6	0	14	0			
New Premises Isolation Backflow Preventers									
4	Installed in 2021[2]	0	0	0	26	0			
5	Inspected and/or tested in 2021[1]	0	0	0	26	0			
6	Failed inspection or test in 2021	0	0	0	0	0			
Premises Isolation Backflow Preventers (existing or new)									
7	Removed from service in 2021[3]	0	0	0	16	0			
Total Premises Isolation Preventers at End of 2021		0	63	1	2211	23	0	0	0

Does PWS track AVBs on irrigation systems? ○ Yes ◉ No

	Table 2: In-Premises Preventers (include preventers within PWS-owned facilities)								
Existing In-Premises Backflow Preventers									
8	In service at beginning of 2021	0	126	1	1104	21	10	1	unk
9	Inspected and/or tested in 2021[1]	0	109	1	907	18	10	0	unk
10	Failed inspection or test in 2021	0	8	0	9	0	0	0	

New In-Premises Backflow Preventers									
11	Installed in 2021[2]	0	3	0	167	2	1	0	unk
12	Inspected and/or tested in 2021[1]	0	3	0	164	2	1	0	unk
13	Failed inspection or test in 2021	0	2	0	0	0	0	0	unk
In-Premises Backflow Preventers (existing or new)									
14	Removed from service in 2021[3]	0	0	0	5	0	1	0	unk
Total In-Premises Preventers at End of 2021[4]		**0**	**129**	**1**	**1266**	**23**	**10**	**1**	**0**
Grand Totals at End of 2021		**0**	**192**	**2**	**3477**	**46**	**10**	**1**	**0**

[1] Initial and/or routine annual inspection (for proper installation and approval status) and/or test (for testable assemblies only, using DOH-approved USC field test procedures).

[2] Includes preventers installed on connections where backflow prevention was not previously required and any preventers that replaced those in service at the beginning of the reporting year. Replacement preventers may be of a different type than the originals.

[3] Existing or new preventers taken out of service, whether or not they were replaced by the same or a different type of preventer.

Part 4B: Other Implementation Activities in 2021

Complete all cells. Enter zero if not applicable.

Water Use Questionnaires	
Did your PWS send any water use questionnaires to customers during 2021?	○ Yes ◉ No

On-site Hazard Surveys				
Did your CCS conduct any on-site hazard surveys during 2021?				○ Yes ◉ No
	Service Connection Type			
	New	**Existing**	**Total**	
1. Number of connections surveyed for cross-connection hazards to PWS.			0	
2. Number of connections requiring backflow prevention to protect PWS.[1,2]			0	

New Exceptions to Premises Isolation	
Did your CCS grant any new premises isolation exceptions in 2021 to high-hazard premises?[3]	○ Yes ◉ No

CCC Enforcement Actions	
Did your PWS take any enforcement actions during 2021?[4]	○ Yes ◉ No

[1] Include services where either premises isolation or in-premises preventers were required to protect the PWS.

[2] Include existing services that need new, additional or higher level backflow prevention.

[3] Submit a completed DOH Exception Form (green) for each new exception granted in the reporting year.

[4] "Enforcement actions" means actions taken by the PWS (such as water shut-off, PWS installation or testing of backflow preventer, assessment of fines, etc.) when the customer fails to comply with the PWS's CCC requirements.

Part 5: Backflow Incidents and "Off-Normal" Events in 2021

	Backflow Incidents, Risk Factors, and Indicators during 2021	Number
Backflow Incidents during 2021		
1	Backflow incidents that contaminated the PWS[5].	0
2	Backflow incidents that contaminated the customer's drinking water system ***only***[5].	0

Risk Factors for Backflow during 2021		
3	Distribution main breaks per 100 miles of pipe.	10.00
4	Low pressure events (<20 psi in PWS distribution system).	0
5	Water outage events.	0
Indicators of Possible Backflow during 2021		
6	Total health-related complaints received by PWS.[6]	0
7	Received during BWA or PN events.[7]	0
8	Received during low pressure or water outage events.	0
9	Total aesthetic complaints (color, taste, odor, air in lines, etc.).	6
10	Received during BWA or PN events.[7]	0
11	Number of these complaints received during low pressure or water outage events.	0

[5] Purveyors must submit a Backflow Incident Report form for each backflow incident known to have contaminated the public water system. DOH is also interested in receiving incident report forms for backflow incidents that contaminated the customer's drinking water system only.

[6] Such as stomach ache, headache, vomiting, diarrhea, skin rashes, etc.

[7] **"BWA"** means **Boil Water Advisory** and **"PN"** means **Public Notification** for water quality reasons.

Part 6: Comments and Clarifications

- Enter comments to:
  - Explain or clarify information in this report.
  - Describe challenges faced or accomplishments made in this reporting year.
  - Share your goals and objectives for the coming reporting year.
- Delete comments that are no longer valid.

Part No.	Date Added	Comments
Pt 1	04-18-2019	Updated back flow software to XC2. in March 2019.Still working on migrating and merging.
Pt 1	05-07-2021	The numbers reflecting 2019 service connections is believed to have been an estimate. The actual number of service connections at the end of 2020 were obtained from our financial analyst who deals directly with the tracking of new and existing service connections.
Pt 1	05-07-2021	The actual number of service connections for 2019 is: Residential-8635 All Other: 273 esidential 8635
Pt 1	05-18-2021	Our previous Backflow manager just recently retired. And since I do not yet have a complete understanding of our new XC2 tracking program and I am unable to locate some of the information that may need to be 100% confident in my report for the 2020 ASR. My plan for 2021 is to ensure that we have at least one more CCS on board, dedicated to the cross connection program as well as finding classes for those who are not up to speed with all the regulations pertaining to cross connection control. And to begin conducting surveys at some the various facilities around the City. , in or to be as accurate as possible with our CCC program.
Pt 1	03-18-2022	We are still trying to get up to speed with our CCC program. Previous information beyond 2020 is still being corrected and numbers on record aren't entirely correct with what we are finding in the field when we are able to access. We are still working on building a stronger more stringent program and I hope to have a couple of certified operators this year dedicated to the program and begin overdo hazard assessments as well as working closer with the building department on new construction.

Part 7: Report Certification and Contact Information

I, Allen Nelson , certify that the information in this form is true, complete and accurate to the best of my knowledge.

Last Saved	03/21/2022	**All ASR Forms Certified/Submitted**	03/21/2022

Designated CCS/CCC Program Manager[1]					
Name	Allen Nelson	**Title**	Water Supply Operator	**CCS Cert #**	8187
Email Address	anelson@cityofcamas.us	**Phone**	360-817-7287	**Phone Ext**	

PWS Manager[2]					
Name	Allen Nelson	**Title**	Water Supply Operator	**Operator Cert #**	8187
Email Address	anelson@cityofcamas.us	**Phone**	360-817-7287	**Phone Ext**	

[1] The CCS responsible for developing and implementing the PWS's CCC program (CCC Program Manager).

[2] The person the designated CCS/CCC Program Manager reports to or other manager having direct oversight of the CCC Program.

Cross-Connection Control Activities (Blue)
Annual Summary Report (ASR) for 2022

PWS ID: **108002** PWS Name: **CAMAS MUNICIPAL WATER SEWER SYSTEM** County: **CLARK**

Part 1: Designated Cross-Connection Control Specialist (CCS) Information

CCS Name	Allen Nelson	CCS Phone	360-817-7287	CCS Cert. #	8187	BAT Cert. #	
CCS is: PWS owner or employee							

Part 2: Status of Cross-Connection Control (CCC) Program at End of 2022

Provide information about the status of your CCC Program at the end of the reporting year.

PWS has:	**A written CCC Program Plan**[1] ◉ Yes ○ No **CCC implementation activities**[2] ◉ Yes ○ No	**Program Plan Last Updated**[3] 10/04/2019

[1] Enter "Yes" if PWS has **any** type of written CCC Program Plan, policies, or procedures. Written CCC Program Plan must be part of a Water System Plan (WSP) or Small Water System Management Program (SWSMP).

[2] Enter "Yes" if PWS implemented **any** CCC Program activities during the reporting year, such as establishing legal authority, conducting hazard evaluations, requiring installation of backflow assemblies to protect the PWS, requiring assembly testing, maintaining CCC records, or enforcing the PWS's or CCC Program requirements.

[3] PWS can update the CCC Program Plan at any time (independent of WSP or SWSMP update).

Provide information regarding PWS's specific CCC Program Elements

Program Element Number	Description of Element [See WAC 246-290-490(3)]	This Program Element is:	
		Included in Written Program Plan	Being Implemented or Is Completed
1	**Legal Authority Established**	◉ Yes ○ No	◉ Yes ○ No
2	**Hazard Evaluation Procedures and Schedules**	◉ Yes ○ No	◉ Yes ○ No
3	**Procedures/Schedules for Ensuring Installation of Backflow Preventers**	◉ Yes ○ No	◉ Yes ○ No
4	**Certified CCS Provided**	◉ Yes ○ No	◉ Yes ○ No
5	**Backflow Preventer Inspection and Testing**	◉ Yes ○ No	◉ Yes ○ No

6	**Assembly Testing Quality Assurance/Quality Control (QA/QC) Program**	◉ Yes ○ No	◉ Yes ○ No
7	**Backflow Incident Response Procedures**	◉ Yes ○ No	◉ Yes ○ No
8	**Public Education Program**	◉ Yes ○ No	◉ Yes ○ No
9	**CCC Records**	◉ Yes ○ No	◉ Yes ○ No
10	**Reclaimed Water Permit**	○ Yes ○ No ◉ N/A	○ Yes ○ No ◉ N/A

Part 3A: PWS Characteristics at End of 2022

Enter the number of connections (new and existing) served by the PWS by type.

Type of Service Connection	Number
Residential (As defined by PWS)	9722
All Other (include dedicated fire lines, dedicated irrigation lines, and PWS-owned facilities such as water and wastewater treatment plants and pumping stations, parks, piers, and docks)	228
Total Number of Connections	9950

Part 3B: Cross-Connection Control for Severe and High-Hazard Premises and High-Hazard Dedicated Lines Served by the PWS

Item 2.

Answer the following questions carefully. These answers control your access to pages 2 and 3 for data entry.

1. Does your PWS serve any severe or high-hazard premises or any high-hazard dedicated fire or irrigation lines? (●) Yes ( ) No

2. Does PWS serve any high-hazard medical premises? (●) Yes ( ) No

- If you answer Yes to both questions, you must enter data in at least one row on page 2 and one row on page 3.
- If you answer Yes to Question 1 and No to Question 2, you must enter data on page 2 only.
- If you answer No to both questions, pages 2 and 3 will be grayed out to prevent data entry.

- Count only premises PWS serves water to.
- Report data as accurately as possible. **DOH currently bases CCC compliance actions on this information.**

Type of Severe or High-Hazard Premises or Dedicated Lines [WAC 246-290-490(4)(b)]	Number of Connections at end of 2022			
	A. Being Served Water by PWS[1]	B. With Premises Isolation by AG/RP[2]	C. With Column B AG Inspected or RP Tested[3]	D. Granted Exception from Premises Isolation
Agricultural (farms and dairies)				
Beverage bottling plants (including breweries)				
Car washes	2	2	2	0
Chemical plants				
Commercial laundries and dry cleaners	2	2	2	0
Both reclaimed water and potable water provided				
Film processing facilities				
Dedicated fire lines with chemical addition or using unapproved auxiliary supplies				
Food processing plants (including canneries, slaughter houses, rendering plants)				
Hospitals, medical centers, medical, dental and veterinary clinics, mortuaries, nursing homes, etc., reported on Part 3C page 3 (totals imported from page 3)	20	6	6	0
Dedicated irrigation systems using purveyor's water supply and chemical addition[4]				

Laboratories	1	1	1	0
Metal plating industries				
Petroleum processing or storage plants	4	4	4	0
Piers and docks				
Radioactive material processing plants or nuclear reactors				
Survey access denied or restricted				
Wastewater lift/pump stations (non-residential only)	9	9	9	0
Wastewater treatment plants	1	1	1	
Unapproved auxiliary water supply interconnected with potable water supply				
Totals	39	25	25	0

[1] Count multiple connections or parallel installations to the same premises as **separate** connections.

[2]Count only connections with premises isolation AGs or RPs. Don't include connections with in-premises preventers only or connections with DCVAs or DCDAs installed for premises isolation. The number in Column B can't be larger than the number in Column A in the same row.

[3] Count only connections whose premises isolation preventers were inspected (AGs) or tested (RPs) during the reporting year.

[4] For example, dedicated irrigation lines to parks, playgrounds, golf courses, cemeteries, estates, etc.

[5] Premises with hazardous materials or processes (requiring isolation by AG or RP), such as aircraft and automotive manufacturers, pulp and paper mills, metal manufacturers, military bases, and wholesale customers that pose a high hazard to the PWS. May be grouped together in categories, for example:"Other manufacturing" or "Other commercial".

Part 3C: Cross-Connection Control for High-Hazard Medical Premises Served by the PWS

- Count only medical premises PWS serves water to.
- Don't count the same premises more than once. If you serve different medical category premises through a single connection, count the connection under the medical category you consider to pose the highest hazard to PWS.
- Report data as accurately as possible. **DOH currently bases CCC compliance actions on this information**

Type of High-Hazard Medical Premises [WAC 246-290-490(4)(b)]	Number of Connections at end of 2022			
	A. Being Served Water by PWS[1]	B. With Premises Isolation by AG/RP[2]	C. With Column B AG Inspected or RP Tested[3]	D. Granted Exception from Premises Isolation
Hospitals				
Hospitals (include psychiatric hospitals and alcohol and drug treatment centers)				
Facilities for Treatment and Care of Patients Not Located in Hospitals Counted Above				
Same day surgery centers				
Out-patient clinics and offices				
Alternative health out-patient clinics and offices				
Psychiatric out-patient clinics and offices				
Chiropractors with water-connected X-ray equipment	6	0	0	0
Hospice care centers				
Childbirth centers				
Kidney dialysis centers				
Blood centers				
Dental clinics and offices	6	1	1	0
Facilities for Housing Patients				
Nursing homes	2	2	2	0
Assisted Living Facilities (formerly Boarding Homes)	3	0	0	0
Residential treatment centers				
Other Medical-Related Facilities				
Mortuaries with embalming equipment	2	2	2	0
Morgues and autopsy facilities (not in hospitals)				

Veterinarian offices, clinics and hospitals	1	1	1	0
Totals	20	6	6	0

[1] Count multiple connections or parallel installations to the same premises as **separate** connections.

[2]Count only connections with premises isolation AGs or RPs. Don’t include connections with in-premises preventers only or connections with DCVAs or DCDAs installed for premises isolation. The number in Column B can’t be larger than the number in Column A in the same row.

[3]Count only connections with premises isolation AGs or RPs. Don't include connections with in-premises backflow preventers only or connections with premises isolation DCVAs or DCDAs isolation.

Part 4A: Backflow Preventer Inventory and Testing Information for 2022

- Complete all fields. Enter **zero (0)**, if no backflow preventers in a specific category.
- Count only backflow preventers relied on to protect the PWS.
- Count AVBs on *irrigation systems only*. Select No to AVB question above Table 2 if PWS doesn't track AVBs.
- Count multiple tests (or failures) for the same backflow preventer as one test (or failure) for that backflow preventer.
- For multiple service connections or parallel installations, count each assembly separately.
- Count RPDAs and DCDAs as ***single*** assemblies. Count the tests of the mainline assembly and bypass assembly as ***one test***. Count the failure of either the mainline or bypass assembly (or the failure of both) as ***one failure***. Count an entire detector assembly taken out of service as ***one assembly removed from service***.
- Count assemblies installed on dedicated fire or irrigation lines as **Premises Isolation Assemblies** in Table 1.

	Backflow Preventer Category and Inspection/Testing Information	Air Gap	RPBA	RPDA	DCVA	DCDA	PVBA	SVBA	AVB
Table 1: Premises Isolation Preventers (include preventers isolating PWS-owned facilities)									
Existing Premises Isolation Backflow Preventers									
1	In service at beginning of 2022	0	63	1	2677	49			
2	Inspected and/or tested in 2022[1]	0	44	0	2275	22			
3	Failed inspection or test in 2022	0	6	0	109	1			
New Premises Isolation Backflow Preventers									
4	Installed in 2022[2]	0	6	0	419	0			
5	Inspected and/or tested in 2022[1]	0	6	0	419	0			
6	Failed inspection or test in 2022	0	0	0	2	0			
Premises Isolation Backflow Preventers (existing or new)									
7	Removed from service in 2022[3]	0	1	0	25	0			
Total Premises Isolation Preventers at End of 2022		0	68	1	3071	49	0	0	0
	Does PWS track AVBs on irrigation systems? ○ Yes ◉ No								
Table 2: In-Premises Preventers (include preventers within PWS-owned facilities)									
Existing In-Premises Backflow Preventers									
8	In service at beginning of 2022	0	72	1	510	21	10	1	unk
9	Inspected and/or tested in 2022[1]	0	70	1	499	18	10	1	unk
10	Failed inspection or test in 2022	0	2	0	11	0	0	0	

New In-Premises Backflow Preventers									
11	Installed in 2022[2]	0	0	0	11	0	0	0	unk
12	Inspected and/or tested in 2022[1]	0	0	0	11	0	0	0	unk
13	Failed inspection or test in 2022	0	0	0	2	0	0	0	unk
In-Premises Backflow Preventers (existing or new)									
14	Removed from service in 2022[3]	0	0	0	0	0	0	0	unk
Total In-Premises Preventers at End of 2022[4]		**0**	**72**	**1**	**521**	**21**	**10**	**1**	**0**
Grand Totals at End of 2022		**0**	**140**	**2**	**3592**	**70**	**10**	**1**	**0**

[1] Initial and/or routine annual inspection (for proper installation and approval status) and/or test (for testable assemblies only, using DOH-approved USC field test procedures).

[2] Includes preventers installed on connections where backflow prevention was not previously required and any preventers that replaced those in service at the beginning of the reporting year. Replacement preventers may be of a different type than the originals.

[3] Existing or new preventers taken out of service, whether or not they were replaced by the same or a different type of preventer.

Part 4B: Other Implementation Activities in 2022

Complete all cells. Enter zero if not applicable.

Water Use Questionnaires	
Did your PWS send any water use questionnaires to customers during 2022?	○ Yes ◉ No

On-site Hazard Surveys				
Did your CCS conduct any on-site hazard surveys during 2022?				○ Yes ◉ No
	Service Connection Type			
	New	**Existing**	**Total**	
1. Number of connections surveyed for cross-connection hazards to PWS.			0	
2. Number of connections requiring backflow prevention to protect PWS.[1,2]			0	

New Exceptions to Premises Isolation	
Did your CCS grant any new premises isolation exceptions in 2022 to high-hazard premises?[3]	○ Yes ◉ No

CCC Enforcement Actions	
Did your PWS take any enforcement actions during 2022?[4]	○ Yes ◉ No

[1] Include services where either premises isolation or in-premises preventers were required to protect the PWS.

[2] Include existing services that need new, additional or higher level backflow prevention.

[3] Submit a completed DOH Exception Form (green) for each new exception granted in the reporting year.

[4] "Enforcement actions" means actions taken by the PWS (such as water shut-off, PWS installation or testing of backflow preventer, assessment of fines, etc.) when the customer fails to comply with the PWS's CCC requirements.

Part 5: Backflow Incidents and "Off-Normal" Events in 2022

	Backflow Incidents, Risk Factors, and Indicators during 2022	Number
Backflow Incidents during 2022		
1	Backflow incidents that contaminated the PWS[5].	0
2	Backflow incidents that contaminated the customer's drinking water system ***only***[5].	0

Risk Factors for Backflow during 2022		
3	Distribution main breaks per 100 miles of pipe.	7.00
4	Low pressure events (<20 psi in PWS distribution system).	0
5	Water outage events.	0
Indicators of Possible Backflow during 2022		
6	Total health-related complaints received by PWS.[6]	0
7	Received during BWA or PN events.[7]	0
8	Received during low pressure or water outage events.	0
9	Total aesthetic complaints (color, taste, odor, air in lines, etc.).	1
10	Received during BWA or PN events.[7]	0
11	Number of these complaints received during low pressure or water outage events.	0

[5] Purveyors must submit a Backflow Incident Report form for each backflow incident known to have contaminated the public water system. DOH is also interested in receiving incident report forms for backflow incidents that contaminated the customer's drinking water system only.

[6] Such as stomach ache, headache, vomiting, diarrhea, skin rashes, etc.

[7] **"BWA"** means **Boil Water Advisory** and **"PN"** means **Public Notification** for water quality reasons.

Part 6: Comments and Clarifications

- Enter comments to:
  - Explain or clarify information in this report.
  - Describe challenges faced or accomplishments made in this reporting year.
  - Share your goals and objectives for the coming reporting year.
- Delete comments that are no longer valid.

Part No.	Date Added	Comments
Pt 1	04-18-2019	Updated back flow software to XC2. in March 2019.Still working on migrating and merging.
Pt 1	05-07-2021	The numbers reflecting 2019 service connections is believed to have been an estimate. The actual number of service connections at the end of 2020 were obtained from our financial analyst who deals directly with the tracking of new and existing service connections.
Pt 1	05-07-2021	The actual number of service connections for 2019 is: Residential-8635 All Other: 273 esidential 8635
Pt 1	05-18-2021	Our previous Backflow manager just recently retired. And since I do not yet have a complete understanding of our new XC2 tracking program and I am unable to locate some of the information that may need to be 100% confident in my report for the 2020 ASR. My plan for 2021 is to ensure that we have at least one more CCS on board, dedicated to the cross connection program as well as finding classes for those who are not up to speed with all the regulations pertaining to cross connection control. And to begin conducting surveys at some the various facilities around the City. , in or to be as accurate as possible with our CCC program.
Pt 1	03-18-2022	We are still trying to get up to speed with our CCC program. Previous information beyond 2020 is still being corrected and numbers on record aren't entirely correct with what we are finding in the field when we are able to access. We are still working on building a stronger more stringent program and I hope to have a couple of certified operators this year dedicated to the program and begin overdo hazard assessments as well as working closer with the building department on new construction.
Pt 1	01-19-2023	We are looking at a dedicated CCCS to hire this year that will begin a more in-depth investigation on the commercial and industrial side of our customers. We have also begun working closer with our building department regarding new construction.
Pt 1	04-10-2023	There are numbers this year that don't coincide with last year's numbers because we have someone dedidcated to data entry for our CCC program and she has been digging into past information and doing a bit of updating.

Part 7: Report Certification and Contact Information

I, Allen Nelson , certify that the information in this form is true, complete and accurate to the best of my knowledge.

Last Saved	04/10/2023	**All ASR Forms Certified/Submitted**	04/10/2023

Designated CCS/CCC Program Manager[1]					
Name	Allen Nelson	**Title**	Water Supply Operator	**CCS Cert #**	8187
Email Address	anelson@cityofcamas.us	**Phone**	360-817-7287	**Phone Ext**	

PWS Manager[2]					
Name	Allen Nelson	**Title**	Water Supply Operator	**Operator Cert #**	8187
Email Address	anelson@cityofcamas.us	**Phone**	360-817-7287	**Phone Ext**	

[1] The CCS responsible for developing and implementing the PWS's CCC program (CCC Program Manager).

[2] The person the designated CCS/CCC Program Manager reports to or other manager having direct oversight of the CCC Program.

Cross-Connection Control Activities (Blue)
Annual Summary Report (ASR) for 2023

PWS ID: **108002** PWS Name: **CAMAS MUNICIPAL WATER SEWER SYSTEM** County: **CLARK**

Part 1: Designated Cross-Connection Control Specialist (CCS) Information

CCS Name	Allen Nelson	CCS Phone	360-817-7287	CCS Cert. #	8187	BAT Cert. #	
CCS is: PWS owner or employee							

Part 2: Status of Cross-Connection Control (CCC) Program at End of 2023

Provide information about the status of your CCC Program at the end of the reporting year.

PWS has:	**A written CCC Program Plan**[1] ◉ Yes ○ No **CCC implementation activities**[2] ◉ Yes ○ No	**Program Plan Last Updated**[3] 10/04/2019

[1] Enter "Yes" if PWS has **any** type of written CCC Program Plan, policies, or procedures. Written CCC Program Plan must be part of a Water System Plan (WSP) or Small Water System Management Program (SWSMP).

[2] Enter "Yes" if PWS implemented **any** CCC Program activities during the reporting year, such as establishing legal authority, conducting hazard evaluations, requiring installation of backflow assemblies to protect the PWS, requiring assembly testing, maintaining CCC records, or enforcing the PWS's or CCC Program requirements.

[3] PWS can update the CCC Program Plan at any time (independent of WSP or SWSMP update).

Provide information regarding PWS's specific CCC Program Elements

Program Element Number	Description of Element [See WAC 246-290-490(3)]	This Program Element is:	
		Included in Written Program Plan	Being Implemented or Is Completed
1	**Legal Authority Established**	◉ Yes ○ No	◉ Yes ○ No
2	**Hazard Evaluation Procedures and Schedules**	◉ Yes ○ No	◉ Yes ○ No
3	**Procedures/Schedules for Ensuring Installation of Backflow Preventers**	◉ Yes ○ No	◉ Yes ○ No
4	**Certified CCS Provided**	◉ Yes ○ No	◉ Yes ○ No
5	**Backflow Preventer Inspection and Testing**	◉ Yes ○ No	◉ Yes ○ No

6	**Assembly Testing Quality Assurance/Quality Control (QA/QC) Program**	◉ Yes ○ No	◉ Yes ○ No
7	**Backflow Incident Response Procedures**	◉ Yes ○ No	◉ Yes ○ No
8	**Public Education Program**	◉ Yes ○ No	◉ Yes ○ No
9	**CCC Records**	◉ Yes ○ No	◉ Yes ○ No
10	**Reclaimed Water Permit**	○ Yes ○ No ◉ N/A	○ Yes ○ No ◉ N/A

Part 3A: PWS Characteristics at End of 2023

Enter the number of connections (new and existing) served by the PWS by type.

Type of Service Connection	Number
Residential (As defined by PWS)	9722
All Other (include dedicated fire lines, dedicated irrigation lines, and PWS-owned facilities such as water and wastewater treatment plants and pumping stations, parks, piers, and docks)	228
Total Number of Connections	9950

Part 3B: Cross-Connection Control for Severe and High-Hazard Premises and High-Hazard Dedicated Lines Served by the PWS

Item 2.

Answer the following questions carefully. These answers control your access to pages 2 and 3 for data entry.

1. Does your PWS serve any severe or high-hazard premises or any high-hazard dedicated fire or irrigation lines? (●) Yes ( ) No

2. Does PWS serve any high-hazard medical premises? (●) Yes ( ) No

- If you answer Yes to both questions, you must enter data in at least one row on page 2 and one row on page 3.
- If you answer Yes to Question 1 and No to Question 2, you must enter data on page 2 only.
- If you answer No to both questions, pages 2 and 3 will be grayed out to prevent data entry.

- Count only premises PWS serves water to.
- Report data as accurately as possible. **DOH currently bases CCC compliance actions on this information.**

Type of Severe or High-Hazard Premises or Dedicated Lines [WAC 246-290-490(4)(b)]	Number of Connections at end of 2023			
	A. Being Served Water by PWS[1]	B. With Premises Isolation by AG/RP[2]	C. With Column B AG Inspected or RP Tested[3]	D. Granted Exception from Premises Isolation
Agricultural (farms and dairies)				
Beverage bottling plants (including breweries)				
Car washes	2	2	2	0
Chemical plants				
Commercial laundries and dry cleaners	2	2	2	0
Both reclaimed water and potable water provided				
Film processing facilities				
Dedicated fire lines with chemical addition or using unapproved auxiliary supplies				
Food processing plants (including canneries, slaughter houses, rendering plants)				
Hospitals, medical centers, medical, dental and veterinary clinics, mortuaries, nursing homes, etc., reported on Part 3C page 3 (totals imported from page 3)	20	6	6	0
Dedicated irrigation systems using purveyor's water supply and chemical addition[4]				

Laboratories	1	1	1	0
Metal plating industries				
Petroleum processing or storage plants	4	4	4	0
Piers and docks				
Radioactive material processing plants or nuclear reactors				
Survey access denied or restricted				
Wastewater lift/pump stations (non-residential only)	9	9	9	0
Wastewater treatment plants	1	1	1	
Unapproved auxiliary water supply interconnected with potable water supply				
Totals	39	25	25	0

[1] Count multiple connections or parallel installations to the same premises as **separate** connections.

[2]Count only connections with premises isolation AGs or RPs. Don't include connections with in-premises preventers only or connections with DCVAs or DCDAs installed for premises isolation. The number in Column B can't be larger than the number in Column A in the same row.

[3] Count only connections whose premises isolation preventers were inspected (AGs) or tested (RPs) during the reporting year.

[4] For example, dedicated irrigation lines to parks, playgrounds, golf courses, cemeteries, estates, etc.

[5] Premises with hazardous materials or processes (requiring isolation by AG or RP), such as aircraft and automotive manufacturers, pulp and paper mills, metal manufacturers, military bases, and wholesale customers that pose a high hazard to the PWS. May be grouped together in categories, for example:"Other manufacturing" or "Other commercial".

Part 3C: Cross-Connection Control for High-Hazard Medical Premises Served by the PWS

- Count only medical premises PWS serves water to.
- Don't count the same premises more than once. If you serve different medical category premises through a single connection, count the connection under the medical category you consider to pose the highest hazard to PWS.
- Report data as accurately as possible. **DOH currently bases CCC compliance actions on this information**

Type of High-Hazard Medical Premises [WAC 246-290-490(4)(b)]	Number of Connections at end of 2023			
	A. Being Served Water by PWS[1]	B. With Premises Isolation by AG/RP[2]	C. With Column B AG Inspected or RP Tested[3]	D. Granted Exception from Premises Isolation
Hospitals				
Hospitals (include psychiatric hospitals and alcohol and drug treatment centers)				
Facilities for Treatment and Care of Patients Not Located in Hospitals Counted Above				
Same day surgery centers				
Out-patient clinics and offices				
Alternative health out-patient clinics and offices				
Psychiatric out-patient clinics and offices				
Chiropractors with water-connected X-ray equipment	6	0	0	0
Hospice care centers				
Childbirth centers				
Kidney dialysis centers				
Blood centers				
Dental clinics and offices	6	1	1	0
Facilities for Housing Patients				
Nursing homes	2	2	2	0
Assisted Living Facilities (formerly Boarding Homes)	3	0	0	0
Residential treatment centers				
Other Medical-Related Facilities				
Mortuaries with embalming equipment	2	2	2	0
Morgues and autopsy facilities (not in hospitals)				

Veterinarian offices, clinics and hospitals	1	1	1	0
Totals	20	6	6	0

[1] Count multiple connections or parallel installations to the same premises as **separate** connections.

[2]Count only connections with premises isolation AGs or RPs. Don’t include connections with in-premises preventers only or connections with DCVAs or DCDAs installed for premises isolation. The number in Column B can’t be larger than the number in Column A in the same row.

[3]Count only connections with premises isolation AGs or RPs. Don't include connections with in-premises backflow preventers only or connections with premises isolation DCVAs or DCDAs isolation.

Part 4A: Backflow Preventer Inventory and Testing Information for 2023

- Complete all fields. Enter **zero (0)**, if no backflow preventers in a specific category.
- Count only backflow preventers relied on to protect the PWS.
- Count AVBs on *irrigation systems only*. Select No to AVB question above Table 2 if PWS doesn't track AVBs.
- Count multiple tests (or failures) for the same backflow preventer as one test (or failure) for that backflow preventer.
- For multiple service connections or parallel installations, count each assembly separately.
- Count RPDAs and DCDAs as ***single*** assemblies. Count the tests of the mainline assembly and bypass assembly as ***one test***. Count the failure of either the mainline or bypass assembly (or the failure of both) as ***one failure***. Count an entire detector assembly taken out of service as ***one assembly removed from service***.
- Count assemblies installed on dedicated fire or irrigation lines as **Premises Isolation Assemblies** in Table 1.

	Backflow Preventer Category and Inspection/Testing Information	Air Gap	RPBA	RPDA	DCVA	DCDA	PVBA	SVBA	AVB
Table 1: Premises Isolation Preventers (include preventers isolating PWS-owned facilities)									
Existing Premises Isolation Backflow Preventers									
1	In service at beginning of 2023	0	183	3	4020	48			
2	Inspected and/or tested in 2023[1]	0	147	2	3418	37			
3	Failed inspection or test in 2023	0	21	1	91	3			
New Premises Isolation Backflow Preventers									
4	Installed in 2023[2]	0	3	0	100	0			
5	Inspected and/or tested in 2023[1]	0	3	0	100	0			
6	Failed inspection or test in 2023	0	0	0	6	0			
Premises Isolation Backflow Preventers (existing or new)									
7	Removed from service in 2023[3]	0	0	0	13	0			
Total Premises Isolation Preventers at End of 2023		0	186	3	4107	48	0	0	0

Does PWS track AVBs on irrigation systems? ○ Yes ◉ No

	Table 2: In-Premises Preventers (include preventers within PWS-owned facilities)								
Existing In-Premises Backflow Preventers									
8	In service at beginning of 2023	0	0	0	12	0	22	0	unk
9	Inspected and/or tested in 2023[1]	0	0	0	9	0	17	0	unk
10	Failed inspection or test in 2023	0	0	0	0	0	2	0	

New In-Premises Backflow Preventers									
11	Installed in 2023[2]	0	0	0	0	0	0	0	unk
12	Inspected and/or tested in 2023[1]	0	0	0	0	0	0	0	unk
13	Failed inspection or test in 2023	0	0	0	0	0	0	0	unk
In-Premises Backflow Preventers (existing or new)									
14	Removed from service in 2023[3]	0	0	0	0	0	0	0	unk
	Total In-Premises Preventers at End of 2023[4]	0	0	0	12	0	22	0	0
	Grand Totals at End of 2023	0	186	3	4119	48	22	0	0

[1] Initial and/or routine annual inspection (for proper installation and approval status) and/or test (for testable assemblies only, using DOH-approved USC field test procedures).

[2] Includes preventers installed on connections where backflow prevention was not previously required and any preventers that replaced those in service at the beginning of the reporting year. Replacement preventers may be of a different type than the originals.

[3] Existing or new preventers taken out of service, whether or not they were replaced by the same or a different type of preventer.

Part 4B: Other Implementation Activities in 2023

Complete all cells. Enter zero if not applicable.

Water Use Questionnaires	
Did your PWS send any water use questionnaires to customers during 2023?	○ Yes ◉ No

On-site Hazard Surveys				
Did your CCS conduct any on-site hazard surveys during 2023?				○ Yes ◉ No
	Service Connection Type			
	New	**Existing**	**Total**	
1. Number of connections surveyed for cross-connection hazards to PWS.			0	
2. Number of connections requiring backflow prevention to protect PWS.[1,2]			0	

New Exceptions to Premises Isolation	
Did your CCS grant any new premises isolation exceptions in 2023 to high-hazard premises?[3]	○ Yes ◉ No

CCC Enforcement Actions	
Did your PWS take any enforcement actions during 2023?[4]	○ Yes ◉ No

[1] Include services where either premises isolation or in-premises preventers were required to protect the PWS.

[2] Include existing services that need new, additional or higher level backflow prevention.

[3] Submit a completed DOH Exception Form (green) for each new exception granted in the reporting year.

[4] "Enforcement actions" means actions taken by the PWS (such as water shut-off, PWS installation or testing of backflow preventer, assessment of fines, etc.) when the customer fails to comply with the PWS's CCC requirements.

Part 5: Backflow Incidents and "Off-Normal" Events in 2023

	Backflow Incidents, Risk Factors, and Indicators during 2023	Number
Backflow Incidents during 2023		
1	Backflow incidents that contaminated the PWS[5].	0
2	Backflow incidents that contaminated the customer's drinking water system ***only***[5].	0

Risk Factors for Backflow during 2023		
3	Distribution main breaks per 100 miles of pipe.	7.00
4	Low pressure events (<20 psi in PWS distribution system).	0
5	Water outage events.	0
Indicators of Possible Backflow during 2023		
6	Total health-related complaints received by PWS.[6]	0
7	Received during BWA or PN events.[7]	0
8	Received during low pressure or water outage events.	0
9	Total aesthetic complaints (color, taste, odor, air in lines, etc.).	5
10	Received during BWA or PN events.[7]	0
11	Number of these complaints received during low pressure or water outage events.	0

[5] Purveyors must submit a Backflow Incident Report form for each backflow incident known to have contaminated the public water system. DOH is also interested in receiving incident report forms for backflow incidents that contaminated the customer's drinking water system only.

[6] Such as stomach ache, headache, vomiting, diarrhea, skin rashes, etc.

[7] **"BWA"** means **Boil Water Advisory** and **"PN"** means **Public Notification** for water quality reasons.

Part 6: Comments and Clarifications

- Enter comments to:
  - Explain or clarify information in this report.
  - Describe challenges faced or accomplishments made in this reporting year.
  - Share your goals and objectives for the coming reporting year.
- Delete comments that are no longer valid.

Part No.	Date Added	Comments
Pt 1	04-18-2019	Updated back flow software to XC2. in March 2019.Still working on migrating and merging.
Pt 1	05-07-2021	The numbers reflecting 2019 service connections is believed to have been an estimate. The actual number of service connections at the end of 2020 were obtained from our financial analyst who deals directly with the tracking of new and existing service connections.
Pt 1	05-07-2021	The actual number of service connections for 2019 is: Residential-8635 All Other: 273 esidential 8635
Pt 1	05-18-2021	Our previous Backflow manager just recently retired. And since I do not yet have a complete understanding of our new XC2 tracking program and I am unable to locate some of the information that may need to be 100% confident in my report for the 2020 ASR. My plan for 2021 is to ensure that we have at least one more CCS on board, dedicated to the cross connection program as well as finding classes for those who are not up to speed with all the regulations pertaining to cross connection control. And to begin conducting surveys at some the various facilities around the City. , in or to be as accurate as possible with our CCC program.
Pt 1	03-18-2022	We are still trying to get up to speed with our CCC program. Previous information beyond 2020 is still being corrected and numbers on record aren't entirely correct with what we are finding in the field when we are able to access. We are still working on building a stronger more stringent program and I hope to have a couple of certified operators this year dedicated to the program and begin overdo hazard assessments as well as working closer with the building department on new construction.
Pt 1	01-19-2023	We are looking at a dedicated CCCS to hire this year that will begin a more in-depth investigation on the commercial and industrial side of our customers. We have also begun working closer with our building department regarding new construction.
Pt 1	04-10-2023	There are numbers this year that don't coincide with last year's numbers because we have someone dedidcated to data entry for our CCC program and she has been digging into past information and doing a bit of updating.
Pt 1	04-15-2024	Our new CCCS and data entry person working together found approximately 400 assemblies that were already in the system, that we didn't know about. As we continue to strengthen our program, we will begin to conduct more hazard assessments in 2024 and hopefully start getting a better understanding of what we need to have a more complete program.

Part 7: Report Certification and Contact Information

I, Allen Nelson , certify that the information in this form is true, complete and accurate to the best of my knowledge.

Last Saved	04/15/2024	**All ASR Forms Certified/Submitted**	04/15/2024

Designated CCS/CCC Program Manager[1]					
Name	Allen Nelson	**Title**	Water Supply Operator	**CCS Cert #**	8187
Email Address	anelson@cityofcamas.us	**Phone**	360-817-7287	**Phone Ext**	

PWS Manager[2]					
Name	Allen Nelson	**Title**	Water Supply Operator	**Operator Cert #**	8187
Email Address	anelson@cityofcamas.us	**Phone**	360-817-7287	**Phone Ext**	

[1] The CCS responsible for developing and implementing the PWS's CCC program (CCC Program Manager).
[2] The person the designated CCS/CCC Program Manager reports to or other manager having direct oversight of the CCC Program.

Cross-Connection Control Activities (Blue)
Annual Summary Report (ASR) for 2025

PWS ID: **108002** PWS Name: **CAMAS MUNICIPAL WATER SEWER SYSTEM** County: **CLARK**

Part 1: Designated Cross-Connection Control Specialist (CCS) Information

CCS Name	Nick Mettler	**CCS Phone**	360-833-3188	**CCS Cert. #**	16006	**BAT Cert. #**	B8057
CCS is: PWS owner or employee							

Part 2: Status of Cross-Connection Control (CCC) Program at End of 2025

Provide information about the status of your CCC Program at the end of the reporting year.

PWS has:	**A written CCC Program Plan**[1] ◉ Yes ○ No **CCC implementation activities**[2] ◉ Yes ○ No	**Program Plan Last Updated**[3] 12/04/2023

[1] Enter "Yes" if PWS has **any** type of written CCC Program Plan, policies, or procedures. Written CCC Program Plan must be part of a Water System Plan (WSP) or Small Water System Management Program (SWSMP).

[2] Enter "Yes" if PWS implemented **any** CCC Program activities during the reporting year, such as establishing legal authority, conducting hazard evaluations, requiring installation of backflow assemblies to protect the PWS, requiring assembly testing, maintaining CCC records, or enforcing the PWS's or CCC Program requirements.

[3] PWS can update the CCC Program Plan at any time (independent of WSP or SWSMP update).

Provide information regarding PWS's specific CCC Program Elements

Program Element Number	Description of Element [See WAC 246-290-490(3)]	This Program Element is:	
		Included in Written Program Plan	Being Implemented or Is Completed
1	**Legal Authority Established**	◉ Yes ○ No	◉ Yes ○ No
2	**Hazard Evaluation Procedures and Schedules**	◉ Yes ○ No	◉ Yes ○ No
3	**Procedures/Schedules for Ensuring Installation of Backflow Preventers**	◉ Yes ○ No	◉ Yes ○ No
4	**Certified CCS Provided**	◉ Yes ○ No	◉ Yes ○ No
5	**Backflow Preventer Inspection and Testing**	◉ Yes ○ No	◉ Yes ○ No

6	**Assembly Testing Quality Assurance/Quality Control (QA/QC) Program**	◉ Yes ○ No	◉ Yes ○ No
7	**Backflow Incident Response Procedures**	◉ Yes ○ No	◉ Yes ○ No
8	**Public Education Program**	◉ Yes ○ No	◉ Yes ○ No
9	**CCC Records**	◉ Yes ○ No	◉ Yes ○ No
10	**Reclaimed Water Permit**	○ Yes ○ No ◉ N/A	○ Yes ○ No ◉ N/A

Part 3A: PWS Characteristics at End of 2025

Enter the number of connections (new and existing) served by the PWS by type.

Type of Service Connection	Number
Residential (As defined by PWS)	9645
All Other (include dedicated fire lines, dedicated irrigation lines, and PWS-owned facilities such as water and wastewater treatment plants and pumping stations, parks, piers, and docks)	585
Total Number of Connections	10230

Part 3B: Cross-Connection Control for Severe and High-Hazard Premises and High-Hazard Dedicated Lines Served by the PWS

Item 2.

Answer the following questions carefully. These answers control your access to pages 2 and 3 for data entry.

1. Does your PWS serve any severe or high-hazard premises or any high-hazard dedicated fire or irrigation lines? (●) Yes ( ) No

2. Does PWS serve any high-hazard medical premises? (●) Yes ( ) No

- If you answer Yes to both questions, you must enter data in at least one row on page 2 and one row on page 3.
- If you answer Yes to Question 1 and No to Question 2, you must enter data on page 2 only.
- If you answer No to both questions, pages 2 and 3 will be grayed out to prevent data entry.

- Count only premises PWS serves water to.
- Report data as accurately as possible. **DOH currently bases CCC compliance actions on this information.**

Type of Severe or High-Hazard Premises or Dedicated Lines [WAC 246-290-490(4)(b)]	Number of Connections at end of 2025			
	A. Being Served Water by PWS[1]	B. With Premises Isolation by AG/RP[2]	C. With Column B AG Inspected or RP Tested[3]	D. Granted Exception from Premises Isolation
Agricultural (farms and dairies)				
Beverage bottling plants (including breweries)	1	1	1	0
Car washes	1	1	1	0
Chemical plants				
Commercial laundries and dry cleaners	2	1	1	0
Both reclaimed water and potable water provided				
Film processing facilities				
Dedicated fire lines with chemical addition or using unapproved auxiliary supplies				
Food processing plants (including canneries, slaughter houses, rendering plants)				
Hospitals, medical centers, medical, dental and veterinary clinics, mortuaries, nursing homes, etc., reported on Part 3C page 3 (totals imported from page 3)	16	11	11	2
Dedicated irrigation systems using purveyor's water supply and chemical addition[4]				

Laboratories	0	0	0	0
Metal plating industries				
Petroleum processing or storage plants	4	4	4	0
Piers and docks				
Radioactive material processing plants or nuclear reactors				
Survey access denied or restricted				
Wastewater lift/pump stations (non-residential only)	9	9	9	0
Wastewater treatment plants	1	1	1	
Unapproved auxiliary water supply interconnected with potable water supply	1	1	1	0
Totals	35	29	29	2

[1] Count multiple connections or parallel installations to the same premises as **separate** connections.

[2]Count only connections with premises isolation AGs or RPs. Don't include connections with in-premises preventers only or connections with DCVAs or DCDAs installed for premises isolation. The number in Column B can't be larger than the number in Column A in the same row.

[3] Count only connections whose premises isolation preventers were inspected (AGs) or tested (RPs) during the reporting year.

[4] For example, dedicated irrigation lines to parks, playgrounds, golf courses, cemeteries, estates, etc.

[5] Premises with hazardous materials or processes (requiring isolation by AG or RP), such as aircraft and automotive manufacturers, pulp and paper mills, metal manufacturers, military bases, and wholesale customers that pose a high hazard to the PWS. May be grouped together in categories, for example:"Other manufacturing" or "Other commercial".

Part 3C: Cross-Connection Control for High-Hazard Medical Premises Served by the PWS

- Count only medical premises PWS serves water to.
- Don't count the same premises more than once. If you serve different medical category premises through a single connection, count the connection under the medical category you consider to pose the highest hazard to PWS.
- Report data as accurately as possible. **DOH currently bases CCC compliance actions on this information**

Type of High-Hazard Medical Premises [WAC 246-290-490(4)(b)]	Number of Connections at end of 2025			
	A. Being Served Water by PWS[1]	B. With Premises Isolation by AG/RP[2]	C. With Column B AG Inspected or RP Tested[3]	D. Granted Exception from Premises Isolation
Hospitals				
Hospitals (include psychiatric hospitals and alcohol and drug treatment centers)				
Facilities for Treatment and Care of Patients Not Located in Hospitals Counted Above				
Same day surgery centers				
Out-patient clinics and offices				
Alternative health out-patient clinics and offices				
Psychiatric out-patient clinics and offices				
Chiropractors with water-connected X-ray equipment	0	0	0	0
Hospice care centers				
Childbirth centers				
Kidney dialysis centers	1	1	1	0
Blood centers				
Dental clinics and offices	6	4	4	2
Facilities for Housing Patients				
Nursing homes	1	1	1	0
Assisted Living Facilities (formerly Boarding Homes)	5	2	2	0
Residential treatment centers				
Other Medical-Related Facilities				
Mortuaries with embalming equipment	2	2	2	0
Morgues and autopsy facilities (not in hospitals)				

Veterinarian offices, clinics and hospitals	1	1	1	0
Totals	16	11	11	2

[1] Count multiple connections or parallel installations to the same premises as **separate** connections.

[2]Count only connections with premises isolation AGs or RPs. Don’t include connections with in-premises preventers only or connections with DCVAs or DCDAs installed for premises isolation. The number in Column B can’t be larger than the number in Column A in the same row.

[3]Count only connections with premises isolation AGs or RPs. Don't include connections with in-premises backflow preventers only or connections with premises isolation DCVAs or DCDAs isolation.

Part 4A: Backflow Preventer Inventory and Testing Information for 2025

- Complete all fields. Enter **zero (0)**, if no backflow preventers in a specific category.
- Count only backflow preventers relied on to protect the PWS.
- Count AVBs on *irrigation systems only*. Select No to AVB question above Table 2 if PWS doesn't track AVBs.
- Count multiple tests (or failures) for the same backflow preventer as one test (or failure) for that backflow preventer.
- For multiple service connections or parallel installations, count each assembly separately.
- Count RPDAs and DCDAs as ***single*** assemblies. Count the tests of the mainline assembly and bypass assembly as ***one test***. Count the failure of either the mainline or bypass assembly (or the failure of both) as ***one failure***. Count an entire detector assembly taken out of service as ***one assembly removed from service***.
- Count assemblies installed on dedicated fire or irrigation lines as **Premises Isolation Assemblies** in Table 1.

	Backflow Preventer Category and Inspection/Testing Information	Air Gap	RPBA	RPDA	DCVA	DCDA	PVBA	SVBA	AVB
Table 1: Premises Isolation Preventers (include preventers isolating PWS-owned facilities)									
Existing Premises Isolation Backflow Preventers									
1	In service at beginning of 2025	0	39	0	1366	32			
2	Inspected and/or tested in 2025[1]	0	24	0	881	17			
3	Failed inspection or test in 2025	0	1	0	30	1			
New Premises Isolation Backflow Preventers									
4	Installed in 2025[2]	0	5	0	5	3			
5	Inspected and/or tested in 2025[1]	0	5	0	5	3			
6	Failed inspection or test in 2025	0	0	0	0	0			
Premises Isolation Backflow Preventers (existing or new)									
7	Removed from service in 2025[3]	0	0	0	2	0			
Total Premises Isolation Preventers at End of 2025		0	44	0	1369	35	0	0	0

Does PWS track AVBs on irrigation systems? ○ Yes ◉ No

	Table 2: In-Premises Preventers (include preventers within PWS-owned facilities)								
Existing In-Premises Backflow Preventers									
8	In service at beginning of 2025	0	156	3	2909	15	18	0	unk
9	Inspected and/or tested in 2025[1]	0	46	2	1805	8	13	0	unk
10	Failed inspection or test in 2025	0	7	1	43	0	2	0	

New In-Premises Backflow Preventers									
11	Installed in 2025[2]	0	13	0	276	0	0	0	unk
12	Inspected and/or tested in 2025[1]	0	13	0	272	0	0	0	unk
13	Failed inspection or test in 2025	0	1	0	2	0	0	0	unk
In-Premises Backflow Preventers (existing or new)									
14	Removed from service in 2025[3]	0	0	0	9	0	0	0	unk
Total In-Premises Preventers at End of 2025[4]		0	169	3	3176	15	18	0	0
Grand Totals at End of 2025		0	213	3	4545	50	18	0	0

[1] Initial and/or routine annual inspection (for proper installation and approval status) and/or test (for testable assemblies only, using DOH-approved USC field test procedures).

[2] Includes preventers installed on connections where backflow prevention was not previously required and any preventers that replaced those in service at the beginning of the reporting year. Replacement preventers may be of a different type than the originals.

[3] Existing or new preventers taken out of service, whether or not they were replaced by the same or a different type of preventer.

Part 4B: Other Implementation Activities in 2025

Complete all cells. Enter zero if not applicable.

Water Use Questionnaires	
Did your PWS send any water use questionnaires to customers during 2025?	○ Yes ◉ No

On-site Hazard Surveys				
Did your CCS conduct any on-site hazard surveys during 2025?				◉ Yes ○ No
	Service Connection Type			
	New	**Existing**	**Total**	
1. Number of connections surveyed for cross-connection hazards to PWS.	302	28	330	
2. Number of connections requiring backflow prevention to protect PWS.[1,2]	302	10	312	

New Exceptions to Premises Isolation	
Did your CCS grant any new premises isolation exceptions in 2025 to high-hazard premises?[3]	○ Yes ◉ No

CCC Enforcement Actions	
Did your PWS take any enforcement actions during 2025?[4]	○ Yes ◉ No

[1] Include services where either premises isolation or in-premises preventers were required to protect the PWS.

[2] Include existing services that need new, additional or higher level backflow prevention.

[3] Submit a completed DOH Exception Form (green) for each new exception granted in the reporting year.

[4] "Enforcement actions" means actions taken by the PWS (such as water shut-off, PWS installation or testing of backflow preventer, assessment of fines, etc.) when the customer fails to comply with the PWS's CCC requirements.

Part 5: Backflow Incidents and "Off-Normal" Events in 2025

	Backflow Incidents, Risk Factors, and Indicators during 2025	Number
Backflow Incidents during 2025		
1	Backflow incidents that contaminated the PWS[5].	0
2	Backflow incidents that contaminated the customer's drinking water system ***only***[5].	0

Risk Factors for Backflow during 2025		
3	Distribution main breaks per 100 miles of pipe.	0.00
4	Low pressure events (<20 psi in PWS distribution system).	0
5	Water outage events.	0
Indicators of Possible Backflow during 2025		
6	Total health-related complaints received by PWS.[6]	0
7	Received during BWA or PN events.[7]	0
8	Received during low pressure or water outage events.	0
9	Total aesthetic complaints (color, taste, odor, air in lines, etc.).	3
10	Received during BWA or PN events.[7]	0
11	Number of these complaints received during low pressure or water outage events.	0

[5] Purveyors must submit a Backflow Incident Report form for each backflow incident known to have contaminated the public water system. DOH is also interested in receiving incident report forms for backflow incidents that contaminated the customer's drinking water system only.

[6] Such as stomach ache, headache, vomiting, diarrhea, skin rashes, etc.

[7] **"BWA"** means **Boil Water Advisory** and **"PN"** means **Public Notification** for water quality reasons.

Part 6: Comments and Clarifications

- Enter comments to:
  - Explain or clarify information in this report.
  - Describe challenges faced or accomplishments made in this reporting year.
  - Share your goals and objectives for the coming reporting year.
- Delete comments that are no longer valid.

Part No.	Date Added	Comments
Pt 1	04-18-2019	Updated back flow software to XC2. in March 2019.Still working on migrating and merging.
Pt 1	05-07-2021	The numbers reflecting 2019 service connections is believed to have been an estimate. The actual number of service connections at the end of 2020 were obtained from our financial analyst who deals directly with the tracking of new and existing service connections.
Pt 1	05-07-2021	The actual number of service connections for 2019 is: Residential-8635 All Other: 273 esidential 8635
Pt 1	05-18-2021	Our previous Backflow manager just recently retired. And since I do not yet have a complete understanding of our new XC2 tracking program and I am unable to locate some of the information that may need to be 100% confident in my report for the 2020 ASR. My plan for 2021 is to ensure that we have at least one more CCS on board, dedicated to the cross connection program as well as finding classes for those who are not up to speed with all the regulations pertaining to cross connection control. And to begin conducting surveys at some the various facilities around the City. , in or to be as accurate as possible with our CCC program.
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Pt 1	04-15-2024	Our new CCCS and data entry person working together found approximately 400 assemblies that were already in the system, that we didn't know about. As we continue to strengthen our program, we will begin to conduct more hazard assessments in 2024 and hopefully start getting a better understanding of what we need to have a more complete program.
Pt 1	03-27-2025	As I am new to the CCCS position as of last June 2024 there will some changes coming to enforce testing coming the reporting year of 2025. We will be getting new Backflow Management Software installed and running within the next couple months. This outdated XC2 has been glitching and is time to replace. Information from the past has been getting corrected and updated to get the most accurate data. We now have in our municipal code that any non-compliance to test we can send a tester to test then bill the utility account for the test, that should help get our compliance percentage up as well. Looking forward to all the new changes coming into 2025. The 2 new exceptions/ green forms I filled out during some hazard surveys were both from dentist offices that

		both have self-contained chairs not connected to our PWS. I will be checking back on those annually for continued hazard s to ensure nothing has changed.
Pt 1	04-06-2026	this past year I have been correcting information within our backflow prevention management software, trying to get the information as correct as possible for our new software that went live at the beginning of 2026. This last year I have been busy combing through the data correcting information from the past several years of input, also doing several hazard surveys at all the new sites and few dozen existing high/severe health hazard sites. The new software is going to help with the organizing of the customer test reminders and failed assemblies to ensure that customers are staying compliant with the testing and maintenance for passing test reports per WAC and CMC. This last year has been a challenge to stay on top of everything as the software change has been rather time consuming and customer addresses have not been changed over to the new software as of today's date 4/6/2026. This next year (2026) is going to be a transition year for the customers to get used to the new testing schedule and non-compliance enforcement action. Good things are happening to ensure safe water for the City of Camas The new software will make tracking it easier, the Camas Municipal Code will make it easier to keep customers compliant on the Backflow assembly testing.

Part 7: Report Certification and Contact Information

I, Nick Mettler , certify that the information in this form is true, complete and accurate to the best of my knowledge.

Last Saved	04/14/2026	**All ASR Forms Certified/Submitted**	04/14/2026

Designated CCS/CCC Program Manager[1]					
Name	Nick Mettler	**Title**	Cross Connection Control Specialist	**CCS Cert #**	16006
Email Address	nmettler@cityofcamas.us	**Phone**	360-833-3188	**Phone Ext**	

PWS Manager[2]					
Name	Allen Nelson	**Title**	Water Supply Operator	**Operator Cert #**	8187
Email Address	anelson@cityofcamas.us	**Phone**	360-817-7287	**Phone Ext**	

[1] The CCS responsible for developing and implementing the PWS's CCC program (CCC Program Manager).

[2] The person the designated CCS/CCC Program Manager reports to or other manager having direct oversight of the CCC Program.

Cross-Connection Control Activities (Blue)
Annual Summary Report (ASR) for 2024

PWS ID: **108002** PWS Name: **CAMAS MUNICIPAL WATER SEWER SYSTEM** County: **CLARK**

Part 1: Designated Cross-Connection Control Specialist (CCS) Information

CCS Name	Nick Mettler	CCS Phone	360-833-3188	CCS Cert. #	16006	BAT Cert. #	
CCS is: PWS owner or employee							

Part 2: Status of Cross-Connection Control (CCC) Program at End of 2024

Provide information about the status of your CCC Program at the end of the reporting year.

PWS has:	**A written CCC Program Plan**[1] ◉ Yes ○ No **CCC implementation activities**[2] ◉ Yes ○ No	**Program Plan Last Updated**[3] 12/04/2023

[1] Enter "Yes" if PWS has **any** type of written CCC Program Plan, policies, or procedures. Written CCC Program Plan must be part of a Water System Plan (WSP) or Small Water System Management Program (SWSMP).

[2] Enter "Yes" if PWS implemented **any** CCC Program activities during the reporting year, such as establishing legal authority, conducting hazard evaluations, requiring installation of backflow assemblies to protect the PWS, requiring assembly testing, maintaining CCC records, or enforcing the PWS's or CCC Program requirements.

[3] PWS can update the CCC Program Plan at any time (independent of WSP or SWSMP update).

Provide information regarding PWS's specific CCC Program Elements

Program Element Number	Description of Element [See WAC 246-290-490(3)]	This Program Element is:	
		Included in Written Program Plan	Being Implemented or Is Completed
1	**Legal Authority Established**	◉ Yes ○ No	◉ Yes ○ No
2	**Hazard Evaluation Procedures and Schedules**	◉ Yes ○ No	◉ Yes ○ No
3	**Procedures/Schedules for Ensuring Installation of Backflow Preventers**	◉ Yes ○ No	◉ Yes ○ No
4	**Certified CCS Provided**	◉ Yes ○ No	◉ Yes ○ No
5	**Backflow Preventer Inspection and Testing**	◉ Yes ○ No	◉ Yes ○ No
6	**Assembly Testing Quality Assurance/Quality Control (QA/QC) Program**	◉ Yes ○ No	◉ Yes ○ No
7	**Backflow Incident Response Procedures**	◉ Yes ○ No	◉ Yes ○ No
8	**Public Education Program**	◉ Yes ○ No	◉ Yes ○ No
9	**CCC Records**	◉ Yes ○ No	◉ Yes ○ No
10	**Reclaimed Water Permit**	○ Yes ○ No ◉ N/A	○ Yes ○ No ◉ N/A

Part 3A: PWS Characteristics at End of 2024

Enter the number of connections (new and existing) served by the PWS by type.

Type of Service Connection	Number
Residential (As defined by PWS)	10151
All Other (include dedicated fire lines, dedicated irrigation lines, and PWS-owned facilities such as water and wastewater treatment plants and pumping stations, parks, piers, and docks)	308
Total Number of Connections	10459

Part 3B: Cross-Connection Control for Severe and High-Hazard Premises and High-Hazard Dedicated Lines Served by the PW

Answer the following questions carefully. These answers control your access to pages 2 and 3 for data entry.

1. Does your PWS serve any severe or high-hazard premises or any high-hazard dedicated fire or irrigation lines? ◉ Yes ○ No

2. Does PWS serve any high-hazard medical premises? ◉ Yes ○ No

- If you answer Yes to both questions, you must enter data in at least one row on page 2 and one row on page 3.
- If you answer Yes to Question 1 and No to Question 2, you must enter data on page 2 only.
- If you answer No to both questions, pages 2 and 3 will be grayed out to prevent data entry.

- Count only premises PWS serves water to.
- Report data as accurately as possible. **DOH currently bases CCC compliance actions on this information.**

Type of Severe or High-Hazard Premises or Dedicated Lines [WAC 246-290-490(4)(b)]	Number of Connections at end of 2024			
	A. Being Served Water by PWS[1]	B. With Premises Isolation by AG/RP[2]	C. With Column B AG Inspected or RP Tested[3]	D. Granted Exception from Premises Isolation
Agricultural (farms and dairies)				
Beverage bottling plants (including breweries)	1	1	1	0
Car washes	2	2	2	0
Chemical plants				
Commercial laundries and dry cleaners	2	2	2	0
Both reclaimed water and potable water provided				
Film processing facilities				
Dedicated fire lines with chemical addition or using unapproved auxiliary supplies				
Food processing plants (including canneries, slaughter houses, rendering plants)				
Hospitals, medical centers, medical, dental and veterinary clinics, mortuaries, nursing homes, etc., reported on Part 3C page 3 (totals imported from page 3)	16	11	11	0
Dedicated irrigation systems using purveyor's water supply and chemical addition[4]				
Laboratories	0	0	0	0
Metal plating industries				
Petroleum processing or storage plants	4	4	4	0
Piers and docks				
Radioactive material processing plants or nuclear reactors				
Survey access denied or restricted				
Wastewater lift/pump stations (non-residential only)	9	9	9	0
Wastewater treatment plants	1	1	1	
Unapproved auxiliary water supply interconnected with potable water supply				
Totals	35	30	30	0

[1] Count multiple connections or parallel installations to the same premises as **separate** connections.

[2] Count only connections with premises isolation AGs or RPs. Don't include connections with in-premises preventers only or connections with DCVAs or DCDAs installed for premises isolation. The number in Column B can't be larger than the number in Column A in the same row.

[3] Count only connections whose premises isolation preventers were inspected (AGs) or tested (RPs) during the reporting year.

[4] For example, dedicated irrigation lines to parks, playgrounds, golf courses, cemeteries, estates, etc.

[5] Premises with hazardous materials or processes (requiring isolation by AG or RP), such as aircraft and automotive manufacturers, pulp and paper mills, metal manufacturers, military bases, and wholesale customers that pose a high hazard to the PWS. May be grouped together in categories, for example:"Other manufacturing" or "Other commercial".

Part 3C: Cross-Connection Control for High-Hazard Medical Premises Served by the PWS

- Count only medical premises PWS serves water to.
- Don't count the same premises more than once. If you serve different medical category premises through a single connection, count the connection under the medical category you consider to pose the highest hazard to PWS.
- Report data as accurately as possible. **DOH currently bases CCC compliance actions on this information**

Type of High-Hazard Medical Premises [WAC 246-290-490(4)(b)]	Number of Connections at end of 2024			
	A. Being Served Water by PWS[1]	B. With Premises Isolation by AG/RP[2]	C. With Column B AG Inspected or RP Tested[3]	D. Granted Exception from Premises Isolation
Hospitals				
Hospitals (include psychiatric hospitals and alcohol and drug treatment centers)				
Facilities for Treatment and Care of Patients Not Located in Hospitals Counted Above				
Same day surgery centers				
Out-patient clinics and offices				
Alternative health out-patient clinics and offices				
Psychiatric out-patient clinics and offices				
Chiropractors with water-connected X-ray equipment	0	0	0	0
Hospice care centers				
Childbirth centers				
Kidney dialysis centers	1	1	1	0
Blood centers				
Dental clinics and offices	6	4	4	0
Facilities for Housing Patients				
Nursing homes	1	1	1	0
Assisted Living Facilities (formerly Boarding Homes)	5	2	2	0
Residential treatment centers				
Other Medical-Related Facilities				
Mortuaries with embalming equipment	2	2	2	0
Morgues and autopsy facilities (not in hospitals)				
Veterinarian offices, clinics and hospitals	1	1	1	0
Totals	16	11	11	0

[1] Count multiple connections or parallel installations to the same premises as **separate** connections.

[2] Count only connections with premises isolation AGs or RPs. Don't include connections with in-premises preventers only or connections with DCVAs or DCDAs installed for premises isolation. The number in Column B can't be larger than the number in Column A in the same row.

[3] Count only connections with premises isolation AGs or RPs. Don't include connections with in-premises backflow preventers only or connections with premises isolation DCVAs or DCDAs isolation.

Part 4A: Backflow Preventer Inventory and Testing Information for 2024

- Complete all fields. Enter **zero (0)**, if no backflow preventers in a specific category.
- Count only backflow preventers relied on to protect the PWS.
- Count AVBs on *irrigation systems only*. Select No to AVB question above Table 2 if PWS doesn't track AVBs.
- Count multiple tests (or failures) for the same backflow preventer as one test (or failure) for that backflow preventer.
- For multiple service connections or parallel installations, count each assembly separately.
- Count RPDAs and DCDAs as ***single*** assemblies. Count the tests of the mainline assembly and bypass assembly as ***one test***. Count the failure of either the mainline or bypass assembly (or the failure of both) as ***one failure***. Count an entire detector assembly taken out of service as ***one assembly removed from service***.
- Count assemblies installed on dedicated fire or irrigation lines as **Premises Isolation Assemblies** in Table 1.

	Backflow Preventer Category and Inspection/Testing Information	Air Gap	RPBA	RPDA	DCVA	DCDA	PVBA	SVBA	AVB
Table 1: Premises Isolation Preventers (include preventers isolating PWS-owned facilities)									
Existing Premises Isolation Backflow Preventers									
1	In service at beginning of 2024	0	29	0	1962	22			
2	Inspected and/or tested in 2024[1]	0	19	0	1533	15			
3	Failed inspection or test in 2024	0	4	0	32	1			
New Premises Isolation Backflow Preventers									
4	Installed in 2024[2]	0	2	0	4	0			
5	Inspected and/or tested in 2024[1]	0	2	0	4	0			
6	Failed inspection or test in 2024	0	0	0	0	0			
Premises Isolation Backflow Preventers (existing or new)									
7	Removed from service in 2024[3]	0	0	0	2	0			
	Total Premises Isolation Preventers at End of 2024	0	31	0	1964	22	0	0	0
	Does PWS track AVBs on irrigation systems? ○ Yes ◉ No								
Table 2: In-Premises Preventers (include preventers within PWS-owned facilities)									
Existing In-Premises Backflow Preventers									
8	In service at beginning of 2024	0	164	3	2194	28	22	0	unk
9	Inspected and/or tested in 2024[1]	0	101	2	1526	20	13	0	unk
10	Failed inspection or test in 2024	0	24	1	39	1	0	0	unk
New In-Premises Backflow Preventers									
11	Installed in 2024[2]	0	3	0	130	2	0	0	unk
12	Inspected and/or tested in 2024[1]	0	3	0	130	2	0	0	unk
13	Failed inspection or test in 2024	0	0	0	1	0	0	0	unk
In-Premises Backflow Preventers (existing or new)									
14	Removed from service in 2024[3]	0	0	0	8	0	0	0	unk
	Total In-Premises Preventers at End of 2024[4]	0	167	3	2316	30	22	0	0
	Grand Totals at End of 2024	0	198	3	4280	52	22	0	0

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Part 4B: Other Implementation Activities in 2024

Complete all cells. Enter zero if not applicable.

Water Use Questionnaires	
Did your PWS send any water use questionnaires to customers during 2024?	○ Yes ◉ No

On-site Hazard Surveys				
Did your CCS conduct any on-site hazard surveys during 2024?			◉ Yes ○ No	
	Service Connection Type			
	New	**Existing**	**Total**	
1. Number of connections surveyed for cross-connection hazards to PWS.	5	12	17	
2. Number of connections requiring backflow prevention to protect PWS.[1,2]	5	12	17	

New Exceptions to Premises Isolation	
Did your CCS grant any new premises isolation exceptions in 2024 to high-hazard premises?[3]	◉ Yes ○ No Number 2

CCC Enforcement Actions	
Did your PWS take any enforcement actions during 2024?[4]	○ Yes ◉ No

[1] Include services where either premises isolation or in-premises preventers were required to protect the PWS.

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Risk Factors for Backflow during 2024		
3	Distribution main breaks per 100 miles of pipe.	7.00
4	Low pressure events (<20 psi in PWS distribution system).	0
5	Water outage events.	0
Indicators of Possible Backflow during 2024		
6	Total health-related complaints received by PWS.[6]	0
7	Received during BWA or PN events.[7]	0
8	Received during low pressure or water outage events.	0
9	Total aesthetic complaints (color, taste, odor, air in lines, etc.).	8
10	Received during BWA or PN events.[7]	0
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Part 7: Report Certification and Contact Information

I, [Certified by] , certify that the information in this form is true, complete and accurate to the best of my knowledge.

Last Saved	03/28/2025	**All ASR Forms Certified/Submitted**	

Designated CCS/CCC Program Manager[1]					
Name	Nick Mettler	**Title**	Cross Connection Control Specialist	**CCS Cert #**	16006
Email Address	nmettler@cityofcamas.us	**Phone**	360-833-3188	**Phone Ext**	

PWS Manager[2]					
Name	Allen Nelson	**Title**	Water Supply Operator	**Operator Cert #**	8187
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APPENDIX L

EXAMPLE BACKFLOW BROCHURE

WHAT IS A BACKFLOW ASSEMBLY TESTER (BAT)?

A person who has shown competence to test and maintain backflow prevention assemblies and who is certified in accordance with Washington State. Also referred to as Certified or Licensed BAT. The City of Camas makes no representation regarding the abilities, performance, or quality of service of the testers listed below.

ANNUAL REMINDER NOTICES ARE SENT BY THE PUBLIC WORKS DEPARTMENT AND TEST RESULTS MUST BE RETURNED TO THE CITY (WAC 246-290-490).

Submit test reports to backflow@cityofcamas.us

Learn more

Washington Administrative Code: Chapter 246-290
Camas Municipal Code: Chapter 13.32

BACKFLOW CONTACTS

1620 SE 8th Ave, Camas, WA 98607
Tel: 360-817-1569

Email: backflow@cityofcamas.us
Website: www.cityofcamas.us/pwwater

City of Camas WASHINGTON

BACKFLOW
& Cross Connection



WHAT IS BACKFLOW?

Backflow may occur due to either "backsiphonage" or "backpressure", in which the flow of water reverses from the normal direction of flow in a piping system. When water or other substances flow in the opposite direction than intended, this allows contaminants to enter the public water system or consumer's plumbing causing a backflow incident.

WHAT IS A BACKFLOW INCIDENT?

A backflow incident occurs anytime there is a water reversal in the drinking water supply (under backflow conditions) via unprotected cross connections. Backflow incidents may cause injury, illness, or death.

WHAT IS CROSS CONNECTION?

A cross connection is any actual or potential physical connection between a "potable water" line and any pipe, vessel, or machine containing a non potable fluid, solid or gas, allowing possible entry to the water system by backflow. This would include, but is not limited to, sewers, drains, conduits, pools, storage reservoirs, plumbing fixtures, or any other device. The non-potable or unapproved water supply system may contain contaminated liquids, solids, or gases, of unknown or unsafe quality. Bypass arrangements such as jumper connections, removable sections, swivel or changeover devices are considered to be a cross connection.

WHAT ARE BACKFLOW PREVENTION ASSEMBLIES?

Backflow Prevention Assemblies are installed on water service lines (or at plumbing fixtures) to prevent backflow of contaminants into drinking water through cross connections. Improper installation or failure to meet testing requirements are grounds for termination of water service. The three basic approved types of assemblies that follow are required to be installed per City of Camas standards and must be tested by a Washington State Certified Backflow Assembly Tester upon installation and yearly thereafter.

REDUCED PRESSURE BACKFLOW ASSEMBLIES (RPBA)

An RPBA is a mechanical backflow preventer that consists of two independently acting, spring-loaded check valves with a mechanically independent, hydraulically operated, spring-loaded pressure differential relief valve between the check valves and below the first check valve.
This assembly is designed to protect against low to high health hazards.

DOUBLE CHECK VALVE ASSEMBLIES (DCVA)

A DCVA is a mechanical backflow preventer that consists of two independently acting, spring-loaded check valves. This assembly should only be used to protect against low health hazards.

PRESSURE VACUUM BREAKER ASSEMBLIES (PVBA)

A PVBA is a mechanical backflow pr
that consists of an independently acting, spring-loaded check valve and an independently acting, spring-loaded, air inlet valve on the discharge side of the check valve. This assembly is designed to protect against a low health hazards under backsiphonage only.

WITHOUT PROPER BACKFLOW PROTECTION, YOUR IRRIGATION SYSTEM COULD ENDANGER THE HEALTH OF YOUR FAMILY, NEIGHBORS, AND OTHERS IN THE COMMUNITY WHO ARE USING THE PUBLIC WATER SYSTEM.

NOTE: Atmospheric Vacuum Breaker's (AVB) are not allowed in the City of Camas.

APPENDIX M

2023 CLARK COUNTY VACANT BUILDABLE LANDS MODEL

VBLM 2023
(LandUseAlternative2)

Capacity and Yield by Jurisdiction

Jurisdiction Label	Housing Units	(%)	Jobs	(%)	Gross Acres	(%)	Buildable Acres	(%)
Battle Ground	6,603	*4.3%*	7,571	*10.2%*	3,307	*11.4%*	1,422	*11.9%*
Camas	5,553	*3.6%*	16,201	*21.9%*	3,278	*11.3%*	1,559	*13.0%*
La Center	2,301	*1.5%*	3,011	*4.1%*	1,058	*3.7%*	479	*4.0%*
Ridgefield	11,810	*7.7%*	7,513	*10.1%*	3,434	*11.9%*	1,520	*12.7%*
Vancouver (City)	61,602	*40.1%*	21,691	*29.3%*	6,753	*23.4%*	2,367	*19.8%*
Vancouver UGA (Clark County)	58,009	*37.8%*	15,823	*21.4%*	8,932	*30.9%*	3,718	*31.1%*
Washougal	7,349	*4.8%*	1,887	*2.5%*	1,846	*6.4%*	770	*6.4%*
Woodland	101	*0.1%*			95	*0.3%*	23	*0.2%*
Yacolt	268	*0.2%*	307	*0.4%*	206	*0.7%*	103	*0.9%*
Total	153,595	*100.0%*	74,004	*100.0%*	28,909	*100.0%*	11,961	*100.0%*

Capacity by Housing Type

Jurisdiction Label	High Density Residential Housing Units	(%)	Low Density Residential Housing Units	(%)
Battle Ground	2,840	*43.0%*	3,763	*57.0%*
Camas	3,444	*62.0%*	2,109	*38.0%*
La Center	1,178	*51.2%*	1,124	*48.8%*
Ridgefield	8,516	*72.1%*	3,293	*27.9%*
Vancouver (City)	55,676	*90.4%*	5,926	*9.6%*
Vancouver UGA (Clark County)	26,845	*46.3%*	31,164	*53.7%*
Washougal	2,412	*32.8%*	4,937	*67.2%*
Woodland			101	*100.0%*
Yacolt	0	*0.0%*	268	*100.0%*
Total	100,911	*65.7%*	52,684	*34.3%*

Notes:
• Yield estimate for the Town of Yacolt is dependent on development of sewer infrastructure.
• Yield estimate for the City of Woodland is exclusively residential housing units (there is neither commercial nor industrial zoning in the Clark County portion of the city).

CLARK COUNTY WASHINGTON
COMMUNITY PLANNING

CLARK COUNTY WASHINGTON
GEOGRAPHIC INFORMATION SERVICES

VBLM Tools Version: 2023-3.0.1-beta

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VBLM 2023
(LandUseAlternative2)

Capacity and Yield by Zoning: City, UGA

	Housing Units	(%)	Jobs	(%)	Gross Acres	(%)	Buildable Acres	(%)
Battle Ground	6,603	4.3%	7,571	10.2%	3,307	11.4%	1,422	11.9%
Incorporated City	5,391	3.5%	5,375	7.3%	2,256	7.8%	986	8.3%
Unincorporated UGA	1,212	0.8%	2,196	3.0%	1,050	3.6%	436	3.6%
Camas	5,553	3.6%	16,201	21.9%	3,278	11.3%	1,559	13.0%
Incorporated City	4,676	3.0%	13,821	18.7%	2,795	9.7%	1,309	10.9%
Unincorporated UGA	877	0.6%	2,379	3.2%	482	1.7%	251	2.1%
La Center	2,301	1.5%	3,011	4.1%	1,058	3.7%	479	4.0%
Incorporated City	2,144	1.4%	2,088	2.8%	828	2.9%	383	3.2%
Unincorporated UGA	157	0.1%	923	1.3%	230	0.8%	96	0.8%
Ridgefield	11,810	7.7%	7,513	10.2%	3,434	11.9%	1,520	12.7%
Incorporated City	5,748	3.7%	5,935	8.0%	2,353	8.1%	1,067	8.9%
Unincorporated UGA	6,062	4.0%	1,578	2.1%	1,081	3.7%	453	3.8%
Vancouver (City)	61,602	40.1%	21,691	29.3%	6,753	23.4%	2,367	19.8%
Incorporated City	61,602	40.1%	21,691	29.3%	6,753	23.4%	2,367	19.8%
Vancouver UGA (Clark County)	58,009	37.8%	15,823	21.4%	8,932	30.9%	3,718	31.1%
Unincorporated UGA	58,009	37.8%	15,823	21.4%	8,932	30.9%	3,718	31.1%
Washougal	7,349	4.8%	1,887	2.6%	1,846	6.4%	770	6.4%
Incorporated City	4,912	3.2%	1,378	1.9%	1,032	3.6%	416	3.5%
Unincorporated UGA	2,437	1.6%	509	0.7%	814	2.8%	354	3.0%
Woodland	101	0.1%	0	0.0%	95	0.3%	23	0.2%
Incorporated City	9	0.0%			5	0.0%	1	0.0%
Unincorporated UGA	91	0.1%			90	0.3%	22	0.2%
Yacolt	268	0.2%	307	0.4%	206	0.7%	103	0.9%
Incorporated City	130	0.1%	163	0.2%	98	0.3%	47	0.4%
Unincorporated UGA	138	0.1%	145	0.2%	108	0.4%	56	0.5%

VBLM 2023
(LandUseAlternative2)

Capacity and Yield by Zoning

Battle Ground (City)

	Gross	Constrained	Market	Infrastructure	Buildable	Housing Units	Jobs
	Acres of Land						
Residential							
Residential 3 units/acre (R3)	174	58	30	27	59	194	0
Redevelopment	10	3	7	0	0	1	
Underutilized	85	25	18	13	29	87	
Vacant	79	30	5	14	30	106	
Residential 5 units/acre (R5)	358	98	54	65	141	959	0
Redevelopment	12	4	8	0	0	2	
Underutilized	135	30	32	23	51	253	
Vacant	211	64	15	41	90	704	
Residential 7 units/acre (R7)	593	191	72	104	226	1,617	0
Redevelopment	21	8	12	0	1	4	
Underutilized	170	61	33	24	52	364	
Vacant	402	121	28	80	173	1,248	
Residential 10 units/acre (R10)	321	73	44	64	139	1,393	0
Redevelopment	9	1	7	0	1	8	
Underutilized	98	32	20	15	32	318	
Vacant	214	41	17	49	107	1,067	
Residential 12 units/acre (R12)	108	33	20	17	38	457	0
Redevelopment	7	1	5	0	1	7	
Underutilized	53	14	12	9	19	223	
Vacant	48	18	3	9	19	228	
Residential 16 units/acre (R16)	92	17	10	20	45	712	0
Redevelopment	1	0	1	0	0	2	
Underutilized	12	2	3	2	4	70	
Vacant	79	14	6	18	40	640	
Residential 20 units/acre (R20)	10	4	2	1	3	59	0
Redevelopment	2	1	1	0	0	2	
Underutilized	5	2	1	1	1	25	
Vacant	4	1	0	1	2	32	
Residential Subtotal	1,655	474	232	298	651	5,391	0
Commercial							
Community Center (CC)	0	0	0	0	0	0	3
Underutilized	0	0	0	0	0	0	3
Downtown (D)	16	3	0	3	10	0	194
Underutilized	12	2	0	2	7	0	141
Vacant	4	1	0	1	3	0	53
Regional Center (RC)	318	45	0	68	204	0	4,087
Underutilized	318	45	0	68	204	0	4,087
Commercial Subtotal	334	48	0	71	214	0	4,284
Industrial							

VBLM 2023
(LandUseAlternative2)

Capacity and Yield by Zoning

Battle Ground (City)

	Gross	Constrained	Market	Infrastructure	Buildable	Housing Units	Jobs
	Acres of Land						
Industrial							
Light Industrial (ML)	197	85	0	28	85	0	761
Underutilized	189	81	0	27	81	0	732
Vacant	8	4	0	1	3	0	29
Westside Employment (WE)	70	21	0	12	37	0	330
Underutilized	70	21	0	12	37	0	330
Industrial Subtotal	267	106	0	40	121	0	1,091
Total	2,256	628	232	410	**986**	**5,391**	**5,375**

VBLM 2023
(LandUseAlternative2)

Capacity and Yield by Zoning

Camas (City)

	Gross	Constrained	Market	Infrastructure	Buildable	Housing Units	Jobs
	Acres of Land						
Residential							
North Shore Higher Density Residential (HD-NS)	106	35	14	18	39	707	0
Underutilized	57	23	10	7	16	289	
Vacant	49	12	4	11	23	418	
North Shore Lower Density Residential (LD-NS)	138	37	25	24	52	316	0
Redevelopment	13	0	12	0	1	4	
Underutilized	34	13	6	5	10	60	
Vacant	91	24	7	19	42	252	
Residential-6,000 (R-6)	22	8	3	3	7	54	0
Redevelopment	2	1	1	0	0	1	
Underutilized	5	2	1	1	1	10	
Vacant	15	5	1	3	6	43	
Residential-7,500 (R-7.5)	157	44	40	22	50	316	0
Redevelopment	38	11	25	0	1	8	
Underutilized	45	11	10	7	16	96	
Vacant	74	22	5	15	32	211	
Residential-10,000 (R-10)	232	69	27	43	93	486	0
Redevelopment	8	3	5	0	0	1	
Underutilized	51	19	10	7	15	62	
Vacant	173	47	13	36	78	423	
Residential-12 (R-12)	75	21	20	11	24	97	0
Redevelopment	17	4	13	0	1	3	
Underutilized	22	5	5	4	8	34	
Vacant	36	12	2	7	15	61	
Residential-15,000 (R-15)	391	132	104	48	108	331	0
Redevelopment	89	27	59	0	3	9	
Underutilized	192	66	38	28	61	182	
Vacant	110	39	7	20	44	140	
Multifamily Residential-10 (MF-10)	37	10	4	7	16	162	0
Redevelopment	2	1	1	0	0	1	
Underutilized	1	1	0	0	0	4	
Vacant	34	8	3	7	16	156	
Multifamily Residential-18 (MF-18)	43	13	7	7	16	286	0
Redevelopment	5	2	3	0	0	6	
Underutilized	9	2	2	1	3	56	
Vacant	29	9	2	6	12	224	
Multifamily Residential-24 (MF-24)	33	5	4	8	17	399	0
Underutilized	9	4	1	1	2	54	
Vacant	24	1	2	7	14	345	
Multifamily Residential-38 (MF-38)	6	0	2	1	3	113	0
Underutilized	6	0	2	1	3	113	
Single Family Residential (R1-6)	16	1	3	4	8	0	0
Underutilized	8	0	2	2	4	0	
Vacant	8	1	1	2	4	0	

VBLM 2023
(LandUseAlternative2)

Capacity and Yield by Zoning

Camas (City)

	Gross	Constrained	Market	Infrastructure	Buildable	Housing Units	Jobs
	Acres of Land						
Residential Subtotal	1,256	375	253	196	433	3,265	0
Commercial							
Community Commercial (CC)	63	10	0	13	40	0	804
Underutilized	63	10	0	13	40	0	801
Vacant	0	0	0	0	0	0	3
Downtown Commercial (DC)	8	1	0	2	5	0	109
Underutilized	8	1	0	2	5	0	109
Mixed Use (MX)	67	5	0	15	46	555	462
Underutilized	62	5	0	14	43	520	433
Vacant	5	1	0	1	3	35	29
Neighborhood Commercial (NC)	2	0	0	0	1	0	20
Underutilized	2	0	0	0	1	0	20
North Shore Commercial (C-NS)	46	6	0	10	30	0	595
Underutilized	46	6	0	10	30	0	595
North Shore Mixed Use (MX-NS)	103	8	0	24	71	856	713
Underutilized	103	8	0	24	71	856	713
Regional Commercial (RC)	319	43	0	69	206	0	4,127
Underutilized	279	38	0	60	181	0	3,621
Vacant	39	5	0	8	25	0	506
Mixed Employment (ME)	368	39	0	82	246	0	4,927
Underutilized	368	39	0	82	246	0	4,927
Commercial Subtotal	975	113	0	216	647	1,411	11,757
Industrial							
Business Park (BP)	19	2	0	4	13	0	116
Underutilized	19	2	0	4	13	0	116
Heavy Industrial (HI)	545	257	0	72	216	0	1,948
Underutilized	545	257	0	72	216	0	1,944
Vacant	1	0	0	0	0	0	4
Industrial Subtotal	564	259	0	76	229	0	2,064
Total	2,795	746	253	488	**1,309**	**4,676**	**13,821**

VBLM 2023
(LandUseAlternative2)

Capacity and Yield by Zoning

La Center (City)

	Gross	Constrained	Market	Infrastructure	Buildable	Housing Units	Jobs
	Acres of Land						
Residential							
Low Density Residential (LDR-7.5)	503	152	81	85	186	999	0
Redevelopment	9	3	6	0	0	2	
Underutilized	285	84	60	44	96	482	
Vacant	210	65	14	41	89	515	
Medium Density Residential (MDR-16)	91	20	13	18	39	527	0
Redevelopment	1	0	1	0	0	1	
Underutilized	35	6	9	7	14	170	
Vacant	55	14	4	12	25	356	
Residential Subtotal	595	172	94	103	225	1,525	0
Commercial							
Downtown Commercial (C-1)	2	0	0	0	1	0	22
Underutilized	1	0	0	0	1	0	19
Vacant	0	0	0	0	0	0	3
Mixed Use (MX)	27	2	0	6	19	179	74
Underutilized	27	2	0	6	19	179	74
Residential/Professional (RP)	12	2	0	2	7	48	30
Underutilized	10	1	0	2	6	41	26
Vacant	2	0	0	0	1	7	4
Junction Plan (JP)	193	19	0	44	131	392	1,961
Underutilized	170	18	0	38	114	342	1,712
Vacant	23	1	0	6	17	50	249
Commercial Subtotal	233	23	0	53	158	619	2,088
Total	828	195	94	156	**383**	**2,144**	**2,088**

VBLM 2023
(LandUseAlternative2)

Capacity and Yield by Zoning

Ridgefield (City)

	Gross	Constrained	Market	Infrastructure	Buildable	Housing Units	Jobs
	Acres of Land						
Residential							
Residential Medium Density - Mixed Use (RMD-MU)	36	11	5	6	13	0	0
Underutilized	22	7	4	3	7	0	
Vacant	14	4	1	3	6	0	
Residential Low Density - 4 (RLD-4)	711	233	109	116	254	1,531	0
Redevelopment	47	9	36	0	2	10	
Underutilized	214	72	43	31	68	368	
Vacant	450	152	30	85	184	1,152	
Residential Low Density - 6 (RLD-6)	201	68	32	31	69	659	0
Redevelopment	24	7	16	0	1	6	
Underutilized	37	13	7	5	12	83	
Vacant	141	49	9	26	57	570	
Residential Low Density - 8 (RLD-8)	80	17	11	16	36	340	0
Redevelopment	5	0	4	0	0	2	
Underutilized	6	2	1	1	2	17	
Vacant	68	14	5	15	33	321	
Residential Medium Density (RMD-16)	46	9	5	10	22	475	0
Redevelopment	2	0	1	0	0	2	
Underutilized	3	1	0	0	1	13	
Vacant	42	7	3	10	21	460	
Single Family Residential (R1-6)	144	30	24	28	62	0	0
Redevelopment	1	0	1	0	0	0	
Underutilized	74	14	18	13	29	0	
Vacant	69	16	5	15	33	0	
Single Family Residential (R1-7.5)	128	41	25	20	43	0	0
Redevelopment	2	0	2	0	0	0	
Underutilized	102	30	22	16	35	0	
Vacant	24	11	1	4	8	0	
Single Family Residential (R1-10)	39	18	5	5	11	0	0
Underutilized	22	10	4	3	6	0	
Vacant	17	8	1	2	5	0	
Residential Subtotal	1,385	427	216	233	510	3,005	0
Commercial							
Commercial Community Business (CCB)	20	1	0	5	14	0	285
Underutilized	20	1	0	5	14	0	285
Commercial Neighborhood Business (CNB)	14	2	0	3	9	0	185
Underutilized	14	2	0	3	9	0	185
Commercial Regional Business (CRB)	123	11	0	28	84	0	1,678
Underutilized	123	11	0	28	84	0	1,678
Central Mixed Use – High Density (CMU-H)	3	0	0	1	2	39	18
Underutilized	3	0	0	1	2	38	18

VBLM 2023
(LandUseAlternative2)

Capacity and Yield by Zoning

Ridgefield (City)

	Gross	Constrained	Market	Infrastructure	Buildable	Housing Units	Jobs
	Acres of Land						
Commercial							
Central Mixed Use – High Density (CMU-H)	3	0	0	1	2	39	18
Vacant	0	0	0	0	0	1	1
Commercial Community Business - Mixed Use (CCB-	34	3	0	8	23	390	186
Underutilized	30	3	0	7	20	339	161
Vacant	4	0	0	1	3	51	25
Commercial Regional Business - Mixed Use (CRB-	138	16	0	30	91	1,536	731
Underutilized	133	15	0	29	88	1,481	705
Vacant	5	1	0	1	3	55	26
Waterfront Mixed Use (WMU)	4	1	0	1	3	36	20
Underutilized	4	1	0	1	3	36	20
Waterfront Mixed Use – High Density (WMU-H)	35	6	0	7	22	368	175
Underutilized	35	6	0	7	22	368	175
Commercial Subtotal	372	40	0	83	249	2,369	3,279
Industrial							
Employment (E)	493	153	0	85	255	0	2,296
Underutilized	461	145	0	79	237	0	2,135
Vacant	32	8	0	6	18	0	161
Employment – Mixed Use (E-MU)	103	31	0	18	53	374	361
Underutilized	101	31	0	17	52	365	352
Vacant	2	0	0	0	1	9	9
Industrial Subtotal	596	184	0	103	308	374	2,656
Total	2,353	651	216	419	**1,067**	**5,748**	**5,935**

VBLM 2023
(LandUseAlternative2)

Capacity and Yield by Zoning

Vancouver (City)

	Gross	Constrained	Market	Infrastructure	Buildable	Housing Units	Jobs
	Acres of Land						
Residential							
Medium Scale Neighborhood (MSN)	505	84	155	40	225	10,650	43
Redevelopment	118	8	99	0	11	514	
Underutilized	144	17	38	14	75	3,560	43
Vacant	244	60	18	26	139	6,577	
Low Scale Neighborhood (LSN)	1,328	262	591	142	333	5,926	0
Redevelopment	593	97	471	0	25	434	
Underutilized	400	89	94	69	149	2,616	
Vacant	334	76	26	73	159	2,876	
Residential Subtotal	1,833	346	746	182	558	16,575	43
Commercial							
Regional Activity Center - City Center (RAC-CX)	978	49	568	44	316	23,397	4,605
Redevelopment	594	20	568	0	6	437	86
Underutilized	374	28	0	43	302	22,432	4,415
Vacant	10	1	0	1	8	528	104
Institutional/Campus (IC)	123	0	103	2	19	134	374
Redevelopment	108	0	103	0	5	39	108
Underutilized	15	0	0	2	13	95	265
Mixed-Use (MU)	2,031	55	1,296	76	603	20,429	8,833
Redevelopment	1,382	18	1,296	0	68	2,315	1,023
Underutilized	628	37	0	74	517	17,487	7,533
Vacant	22	0	0	3	18	627	277
Commercial Subtotal	3,132	104	1,967	123	938	43,960	13,812
Industrial							
Heavy Industrial (IH)	1,037	391	0	162	485	0	4,366
Underutilized	1,013	381	0	158	474	0	4,265
Vacant	24	9	0	4	11	0	101
Industrial/Employment (IE)	751	237	0	129	386	1,066	3,470
Underutilized	722	236	0	121	364	1,008	3,280
Vacant	29	1	0	7	21	59	190
Industrial Subtotal	1,788	627	0	290	871	1,066	7,836
Total	6,753	1,078	2,713	595	**2,367**	**61,602**	**21,691**

VBLM 2023
(LandUseAlternative2)

Capacity and Yield by Zoning

Washougal (City)

	Gross	Constrained	Market	Infrastructure	Buildable	Housing Units	Jobs
	Acres of Land						
Residential							
Multiple-family Residential (AR-16)	9	5	0	1	3	84	0
Redevelopment	0	0	0	0	0	0	
Vacant	9	5	0	1	3	84	
Multiple-family Residential (AR-22)	6	2	2	1	2	36	0
Redevelopment	2	1	2	0	0	4	
Underutilized	1	0	0	0	0	9	
Vacant	2	1	0	0	1	23	
Single-family Residential (R1-5)	51	11	13	9	19	406	0
Redevelopment	10	1	9	0	0	9	
Underutilized	8	2	2	1	3	49	
Vacant	34	8	3	7	16	349	
Single-family Residential (R1-7.5)	312	89	70	48	106	1,328	0
Redevelopment	60	14	43	0	2	27	
Underutilized	65	22	13	10	21	249	
Vacant	187	53	13	38	83	1,052	
Single-family Residential (R1-10)	105	28	26	16	35	311	0
Redevelopment	23	8	14	0	1	6	
Underutilized	41	12	9	6	14	113	
Vacant	41	9	3	9	20	193	
Single-family Residential (R1-15)	288	92	47	47	103	578	0
Redevelopment	34	12	21	0	1	6	
Underutilized	62	21	12	9	20	98	
Vacant	191	58	13	38	82	474	
Single Family Residential (R1-7.5)	8	4	0	1	3	0	0
Vacant	8	4	0	1	3	0	
Single Family Residential (R1-10)	1	0	1	0	0	0	0
Redevelopment	1	0	1	0	0	0	
Residential Subtotal	780	229	159	122	270	2,745	0
Commercial							
Community Commercial (CC)	16	1	0	4	12	173	116
Underutilized	15	1	0	4	11	160	107
Vacant	1	0	0	0	1	14	9
Convenience Commercial (CV)	0	0	0	0	0	4	3
Underutilized	0	0	0	0	0	4	3
Highway Commercial (CH)	45	5	0	10	30	1,185	356
Underutilized	43	5	0	10	29	1,170	346
Vacant	1	0	0	0	1	15	10
Town Center Core (TC-C)	14	2	0	3	9	170	76
Underutilized	2	0	0	1	2	28	12
Vacant	12	2	0	2	7	142	63

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Capacity and Yield by Zoning

Washougal (City)	Gross	Constrained	Market	Infrastructure	Buildable	Housing Units	Jobs
	Acres of Land						
Commercial							
Town Center East Village (TC-EV)	53	8	0	11	34	620	276
Underutilized	53	8	0	11	34	620	276
Town Center West Village (TC-WV)	2	0	0	0	1	15	10
Underutilized	2	0	0	0	1	15	10
Commercial Subtotal	131	16	0	29	86	2,167	835
Industrial							
Heavy Industrial (HI)	121	44	0	14	60	0	543
Underutilized	119	43	0	13	59	0	535
Vacant	2	1	0	0	1	0	7
Industrial Subtotal	121	44	0	14	60	0	543
Total	1,032	289	159	164	**416**	**4,912**	**1,378**

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Capacity and Yield by Zoning

Woodland (City)

	Gross	Constrained	Market	Infrastructure	Buildable	Housing Units	Jobs
	Acres of Land						
Residential							
Low Density Residential (LDR-6)	5	3	1	1	1	9	0
Underutilized	5	3	1	1	1	9	
Vacant	0	0	0	0	0	1	
Residential Subtotal	5	3	1	1	1	9	0
Total	5	3	1	1	1	**9**	**0**

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Capacity and Yield by Zoning

Yacolt (Town)

	Gross	Constrained	Market	Infrastructure	Buildable	Housing Units	Jobs
	Acres of Land						
Residential							
Single-family Residential (R1-10)	9	1	2	2	4	18	0
Redevelopment	2	0	2	0	0	0	
Vacant	7	0	1	2	4	18	
Single-family Residential (R1-12.5)	73	14	13	14	31	112	0
Redevelopment	10	3	7	0	0	1	
Underutilized	6	2	1	1	2	7	
Vacant	56	9	5	13	29	104	
Residential Subtotal	81	14	15	16	36	130	0
Commercial							
Community Commercial (C2)	5	0	0	1	3	0	69
Underutilized	4	0	0	1	3	0	58
Vacant	1	0	0	0	1	0	11
Neighborhood Commercial (C1)	2	0	0	1	2	0	35
Underutilized	2	0	0	1	2	0	35
Commercial Subtotal	7	0	0	2	5	0	104
Industrial							
Light Industrial (ML)	10	1	0	2	7	0	59
Underutilized	10	1	0	2	7	0	59
Industrial Subtotal	10	1	0	2	7	0	59
Total	98	15	15	20	**47**	**130**	**163**

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Capacity and Yield by Zoning

Unincorporated UGA

	Gross	Constrained	Market	nfrastructure	uildable	Housing Units	Jobs
	Acres of Land						
Residential							
Battle Ground (Unincorporated UGA)	**729**	**167**	**198**	**113**	**251**	**1,212**	**0**
Residential 3 units/acre (R3)	430	93	135	63	140	419	0
Redevelopment	81	22	57	0	3	9	
Underutilized	317	65	75	55	121	362	
Vacant	32	6	3	7	16	48	
Residential 5 units/acre (R5)	90	25	20	14	31	155	0
Redevelopment	1	0	0	0	0	0	
Underutilized	87	24	19	14	30	152	
Vacant	1	0	0	0	1	3	
Residential 7 units/acre (R7)	148	39	21	28	60	421	0
Redevelopment	1	0	0	0	0	0	
Underutilized	67	17	15	11	24	170	
Vacant	80	22	6	16	36	250	
Residential 10 units/acre (R10)	56	10	22	7	17	172	0
Redevelopment	16	2	13	0	1	14	
Underutilized	36	7	8	6	14	136	
Vacant	4	1	0	1	2	22	
Residential 16 units/acre (R16)	5	0	0	1	3	46	0
Vacant	5	0	0	1	3	46	
Camas (Unincorporated UGA)	**312**	**54**	**68**	**60**	**130**	**844**	**0**
North Shore Higher Density Residential (HD-NS)	30	0	6	8	17	299	0
Redevelopment	1	0	1	0	0	1	
Underutilized	12	0	4	3	6	101	
Vacant	18	0	2	5	11	197	
North Shore Lower Density Residential (LD-NS)	23	2	5	5	11	67	0
Redevelopment	1	0	1	0	0	0	
Underutilized	11	2	3	2	4	26	
Vacant	11	0	1	3	7	41	
Residential-10,000 (R-10)	44	5	12	9	19	75	0
Redevelopment	1	0	1	0	0	0	
Underutilized	41	5	11	8	17	68	
Vacant	3	0	0	1	2	6	
Residential-12 (R-12)	88	20	14	17	38	150	0
Redevelopment	3	0	2	0	0	1	
Underutilized	33	9	7	5	12	46	
Vacant	52	10	4	12	26	104	
Multifamily Residential-10 (MF-10)	10	0	4	1	3	35	0
Redevelopment	3	0	2	0	0	2	
Underutilized	7	0	2	1	3	32	
Single Family Residential (R1-6)	116	26	28	20	43	218	0
Redevelopment	6	0	5	0	0	1	
Underutilized	94	22	21	16	34	175	
Vacant	17	4	1	4	8	41	

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Capacity and Yield by Zoning

Unincorporated UGA	Gross	Constrained	Market	nfrastructure	uildable	Housing Units	Jobs
	Acres of Land						
Residential							
La Center (Unincorporated UGA)	**125**	**46**	**24**	**17**	**38**	**157**	**0**
Residential (R-12)	12	3	3	2	4	32	0
Underutilized	12	3	3	2	4	32	
Single Family Residential (R1-6)	29	10	6	4	9	33	0
Underutilized	29	10	6	4	9	33	
Single Family Residential (R1-7.5)	52	20	10	7	15	57	0
Underutilized	52	20	10	7	15	57	
Vacant	0	0	0	0	0	0	
Single Family Residential (R1-10)	3	1	1	1	1	5	0
Underutilized	3	1	1	1	1	5	
Single Family Residential (R1-20)	30	13	5	4	8	30	0
Underutilized	30	13	5	4	8	30	
Ridgefield (Unincorporated UGA)	**748**	**218**	**149**	**120**	**261**	**3,654**	**208**
Residential Medium Density - Mixed Use (RMD-MU)	281	80	49	48	104	2,622	208
Underutilized	213	67	44	32	70	1,768	140
Vacant	68	13	6	16	34	854	68
Residential Medium Density - MU, PF (RMD-MU-PF)	14	3	3	2	5	110	0
Underutilized	13	3	3	2	5	99	0
Vacant	1	0	0	0	1	12	0
Residential Low Density - 6 (RLD-6)	65	28	11	8	18	129	0
Redevelopment	1	0	0	0	0	0	
Underutilized	57	24	10	7	16	114	
Vacant	6	3	0	1	2	15	
Residential (R-12)	37	14	6	6	12	158	0
Underutilized	27	9	5	4	9	114	
Vacant	10	4	1	2	3	44	
Single Family Residential (R1-6)	120	30	22	21	46	242	0
Underutilized	85	20	20	14	31	162	
Vacant	35	11	2	7	15	79	
Single Family Residential (R1-7.5)	123	34	27	19	42	220	0
Redevelopment	1	0	1	0	0	0	
Underutilized	120	33	26	19	42	216	
Vacant	2	1	0	0	1	4	
Single Family Residential (R1-10)	108	29	32	15	33	173	0
Redevelopment	17	2	14	0	1	4	
Underutilized	78	23	16	12	26	136	
Vacant	13	3	1	3	6	33	
Vancouver (Unincorporated UGA)	**6,278**	**1,227**	**1,880**	**857**	**2,314**	**51,313**	**0**
Multifamily Residential (R-24)	609	136	133	53	288	6,518	0
Redevelopment	37	3	30	0	3	74	
Underutilized	368	75	88	32	173	3,799	

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Capacity and Yield by Zoning

Unincorporated UGA

	Gross	Constrained	Market	nfrastructure	uildable	Housing Units	Jobs
	Acres of Land						
Residential							
Vancouver (Unincorporated UGA)	**6,278**	**1,227**	**1,880**	**857**	**2,314**	**51,313**	**0**
Vacant	205	58	15	21	112	2,645	
Multifamily Residential (R-32)	409	76	102	35	195	5,317	0
Redevelopment	69	13	51	0	6	152	
Underutilized	137	20	35	13	69	1,875	
Vacant	202	44	16	22	120	3,290	
Multifamily Residential (R-40)	34	7	9	3	15	576	0
Redevelopment	8	0	7	0	1	28	
Underutilized	7	3	1	0	2	81	
Vacant	20	4	2	2	12	468	
Multifamily Residential (R-45)	166	17	38	17	94	4,030	0
Redevelopment	9	1	7	0	1	33	
Underutilized	100	14	26	10	51	2,185	
Vacant	57	2	6	8	42	1,812	
Multifamily Residential (R-50)	16	1	11	0	3	158	0
Redevelopment	12	1	10	0	1	56	
Underutilized	4	1	1	0	2	85	
Vacant	1	0	0	0	0	17	
Multifamily Residential (HWY99/MF)	27	7	7	2	11	1,114	0
Redevelopment	6	1	4	0	1	50	
Underutilized	6	2	1	0	2	224	
Vacant	15	4	1	2	8	840	
Office Residential (OR-24)	1	0	1	0	0	2	0
Redevelopment	1	0	1	0	0	2	
Office Residential (OR-32)	3	1	0	0	2	46	0
Vacant	3	1	0	0	2	46	
Office Residential (OR-40)	91	15	17	9	49	1,864	0
Redevelopment	1	0	1	0	0	3	
Underutilized	50	7	13	5	26	970	
Vacant	39	8	3	4	23	891	
Office Residential (OR-45)	24	8	2	2	12	525	0
Underutilized	3	1	1	0	1	59	
Vacant	21	7	1	2	11	466	
Single Family Residential (R1-5)	523	106	131	89	197	4,398	0
Redevelopment	71	8	60	0	3	69	
Underutilized	225	46	54	39	86	1,864	
Vacant	228	52	18	50	108	2,465	
Single Family Residential (R1-6)	1,706	225	636	260	585	13,083	0
Redevelopment	459	46	393	0	21	451	
Underutilized	795	114	204	150	326	7,113	
Vacant	452	65	39	110	239	5,519	
Single Family Residential (R1-7.5)	1,253	261	352	198	441	9,848	0
Redevelopment	230	30	190	0	10	218	
Underutilized	552	137	124	91	199	4,336	

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Capacity and Yield by Zoning

Unincorporated UGA

	Gross	Constrained	Market	nfrastructure	uildable	Housing Units	Jobs
	Acres of Land						
Residential							
Vancouver (Unincorporated UGA)	**6,278**	**1,227**	**1,880**	**857**	**2,314**	**51,313**	**0**
Vacant	472	95	38	107	232	5,294	
Single Family Residential (R1-10)	1,016	242	337	135	303	3,171	0
Redevelopment	259	51	198	0	10	106	
Underutilized	552	140	124	91	198	2,015	
Vacant	205	51	15	44	95	1,049	
Single Family Residential (R1-20)	400	123	104	53	119	665	0
Redevelopment	72	6	63	0	3	18	
Underutilized	143	40	31	23	49	266	
Vacant	184	77	11	30	66	381	
Washougal (Unincorporated UGA)	**761**	**163**	**153**	**140**	**305**	**2,313**	**0**
Single-family Residential (R1-5)	88	16	21	16	35	601	0
Redevelopment	1	0	0	0	0	0	
Underutilized	77	11	20	15	32	601	
Vacant	10	4	1	2	3	0	
Single-family Residential (R1-7.5)	98	20	24	17	36	437	0
Redevelopment	3	0	2	0	0	1	
Underutilized	91	19	22	16	35	418	
Vacant	4	1	0	1	1	18	
Single-family Residential (R1-10)	142	21	33	28	61	433	0
Redevelopment	4	1	3	0	0	1	
Underutilized	103	11	28	20	44	355	
Vacant	36	9	3	8	16	77	
Single-family Residential (R1-15)	294	59	47	59	129	648	0
Redevelopment	1	0	1	0	0	0	
Underutilized	134	21	34	25	54	271	
Vacant	159	37	12	34	75	377	
Single Family Residential (R1-7.5)	35	10	7	6	12	53	0
Redevelopment	0	0	0	0	0	0	
Underutilized	30	9	6	5	10	44	
Vacant	4	1	0	1	2	9	
Single Family Residential (R1-10)	104	37	21	14	31	140	0
Redevelopment	7	2	4	0	0	1	
Underutilized	84	29	16	12	26	116	
Vacant	14	6	1	2	5	23	
Woodland (Unincorporated UGA)	**90**	**45**	**14**	**10**	**22**	**91**	**0**
Single Family Residential (R1-10)	90	45	14	10	22	91	0
Underutilized	90	45	14	10	22	91	
Yacolt (Unincorporated UGA)	**85**	**16**	**11**	**18**	**40**	**138**	**0**
Single-family Residential (R1-12.5)	76	15	8	17	36	126	0
Underutilized	15	3	4	3	6	20	
Vacant	61	12	5	14	30	106	

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Capacity and Yield by Zoning

Unincorporated UGA	Gross	Constrained	Market	nfrastructure	uildable	Housing Units	Jobs
	Acres of Land						
Residential							
Yacolt (Unincorporated UGA)	**85**	**16**	**11**	**18**	**40**	**138**	**0**
Single Family Residential (R1-20)	10	2	2	2	4	13	0
Underutilized	8	1	2	2	3	11	
Vacant	2	1	0	0	1	2	
Residential Subtotal	9,128	1,936	2,496	1,336	3,361	59,723	208
Commercial							
Battle Ground (Unincorporated UGA)	**72**	**8**	**0**	**16**	**48**	**0**	**965**
Regional Center (RC)	63	7	0	14	42	0	838
Underutilized	56	7	0	12	37	0	745
Vacant	7	1	0	2	5	0	93
Neighborhood Commercial (NC)	9	1	0	2	6	0	128
Underutilized	9	1	0	2	6	0	128
Camas (Unincorporated UGA)	**171**	**10**	**0**	**40**	**120**	**33**	**2,379**
Community Commercial (CC)	21	1	0	5	15	0	304
Underutilized	21	1	0	5	15	0	304
North Shore Commercial (C-NS)	12	0	0	3	9	0	178
Underutilized	12	0	0	3	9	0	178
North Shore Mixed Use (MX-NS)	4	0	0	1	3	33	27
Underutilized	4	0	0	1	3	33	27
Mixed Employment (ME)	134	9	0	31	94	0	1,870
Underutilized	134	9	0	31	94	0	1,870
La Center (Unincorporated UGA)	**57**	**8**	**0**	**12**	**37**	**0**	**734**
Downtown Commercial (C-1)	57	8	0	12	37	0	734
Underutilized	57	8	0	12	37	0	734
Ridgefield (Unincorporated UGA)	**63**	**7**	**0**	**14**	**42**	**595**	**375**
Commercial Neighborhood Business (CNB)	4	0	0	1	2	0	0
Underutilized	4	0	0	1	2	0	
Commercial Neighborhood Business - MU (CNB-MU)	53	6	0	12	35	595	284
Underutilized	53	6	0	12	35	595	284
Neighborhood Commercial (NC)	7	1	0	2	5	0	91
Underutilized	7	1	0	2	5	0	91
Vancouver (Unincorporated UGA)	**1,008**	**70**	**290**	**133**	**515**	**6,696**	**7,829**
Community Commercial (CC)	162	8	0	38	115	0	2,305
Underutilized	138	7	0	33	98	0	1,958
Vacant	24	1	0	6	17	0	347

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Capacity and Yield by Zoning

Unincorporated UGA

	Gross	Constrained	Market	nfrastructure	uildable	Housing Units	Jobs
	Acres of Land						
Commercial							
Vancouver (Unincorporated UGA)	**1,008**	**70**	**290**	**133**	**515**	**6,696**	**7,829**
General Commercial (GC)	243	22	0	55	166	0	3,324
Underutilized	226	20	0	52	155	0	3,099
Vacant	17	2	0	4	11	0	225
Neighborhood Commercial (NC)	17	1	0	4	12	0	238
Underutilized	17	1	0	4	12	0	238
Klineline, 99 Commons, and Totem TC (HWY99/K9T)	150	12	92	0	46	2,322	697
Redevelopment	104	7	92	0	5	241	72
Underutilized	44	5	0	0	40	1,991	597
Vacant	2	0	0	0	2	90	27
Parks Common, and Minnehaha GV (HWY99/PM)	35	2	22	0	11	285	171
Redevelopment	25	2	22	0	1	28	17
Underutilized	11	1	0	0	10	256	154
Tenny Creek, and Totem TC (HWY99/TNT)	11	0	6	0	5	179	72
Redevelopment	6	0	6	0	0	11	5
Underutilized	2	0	0	0	2	71	28
Vacant	3	0	0	0	3	97	39
Transitional Area (HWY99/T)	240	14	171	0	54	1,353	812
Redevelopment	191	11	171	0	9	225	135
Underutilized	47	3	0	0	43	1,084	650
Vacant	2	0	0	0	2	44	26
Mixed Use (MX)	150	10	0	35	105	2,557	210
Underutilized	114	6	0	27	81	1,960	161
Vacant	37	4	0	8	25	596	49
Washougal (Unincorporated UGA)	**43**	**2**	**0**	**10**	**31**	**125**	**349**
Community Commercial (CC)	12	0	0	3	8	125	83
Underutilized	12	0	0	3	8	125	83
Community Commercial - Schools (CC-S)	31	1	0	8	23	0	266
Underutilized	31	1	0	8	23	0	266
Yacolt (Unincorporated UGA)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
General Commercial (GC)	0	0	0	0	0	0	0
Underutilized	0	0	0	0	0	0	0
Commercial Subtotal	1,414	104	290	226	794	7,448	12,631
Industrial							
Battle Ground (Unincorporated UGA)	**249**	**67**	**0**	**46**	**137**	**0**	**1,231**
Westside Employment (WE)	249	67	0	46	137	0	1,231
Underutilized	249	67	0	46	137	0	1,231

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Capacity and Yield by Zoning

Unincorporated UGA	Gross	Constrained	Market	nfrastructure	uildable	Housing Units	Jobs
	Acres of Land						
Industrial							
La Center (Unincorporated UGA)	**48**	**20**	**0**	**7**	**21**	**0**	**189**
Light Industrial (IL)	48	20	0	7	21	0	189
Underutilized	48	20	0	7	21	0	189
Ridgefield (Unincorporated UGA)	**270**	**71**	**0**	**50**	**149**	**1,812**	**995**
Employment – Mixed Use, 3-way Split (E-MU-3)	196	52	0	36	108	1,812	626
Underutilized	196	52	0	36	108	1,812	626
Business Park (BP)	74	19	0	14	41	0	369
Underutilized	70	18	0	13	39	0	353
Vacant	4	2	0	1	2	0	16
Light Industrial (IL)	0	0	0	0	0	0	0
Underutilized	0	0	0	0	0	0	0
Vancouver (Unincorporated UGA)	**1,645**	**461**	**0**	**296**	**888**	**0**	**7,994**
Business Park (BP)	794	240	0	139	416	0	3,740
Underutilized	731	229	0	125	376	0	3,385
Vacant	63	11	0	13	39	0	355
Heavy Industrial (IH)	0	0	0	0	0	0	2
Underutilized	0	0	0	0	0	0	2
Light Industrial (IL)	851	221	0	157	472	0	4,252
Underutilized	810	215	0	149	446	0	4,014
Vacant	41	6	0	9	27	0	238
Washougal (Unincorporated UGA)	**10**	**0**	**0**	**0**	**18**	**0**	**160**
Heavy Industrial (IH)	10	0	0	0	18	0	160
Underutilized	10	0	0	0	18	0	160
Yacolt (Unincorporated UGA)	**23**	**2**	**0**	**5**	**16**	**0**	**145**
Light Industrial (IL)	23	2	0	5	16	0	145
Underutilized	23	2	0	5	16	0	145
Industrial Subtotal	2,246	621	0	404	1,229	1,812	10,715
Total	12,789	2,661	2,786	1,965	**5,384**	**68,984**	**23,554**

APPENDIX N

WATER USE EFFICIENCY MEETING MINUTES AND AGENDA

~ To be included in a future submittal. ~

APPENDIX O

WATER LOSS CONTROL ACTION PLAN

Water System Plan Update



Water Loss Control Action Plan

September 2026 / DRAFT

carollo

SECTION 1 INTRODUCTION

From 2022 to 2024, the average distribution system leakage (DSL) was approximately 11.2 percent for the City of Camas (City), triggering the requirement of a completion of a Water Loss Control Action Plan (WLCAP). In successive years, the DSL has decreased, and the standard of 10 percent or less is believed to be achievable within the next 10 years. This plan addresses how the City will mitigate DSL, sets a goal of when it will meet the regulation, and how it intends to fund necessary projects to support controlling water loss.

SECTION 2 WATER LOSS CONTROL METHODS

As mentioned above, the City is slightly over the 10 percent standard based on their Annual Water Use Efficiency Report data. Note that the 2025 DSL brings the three-year rolling average DSL under the 10 percent threshold; however, the data collected for 2025 seems unreliable. In 2025 the City underwent a billing system software change. Consumption data for 2025 is from two different sources which is believed to be the reason why consumption may be over-reported. Therefore, the City elected to complete a WLCAP to show their commitment to ensuring that DSL is consistently 10 percent or less.

To control water loss, the City intends to continue implementing leak detection and mitigation by alerting and visiting customers where leaks are detected as well as leveraging the advanced metering infrastructure (AMI) meters that have been installed for 100 percent of the City's customers. AMI meters collect and transmit data in real time to the finance department at the City, which will aid in detecting leaks quickly. Furthermore, these meters will be repaired and/or replaced per manufacturer recommendations as needed. Leakage has been decreasing in the distribution system already based on the Annual Water Use Efficiency Reports as outlined in Table 1.

Table 1 The City's Yearly DSL

Year	DSL (%)	3-Year Rolling Average DSL (%)
2021	14.7	14.2
2022	14.2	14.5
2023	10.3	13.1
2024	9.2	11.2
2025	0.7	6.7

Additionally, a pipeline replacement program will be included in the City's Capital Improvement Program (CIP) to replace aging cast iron and steel pipe installed before 1960, the majority of which were installed prior to 1940. This piping accounts for 19 percent of the system. By replacing the aging infrastructure, leakage should decrease further, improving the City's DSL.

With these measures and projects implemented, the City is committed to meeting the DSL standard on a consistent basis by 2036.

SECTION 3 DATA ACCURACY AND COLLECTION EVALUATION

As mentioned above, the AMI meters should improve the data accuracy and collection for the distribution system since data is collected in real time and transmitted to the finance department at the City. This reduces data errors caused by human error, such as manually inputting or collecting data. Furthermore, the City switched to monthly billing instead of bi-monthly billing, making it more manageable to verify data accuracy.

Data accuracy could be further improved simply by installing new meters when they start to fail since meters are designed to read low when this occurs. This could potentially lead to under reporting of consumption. The City will repair and/or replace meters in a timely manner to mitigate this implication.

It is believed that the low DSL value in 2025 was primarily due to a switch in billing systems. This could have led to errors in accounting of consumption and possibly double counting. The 92 percent reduction in DSL from 2024 to 2025 does not seem plausible. Therefore, the City considered the 2024 three-year rolling average instead of the 2025 three-year rolling average to err on the side of caution. Moving forward, it is expected that the data accuracy should be stable since continuity will be established using the new billing system.

SECTION 4 FUNDING FOR WATER LOSS CONTROL PROGRAM

The City realizes that funding is critical to apply successful measures and programs. Currently, it is not anticipated that alerting customers about leakage will need additional funding as this is a current practice done by the City. Also, the meters have been replaced with AMI meters recently as well, so this measure is also not expected to be a significant additional cost to the City in the near future.

The costliest method for controlling water loss is the pipe replacement program. By including this in the CIP, as mentioned above, the City is preparing a funding strategy for this program. Possible options that can be considered are modifying customer rates and applying for funding to replace the aging infrastructure. The City will assess which is the best option once the cost of the program is determined.

APPENDIX P

WATER USE EFFICIENCY PROGRAM

Water System Plan Update



Water Use Efficiency Program

September 2026 / DRAFT

carollo

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Abbreviations

2026 WSP	2026 Water System Plan Update
ADD	average day demand
AFY	acre-feet per year
cfs	cubic feet per second
City	City of Camas
DOH	Department of Health
DSL	distribution system leakage
Ecology	Department of Ecology
ERU	equivalent residential unit
gpm	gallons per minute
LWWF	Lower Washougal Wellfield
mgd	million gallons per day
MMD	maximum day demand
O&M	operations and maintenance
Qa	annual water right
Qi	instantaneous water right
SFR	single-family residential
WAC	Washington Administrative Code
WLCAP	Water Loss Control Action Plan
WUE	Water Use Efficiency
WWTP	wastewater treatment plant

SECTION 1 INTRODUCTION

The City of Camas (City) promotes efficient water use to conserve and protect their existing water supplies for present and future residents. The City promotes water conservation and efficient use of water through a variety of activities that encompass their Water Use Efficiency (WUE) Program. The WUE Program encourages water conservation and utilizes continued improvements to reduce leakages and water loss in the City's system. This report details both the City's existing WUE programs.

SECTION 2 WUE PROGRAM BACKGROUND

In 2003, the Washington State Legislature passed the Engrossed Second Substitute House Bill 1338, known as the Municipal Water Law or the WUE rule, to address the increasing demand on Washington's water resources. This law established that all municipal water suppliers must use water more efficiently in exchange for water right certainty and flexibility to help them meet future demand.

The WUE rule, which became effective on January 22, 2007, emphasizes the importance of measuring water use and evaluating the effectiveness of the water supplier's WUE program. The intent is to minimize water withdrawals and water use by implementing water saving activities and adopting policies, resolutions, ordinances, or bylaws. This report follows the guidelines set forth in the *Water Use Efficiency Guide Book*, Fourth Edition, (January 2025) as well as the *Water System Planning Handbook* (April 1997).

SECTION 3 WATER SUPPLY CHARACTERISTICS

3.1 Source

The City obtains its water from two surface water sources and 10 wells. Eight of the groundwater sources (Wells 5, 6, 7, 8, 10, 11, 12, 14) are located in the City's Lower Washougal Wellfield (LWWF), in the lower Washougal floodplain near downtown Camas. Wells 7, 8, 10, 11 and 12 are often referred to as the City's "Oak Park" wellfield. Well 13 is north and west of the Oak Park wells and is effectively part of the same wellfield pumping center but is not typically referenced as being part of the LWWF. The remaining well (Well 9) is located in the uplands about two miles north of the Columbia River and 1.5 miles west of Lacamas Lake. Groundwater sources receive disinfection and other water quality treatment before entering the distribution system.

The City's Boulder and Jones Creek surface water diversions are located in the headwaters of the Washougal River drainage. These sources are treated at the City's slow sand filtration plant.

3.2 Water Rights Summary

The City's water system (Department of Health [DOH] ID 108002) currently has 2 water right claims which have been modified by Certificates of Change, 11 certificated water rights, and 5 water right permits. A summary of the City's water rights is provided in Table 1. Note, the City requested in March 2026 that the

Department of Ecology (Ecology) extend the development schedule on each of the City's five water right permits to 2031. The City's current plan for developing the wells is presented in Section 8.4 of the 2026 Water System Plan Update (2026 WSP).

The City has limitations on its water rights that complicate the calculation of total instantaneous water right (Qi) and annual water right (Qa) as described below:

- Jones and Boulder Creek surface water sources may only be operated seasonally from October 31 through May 15, as directed by Permit G2-30144. The Qa for periods outside of the operating time window are used to maintain instream flow in the Creeks (not for City use).
- Historically, water right permits and certificates with priority dates before 1979 were limited by Ecology to a "total combined maximum Qa of 5,750 acre-feet per year (AFY)". However, modifications to the City's water right claims resulted in the recognition of an additional 550 AFY which increased the total Qa to 6,300 AFY with priority dates before 1979.
- Withdrawals from Well 9 are considered non-additive. The certificate does not increase the cumulative annual total of all rights but does increase the Qi.
- Certificate CG2-20938 (an irrigation water right allocating 330 gallons per minute (gpm) and 106 AFY for use between May 1 to October 1) was acquired by the City in 2015 and transferred into permanent trust as instream baseflow support for Lacamas Creek. The City retains the option to request to apply the consumptive use portion of the right (90.3 AFY) as potential mitigation for future water use within the Lacamas Creek drainage downstream of the water right location.

The City's resulting water rights equate to a Qi of 14,045 gpm (20.2 million gallons per day [mgd]), an additive Qa of 11,090 AFY (9.9 mgd), and a non-additive Qa of 210 AFY (0.3 mgd) as described by Permit G2-30756 (see Page 2) and Certificate G2-27384 (Well 9).

Table 1 Water Right Summary

Source	ID Number	Priority Date	Instantaneous Qi (gpm)	Annual Qa (AFY)
Claims				
Well 1	Claim 121022 transferred to Well 10(6)			
Well 2	Certificate C-85-A transferred to Well 12(6)			
Well 3	Claim 121023 transferred to Well 11(6)			
Well 4	Certificate G2-GWC4079 transferred to Well 13(6)			
Certificates				
Boulder Creek(7)	C-712	08/22/1923	1,120 (2.5 cfs)	977(2) (A)(9)
	CS2-SWC 712			843 A (Instream Flow)
Jones Creek(7)	C-711	09/05/1930	450 (1.0 cfs)	393(3) (A)(9)
	CS2-SWC 711			337 A (Instream Flow)
Well 5	G 6636-A G2-*09325C	03/22/1968	600	920(4) (A)(9)
Well 6	G 6635-A G2-*09325C	03/22/1968	1,500	2,400(4) (A)(9)
Well 7	G2-00501	03/22/1971	1,000	530(5) (A)(9)

Source	ID Number	Priority Date	Instantaneous Qi (gpm)	Annual Qa (AFY)
Well 8	G2-24400	02/04/1977	900	530[5] (A)[9]
Well 9	G2-27384	08/13/1986	650	210 (N)[10]
Well 10	G2-CV1-2P159	06/11/1974	900	320 (A)[9]
Well 11	G2-CV1-2P160	06/11/1974	1,200	230[5] (A)[9]
Well 12	C-85-A G2-*0004C	07/21/1945	900	118 (A)[9]
Well 13	G2-GWC4079 G2-*05130C	02/12/1959	1,325	1,208[5] (A)[9]
Permits				
Lower Washougal Wellfield	G2-30144	08/21/1986[11]	500 (At Well 8)	2,150 (A)[9] (All 8 wells)
Well 14 (Anderson Site)	G2-30145	08/21/1986[11]	1,000	880 (A)[9]
Parkers Landing	G2-30146	08/21/1986[11]	1,000	880 (A)[9]
Treatment Plant Well	G2-30147	08/21/1986[11]	1,000	880 (A)[9]
Umbrella Wellfield	G2-30756	01/08/2020	6,700	11,090[12] (All 8 wells)
Total[13]			**14,045**	**11,090 (A)[9]** **210 (N)**
Pending Applications				
Steigerwald Regional Supply[8]	G2-30528		17,213	13,555

Notes:

(1) Claims are considered valid until proven otherwise through an adjudication process.
(2) This source was formerly known as the Little Washougal River. The certificate refers to an Qi and does not specify an annual withdrawal. An Ecology Report of Examination for Well 7 (G2-00501) summarizes existing water rights, including 1,820 AFY for Boulder Creek (C-712), based on continuous withdrawal at the instantaneous right specified.
(3) The certificate refers to an Qi and does not specify an annual withdrawal. An Ecology Report of Examination for Well 7 (G2-00501) summarizes existing water rights, including 730 AFY for Jones Creek (C-711), based on continuous withdrawal at the Qi specified.
(4) The Permit and Report of Examination preceding this certificate limited water rights to “the total quantity withdrawn or diverted from all sources is not to exceed 3,300 AFY.
(5) The Permit and Report of Examination preceding this certificate limited water rights to “the total quantity withdrawn or diverted from all sources is not to exceed 5,750 AFY.
(6) Well 10, 11, and 12 were installed to replace Well 1, 2 and 3, which have failed due to collapsed well casings; see Pacific Groundwater Group report dated June 9, 2003. Well 13 replaced Well 4 after Well 4 was determined to be groundwater under the influence of surface water; see Pacific Groundwater Group report dated August 14, 2006. G2-CV1-2P160, which is now associated with Well 10, allowed for seasonal between May 1st and August 31st. Year-round operation of Well 10 is authorized under Permit G2-30144 for the LWWF.
(7) See Ecology agreement that limits withdrawal from the surface water sources from May 15 through October 31.
(8) Joint application with City of Camas and City of Washougal.
(9) (A) = Additive water right, additive to other rights.
(10) (N) = Non-additive water right, not included when summing a cumulative total of all rights.
(11) The original Ecology Report of Examination for these permits indicated a priority date of 08/21/2003. However, Ecology assigned a priority date of 08/13/1986 via amended permits to match with the date of the Clark County Reservation identified by watershed planning for WRIAs 27/28.
(12) Installation of one future well in the LWWF is included under this permit.
(13) Due to permit and certificate restrictions, the total Qi and Qa do not equal the sum of quantities for each column.

cfs - cubic feet per second.

3.3 Water Rights Analysis

The City's water rights were compared to existing, 5-year (2031), 10-year (2036), and 20-year (2046) demand projections to establish water right surplus or deficiency. Both Qi and Qa were considered and are summarized in Tables 2 and 3, respectively.

The City currently has surplus water rights based on the actual well pumping in 2024, which was considered to be the existing condition. Note, the reported values reflect the pumping over the entire year, where not all wells were pumped at the same time.

Table 2 Instantaneous Water Rights (Qi) Summary

Year	MDD – High Scenario(1) (gpm)	Instantaneous Water Right (Qi) (gpm)	Surplus/Deficiency (gpm)
Existing	6,765(2)	12,475(3)	5,710
2031	8,620	12,475 (3)	3,855
2036	10,490	12,475 (3)	1,985
2046	14,080	12,475 (3)	-1,605

Notes:
(1) Future values based on high MDD demand projection scenario.
(2) Based on actual 2024 maximum day production data.
(3) Instantaneous water rights of 14,045 gpm shown in Table 8.1 minus 1,570 gpm of surface water rights not available during the summer months.
MDD - maximum day demand.

Table 3 Annual Water Rights (Qa) Summary

Year	ADD - High Scenario(1) (AFY)	Annual Water Right (Qa) (AFY)	Surplus/Deficiency (AFY)
Existing	5,230(2)	11,090	5,860
2031	6,610	11,090	4,480
2036	8,070	11,090	3,020
2046	10,910	11,090	180

Notes:
(1) Future values based on high ADD demand projection scenario.
(2) Based on actual 2024 annual production data.
ADD - average day demand.

For the future water rights evaluation, the forecasted source production was based on the high demand projection scenario. The high demand scenario generally reflects the water use rates from the period of highest demands in the last eight years. Use of the highest projected demands is intended to support the City in planning for sufficient physical supplies to meet demands and provide sufficient time for phasing in new supplies, which is typically a multi-year process.

The City is expected to have sufficient Qa through the next 20 years; however, the City is expected to have a Qi deficiency of 1,605 gpm by 2046. The City plans to meet this deficiency by a combination of improving pumping yields from existing well facilities, developing all of its existing water rights, and securing water rights for additional supply sources. Additionally, the City will continue to encourage water use efficiency including the reduction of irrigation use, which is a major driver for the relatively high projected MDD.

3.4 Production and Delivery System

The City's water system has an available water production capacity of approximately 15.5 mgd and delivers potable water throughout 26 pressure zones. Water is conveyed through more than 159 miles of transmission and distribution pipelines and supported by seven storage reservoirs with a combined capacity of approximately 9.95 million gallons. Ten booster pumping stations and numerous pressure control facilities help move water between service areas, maintain system pressures, and meet varying customer demands across the system. System operations are monitored and controlled through the City's SCADA system, which provides real-time oversight of storage levels, pumping operations, flows, and other critical system functions.

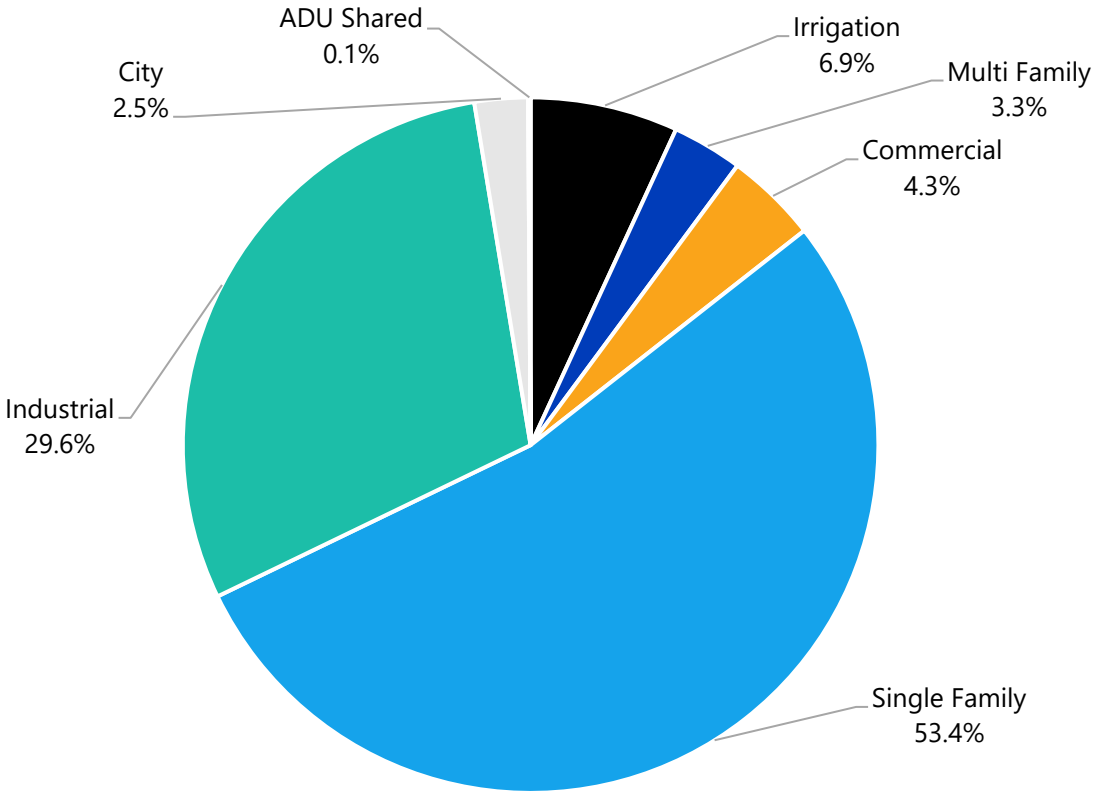


Figure 1 2017 to 2024 Average Water Demand by Customer Class

SECTION 4 2013 TO 2024 WUE PROGRAM SUMMARY

The previous program's demand-side goals were to reduce customer consumption per equivalent residential unit (ERU) by 1 percent or approximately 2 gpd per year over the next six years. Figure 2 compares the City's actual single-family residential (SFR) demand to the demand-side WUE goal to demonstrate the effectiveness of the City's WUE Program. The goal demand begins at 260 gpd/ERU, which represents the 2013 to 2015 average demand used as the planning ERU in the 2019 Water System Plan. The goal demand was then reduced by 2 gpd each year, consistent with the City's goal. As shown in Figure 2, actual SFR demand has generally remained below or near the goal demand, indicating that the

City has been successful in meeting its demand-side WUE objective. Note that the 2016 data is represented with a dashed bar. This is because 2016 data was not available; therefore, the 2016 demand is estimated as the average of 2015 and 2017 demands.

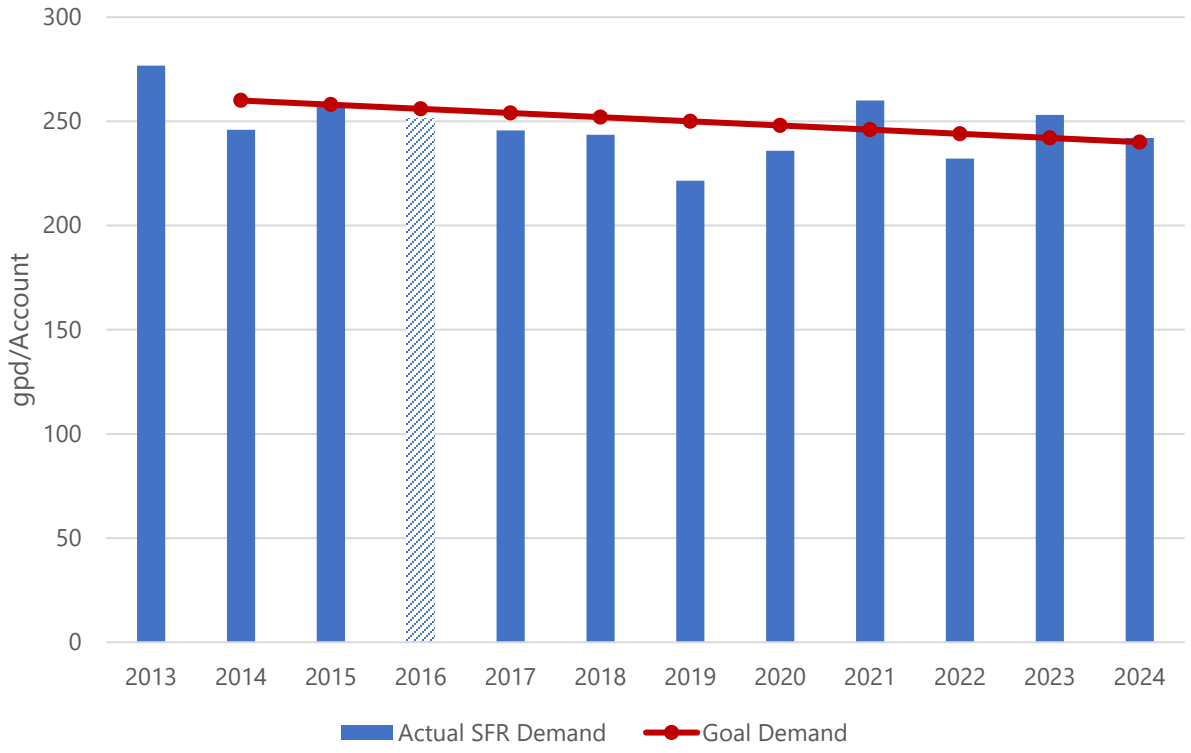


Figure 2 Actual Compared to Goal Single-Family Residential Demand

SECTION 5 DISTRIBUTION SYSTEM LEAKAGE

Distribution system leakage (DSL) is a significant element of supply-side WUE requirements. DSL above 10 percent on a three year rolling average is considered excessive and necessitates the creation of a Water Loss Control Action Plan (WLCAP). DSL is the difference between total water production and metered water use. The estimate of DSL is dependent on the accuracy of meter readings for supply and customer meters. Table 4 presents the City's reported three year rolling average DSL from 2021 through 2025. The City has averaged above their WUE program goal and DOH standard of 10 percent, but the City is making progress in mitigating DSL with it decreasing in successive years. Note that the 2025 three year rolling average is under the 10 percent threshold; however, it is possible that there may be inaccuracies in the data collected for 2025 as the billing system shifted to a new one. Therefore, the City will complete a WLCAP to address their DSL.

Table 4 Distribution System Leakage (3-year Rolling Average)

Year	3-Year Rolling Average DSL (%)
2021	14.2
2022	14.5
2023	13.1
2024	11.2
2025	6.7

The DSL in Table 4 differs from that calculated in Chapter 5 - Water Requirements of the 2026 WSP, where Chapter 5 evaluated historical billing data for consumption. The City is not able to account for the differences; however, it is believed to be related to year end meter reading. In 2025 the City transitioned its billing software. Consumption data for 2025 was compiled from two sources which may account for the low reported water consumption.

SECTION 6 2027 TO 2032 WUE PROGRAM

The City's current WUE Program was established as part of the 2026 WSP. Per the Washington Administrative Code (WAC) 246-290-830(4)(a), all water purveyors with 1,000 or more connections are required to set efficiency goals through a public process. The established goals promote WUE for internal operations and for water customers. The past WUE Program goals were established in the 2010 WSP and subsequently re-established in 2013, 2019, and 2026:

- **Demand-Side Goal:** Reduce customer consumption per ERU by 1 percent over the next six years.
- **Supply-Side Goal:** Continue to reduce distribution loss to 10 percent or less over the next five years.

6.1 Supply-Side Measures

The City implements the following supply-side measures as part of their WUE Program. A number of these measures are mandated by Washington State DOH per the WUE Guidebook. The following summarizes the City's supply-side measures:

1. Record and monitor supply source production (Mandatory).
2. Record and monitor customer demands through customer water meters (Mandatory).
3. Test and calibrate industrial and commercial meters annually (Mandatory).
4. The City will repair and/or replace residential meters per manufacturer recommendations.
5. Perform annual leak detection surveys through a private contractor. Hydrants and valves are checked as part of leak detection surveys (Mandatory).
6. Repair or replace old distribution system piping with defects as budget allows.
7. Reclaimed Water: Treated wastewater is used for washdown and process use and for landscape irrigation at the wastewater treatment plant (WWTP) (Mandatory to evaluate reclaimed water).

6.2 Demand-Side Measures

The City implements a number of demand-side measures. These measures are similar to many of the example WUE measures presented in Appendix B of the *Water Use Efficiency Guidebook*. The City provides an overview of their WUE activities on their Water Services website (http://www.ci.camas.wa.us/index.php/pwwater). The City's various public outreach activities meet the DOH requirement for educating customers about WUE. The following provides a summary of the City's demand-side measures:

1. City staff alert and visit customers where customer leaks are identified.
2. Promote installation of smart controllers for City-wide users.
3. Educate the public on conservation and water-saving devices at community events, such as Camas Days, and on the City website (http://www.ci.camas.wa.us/images/DOCS/WATER_SEWER/REPORTS/waterconservation.pdf).
4. Promote xeriscaping and Low Impact Development to reduce irrigation requirements for new developments.
5. Promote irrigation systems to incorporate drip systems or micro sprayers.
6. Promote odd/even day and late night or early morning irrigation for all customers.
7. Provide monthly billing to all customers.
8. Send water savings tips to customers in the annual water quality report.
9. Onsite irrigation at the WWTP with treated effluent.

The above supply- and demand-side WUE measures are effective in encouraging WUE for the water system.

6.3 Mandatory Measures

The WUE Program includes supply side measures that the City implements to understand and control leakage including new meters and leak detection surveys. The City's WUE Program will continue to meet the following mandatory measures in the future:

- Install production (source) meters.
- Install consumption (service) meters.
- Perform meter calibration.
- Implement a water loss control action plan to control leakage if the three year rolling average exceeds 10 percent.
- Educate customers about WUE practices.
- Evaluate rates that encourage water demand efficiency, as discussed in a subsequent section.
- Evaluate reclamation opportunities, as discussed in a subsequent section.

6.3.1 Rate Structure

The City's current rate structure bills customers on a uniform volumetric charge. In 2010, the City added a consumption-based element to sewer rates based on average winter water consumption, which was thought to encourage water efficiency. In 2023, a rate study was performed that evaluated a tiered rate structure. Ultimately, it was determined that the current rate structure would remain in place. Future rate studies will continue to reevaluate rate structures to encourage conservation.

6.3.2 Reclaimed Water

Per WAC 246-290-100 and WUE requirements, water systems with over 1,000 connections must evaluate reclaimed water opportunities. As mentioned previously, the City currently uses treated wastewater at the WWTP. In addition, the City previously evaluated reclaimed water opportunities in 2006 with costs escalated to 2025 dollars in the concurrent effort of updating the General Sewer Plan, considering a multitude of locations to use the water for irrigation; Figure 1 displays locations with irrigation connections. Overall, it was concluded that using reclaimed water as irrigation water was not economically feasible, and therefore, the reclaimed water system will not be expanded at this time.

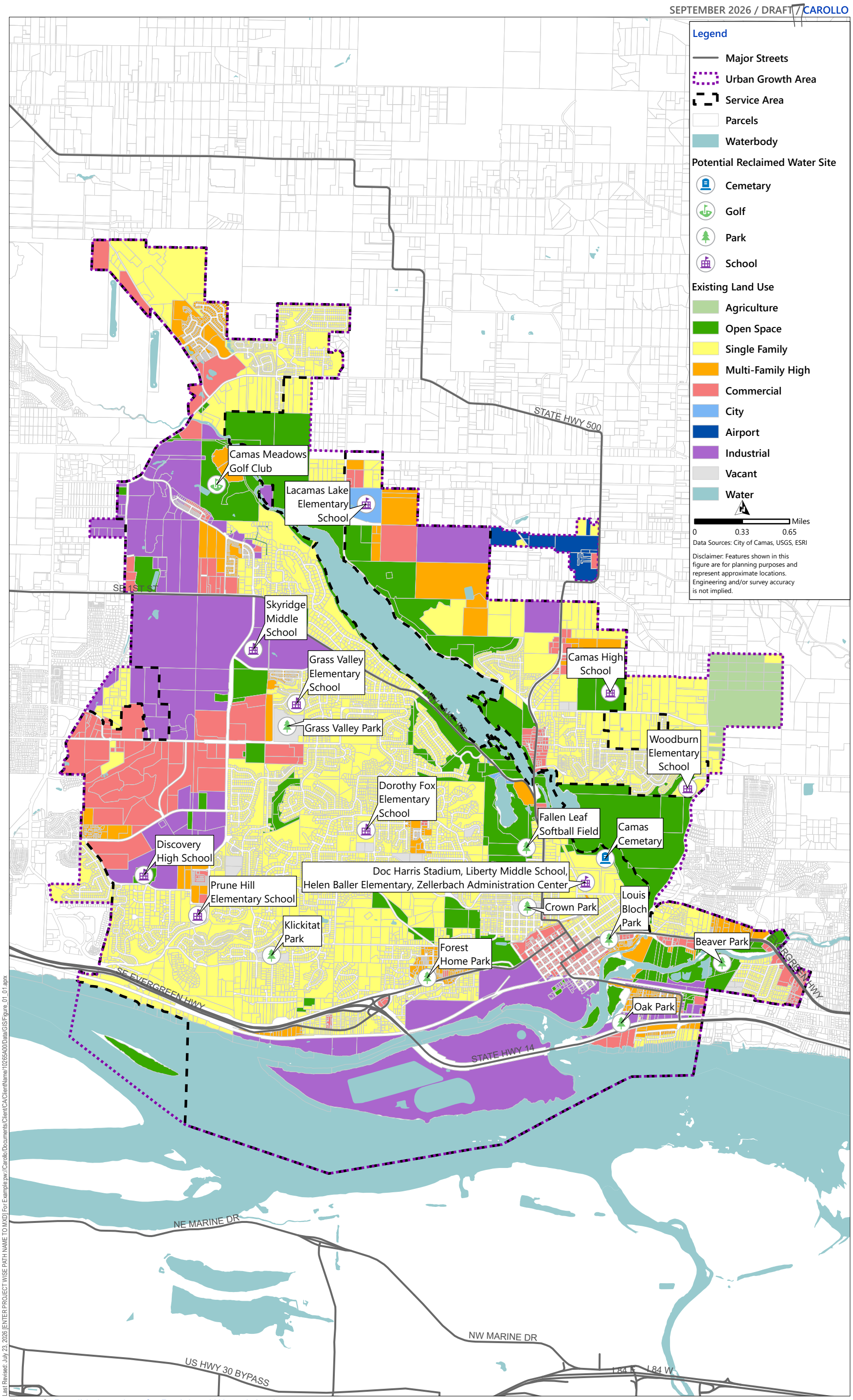


Figure 3 Possible Locations for Reclaimed Water Irrigation

6.3.3 Projected Demands with WUE Goals

The projected water demands considering the water savings from the City's WUE Program were represented with the low demand scenario presented in Chapter 5 of the 2026 WSP. Projected demands with WUE savings were compared to the medium demand projection. The low demand projection assumes a 2025 demand of 242 gpd/ERU while the medium demand projections assume a 2025 demand of 248 gpd/ERU. The low demand projection also assumes the WUE Program will help to reduce the MDD to ADD peaking factor by approximately 0.45 percent. The low and medium demand projections assume the City's DSL is 9.1 and 10 percent, respectively. Table 5 presents the projected ADD and MDD with and without the WUE Program for the 20-year planning period. The projected demands with the WUE Program are also shown in Figure 4. For ADD, WUE measures are projected to provide a reduction of 1.0 mgd), or 11.9 percent, by 2046. For MDD, WUE measures are projected to provide a reduction of 2.4 mgd, or 14.6 percent, by 2046.

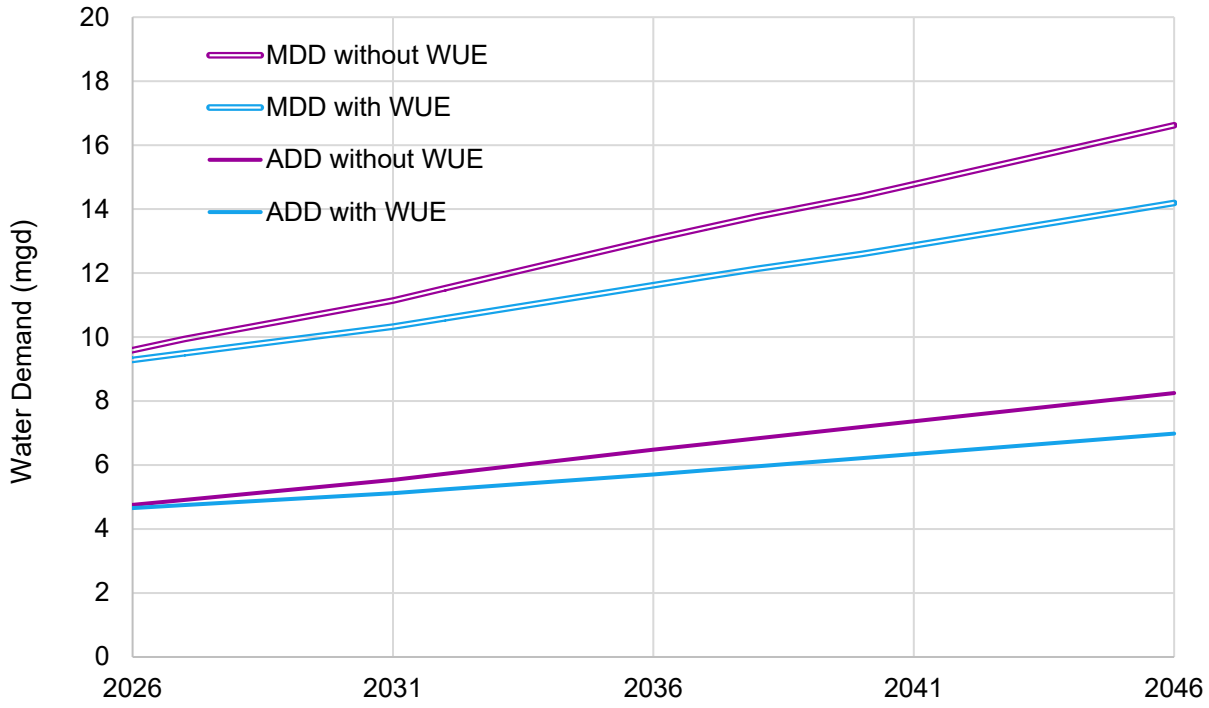


Figure 4 Projected Demands With and Without Water Use Efficiency

Table 5 WUE Demand Projections

Demand Scenario	2046 Projection with WUE (mgd)	2046 Projection without WUE (mgd)	Water Savings (mgd)	Percent Savings
ADD	7.4	8.4	1.0	11.9
MDD	14.2	16.6	2.4	14.6

6.4 WUE Program Effectiveness

The effectiveness of the existing WUE program was evaluated using system-wide water use data. Measuring the effectiveness of the City's future WUE Program against the established goals could be similarly evaluated using system-wide water use data. Estimating the water savings directly resulting from the City's WUE Program in a single year is difficult. Therefore, long-term trends should be use to more clearly show the impact of the City's WUE Program.

The first step would be to establish a baseline from historical information. The second step is to evaluate the resulting water use after promoting WUE through targeted activities and events to customers. It is recommended that water use be tracked for at least a year to identify trends. Some consideration needs to be given to variations in weather and economic conditions. Another method would be to perform the same before/after water use analysis for WUE Program participants who volunteer and provide their address. The resulting information would be valuable for the City to correlate its WUE Program efforts with direct water savings for its customers.

Advanced Metering Infrastructure (AMI) was implemented in 2025. The City plans to leverage this data in its targeted public education programs to customers in a particular area or user profile, such as heavy irrigators. Using AMI, the City can estimate overall usage, irrigation usage, and peak water use rates.

6.5 Budget

The City recognizes the importance of continuing their WUE measures and considers it a core function of the Utility. The WUE program provides cost savings through demand reduction and reduction in DSL. Continuing the WUE Program can assist the City in meeting peak demands and avoiding curtailment periods.

The City does not officially track staff time or project costs associated with WUE. The supply-side WUE measures, such as metering and leak detection, are core activities of the Utility and are funded through Utility Capital Improvement and operations and maintenance (O&M) funds. The City estimates that it dedicates approximately 0.5 full-time-equivalents of staff time to conduct demand-side measures across its Water Utility, finances department, and development services staff. It is not possible to estimate the cost of each demand-side measure; therefore, a cost-benefit comparison cannot be calculated.

Due to AMI capabilities, it is anticipated that the City will further personalize water use communications with customers without increasing staff effort. Future supply-side WUE measures will be funded, as appropriate, through the Capital Improvement and O&M funds. If AMI detects a large number of existing and new leaks, the City will evaluate the need for additional personnel in its meter maintenance group to address leaks.

APPENDIX Q

CONSUMER CONFIDENCE REPORTS 2017-2024

ANNUAL WATER QUALITY REPORT

2017 Consumer Confidence Report

CONTACT US:

Public Works
Water Department:
360-817-1563

Backflow Prevention:
360-817-1569
Email: backflow@cityofcamas.us

Water Billing
616 NE Fourth Avenue
Camas, WA 98607
360-834-2462

After Hours/Holiday
Water Emergency
360-737-0592

Camas Connect 24/7:
Stay Connected! Make service requests and follow the work flow.

Download our new mobile app, or visit online:
www.cityofcamas.us/index.php/service-request

City of Camas Website:
www.cityofcamas.us

Water is a precious and limited resource. Use it wisely.

Attention Non-English Speaking Customers

This report contains important information about your drinking water. Translate it or speak with someone who can translate it for you.

Russian
Это сообщение содержит важную информацию о вашей питьевой воде. Переведите это или говорите с кем - то, кто может перевести это для Вас.

Spanish
Este informe contiene información importante acerca de su agua potable. Haga que alguien lo traduzca para usted, o hable con alguien que lo entienda.

Water Quality Results

At the City of Camas we understand how important it is to ensure we provide high quality water. The health of our consumers and their families is paramount and our goal is to provide you with a safe and dependable supply of drinking water. We work diligently to provide top quality water to a residential population of 23,080.

Our drinking water is safe and surpasses all State and Federal health standards.

We ask that all of our customers help us protect our water sources, which are the heart of our community, our way of life, and our children's future. This report provides a summary of the tests and processes performed to ensure the safety of your drinking water. For more information or questions about this report, please contact Public Works call 360-817-1563, or email publicworks@cityofcamas.us



Public Water System ID 108002

Water Conservation

The average daily water consumption in Camas for 2017 was 4.01 million gallons (mg/d) per day. During our peak usage day on July 22nd, 2017 we consumed 8.3 million gallons. Most of this increase in the summer months is due to irrigation demand. We are once again asking for your help to implement a voluntary odd/even lawn watering program for residential customers. Water on odd days if your house number ends in an odd number, and even days if it ends in an even number.

To view more water saving tips for residential use visit the following websites: www.irrigationtutorials.com/faq/save-water.htm and www.home-water-works.org/water-conservation-tips/home



Voluntary Odd/Even Watering Program

Water Use Facts

A leaky faucet can waste 100 gallons a day.

An average bath requires 37 gallons of water.

What's Ahead

The City of Camas Cross Connection Control Program is being updated. Be on the look out for increased information regarding backflow regulations and testing requirements.

Approximately 65% of the City's water meters have been replaced with advanced radio read meters. The City is continuing the replacement project and will be upgrading appro[illegible] 600 additional meters in 2017

Important Health Information

Drinking water, including bottled water, may reasonably be expected to contain small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline 800-426-4791.

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases, radio-active material. It can also pick up substances resulting from the presence of animals or from human activity.

Contaminants that may be present in source water before we treat it include:

- Microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- Inorganic contaminants, such as salts and metals, which can be naturally-occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, and mining or farming.
- Pesticides and herbicides, which may come from a variety of sources such as agriculture and residential uses.
- Radioactive contaminants, which are naturally occurring.
- Organic chemical contaminants, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.

In order to ensure that tap water is safe to drink, EPA prescribes regulations which limit the amount of certain contaminants in water provided by public water systems. We treat our water according to the EPA's regulations. Food and Drug Administration regulations establish limits for contaminants in bottled water which must provide the same protection for public health. Some people may be more vulnerable to contaminants in drinking water than the general population.

Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by cryptosporidium and other microbiological contaminants are available from the Safe Drinking Water Hotline at 1-800-426-4791.

EPA Statement for Lead and Copper

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City of Camas is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to two minutes before using water for drinking or cooking. The EPA requires the City to conduct lead testing every three years.

Copper is a mineral component naturally found in solids. In the correct amounts, it is an essential nutrient for humans and plants. In Washington State, most copper in drinking water comes from corrosion of household plumbing. Plumbing sources can include copper pipe and brass fixtures. Copper from plumbing corrosion can accumulate overnight. Although copper is an essential mineral in the diet, too much copper can cause health problems. Copper is widely distributed within the tissues of the body, but accumulates primarily in the liver and kidneys. A single dose of 15 mg of copper can cause nausea, vomiting, diarrhea, and intestinal cramps.

If you are concerned about lead or copper in your water, you may wish to have your water tested. Information on lead and copper in your drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead

To Reduce Lead and Copper Exposure

1. When your water has been sitting for several hours, flush the pipe by running the cold water tap until the water is noticeably colder before using the water for drinking or cooking.

2. Use only cold water for drinking, cooking, and making baby formula. Hot water may contain higher levels of copper.

3. Frequently clean the filter screens and aerators in faucets to remove captured particles.

4. If building or remodeling, only use "lead free" or low lead piping and materials. Avoid using copper piping or brass fixtures for locations where water will be consumed or used in food preparation.

Contaminants Inorganic	Maximum Contaminant Level Goal mg/L	Action Level (AL) mg/L	Camas Water Results g/L	Sample Year	# of Samples Exceeding AL	Violation	Typical Sources
Lead (ppb) at Consumers Tap	0	0.015	0.0026	2015	0 of 30	NO	Corrosion of household plumbing systems; erosion of natural deposits
Copper	0	1.30	0.6100	2015	0 of 30	NO	

Unregulated Contaminants Monitoring

Unregulated contaminants are those for which the EPA has not established drinking water standards. The purpose of unregulated contaminant monitoring is to help EPA determine their occurrence in drinking water and potential need for future regulation. For more information, go to:

http://water.epa.gov/lawsregs/rulesregs/sdwa/ucmr/ucmr3/ or contact the Safe Drinking Water Hotline at 1-800-426-4791, or at: http://water.epa.gov/drink/contact.cfm

2017 Water Quality Test Results

The City of Camas has its water analyzed for more than 200 different regulated and unregulated contaminants. Only the samples that have detect of contaminants are required by law to be reported to the public. The contaminants listed below are REGULATED and were in our water during 2017. All samples taken are from treated water that is delivered to the distribution system. All contaminants tested were below levels allowed by Federal and State agencies. We have provided definitions below to help you understand the terms and abbreviations that are used in the Test Results.

In some cases, certain contaminants are granted waivers from monitoring. This is due to past consecutive years of non-detectable results, or results lower that the State Reporting Level (SRL).

Important Terms and Abbreviations

Maximum Contaminant Level (MCL): The "Maximum Allowed" is the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

Maximum Contaminant Level Goal (MCLG) : The "Goal" is the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

Milligrams Per Liter (MG/L): A unit of measurement used in reporting the concentration of matter in water as determined by water analyses.

Nephelometric Turbidity Unit (NTU): Nephelometric Turbidity Unit is a measure of the clarity of water. Turbidity in excess of 5 NTU is just noticeable to the average person.

Parts Per Million (ppm): A unit of measurement used in reporting the concentration of matter in water as determined by water analyses.

pCi/L: Picocuries per liter is a unit for measuring radioactive concentrations. The curie (Ci) unit is the activity of 1 gram of pure radium.

N/A (Not applicable): Means EPA has not established MCLGs for these substances.

Ug/L: Units of measurement in micrograms/liter. A unit of concentration for dissolved substances based on their weights.

Regulated Contaminants Unit Measurement	Violation	Range of Level Detected	Ideal Goal (MCLG)	MAX Allowed (MCL)	Description & Origin of Substance
Health Related (Primary) Standards: Inorganic					
Fluoride (MG/L)	No	0.31-1.13	1	4	Sodium fluoride added to Camas water to maintain good dental hygiene.
Nitrates (MG/L) (As Nitrogen)	No	1.30-1.60	10	10	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural products.
Health Related Standards: Radiological					
Radium 228	No	.0366 -.313	0.00	5 pCi/L	Erosion of natural deposits leaching into the groundwater.
Other Substances					
Total Hardness (ppm)	No	22	N/A	N/A	Hardness units are in ppm as $CaCO^3$ (calcium carbonate equivalent units).
Turbidity (NTU)	No	0.33	N/A	N/A	Turbidity is a measure of the cloudiness of water.
Disinfection By-Products and Residuals within the Distribution System					
Haloacetic Acids (UG/L)	No	6.9	48	60	By-product of drinking water disinfection.
Total Trihalomethanes (UG/L) *	No	4.50-10.00	60	80	Chlorination by-product caused by the reaction of chlorine with organic matter.

New Water System Supply

As the City of Camas continues to grow, our water system serves a greater population each year. The City is currently seeking new water system supply to meet the needs of our growing population. You may hear about a new groundwater well called "Well 17", which the City is in the active planning stages. This includes finding a suitable location, testing for water availability and quality and seeking new water rights from the Department of Ecology. This process will take at least two years to complete but the City is committed to delivering clean and reliable drinking water to our citizens and meeting growing dema

Our Water System

The City of Camas has multiple water sources that include surface and ground water. The surface water sources, Boulder and Jones Creeks, are located on the south side of Larch Mountain, northeast of Camas. Surface water was not used in 2017. The ground water sources include nine wells near the Washougal river and one well in Grass Valley. All water sources are treated with chlorine for disinfection, fluoride for good dental health and sodium hydroxide to reduce the corrosion of copper piping to meet State and EPA standards. Water pressure and fire flows are maintained throughout the service area with seven distribution reservoirs, nine pump stations, and over 160 miles of pipeline.

Water Leaks

Locate your master water supply valve and label it. The master supply valve can be turned off in case of a major leak or broken pipe.

The majority of leaks in residential plumbing systems are found at the toilet tank (fill and flapper valves).

Other common areas for leaks include:

- Lawn irrigation valves and lines
- Hose in yard turned on or leaking
- Ornamental fountains, fish ponds
- Relief valve or fittings on water heater
- Leaking pipes or fittings in the house
- Line between the meter and the house
- Dripping faucets in bathrooms or sinks
- Outside faucet open or dripping

The City is actively working to reduce system leaks. If you suspect a leak in your neighborhood please call 360-817-1563.



Check out this helpful website at www.epa.gov/watersense/fixaleak

City of Camas Numbers
Residential population served: 23,080
The Camas water system contains:
Seven reservoirs
Nine pump stations
8,649 water meters
Ten wells
More than 500 fire hydrants

Five Simple Water Conservation Tips

1. Fix leaks inside and outside, including old leaky faucets, toilets, hoses, and sprinkler systems.
2. Choose water saving fixtures and appliances and you will use 30% less water.
3. Sweep porches, driveways and sidewalks rather than hosing, to not only conserve water, but to avoid runoff.
4. Water late at night or early in the morning (10:00 pm to 6:00 am).
5. Take a short shower instead of a bath.

An inch of water per week is enough to keep lawns green.

For more water saving ideas see our newsletters, news releases, and/or printed material available at City Hall and the Operations Center, or visit our website at : www.cityofcamas.us/pwwater





It's Yearly Backflow Testing Time!

Make sure to schedule your yearly backflow inspection. If you are a property owner and have an in-ground sprinkler system you are required by State and local laws to install and maintain a backflow prevention device on your service line, and have it inspected yearly by a certified backflow tester. If you have more questions call our Backflow Cross Connection Hotline at 360-817-1569, or email us at backflow@cityofcamas.us. For more information and a current list of certified backflow testers visit www.cityofcamas.us/index.php/pwwater#backflowirrigation

Water Quality Monitoring

The City of Camas routinely monitors for constituents in your drinking water according to Federal and State laws. Field and laboratory analyses include tests for bacteria, as well as chemical and physical indicators. Reports are submitted monthly to the Department of Health to report that your water meets all drinking water standards. Should there ever be a public health concern, you would be notified immediately.

Please report possible water pollution (illicit discharge) to the City of Camas 360-817-1563, or the Department of Ecology SW Regional Office 360-407-6300

2018

CONSUMER CONFIDENCE REPORT

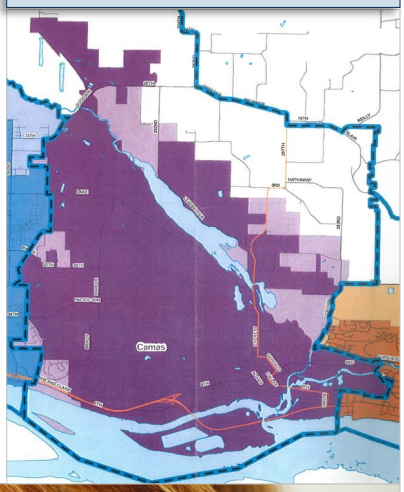
City of Camas Annual Water Quality Report

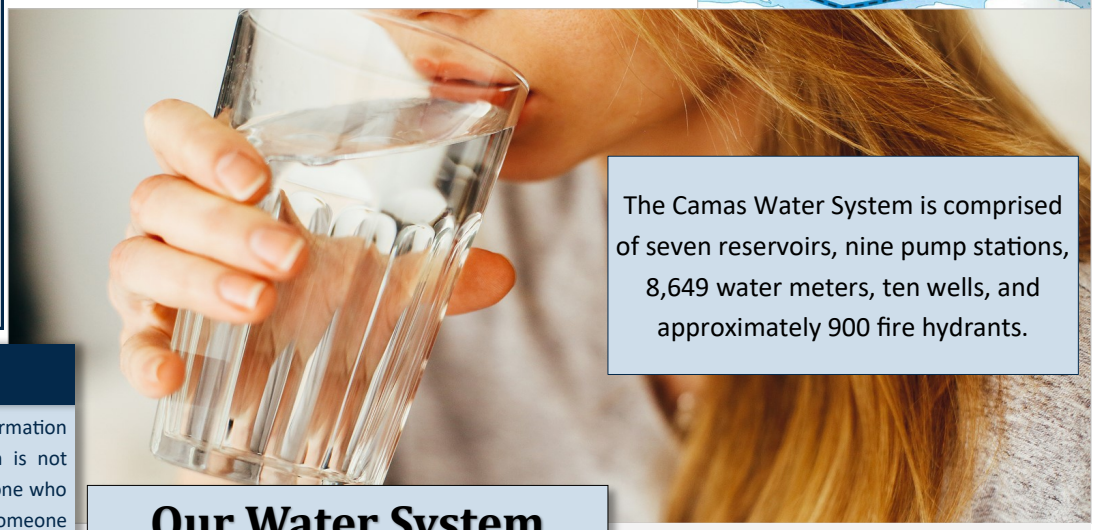
Public Water System ID: 108002

The City of Camas is pleased to present the annual Water Quality Report, which provides the public with water testing results. The health of our consumers and their families is paramount and our goal is to provide the community with a safe and dependable supply of drinking water.

At the City of Camas we understand how important it is to ensure we provide high quality water. We work diligently to provide top quality water to a growing residential population of 23,770.

More information about Camas drinking water and what we're doing to keep your water safe can be found online at www.cityofcamas.us/pwwater





The Camas Water System is comprised of seven reservoirs, nine pump stations, 8,649 water meters, ten wells, and approximately 900 fire hydrants.

CONTACT US

City Hall
616 NE Fourth Ave
Camas, WA 98607
360-834-2462
www.cityofcamas.us

Public Works
360-817-1563
publicworks@cityofcamas.us

After-Hours/Holiday Water Emergency: 360-737-0592

Cross-Connection Control
backflow@cityofcamas.us
360-817-1569

Camas Connect 24/7
Download our city app to make service requests, or go to www.cityofcamas.us/service-request

IMPORTANT!

This report contains important information about your drinking water. If English is not your first language, please have someone who can translate it for you, or speak with someone who understands it.

Este informe contiene información importante sobre su agua potable. Si el inglés no es su primer idioma, tenga a alguien que pueda traducirlo por usted o hable con alguien que lo entienda.

Ce rapport contient des informations importantes sur votre eau potable. Si l'anglais n'est pas votre langue maternelle, demandez à quelqu'un de le traduire à votre place ou de parler à quelqu'un qui le comprend.

Этот отчет содержит важную информацию о вашей питьевой воде. Если английский не является вашим родным языком, попросите кого-нибудь, кто может перевести его для вас, или поговорить с кем-то, кто понимает его.

Our Water System

The City of Camas has multiple water sources that include surface and ground water. The surface water sources (Boulder and Jones Creeks) are located on the south-side of Larch Mountain, northeast of Camas. Surface water was not used in 2018. The ground water sources include nine wells near the Washougal river and one well in Grass Valley. All water sources are treated with chlorine for disinfection, fluoride for good dental health and sodium hydroxide to reduce the corrosion of copper piping to meet State and EPA standards. Water pressure and fire flows are maintained throughout the service area with seven distribution reservoirs, nine pump stations, and over 160 miles of pipeline.

We've got news!

Follow City of Camas on social media and on the city's website for the latest in updates and alerts:

Website: www.cityofcamas.us
Twitter: www.twitter.com/CityofCamas— @CityofCamas
Facebook: www.facebook.com/cityofcamas

1516

2018 Water Quality Summary

Our drinking wat
and surpasses all State and
Federal health standards!



The City of Camas routinely monitors for contaminants in your drinking water according to Federal and State laws. Field and laboratory analyses include tests for bacteria, as well as chemical and physical indicators. Reports are submitted monthly to the Department of Health to report that City water meets all drinking water standards. Contaminants that were detected are listed in the following tables.

Should there ever be a public health concern, you would be notified immediately. Please report possible water pollution (illicit discharge) to the City of Camas 360-817-1563, or the Department of Ecology-SW Regional Offices 360-407-6300.

Definitions

MCL (Maximum Contaminant Level): The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as possible using the best available treatment technologies.

MCLG (Maximum Contaminant Level Goal): The maximum level of a contaminant in drinking water below which there is no known or expected health risk. MCLGs allow for a margin of safety.

AL (Action Level): The concentration of a contaminant which, if exceeded, triggers treatments or other requirements that a waster system must follow.

Milligram Per Liter (mg/L): A unit of measurement used in reporting the concentration of matter in water as determined by water analyses.

NTU (Nephelometric Turbidity Unit): Turbidity is a measure of the clarity of water. Turbidity in excess of 5 NTU is just noticeable to the average person.

Definitions

ug/L: Units of measurement in micrograms/liter. A unit of concentration for dissolved substances based on their weights.

ppm: (1 parts per million = 1 mh/L = 1 milligram per liter)

ppb: (1 parts per billion = 0.001 mg/L = 1 microgram per liter)

pCi/L: Picocuries per liter is a unit for measuring radioactive concentrations. The curie (Ci) unit is the activity of 1 gram of pure radium.

NA (Not Applicable): Means that the U.S. EPA has not established MCLGs for these substances.

ND (Not Detected): A compound that was analyzed and not detected at a level greater than or equal to the state reporting level.

2018 Detected Contaminants

		EPA Regulations		City of Camas Water Quality Results	
Regulated Contaminants	**Units**	**Ideal Level/Goal (MCLG)**	**Maximum Level (MCL)**	**Range of Level Detected**	**Violation**
Fluoride	mg/L	.5—2.9	4	.42—.9	No
Fluoride is added to your water in carefully controlled levels for dental health. In May 2016, the Washington State Department of Health changed the fluoridation requirement to a target of 0.7 mg/L from the previous target of 0.7-1.2 mg/L.					
Nitrates ***(as nitrogen)***	mg/L	10	10	Not Detected—1.7	No
Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural products.					
Haloacetic Acid (5)	ug/L	48	60	2.9	No
Trihalomethanes	ug/L	60	80	4.5	No
Haloacetic acids (HAA5) and trihalomethanes form as by-products of the chlorination process that is used to kill or inactivate disease-causing microbes.					

Unregulated contaminants are those for which the EPA has not established drinking water standards. The purpose of unregulated contaminant monitoring is to help EPA determine their occurrence in drinking water and potential need for future regulation. For more information, go to: https://www.epa.gov/dwucmr/third-unregulated-contaminant-monitoring-rule or contact the Safe Drinking Water Hotline at 1-800-426-4791 or via website https://www.epa.gov/home/epa-hotlines.

1517

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases, radio-active material. It can also pick up substances resulting from the presence of animals or from human activity. To ensure that tap water is safe to drink, the Washington Department of Health and the United State Environmental Protection Agency (EPA) prescribes regulations that limit the amount of certain contaminants in the water provided by public water systems. Contaminants that may be present in source water before we treat it include:

Mandatory EPA Statement for All Community Water Systems

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791).

Some people may be more vulnerable to contaminants in drinking water than the general population. Immunocompromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. The US EPA-Center for Disease Control guidelines on appropriate means to lessen the risk of infection by cryptosporidium and other microbiological contaminants are from the EPA's Safe Drinking Water website.

- **Microbial Contaminants**, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- **Inorganic Contaminants**, such as salts and metals, which can be naturally-occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, and mining or farming.
- **Pesticides and Herbicides**, which may come from a variety of sources such as agriculture and residential uses.
- **Organic Chemicals**, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff, and septic systems.

Lead & Copper

In 2018, the City tested thirty residences for lead and copper. The highest result was 0.0026 mg/L for Lead, and 0.6100 mg/L in Copper. No households exceeded the action level. The next sampling event is scheduled for 2021.

Parameter	Major Source	Units	(MCLG) mg/L	(AL) mg/L	City Results mg/L	Violation
Lead *(at consumers tap)*	Plumbing, erosion of natural deposits.	ppb	0	0.015	.0010—.0034	No
Copper		ppm	0	1.30	.027—.55	No

To Reduce Lead and Copper Exposure

1. When your water has been sitting for several hours, flush the pipe by running the cold water tap until the water is noticeably colder before using the water for drinking or cooking.
2. Use only cold water for drinking, cooking, and making baby formula. Hot water may contain higher levels of copper.
3. Frequently clean the filter screens and aerators in faucets to remove captured particles.
4. If building or remodeling, only use "lead free" or low lead piping and materials. Avoid using copper piping or brass fixtures for locations where water will be consumed or used in food preparation.

EPA STATEMENT

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City of Camas is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to two minutes before using water for drinking or cooking. The EPA requires the City to conduct lead testing every three years.

Copper is a mineral component naturally found in solids. In the correct amounts, it is an essential nutrient for humans and plants. In Washington State, most copper in drinking water comes from corrosion of household plumbing. Plumbing sources can include copper pipe and brass fixtures. Copper from plumbing corrosion can accumulate overnight. Although copper is an essential mineral in the diet, too much copper can cause health problems. Copper is widely distributed within the tissues of the body, but accumulates primarily in the liver and kidneys. A single dose of 15 mg of copper can cause nausea, vomiting, diarrhea, and intestinal cramps.

If you are concerned about lead or copper in your water, you may wish to have your water tested. Information on lead and copper in your drinking water, testing methods, and steps you can take to minimize exposure is available from the **Safe Drinking Water Hotline 1-800-426-4791, or at www.epa.gov/safewater/lead.**

Water Conservation

In 2018, the **average daily water consumption in Camas was 4.2 million gallons**. Our **peak usage day was on August 19, 2018, when 8,335,000 gallons were consumed**. Most of this increase in the summer months, is due to irrigation demands. We are once again asking for the publics help to implement a voluntary odd/even lawn watering program for residential customers. Water on odd days for home addresses that end in an odd number, and even days if it ends in an even number.

In 2018, the City replaced approximately 470 advanced radio read water meters. We will be continuing the water meter replacement project and upgrading approximately 529 additional meters in 2019.

City Water Saving Commitments

- To reduce the customer consumption per ERU by one percent or approximately two gallons-per-day per year over the next six years. The City will continue to reduce distribution system loss at-or-below ten percent for the next five years.
- Replacing industrial, commercial, and residential service meters with the new radio read meters, which will allow the City to log usage more effectively to notify customers about continuous leaks or high consumption.
- Encourage the installation of smart controllers on irrigation systems for the school district and industrial users.
- Educate the public on water-saving devices, and distribute water conservation kits and water-saving devices to homeowners. Continue metering all sources.
- Replace water mains and service lines in problematic areas and complete Capital Projects in accordance with the new Water System Plan Update.

Community Involvement to Reduce Water Leaks

Locate your master water supply valve and label it. The master supply valve can be turned off in case of a major leak or broken pipe. The majority of leaks in residential plumbing systems are found at the toilet tank (fill and flapper valves).

CONSERVATION TIPS

Fix leaks on old leaky faucets, toilets, hoses, and sprinkler systems.

Choose water saving fixtures and appliances and you will use 30% less water.

Sweep porches, driveways & sidewalks rather than hosing, to not only conserve water, but to avoid runoff.

Water late at night or early in the morning (10:00 pm or 6:00 am).

Take a short shower instead of a bath.

Other common leaks include:

- Lawn irrigation valves and lines
- Yard hose turned on or leaking
- Ornamental fountains & fish ponds
- Water heater relief valve or fittings
- Leaking house pipes or fittings
- Leaking between the house and meter
- Inside and outside dripping faucets

The City is actively working to reduce system leaks. If you suspect a leak in your neighborhood please call City of Camas at 360-817-1563.

Cross Connection Program

What is backflow?

Backflow is the undesirable reversal of the flow of water from the intended direction of flow. When this occurs, other liquids, mixtures, gases or substances can enter the potable water piping through cross connection. Under the right hydraulic conditions, backflow can result in contamination of the water supply, which is called backsiphonage and backpressure.



How to keep our drinking water clean and safe

Locate or install a backflow device

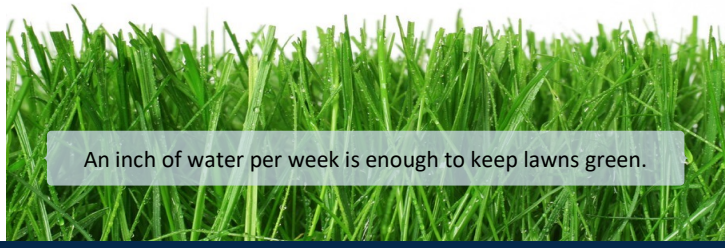
If you have an underground irrigation system, check to see if you have a backflow assembly. The backflow assembly is a brass valve usually found between your water meter and the point where your water service line enters your home, usually in a small green box similar to a meter box. If your irrigation system does not include backflow assembly or if you are installing a new underground irrigation system, City of Camas plumbing code requires you to install a *Double Check Valve Assembly (DCVA)* at a minimum.

Test your backflow assembly device annually

Once you have your backflow assembly installed or located, make sure to have it tested annually by a state-certified backflow assembly tester. If you are a property owner and have an in-ground sprinkler system you are required by state and local laws (WAC 246-290) to install and maintain a backflow prevention device on your service line, and have it inspected yearly by a Washington State Certified Backflow Assembly Tester (BAT). If you have more questions call our Backflow Hotline at 360-817-1569, or email us at backflow@cityofcamas.us

Properly winterizing your irrigation system

During the fall, most irrigation systems will need to be winterized to prevent pipes from freezing and breaking. Many times this involves using compressed air to blow out the excess water left in the irrigation piping. Although this is the best method, backflow of compressed air and contaminants may enter the drinking water distribution system and cause damage and or health risks if not performed properly. Make sure the compressed air is connected to a properly installed blowout connection to avoid inadvertently introducing air into our water system.



An inch of water per week is enough to keep lawns green.

Stop these biggest water consumers first! Look for the Water Sense label on new plumbing fixtures; Repair leaky toilets or install high efficiency low flow toilets; Consider purchasing a water-energy-efficient washer and use water-savings habits such as washing full loads only. Repair leaky faucets, and turn off water when you shave or brush your teeth, Install low flow showerheads and take shorter showers. **For more information Visit City Hall to pick up printed material or visit our website at www.cityofcamas.us/pwwater, or check out this the EPA's website at www.epa.gov/watersense/fixaleak.**

1519

2019

CONSUMER CONFIDENCE REPORT

City of Camas Annual Water Quality Report

Public Water System ID: 108002

CONTACT US

City Hall
616 NE Fourth Ave
Camas, WA 98607
360-834-2462
www.cityofcamas.us

Public Works
360-817-1563
publicworks@cityofcamas.us

After-Hours/Holiday Water Emergency: 360-737-0592

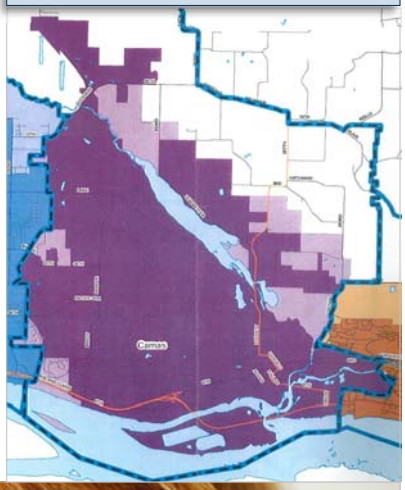
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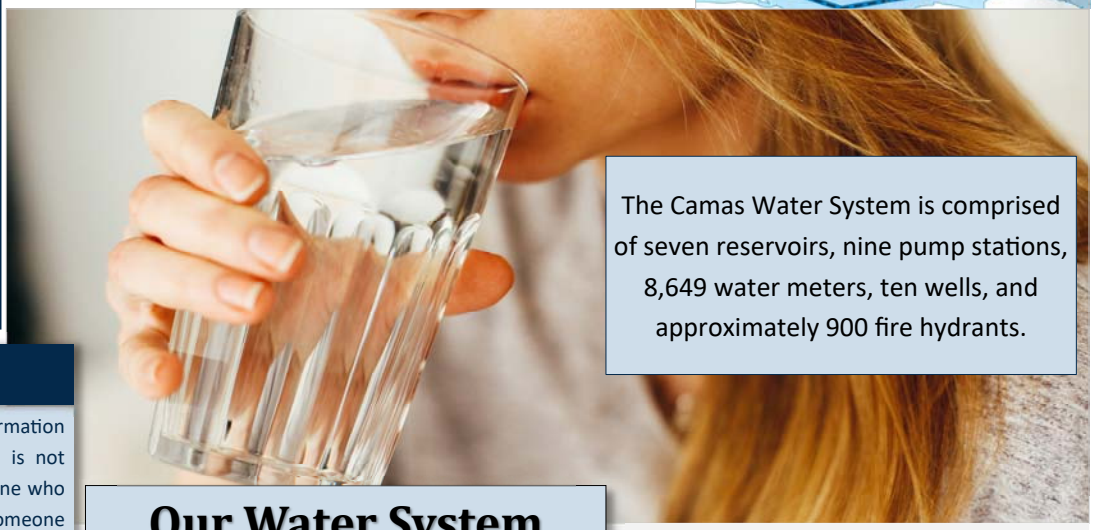
Camas Connect 24/7
Download our city app to make service requests, or go to www.cityofcamas.us/service-request

The City of Camas is pleased to present the annual Water Quality Report, which provides the public with water testing results. The health of our consumers and their families is paramount and our goal is to provide the community with a safe and dependable supply of drinking water.

At the City of Camas we understand how important it is to ensure we provide high quality water. We work diligently to provide top quality water to a growing residential population of approximately 25,000.

More information about Camas drinking water and what we're doing to keep your water safe can be found online at www.cityofcamas.us/pwwater.





The Camas Water System is comprised of seven reservoirs, nine pump stations, 8,649 water meters, ten wells, and approximately 900 fire hydrants.

IMPORTANT!

This report contains important information about your drinking water. If English is not your first language, please have someone who can translate it for you, or speak with someone who understands it.

Este informe contiene información importante sobre su agua potable. Si el inglés no es su primer idioma, tenga a alguien que pueda traducirlo por usted o hable con alguien que lo entienda.

Ce rapport contient des informations importantes sur votre eau potable. Si l'anglais n'est pas votre langue maternelle, demandez à quelqu'un de le traduire à votre place ou de parler à quelqu'un qui le comprend.

Этот отчет содержит важную информацию о вашей питьевой воде. Если английский не является вашим родным языком, попросите кого-нибудь, кто может перевести его для вас, или поговорить с кем-то, кто понимает его.

Our Water System

The City of Camas has multiple water sources that include surface and ground water. The surface water sources (Boulder and Jones Creeks) are located on the south-side of Larch Mountain, northeast of Camas. Surface water was not used in 2019. The ground water sources include nine wells near the Washougal river and one well in Grass Valley. All water sources are treated with chlorine for disinfection, fluoride for good dental health and sodium hydroxide to reduce the corrosion of copper piping to meet State and EPA standards. Water pressure and fire flows are maintained throughout the service area with seven distribution reservoirs, nine pump stations, and over 160 miles of pipeline.

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1520

2019 Water Quality Summary

Our drinking wat
and surpasses all State and
Federal health standards!



The City of Camas routinely monitors for contaminants in your drinking water according to Federal and State laws. Field and laboratory analyses include tests for bacteria, as well as chemical and physical indicators. Reports are submitted monthly to the Department of Health to report that City water meets all drinking water standards. Contaminants that were detected are listed in the following tables.

Should there ever be a public health concern, you would be notified immediately. Please report possible water pollution (illicit discharge) to the City of Camas 360-817-1563, or the Department of Ecology-SW Regional Offices 360-407-6300.

Definitions

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Milligram Per Liter (mg/L): A unit of measurement used in reporting the concentration of matter in water as determined by water analyses.

NTU (Nephelometric Turbidity Unit): Turbidity is a measure of the clarity of water. Turbidity in excess of 5 NTU is just noticeable to the average person.

Definitions

ug/L: Units of measurement in micrograms/liter. A unit of concentration for dissolved substances based on their weights.

ppm: (1 parts per million = 1 mh/L = 1 milligram per liter)

ppb: (1 parts per billion = 0.001 mg/L = 1 microgram per liter)

pCi/L: Picocuries per liter is a unit for measuring radioactive concentrations. The curie (Ci) unit is the activity of 1 gram of pure radium.

NA (Not Applicable): Means that the U.S. EPA has not established MCLGs for these substances.

ND (Not Detected): A compound that was analyzed and not detected at a level greater than or equal to the state reporting level.

2019 Detected Contaminants

		EPA Regulations		City of Camas Water Quality Results	
Regulated Contaminants	**Units**	**Ideal Level/Goal (MCLG)**	**Maximum Level (MCL)**	**Range of Level Detected**	**Violation**
Fluoride	mg/L	.5—.9	4	.45—.84	No
Fluoride is added to your water in carefully controlled levels for dental health. In May 2016, the Washington State Department of Health changed the fluoridation requirement to a target of 0.7 mg/L from the previous target of 0.7-1.2 mg/L.					
Nitrates ***(as nitrogen)***	mg/L	10	10	Not Detected—1.4	No
Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural products.					
Haloacetic Acid (5)	ug/L	48	60	1.0-1.1	No
Trihalomethanes	ug/L	60	80	2.3-4.1	No
Haloacetic acids (HAA5) and trihalomethanes form as by-products of the chlorination process that is used to kill or inactivate disease-causing microbes.					

Unregulated contaminants are those for which the EPA has not established drinking water standards. The purpose of unregulated contaminant monitoring is to help EPA determine their occurrence in drinking water and potential need for future regulation. For more information, go to: https://www.epa.gov/dwucmr/third-unregulated-contaminant-monitoring-rule or contact the Safe Drinking Water Hotline at 1-800-426-4791 or via website https://www.epa.gov/home/epa-hotlines.

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In general, the sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases, radio-active material. It can also pick up substances resulting from the presence of animals or from human activity. To ensure that tap water is safe to drink, the Washington Department of Health and the United State Environmental Protection Agency (EPA) prescribe regulations that limit the amount of certain contaminants in the water provided by public water systems. Contaminants that may be present in source water before we treat it include:

Mandatory EPA Statement for All Community Water Systems

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791).

Some people may be more vulnerable to contaminants in drinking water than the general population. Immunocompromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. The US EPA-Center for Disease Control guidelines on appropriate means to lessen the risk of infection by cryptosporidium and other microbiological contaminants are from the EPA's Safe Drinking Water website.

- **Microbial Contaminants**, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- **Inorganic Contaminants**, such as salts and metals, which can be naturally-occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, and mining or farming.
- **Pesticides and Herbicides**, which may come from a variety of sources such as agriculture and residential uses.
- **Organic Chemicals**, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff, and septic systems.

Lead & Copper

In 2018, the City tested thirty residences for lead and copper. The highest result was 0.0026 mg/L for Lead, and 0.6100 mg/L in Copper. No households exceeded the action level. The City was not required to test for lead or copper in 2019. The next sampling event is scheduled for 2021.

Parameter	Major Source	Units	(MCLG) mg/L	(AL) mg/L	City Results mg/L	Violation
Lead *(at consumers tap)*	Plumbing, erosion of natural deposits.	ppb	0	0.015	.0010—.0034	No
Copper		ppm	0	1.30	.027—.55	No

To Reduce Lead and Copper Exposure

1. When your water has been sitting for several hours, flush the pipe by running the cold water tap until the water is noticeably colder before using the water for drinking or cooking.
2. Use only cold water for drinking, cooking, and making baby formula. Hot water may contain higher levels of copper.
3. Frequently clean the filter screens and aerators in faucets to remove captured particles.
4. If building or remodeling, only use "lead free" or low lead piping and materials. Avoid using copper piping or brass fixtures for locations where water will be consumed or used in food preparation.

EPA STATEMENT

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City of Camas is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to two minutes before using water for drinking or cooking. The EPA requires the City to conduct lead testing every three years.

Copper is a mineral component naturally found in solids. In the correct amounts, it is an essential nutrient for humans and plants. In Washington State, most copper in drinking water comes from corrosion of household plumbing. Plumbing sources can include copper pipe and brass fixtures. Copper from plumbing corrosion can accumulate overnight. Although copper is an essential mineral in the diet, too much copper can cause health problems. Copper is widely distributed within the tissues of the body, but accumulates primarily in the liver and kidneys. A single dose of 15 mg of copper can cause nausea, vomiting, diarrhea, and intestinal cramps.

If you are concerned about lead or copper in your water, you may wish to have your water tested. Information on lead and copper in your drinking water, testing methods, and steps you can take to minimize exposure is available from:

Safe Drinking Water Hotline 1-800-426-4791, or at www.epa.gov/safewater/lead.

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Water Conservation

In 2019, the average daily water consumption in Camas was 3.96 million gallons. Our peak usage day was on June 15, 2019, when 7,693,000 gallons were consumed. Most of this increase in the summer months is due to irrigation demands. We are once again asking for the public's help to implement a voluntary odd/even lawn watering program for residential customers. Water on odd days for home addresses that end in an odd number, and even days if it ends in an even number.

In 2019, the City replaced approximately 596 advanced radio read water meters. We will be continuing the water meter replacement project and upgrading additional meters in 2020.

City Water Saving Commitments

- To reduce the customer consumption per home by one percent or approximately two gallons-per-day per year over the next six years. The City will maintain distribution system loss at-or-below ten percent for the next five years.
- Replacing industrial, commercial, and residential service meters with the new radio read meters, which will allow the City to log usage more effectively to notify customers about continuous leaks or high consumption.
- Encourage the installation of smart controllers on irrigation systems for the school district and industrial users.
- Educate the public on water-saving devices, and distribute water conservation kits and water-saving devices to homeowners. Continue metering all sources.
- Replace water mains and service lines in problematic areas and complete Capital Projects in accordance with the new Water System Plan Update.

Community Involvement to Reduce Water Leaks

Locate your master water supply valve and label it. The master supply valve can be turned off in case of a major leak or broken pipe. The majority of leaks in residential plumbing systems are found at the toilet tank (fill and flapper valves).

CONSERVATION TIPS

Fix leaks on old leaky faucets, toilets, hoses, and sprinkler systems.

Choose water saving fixtures and appliances and you will use 30% less water.

Sweep porches, driveways & sidewalks rather than hosing, to not only conserve water, but to avoid runoff.

Water late at night or early in the morning (10:00 pm or 6:00 am).

Take a short shower Instead of a bath.

An inch of water per week is enough to keep lawns green.

Other common leaks include:

- Lawn irrigation valves and lines
- Yard hose turned on or leaking
- Ornamental fountains & fish ponds
- Water heater relief valve or fittings
- Leaking house pipes or fittings
- Leaking between the house and meter
- Inside and outside dripping faucets

The City is actively working to reduce system leaks. If you suspect a leak in your neighborhood please call City of Camas at 360-817-1563.

Cross Connection Program

What is Backflow?

Backflow is the undesirable reversal of the flow of water from the intended direction of flow. When this occurs, other liquids, mixtures, gases or substances can enter the potable water piping through cross connection. Under the right hydraulic conditions, backflow can result in contamination of the water supply, which is called back siphonage and backpressure.



How to keep our drinking water clean and safe:

Locate or install a backflow device

If you have an underground irrigation system, check to see if you have a backflow assembly. The backflow assembly is a brass valve usually found between your water meter and the point where your water service line enters your home, usually in a small green box similar to a meter box. If your irrigation system does not include backflow assembly or if you are installing a new underground irrigation system, City of Camas plumbing code requires you to install a *Double Check Valve Assembly (DCVA)* at a minimum.

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2020 Consumer Confidence Report

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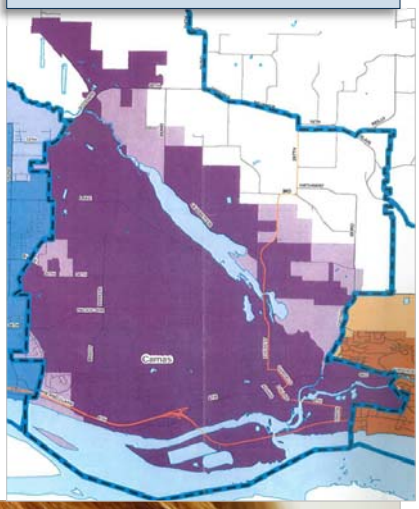
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Public Water System ID: 108002





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1524

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Our drinking wat
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2020 Detected Contaminants

		EPA Regulations		City of Camas Water Quality Results	
Regulated Contaminants	**Units**	**Ideal Level/Goal (MCLG)**	**Maximum Level (MCL)**	**Range of Level Detected**	**Violation**
Fluoride	mg/L	.50 -.90	4	.48 - 1.09	No
Fluoride is added to your water in carefully controlled levels for dental health. In May 2016, the Washington State Department of Health changed the fluoridation requirement to a target of 0.7 mg/L from the previous target of 0.7-1.2 mg/L.					
Nitrates ***(as nitrogen)***	mg/L	10	10	Not Detected - 1.30	No
Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural products.					
Haloacetic Acid (5)	ug/L	48	60	.64 - 1.90	No
Trihalomethanes	ug/L	60	80	.29 - .54	No
Haloacetic acids (HAA5) and trihalomethanes form as by-products of the chlorination process that is used to kill or inactivate disease-causing microbes.					
Radionuclides - Naturally Occurring Substances In Drinking Water					
Gross Alpha	pCil	0	15	2.34 -2.95	No
Radium 228	pCil	0	5	.974 -.713	No
Total Coliform Bacteria	%	0	<5% Positive/Mo.	0	No

Unregulated contaminants are those for which the EPA has not established drinking water standards. The purpose of unregulated contaminant monitoring is to help EPA determine their occurrence in drinking water and potential need for future regulation. For more information, go to: https://www.epa.gov/dwucmr/third-unregulated-contaminant-monitoring-rule or contact the Safe Drinking Water Hotline at 1-800-426-47 via website https://www.epa.gov/home/epa-hotlines.

Sources of Drinking Water

In general, the sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases, radio-active material. It can also pick up substances resulting from the presence of animals or from human activity. To ensure that tap water is safe to drink, the Washington Department of Health and the United State Environmental Protection Agency (EPA) prescribe regulations that limit the amount of certain contaminants in the water provided by public water systems. Contaminants that may be present in source water before we treat it include:

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- **Radioactive Contaminants**, which are naturally occurring as a result of mining and/or gas production.

Lead & Copper

In 2018, the City tested thirty residences for lead and copper. The highest result was 0.0026 mg/L for Lead, and 0.6100 mg/L in Copper. No households exceeded the action level. The City was not required to test for lead or copper in 2020. The next sampling event is scheduled for 2021.

Parameter	Major Source	Units	(MCLG) mg/L	(AL) mg/L	City Results mg/L	Violation
Lead *(at consumers tap)*	Plumbing, erosion of natural deposits.	ppb	0	0.015	.0010—.0034	No
Copper		ppm	0	1.30	.027—.55	No

To Reduce Lead and Copper Exposure

- When your water has been sitting for several hours, flush the pipe by running the cold water tap until the water is noticeably colder before using the water for drinking or cooking.
- Use only cold water for drinking, cooking, and making baby formula. Hot water may contain higher levels of copper.
- Frequently clean the filter screens and aerators in faucets to remove captured particles.
- If building or remodeling, only use "lead free" or low lead piping and materials. Avoid using copper piping or brass fixtures for locations where water will be consumed or used in food preparation.

EPA STATEMENT

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City of Camas is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to two minutes before using water for drinking or cooking. The EPA requires the City to conduct lead testing every three years.

Copper is a mineral component naturally found in solids. In the correct amounts, it is an essential nutrient for humans and plants. In Washington State, most copper in drinking water comes from corrosion of household plumbing. Plumbing sources can include copper pipe and brass fixtures. Copper from plumbing corrosion can accumulate overnight. Although copper is an essential mineral in the diet, too much copper can cause health problems. Copper is widely distributed within the tissues of the body, but accumulates primarily in the liver and kidneys. A single dose of 15 mg of copper can cause nausea, vomiting, diarrhea, and intestinal cramps.

If you are concerned about lead or copper in your water, you may wish to have your water tested. Information on lead and copper in your drinking water, testing methods, and steps you can take to minimize exposure is available from:

Safe Drinking Water Hotline 1-800-426-4791, or at www.epa.gov/safewater/lead.

1526

Water Conservation

In 2020 the average daily water consumption in Camas was 4.22 million gallons. Our peak usage day was on August 16, 2020, when 8,686,000 gallons were consumed. Most of this increase in the summer months is due to irrigation demands. We are once again asking for the public's help to implement a voluntary odd/even lawn watering program for residential customers. Water on odd days for home addresses that end in an odd number, and even days if it ends in an even number.

City Water Saving Commitments

- To reduce the customer consumption per home by one percent or approximately two gallons-per-day per year over the next six years. The City will maintain distribution system loss at-or-below ten percent for the next five years.
- Replacing industrial, commercial, and residential service meters with the new radio read meters, which will allow the City to log usage more effectively to notify customers about continuous leaks or high consumption.
- Encourage the installation of smart controllers on irrigation systems for the school district and industrial users.
- Educate the public on water-saving devices, and distribute water conservation kits and water-saving devices to homeowners. Continue metering all sources.
- Replace water mains and service lines in problematic areas and complete Capital Projects in accordance with the new Water System Plan Update.

Community Involvement to Reduce Water Leaks

Locate your master water supply valve and label it. The master supply valve can be turned off in case of a major leak or broken pipe. The majority of leaks in residential plumbing systems are found at the toilet tank (fill and flapper valves).

Other common leaks include:

- Lawn irrigation valves and lines
- Yard hose turned on or leaking
- Ornamental fountains & fish ponds
- Water heater relief valve or fittings
- Leaking house pipes or fittings
- Leaking between the house and meter
- Inside and outside dripping faucets

The City is actively working to reduce system leaks. If you suspect a leak in your neighborhood please call City of Camas at 360-817-1563.

CONSERVATION TIPS

Fix leaks on old leaky faucets, toilets, hoses, and sprinkler systems.

Choose water saving fixtures and appliances and you will use 30% less water.

Sweep porches, driveways & sidewalks rather than hosing, to not only conserve water, but to avoid runoff.

Water late at night or early in the morning (10:00 pm or 6:00 am).

Take a short shower Instead of a bath.

An inch of water per week is enough to keep lawns green.

Cross Connection Program

Annual Backflow Test Required - Cross-Connection Prevention



Backflow is the undesirable reversal of the flow of water from the intended direction of flow. When this occurs, other liquids, mixtures, gases or substances can enter the potable water piping through cross connection. Under the right hydraulic conditions, backflow can result in contamination of the water supply, which is called back siphonage and back pressure.

How to keep our drinking water clean and safe:

Locate or install a backflow device

If you have an underground irrigation system, check to see if you have a backflow assembly. The backflow assembly is a brass valve usually found between your water meter and the point where your water service line enters your home, usually in a small green box similar to a meter box. If your irrigation system does not include backflow assembly or if you are installing a new underground irrigation system, City of Camas plumbing code requires you to install a *Double Check Valve Assembly (DCVA)* at a minimum.

Test your backflow assembly device annually

Once you have your backflow assembly installed or located, make sure to have it tested annually by a state-certified backflow assembly tester. If you are a property owner and have an in-ground sprinkler system you are required by state and local laws (WAC 246-290) to install and maintain a backflow prevention device on your service line, and have it inspected yearly by a Washington State Certified Backflow Assembly Tester BAT). View our Certified Backflow Tester List on the City website: https://www.cityofcamas.us/publicworks/page/backflow-and-cross-connection-prevention.

If you have more questions call our Backflow Hotline at 360-817-1569, or email us at backflow@cityofcamas.us

Properly winterizing your irrigation system

During the fall, most irrigation systems will need to be winterized to prevent pipes from freezing and breaking. Many times this involves using compressed air to blow out the excess water left in the irrigation piping. Although this is the best method, backflow of compressed air and contaminants may enter the drinking water distribution system and cause damage and or health risks if not performed properly. Make sure the compressed air is connected to a properly installed blowout connection to avoid inadvertently introducing air into our water system.

For more water-leak information, check the EPA's website at www.epa.gov/watersense/fixaleak.



2021 Consumer Confidence Report

CONTACT US

City Hall
616 NE Fourth Ave
Camas, WA 98607
360-834-2462
www.cityofcamas.us

Public Works
360-817-1563
publicworks@cityofcamas.us

After-Hours/Holiday Water Emergency: 360-737-0592

Cross-Connection Control
backflow@cityofcamas.us
360-817-1569

Camas Connect 24/7
Download our city app to make service requests, or go to www.cityofcamas.us/service-request

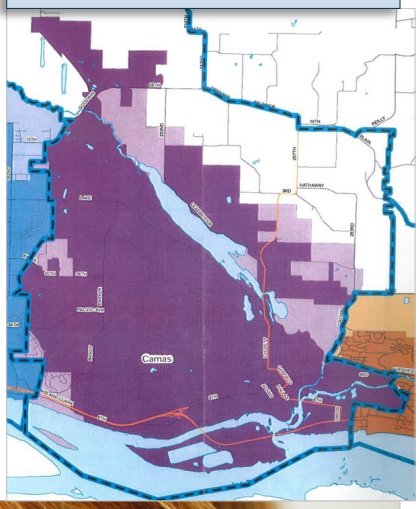
City of Camas Annual Water Quality Report

The City of Camas is pleased to present the annual Water Quality Report, which provides the public with water testing results. The health of our consumers and their families is paramount and our goal is to provide the community with a safe and dependable supply of drinking water.

At the City of Camas we understand how important it is to ensure we provide high quality water. We work diligently to provide top quality water to our growing residential population.

More information about Camas drinking water and what we're doing to keep your water safe can be found online at www.cityofcamas.us/publicworks/page/water-services

Public Water System ID: 108002





IMPORTANT!

This report contains important information about your drinking water. If English is not your first language, please have someone who can translate it for you, or speak with someone who understands it.

Este informe contiene información importante sobre su agua potable. Si el inglés no es su primer idioma, tenga a alguien que pueda traducirlo por usted o hable con alguien que lo entienda.

Ce rapport contient des informations importantes sur votre eau potable. Si l'anglais n'est pas votre langue maternelle, demandez à quelqu'un de le traduire à votre place ou de parler à quelqu'un qui le comprend.

Этот отчет содержит важную информацию о вашей питьевой воде. Если английский не является вашим родным языком, попросите кого-нибудь, кто может перевести его для вас, или поговорить с кем-то, кто понимает его.

Our Water System

The City of Camas has multiple water sources that include surface and ground water. The surface water sources (Boulder and Jones Creeks) are located on the south-side of Larch Mountain, northeast of Camas. Surface water was not used in 2021. The ground water sources include nine wells near the Washougal river and one well in Grass Valley. All water sources are treated with chlorine for disinfection, fluoride for good dental health and sodium hydroxide to reduce the corrosion of copper piping to meet State and EPA standards. Water pressure and fire flows are maintained throughout the service area with eight distribution reservoirs, nine pump stations, and over 160 miles of pipeline.

We've got news!

Follow City of Camas on social media and on the city's website for the latest in updates and alerts:

Website: www.cityofcamas.us
Twitter: www.twitter.com/CityofCamas— @CityofCamas
Facebook: www.facebook.com/cityofcamas

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2021 Water Quality Summary

Our drinking wat
and surpasses all State and
Federal health standards!



The City of Camas routinely monitors for contaminants in your drinking water according to Federal and State laws. Field and laboratory analyses include tests for bacteria, as well as chemical and physical indicators. Reports are submitted monthly to the Department of Health to report that City water meets all drinking water standards. Contaminants that were detected are listed in the following tables.

Should there ever be a public health concern, you would be notified immediately. Please report possible water pollution (illicit discharge) to the City of Camas 360-817-1563, or the Department of Ecology-SW Regional Offices 360-407-6300.

Definitions

MCL (Maximum Contaminant Level): The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as possible using the best available treatment technologies.

MCLG (Maximum Contaminant Level Goal): The maximum level of a contaminant in drinking water below which there is no known or expected health risk. MCLGs allow for a margin of safety.

AL (Action Level): The concentration of a contaminant which, if exceeded, triggers treatments or other requirements that a waster system must follow.

Milligram Per Liter (mg/L): A unit of measurement used in reporting the concentration of matter in water as determined by water analyses.

NTU (Nephelometric Turbidity Unit): Turbidity is a measure of the clarity of water. Turbidity in excess of 5 NTU is just noticeable to the average person.

ug/L: Units of measurement in micrograms/liter. A unit of concentration for dissolved substances based on their weights.

ppm: (1 parts per million = 1 mh/L = 1 milligram per liter)

ppb: (1 parts per billion = 0.001 mg/L = 1 microgram per liter)

pCi/L: Picocuries per liter is a unit for measuring radioactive concentrations. The curie (Ci) unit is the activity of 1 gram of pure radium.

NA (Not Applicable): Means that the U.S. EPA has not established MCLGs for these substances.

ND (Not Detected): A compound that was analyzed and not detected at a level greater than or equal to the state reporting level.

2021 Detected Contaminants

		EPA Regulations		City of Camas Water Quality Results	
Regulated Contaminants	**Units**	**Ideal Level/Goal (MCLG)**	**Maximum Level (MCL)**	**Range of Level Detected**	**Violation**
Fluoride	mg/L	.50 -.90	4	.34—1.03	No
Fluoride is added to your water in carefully controlled levels for dental health. In May 2016, the Washington State Department of Health changed the fluoridation requirement to a target of 0.7 mg/L from the previous target of 0.7-1.2 mg/L.					
Nitrates ***(as nitrogen)***	mg/L	10	10	Not Detected—2.9	No
Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural products.					
Haloacetic Acid (5)	ug/L	48	60	Not Detected—1.4	No
Trihalomethanes	ug/L	60	80	2.5-6.5	No
Haloacetic acids (HAA5) and trihalomethanes form as by-products of the chlorination process that is used to kill or inactivate disease-causing microbes.					
Radionuclides - Naturally Occurring Substances In Drinking Water					
Gross Alpha	pCil	0	15	2.67	No
Radium 228	pCil	0	5	.670	No
Total Coliform Bacteria	%	0	<5% Positive/Mo.	0	No

Unregulated contaminants are those for which the EPA has not established drinking water standards. The purpose of unregulated contaminant monitoring is to help EPA determine their occurrence in drinking water and potential need for future regulation. For more information, go to: https://www.epa.gov/dwucmr/third-unregulated-contaminant-monitoring-rule or contact the Safe Drinking Water Hotline at 1-800-426-47
via website https://www.epa.gov/home/epa-hotlines.

Sources of Drinking Water

In general, the sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases, radio-active material. It can also pick up substances resulting from the presence of animals or from human activity. To ensure that tap water is safe to drink, the Washington Department of Health and the United State Environmental Protection Agency (EPA) prescribe regulations that limit the amount of certain contaminants in the water provided by public water systems. Contaminants that may be present in source water before we treat it include:

Mandatory EPA Statement for All Community Water Systems

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791).

Some people may be more vulnerable to contaminants in drinking water than the general population. Immunocompromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. The US EPA-Center for Disease Control guidelines on appropriate means to lessen the risk of infection by cryptosporidium and other microbiological contaminants are from the EPA's Safe Drinking Water website.

- **Microbial Contaminants**, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- **Inorganic Contaminants**, such as salts and metals, which can be naturally-occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, and mining or farming.
- **Pesticides and Herbicides**, which may come from a variety of sources such as agriculture and residential uses.
- **Organic Chemicals**, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff, and septic systems.
- **Radioactive Contaminants**, which are naturally occurring as a result of mining and/or gas production.

Lead & Copper

In 2021, the City tested thirty two residences for lead and copper. The highest level for copper was 0.93 mg/L. The highest level for lead was .019mg/L. To be in compliance with the Lead and Copper Rules, our system must fall within the 90th percentile of samples collected, where sample results are less than or equal to the action level for lead and copper. The action level for Lead is .015 mg/L and the action level for Copper is 1.3mg/L.

Parameter	Major Source	Units	(MCLG) mg/L	(AL)	City Results mg/L	Violation
Lead *(at consumers tap)*	Plumbing, erosion of natural deposits.	ppb	0	0.015	Not Detected —.019	No
Copper		ppm	0	1.30	.021—.93	No

To Reduce Lead and Copper Exposure

- When your water has been sitting for several hours, flush the pipe by running the cold water tap until the water is noticeably colder before using the water for drinking or cooking.
- Use only cold water for drinking, cooking, and making baby formula. Hot water may contain higher levels of copper.
- Frequently clean the filter screens and aerators in faucets to remove captured particles.
- If building or remodeling, only use "lead free" or low lead piping and materials. Avoid using copper piping or brass fixtures for locations where water will be consumed or used in food preparation.

EPA STATEMENT

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City of Camas is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to two minutes before using water for drinking or cooking. The EPA requires the City to conduct lead testing every three years.

Copper is a mineral component naturally found in solids. In the correct amounts, it is an essential nutrient for humans and plants. In Washington State, most copper in drinking water comes from corrosion of household plumbing. Plumbing sources can include copper pipe and brass fixtures. Copper from plumbing corrosion can accumulate overnight. Although copper is an essential mineral in the diet, too much copper can cause health problems. Copper is widely distributed within the tissues of the body, but accumulates primarily in the liver and kidneys. A single dose of 15 mg of copper can cause nausea, vomiting, diarrhea, and intestinal cramps.

If you are concerned about lead or copper in your water, you may wish to have your water tested. Information on lead and copper in your drinking water, testing methods, and steps you can take to minimize exposure is available from:

Safe Drinking Water Hotline 1-800-426-4791, or at www.epa.gov/safewater/lead.

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Water Conservation

In 2021 the average daily water consumption in Camas was 4.75 million gallons. Our peak usage day was on July 22, 2021, when 11,670,000 gallons were consumed. Most of this increase in the summer months is due to irrigation demands. We are once again asking for the public's help to implement a voluntary odd/even lawn watering program for residential customers. Water on odd days for home addresses that end in an odd number, and even days if it ends in an even number.

City Water Saving Commitments

- To reduce the customer consumption per home by one percent or approximately two gallons-per-day per year over the next six years. The City will maintain distribution system loss at-or-below ten percent for the next five years.
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Community Involvement to Reduce Water Leaks

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Properly winterizing your irrigation system

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2022 Consumer Confidence Report

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www.cityofcamas.us

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Cross-Connection Control
backflow@cityofcamas.us
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Engage Camas
www.Engagecamas.com

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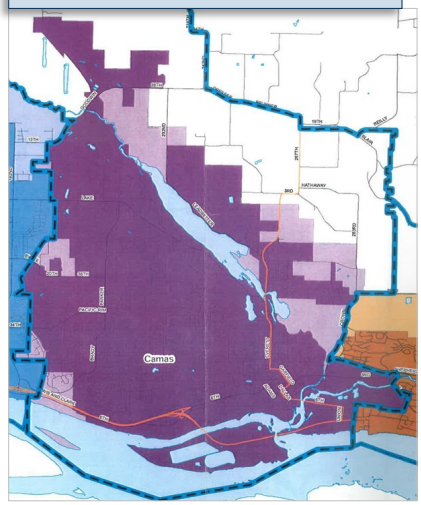
City of Camas Annual Water Quality Report

Public Water System ID: 108002

The City of Camas is pleased to present the annual Water Quality Report, which provides the public with water testing results. The health of our consumers and their families is paramount and our goal is to provide the community with a safe and dependable supply of drinking water.

At the City of Camas we understand how important it is to ensure we provide high quality water. We work diligently to provide top quality water to our growing residential population.

More information about Camas drinking water and what we're doing to keep your water safe can be found online at www.cityofcamas.us/publicworks/page/water-services





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The City of Camas has multiple water sources that include surface and ground water. The surface water sources (Boulder and Jones Creeks) are located on the south-side of Larch Mountain, northeast of Camas. Surface water was not used in 2022. The ground water sources include nine wells near the Washougal river and one well in Grass Valley. All water sources are treated with chlorine for disinfection, fluoride for good dental health and sodium hydroxide to reduce the corrosion of piping to meet State and Environmental Protection Agency (EPA) standards. Water pressure and fire flows are maintained throughout the service area with eight distribution reservoirs, nine pump stations, and over 160 miles of pipeline.

2022 Water Quality Summary

Our drinking wat
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Should there ever be a public health concern, you would be notified immediately. Please report possible water pollution (through illicit discharge or contamination) to the City of Camas 360-817-1563, or the Department of Ecology-SW Regional Offices 360-407-6300.

Definitions

MCL (Maximum Contaminant Level): The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as possible using the best available treatment technologies.

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ppm: (1 parts per million = 1 mg/L = 1 milligram per liter)

ppb: (1 parts per billion = 0.001 µg/L = 1 microgram per liter)

ppt: (1 parts per trillion = 1 ng/L = 1 nanogram per liter)

pCi/L: Picocuries per liter is a unit for measuring radioactive concentrations. The curie (Ci) unit is the activity of 1 gram of pure radium.

NA (Not Applicable): Means that the U.S. EPA has not established MCLGs for these substances.

ND (Not Detected): A compound that was analyzed and not detected at a level greater than or equal to the state reporting level.

Ng/L: Nanograms per liter

2022 Detected Contaminants

		EPA Regulations		City of Camas Water Quality Results	
Regulated Contaminants	**Units**	**Ideal Level/Goal (MCLG)**	**Maximum Level (MCL)**	**Range of Level Detected**	**Violation**
Fluoride	mg/L	.50 -.90	4	.16-1.10	No
Fluoride is added to your water in carefully controlled levels for dental health. In May 2016, the Washington State Department of Health changed the fluoridation requirement to a target of 0.7 mg/L from the previous target of 0.7-1.2 mg/L.					
Nitrates ***(as nitrogen)***	mg/L	10	10	Not Detected—2.1	No
Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural products.					
Haloacetic Acid (5)	ug/L	48	60	Not Detected	No
Trihalomethanes	ug/L	60	80	5.7-7.6	No
Haloacetic acids (HAA5) and trihalomethanes form as by-products of the chlorination process that is used to kill or inactivate disease-causing microbes.					
Radionuclides - Naturally Occurring Substances In Drinking Water					
Gross Alpha	pCil	0	15	2.68	No
Radium 228	pCil	0	5	.739	No
Total Coliform Bacteria	%	0	<1% Positive/Mo.	0	No

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2022 Detected Contaminants continued...

A Volatile Organic Chemical (VOC) sample was inadvertently missed at the Washougal Wellfield (source 5-18) in 2022. Through coordination with The Department of Health, the sample was taken in March 2023 resulting in a non-detect.

Sources of Drinking Water

In general, the sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases, radio-active material. It can also pick up substances resulting from the presence of animals or from human activity. To ensure that tap water is safe to drink, the Washington Department of Health and EPA prescribe regulations that limit the amount of certain contaminants in the water provided by public water systems. Contaminants that may be present in source water before we treat it include:

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Lead & Copper

In 2022, the City tested thirty two residences for lead and copper. The highest level for copper was 0.93 mg/L. The highest level for lead was .019mg/L. To be in compliance with the Lead and Copper Rules, sample results must be less than or equal to the action level for lead and copper. The action level for Lead is .015 mg/L and the action level for Copper is 1.3mg/L.

Parameter	Major Source	Units	(MCLG) mg/L	(AL) mg/L	City Results mg/L	Violation
Lead *(at consumers tap)*	Plumbing, erosion of natural deposits.	ppb	0	0.015	Not Detected —	No
Copper		ppm	0	1.30	.021—.93	No

To Reduce Lead and Copper Exposure

- When your water has been sitting for several hours, flush the pipe by running the cold water tap until the water is noticeably colder before using the water for drinking or cooking.
- Use only cold water for drinking, cooking, and making baby formula. Hot water may contain higher levels of copper.
- Frequently clean the filter screens and aerators in faucets to remove captured particles.
- If building or remodeling, only use "lead free" or low lead piping and materials. Avoid using copper piping or brass fixtures for locations where water will be consumed or used in food preparation.

EPA Statement

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City of Camas is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to two minutes before using water for drinking or cooking. The EPA requires the City to conduct lead testing every three years.

Copper is a mineral component naturally found in solids. In the correct amounts, it is an essential nutrient for humans and plants. In Washington State, most copper in drinking water comes from corrosion of household plumbing. Plumbing sources can include copper pipe and brass fixtures. Copper from plumbing corrosion can accumulate overnight. Although copper is an essential mineral in the diet, too much copper can cause health problems. Copper is widely distributed within the tissues of the body, but accumulates primarily in the liver and kidneys. A single dose of 15 mg of copper can cause nausea, vomiting, diarrhea, and intestinal cramps.

If you are concerned about lead or copper in your water, you may wish to have your water tested. Information on lead and copper in your drinking water, testing methods, and steps you can take to minimize exposure is available from:

Safe Drinking Water Hotline 1-800-426-4791, or at www.epa.gov/safewater/lead.

PFAS

In 2021, the Washington State Board of Health (SBOH) adopted a rule that requires water system utilities, including the City of Camas, to test for Per and Polyfluoroalkyl substances (PFAS). PFAS are a new class of contaminants not currently regulated by the EPA which include Perfluorooctanoic acid (PFOA) and Perfluorooctanioc Sulfonic Acid (PFOS). The rule requires the City to notify you if any test results exceed a State Action Level. EPA has not yet set an action level but one is expected sometime in 2024 that is anticipated to be lower than the state action level (SAL).

The City recently completed another sampling for PFAS at all of its wells in March of 2023. The testing resulted in no detection for PFOA or PFOS at any of the City wells. PFAS detection below 4 parts per trillion is considered a non-detect. The City will continue to sample for PFAS as required by the Washington Department of Health on a quarterly basis at all of its wells. Complete information for 2023 will be provided in next years Annual Water Quality Report.

Source	PFOA Result (ppt)	PFOA SAL 10ppt	PFOS Result (ppt)	PFOS SAL 15ppt
Well 5 (S-06)	3.6	Below	6.9	Below
WFW (S-19)	ND	NA	3.1	Below
WFE (S-18)	ND	NA	3.3	Below
Well 13 (S-16)	3.6	Below	21	Above

ND: None Detected **NA:** Not Applicable

The City continues to monitor the water system, coordinate with the Department of Health, and investigate options for treatment of PFAS in the City's water system. For more information, please visit the City's website.

Water Conservation

In 2022 the average daily water consumption in Camas was 4.49 million gallons. Our peak usage day was on July 29, 2022, when 8,781,000 gallons were consumed. Most of this increase in the summer months is due to irrigation demands. We are once again asking for the public's help to implement a voluntary odd/even lawn watering program for residential customers. Water on odd days for home addresses that end in an odd number, and even days if it ends in an even number.

City Water Saving Commitments

- To reduce the customer consumption per home by one percent, or approximately two gallons-per-day per year over the next six years. The City will maintain distribution system loss at-or-below ten percent for the next five years.
- Replacing industrial, commercial, and residential service meters with new radio read meters, which will allow the City to log usage more effectively to notify customers about continuous leaks or high consumption.
- Encourage the installation of smart controllers on irrigation systems for the school district and industrial users.
- Educate the public on water-saving devices. Continue metering all sources.
- Replace water mains and service lines in problematic areas and complete Capital Projects in accordance with the new Water System Plan Update.

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Other common leaks include:

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CONSERVATION TIPS

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How to keep our drinking water clean and safe:

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If you have an underground irrigation system, check to see if you have a backflow assembly. The backflow assembly is a brass valve usually found between your water meter and the point where your water service line enters your home, usually in a small green box similar to a meter box. If your irrigation system does not include a backflow assembly or if you are installing a new underground irrigation system, City of Camas plumbing code requires you to install a *Double Check Valve Assembly (DCVA)* at a minimum.

Test your backflow assembly device annually

Once you have your backflow assembly installed or located, make sure to have it tested annually by a state-certified backflow assembly tester. If you are a property owner and have an in-ground sprinkler system you are required by state and local laws (WAC 246-290) to install and maintain a backflow prevention device on your service line, and have it inspected yearly by a Washington State Certified Backflow Assembly Tester (BAT). View our Certified Backflow Tester List on the City website: Backflow and Cross-Connection Prevention | Camas WA (cityofcamas.us).

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During the fall, most irrigation systems will need to be winterized to prevent pipes from freezing and breaking. Many times this involves using compressed air to blow out the excess water left in the irrigation piping. Although this is the best method, backflow of compressed air and contaminants may enter the drinking water distribution system and cause damage and or health risks if not performed properly. Make sure the compressed air is connected to a properly installed blowout connection to avoid inadvertently introducing air into the City's water system.

For more water-leak information, check the EPA's website at www.epa.gov/watersense/fixaleak.

We've got news!

Follow City of Camas on social media and on the city's website for the latest in updates and alerts:

Website: www.cityofcamas.us
Facebook: www.facebook.com/cityofcamas
Engage Camas: www.Engagecamas.com



2023 Consumer Confidence Report

CONTACT US

City Hall
616 NE Fourth Ave
Camas, WA 98607
360-834-2462
www.cityofcamas.us

Public Works
360-817-1563
publicworks@cityofcamas.us

After-Hours/Holiday Water Emergency: 360-737-0592

Cross-Connection Control
backflow@cityofcamas.us
360-817-1569

Camas Connect 24/7
Download our city app to make service requests, or go to www.cityofcamas.us/service-request

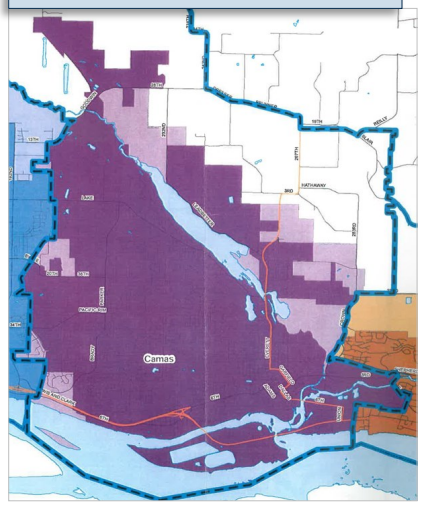
City of Camas Annual Water Quality Report

Public Water System ID: 108002

The City of Camas is pleased to present the annual Water Quality Report, which provides the public with water testing results. The health of our consumers and their families is paramount and our goal is to provide the community with a safe and dependable supply of drinking water.

At the City of Camas we understand how important it is to ensure we provide high quality water. We work diligently to provide top quality water to our growing residential population.

More information about Camas drinking water and what we're doing to keep your water safe can be found online at www.cityofcamas.us/publicworks/page/water-services





IMPORTANT!

This report contains important information about your drinking water. If English is not your first language, please have someone who can translate it for you, or speak with someone who understands it.

Este informe contiene información importante sobre su agua potable. Si el inglés no es su primer idioma, tenga a alguien que pueda traducirlo por usted o hable con alguien que lo entienda.

Ce rapport contient des informations importantes sur votre eau potable. Si l'anglais n'est pas votre langue maternelle, demandez à quelqu'un de le traduire à votre place ou de parler à quelqu'un qui le comprend.

Этот отчет содержит важную информацию о вашей питьевой воде. Если английский не является вашим родным языком, попросите кого-нибудь, кто может перевести его для вас, или поговорить с кем-то, кто понимает его.

Our Water System

The City of Camas has multiple water sources that include surface and ground water. The surface water sources (Boulder and Jones Creeks) are located on the south-side of Larch Mountain, northeast of Camas. Surface water was not used in 2022. The ground water sources include nine wells near the Washougal river and one well in Grass Valley. All water sources are treated with chlorine for disinfection, fluoride for good dental health and sodium hydroxide to reduce the corrosion of copper piping to meet State and EPA standards. Water pressure and fire flows are maintained throughout the service area with eight distribution reservoirs, nine pump stations, and over 160 miles of pipeline.

2023 Water Quality Summary

Our drinking wat
and surpasses all State and
Federal health standards!



The City of Camas routinely monitors for contaminants in your drinking water according to Federal and State laws. Field and laboratory analyses include tests for bacteria, as well as chemical and physical indicators. Reports are submitted monthly to the Department of Health to report that City water meets all drinking water standards. Contaminants that were detected are listed in the following tables.

Should there ever be a public health concern, you would be notified immediately. Please report possible water pollution (illicit discharge) to the City of Camas 360-817-1563, or the Department of Ecology-SW Regional Offices 360-407-6300.

Definitions

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Milligram Per Liter (mg/L): A unit of measurement used in reporting the concentration of matter in water as determined by water analyses.

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µg/L: Units of measurement in micrograms/liter.

ppm: (1 parts per million = 1 mg/L = 1 milligram per liter)

ppb: (1 parts per billion = 0.001 µg/L = 1 microgram per liter)

ppt: (1 parts per trillion = 1 ng/L = 1 nanogram per liter)

pCi/L: Picocuries per liter is a unit for measuring radioactive concentrations. The curie (Ci) unit is the activity of 1 gram of pure radium.

NA (Not Applicable): Means that the U.S. EPA has not established MCLGs for these substances.

ND (Not Detected): A compound that was analyzed and not detected at a level greater than or equal to the state reporting level.

Ng/L: Nanograms per liter

2023 Detected Contaminants

		EPA Regulations		City of Camas Water Quality Results	
Regulated Contaminants	**Units**	**Ideal Level/Goal (MCLG)**	**Maximum Level (MCL)**	**Range of Level Detected**	**Violation**
Fluoride	mg/L	.50 -.90	4	.13 - 1.11	No
Fluoride is added to your water in carefully controlled levels for dental health. In May 2016, the Washington State Department of Health changed the fluoridation requirement to a target of 0.7 mg/L from the previous target of 0.7-1.2 mg/L.					
Nitrates ***(as nitrogen)***	mg/L	10	10	Not Detected—1.7	No
Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural products.					
Haloacetic Acid (5)	ug/L	48	60	.87—1.0	No
Trihalomethanes	ug/L	60	80	.50—4.1	No
Haloacetic acids (HAA5) and trihalomethanes form as by-products of the chlorination process that is used to kill or inactivate disease-causing microbes.					
Radionuclides - Naturally Occurring Substances In Drinking Water					
Gross Alpha	pCil	0	15	2.16	No
Radium 228	pCil	0	5	.760	No
Total Coliform Bacteria	%	0	<1% Positive/Mo.	0	No

Unregulated contaminants are those for which the EPA has not established drinking water standards. The purpose of unregulated contaminant monitoring is to help EPA determine their occurrence in drinking water and potential need for future regulation. For more information, go to: https://www.epa.gov/dwucmr/third-unregulated-contaminant-monitoring-rule or contact the Safe Drinking Water Hotline at 1-800-426-47
via website https://www.epa.gov/home/epa-hotlines.

2023 Detected Contaminants continued...

A VOC was missed at WFE (5-18) which caused a non-compliance letter for 2022. The sample was taken in March 2023 resulting in a non-detect. This brought the source back into compliance.

Sources of Drinking Water

In general, the sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases, radio-active material. It can also pick up substances resulting from the presence of animals or from human activity. To ensure that tap water is safe to drink, the Washington Department of Health and the United State Environmental Protection Agency (EPA) prescribe regulations that limit the amount of certain contaminants in the water provided by public water systems. Contaminants that may be present in source water before we treat it include:

- **Microbial Contaminants**, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- **Inorganic Contaminants**, such as salts and metals, which can be naturally-occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, and mining or farming.
- **Pesticides and Herbicides**, which may come from a variety of sources such as agriculture and residential uses.
- **Organic Chemicals**, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff, and septic systems.
- **Radioactive Contaminants**, which are naturally occurring as a result of mining and/or gas production.

Mandatory EPA Statement for All Community Water Systems

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791).

Some people may be more vulnerable to contaminants in drinking water than the general population. Immunocompromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. The US EPA-Center for Disease Control guidelines on appropriate means to lessen the risk of infection by cryptosporidium and other microbiological contaminants are from the EPA's Safe Drinking Water website.

Lead & Copper

In 2022, the City tested thirty two residences for lead and copper. The highest level for copper was 0.93 mg/L. The highest level for lead was .019mg/L. To be in compliance with the Lead and Copper Rules, our system must fall within the 90th percentile of samples collected, where sample results are less than or equal to the action level for lead and copper. The action level for Lead is .015 mg/L and the action level for Copper is 1.3mg/L. Lead & Copper sampling for 2024 will begin in the fall.

Parameter	Major Source	Units	(MCLG) mg/L	(AL) mg/L	City Results mg/L	Violation
Lead *(at consumers tap)*	Plumbing, erosion of natural deposits.	ppb	0	0.015	Not Detected —	No
Copper		ppm	0	1.30	.021—.93	No

To Reduce Lead and Copper Exposure

- When your water has been sitting for several hours, flush the pipe by running the cold water tap until the water is noticeably colder before using the water for drinking or cooking.
- Use only cold water for drinking, cooking, and making baby formula. Hot water may contain higher levels of copper.
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Copper is a mineral component naturally found in solids. In the correct amounts, it is an essential nutrient for humans and plants. In Washington State, most copper in drinking water comes from corrosion of household plumbing. Plumbing sources can include copper pipe and brass fixtures. Copper from plumbing corrosion can accumulate overnight. Although copper is an essential mineral in the diet, too much copper can cause health problems. Copper is widely distributed within the tissues of the body, but accumulates primarily in the liver and kidneys. A single dose of 15 mg of copper can cause nausea, vomiting, diarrhea, and intestinal cramps.

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PFOS

In 2021, the Washington State Board of Health (SBOH) adopted a rule that requires water system utilities, including the City of Camas, to test for PFAS. PFAS are a new class of contaminants not currently regulated by the Environmental Protection Agency (EPA). The rule also requires the City to notify you if any test results exceed a State Action Level. EPA has not yet set an action level but one is expected sometime in 2024.

The City recently completed another sampling for PFOS at all its wells in March of 2023. The testing resulted in no detection for PFOA or PFOS at any of the sites sampled in 2022. Detection below 4 parts per trillion is considered a non-detect. The City will continue to sample for PFAS as requested by the Washington Department of Health on a quarterly basis at all of its wells.

Source	PFOA Result	PFOA SAL 10ppt	PFOS Result	PFOS SAL 15ppt
Well 5 (S-06)	3.6	Below	6.9	Below
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In 2023 the average daily water consumption in Camas was 4.66 million gallons. Our peak usage day was on August 23, 2023, when 8,796,000 gallons were consumed. Most of this increase in the summer months is due to irrigation demands. We are once again asking for the public's help to implement a voluntary odd/even lawn watering program for residential customers. Water on odd days for home addresses that end in an odd number, and even days if it ends in an even number.

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Facebook: www.facebook.com/cityofcamas



2024 Consumer Confidence Report

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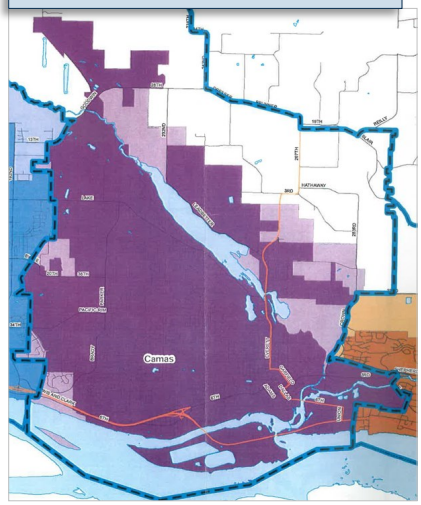
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2024 Detected Contaminants

		EPA Regulations		City of Camas Water Quality Results	
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Fluoride	mg/L	.50 -.90	4	.12-1.24	No
Fluoride is added to your water in carefully controlled levels for dental health. In May 2016, the Washington State Department of Health changed the fluoridation requirement to a target of 0.7 mg/L from the previous target of 0.7-1.2 mg/L.					
Nitrates ***(as nitrogen)***	mg/L	10	10	Not Detected—2.0	No
Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural products.					
Haloacetic Acid (5)	ug/L	48	60	No Detected	No
Trihalomethanes	ug/L	60	80	2.9-3.5	No
Haloacetic acids (HAA5) and trihalomethanes form as by-products of the chlorination process that is used to kill or inactivate disease-causing microbes.					
Radionuclides - Naturally Occurring Substances In Drinking Water					
Gross Alpha	pCil	0	15	.102	No
Radium 228	pCil	0	5	.954	No
Total Coliform Bacteria	%	0	<1% Positive/Mo.	0	No

Unregulated contaminants are those for which the EPA has not established drinking water standards. The purpose of unregulated contaminant monitoring is to help EPA determine their occurrence in drinking water and potential need for future regulation. For more information, go to: https://www.epa.gov/dwucmr/third-unregulated-contaminant-monitoring-rule or contact the Safe Drinking Water Hotline at 1-800-426-47
via website https://www.epa.gov/home/epa-hotlines.

2024 Detected Contaminants continued...

Sources of Drinking Water

In general, the sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases, radio-active material. It can also pick up substances resulting from the presence of animals or from human activity. To ensure that tap water is safe to drink, the Washington Department of Health and the United State Environmental Protection Agency (EPA) prescribe regulations that limit the amount of certain contaminants in the water provided by public water systems. Contaminants that may be present in source water before we treat it include:

- **Microbial Contaminants**, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- **Inorganic Contaminants**, such as salts and metals, which can be naturally-occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, and mining or farming.
- **Pesticides and Herbicides**, which may come from a variety of sources such as agriculture and residential uses.
- **Organic Chemicals**, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff, and septic systems.
- **Radioactive Contaminants**, which are naturally occurring as a result of mining and/or gas production.

Mandatory EPA Statement for All Community Water Systems

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791).

Some people may be more vulnerable to contaminants in drinking water than the general population. Immunocompromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. The US EPA-Center for Disease Control guidelines on appropriate means to lessen the risk of infection by cryptosporidium and other microbiological contaminants are from the EPA's Safe Drinking Water website.

Lead & Copper

In 2024, the City tested thirty two residences for lead and copper. The highest level for copper was 0.73 mg/L. The highest level for lead was .014mg/L. To be in compliance with the Lead and Copper Rules, our system must fall within the 90th percentile of samples collected, where sample results are less than or equal to the action level for lead and copper. The action level for Lead is .015 mg/L and the action level for Copper is 1.3mg/L. The next round of lead sampling will occur in fall of 2027.

Parameter	Major Source	Units	(MCLG) mg/L	(AL) mg/L	City Results mg/L	Violation
Lead *(at consumers tap)*	Plumbing, erosion of natural deposits.	ppb	0	0.015	ND –.014	No
Copper		ppm	0	1.30	ND-.73	No

To Reduce Lead and Copper Exposure

- When your water has been sitting for several hours, flush the pipe by running the cold water tap until the water is noticeably colder before using the water for drinking or cooking.
- Use only cold water for drinking, cooking, and making baby formula. Hot water may contain higher levels of copper.
- Frequently clean the filter screens and aerators in faucets to remove captured particles.
- If building or remodeling, only use "lead free" or low lead piping and materials. Avoid using copper piping or brass fixtures for locations where water will be consumed or used in food preparation.

EPA Statement

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City of Camas is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to two minutes before using water for drinking or cooking. The EPA requires the City to conduct lead testing every three years.

Copper is a mineral component naturally found in solids. In the correct amounts, it is an essential nutrient for humans and plants. In Washington State, most copper in drinking water comes from corrosion of household plumbing. Plumbing sources can include copper pipe and brass fixtures. Copper from plumbing corrosion can accumulate overnight. Although copper is an essential mineral in the diet, too much copper can cause health problems. Copper is widely distributed within the tissues of the body, but accumulates primarily in the liver and kidneys. A single dose of 15 mg of copper can cause nausea, vomiting, diarrhea, and intestinal cramps.

If you are concerned about lead or copper in your water, you may wish to have your water tested. Information on lead and copper in your drinking water, testing methods, and steps you can take to minimize exposure is available from:

Safe Drinking Water Hotline 1-800-426-4791, or at www.epa.gov/safewater/lead.

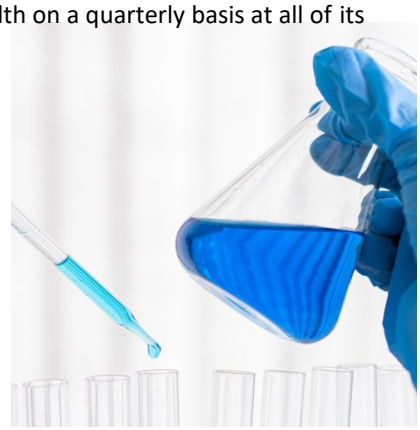
PFOS

In 2021, the Washington State Board of Health (SBOH) adopted a rule that requires water system utilities, including the City of Camas, to test for PFAS. PFAS are a new class of contaminants not currently regulated by the Environmental Protection Agency (EPA). The rule also requires the City to notify you if any test results exceed a State Action Level (SAL). EPA adopted limits of 4 ppt for PFOA and PFOS in April of 2024.

The City recently completed another sampling for PFOS at all its wells in June and July 2024 of 4 ppt. The testing resulted in no detection for PFOA or PFOS at any of the sites sampled in 2022. Detection below 4 parts per trillion is considered a non-detect. The City will continue to sample for PFAS as requested by the Washington Department of Health on a quarterly basis at all of its

Source	PFOA Result	PFOA SAL 10 ppt	PFOS Result	PFOS SAL 15 ppt
Well 5 (S-06)	5.	Below	7.2	Below
WFW (S-19)	ND	Below	3.2	Below
WFE (S-17)	ND	NA	ND	Below
Well 13 (S-16)	ND	NA	8.3	Below

ND: None Detected **NA:** Not Applicable



Water Conservation

In 2024 the average daily water consumption in Camas was 4.66 million gallons. Our peak usage day was on July 8, 2024, when 10,243,000 gallons were consumed. Most of this increase in the summer months is due to irrigation demands. We are once again asking for the public's help to implement a voluntary odd/even lawn watering program for residential customers. Water on odd days for home addresses that end in an odd number, and even days if it ends in an even number.

City Water Saving Commitments

- To reduce the customer consumption per home by one percent or approximately two gallons-per-day per year over the next six years. The City will maintain distribution system loss at-or-below ten percent for the next five years.
- Replacing industrial, commercial, and residential service meters with the new radio read meters, which will allow the City to log usage more effectively to notify customers about continuous leaks or high consumption.
- Encourage the installation of smart controllers on irrigation systems for the school district and industrial users.
- Educate the public on water-saving devices, and distribute water conservation kits and water-saving devices to homeowners. Continue metering all sources.
- Replace water mains and service lines in problematic areas and complete Capital Projects in accordance with the new Water System Plan Update.

Community Involvement to Reduce Water Leaks

Locate your master water supply valve and label it. The master supply valve can be turned off in case of a major leak or broken pipe. The majority of leaks in residential plumbing systems are found at the toilet tank (fill and flapper valves).

Other common leaks include:

- Lawn irrigation valves and lines
- Yard hose turned on or leaking
- Ornamental fountains & fish ponds
- Water heater relief valve or fittings
- Leaking house pipes or

CONSERVATION TIPS

Fix leaks on old leaky faucets, toilets, hoses, and sprinkler systems.

Choose water saving fixtures and appliances and you will use 30% less water.

Sweep porches, driveways & sidewalks rather than hosing, to not only conserve water, but to avoid runoff.

Water late at night or early in the morning (10:00 pm or 6:00 am).

An inch of water per week is enough to keep lawns green.

Take a short shower instead of a bath

Cross Connection Program

Annual Backflow Test Required

Cross-Connection Prevention

Backflow is the undesirable reversal of the flow of water from the intended direction of flow. When this occurs, other liquids, mixtures, gases or substances can enter the potable water piping through cross connection. Under the right hydraulic conditions, backflow can result in contamination of the water supply, which is called back siphonage and back pressure.



How to keep our drinking water clean and safe:

Locate or install a backflow device

If you have an underground irrigation system, check to see if you have a backflow assembly. The backflow assembly is a brass valve usually found between your water meter and the point where your water service line enters your home, usually in a small green box similar to a meter box. If your irrigation system does not include backflow assembly or if you are installing a new underground irrigation system, City of Camas plumbing code requires you to install a *Double Check Valve Assembly (DCVA)* at a minimum.

Test your backflow assembly device annually

Once you have your backflow assembly installed or located, make sure to have it tested annually by a state-certified backflow assembly tester. If you are a property owner and have an in-ground sprinkler system you are required by state and local laws (WAC 246-290) to install and maintain a backflow prevention device on your service line, and have it inspected yearly by a Washington State Certified Backflow Assembly Tester (BAT). View our Certified Backflow Tester List on the City website: Backflow and Cross-Connection Prevention | Camas WA (cityofcamas.us).

If you have more questions call our Backflow Hotline at 360-817-1569, or email us at backflow@cityofcamas.us

Properly winterizing your irrigation system

During the fall, most irrigation systems will need to be winterized to prevent pipes from freezing and breaking. Many times this involves using compressed air to blow out the excess water left in the irrigation piping. Although this is the best method, backflow of compressed air and contaminants may enter the drinking water distribution system and cause damage and or health risks if not performed properly. Make sure the compressed air is connected to a properly installed blowout connection to avoid inadvertently introducing air into our water system.

For more water-leak information, check the EPA's website at www.epa.gov/watersense/fixaleak.

We've got news!

Follow City of Camas on social media and on the city's website for the latest in updates and alerts:

Website: www.cityofcamas.us
Twitter: www.twitter.com/CityofCamas— @CityofCamas
Facebook: www.facebook.com/cityofcamas



APPENDIX R

WATER FACILITY INVENTORY

WATER FACILITIES INVENTORY (WFI) FORM

ONE FORM PER SYSTEM

Quarter: 1
Updated: 12/20/
Item 2.
Printed: 3/6/2026
WFI Printed For: On-Demand
Submission Reason: Pop/Connect Update

RETURN TO: Central Services - WFI, PO Box 47822, Olympia, WA, 98504-7822 or email wfi@doh.wa.gov

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
10800 2	CAMAS MUNICIPAL WATER SEWER SYSTEM	CLARK	A	Comm

6. PRIMARY CONTACT NAME & MAILING ADDRESS	7. OWNER NAME & MAILING ADDRESS
ALLEN J. NELSON [WATER SUPPLY] CITY HALL 1620 SE 8TH AVE CAMAS, WA 98607	CAMAS, CITY OF ROB CHARLES 616 NE 4TH AVE CAMAS, WA 98607 ACTING PUBLIC WORKS DI
STREET ADDRESS IF DIFFERENT FROM ABOVE	**STREET ADDRESS IF DIFFERENT FROM ABOVE**
ATTN	ATTN
ADDRESS	ADDRESS
CITY STATE ZIP	CITY STATE ZIP

9. 24 HOUR PRIMARY CONTACT INFORMATION		10. OWNER CONTACT INFORMATION	
Primary Contact Daytime Phone: (360) 817-7287		Owner Daytime Phone: (360) 817-7899	
Primary Contact Mobile/Cell Phone: (360) 690-5095		Owner Mobile/Cell Phone:	
Primary Contact Evening Phone: (xxx)-xxx-xxxx		Owner Evening Phone:	
Fax:	E-mail: AxxxxxN@CITYOFCAMAS.US	Fax: (360) 834-1535	E-mail: rxxxxxxs@cityofcamas.us

11. SATELLITE MANAGEMENT AGENCY - SMA (check only one)

- [x] Not applicable (Skip to #12)
- [ ] Owned and Managed
- [ ] Managed Only
- [ ] Owned Only

SMA NAME: _____ SMA Number:

12. WATER SYSTEM CHARACTERISTICS (mark all that apply)

- [ ] Agricultural
- [x] Commercial / Business
- [x] Day Care
- [x] Food Service/Food Permit
- [ ] 1,000 or more person event for 2 or more days per year
- [x] Hospital/Clinic
- [x] Industrial
- [x] Licensed Residential Facility
- [x] Lodging
- [x] Recreational / RV Park
- [x] Residential
- [x] School
- [ ] Temporary Farm Worker
- [x] Other (church, fire station, etc.):
- [ ] RTCR Seasonal System

13. WATER SYSTEM OWNERSHIP (mark only one)				14. STORAGE CAPACITY (gallons)
[ ] Association	[ ] County	[ ] Investor	[ ] Special District	
[x] City / Town	[ ] Federal	[ ] Private	[ ] State	8,500,000

- SEE NEXT PAGE FOR A COMPLETE LIST OF SOURCES -

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WATER FACILITIES INVENTORY (WFI) FORM - Continued

Item 2.

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
10800 2	CAMAS MUNICIPAL WATER SEWER SYSTEM	CLARK	A	Comm

15	16	17	18									19			20	21						22	23	24			
	SOURCE NAME	INTERTIE	SOURCE CATEGORY									USE				TREATMENT						DEPTH		SOURCE LOCATION			
Source Number	LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456 IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME Example: SEATTLE	INTERTIE SYSTEM ID NUMBER	WELL	WELL FIELD	WELL IN A WELL FIELD	SPRING	SPRING FIELD	SPRING IN SPRINGFIELD	SEA WATER	SURFACE WATER	RANNEY / INF. GALLERY	OTHER	PERMANENT	SEASONAL	EMERGENCY	SOURCE METERED	NONE	CHLORINATION	FILTRATION	FLUORIDATION	IRRADIATION (UV)	OTHER	DEPTH TO FIRST OPEN INTERVAL IN FEET	CAPACITY (GALLONS PER MINUTE)	1/4, 1/4 SECTION	SECTION NUMBER	TOWNSHIP	RANGE
S01	BOULDER CREEK									X					X	Y		X	X	X		X		500	SW NE	04	02N	04E
S02	JONES CREEK									X					X	Y		X	X	X		X		500	SE SW	03	02N	04E
S06	DEEP WELL #5 AFP623		X											X		Y		X		X		X	71	600	SW SE	12	01N	03E
S07	DEEP WELL #6 AFP624				X								X			Y	X						85	1400	NE SW	12	01N	03E
S08	DEEP WELL #7 AFP628				X								X			Y	X						49	950	NW SW	12	01N	03E
S09	DEEP WELL #8 AFP629				X								X			Y	X						44	1350	NW SW	12	01N	03E
S11	WELL #9 AFP631 16"		X											X		Y		X		X			145	650	NE NW	04	01N	03E
S13	WELL #11 AHM259				X								X			Y	X						80	1200	NW SW	12	01N	03E
S14	WELL #12 AHM266				X								X			Y	X						81	1300	NW SW	12	01N	03E
S15	WELL #10 AGP495				X								X			Y	X						82	1300	NW SW	12	01N	03E
S16	WELL #13 ALL997		X										X			Y		X		X		X	80	1325	NE SE	47	01N	03E
S17	WELL #14 BAM409				X								X			Y	X						58	1000	NE SW	12	01N	03E
S18	Eastern WF(S07, S17)			X									X			N		X		X		X	58	2400	NW SW	12	01N	03E
S19	Western WF (S08, 9, 13,14,15)			X									X			N		X		X		X	44	6100			00N	00E

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WATER FACILITIES INVENTORY (WFI) FORM - Continued

Item 2.

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
10800 2	CAMAS MUNICIPAL WATER SEWER SYSTEM	CLARK	A	Comm

	ACTIVE SERVICE CONNECTIONS	DOH USE ONLY! CALCULATED ACTIVE CONNECTIONS	DOH USE ONLY! APPROVED CONNECTIONS
25. SINGLE FAMILY RESIDENCES (How many of the following do you have?)		11254	Unspecified
A. Full Time Single Family Residences (Occupied 180 days or more per year)	9075		
B. Part Time Single Family Residences (Occupied less than 180 days per year)	0		
26. MULTI-FAMILY RESIDENTIAL BUILDINGS (How many of the following do you have?)			
A. Apartment Buildings, condos, duplexes, barracks, dorms	372		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied more than 180 days/year	2179		
C. Part Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied less than 180 days/year	0		
27. NON-RESIDENTIAL CONNECTIONS (How many of the following do you have?)			
A. Recreational Services and/or Transient Accommodations (Campsites, RV sites, hotel/motel/overnight units)	0	0	
B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc.	588	588	
28. TOTAL SERVICE CONNECTIONS		11842	

29. FULL-TIME RESIDENTIAL POPULATION

A. How many residents are served by this system 180 or more days per year? 27703

30. PART-TIME RESIDENTIAL POPULATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many part-time residents are present each month?												
B. How many days per month are they present?												

31. TEMPORARY & TRANSIENT USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many total visitors, attendees, travelers, campers, patients or customers have access to the water system each month?	1794	1482	1638	1716	1716	1560	1560	1716	1560	1794	1482	1560
B. How many days per month is water accessible to the public?	23	19	21	22	22	20	20	22	20	23	19	20

32. REGULAR NON-RESIDENTIAL USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. If you have schools, daycares, or businesses connected to your water system, how many students, daycare children and/or employees are present each month that are NOT already included in the residential population?	4013	4013	4013	4013	4013	4013	2148	2148	4013	4013	4013	4013
B. How many days per month are they present?	20	20	22	21	22	21	21	23	20	23	19	20

33. ROUTINE COLIFORM SCHEDULE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	30	30	30	30	30	30	30	30	30	30	30	30

34. NITRATE SCHEDULE	QUARTERLY	ANNUALLY	ONCE EVERY 3 YEARS
(One Sample per source by time period)			

35. Reason for Submitting WFI:

☐ Update - Change ☐ Update - No Change ☐ Inactivate ☐ Re-Activate ☐ Name Change ☐ New System ☐ Other _____

36. I certify that the information stated on this WFI form is correct to the best of my knowledge.

SIGNATURE: _____ **DATE:** _____

PRINT NAME: _____ **TITLE:** _____

1550

Intentionally left blank

WS ID	WS Name
10800	CAMAS MUNICIPAL WATER SEWER SYSTEM

Total WFI Printed: 1

1553

Division of Environmental Public Health
Washington State Department of
HEALTH

Water Facilities Inventory (WFI)

Report Create Date:	3/6/2026		
Water System Id(s):	108002		
Print Data on Distribution Page:	ALL		
Print Copies For:	DOH Copy		
Water System Name:	ALL		
County:	-- Any --		
Region:	ALL		
Group:	ALL		
Type:	ALL		
Permit Renewal Quarter:	ALL		
Water System Is New:	ALL		
Water System Status:	ALL		
Water Status Date From:	ALL	**To**	ALL
Water System Update Date	ALL	**To**	ALL
Owner Number:	ALL		
SMA Number:	ALL		
SMA Name:	ALL		
Active Connection Count From:	ALL	**To:**	ALL
Approved Connection Count	ALL	**To:**	ALL
Full-Time Population From:	ALL	**To:**	ALL
Water System Expanding	ALL		
Source Type:	ALL		
Source Use:	ALL		
WFI Printed For:	On-Demand		

1554

APPENDIX S

WATER RIGHT DOCUMENTATION

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
WATER RIGHT CLAIMS REGISTRATION

WATER RIGHT CLAIM

RECEIVED
[illegible] ECOLOGY
JUL 17 1974 132-272
[illegible] NUMBER NONE

1. NAME CITY OF CAMAS, WASHINGTON

ADDRESS 616 N.E. 4th Avenue

Camas, Washington ZIP CODE 98607

2. SOURCE FROM WHICH THE RIGHT TO TAKE AND MAKE USE OF WATER IS CLAIMED: Ground (SURFACE OR GROUND WATER)

W.R.I.A. 28 (LEAVE BLANK)

A. IF GROUND WATER, THE SOURCE IS Deep Well No. 1

B. IF SURFACE WATER, THE SOURCE IS

3. THE QUANTITIES OF WATER AND TIMES OF USE CLAIMED:

A. QUANTITY OF WATER CLAIMED 900 gpm PRESENTLY USED 900 gpm (CUBIC FEET PER SECOND OR GALLONS PER MINUTE)

B. ANNUAL QUANTITY CLAIMED 320 PRESENTLY USED Average 300 (ACRE FEET PER YEAR)

C. IF FOR IRRIGATION, ACRES CLAIMED PRESENTLY IRRIGATED

D. TIME(S) DURING EACH YEAR WHEN WATER IS USED: All Year

4. DATE OF FIRST PUTTING WATER TO USE: MONTH Unknown YEAR Before 1942

5. LOCATION OF THE POINT(S) OF DIVERSION/WITHDRAWAL: 2159 FEET North AND 667 FEET East FROM THE Southwest CORNER OF SECTION 12

BEING WITHIN Southwest quarter OF SECTION 12 T. 1 N., R. 3 E (E. OR W.) W.M.

IF THIS IS WITHIN THE LIMITS OF A RECORDED PLATTED PROPERTY, LOT BLOCK OF

Within the City limits of the City of Camas
(GIVE NAME OF PLAT OR ADDITION)

6. LEGAL DESCRIPTION OF LANDS ON WHICH THE WATER IS USED: Municipal supply

Clark COUNTY Washington

7. PURPOSE(S) FOR WHICH WATER IS USED: Municipal - Domestic Supply

8. THE LEGAL DOCTRINE(S) UPON WHICH THE RIGHT OF CLAIM IS BASED:

DO NOT USE THIS SPACE

THE FILING OF A STATEMENT OF CLAIM DOES NOT CONSTITUTE AN ADJUDICATION OF ANY CLAIM TO THE RIGHT TO USE OF WATERS AS BETWEEN THE WATER USE CLAIMANT AND THE STATE OR AS BETWEEN ONE OR MORE WATER USE CLAIMANTS AND ANOTHER OR OTHERS. THIS ACKNOWLEDGEMENT CONSTITUTES RECEIPT FOR THE FILING FEE.

DATE RETURNED THIS HAS BEEN ASSIGNED WATER RIGHT CLAIM REGISTRY NO.

FEB 7 1975 21022

DIRECTOR - DEPARTMENT OF ECOLOGY

I HEREBY SWEAR THAT THE ABOVE INFORMATION IS TRUE AND ACCURATE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

X CITY OF CAMAS, WASHINGTON

DATE June 11, 1974

IF CLAIM FILED BY DESIGNATED REPRESENTATIVE, PRINT OR TYPE FULL NAME AND MAILING ADDRESS OF AGENT BELOW.

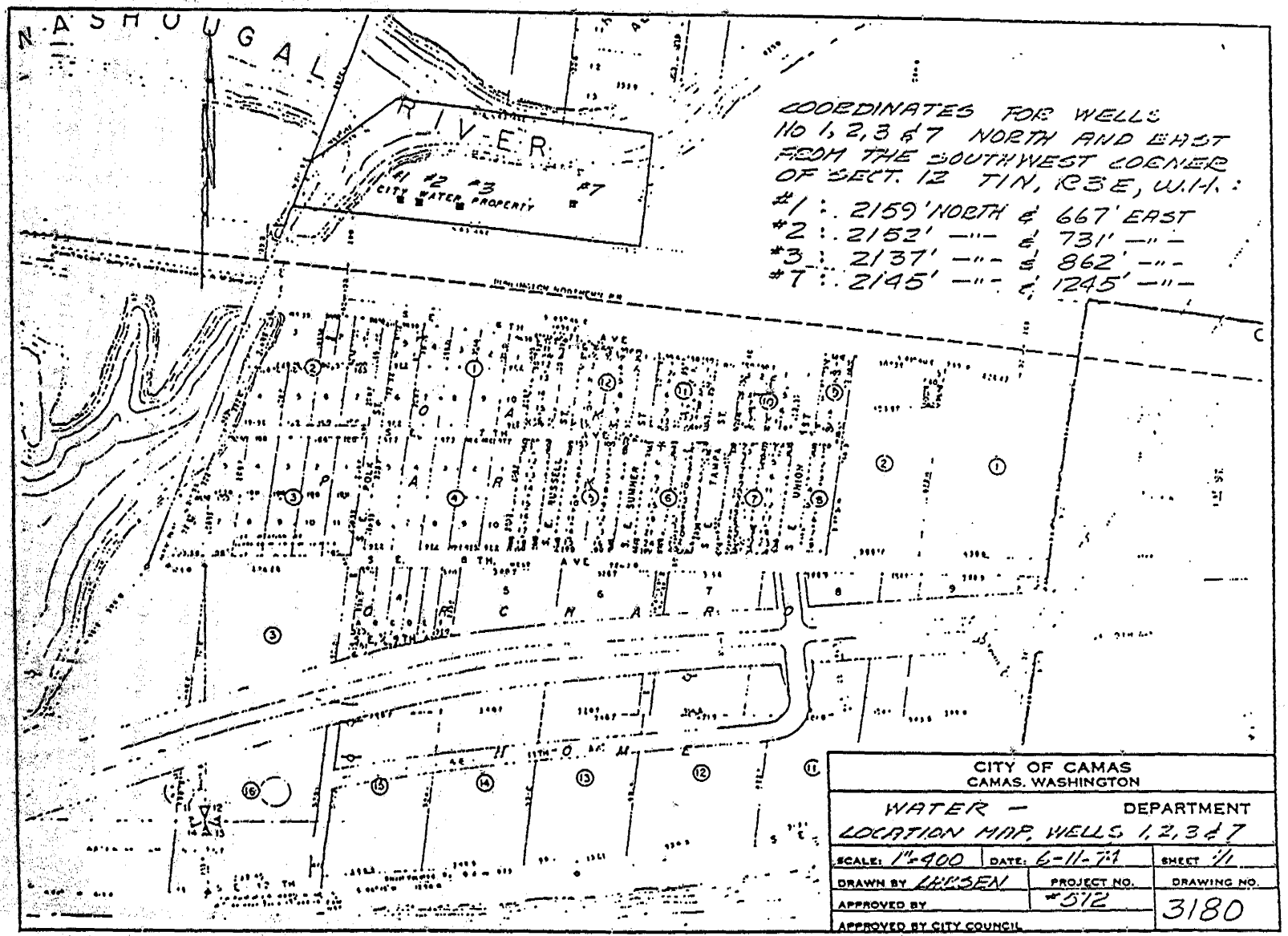
BY: Lewis Angelo
Lewis Angelo, Director of Public Works

☐ ADDITIONAL INFORMATION RELATING TO WATER QUALITY AND/OR WELL CONSTRUCTION IS AVAILABLE.

A FEE OF $2.00 MUST ACCOMPANY THIS WATER RIGHT CLAIM

ORIGINAL DWR

RETURN ALL THREE COPIES WITH CARBONS INTACT, ALONG WITH YOUR FEE TO:
DEPARTMENT OF ECOLOGY
WATER RIGHT CLAIMS REGISTRATION
P.O. BOX 829 OLYMPIA, WASHINGTON 98504


N. A S H O U G A L
R I V E R
#1 #2 #3 #7
CITY WATER PROPERTY
COORDINATES FOR WELLS
#1, 2, 3 & 7 NORTH AND EAST
FROM THE SOUTHWEST CORNER
OF SECT. 12 T1N, R3E, W.M.:
#1 : 2159' NORTH & 667' EAST
#2 : 2152' —"— & 731' —"—
#3 : 2137' —"— & 862' —"—
#7 : 2145' —"— & 1245' —"—
OAK AVE
C H A R
11TH-0 AVE
CITY OF CAMAS
CAMAS, WASHINGTON
WATER — DEPARTMENT
LOCATION MAP, WELLS 1, 2, 3 & 7
SCALE: 1"=400
DATE: 6-11-71
SHEET #1
DRAWN BY LARSEN
PROJECT NO. #512
DRAWING NO. 3180
APPROVED BY
APPROVED BY CITY COUNCIL

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
WATER RIGHT CLAIMS REGISTRATION

WATER RIGHT CLAIM

RECEIVED
STATE DEPARTMENT OF ECOLOGY
JUN 21 1974 132273
CASH ___ CHECK ___ MONEY ORDER ___

1. NAME CITY OF CAMAS, WASHINGTON

ADDRESS 616 N.E. 4th Avenue

Camas, Washington ZIP CODE 98607

2. SOURCE FROM WHICH THE RIGHT TO TAKE AND MAKE USE OF WATER IS CLAIMED: Ground (SURFACE OR GROUND WATER)

W.R.I.A. 28 (LEAVE BLANK)

A. IF GROUND WATER, THE SOURCE IS Deep Well No. 2

B. IF SURFACE WATER, THE SOURCE IS

3. THE QUANTITIES OF WATER AND TIMES OF USE CLAIMED:

A. QUANTITY OF WATER CLAIMED 900 gpm PRESENTLY USED 900 gpm
(CUBIC FEET PER SECOND OR GALLONS PER MINUTE)

B. ANNUAL QUANTITY CLAIMED 230 PRESENTLY USED 200
(ACRE FEET PER YEAR)

C. IF FOR IRRIGATION, ACRES CLAIMED PRESENTLY IRRIGATED

D. TIME(S) DURING EACH YEAR WHEN WATER IS USED: The months of May through August

4. DATE OF FIRST PUTTING WATER TO USE: MONTH Unknown YEAR Before 1945

5. LOCATION OF THE POINT(S) OF DIVERSION/WITHDRAWAL: 2152 FEET North AND 731 FEET East FROM THE Southwest CORNER OF SECTION 12

BEING WITHIN Southwest quarter OF SECTION 12 T. 1 N., R. 3 E (E.OR W.) W.M.

IF THIS IS WITHIN THE LIMITS OF A RECORDED PLATTED PROPERTY, LOT ___ BLOCK ___ OF Within the City limits of the City of Camas
(GIVE NAME OF PLAT OR ADDITION)

6. LEGAL DESCRIPTION OF LANDS ON WHICH THE WATER IS USED: Municipal supply

Clark COUNTY Washington

7. PURPOSE(S) FOR WHICH WATER IS USED: Municipal - Domestic Supply

8. THE LEGAL DOCTRINE(S) UPON WHICH THE RIGHT OF CLAIM IS BASED:

DO NOT USE THIS SPACE
THE FILING OF A STATEMENT OF CLAIM DOES NOT CONSTITUTE AN ADJUDICATION OF ANY CLAIM TO THE RIGHT TO USE OF WATERS AS BETWEEN THE WATER USE CLAIMANT AND THE STATE OR AS BETWEEN ONE OR MORE WATER USE CLAIMANTS AND ANOTHER OR OTHER PERSONS. NOR DOES IT CONSTITUTE PROOF OF THE EXTENT OF THE RIGHT CLAIMED.
DATE RETURNED: THIS HAS BEEN AMENDED BY
WATER RIGHT CLAIM REGISTRY NO.
RECEIVED JUN 24 10 28
DIRECTOR, DEPARTMENT OF ECOLOGY

I HEREBY SWEAR THAT THE ABOVE INFORMATION IS TRUE AND ACCURATE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

X CITY OF CAMAS, WASHINGTON

DATE June 11, 1974

IF CLAIM FILED BY DESIGNATED REPRESENTATIVE, PRINT OR TYPE FULL NAME AND MAILING ADDRESS OF AGENT BELOW.

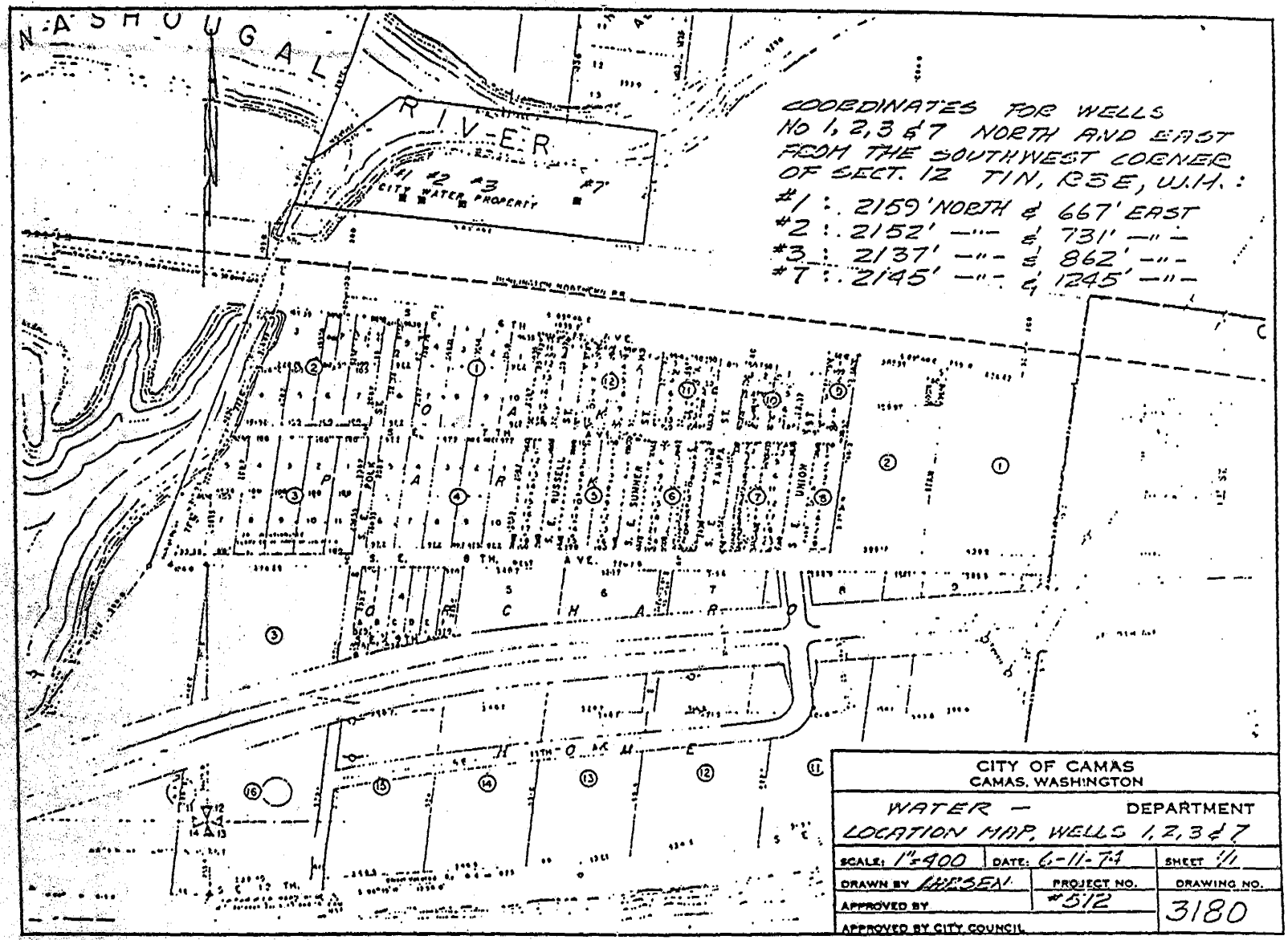
BY: Lewis Angelo
Lewis Angelo, Director of Public Works

☐ ADDITIONAL INFORMATION RELATING TO WATER QUALITY AND/OR WELL CONSTRUCTION IS AVAILABLE.

A FEE OF $7.00 MUST ACCOMPANY THIS WATER RIGHT CLAIM

ORIGINAL DWR

RETURN ALL THREE COPIES WITH CARBONS INTACT, ALONG WITH YOUR FEE TO:
DEPARTMENT OF ECOLOGY
WATER RIGHT CLAIMS REGISTRATION
P.O. BOX 829 OLYMPIA, WASHINGTON 98504


N A S H O U G A L
R I V E R
#1 #2 #3 #7
CITY WATER PROPERTY
COORDINATES FOR WELLS
No 1, 2, 3 & 7 NORTH AND EAST
FROM THE SOUTHWEST CORNER
OF SECT. 12 T1N, R3E, W.M.:
#1 : 2159' NORTH & 667' EAST
#2 : 2152' —"— & 731' —"—
#3 : 2137' —"— & 862' —"—
#7 : 2145' —"— & 1245' —"—
CITY OF CAMAS
CAMAS, WASHINGTON
WATER — DEPARTMENT
LOCATION MAP, WELLS 1, 2, 3 & 7
SCALE: 1"=400
DATE: 6-11-74
SHEET 1/1
DRAWN BY
PROJECT NO. #512
DRAWING NO. 3180
APPROVED BY
APPROVED BY CITY COUNCIL

F No. 369—1923. Approved as to Form by Dept. of Efficiency. 8509.

CERTIFICATE RECORD NO. 2, PAGE NO. 711

STATE OF WASHINGTON, COUNTY OF Clark

CERTIFICATE OF WATER RIGHT

(For rights perfected under original, enlargement or secondary permits.)

(In accordance with the provisions of Chapter 117, Laws of Washington for 1917, and the regulations of the State Hydraulic Engineer thereunder.)

This is to certify, that City of Camas, *of* Camas, *State of* Washington, *has made proof to the satisfaction of the State Supervisor of Hydraulics of Washington, of a right to the use of the waters of* Jones Creek, *a tributary of* Little Washougal River *for the purposes of* domestic supplies, *under* Appropriation *Permit No.* 1575, *of the State Supervisor of Hydraulics, and that said right to the use of said waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Hydraulics of Washington and entered of record in Volume* 2, *at Page* 711, *on the* 28th *day of* July, *19*33; *that the right hereby confirmed dates from* September 5th, *19*30; *that the amount of water to which such right is entitled and hereby confirmed, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed* 1.0 *cubic feet per second.*

A description of the lands under such right, and to which the water hereby confirmed is appurtenant, or if for other purposes, the place where such water is put to beneficial use, is as follows:

PLACE OF USE			LEGAL SUBDIVISION	[illegible]	[illegible]
Section	Township	Range			
			City of Camas		

The right to the use of the water aforesaid hereby confirmed is restricted to the lands or place of herein described, except as provided in Section 39, Chapter 117, Session Laws 1917.

WITNESS the seal and signature of the State Supervisor of Hydraulics affixed this 28th *day of* July, *19*33.

State Supervisor of Hydraulics.

ENGINEERING DATA

0.

NOTICE OF PETITION FOR CHANGE OF
POINT OF DIVERSION OF WATER.

TO WHOM IT MAY CONCERN:

Notice is hereby given that the City of Camas, Clark County, Washington, has filed a petition with the State Supervisor of Hydraulics, Olympia, Washington, for a permit to change the point of diversion of one cubic foot per second of the waters of Jones Creek from a point set out in water right permit 1575 as NW¼ of NW¼ of Sec. 10, Twp. 2 N., Rge. 4 E.W.M., to a point within the SW¼ of SW¼ of Sec. 3, Twp. 2 N., Rge. 4 E.W.M., such point being approximately one-half mile above the point of diversion described in permit, all in Clark County, Wash.

Any person, firm or corporation whose right will be injuriously affected by the granting of said petition may file with the Supervisor of Hydraulics, at Olympia, Washington, such objections or representations, in writing, as he may desire to make within thirty (30) days after the date of last publication, which date is _____.

Witness my hand and official seal this 24th day of April, 1933.

CHAS. J. BARTHOLET
State Supervisor of Hydraulics

PERMIT

This is to certify that I have examined the foregoing application and do hereby grant the same, subject to the following limitations and conditions. ~~If for irrigation, this appropriation shall be subject to such reasonable rotation system as may be ordered by the State Supervisor of Hydraulics.~~ And is further subject to rights of C. W. Cottrell under certificate #121, for the appropriation and use of waters of Little Washougal River of which Jones Creek is a tributary.

The amount of water appropriated shall be limited to the amount which can be applied to beneficial use and not to exceed 1.0 *cubic feet per second, or its equivalent in case of rotation. The priority date of this permit is* September 5th, 1930.

Actual construction work shall begin on or before December 1st, 1931 *and shall thereafter be prosecuted with reasonable diligence and be completed on or before* December 1st, 1932

Complete application of the water to the proposed use shall be made on or before December 1st, 1933.

Given under my hand and the seal of this office at Olympia, Washington, this 2nd *day of* December, 1930.

Chas. J. Bartholet
State Supervisor of Hydraulics.

Application No. 3[illegible]6
Permit No. 1575

PERMIT
To Appropriate Public Waters of the State of Washington

Filed by City of Camas
County of Clark

This instrument was first received in the office of the State Supervisor of Hydraulics, Olympia, Washington, on the 5th *day of* September, 1930, *at* 8:30 *o'clock* A. M.

Approved December 2nd, 1930

Recorded in Book No. 7 *of Permits, on Page* 1575

CHAS. J. BARTHOLET
State Supervisor of Hydraulics.

JAY CROWELL, PUBLIC PRINTER

Before your certificate of water right is issued it will be necessary for you to file with the State Supervisor of Hydraulics a copy of each of the following reports:

1st. Progress reports (in case temporary permit is issued).
2nd. Affidavit of publication of notice of water right application.
3rd. Notice of beginning of construction.
4th. Notice of prosecution of work with diligence.
5th. Notice of completion of construction.
6th. Notice of application of water to a beneficial use.
7th. Proof of appropriation of water.

Upon a satisfactory showing that the appropriation has been perfected as provided by statute the State Supervisor of Hydraulics will issue a water right certificate.

[illegible]ks will be furnished by the office of State Supervisor of Hydraulics.

APPLICATION NO. 5126

CITY OF CAMAS

Examination made November 3rd & 4th, 1930

This application is for 1.0 c.f.s. for domestic use from Jones Creek a tributary of Washougal River.

November 3rd I talked to Mr. R. C. Sugg, Attorney for Mr. C. W. Cottrell who is making protest against the issuance of permit on this application. He stated he questioned the City of Camas right to Jones Creek but suggested I go over the ground with Mr. Cottrell.

November 4th I went over the ground with Mr. W. H. Barber, City Clerk and Superintendent of Water for City of Camas, also, in reference to application No. 924. Mr. Barber stated that a survey was made in 1925 and this system installed same year from the Little Washougal consisting of two reservoirs on hill above Camas and approximately 11 miles of pipe line. The main from reservoirs to "Y" is of 10 inch steel pipe the portion from "Y" to diversion of Little Washougal is of 8 inch steel pipe. The "Y" was installed for the purpose of diverting a portion of Jones Creek when the city needed the additional water.

There is approximately 6.0 c.f.s. in Jones Creek today.

I then went with Mr. Cottrell over the ground on Washougal River. There is approximately 15.0 c.f.s. in the Little Washougal at the mouth. Mr. Cottrell has a 75 K.W. plant on Washougal River about one-half mile below mouth of Little Washougal which is a part of supply. There is approximately 12.0 c.f.s. going over dam not utilized today.

Mr. Cottrell has another 2 unit hydro plant on Washougal River above mouth of Little Washougal which this application does not affect, it develops 362 K.W. He also has a 340 K.W. Diesel plant at Washougal.

Mr. Barber stated that the water supply from Little Washougal was so inadequate this summer that rigid restrictions were necessary and if they would of had fires the storage supply would have been exhausted.

Mr. Cottrell stated that shortage was experienced only at extreme low water.

The City of Camas has no other means of water supply. A permit should be issued the applicant for 1.0 c.f.s. subject to existing rights.

A. E. Hanson

Signed this 15 day of Nov. 1930.

OK. for Permit and to Permit 465

Form No. 349—1933. Approved as to Form by Dept. of Efficiency. 8189.

CERTIFICATE RECORD NO. 2, PAGE NO. 712

STATE OF WASHINGTON, COUNTY OF Clark

CERTIFICATE OF WATER RIGHT

(For rights perfected under original, enlargement or secondary permits.)

(In accordance with the provisions of Chapter 117, Laws of Washington for 1917, and the regulations of the State Hydraulic Engineer thereunder.)

This is to certify, that City of Camas, *of* Camas, *State of* Washington, *has made proof to the satisfaction of the State Supervisor of Hydraulics of Washington, of a right to the use of the waters of* Little Washougal River, *a tributary of* Washougal River, *for the purposes of* municipal supply, *under* Appropriation Permit No. 1576, *of the State Supervisor of Hydraulics, and that said right to the use of said waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Hydraulics of Washington and entered of record in Volume* 2, *at Page* 712, *on the* 28th *day of* July, 1933; *that the right hereby confirmed dates from* August 22nd, 19 23; *that the amount of water to which such right is entitled and hereby confirmed, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed* 2.5 *cubic feet per second.*

A description of the lands under such right, and to which the water hereby confirmed is appurtenant, or if for other purposes, the place where such water is put to beneficial use, is as follows:

PLACE OF USE			LEGAL SUBDIVISION		
Section	Township	Range			
			City of Camas		

The right to the use of the water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Section 39, Chapter 117, Session Laws 1917.

WITNESS the seal and signature of the State Supervisor of Hydraulics affixed this 28th *day of* July, 19 33.

Chas. Danckaert

State Supervisor of Hydraulics.

Examined by

PERMIT

STATE OF WASHINGTON,
COUNTY OF THURSTON. } ss.

This is to certify that I have examined the foregoing application and do hereby grant the same, subject to the following limitations and conditions. ~~Before making use of this appropriation it shall be subject to such reasonable regulation as may be made and ordered by the State Hydraulic Engineer~~ And is further subject to rights of C. W. Cottrell under certificate #121, for the appropriation and use of waters of Little Washougal River of which Jones Creek is a tributary.

The amount of water appropriated shall be limited to the amount which can be applied to beneficial use and not to exceed 2½ *cubic feet per second, or its equivalent in case of rotation.*

The priority date of this permit is August 22nd, 1923

Actual construction work shall begin on or before December 1st, 1931 *and shall thereafter be prosecuted with reasonable diligence and be completed on or before* December 1st, 1932

Complete application of the water to the proposed use shall be made on or before December 1st, 1933

WITNESS my hand this 2nd *day of* December, *19*30.

Chas. J. Barkhouse
State Hydraulic Engineer.

This form approved by the State Hydraulic Engineer, 1917.

Application No. 924
Permit No. 1575

PERMIT
To Appropriate the Public Waters of the State of Washington

Issued to City of Camas

County of Clark

This instrument was first received in the office of the State Hydraulic Engineer, Olympia, Washington, on the 22nd *day of* August, *19*23, *at* 1:45 *o'clock* P. M.

Returned to applicant for correction

Corrected Application received .....

Approved December 2nd, 1930

Recorded in Book No. 7 *of Permits, on Page* 1576

CHAS. J. BARKHOUSE
State Hydraulic Engineer,

FRANK M. LAMBORN, PUBLIC PRINTER, OLYMPIA

Before your certificate of water right is issued it will be necessary for you to fill out and file with the State Hydraulic Engineer a copy of each of the following reports:

1st. Progress report.
2nd. Notice of water right application.
3rd. Notice to begin construction.
4th. Notice of prosecution of work with diligence.
5th. Notice of completion of construction.
6th. Notice of application of water to a beneficial use.
7th. Proof of appropriation of water.

Upon a satisfactory showing that the appropriation has been perfected as provided by statute the State Hydraulic Engineer will issue a water right certificate.

(Blanks will be furnished by the office of State Hydraulic Engineer.)

APPLICATION NO. 924

CITY OF CAMAS

Examination made November 4, 1950

This application is for 2.5 c.f.s. from Little Washougal a tributary to Washougal River for domestic and municipal supply.

Mr. Sugg stated he did not question in his mind the legal right of this application.

I went over the ground with Mr. W. H. Barber, City Clerk and Superintendent of City Water and found the following:

This system was installed in 1925 after a survey had been made, a part of which included a survey for pipe line extended to Jones Creek. The main is of 10" steel pipe from the two reservoirs on a hill about a mile above town of Camas a distance of about 9 miles to a "Y" then approximately 2 miles of 8" pipe to point of diversion. There is approximately 2.5 c.f.s. now running in pipe line and approximately 1.5 c.f.s. going past intake.

Mr. Barber stated that they were taking all of the water up to the recent rains about a week ago and was not filling the pipe and the City of Camas was under a dangerous water shortage.

This application is in reference to application No. 5126.

A. G. Stevens

Signed this 15 day of Nov. 1950.

V.K.
Subject to prior Permit #465

WELL No3

CERTIFICATE RECORD No. 1 PAGE No. 85-A

STATE OF WASHINGTON, COUNTY OF Clark

Certificate of Ground Water Right

Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and the rules and regulations of the State Supervisor of Hydraulics thereunder.

THIS IS TO CERTIFY That THE CITY OF CAMAS

of Camas, Washington, has made proof to the satisfaction of the State Supervisor of Hydraulics of Washington, of a right to the use of the ground waters of a Well

located within the NW¼ of SW¼ of Sec. 12 Twp. 1 N. Rge. 3 E.W.M.

for the purpose of Municipal Supply

under Ground Water Permit No. 2 issued by the State Supervisor of Hydraulics, and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Hydraulics of Washington and entered of record in Volume 1 at page 85-A ; that the quantity of ground water to which such right is entitled and hereby confirmed for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 1200 gallons per minute; 118 acre-feet per year; That the right hereby confirmed dates from July 21, 1945.

~~for irrigation of xxxxxxxxxxxxxx acres.~~

A description of the lands under such right to which the ground water hereby confirmed is appurtenant, and the place where such water is put to beneficial use, is as follows:

City of Camas, Clark County, Washington.

The right to the use of the ground water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Hydraulics affixed this 13th day of November, 19 47

State Supervisor of Hydraulics.

S. F. No. 7334—6-45—3C. 9235.

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION AND DEVELOPMENT
DIVISION OF HYDRAULICS

Permit to Appropriate Public Ground Waters of the State of Washington

Book No. 1 of Ground Water Permits, on page 2 under Application No. 4

The City of Camas

of City Hall, Camas, Washington

is hereby granted a permit to appropriate the following described public ground waters of the State of Washington, subject to existing rights, and to the limitations and provisions set out herein.

Priority date of this permit is July 21, 1945

Source of the proposed ground water appropriation is a well

within area, sub-area

zone. Name or number of works is

Quantity of water appropriated shall be limited to the amount which can be beneficially applied and not to exceed 1200 gallons per minute; 118 acre-feet per year, to be used for the following purposes: Municipal supply

as more definitely set out below.

Location of the well, tunnel, or infiltration trench is North 7°31' East 480 feet and South 83°46' East 112 feet from the Northwest corner of Block 1 of Oak Park Addition to the City of Camas, being within NW¼ of SW¼ of Sec. 12, Twp. 1 N., Rge. 3 E.W.M.,

county of Clark

Use, or uses to which water is to be applied:

For municipal supply: 1200 gallons per minute; acre-feet per year, to supply The City of Camas

For irrigation: gallons per minute; acre-feet per year, for the irrigation of acres.

For miscellaneous uses: gallons per minute; acre-feet per year, for

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

City of Camas, Clark County, Washington

DESCRIPTION OF WORKS FROM WHICH WATER IS TO BE WITHDRAWN

The well will be Drilled (Dug or drilled) and have a diameter of 14 inches, and depth of 95 feet.

Description of tunnel or infiltration trench:

(Please read carefully provisions below)

Particular specifications required by the Supervisor of Hydraulics for the purpose of preventing waste of public waters:

Construction work shall begin on or before July 1, 1946 and shall thereafter be prosecuted with reasonable diligence and completed on or before October 1, 1946 and complete application of water to proposed use shall be made on or before October 1, 1947

Given under my hand and the seal of this office at Olympia, Washington, this 20th day of September 1945

CLARENCE B. SHAIN
State Supervisor of Hydraulics

By: Chas J. Northwest
Deputy.

GROUND WATER

APPLICATION NO. 4

... City of Camas.

The application of the City of Camas for the appropriation of 1200 gallons per minute from ground water through a well, which will be designated Well No. 3, was approved for a permit on September 6.

On September 21 the undersigned visited the locality, accompanied by Mr. Arthur K. Piper, Ground Water Geologist.

The City has a gravity water supply and an additional water supply from two wells. The supply from both of which sources does not furnish sufficient water for the town during the dry months. It was therefore found by the City officials that additional water had to be obtained in order to meet its requirements. For that reason they planned a third well to augment the water supply during critical periods.

Judging from the wells now in use, the amount of water applied for will be available and will be put to an important beneficial use.

Permit has been approved.

Signed this 25th day of September, 1945.

CHAS. J. BARTHOLET
Consulting Engineer

CERTIFICATE RECORD NO. 9 PAGE NO. 4072-A

STATE OF WASHINGTON, COUNTY OF Clark

Certificate of Ground Water Right

Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the State Supervisor of Water Resources thereunder.

THIS IS TO CERTIFY That CITY OF CAMAS, WASHINGTON

of _____, has made proof to the satisfaction of the State Supervisor of Water Resources of Washington, of a right to the use of the ground waters of a well located within NW¼ NW¼ Sec. 12, Twp. 1 N., R. 3 E. W.M., for the purpose of municipal supply under and subject to provisions contained in Ground Water Permit No. 4804 issued by the State Supervisor of Water Resources and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Water Resources of Washington and entered of record in Volume 9 at page 4072-A, that the right hereby confirmed dates from February 12, 1959; that the quantity of ground water under the right hereby confirmed for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 1325 gallons per minute; 1208 acre-feet per year for municipal supply.

Special provisions required by the Supervisor of Water Resources: _____

A description of the lands to which such ground water right is appurtenant:

City of Camas, Clark County, Washington.

The right to the use of the ground water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Water Resources affixed this 24th day of November, 19 61.

M Grantham

S. F. No. 7336—12-58—20M. 58139.

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
DIVISION OF WATER RESOURCES

Permit to Appropriate Public Ground Waters of the State of Washington

Book No. 10 of Ground Water Permits, on page 4[illegible] under Application No. 5130

CITY OF CAMAS, WASHINGTON

or

is hereby granted a permit to appropriate the following described public ground waters of the State of Washington, subject to existing rights, and to the limitations and provisions set out herein.

Priority date of this permit is February 12, 1959

Source of the proposed ground water appropriation is a well

within _____ area, _____ sub-area

_____ zone. Name or number of works is _____

Quantity of water appropriated shall be limited to the amount which can be beneficially applied and not to exceed 1500 gallons per minute; 1206 acre-feet per year, to be used for the following purposes: municipal supply

as more definitely set out below.

Location of the well, tunnel, or infiltration trench is N.10°E. 150 feet from west quarter corner of sec.12

being within NW¼NW¼, sec.12, T.1 N., R.3 E.W.M.

county of Clark

Use, or uses to which water is to be applied:

For municipal supply: 1500 gallons per minute; 1206 acre-feet per year, to supply the City of Camas.

For irrigation: _____ gallons per minute; _____ acre-feet per year, for the irrigation of _____ acres.

For miscellaneous uses: _____ gallons per minute; _____ acre-feet per year for _____

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

City of Camas, Clark County, Washington.

DESCRIPTION OF WORKS FROM WHICH WATER IS TO BE WITHDRAWN

The well will be drilled and have a diameter of 16 inches and depth of 135 feet.
(dug or drilled)

Description of tunnel or infiltration trench:

(Please read carefully provisions below).

Particular specifications required by the Supervisor of Water Resources for the purpose of preventing waste of public waters:

Construction work shall begin on or before May 1, 1960

and shall thereafter be prosecuted with reasonable diligence and completed on or before November 1, 1960

and complete application of water to proposed use shall be made on or before November 1, 1961

Given under my hand and the seal of this office at Olympia, Washington, this 6th day of May, 1959.

M. B. Watkins

State Supervisor of Water Resources

S. F. No. 1108-4-57-500M-1

RETURN TO:
DIVISION OF WATER RESOURCES
335 GENERAL ADMINISTRATION BLDG
OLYMPIA

RECEIVED
DIVISION OF WATER RESOURCES
JUL 15 1959

RECORD BY WELL DRILLER OR OTHER CONSTRUCTOR OF WORKS FOR WITHDRAWAL OF GROUND WATER

Under Permit No. G. W. 4804

("The well driller or other constructor of works for the withdrawal of public ground waters shall be obligated to furnish the permittee a certified record of the factual information necessary to show compliance with the provisions of this section." Sec. 8, Chap. 263, Laws of 1945.)

1. City of Camas, Washington
(Name and address of owner of well or other works for withdrawal of water)

2. Type; name or number of works where water is taken Well
(Well, tunnel or infiltration trench)

3. Date on which work on well or other structure was started June 2, 1959

4. Date on which work was completed July 7, 1959

5. If work on well or other structure was abandoned, give date _____

and reason for abandonment _____

6. DESCRIPTION OF WORKS:

(a) WELL: Depth 112 ft. Diameter 16 in. or ft. Dug or drilled Drilled

Flowing or pump well _____ Water Temp. 46 degrees

IF PUMP WELL: Type and size of pump is Test pump: 1500 g.p.m. pump 11½" bowl
9" pump column

Type and size of motor or engine is Gulberson Diesel 210 h.p.

Depth from ground surface to water level before pumping 35 ft.

After continuous operation for 8 hours (At least four), the measured discharge of the pump is 1500 g.p.m., and the drawdown of water level is 24 ft. (Pumping level minus static water level)

Recovery data (taken after pump has been shut off) (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level
Immediate recovery.			

Date of test June 29, 1959

IF FLOWING WELL: Measured discharge _____ g.p.m. on _____ (Date)

Shut-in pressure at ground surface _____ lbs. per sq. in. on _____ (Date)

Water is controlled by _____ (Cap, valve, etc.)

CASING: (Give diameter, commercial specifications and depth below ground surface of each casing size.)

16 in. diameter _____ from 0 to 112 ft.

_____ in. diameter _____ from _____ to _____ ft.

_____ in. diameter _____ from _____ to _____ ft.

_____ in. diameter _____ from _____ to _____ ft.

Describe and show depth of shoe, plug, adapter, liner or other details:

Grout seal from 32-35.
Grout seal from 15-18

OK

Perforated casing or screens:

60 perf. per ft. each perf. 1&3/8 by 3/8" from 82 to 102 ft.
(Number per foot and dia. of perforations, or describe screen)

from ____ to ____ ft.

from ____ to ____ ft.

from ____ to ____ ft.

from ____ to ____ ft.

LOG OF WELL OR TUNNEL: (Describe each stratum or formation clearly, indicate if water bearing, and give thickness and depth as indicated.)

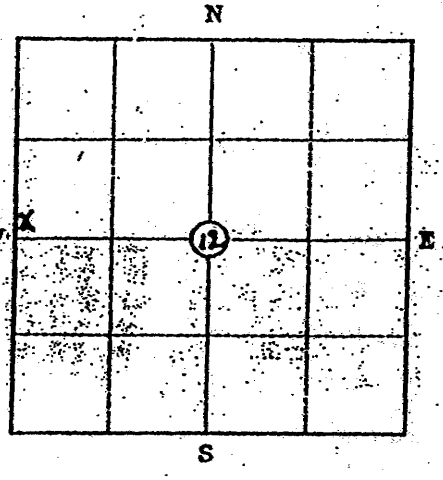
MATERIAL	Thickness (Feet)	Depth to bottom (Feet)
Top soil	3	3
Gravel and boulders	9	12
Gravel, some binder	9	21
Gravel and boulders	11	32
Cemented gravel	21	53
Loose sand and gravel, some silt	22	75
Loose sand and gravel, water-bearing	24	99
Large gravel and sand	11	110
Clay and gravel	2	112

(b) INFILTRATION TRENCH OR TUNNEL: Type ____

Dimensions: ____
(Tunnel—length, course, and cross-sectional size) (Trench—minimum and maximum depths)

Bottom width ____ ft. Discharge ____ g.p.m. Date of test ____

Position of water bearing stratum with reference to portal of tunnel ____



Scale: 1" = 2000'

Sec. 12 Twp. 1N Rge. 3E

Show approximate location of well or other works with (X) on section plat at left.

W. A. Shaw
Signature of well driller or other constructor

8110 S.E. Sunset Lane, Portland, Ore.
Address

STATE PRINTING PLANT OLYMPIA, WASH., 1947

well #4

Item 2.

Report of Examination on Ground Water

Received date 2-5-59 Date of exam 2-12-59 Appl. No 5130

Name City of Camas Address Camas, Washington

Type of works well Dimensions 16"x125'

Progress of works not begun

Quantity applied for 1500 g.p.m. acre-feet per year

Legal sub. W½NW¼ Sec. 12 Twp. 1 N. Rge. 3 E. County Clark

Use municipal water supply

Irrigation-acreage: Present Planned Feasible

Municipal: Population 5391 as of 1959

Industrial

Time pump will be operated

Other water rights appurtenant to this land Cert's. 711, 712 & 85 A

Proximity to existing works, springs, wells, or streams approximately 300' to Washougal River; approx. 35' above river level

Area Sub-area Zone

RECOMMENDATIONS

Approved for 1500 g.p.m. 1208 acre-feet per year, subject to existing water rights. (1 acre-foot 325,850 gallons.)

The water requirement for municipl supply is calculated on a per capita consumption of 200 gallons a day or 0.224 acre-feet per year, a total of 1208 acre-feet per year for 5391 persons, less any quantity diverted to this use under existing water rights.

The installation of an access port to well as described in attached Ground Water Bulletin No. 1 is recommended.

Signed this 13th day of April, 1959.

DEE MOLENAAR, Geologist
Division of Water Resources

1576

S. F. No. 2361—(Rev. 10-69)—10-69—534 15000.

CERTIFICATE RECORD NO. 14, PAGE NO. 6636-A

STATE OF WASHINGTON, COUNTY OF Clark

CERTIFICATE OF GROUND WATER RIGHT

(Issued in accordance with the provisions of Chapter 263, Laws of Washington of 1945, and amendments thereto, and the rules and regulations of the Department of Water Resources thereunder.)

THIS IS TO CERTIFY That CITY OF CAMAS

of Camas, Washington, has made proof to the satisfaction of the Department of Water Resources of a right to the use of the public ground waters of the State of Washington from a well

located within Lot 9, Plat of Orchard Home within the City of Camas and road right of way abutting thereto to the east, of Sec. 12, Twp. 1 N., R. 3 E., W.M.,

for the purpose(s) of Municipal supply

under and specifically subject to provisions contained in Ground Water Permit No. 8627 issued by the Department of Water Resources and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the Department of Water Resources and entered of record in Volume 14 at page 6636-A; that the priority of the right hereby confirmed dates from March 22, 1968; that the quantity of ground water under the right hereby confirmed for the aforesaid purposes, is limited to an amount actually beneficially used for said purposes, and shall not exceed 600 gallons per minute, 920 acre-feet per year for municipal supply continuously during entire year to supply an estimated population of 8550 by 1970.

16636-A

A description of the lands to which such ground water right is appurtenant is as follows:

City of Camas

The right to use of water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in RCW 90.03.380, 90.03.390 and 90.44.020.

This certificate of ground water right is specifically subject to relinquishment for nonuse of water as provided in RCW 90.14.180.

WITNESS the seal and signature of the Assistant Director, Division of Water Management, Department of Water Resources, affixed this 17th day of November, 19 69

Glen L. Liddell

Assistant Director
Division of Water Management
Department of Water Resources

Engineering Data

S. F. No. 7234—OS—4-67.

STATE OF WASHINGTON
DEPARTMENT OF WATER RESOURCES
DIVISION OF WATER MANAGEMENT

Permit to Appropriate Public Ground Waters of the State of Washington

Book No. 18 of Ground Water Permits, on page 8627 under Application No. 9326

CITY OF CAMAS

of Camas, Washington

is hereby granted a permit to appropriate the following described public ground waters of the State of Washington, subject to existing rights, and to the limitations and provisions set out herein.

Priority date of this permit is March 22, 1968

Source of the proposed ground water appropriation is a well

within _____ area, _____ sub-area

_____ zone. Name or number of works is _____

Quantity of water appropriated shall be limited to the amount which can be beneficially applied and not to exceed 700 gallons per minute; 1120 acre-feet per year, to be used for the following purposes: municipal supply

as more definitely set out below.

Location of the well, tunnel, or infiltration trench is 2760 feet east and 840 feet north of southwest corner of Sec. 12

being within Lot 9, Plat of Orchard Home within City of Camas and road right-of-way abutting thereto to the east, of Sec. 12, T. 1 N., R. 3 E.W.M.

county of Clark

Use, or uses to which water is to be applied:

For municipal supply: 700 gallons per minute; 1120 acre-feet per year,

to supply municipal supply for estimated population of 8500 by 1970

For irrigation: _____ gallons per minute; _____ acre-feet per year,

for the irrigation of _____ acres.

For miscellaneous uses: _____ gallons per minute; _____ acre-feet per year,

for _____

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

City of Camas

1578

DESCRIPTION OF WORKS FROM WHICH WATER IS TO BE WITHDRAWN

The well will be drilled (Dug or drilled) and have a diameter of 8 inches, and depth of 70 feet.

Description of tunnel or infiltration trench:

Please read carefully provisions below)

Particular specifications required by the Department of Water Resources for the purpose of preventing waste of public waters:

Issued as a supplementary supply to Surface Water Certificates 711 and 712, Ground Water Certificates 85-A and 4072-A and concurrent Ground Water Application 9325, for 700 gallons per minute and ~~1120~~ 2240 acre-feet per year; the total quantity withdrawn or diverted from all sources is not to exceed 3300 acre-feet per year.

Construction work shall begin on or before Started

and shall thereafter be prosecuted with reasonable diligence and completed on or before September 1, 1969

and complete application of water to proposed use shall be made on or before September 1, 1970

Given under my hand and the seal of this office at Olympia, Washington, this 21st day of August, 19 68.

Glen H. Faddis

Assistant Director
Division of Water Management
Department of Water Resources

File Original and First Copy with the Division of Water Resources
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. 9326
Permit No. 8627

(1) OWNER: Name City of Camas Address 616 N.E. 4th Avenue

(2) LOCATION OF WELL: County Clark - Lot 9, Plat of Orchard 54 ¼ SE ¼ Sec. 12 T. 1 N. R. 3E W.M.
Bearing and distance from section or subdivision corner: Home within City of Camas& road right of way abutting thereto the East of Sec. 12 TIN R3 East of WM

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 5
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 71 ft. Depth of completed well 71 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 8" Diam. from ft. to ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☒ No ☐
Type of perforator used
SIZE of perforations 3/8" in. by 1-1/4" in.
408 perforations from 44'6" ft. to 65 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☐ No ☐ To what depth? 22 ft.
Material used in seal Concrete grout
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off gravity

(7) PUMP: Manufacturer's Name Johnson
Type: V.H.S. Turbine H.P. 75

(8) WATER LEVELS: Land-surface elevation above mean sea level 36 ft.
Static level 36 ft. below top of well Date 7-25-68
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? O.J. Norris
Yield: 450 gal./min. with 1 ft. drawdown after 8 hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test 3-16-68
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 53° Was a chemical analysis made? Yes ☒ No ☐

See attached copy

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7154—(Rev. 2-66)—3-66—5M—WR/6

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Surface dirt with small boulder	0	3
Gravel & Bouxlers, very little binder	3	7
Gravel & boulders w/ clay binder	7	21
Large gravel & small boulders, loose	21	24
Med. size gravel, fairly loose	24	33
Med size gravel	33	35
Large to fine gravel, some red gravel	35	45
Started making water at 35 feet		
Med. to fine gravel, clean some red - very little sand	45	48
Some larger gravel	48	56
Med. to fine gravel, clean & loose	56	60
Med to fine gravel clean, loose	60	65
Med to fine gravel, clean, loose	65	67' 6"
Loose gravel formation	67'6"	68' 6"
Loose gravel formation	68'6"	69' 6"
Fine yellow sand	69'6"	71
Sealed bottom with concrete	71	

Work started Feb. 14 19 68 Completed Mar. 19 19 68

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME O.J. NORRIS - WATER WELL DRILLING
(Person, firm, or corporation) (Type or print)
Address 4411 N.E. 59th Avenue Vancouver, Washington

[Signed] O. J. Norris
(Well Driller)

License No. 223 02 4069 Date Sept. 9, 19 68

Report of Examination on Ground Water

Received date March 22, 1968 Date of exam May 28, 1968 Appl. No. 9326

Name City of Camas Address 616 N.E. 4th Ave., Camas, Wash. 98607

Type of works a well Dimensions 8" x 70'

Progress of works Started

Quantity applied for 700 g.p.m. acre-feet per year

Legal sub / Sec 12 Twp 1 N. Rge 3 E. County Clark

Lot 9, Plat of Orchard Home within City of Camas & road right of way abutting thereto to the east

Use Municipal supply

Irrigation-acreage: Present Planned Feasible

Municipal: Population 8500 as of 1970

Industrial

Time pump will be operated May 1st through September 30th

Other water rights appurtenant to this land SW Cert. 711 for 1.0 cfs from Jones Cr. for dom. supply; SW Cert. 712 for 2.5 cfs from Little Washougal R. for Munic. supply; GW Cert. 85-A for 1200 gpm, 118 ac-ft/yr for munic. supply; GW Cert. 4072-A for 1325 gpm; 1208 ac-ft/yr for mun. sup.; and concurrent GW App. 9325 for 1500 gpm for mun. supply.

Proximity to existing works, springs, wells, or streams / City of Washougal, northeasterly 1200 feet

Area Sub-area Zone

RECOMMENDATIONS

Approved for 700 g.p.m. 1120 acre-feet per year, subject to existing water rights. (1 acre-foot 325,850 gallons.)

It is noted that the well site and water transmission facilities therefrom are not located upon the land owned by the applicant. Applicant is, accordingly, advised that the issuance of permit by this department for appropriation of the waters in question does not convey a right of access to, or other right to use, land which the applicant does not legally possess. Obtainment of such right is a private matter between applicant and owner of that land.

Use of the waters to be appropriated under this application will be for a public water supply. State Board of Health rules require every owner of a public water supply to obtain written approval from the State Director of Health prior to any new construction or alterations of a public water supply. The applicant is advised to contact the Washington State Department of Health, 304 Public Health Building, Olympia, with regard to the need for compliance.

The following water rights are appurtenant to this land:

Certificate Number	c.f.s./g.p.m.
Surface Water Cert. 711	1.0 c.f.s.
Surface Water Cert. 712	2.5 c.f.s.
Ground Water Cert. 85-A	1200 g.p.m.
Ground Water Cert. 4072-A	1325 g.p.m.
Concurrent Ground Water Appli. 9325	1500 g.p.m.

(over)

The total requirement based on an engineering study is 345 gallons per capita per day for all purposes for an estimated population of 8500 by 1970, or approximately 3300 acre-feet per year.

The quantity recommended under this application is 700 gallons per minute pumping continuously, or 1120 acre-feet per year.

The permit when issued will carry the following provision: "Issued as a supplementary supply to Surface Water Certificates 711 and 712, Ground Water Certificates 85-A and 4072-A and concurrent Ground Water Application 9225, for 700 gallons per minute and 1120 acre-feet per year, the total quantity withdrawn or diverted from all sources is not to exceed 3300 acre-feet per year."

Signed at Olympia, Washington
this 5 day of June, 1968

B. A. CAMERON, Engineer
Division of Water Management

S. F. No. 7341—(Rev. 10-801—10-60—33M 12000.

CERTIFICATE RECORD NO. 14, PAGE NO. 6435-A

STATE OF WASHINGTON, COUNTY OF Clark

CERTIFICATE OF GROUND WATER RIGHT

(Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Water Resources thereunder.)

THIS IS TO CERTIFY That CITY OF CAMAS

of Camas, Washington, has made proof to the satisfaction of the Department of Water Resources of a right to the use of the public ground waters of the State of Washington from a well

located within David C. Parker D.L.C. No. 48

Sec. 12, Twp. 1 N., R. 3 E. W.M.,

for the purpose(s) of Municipal supply

under and specifically subject to provisions contained in Ground Water Permit No. 8344

issued by the Department of Water Resources and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the Department of Water Resources and entered of record in Volume 14 at page ~~6435-A~~ 6635-A; that the priority of the right hereby confirmed dates from March 22, 1968; that the quantity of ground water under the right hereby confirmed for the aforesaid purposes, is limited to an amount actually beneficially used for said purposes, and shall not exceed 1500 gallons per minute, 2400 acre-feet per year for municipal supply to supply a population of 8500 by 1970 continuously during entire year.

A description of the lands to which such ground water right is appurtenant is as follows:

City of Camas

The right to use of water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in RCW 90.03.380, 90.03.390 and 90.44.020.

This certificate of ground water right is specifically subject to relinquishment for nonuse of water as provided in RCW 90.14.180.

WITNESS the seal and signature of the Assistant Director, Division of Water Management, Department of Water Resources, affixed this 17th day of November, 19 69

C-37

Glen H. Lidke

STATE OF WASHINGTON
DEPARTMENT OF WATER RESOURCES
DIVISION OF WATER MANAGEMENT

Permit to Appropriate Public Ground Waters of the State of Washington

Book No. 18 of Ground Water Permits, on page 8544 under Application No. [illegible]

CITY OF CAMAS

of Camas, Washington

is hereby granted a permit to appropriate the following described public ground waters of the State of Washington, subject to existing rights, and to the limitations and provisions set out herein.

Priority date of this permit is March 22, 1968

Source of the proposed ground water appropriation is a well

within _____ area, _____ sub-area

_____ zone. Name or number of works is _____

Quantity of water appropriated shall be limited to the amount which can be beneficially applied and not to exceed 1500 gallons per minute; 2400 acre-feet per year, to be used for the following purposes: municipal supply

as more definitely set out below.

Location of the well, tunnel, or infiltration trench is 2300 feet east and 1800 feet north of southwest corner of Sec. 12

being within David C. Parker D.L.C. No. 48 of Sec. 12, T. 1 N., R. 3 E.W.M.

county of Clark

Use, or uses to which water is to be applied:

For municipal supply: 1500 gallons per minute; 2400 acre-feet per year, to supply a population of 8500 by 1970 continuously during entire year.

For irrigation: _____ gallons per minute; _____ acre-feet per year, for the irrigation of _____ acres.

For miscellaneous uses: _____ gallons per minute: _____ acre-feet per year, for _____

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

City of Camas

DESCRIPTION OF WORKS FROM WHICH WATER IS TO BE WITHDRAWN

The well will be drilled (Dug or drilled) and have a diameter of 16 inches, and depth of 85 feet.

Description of tunnel or infiltration trench:

Please read carefully provisions below)

Particular specifications required by the Department of Water Resources for the purpose of preventing waste of public waters: 1) The installation of an access port as described in attached Ground Water Bulletin No. 1 shall be required prior to issuance of final Certificate of Water Right. 2) Issued as a supplementary supply to Surface Water Certificates 711 and 712, Ground Water Certificates 85-A and 4072-A and concurrent Ground Water Application 9126, for 1500 gallons per minute and 2400 acre-feet per year; the total quantity withdrawn or diverted from all sources is not to exceed 3300 acre-feet per year.

(Gallons per min.) 2400

Construction work shall begin on or before July 1, 1969

and shall thereafter be prosecuted with reasonable diligence and completed on or before July 1, 1970

and complete application of water to proposed use shall be made on or before July 1, 1971

Given under my hand and the seal of this office at Olympia, Washington, this 20th day of June, 1968

Glen H. Fuller

Assistant Director
Division of Water Management
Department of Water Resources

WELL #6

Report of Examination on Ground Water

Received date March 22, 1968 Date of exam. May 28, 1968 Appl. No. 9325

Name City of Camas Address 616 N.E. 4th Ave., Camas, Wash. 98607

Type of works a well Dimensions 16" x 85'

Progress of works Not started

Quantity applied for 1500 g.p.m. 2300 acre-feet per year

David C. Parker D.L.C. No. 48

Legal sub. / Sec. 12 Twp. 1 N. Rge. 3 E. County Clark

Use Municipal supply

Irrigation-acreage: Present Planned Feasible

Municipal: Population 8500 as of 1970

Industrial

Time pump will be operated Continuously

Other water rights appurtenant to this land SW Cert. 711 for 1.0 cfs from Jones Cr. for dom. supply; SW Cert. 712 for 2.5 cfs from Little Washougal R. for munic. supply; GW Cert. 85-A for 1200 gpm, 118 ac-ft/yr for munic. supply; GW Cert. 4072-A for 1325 g.p.m; 1208 ac-ft/yr for mun. sup.; and concurrent GW App. 9326 for mun. supply, 700 gpm.

Proximity to existing works, springs, wells, or streams City of Camas, west 1300 feet: City of Washougal, east 1300 feet

Area Sub-area Zone

RECOMMENDATIONS

Approved for 1500 g.p.m. 2400 acre-feet per year, subject to existing water rights. (1 acre-foot 325,850 gallons.)

It is noted that the well site and water transmission facilities therefrom are not located upon the land owned by the applicant. Applicant is, accordingly, advised that the issuance of permit by this department for appropriation of the waters in question does not convey a right of access to, or other right to use, land which the applicant does not legally possess. Obtainment of such right is a private matter between applicant and owner of that land.

Use of the waters to be appropriated under this application will be for a public water supply. State Board of Health rules require every owner of a public water supply to obtain written approval from the State Director of Health prior to any new construction or alterations of a public water supply. The applicant is advised to contact the Washington State Department of Health, 304 Public Health Building, Olympia, with regard to the need for compliance.

The installation of an access port as described in attached Ground Water Bulletin No. 1 shall be required prior to issuance of final Certificate of Water Right. The applicant may, for his own convenience, wish to install an air-line and gage in addition to the access port.

(over)

The following water rights are appurtenant to this land:

Certificate Number	c.f.s./g.p.m.
Surface Water Cert. 711	1.0 c.f.s.
Surface Water Cert. 712	2.5 c.f.s.
Ground Water Cert. 85-A	1200 g.p.m.
Ground Water Cert. 4072-A	1325 g.p.m.
Concurrent Ground Water Appli. 9326	700 g.p.m.

The total requirement based on an engineering study is 345 gallons per capita per day for all purposes for an estimated population of 8500 by 1970, or approximately 3300 acre-feet per year.

The quantity recommended under this application is 1500 gallons per minute pumping continuously, or 2400 acre-feet per year.

The permit when issued will carry the following provision: "Issued as a supplementary supply to Surface Water Certificates 711 and 712, Ground Water Certificates 85-A and 4072-A and concurrent Ground Water Application 9326, for 1500 gallons per minute and 2400 acre-feet per year; the total quantity withdrawn or diverted from all sources is not to exceed 3300 acre-feet per year."

Signed at Olympia, Washington
this 2 day of June, 1968

B. A. CAMERON, Engineer
Division of Water Management

File Original and First Copy with the Division of Water Resources
Second Copy -- Owner's Copy
Third Copy -- Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. 9325
Permit No. 8544

(1) OWNER: Name City of Camas Address 616 N.E. 4th Avenue

(2) LOCATION OF WELL: County Clark David C Parker D.L.C. #48 NE¼ SW¼ Sec. 12 T. 1 N. R. 3E W.M.
Bearing and distance from section or subdivision corner.

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 6
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 16 inches.
Drilled 85 ft. Depth of completed well 85 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 16"OD Diam. from 0 ft. to 85 ft.
Threaded ☐ ____" Diam. from ____ ft. to ____ ft.
Welded ☒ ____" Diam. from ____ ft. to ____ ft.

Perforations: Yes ☒ No ☐
Type of perforator used Mill knife
SIZE of perforations 5/16 in. by 3-1/2 in.
____ perforations from ____ ft. to ____ ft.
552 perforations from 56 ft. to 80 ft.
____ perforations from ____ ft. to ____ ft.

Screens: Yes ☐ No ☒
Manufacturer's Name ____
Type ____ Model No. ____
Diam. ____ Slot size ____ from ____ ft. to ____ ft.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ____
Gravel placed from ____ ft. to ____ ft.

Surface seal: Yes ☒ No ☐ To what depth? 22 ft.
Material used in seal Concrete grout
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ____ Depth of strata 27
Method of sealing strata off ____

(7) PUMP: Manufacturer's Name ____
Type: ____ H.P. ____

(8) WATER LEVELS: Land-surface elevation above mean sea level 48 ft.
Static level 45 ft. below top of well Date 6-29-68
Artesian pressure ____ lbs. per square inch Date ____
Artesian water is controlled by ____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? City
Yield: 1600 gal./min. with 5 ft. drawdown after 12 hrs
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test June 29, 1968
Bailer test ____ gal./min. with ____ ft drawdown after ____ hrs.
Artesian flow ____ g.p.m. Date ____
Temperature of water 53° Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG:
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Surface Soil	0	2
Gravel & Small Boulders	2	6
Gravel & Boulders	6	10
Gravel & Small Boulders	10	14
Boulders	14	15
Pea Gravel	15	17
Boulders	17	19
Boulders	19	21
Large to Medium gravel	21	26
Medium to fine gravel, some sand	26	30
Medium to fine gravel with a few boulders	30	40
Med. to fine gravel with fine sand	40	48'6"
Med to fine gravel with some sand	48'6"	53
Water bearing gravel and sand	53	55
Med to fine gravel, water bearing	55	59
Med to fine gravel, water bearing	59	69
Med to fine gravel, some black sand water bearing	69	76
Med to large gravel	76	80
Gravel & small boulders, very tight formation	80	83'9"
Med hard gray rock	83'9"	85

Work started June 5, 1968 Completed 6-27-68, 19

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME O.J. NORRIS-WATER WELL DRILLING
(Person, firm, or corporation) (Type or print)
Address 4411 N.E. 59th Avenue Vancouver, Washington

[Signed] O. J. Norris
(Well Driller)

License No. 223 02 4069 Date Sept. 9, 1968

See Enclosed

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 1386—(Rev. 3-66)—3-66—5M. 4516

CK/WCR

S. F. No. 2361—(Rev. 6-70).

WELL No 7

Item 2.

CERTIFICATE RECORD NO. ——, PAGE NO. G 2-00501 C

STATE OF WASHINGTON, COUNTY OF Clark

CERTIFICATE OF GROUND WATER RIGHT

(Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology thereunder.)

THIS IS TO CERTIFY That CITY OF CAMAS

of Camas, Washington, has made proof to the satisfaction of the Department of Ecology of a right to the use of the public ground waters of the State of Washington from a well

located within a portion of David C. Parker D.L.C. #48 lying within the SW¼ within the city limits of Camas

Sec. 12, Twp. 1 N., R. 3 E., W.M.,

for the purpose(s) of municipal supply

under and specifically subject to provisions contained in Ground Water Permit No. 10515 issued by the Department of Ecology and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the Department of Ecology and entered of record in Volume — at page 1 G 2-00501 C ; that the priority of the right hereby confirmed dates from March 22, 1971 ; that the quantity of ground water under the right hereby confirmed for the aforesaid purposes, is limited to an amount actually beneficially used for said purposes, and shall not exceed 1000 gallons per minute; 530 acre-feet per year, during entire year for municipal supply.

A description of the lands to which such ground water right is appurtenant is as follows:

Area served by the City of Camas.

The right to use of water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in RCW 90.03.380, 90.03.390 and 90.44.020.

This certificate of ground water right is specifically subject to relinquishment for nonuse of water as provided in RCW 90.14.180.

Given under my hand and seal of this office at Olympia, Washington, this 16th day of February, 1973

JOHN A. BIGGS, Director
Department of Ecology

by R. L. Bolton

Engineering Data
TM

C-43

Well No 7

S. F. No. 7354—(Rev. 6-70)

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Permit to Appropriate Public Waters of the State of Washington

Book No. 22 of Ground Water Permits, on page 10515 under Application No. 11718

CITY OF CAMAS

of CAMAS, WASHINGTON

is, pursuant to the Report of Examination which has been accepted by the applicant, hereby granted a permit to appropriate the following described public ground waters of the State of Washington, subject to existing rights and to the limitations and provisions set out herein.

Priority date of this permit is March 22, 1971

Source(s) of the proposed ground water appropriation is/~~are~~ a well

The quantity of water appropriated shall be limited to the amount which can be beneficially applied and not to exceed 1000 gallons per minute; 530 acre-feet per year, to be used for the following purposes: municipal supply

as more definitely set out below.

Approximate location(s) of the point(s) of withdrawal is/~~are~~ 1245 feet east and 2145 feet north of southeast corner of Sec. 12

being within A portion of David C. Parker D.L.C. # 48 lying within the SW¼ within the city limits of Camas

of Sec. 12, Twp. 1 N., Rge. 3 E. W.M., Clark County.

The use, or uses, to which water is to be applied:

~~Domestic~~/municipal supply: 1000 gallons per minute; 530 acre-feet per year, during entire year.

Irrigation: gallons per minute; acre-feet per year from to each year, for the irrigation of acres.

Other use(s): gallons per minute: acre-feet per year, from to each year, for

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Area served by the City of Camas

1590

ADDITIONAL LIMITATIONS AND PROVISIONS: The installation and maintenance of an access port as described in Ground Water Bulletin No. ' shall be required prior to issuance of final Certificate of Water Right.

The total amount of water to be withdrawn or diverted, which includes the amounts as approved in Surface Water Certificates No. 711 and 712 and Ground Water Certificates Nos. 85, 4072, 6635 and 6636 shall not exceed 5750 acre-feet per year.

Nothing in this permit shall **be construed as excusing the permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations including those administered by local agencies under the Shoreline Management Act of 1971.**

DESCRIPTION OF PROPOSED WORKS:

The well will be drilled (Dug or drilled) and have a diameter of 14 inches, and depth of 85 feet.

Description of tunnel or infiltration trench: _____

DEVELOPMENT SCHEDULE:

Construction work shall begin on or before Started

and shall thereafter be prosecuted with reasonable diligence and completed on or before November 1, 1972

and complete application of water to proposed use shall be made on or before November 1, 1973

This permit shall be subject to cancellation should the permittee fail to comply with the above development schedule and/or fail to give notice to the Department of Ecology on forms provided by that Department documenting such compliance.

Given under my hand and the seal of this office at Olympia, Washington, this 10th day of November 19 71.

JOHN A. BIGGS, *Director*
Department of Ecology

by R. Jerry Bollen

ENGINEERING DATA

File Original and First Copy with the Division of Water Resources
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. 11716
Permit No. .....

(1) OWNER: Name CITY OF CAMAS, WASH Address 616 NE 4TH AVE CAMAS, WASH

(2) LOCATION OF WELL: County CLARK — NE¼ SW¼ Sec 12 T 1 N. R 3E W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 7
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 14 inches.
Drilled 84 ft. Depth of completed well 84 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 14" Diam. from +5 ft. to 84 ft.
Threaded ☒ ..." Diam. from ... ft. to ... ft.
Welded ☒ ..." Diam. from ... ft. to ... ft.

Perforations: Yes ☒ No ☐
Type of perforator used STAR
SIZE of perforations 3/8 in. by 1¼ in.
520 perforations from 49 ft. to 77 ft.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.

Screens: Yes ☐ No ☒
Manufacturer's Name ...
Type ... Model No. ...
Diam. ... Slot size ... from ... ft. to ... ft.
Diam. ... Slot size ... from ... ft. to ... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ...
Gravel placed from ... ft. to ... ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal CEMENT GROUT
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ... Depth of strata ...
Method of sealing strata off ...

(7) PUMP: Manufacturer's Name ...
Type: Submersible turbine HP 100

1-25-75 JM

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 8.5 ft. below top of well Date 6/22/71
Artesian pressure ... lbs. per square inch Date ...
Artesian water is controlled by ... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? STRASSER
Yield: 1000 gal./min. with 4 ft. drawdown after 1½ hrs.
" 1425 " 5 " 6 "
" 1200 " 4 " 24 "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
IMMEDIATE	RECOVERY				

Date of test JUNE 22, 1971
Bailer test ... gal./min. with ... ft. drawdown after ... hrs.
Artesian flow ... g.p.m. Date ...
Temperature of water 57 Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
GRAVEL AND BOULDERS	0	8
GRAVEL, SOME CLAY	8	18
CEMENTED GRAVEL	18	20
LOOSE GRAVEL	20	30
PACKED GRAVEL	30	36
GRAVEL AND GREY CLAY	36	39
LOOSE GRAVEL (WATER)	39	65
MEDIUM GRAVEL (WATER)	65	70
LARGE GRAVEL (WATER)	70	81
RED CLAY	81	84

RECEIVED
DEPARTMENT OF ECOLOGY
JUL 1 1971
AM
7 8 9 10 11 12 1 2 3 4 5 6 PM

Work started JUNE 7, 19 71 Completed JUNE 25, 19 71

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME R.J. STRASSER DRILLING CO (Person, firm, or corporation) (Type or print)
Address 8110 SE SUNSET LANE PORTLAND ORE
[Signed] Robert L Strasser (Well Driller)
License No 223022806 Date JULY 12, 19 71

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7256—(Rev. 2-68)—1000—GM. 4816.

OK/WR

well #7

Report of Examination on Ground Water

Received date March 22, 1971 Date of exam. August 31, 1971 Appli. No. 11718

Name City of Camas Address 616 N.E. 4th Ave., Camas WA 98607

Type of works A well Dimensions 14" x 85'

Progress of works Well drilled and capped

Quantity applied for 1000 g.p.m. 530 acre-feet per year of David C. Parker D.L.C. #48 within the City of Camas (lying within the SW¼)

Legal sub A portion/Sec. 12 Twp. 1 Rge. 3 E. County Clark

Use Municipal supply

Irrigation-acreage: Present Planned Feasible

Municipal: ~~Population~~ Area served 15,000 as of 1990

Industrial

Time pump will be operated Continuously

Other water rights appurtenant to this land See Surface Water Certificates Nos. 712 & 711; Ground Water Certificates Nos. 85, 4072, 6635 and 6636

Proximity to existing works, springs, wells, or streams City of Camas, west 400'; City of Camas, southeasterly 1000'; City of Camas, north; Washougal River, north 200'

Area Sub-area Zone

RECOMMENDATIONS

Approved for 1000 g.p.m. 530 acre-feet per year, subject to existing water rights. (1 acre-foot 325,850 gallons.)

The installation of an access port as described in attached Ground Water Bulletin No. 1 shall be required prior to issuance of final certificate of water right. The applicant may, for his own convenience, wish to install an airline and gage in addition to the access port.

Use of the waters to be appropriated under this application will be for a public water supply. State Board of Health rules require every owner of a public water supply to obtain written approval from the Assistant Secretary, Division of Health prior to any new construction or alterations of a public water supply. The applicant is advised to contact the Washington State Division of Health, Public Health Bldg. No. 7, Thurston Airdustrial Center, Olympia, with regard to the need for compliance.

The following water rights are appurtenant to this land:

Certificate No.	c.f.s./g.p.m.	ac-ft per yr.
SWC 711	1.0 c.f.s.	730
SWC 712	2.5 c.f.s.	1820
GWC 85-A	1200 g.p.m.	118
GWC 4072-A	1325 g.p.m.	1208
GWC 6635	1500 g.p.m.	2400
GWC 6636	600 g.p.m.	920

The total requirement based on an engineering study is 345 gallons per capita per day for all purposes for an estimated population of 15,000 by 1990 or approximately 5,750 acre-feet per year.

The quantity recommended under this application is 1000 gallons per minute not to exceed 530 acrefeet per year as requested in the application.

The permit when issued will carry the following provision: 'The total amount of water to be withdrawn or diverted, which includes the amounts as approved in Surface Water Certificates Nos. 711 and 712 and Ground Water Certificates Nos. 85, 4072, 6635 and 6636 shall not exceed 5,750 acre-feet per year."

Additionally, the permit when issued shall carry the following provision: "Nothing in this permit shall be construed as excusing the permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations including those administered by local agencies under the Shoreline Management Act of 1971."

Signed at Olympia, Washington
this 28th day of September, 1971.

JERRY LOUTHAIN, Engineer
Department of Ecology

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

CERTIFICATE OF WATER RIGHT

☐ Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

☒ Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
February 4, 1977	G 2-24400	G 2-24400 P	G 2-24400 C

NAME
CITY OF CAMAS

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
P.O. Box 1055	Camas	Washington	98607

This is to certify that the herein named applicant has made proof to the satisfaction of the Department of Ecology of a right to the use of the public waters of the State of Washington as herein defined, and under and specifically subject to the provisions contained in the Permit issued by the Department of Ecology, and that said right to the use of said waters has been perfected in accordance with the laws of the State of Washington, and is hereby confirmed by the Department of Ecology and entered of record as shown.

PUBLIC WATER TO BE APPROPRIATED

SOURCE
well

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE-FEET PER YEAR
	900	530

QUANTITY, TYPE OF USE, PERIOD OF USE		
530 acre-feet per year	municipal supply	continuously

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL
1375 feet East and 2145 feet North of Southwest corner of Section 12.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
SW¼	12	1	3 E	28	Clark

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Area served by the Camas Municipal water system.

"The total amount of water to be withdrawn or diverted, which includes the amounts as approved in Surface Water Certificate No. 711 and 712 and Ground Water Certificate Nos. 85A, 4072 A, 6635 A and G 2-00501 and this certificate shall not exceed 5750 acre-feet per year."

↑ 6635A ?

The access port as required on your permit shall be maintained at all times.

"All water wells constructed within the state shall meet the minimum standards for construction and maintenance as provided under Chapter 18.104 RCW (Washington Water Well Construction Act of 1971) and Chapter 173-160 WAC (Minimum Standards for Construction and maintenance of Water Wells)."

The right to the use of the water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in RCW 90.03.380, 90.03.390, and 90.44.020.

This certificate of water right is specifically subject to relinquishment for nonuse of water as provided in RCW 90.14.180.

Given under my hand and the seal of this office at Olympia *Washington, this* 23rd *day of* May, *19* 79

WILBUR G. HALLAUER, DIRECTOR
Department of Ecology

by E.W. ASSELSTINE, Regional Manager

ENGINEERING DATA
OK RPS
OTES

FOR COUNTY USE ONLY

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. 52-24400P
Permit No.

(1) OWNER: Name City of Camas Address Camas, Washington

(2) LOCATION OF WELL: County Clark NW¼ SW¼ Sec. 12 T. 1 N. R. 3E W.M.
Bearing and distance from section or subdivision corner 1375 E. & 2145' N of SW Cor of Sec 12

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 8
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 14 inches.
Drilled 87 ft. Depth of completed well 87 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 14" Diam. from 0 ft. to 87 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.
(3' riser added for future fill)
Perforations: Yes ☒ No ☐
Type of perforator used Mills Knife
Size of perforations 3/8 in. by 3½ in.
8 rows perforations from 44 ft. to 79 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft
Material used in seal Cement
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 33.2 ft. below top of well Date 5/10/77
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? driller
Yield: 1,040 gal./min. with 1.15 ft. drawdown after ½ hrs.
" 1,791 " 3.60 " 6 "
" 1,921 " 3.65 " 7 "
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
0:00	36.85				
7:00	34.00				
minutes					

Date of test 5/10/77
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 50° Was a chemical analysis made? Yes ☒ No ☐

OK PTS

(10) WELL LOG:
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Topsoil	0	6"
Gravel, small boulders	6"	4'
Gravel, boulders	4'	21'
Gravel, small boulders, brown clay seams	21'	37'
Gravel, loose, some brown clay	37'	39'
Gravel, sand, gray	39'	42'
Gravel, sand, gray, water bearing	42'	49'
Gravel, medium size, sand, gray, loose, water bearing	49'	55'
Gravel, small to large, loose, water bearing	55'	75'
Gravel, medium to large, loose	75'	79'
Gravel, large, red clay	79'	82'
Clay, red	82'	87'

RECEIVED
JUL 6 '77
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started 4/14 19 77 Completed 5/19 19 77

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME NORRIS DRILLING & PUMP CO., INC.
(Person, firm, or corporation) (Type or print)
Address 11026 N.E. St. Johns Blvd. Vancouver, Washington 98665

[Signed] O. J. Norris
(Well Driller)

License No. 0366 Date June 6 19 77

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

PERMIT

TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☐ Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

☒ Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
February 4, 1977	G 2-24400	G 2-24400 P	

NAME
CITY OF CAMAS

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
616 NE 4th Ave. PO Box 1065	Camas	Washington	98607

The applicant is, pursuant to the Report of Examination which has been accepted by the applicant, hereby granted a permit to appropriate the following described public waters of the State of Washington, subject to existing rights and to the limitations and provisions set out herein.

PUBLIC WATER TO BE APPROPRIATED

SOURCE
well

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE-FEET PER YEAR
	900	530

QUANTITY, TYPE OF USE, PERIOD OF USE
530 acre-feet per year — municipal supply — continuously

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL
1375 feet East and 2145 feet North of Southwest corner of Section 12.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
SW¼	12	1	3 E	28	Clark

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Area served by the Camas Municipal water system.

DESCRIPTION OF PROPOSED WORKS

Well 14" x 85', 100 HP pump to municipa water system.

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
Started	July 1, 1979	July 1, 1980

PROVISIONS

"The total amount of water to be withdrawn or diverted, which includes the amounts as approved in surface water certificate No. 711 and 712 and Ground Water Certificate Nos. 85A, 4072 A, 5635 A and G2-00501 and this permit shall not exceed 5750 acre-feet per year.

The installation of an access port as described in Ground Water Bulletin No. 1 shall be required prior to issuance of final certificate of water right. The permittee, may for his own convenience, wish to install an airline and gage in addition to the access port.

"All water wells constructed within the state shall meet the minimum standards for construction and maintenance as provided under Chapter 18.104 RCW (Washington Water Well Construction Act of 1971) and Chapter 173-160 WAC (Minimum Standards for Construction and maintenance of Water Wells)."

Nothing in this permit shall be construed as excusing the permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations including those administered by local agencies under the Shoreline Management Act of 1971.

This permit shall be subject to cancellation should the permittee fail to comply with the above development schedule and/or fail to give notice to the Department of Ecology on forms provided by that Department documenting such compliance.

Given under my hand and the seal of this office at Olympia *Washington, this* 15th *day of* March, *19* 78

WILBUR HALLAUER, DIRECTOR
Department of Ecology

by E.W. Asselstine

E.W. Asselstine, Regional Manager

ENGINEERING DATA
OK RPB

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

REPORT OF EXAMINATION
TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☐ Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology)

☒ Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
February 4, 1977	G 2-24400		

NAME
CITY OF CAMAS

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
616 NE 4 th Ave	Camas	Washington	98607

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
well

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE-FEET PER YEAR
	900	530

QUANTITY, TYPE OF USE, PERIOD OF USE		
530 acre-feet per year	municipal supply	continuously

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL
1375 feet East and 2145 feet North of Southwest corner of Section 12.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
SW¼	12	1	3 E	28	Clark

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Area served by the Camas Municipal water system.

1600

DESCRIPTION OF PROPOSED WORKS

...1 14" x 85', 100 HP pump to municipal water system.

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
Started	July 1, 1979	July 1, 1980

PROVISIONS

Recommend this application be approved for 900 gallon per minute and 530 acre-feet per year for a municipal supply for the City of Camas.

The following water rights are appurtenant to this land.

Certificate No.	CFS/GPM	Acre-feet per year
SWC 711	1.0 CFS	730
SWC 712	2.5 CFS	1820
GWC 85-A	1200 GPM	118
GWC 4072 A	1325 GPM	1208
GWC 6635	1500 GPM	2400
GWC 6636	600 GPM	920
G2 - 00501 C	1000 GPM	530

... total requirement based on an engineering study is 345 gallons per capita per day for all ...poses for an estimated population of 15,000 by 1990 or approximately 5,750 acre-feet per year. The permit when issued will carry the following provision: "The total amount of water to be withdrawn or diverted, which includes the amounts as approved in surface water certificate Nos. 711 and 712 and Ground Water Certificate Nos. 85A, 4072A, 6635 A 6636 A and G2-00501 and this application shall not exceed 5750 acre-feet per year.

The installation of an access port as described in attached Ground Water Bulletin No. 1 shall be required prior to issuance of final certificate of water right. The applicant may for his own convenience, wish to install an airline and gage in addition to the access port.

Use of the waters to be appropriated under this application will be for a public water supply. State Board of Health rules require every owner of a public water supply to obtain written approval from the Water Supply and Waste Section, Department of Social and Health Services, Mail Stop 4-1, Building 4, Olympia, Washington, 98504, prior to any new construction or alterations of a public water supply.

"All water wells constructed within the state shall meet the minimum standards for construction and maintenance as provided under Chapter 18.104 RCW (Washington Water Well Construction Act of 1971) and Chapter 173-160 WAC (Minimum Standards for Construction and Maintenance of Water Wells)."

Nothing in this application shall be construed as excusing the applicant from compliance with any applicable federal, state, or local statutes, ordinances, or regulations including those administered by local agencies under the Shoreline Management Act of 1971.

...ned at Olympia, Washington,
...is 4 day of August, 1977.

Robert P. Burrell
Robert P. Burrell
Department of Ecology

1601

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

PERMIT

TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☐ Surface Water (issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regul the Department of Ecology.)

☒ Ground Water (issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regu the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
August 13, 1986	G2-27384	G2-27384 P	

NAME
City of Camas

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
616 NE 4th Avenue	Camas	Washington	98607

The applicant is, pursuant to the Report of Examination which has been accepted by the applicant, hereby granted a permit to appr the following described public waters of the State of Washington, subject to existing rights and to the limitations and provisions s herein.

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
Well No. 9

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE-FEET PER YEAR
	650	210 Supplemental

QUANTITY, TYPE OF USE, PERIOD OF USE		
210 acre-feet per year Supplemental to existing rights	Municipal Supply	Year-round, as needed

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION–WITHDRAWAL
600 feet south and 700 feet west of the north quarter corner of Section 4.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
NE¼NW¼	4	1	3E	28	Clark

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Area served by the City of Camas.

1602

This permit is subject to the implementation of the minimum requirements established in the Interim Guidel for Public Water Systems Regarding Water Use Reporting, Demand Forecasting Methodology and Conserva Programs, July 1990.

Under RCW 90.03.005 and 90.54.020(6), conservation and improved water use efficiency must be emphas in the management of the states water resources, and must be considered as a potential new source of wa Accordingly, as part of the terms of this permit, the applicant shall prepare and implement a water conserva plan approved by Department of Health. The standards for such a plan may be obtained from either Department of Health or the Department of Ecology.

The Water Resources Act of 1971 specifies certain criteria regarding utilization and management of the wa of the state in the best public interest. Use of water may be subject to regulation at certain times, based on necessity to maintain water quantities sufficient for preservation of the natural environment.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Item 2.

REPORT OF EXAMINATION

TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☐ Surface Water (issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regu... the Department of Ecology.)

☒ Ground Water (issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regu... the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
August 13, 1986	G2-27384		

NAME
City of Camas

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
616 NE 4th Avenue	Camas	Washington	98607

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
Well No. 9

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE-FEET PER YEAR
	650	210 Supplemental

QUANTITY, TYPE OF USE, PERIOD OF USE		
210 acre-feet per year Supplemental to existing rights	Municipal Supply	Year-round, as needed

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION–WITHDRAWAL
600 feet south and 700 feet west of the north quarter corner of Section 4.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
NE¼NW¼	4	1	3E	28	Clark

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Area served by the City of Camas.

1604

Existing City of Camas rights. The City of Camas has several surface and ground water rights and clair shown below:

Little Washougal River (reach now known as Boulder Creek), Certificate No. S 711 C, is for 1.0 cfs an acre-feet per year (AF/Y). This source is subject to low flow conditions in the summer.

Jones Creek, Certificate No. S 712 C, is for 2.5 cfs and 1820 AF/Y. This source goes low in the summer

Well No. 1, Claim No. 121022 for vested rights, is for 900 gpm and 320 AF/Y. The well is no longer use a regular basis.

Well No. 2, Claim No. 121023 for vested rights, is for 900 gpm and 230 AF/Y. The well is no longer use a regular basis.

Well No. 3, Certificate No. G 85-A C, is for 1200 gpm and 118 AF/Y.

Well No. 4, Certificate No. G 4072 C, is for 1325 gpm and 1208 AF/Y.

Well No. 5, Certificate No. G 6636 C, is for 600 gpm and 920 AF/Y.

Well No. 6, Certificate No. G 6635 C, is for 1500 gpm and 2400 AF/Y.

Well No. 7, Certificate No. G2-00501, is for 1000 gpm and 530 AF/Y.

Well No. 8, Certificate No. G2-24400, is for 900 gpm and 530 AF/Y.

Under the provisions of Certificates No. G2-00501C and G2-24400, the total annual quantity allowed u existing rights is 5,750 AF/Y.

Clark County Reservation. Under the provisions of Chapter 173-592 WAC, Reservation of Future Public W Supply for Clark County, ground water was reserved for future beneficial use for public water supply in C County. Since the enactment of this reservation, water rights issued pursuant to WAC 173-592 have rece a priority date of August 13, 1986, the effective date of said regulation. The total reservation quantity is 97 gpm and 65,300 AF/Y prorated by aquifer as follows:

1) Columbia River Alluvium (1A) and Sandy River Mudstone (1C) 77,000 gpm, 51,800 AF/Y;

2) Upper Troutdale (1B-2B) 20,000 gpm, 13,500 AF/Y.

The subject well is completed within the Upper Troutdale sediments. This appropriation, therefore, falls ur WAC 173-592 and will, when permitted, be debited against the reserved quantity for the Upper Trout aquifers. In addition, the permit will carry the August 13, 1986, priority date of the reservation.

Annual quantity supplemental to existing rights. The total annual allocation under the City's existing rig 5,750 AF/Y, was based on a projected population of 15,000. The City of Camas' actual water use for the 1989 amounted to 1,930 acre-feet for a population of 6,600 (Clark County Coordinated Water system P Update, April 1991; Intergovernmental Resource Center population summary, March 1990).

The City's annual water use should remain within existing rights (5,750 AF/Y) for the foreseeable fut Therefore the annual quantity recommended for this permit will be supplemental to existing rights, augmen system supply within the 5,750 AF/Y already authorized.

Quantities from this well. Due to the apparent limitations of the aquifer, this well is probably not suitable use as a major production well, but it could serve to boost system capacity during peak periods. Mr. Levi requested that the permit authorize a maximum withdrawal of 650 gpm up to 20% of the time on average allow the City to determine the optimum rate and pumping schedule. Accordingly, the permit will autho 650 gpm and 210 AF/Y from Well 9, subject to the provisions below.

Water right certificate. Pursuant to RCW 90.03.330 and 90.44.080, a final certificate will be issued upo showing satisfactory to the Department that the appropriation has been perfected in compliance with the ter of the subject permit. The certificated withdrawal rate and annual quantity will reflect a sustainable yield a protection of senior rights, within the amounts specified on the permit. Monitoring and data submittal will required under the certificate as well as the permit.

The Water Resources Act of 1971 specifies certain criteria regarding utilization and management of the
of the state in the best public interest. Favorable consideration of this application has been based on suf
waters available, at least during portions of the year. However, it is pointed out to the applicant that th
of water may be subject to regulation at certain times, based on the necessity to maintain water qua
sufficient for preservation of the natural environment.

REPORTED BY: Vennie Wright DATE: October 12, 1992

The statutory permit fee for this application is $20.00.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
REPORT OF EXAMINATION

Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

[X] Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
August 21, 2003	G2-30144		

NAME
City of Camas

ADDRESS (STREET)	CITY	STATE	ZIP CODE
616 NE Fourth Avenue	Camas	WA	98607

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
8 Wells (Lower Washougal Wellfield)
TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE FEET PER YEAR
	500	2,150

QUANTITY, TYPE OF USE, PERIOD OF USE

2,150 acre-feet per year	Municipal	Year-round, as needed

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL

Well 5: 2600ft E & 790ft N of SW corner of Section 12, T1NR3E; Parcel=87268000; Lat=45.58059763; Long=122.38336343
Well 6: 2410ft E & 1795ft N of SW corner of Section 12, T1NR3E; Parcel=89927000; Lat=45.58340428; Long=122.38412204
Well 7: 1280ft E & 2110ft N of SW corner of Section 12, T1NR3E; Parcel=89891000; Lat=45.58431461; Long=122.38852327
Well 8: 1410ft E & 2080ft N of SW corner of Section 12, T1NR3E; Parcel=89888000; Lat=45.58426809; Long=122.38802699
Well 10: 790ft E & 2170ft N of SW corner of Section 12, T1NR3E; Parcel=89866000; Lat=45.58447735; Long=122.39044258
Well 11: 1060ft E & 2145ft N of SW corner of Section 12, T1NR3E; Parcel=89892000; Lat=45.58439709; Long=122.38937969
Well 12: 1030ft E & 2145ft N of SW corner of Section 12, T1NR3E; Parcel=89892000; Lat=45.58439492; Long=122.38950256
Well 13: 15ft E & 3410ft N of SW corner of Section 12, T1NR3E; Parcel=90928000; Lat=45.58783343; Long=122.39350782

SMALLEST SUBDIVISION	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
	12	1 N	3 E.W.M.	28	Clark

POINT OF WITHDRAWAL NAME	PARCEL NUMBER	LATITUDE	LONGITUDE	DATUM NAD 83 (orthophoto)
Washougal River Wellfield	See above	See above	See above	

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED
[Attachment 1 shows location of the authorized place of use and point(s) of diversion or withdrawal]

Area served by the City of Camas. The place of use of this water right is the service area described in the currently approved Water System Plan as approved by the Washington State Department of Health. RCW 90.03.386 may have the effect of revising the place of use of this water right if the criteria in section RCW 90.03.386(2) are met.

DESCRIPTION OF PROPOSED WORKS

8 Existing Wells in the Lower Washougal Wellfield

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
August 1, 2008	August 1, 2015	August 1, 2025

PROVISIONS

Monitoring

The City of Camas shall develop a monitoring plan that includes the following:

a.) Monitor water levels in existing wells (TW-C and Well 4) and three new monitoring wells. The new monitoring wells must be installed as a cluster in the lower Washougal River in general proximity to the Georgia Pacific wellfield (where the largest drawdown occurs in the area). Two wells must be completed in the lower permeability streambed unit that lies beneath the river, and the third well must be completed in the more permeable PAA aquifer. All water levels must be measured to the nearest tenth of a foot, on an hourly basis during baseflow periods. New monitoring wells must be accurately located within 10 feet horizontally and 0.1 foot vertically. All monitoring wells must be constructed according to WAC 173-160-400.

b.) The City shall install a continuous river stage monitoring station in vicinity of the new monitoring wells. The monitoring station must include a staff gage which is accurately located within 10 feet horizontally and 0.1 foot vertically. Stage readings shall also be recorded on an hourly basis.

c.) Aquifer tests on the new Camas production wells must coincide with summer/fall low-flow periods and include seepage surveys during testing events. New supply wells must be accurately located within 10 feet horizontally and 0.1 foot vertically.

d.) The City shall submit water level data from their monitoring network for the previous year by January 31 to the Department of Ecology. Data shall be provided in a digital format along with a two page summary attached. A more thorough monitoring report must be provided after 5 years from the date of issuance of this water right or when this permit is perfected (whichever comes first), to further evaluate the effects of pumping on the Washougal River.

Operations of Surface Water System

1. Prior to groundwater being withdrawn under this water right, the City of Camas must cease their surface water diversions from Jones and Boulder Creeks between May 15 and October 31 of each year. At the State's discretion, the water rights associated with these diversions will be placed into the State's Trust Water Program as permanent, seasonal donations.

Metering and Reporting Diversions

1. An approved measuring device shall be installed and maintained for each of the wells authorized by this water right, in accordance with the rule "Requirements for Measuring and Reporting Water Use", WAC 173-173.

2. Reported water use data shall be submitted via the Internet. To set up an Internet reporting account, access https://fortress.wa.gov/ecy/wrx/wrx/Meteringx/. If you do not have Internet access, contact the Southwest Regional Office for forms to submit your data.

3. Chapter 173-173 WAC describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition Ecology for modifications to some of the requirements. Installation, operation, and maintenance requirements are enclosed as a document entitled "Water Measurement Device Installation and Operation Requirements."

4. Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable times, to the records of water use that are kept to meet the above conditions and may inspect, at reasonable times, any measuring device used to meet the above conditions.

Development Schedule

1. The development schedule shall be as follows:

   - Construction shall begin by August 1, 2008

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
REPORT OF EXAMINATION

Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

[X] Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
August 21, 2003	G2-30145		

NAME
City of Camas

ADDRESS (STREET)	CITY	STATE	ZIP CODE
616 NE Fourth Avenue	Camas	WA	98607

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
Proposed Well (Anderson Site)

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE FEET PER YEAR
	1000	880

QUANTITY, TYPE OF USE, PERIOD OF USE

880 acre-feet per year	Municipal	Year-round, as needed

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL

1900 feet north and 2050 feet west of SE corner of Section 12

SMALLEST SUBDIVISION	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
NW 1/4 SE 1/4	12	1 N	3 E.W.M.	28	Clark

POINT OF WITHDRAWAL NAME	PARCEL NUMBER	LATITUDE	LONGITUDE	DATUM
Anderson proposed well	91045003	45.58349161	122.38087177	NAD 83 (orthophoto)

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED
[Attachment 1 shows location of the authorized place of use and point(s) of diversion or withdrawal]

Area served by the City of Camas. The place of use of this water right is the service area described in the currently approved Water System Plan as approved by the Washington State Department of Health. RCW 90.03.386 may have the effect of revising the place of use of this water right if the criteria in section RCW 90.03.386(2) are met.

DESCRIPTION OF PROPOSED WORKS

A proposed well

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
August 1, 2008	August 1, 2015	August 1, 2025

PROVISIONS

Monitoring

The City of Camas shall develop a monitoring plan that includes the following:

a.) Monitor water levels in existing wells (TW-C and Well 4) and three new monitoring wells. The new monitoring wells must be installed as a cluster in the lower Washougal River in general proximity to the Georgia Pacific wellfield (where the largest drawdown occurs in the area). Two wells must be completed in the lower permeability streambed unit that lies beneath the river, and the third well must be completed in the more permeable PAA aquifer. All water levels must be measured to the nearest tenth of a foot, on an hourly basis during baseflow periods. New monitoring wells must be accurately located within 10 feet horizontally and 0.1 foot vertically. All monitoring wells must be constructed according to WAC 173-160-400.

b.) The City shall install a continuous river stage monitoring station in vicinity of the new monitoring wells. The monitoring station must include a staff gage which is accurately located within 10 feet horizontally and 0.1 foot vertically. Stage readings shall also be recorded on an hourly basis.

c.) Aquifer tests on the new Camas production wells must coincide with summer/fall low-flow periods and include seepage surveys during testing events. New supply wells must be accurately located within 10 feet horizontally and 0.1 foot vertically.

d.) The City shall submit water level data from their monitoring network for the previous year by January 31 to the Department of Ecology. Data shall be provided in a digital format along with a two page summary attached. A more thorough monitoring report must be provided after 5 years from the date of issuance of this water right or when this permit is perfected (whichever comes first), to further evaluate the effects of pumping on the Washougal River.

Operations of Surface Water System

1. Prior to groundwater being withdrawn under this water right, the City of Camas must cease their surface water diversions from Jones and Boulder Creeks between May 15 and October 31 of each year. At the State's discretion, the water rights associated with these diversions will be placed into the State's Trust Water Program as permanent, seasonal donations.

Metering and Reporting Diversions

1. An approved measuring device shall be installed and maintained for each of the wells authorized by this water right, in accordance with the rule "Requirements for Measuring and Reporting Water Use", WAC 173-173.

2. Reported water use data shall be submitted via the Internet. To set up an Internet reporting account, access https://fortress.wa.gov/ecy/wrx/wrx/Meteringx/. If you do not have Internet access, contact the Southwest Regional Office for forms to submit your data.

3. Chapter 173-173 WAC describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition Ecology for modifications to some of the requirements. Installation, operation, and maintenance requirements are enclosed as a document entitled "Water Measurement Device Installation and Operation Requirements."

4. Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable times, to the records of water use that are kept to meet the above conditions and may inspect, at reasonable times, any measuring device used to meet the above conditions.

Development Schedule

1. The development schedule shall be as follows:

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
REPORT OF EXAMINATION

☐ Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

☒ Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
August 21, 2003	G2-30146		

NAME

City of Camas

ADDRESS (STREET)	CITY	STATE	ZIP CODE
616 NE Fourth Avenue	Camas	WA	98607

PUBLIC WATERS TO BE APPROPRIATED

SOURCE

Proposed Well (Parkers Landing)

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE FEET PER YEAR
	1000	880

QUANTITY, TYPE OF USE, PERIOD OF USE

880 acre-feet per year	Municipal	Year-round, as needed

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL

200 feet north and 2500 feet west of the SE corner of Section 12

SMALLEST SUBDIVISION	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
SW 1/4 SE 1/4	12	1 N	3 E.W.M.	28	Clark

POINT OF WITHDRAWAL NAME	PARCEL NUMBER	LATITUDE	LONGITUDE	DATUM
Parkers Landing proposed well	73134162	45.57960601	122.38210695	NAD 83 (orthophoto)

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

[Attachment 1 shows location of the authorized place of use and point(s) of diversion or withdrawal]

Area served by the City of Camas. The place of use of this water right is the service area described in the currently approved Water System Plan as approved by the Washington State Department of Health. RCW 90.03.386 may have the effect of revising the place of use of this water right if the criteria in section RCW 90.03.386(2) are met.

DESCRIPTION OF PROPOSED WORKS

A proposed well

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
August 1, 2008	August 1, 2015	August 1, 2025

PROVISIONS

Monitoring

The City of Camas shall develop a monitoring plan that includes the following:

a.) Monitor water levels in existing wells (TW-C and Well 4) and three new monitoring wells. The new monitoring wells must be installed as a cluster in the lower Washougal River in general proximity to the Georgia Pacific wellfield (where the largest drawdown occurs in the area). Two wells must be completed in the lower permeability streambed unit that lies beneath the river, and the third well must be completed in the more permeable PAA aquifer. All water levels must be measured to the nearest tenth of a foot, on an hourly basis during baseflow periods. New monitoring wells must be accurately located within 10 feet horizontally and 0.1 foot vertically. All monitoring wells must be constructed according to WAC 173-160-400.

b.) The City shall install a continuous river stage monitoring station in vicinity of the new monitoring wells. The monitoring station must include a staff gage which is accurately located within 10 feet horizontally and 0.1 foot vertically. Stage readings shall also be recorded on an hourly basis.

c.) Aquifer tests on the new Camas production wells must coincide with summer/fall low-flow periods and include seepage surveys during testing events. New supply wells must be accurately located within 10 feet horizontally and 0.1 foot vertically.

d.) The City shall submit water level data from their monitoring network for the previous year by January 31 to the Department of Ecology. Data shall be provided in a digital format along with a two page summary attached. A more thorough monitoring report must be provided after 5 years from the date of issuance of this water right or when this permit is perfected (whichever comes first), to further evaluate the effects of pumping on the Washougal River.

Operations of Surface Water System

1. Prior to groundwater being withdrawn under this water right, the City of Camas must cease their surface water diversions from Jones and Boulder Creeks between May 15 and October 31 of each year. At the State's discretion, the water rights associated with these diversions will be placed into the State's Trust Water Program as permanent, seasonal donations.

Metering and Reporting Diversions

1. An approved measuring device shall be installed and maintained for each of the wells authorized by this water right, in accordance with the rule "Requirements for Measuring and Reporting Water Use", WAC 173-173.

2. Reported water use data shall be submitted via the Internet. To set up an Internet reporting account, access https://fortress.wa.gov/ecy/wrx/wrx/Meteringx/. If you do not have Internet access, contact the Southwest Regional Office for forms to submit your data.

3. Chapter 173-173 WAC describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition Ecology for modifications to some of the requirements. Installation, operation, and maintenance requirements are enclosed as a document entitled "Water Measurement Device Installation and Operation Requirements."

4. Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable times, to the records of water use that are kept to meet the above conditions and may inspect, at reasonable times, any measuring device used to meet the above conditions.

Development Schedule

1. The development schedule shall be as follows:

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
REPORT OF EXAMINATION

Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

[X] Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
August 21, 2003	G2-30147		

NAME

City of Camas

ADDRESS (STREET)	CITY	STATE	ZIP CODE
616 NE Fourth Avenue	Camas	WA	98607

PUBLIC WATERS TO BE APPROPRIATED

SOURCE

Proposed Well (Treatment Plant Well)

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE FEET PER YEAR
	1000	880

QUANTITY, TYPE OF USE, PERIOD OF USE

880 acre-feet per year | Municipal | Year-round, as needed

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL

200 feet north and 200 feet west of the SW corner of Section 12

SMALLEST SUBDIVISION	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
SW 1/4 SW ¼	12	1 N	3 E.W.M.	28	Clark

POINT OF WITHDRAWAL NAME	PARCEL NUMBER	LATITUDE	LONGITUDE	DATUM
Treatment Plant proposed well	87360000	45.57902697	122.39273145	NAD 83 (orthophoto)

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

[Attachment 1 shows location of the authorized place of use and point(s) of diversion or withdrawal]

Area served by the City of Camas. The place of use of this water right is the service area described in the currently approved Water System Plan as approved by the Washington State Department of Health. RCW 90.03.386 may have the effect of revising the place of use of this water right if the criteria in section RCW 90.03.386(2) are met.

DESCRIPTION OF PROPOSED WORKS

A proposed well

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
August 1, 2008	August 1, 2015	August 1, 2025

PROVISIONS

Monitoring

The City of Camas shall develop a monitoring plan that includes the following:

a.) Monitor water levels in existing wells (TW-C and Well 4) and three new monitoring wells. The new monitoring wells must be installed as a cluster in the lower Washougal River in general proximity to the Georgia Pacific wellfield (where the largest drawdown occurs in the area). Two wells must be completed in the lower permeability streambed unit that lies beneath the river, and the third well must be completed in the more permeable PAA aquifer. All water levels must be measured to the nearest tenth of a foot, on an hourly basis during baseflow periods. New monitoring wells must be accurately located within 10 feet horizontally and 0.1 foot vertically. All monitoring wells must be constructed according to WAC 173-160-400.

b.) The City shall install a continuous river stage monitoring station in vicinity of the new monitoring wells. The monitoring station must include a staff gage which is accurately located within 10 feet horizontally and 0.1 foot vertically. Stage readings shall also be recorded on an hourly basis.

c.) Aquifer tests on the new Camas production wells must coincide with summer/fall low-flow periods and include seepage surveys during testing events. New supply wells must be accurately located within 10 feet horizontally and 0.1 foot vertically.

d.) The City shall submit water level data from their monitoring network for the previous year by January 31 to the Department of Ecology. Data shall be provided in a digital format along with a two page summary attached. A more thorough monitoring report must be provided after 5 years from the date of issuance of this water right or when this permit is perfected (whichever comes first), to further evaluate the effects of pumping on the Washougal River.

Operations of Surface Water System

1. Prior to groundwater being withdrawn under this water right, the City of Camas must cease their surface water diversions from Jones and Boulder Creeks between May 15 and October 31 of each year. At the State's discretion, the water rights associated with these diversions will be placed into the State's Trust Water Program as permanent, seasonal donations.

Metering and Reporting Diversions

1. An approved measuring device shall be installed and maintained for each of the wells authorized by this water right, in accordance with the rule "Requirements for Measuring and Reporting Water Use", WAC 173-173.

2. Reported water use data shall be submitted via the Internet. To set up an Internet reporting account, access https://fortress.wa.gov/ecy/wrx/wrx/Meteringx/. If you do not have Internet access, contact the Southwest Regional Office for forms to submit your data.

3. Chapter 173-173 WAC describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition Ecology for modifications to some of the requirements. Installation, operation, and maintenance requirements are enclosed as a document entitled "Water Measurement Device Installation and Operation Requirements."

4. Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable times, to the records of water use that are kept to meet the above conditions and may inspect, at reasonable times, any measuring device used to meet the above conditions.

Development Schedule

1. The development schedule shall be as follows:

RECEIVED
SEP 04 2001
Washington State

For Ecology Use
Fee Paid _____
Date _____

State of Washington
Application for a Water Right

Please follow the attached instructions to avoid unnecessary delays.

Section 1. APPLICANT - PERSON, ORGANIZATION, OR WATER SYSTEM

Name City of Camas Home Tel:( ) -
Mailing Address 616 NE 4th Ave. Work Tel:(360) 834 - 3451
City Camas State WA Zip+4 98607 + FAX:(360) 834 - 1535

Section 2. CONTACT - PERSON TO CALL ABOUT THE APPLICATION

☐ Same as above

Name Eric Levison Home Tel:( ) -
Mailing Address 616 NE 4th Ave. Work Tel:(360) 834 - 3451
City Camas State WA Zip+4 98607 + FAX:(360) 834 - 1535
Relationship to applicant Engineering Manager - City of Camas

Section 3. STATEMENT OF INTENT

Municipal

The applicant requests a permit to use not more than 1,000 (☒ gallons per minute or ☐ cubic feet per second) from a ☐ surface water source or ☒ ground water source (check only one) for the purpose(s) of Domestic/Public Supply. **ATTACH A "LEGAL" DESCRIPTION OF THE PLACE OF USE.** (See instructions.) *NOTE: A tax parcel number or a plat number is not sufficient.* Area served by City of Camas.
Estimate a maximum annual quantity to be used in acre-feet per year: 1200 AF/YR

☐ Check if the water use is proposed for a short-term project. Indicate the period of time that the water will be needed:
From ___/___/___ to ___/___/___

Section 4. WATER SOURCE

If SURFACE WATER	If GROUNDWATER
Name the water source and indicate if stream, spring, lake, etc. If unnamed, write "unnamed spring," "unnamed stream," etc.: Number of diversions:	A permit is desired for 2 well(s).
Source flows into (name of body of water):	Size & depth of well(s): 12-inch deep 150 feet deep

LOCATION

Enter the north-south and east-west distances in feet from the point of diversion or withdrawal to the nearest section corner: 1600 feet east and 1000 feet south of the NW 1/4 of Section 28, Township 2 North, Range 3 East

¼ of	¼ of	Section	Township	Range(E/W)	County	If location of source is platted, complete below: Lot	Block	Subdivision
NE	NW	28	2N	3E	Clark			

For Ecology Use Date Received: 9-4-01 Priority Date: 9.4.01
SEPA: Exempt/Not Exempt FERC License # Dept. Of Health #
Date Accepted As Complete 9-21-01 By SC Date Returned By WRIA: 28

ECY 040-1-14 Rev. 9/95 F

APPLICATION

Appl. No.: G2-30019

Q 9-3201d

98

Section 5. GENERAL WATER SYSTEM INFORMATION

A. Name of system, if named: Camas Municipal Water-Sewer System

B. Briefly describe your proposed water system. (See instructions.)

Two 12-inch supply wells will be constructed to depths of 150 feet. The wells will be used to provide water supply to municipal and industrial water users that are served by the City of Camas in the Lacamas Basin area. See 1996 Water System Plan documents for other related water system information.

C. Do you already have any water rights or claims associated with this property or system? ☒ YES ☐ NO
PROVIDE DOCUMENTATION. See list of City Water Rights and claims that are attached.

Section 6. DOMESTIC / PUBLIC WATER SUPPLY SYSTEM INFORMATION
(Completed for all domestic/public supply uses.)

A. Number of "connections" requested: 4896 (current number of connections) Type of connection Municipal Industrial Hookup (Homes, Apartment, Recreational, etc.)

B. Are you within the area of an approved water system? ☒ YES ☐ NO
If yes, explain why you are unable to connect to the system. *Note: Regional water systems are identified by your County Health Department.* The applicant (City of Camas) is the regional water provider.

Complete C. and D. only if the proposed water system will have fifteen or more connections.

C. Do you have a current water system plan approved by the Washington State Department of Health? ☒ YES ☐ NO
If yes, when was it approved? 1996 Please attach the current approved version of your plan.
Note: City is currently updating water system plan. New plan should be approved in early 2002.

D. Do you have an approved conservation plan? ☒ YES ☐ NO
If yes, when was it approved? 1996 Please attach the current approved version of your plan.
Note: Water Conservation Plan incorporated into 1996 Water System Plan, which is currently being updated.

Section 7. IRRIGATION/AGRICULTURAL/FARM INFORMATION
(Complete for all irrigation and agriculture uses.) N/A

A. Total number of acres to be irrigated: _____

B. List total number of acres for other specified agricultural uses:

Use _____ Acres _____
Use _____ Acres _____
Use _____ Acres _____

C. Total number of acres to be covered by this application: _____

D. Family Farm Act (Initiative Measure Number 59, November 3, 1977)
Add up the acreage in which you have a controlling interest, including only:
‡ Acreage irrigated under water rights acquired after December 8, 1977;
‡ Acreage proposed to be irrigated under this application;
‡ Acreage proposed to be irrigated under other pending application(s).

1. Is the combined acreage greater than 2000 acres? ☐ YES ☐ NO
2. Do you have a controlling interest in a Family Farm Development Permit? ☐ YES ☐ NO
If yes, enter permit no: _____

E. Farm uses:
Stockwater - Total # of animals _____ Animal type _____ (If dairy cattle, see below)
Dairy - # Milking _____ # Non-milking _____

Section 8. WATER STORAGE

Will you be using a dam, dike, or other structure to retain or store water? ☐ YES ☒ NO

NOTE: If you will be storing 10 acre-feet or more of water and/or if the water depth will be 10 feet or more at the deepest point, and some portion of the storage will be above grade, you must also apply for a reservoir permit. You can get a reservoir permit application from the Department of Ecology.

Section 9. DRIVING DIRECTIONS

Provide detailed driving instructions to the project site. From Lacey, WA, go southbound on I-5. Take I-205 exit at Hazel Dell. Proceed southbound on I-205 to SR-14. Take SR-14 eastbound to Brady Road. Proceed north on Brady Road which turns into NW Parker Avenue. Continue northbound on NW Parker to SE 1st Street. Go westbound on NW 1st to 216th Ave. Take 216th Ave. northbound to Camas Meadows Golf Course. Take service road through golf course to well site.

Section 10. REQUIRED MAP

A. Attach a map of the project. (See instructions.)

Section 11. PROPERTY OWNERSHIP

A. Does the applicant own the land on which the water will be used? ☐ YES ☒ NO
If no, explain the applicant's interest in the place of use and provide the name(s) and address(es) of the owner(s):

The City will use the water for supply within their service area.

B. Does the applicant own the land on which the water source is located? ☐ YES ☒ NO
If no, submit a copy of agreement:
The City will purchase property as part of the supply well development.

I certify that the information above is true and accurate to the best of my knowledge. I understand that in order to process my application, I grant staff from the Department of Ecology access to the site for inspection and monitoring purposes. Even though I may have been assisted in the preparation of the above application by the employees of the Department of Ecology, all responsibility for the accuracy of the information rests with me.

CITY OF CAMAS E. Levison ERIC LEVISON — 8/29/01
Applicant (or authorized representative) — Date

Landowner for place of use (if same as applicant, write "same") — Date

Use this page to continue your answers to any questions on the application. Please indicate section number before answer.

We are returning your application for the following reason(s):	
_____ Examination fee was not enclosed	APPLICANT PLEASE RETURN TO CASHIER, PO BOX 5128, LACEY, WA 98509-5128
_____ Section number(s) _____ is/are incomplete	APPLICANT PLEASE RETURN TO THE APPROPRIATE REGIONAL OFFICE
Explanation:	
Please provide the additional information requested above and return your application by _____ _____ *(date).*	

Ecology staff_____ Date_____

To receive this document in alternative format, contact Lisa Newman at (360) 407-6604 (Voice) or (360) 407-6006 (TDD).

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
P.O. Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

October 1, 2001

City of Camas
Attn Eric Levison
616 NE 4th Avenue
Camas WA 98607

Re: Water Right Application No. G2-30018

This letter is to acknowledge that the Washington State Department of Ecology received your water right application. We have assigned your application the number indicated above. Please include this number in future correspondence regarding your application with the Department of Ecology.

When we begin actively evaluating applications in your area, we will prepare a public notice and send it to you with publication instructions. It will be sometime before we are able to begin working in your area. In the meantime, please notify Ecology of changes such as address, property ownership, or variations in your proposed water use plans.

The availability of water in Washington state is a serious problem. Much of the water in our state has already been appropriated. The competition for water has escalated with our state's increasing population, conflicting water policy issues, and grave declines in salmon and other fish populations. A new watershed management law brings us a step closer to addressing some of these issues. It sets into motion a locally based process to address water quantity, quality, and habitat issues. Watershed management will help meet challenges for getting water to people, industries, farms, and fish.

In some areas of the state, we are continuing to evaluate applications within watersheds where we have previously gathered information and completed watershed assessments. We are also continuing to process water right permit or change applications that are intended to address public health and safety emergencies, the natural environment, or are for nonconsumptive withdrawals. All other applications are grouped by watershed and processed according to the date of submittal, and when we have enough information and staff resources to make decisions.

If you would like further information on your application, please contact the Southwest Regional Office at (360) 407-0240.

Sincerely,

J. Mike Harris

J. Mike Harris
Water Resources Supervisor
Southwest Regional Office

JMH:th (applet.doc)

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
P.O. Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

October 1, 2001

City of Camas
Attn Eric Levison
616 NE 4th Avenue
Camas WA 98607

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Sincerely,

J. Mike Harris

J. Mike Harris
Water Resources Supervisor
Southwest Regional Office

JMH:th (applet.doc)

CITY OF CAMAS
616 Northeast Fourth Avenue
P.O. Box 1055
Camas, Washington 98607
http://www.ci.camas.wa.us

RECEIVED
DEPT. OF ECOLOGY/SWRO

'01 SEP -4 A10 :37

August 29, 2001

DEPARTMENT OF PUBLIC WORKS

Mr. Mike Harris
Department of Ecology
300 Desmond Drive
P.O. Box 47600
Olympia, WA 98504-7600

Subject: ***Water Right Application Submittals***
City of Camas

Dear Mr. Harris:

Enclosed you will find two water right applications along with the statutory examination fee of $10.00 for each water right application (total of $20.00). The enclosed applications are for new water supply sources in the Lacamas Basin.

The City of Camas would like to develop three new supply wells under these applications to meet the rapid growth, which is occurring in the western portion of our service area. We recently completed an extensive test well drilling program in this area. The results of the exploratory drilling and aquifer testing are summarized in the attached report titled *City of Camas, Westside Test Well Drilling Program (PGG, 2001).*

At your convenience, we would like to schedule a meeting with you and your staff to discuss the results of our test well program and strategies for obtaining water right permits for new production wells.

We appreciate your assistance on this matter.

Sincerely,

Eric Levison
Engineering Manager

Enclosures: Water Right Applications

rls:g:\pworks\eric\harris 082901.doc

Printed By: Dawn Merryman
On: 09/07/2001 At: 10:10 am

RECEIPT

Receipt Number **02-00512**

Department of Ecology (4610)
PO Box 5128
Lacey, WA 98509-5128
(360) 407-7095

Current Document Number **461G0355CJ** Date **09/10/2001** FM **03**

Remitter Name **CAMAS CITY** Receipt Name

Check/Draw Number **4149**
Document Amount **$20.00**
Method of Payment **Check**
Comment Description **WATER RIGHTS**

Ref Doc Nr	Ref Doc Sfx	Inv Nr	Id Nr	Prgm Cd	T C	R	Fund	Maj Grp	Maj Src	Sub Src	Cnty	Work Cls	PIC	AI	Org	Prj	Sub Prj	Prj Phs	Sub Obj	Sub Sub Obj	Var GL	Sub Sid Dr	Sub Sid Cr	Alloc Amt
				H00	001		001	02	85	000010														$20.00

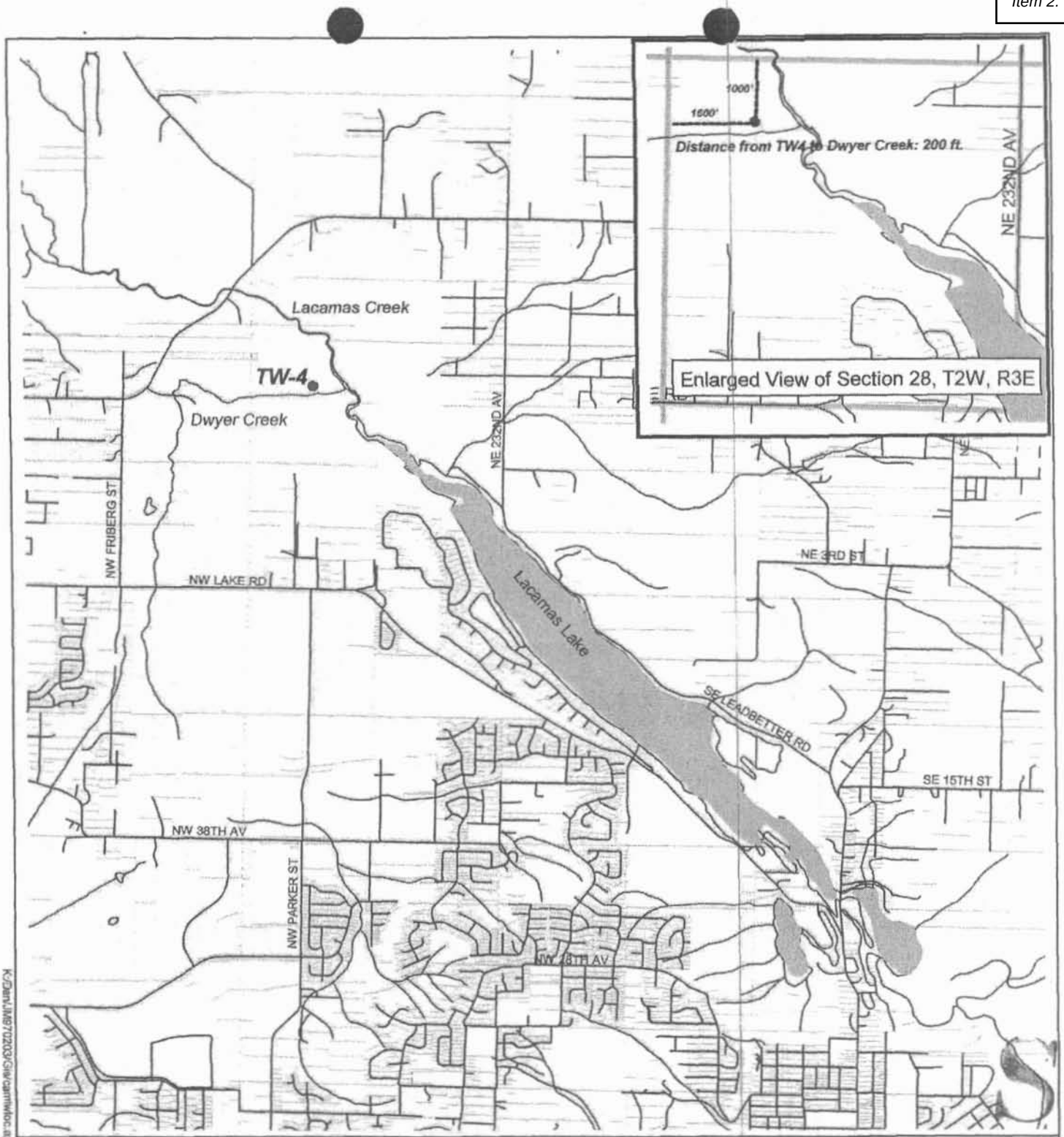
1622

TABLE 1-3

City of Camas Water Right Summary

Source	Location of Diversion	Identification Number	Priority Date	Instantaneous Quantity Q_i (gpm)	Annual Quantity Q_a (ac-ft/yr.)
Claims					
Well No. 1	2159 ft. N, 667 ft. E, from the SW corner, S12, T1N, R3E	121022	6/11/74	900	320(1)
Well No. 2	2152 ft. N, 731 ft. E, from the SW corner, S12, T1N, R3E	121023	6/11/74	900	230(1)
Certificates					
Boulder Creek	(need this info)	S 712 C	8/22/23	1120 [2.5 cfs]	1820(2) (P)
Jones Creek	SE1/4, SW1/4, S3, T2N,R4E	S 711 C	9/5/30	450 [1.0 cfs]	730(3) (P)
Well No. 3	NW1/4, SW1/4, S12,T1N, R3E	G 85-A C	7/21/45	1200	118 (P)
Well No. 4	W1/2, NW1/4, S12, T1N, R3E	G 4072-A C	2/12/59	1325	1208 (S)
Well No. 5	Lot 9 of Orchard Homes, 2760 ft. E, 840 ft. N from SW corner, S12, T1N, R3E	G 6636-A C	3/22/68	600	920(4) (P)
Well No. 6	2300 ft. E, 1800 ft. N from SW corner, S12, T1N, R3E	G 6635-A C	3/22/68	1500	2400(4) (P)
Well No. 7	1245 ft. E, 2145 ft. N from SW corner, S12, T1N, R3E	G2-00501 C	3/22/71	1000	530(5) (P)
Well No. 8	1375 ft. E, 2145 ft. N from SW corner, S12, T1N, R 3E	G2-24400 C	2/4/77	900	530(5) (P)
Permits					
Well No. 9	600 ft. S, 700 ft. W from N1/4 corner, S4, T1N, R3E	G4-27384 P	8/13/86	650	210(5) (S)
Total	Sum of all existing water right certificates and permits. **These values do not include claims.**			**SW = 1570 gpm GW = 7175 gpm Total = 8745 gpm**	**SW = 2550 ac-ft. GW = 3200 ac-ft. Total = 5750 ac-ft.**

(1) Claims must go through an adjudication procedure in state court to determine validity.
(2) This source was formerly known as the Little Washougal River. The certificate refers to an instantaneous quantity (Q_i) and does not specify an annual withdrawal. A DOE Report of Examination for Well No. 7 (G2-00501 C) summarizes existing water rights including 1820 ac-ft/yr. for Boulder Creek (S 712 C) based on continuous withdrawal at the instantaneous right specified.
(3) The certificate refers to an instantaneous quantity (Q_i) and does not specify an annual withdrawal. A DOE Report of Examination for Well No. 7 (G2-00501 C) summarizes existing water rights including 730 ac-ft/yr. for Jones Creek (S 711 C) based on continuous withdrawal at the instantaneous right specified.
(4) The Permit and Report of Examination preceding this certificate limited water rights to "the total quantity withdrawn or diverted from all sources is not to exceed 3300 ac-ft/yr."
(5) The Permit and Report of Examination preceding this certificate provided for "the total amount of water to be withdrawn or diverted, which includes the amounts as approved in Surface Water Certificates No. 711 and 712 and Ground Water Certificates No. 85,4072, 6635, 6636, shall not exceed 5750 ac-ft/yr."
(P) Primary water right, additive to other rights.
(S) Supplemental water right, not additive or considered when summing a cumulative total of all rights.



Legend

- Proposed Supply Well Site
- Roads
- Parcels
- Rivers, Streams
- Water bodies

0 4000 Feet

Figure 1
Proposed Well Location Map

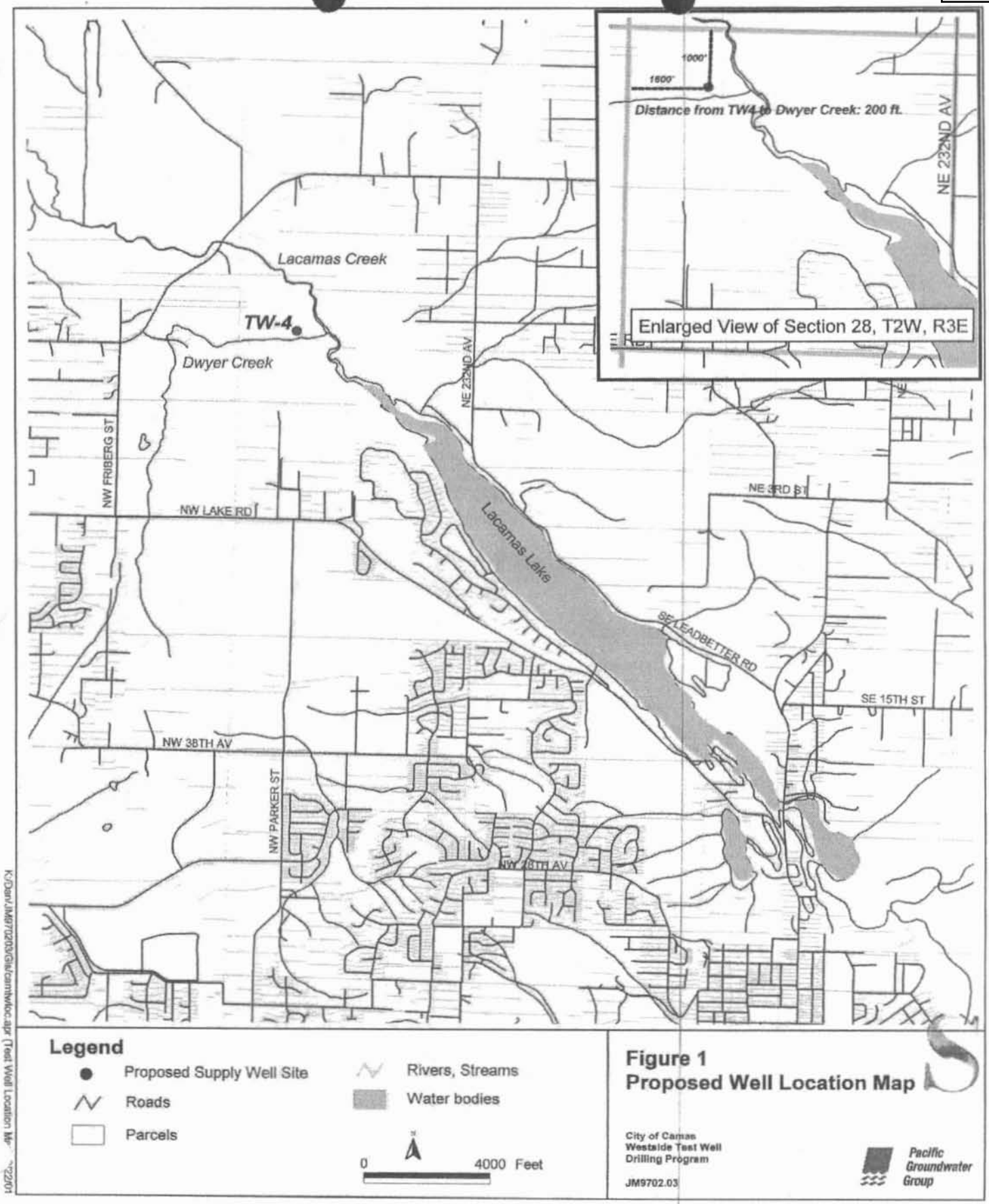
City of Camas
Westside Test Well
Drilling Program

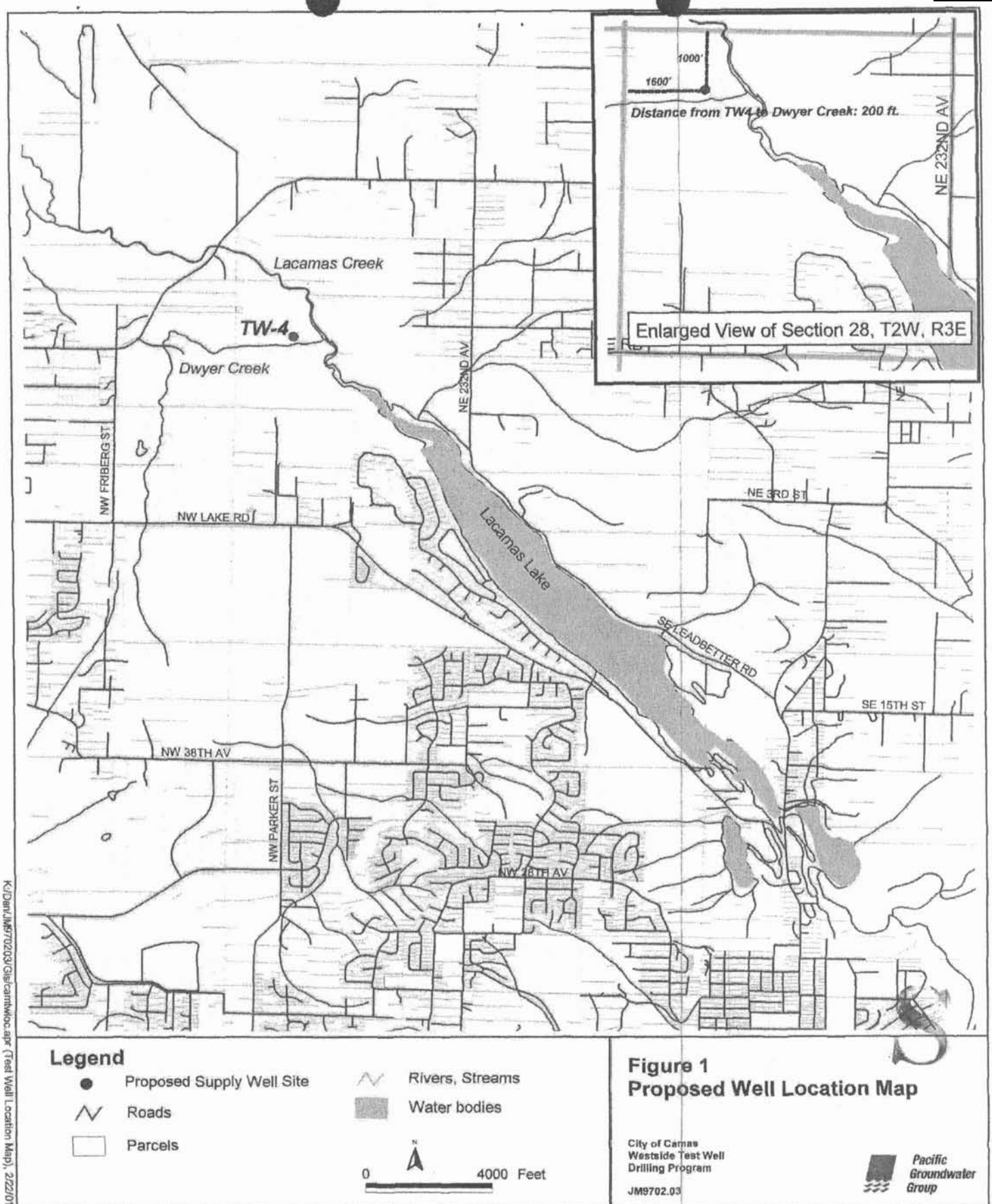
JM9702.03

Pacific Groundwater Group

K:\Dan\JM9702\03\Siw\camwloc.apr (Test Well Location Map), 2/22/01

1624


Enlarged View of Section 28, T2W, R3E
1000'
1600'
Distance from TW4 to Dwyer Creek: 200 ft.
NE 232ND AV
Lacamas Creek
TW-4
Dwyer Creek
NW FRIBERG ST
NW LAKE RD
NE 3RD ST
Lacamas Lake
SE LEADBETTER RD
SE 15TH ST
NW 38TH AV
NW PARKER ST
Legend
Proposed Supply Well Site
Roads
Parcels
Rivers, Streams
Water bodies
0
4000 Feet
Figure 1
Proposed Well Location Map
City of Camas
Westside Test Well
Drilling Program
JM9702.03
Pacific Groundwater Group



K:\Dart\JM9702\03\Gis\camtwloc.apr (Test Well Location Map), 2/22/01

Item 2.

Account Transfers | Recurring Transfers | Third-Party Transfers | External Transfers
IRA/ESA Certificate Add-On

Third Party Transfer Confirmation

Transfer of funds successfully completed. See the new account balances below.

From Account:	Share Savings 1274297009 KENNETH C ALEXANDER
From Account Balance:	$14.25
To Account:	EveryDay Checking 1274297710 ERNESTINE P ALEXANDER
Payment Amount:	$3,325.00
Effective Date:	03/09/2009
Confirmation Number:	304756

Print Receipt

1627

ROTORK CONTROLS, INC.
SCOPE OF WORK
START UP/COMMISSIONING OF ROTORK ACTUATORS

JOB SITE LOCATION: WARDEN, WASHINGTON

Rotork Field Engineer will:

1. Inspect all installed Rotork actuators for proper orientation.
2. Inspect all installed Rotork actuators for proper wiring terminations.
3. Electrically power up Rotork actuators and perform initial programming.
4. Set both the Open and Closed limits on the Rotork actuators.
5. Electrically stroke all valves with Rotork actuators to ensure proper operation.
6. Provide customer with the Field Service Report for their records.
7. Correct any discrepancies found during this course of work.

rotork
factory service

2180 South Mc Dowell Blvd. Suite B
Petaluma, CA 94954
Phone: (707) 769-4880
Fax: (707) 769-4888

Service Report

Job No.:
Engineer:
Date:
Site:

Site Contact:
Phone Number:
Date Service Performed:
PO Number:
Type of Service:

Serial Number:	**Type:**	**WD:**	**RPM:**	**Volts:**
Gearbox Type:	**Valve Type:**		**Service Type:**	**Valve Tag No:**

Reported Problem:

Work Completed:

If there is additional work needed, please explain:

Rotork Site Training Syllabus (for IQT)

I. Introduction to Rotork

A. Tech introduction
B. Rotork Controls, Inc.
C. Types and models of actuators. Sizing, classifications. Nameplates.
D. Documentation, Rotork.com
1) IQT- E110, E120, E175, E185, Wiring diagrams

II. IQT

A. Nomenclature and parts ID.
1) Gearcase, center column, drive bushings, battery, seals and o-rings.
2) Motor & wormwheel, resolver.
3) Handwheel, hand/auto lever, H/A cover.
4) Electronics- Cover (UV Window/ local controls), main pcb, power module, motor control pcb
5) Options, if applicable

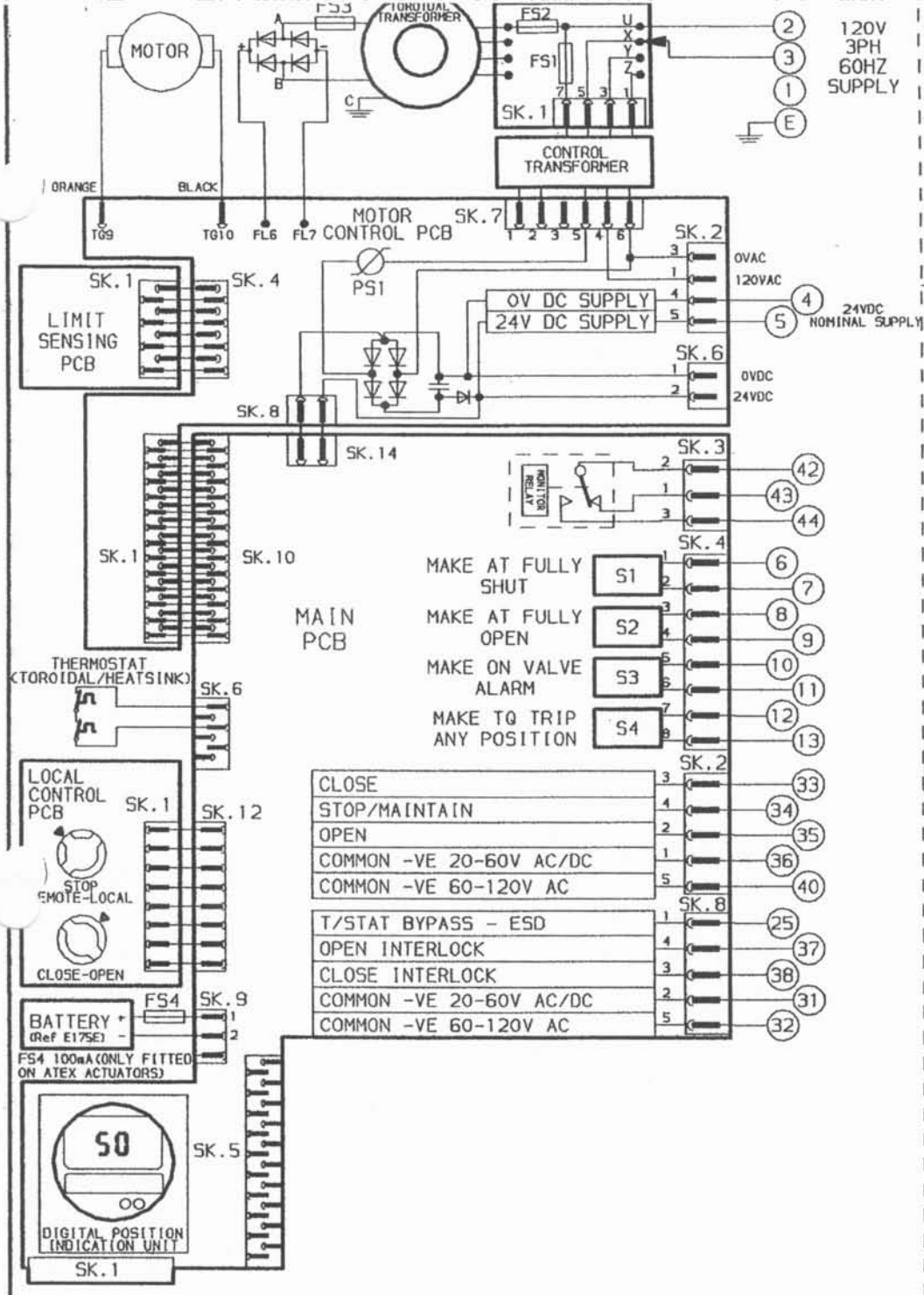
III. Operation, set-up and calibration (using live demo actuator)

A. Manual operation B. Setting tool and display
C. Menu structure and functions
1) Torque display, password screen
2) Primary functions- open/close action, torque setting, limit setting.
3) Secondary functions-Indication, ESD(emerg shut down), options, IQT type and speed.
D. Local operation
E. Remote operation
1) Remote voltage supplies 2) Remote control configurations 3) Network options
F. Installation and adaption
G.Troubleshooting
1) Alarms 2) Help screens 3) Common faults and checks
H. Maintenance - 1) Lubrication 2) inspection 3) spares

IV. Advanced Functions and Utilities (using laptop and PDA)

A. Insight
B. Configuration Files
C. Datalogger files
1) Torque profiles (for baseline files/trending, torque issues)
2) Event logging and review

V. Conclusion- Review and Follow-up



RWS300

TRANSFORMER TAPPING

TYPE 1

TAP	NOM	RANGE
Z	120	96-144
FS1-250mA A/S FS2-5A A/S		

FUSE FS3 - 20A ATO FAST ACTING

PS1 SELF RESETTING FUSE

NOTE

REFER TO PUBLICATION E175E FOR APPROVED FUSES FS1, FS2 AND FS3.

MAX EXTERNAL LOAD ON TERMINALS 4 & 5 TO BE 5W.

CONTROL SIGNAL THRESHOLD VOLTAGES TO BE MINIMUM 'ON' 20V AC/DC
MAXIMUM 'OFF'= 3V
MINIMUM CONTROL SIGNAL DURATION TO BE 300mS.

CURRENT DRAWN FROM EACH REMOTE CONTROL SIGNAL IS 5mA ON 24V DC OR 12mA ON 120V AC

WIRES ARE IDENTIFIED AT EACH END BY TERMINAL No. OR TAG No.

INDICATION CONTACTS S1-S4 ARE SHOWN IN THEIR DEFAULT CONFIGURATION. CONTACTS MAY BE CONFIGURED FOR ANY OF THE FUNCTIONS DESCRIBED IN E175E

IQT

No	DATE	REVISION DETAILS
01	061008	FIRST ISSUE

www.rotork.com

CONFIG BY TPW
DATE 061008

6000-000 B1, C1, 41, M1
CUSTOMER SPECIFIC

1631

Rotork Site Training Syllabus (for IQMKII)

I. Introduction to Rotork

A. Tech introduction
B. Rotork Controls, Inc.
C. Types and models of actuators. Sizing, classifications. Nameplates.
D. Documentation, Rotork.com
1) IQMKII- E110, E120, E170E2, E170E3, E180, Wiring diagrams

II. IQMKII

A. Nomenclature and parts ID.
1) Gearcase, center column, resolver drive, battery, terminal block/cover, seals and o-rings.
2) Motor & wormwheel, torque transducer (piezo assembly).
3) Handwheel (THW, SHW), Hand/Auto (H/A) lever
4) Electronics- Cover (UV window, local controls), main pcb, power module, resolver
5) Bases, drive bushings.
6) Options, gearboxes, if applicable

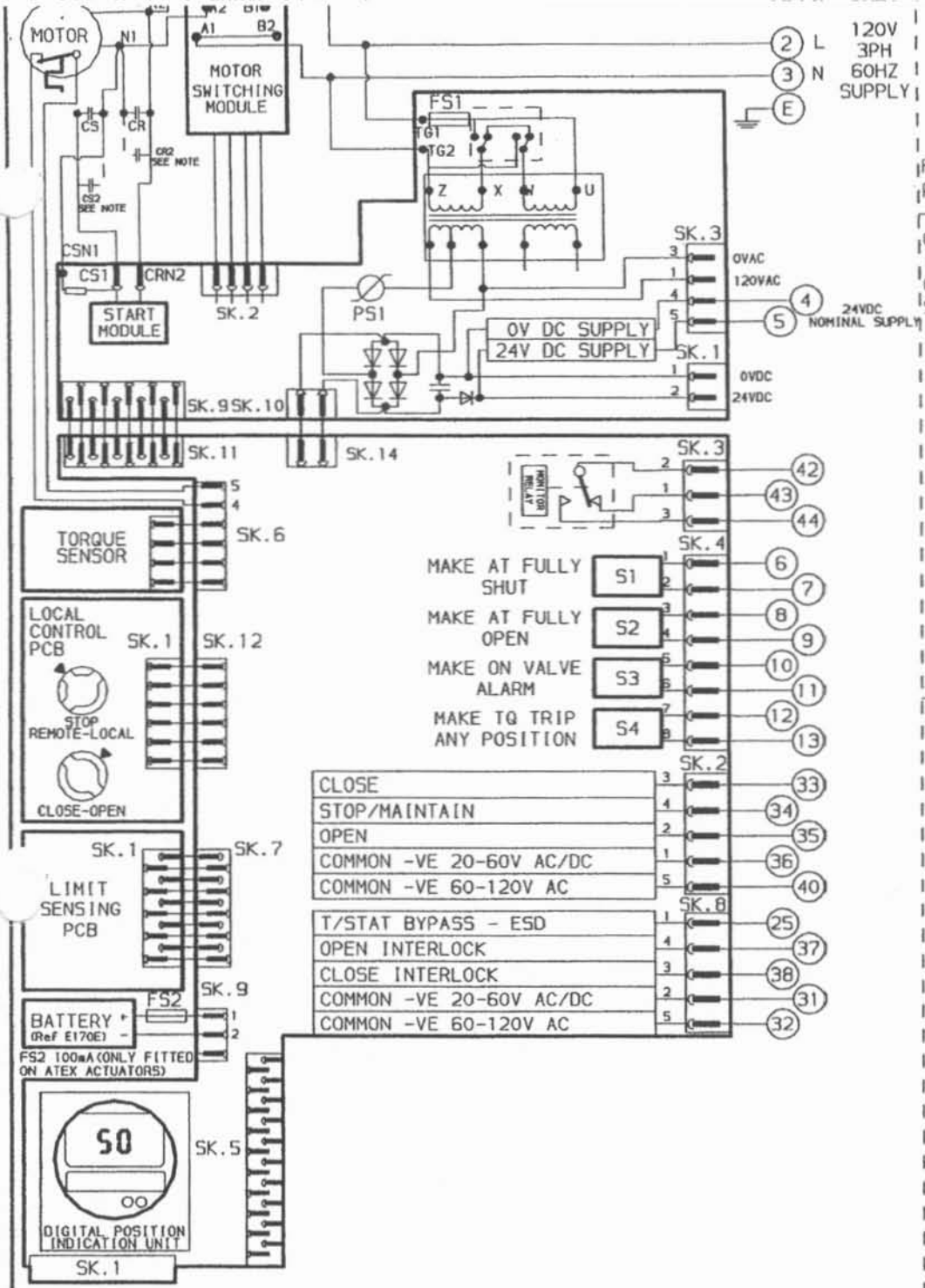
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B. Configuration Files
C. Datalogger files
1) Torque profiles (for baseline files/trending, torque issues)
2) Event logging and review

V. Conclusion- Review and Follow-up



RWS300

TRANSFORMER TAPPING

VOLTAGE	60HZ
LOW	92-135

FUSE FS1 - 500mA ANTI-SURGE
PS1 SELF RESETTING FUSE.

CAPACITOR START/RUN
(CS/CS2 and CR/CR2)
COMBINATIONS & VALUES VARY WITH
SUPPLY VOLTAGE & ACTUATOR SIZE.

NOTE

REFER TO PUBLICATION E170E FOR APPROVED FUSES FS1 AND FS2.

MAX EXTERNAL LOAD ON TERMINALS 4 & 5 TO BE 5W.

CONTROL SIGNAL THRESHOLD VOLTAGES
TO BE MINIMUM 'ON' 20V AC/DC
MAXIMUM 'OFF'= 3V
MINIMUM CONTROL SIGNAL DURATION
TO BE 300mS.

CURRENT DRAWN FROM EACH REMOTE CONTROL SIGNAL IS 5mA ON 24V DC OR 12mA ON 120V AC

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1Q

No	DATE	REVISION DETAILS
01	061008	FIRST ISSUE

www.rotork.com

CONFIG BY TPW
DATE 061008

3001-000 B1, C1, 41, M1
CUSTOMER SPEC

1633

CITY OF CAMAS
616 Northeast Fourth Avenue
P.O. Box 1055
Camas, Washington 98607
http://www.ci.camas.wa.us

RECEIVED
DEPT. OF ECOLOGY/SWRO

'01 SEP -4 A10 :37

August 29, 2001

DEPARTMENT OF PUBLIC WORKS

Mr. Mike Harris
Department of Ecology
300 Desmond Drive
P.O. Box 47600
Olympia, WA 98504-7600

Subject: ***Water Right Application Submittals***
City of Camas

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We appreciate your assistance on this matter.

Sincerely,

Eric Levison
Engineering Manager

Enclosures: Water Right Applications

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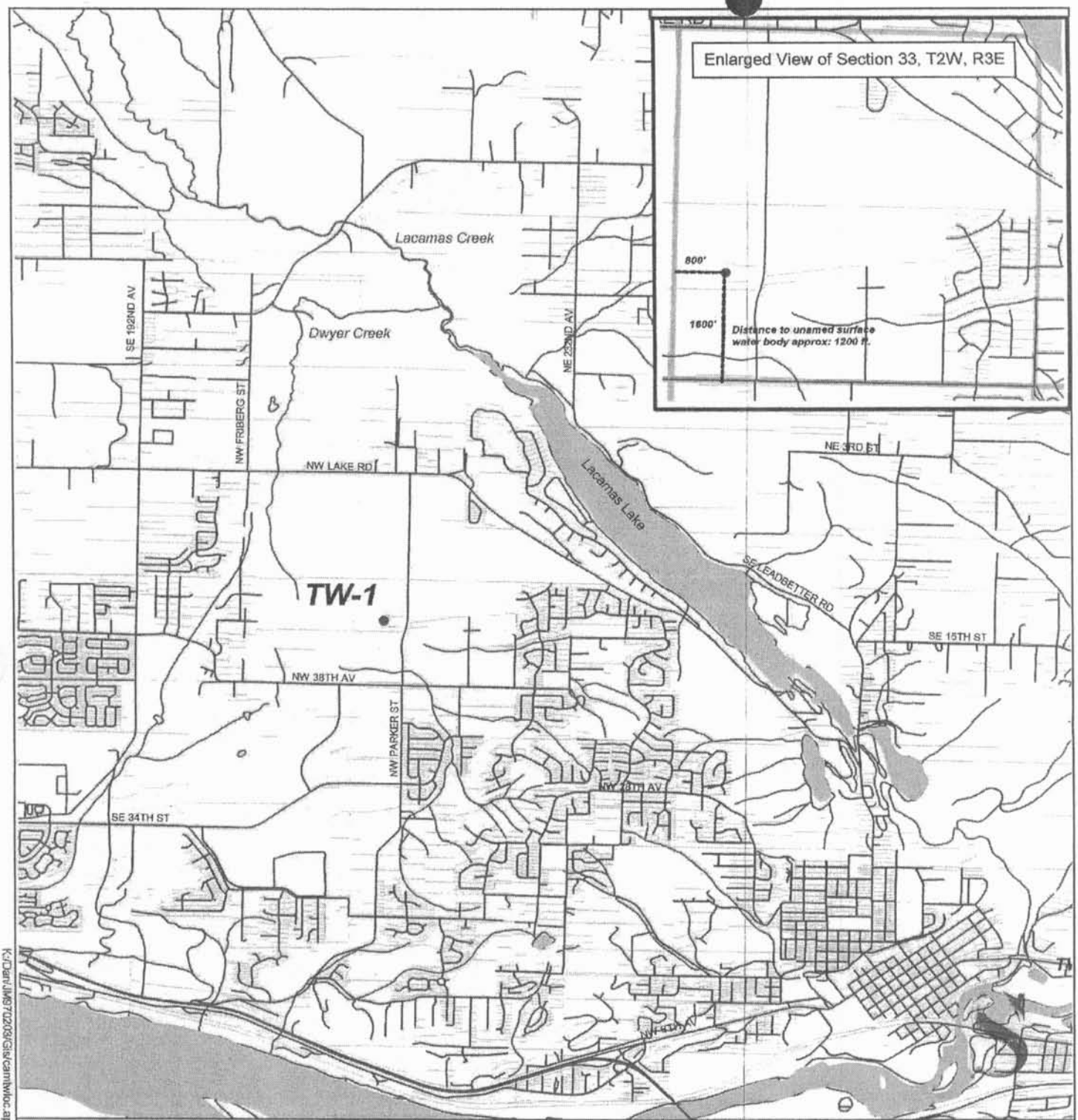


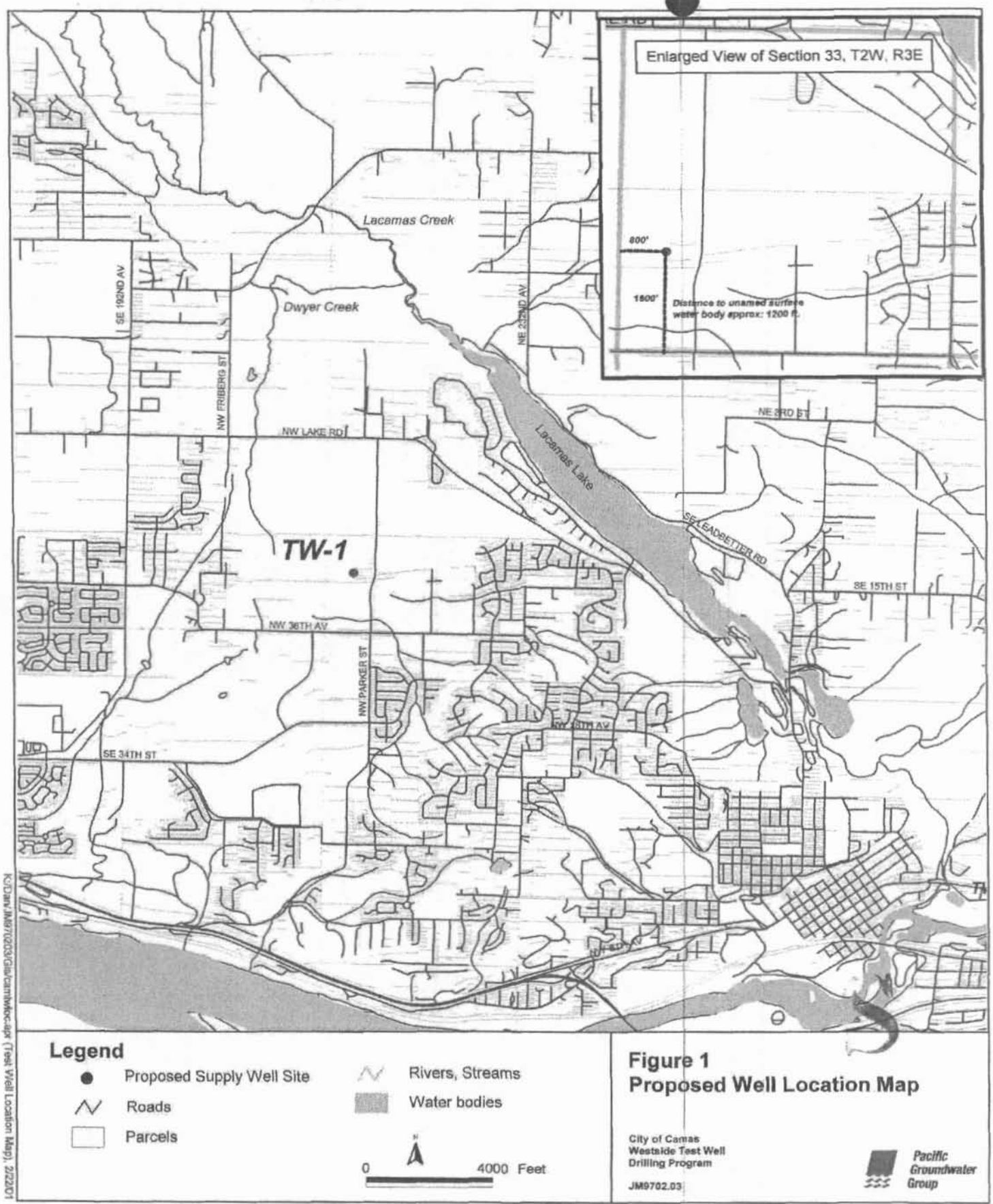
Figure 1
Proposed Well Location Map

City of Camas
Westside Test Well
Drilling Program

JM9702.03

Pacific Groundwater Group

K:\Darv\JM9702\03\Gis\camtwloc.apr (Test Well Location Map) 1/22/01



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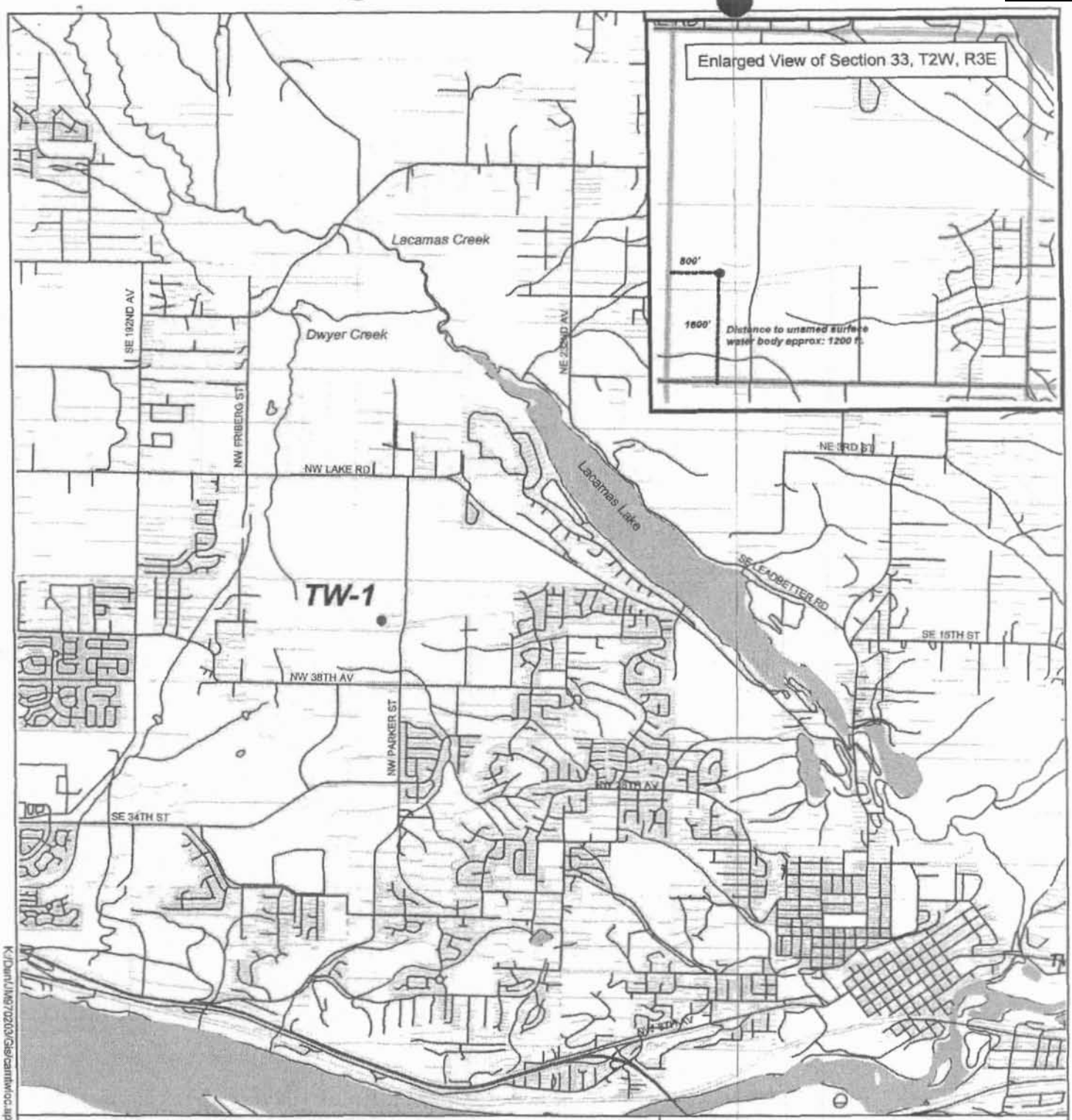


Figure 1
Proposed Well Location Map

City of Camas
Westside Test Well
Drilling Program
JM9702.03

Pacific Groundwater Group

K:\Dwrt\JM9702\03\Gis\camtwloc.apr (Test Well Location Map), 2/22/01

TABLE 1-3

City of Camas Water Right Summary

Source	Location of Diversion	Identification Number	Priority Date	Instantaneous Quantity Q_i (gpm)	Annual Quantity Q_a (ac-ft/yr.)
Claims					
Well No. 1	2159 ft. N, 667 ft. E, from the SW corner, S12, T1N, R3E	121022	6/11/74	900	320(1)
Well No. 2	2152 ft. N, 731 ft. E, from the SW corner, S12, T1N, R3E	121023	6/11/74	900	230(1)
Certificates					
Boulder Creek	(need this info)	S 712 C	8/22/23	1120 [2.5 cfs]	1820(2) (P)
Jones Creek	SE1/4, SW1/4, S3, T2N,R4E	S 711 C	9/5/30	450 [1.0 cfs]	730(3) (P)
Well No. 3	NW1/4, SW1/4, S12,T1N, R3E	G 85-A C	7/21/45	1200	118 (P)
Well No. 4	W1/2, NW1/4, S12, T1N, R3E	G 4072-A C	2/12/59	1325	1208 (S)
Well No. 5	Lot 9 of Orchard Homes, 2760 ft. E, 840 ft. N from SW corner, S12, T1N, R3E	G 6636-A C	3/22/68	600	920(4) (P)
Well No. 6	2300 ft. E, 1800 ft. N from SW corner, S12, T1N, R3E	G 6635-A C	3/22/68	1500	2400(4) (P)
Well No. 7	1245 ft. E, 2145 ft. N from SW corner, S12, T1N, R3E	G2-00501 C	3/22/71	1000	530(5) (P)
Well No. 8	1375 ft. E, 2145 ft. N from SW corner, S12, T1N, R 3E	G2-24400 C	2/4/77	900	530(5) (P)
Permits					
Well No. 9	600 ft. S, 700 ft. W from N1/4 corner, S4, T1N, R3E	G4-27384 P	8/13/86	650	210(5) (S)
Total	Sum of all existing water right certificates and permits. These values do not include claims.			**SW = 1570 gpm GW = 7175 gpm Total = 8745 gpm**	**SW = 2550 ac-ft. GW = 3200 ac-ft. Total = 5750 ac-ft.**

(1) Claims must go through an adjudication procedure in state court to determine validity.
(2) This source was formerly know as the Little Washougal River. The certificate refers to an instantaneous quantity (Q_i) and does not specify an annual withdrawal. A DOE Report of Examination for Well No. 7 (G2-00501 C) summarizes existing water rights including 1820 ac-ft/yr. for Boulder Creek (S 712 C) based on continuous withdrawal at the instantaneous right specified.
(3) The certificate refers to an instantaneous quantity (Q_i) and does not specify an annual withdrawal. A DOE Report of Examination for Well No. 7 (G2-00501 C) summarizes existing water rights including 730 ac-ft/yr. for Jones Creek (S 711 C) based on continuous withdrawal at the instantaneous right specified.
(4) The Permit and Report of Examination preceding this certificate limited water rights to "the total quantity withdrawn or diverted from all sources is not to exceed 3300 ac-ft/yr."
(5) The Permit and Report of Examination preceding this certificate provided for "the total amount of water to be withdrawn or diverted, which includes the amounts as approved in Surface Water Certificates No. 711 and 712 and Ground Water Certificates No. 85,4072, 6635, 6636, shall not exceed 5750 ac-ft/yr."
(P) Primary water right, additive to other rights.
(S) Supplemental water right, not additive or considered when summing a cumulative total of all rights.

Printed By: Dawn Merryman
On: 09/07/2001 At: 10:10 am

RECEIPT

Receipt Number 02-0051

Department of Ecology (4610)
PO Box 5128
Lacey, WA 98509-5128
(360) 407-7095

Current Document Number 461G0355CJ Date 09/10/2001 FM 03

Remitter Name CAMAS CITY Receipt Name

Check/Draw Number 4149
Document Amount $20.00
Method of Payment Check
Comment Description WATER RIGHTS

Ref Doc Nr	Ref Doc Sfx	Inv Nr	Id Nr	Prgm Cd	T C	R	Fund	Maj Grp	Maj Src	Sub Src	Cnty	Work Cls	PIC	AI	Org	Prj	Sub Prj	Prj Phs	Sub Obj	Sub Sub Obj	Var GL	Sub Sid Dr	Sub Sid Cr	Alloc Amt
				H00	001		001	02	85	000010														$20.00

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RECEIVED
DEPT. OF ECOLOGY/SWRO
'01 NOV -5 A11 :26

State of Washington
DEPARTMENT OF FISH AND WILDLIFE
Mailing Address: 600 Capitol Way N • Olympia, WA 98501-1091 • (360) 902-2200, TDD (360) 902-2207
Main Office Location: Natural Resources Building • 1111 Washington Street SE • Olympia, WA

October 31, 2001

Department of Ecology
Southwest Regional Office
7272 Cleanwater Lane
Olympia, Washington 98504-6811

WATER RIGHT APPLICATION REVIEW

Application Number: G230018

Applicant: City of Camas
616 NE 4th Avenue
Camas, Washington 98607

WRIA: 28
Water: Well near Lacamas Lake and the Columbia River.
This water and/or affected reaches downstream are inhabited by:

Based on: ☐ Site-specific observations ☐ WDFW database or GIS
☐ Literature ☐ Knowledge of this type of stream

Amount: cfs 359.00 gpm 300.00 acre-ft
Point of diversion: NW1/4 SW1/4 of S33 T2N R3E.
Point of use:

WDFW recommended conditions:

☐ Instream flows in WAC 173-5

☐ This water right should be subject to any established lake levels, if any.

Instream flows based on: ☐ IFIM study ☐ USGS toe-width ☐ Tennant
☐ Other:

WDFW requests that water right be subject to the following instream flows or natural flow, whichever is less:

Jan
Feb
Mar
Apr
May
Jun

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Jul
Aug
Sep
Oct
Nov
Dec

Instream flows to be measured at:

Other conditions requested by WDFW indicated by ☐:

☐ HPA

☐ Screen intake if accessible to fish (to be determined during application for HPA) according to WDFW standards.

☐ Based upon review of fish resources present, type and amount of water use, condition of habitat, and amount of water available, WDFW REQUESTS DENIAL of this application, in accordance with RCW 75.20.050, IF THIS SPACE IS CHECKED.

☐ WDFW recommends modification of this proposal to minimize impacts to fish.

☐ WDFW is a landowner and water user that will be affected by this proposed use.

☐ Please HOLD this application pending field review. WDFW staff will provide detailed response by

☐ Granting this water right application would adversely affect WDFW's existing water rights for a facility. We request the following conditions for this water right if it is granted.

Rationale for WDFW recommendations if not based on existing rules or statutes: WDFW has no objections to this application.

Additional Comments:

Karen Kloempken

Karen Kloempken
Water Rights Biologist
360-902-2615
Fax: 360-902-2946
E-mail: kloemkak@dfw.wa.gov

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1641

ECOLOGY

State of Washington
Application for a Water Right

Please follow the attached instructions to avoid unnecessary delays.

For Ecology Use
Fee Paid _____
Date _____

Section 1. APPLICANT - PERSON, ORGANIZATION, OR WATER SYSTEM

Name City of Camas Home Tel:( ) -

Mailing Address 616 NE 4th Ave. Work Tel:(360) 834 - 3451

City Camas State WA Zip+4 98607 + FAX:(360) 834 - 1535

Section 2. CONTACT - PERSON TO CALL ABOUT THE APPLICATION

☐ Same as above

Name Eric Levison Home Tel:( ) -

Mailing Address 616 NE 4th Ave. Work Tel:(360) 834 - 3451

City Camas State WA Zip+4 98607 + FAX:(360) 834 - 1535

Relationship to applicant Engineering Manager - City of Camas

Section 3. STATEMENT OF INTENT

Municipal

The applicant requests a permit to use not more than 350 (☒ gallons per minute or ☐ cubic feet per second) from a ☐ surface water source or ☒ ground water source (check only one) for the purpose(s) of Domestic/Public Supply. **ATTACH A "LEGAL" DESCRIPTION OF THE PLACE OF USE.** (See instructions.) *NOTE: A tax parcel number or a plat number is not sufficient.* Area served by City of Camas

Estimate a maximum annual quantity to be used in acre-feet per year: 300 AF/YR

☐ Check if the water use is proposed for a short-term project. Indicate the period of time that the water will be needed:

From ___/___/___ to ___/___/___

Section 4. WATER SOURCE

If SURFACE WATER	If GROUNDWATER
Name the water source and indicate if stream, spring, lake, etc. If unnamed, write "unnamed spring," "unnamed stream," etc.: Number of diversions:	A permit is desired for 1 well(s).
Source flows into (name of body of water):	Size & depth of well(s): 12-inch well 400 feet deep

LOCATION

Enter the north-south and east-west distances in feet from the point of diversion or withdrawal to the nearest section corner: 1600 feet north and 800 feet east of the SW 1/4 of Section 33, Township 2 North, Range 3 East

¼ of	¼ of	Section	Township	Range(E/W)	County	If location of source is platted, complete below: Lot	Block	Subdivision
NW	SW	33	2N	3E	Clark			

For Ecology Use Date Received: 9-4-01 Priority Date: 9-4-01

SEPA: Exempt/Not Exempt FERC License # Dept. Of Health #

Date Accepted As Complete 9-21-01 By SC Date Returned By WRIA 28

ECY 040-1-14
Rev. 9/95 F

APPLICATION

Appl. No.: G2-30018

1642

e9-30018

Section 5. GENERAL WATER SYSTEM INFORMATION

A. Name of system, if named: Camas Municipal Water-Sewer System

B. Briefly describe your proposed water system. (See instructions.)

One 12-inch supply well will be constructed to a depth of 400 feet. The well will be used to provide water supply to municipal and industrial water users that are served by the City of Camas in the Lacamas Basin Area. See City's 1996 Water System Plan documents for other related water system information.

C. Do you already have any water rights or claims associated with this property or system? ☒ YES ☐ NO
PROVIDE DOCUMENTATION. See list of city water right permits and claims that are attached.

Section 6. DOMESTIC / PUBLIC WATER SUPPLY SYSTEM INFORMATION
(Completed for all domestic/public supply uses.)

A. Number of "connections" requested: 4896 Type of connection Municipal Industrial Hookup
(Homes, Apartment, Recreational, etc.)

B. Are you within the area of an approved water system? ☒ YES ☐ NO
If yes, explain why you are unable to connect to the system. *Note: Regional water systems are identified by your County Health Department.* The applicant (City of Camas) is the regional water provider.

Complete C. and D. only if the proposed water system will have fifteen or more connections.

C. Do you have a current water system plan approved by the Washington State Department of Health? ☒ YES ☐ NO
If yes, when was it approved? 1996 Please attach the current approved version of your plan.
Note: City is currently updating their Waster System Plan. The new plan should be approved in early 2002.

D. Do you have an approved conservation plan? ☒ YES ☐ NO
If yes, when was it approved? 1996 Please attach the current approved version of your plan.
Note: Water Conservation Plan incorporated into 1996 Water System Plan which is currently being updated.

Section 7. IRRIGATION/AGRICULTURAL/FARM INFORMATION
(Complete for all irrigation and agriculture uses.) N/A

A. Total number of acres to be irrigated: _____

B. List total number of acres for other specified agricultural uses:

Use _____ Acres _____
Use _____ Acres _____
Use _____ Acres _____

C. Total number of acres to be covered by this application: _____

D. Family Farm Act (Initiative Measure Number 59, November 3, 1977)
Add up the acreage in which you have a controlling interest, including only:
‡ Acreage irrigated under water rights acquired after December 8, 1977;
‡ Acreage proposed to be irrigated under this application;
‡ Acreage proposed to be irrigated under other pending application(s).

1. Is the combined acreage greater than 2000 acres? ☐ YES ☐ NO
2. Do you have a controlling interest in a Family Farm Development Permit? ☐ YES ☐ NO
If yes, enter permit no: _____

E. Farm uses:
Stockwater - Total # of animals _____ Animal type _____ (If dairy cattle, see below)
Dairy - # Milking _____ # Non-milking _____

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Section 8. WATER STORAGE

Will you be using a dam, dike, or other structure to retain or store water? ☐ YES ☒ NO

NOTE: If you will be storing 10 acre-feet or more of water and/or if the water depth will be 10 feet or more at the deepest point, and some portion of the storage will be above grade, you must also apply for a reservoir permit. You can get a reservoir permit application from the Department of Ecology.

Section 9. DRIVING DIRECTIONS

Provide detailed driving instructions to the project site. From Lacey, WA, go southbound on I-5. Take I-205 exit at Hazel Dell. Proceed southbound on I-205 to SR-14. Take SR-14 eastbound to Brady Road. Proceed northbound on Brady Road, which turns into NW Parker Avenue, continue northbound on NW Parker Avenue past 20th Street NW. Turn into Fire Station Property, which is located on west side of NW Parker Avenue.

Section 10. REQUIRED MAP

A. Attach a map of the project. (See instructions.)

Section 11. PROPERTY OWNERSHIP

A. Does the applicant own the land on which the water will be used? ☐ YES ☒ NO
If no, explain the applicant's interest in the place of use and provide the name(s) and address(es) of the owner(s):

The City will use the water for supply within their service area.

B. Does the applicant own the land on which the water source is located? ☐ YES ☐ NO
If no, submit a copy of agreement:

The City will purchase the property as part of the supply well development.

I certify that the information above is true and accurate to the best of my knowledge. I understand that in order to process my application, I grant staff from the Department of Ecology access to the site for inspection and monitoring purposes. Even though I may have been assisted in the preparation of the above application by the employees of the Department of Ecology, all responsibility for the accuracy of the information rests with me.

City of Camas E. Levison Eric Levison — 8/20/01

Applicant (or authorized representative) — Date

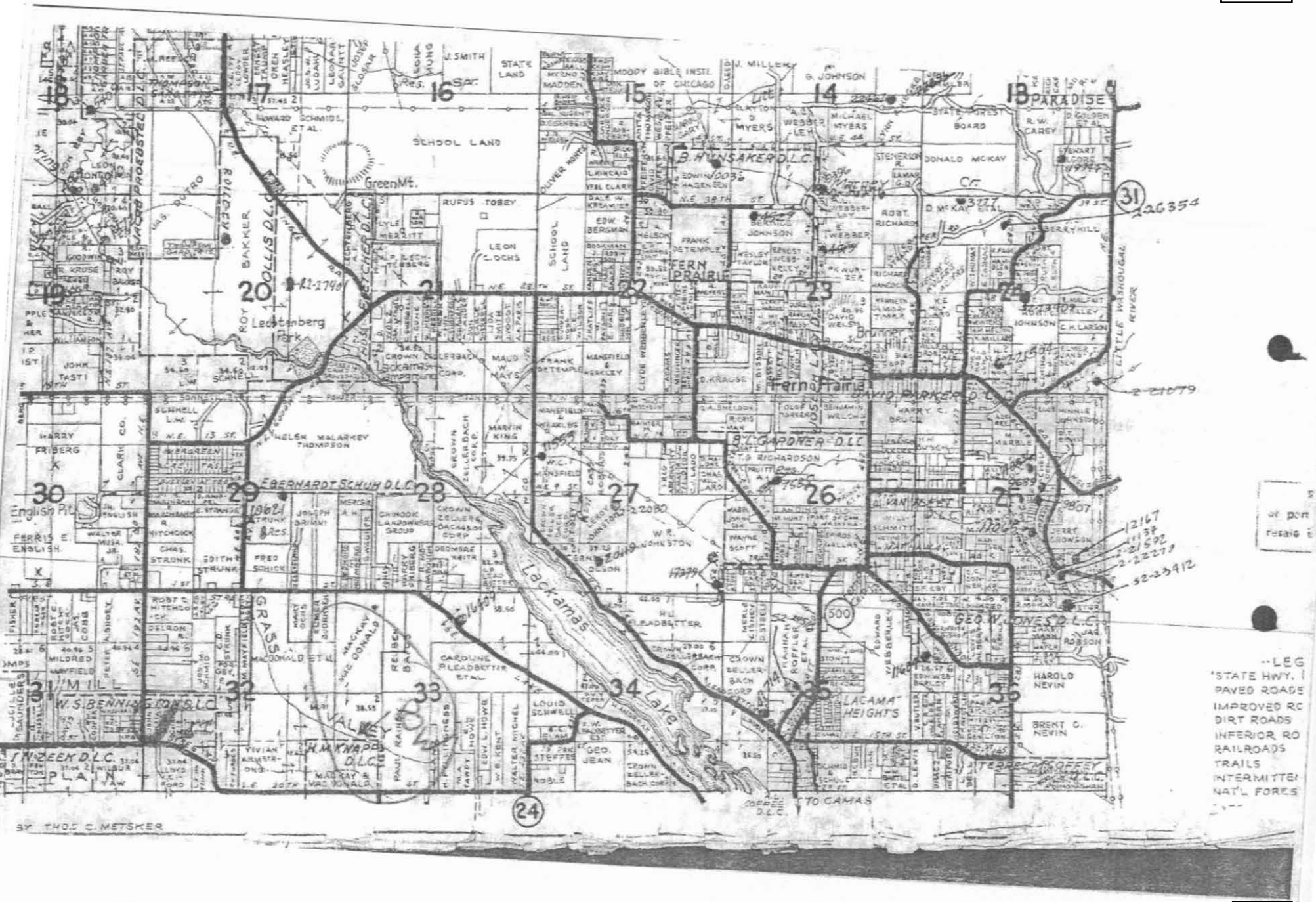
Landowner for place of use (if same as applicant, write "same") — Date

Use this page to continue your answers to any questions on the application. Please indicate section number before answer.

We are returning your application for the following reason(s):	
_____ Examination fee was not enclosed	APPLICANT PLEASE RETURN TO CASHIER, PO BOX 5128, LACEY, WA 98509-5128
_____ Section number(s) _____ is/are incomplete	APPLICANT PLEASE RETURN TO THE APPROPRIATE REGIONAL OFFICE
Explanation:	
Please provide the additional information requested above and return your application by _____ _____ *(date).*	

Ecology staff_____ Date_____

To receive this document in alternative format, contact Lisa Newman at (360) 407-6604 (Voice) or (360) 407-6006 (TDD).


SCHOOL LAND
GreenMt.
Leabtenberg Park
FERN PRAIRIE
Fern Prairie
Lackamas Lake
LACAMA HEIGHTS
PARADISE
B. HUNSAKER D.L.C.
EBERHARDT SCHUH D.L.C.
W. S. BENNINGTON D.L.C.
H.M. KNAPP D.L.C.
GEO. W. JONES D.L.C.
P. T. GARDNER D.L.C.
TO CAMAS
BY THOS. C. METSKER

1646

616 NE 4th Avenue
PO Box 1055
Camas WA 98607

WASHINGTON STATE DEPARTMENT OF ECOLOGY

STATE OF WASHINGTON
CERTIFICATE OF CHANGE ON A CLAIM

Document Title: Certificate of Water Right

Agency: Department of Ecology
Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775

Applicant: **City of Camas**
616 NE 4th Ave
PO Box 1055
Camas, WA 98607

Reference Number:

PRIORITY DATE	CLAIM NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
3/09/2001	G2-121022		G2-CV1-2P159

This is to certify that the herein named applicant has made proof to the satisfaction of the Department of Ecology of a right to the use of the public waters of the State of Washington as herein defined, and under and specifically subject to the provisions contained in the Permit issued by the Department of Ecology, and that said right to the use of said waters has been perfected in accordance with the laws of the State of Washington, and is hereby confirmed by the Department of Ecology and entered of record as shown, but is limited to an amount actually beneficially used.

PUBLIC WATERS TO BE APPROPRIATED

SOURCE	TRIBUTARY OF (IF SURFACE WATERS)
Well 12	

MAX. CUBIC FEET PER SECOND	MAX GALLONS PER MINUTE	MAX. ACRE-FEET PER YEAR
	900 GPM	320 AF/Y

QUANTITY/TYPE OF USE/PERIOD OF USE

320 Acre-feet per year Municipal Supply Year-round, as needed

LEGAL DESCRIPTION OF LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF WITHDRAWAL

2240 feet North and 1000 feet East of the Southwest corner of Section 12.

¼ ¼	SECTION	TOWNSHIP N.	RANGE (E. OR W.) W.M.	W.R.I.A.	COUNTY
NW ¼ SW ¼	12	1	3E	28	Clark

PARCEL # 89892000

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

1/4 1/4	SECTION	TOWNSHIP N.	RANGE (E. OR W.) W.M.	W.R I.A.	COUNTY
N/A	N/A	N/A	N/A	28	Clark

PARCEL #

Area served by City of Camas for municipal supply.

N/A

CONTINUED LEGAL DESCRIPTION FOR PROPERTY ON WHICH WATER IS TO BE USED

N/A

PROVISIONS

All conditions and requirements contained in reports of examination or permits previously issued apply to this certificate unless specifically noted below.

The water appropriated under this application will be used for public water supply. The State Board of Health rules require public water supply owners to obtain written approval from the Office of Water Supply, Department of Health, 1112 SE Quince Street, PO Box 47890, Olympia, Washington 98504-7890, prior to any new construction or alterations of a public water supply system.

An approved measuring device shall be installed and maintained for each of the sources identified by this water right in accordance with the rule "Requirements for Measuring and Reporting Water Use", Chapter 173-173 WAC.

Water use data shall be recorded monthly. The maximum rate of diversion/withdrawal and the annual total volume shall be submitted to Ecology by January 31st of each calendar year.

The following information shall be included with each submittal of water use data: owner, contact name if different, mailing address, daytime phone number, WRIA, Permit/Certificate/Claim No., source name, annual quantity used including units, maximum rate of diversion including units, monthly meter readings including units, peak monthly flow including units, Department of Health WFI water system number and source number(s), well tag number, and period of use. In the future, Ecology may require additional parameters to be reported or more frequent reporting. Ecology prefers web based data entry, but does accept hard copies. Ecology will provide forms and electronic data entry information. Submit data to: Department of Ecology, SWRO/WR PO Box 47775, Olympia, WA 98504-7775.

Chapter 173-173 WAC describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition Ecology for modifications to some of the requirements. Installation, operation and maintenance requirements are enclosed as a document entitled "Water Measurement Device Installation and Operation Requirements".

Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable

(continued on page 3)

The right to use of the water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in RCW 90.03.380, 90.03.390, and 90.44.100.

This certificate of water right is specifically subject to relinquishment for non-use of water as provided in Chapter 90.14 RCW.

Given under my hand and the seal of this office at Olympia, Washington, this 5th *day of* February, *2008.*

DEPARTMENT OF ECOLOGY STATE OF WASHINGTON

Jay Manning, Director
Department of Ecology

By Thomas Loranger
Thomas Loranger Section Manager

OK

Provisions Continued

times, to the records of water use that are kept to meet the above conditions, and to inspect at reasonable times any measuring device used to meet the above conditions.

All wells constructed in the State shall meet the construction requirements of Chapter 173-160 WAC entitled "Minimum Standards for the Construction and Maintenance of Wells" and Chapter 18-104 RCW entitled "Water Well Construction, Act (1971)."

In accordance with Chapter 173-160 WAC, wells shall not be located within certain minimum distances of potential sources of contamination. These minimum distances shall comply with local health regulations, as appropriate. In general, wells shall be located at least 100 feet from sources of contamination. Wells shall not be located within 1,000 feet of a solid waste landfill.

Nothing in this approval shall be construed as lessening or enlarging any water rights represented by Water Right Claim No's 121022 & 121023. The water use authorized under this filing (fill in with water right no.) shall be considered supplemental to any water rights confirmed for said claim as a result of a general adjudication through Superior Court, should adjudication be undertaken.

PO Box 1055
Camas WA 98607

STATE OF WASHINGTON
CERTIFICATE OF CHANGE ON A CLAIM

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Document Title: Certificate of Water Right

Agency: Department of Ecology
Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775

Applicant: **City of Camas**
616 NE 4th Ave
PO Box 1055
Camas, WA 98607

Reference Number:

PRIORITY DATE	CLAIM NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
4/06/2001	G2-121023		G2-CV1-2P160

This is to certify that the herein named applicant has made proof to the satisfaction of the Department of Ecology of a right to the use of the public waters of the State of Washington as herein defined, and under and specifically subject to the provisions contained in the Permit issued by the Department of Ecology, and that said right to the use of said waters has been perfected in accordance with the laws of the State of Washington, and is hereby confirmed by the Department of Ecology and entered of record as shown, but is limited to an amount actually beneficially used.

PUBLIC WATERS TO BE APPROPRIATED

SOURCE	TRIBUTARY OF (IF SURFACE WATERS)
Well 10	

MAX. CUBIC FEET PER SECOND	MAX. GALLONS PER MINUTE	MAX. ACRE-FEET PER YEAR
	900	230

QUANTITY/TYPE OF USE/PERIOD OF USE

230 Acre-feet per year Municipal Supply Seasonal Use, May 1 – August 31

LEGAL DESCRIPTION OF LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF WITHDRAWAL

2220 feet North and 710 feet East of the Southwest corner of Section 12.

¼ ¼	SECTION	TOWNSHIP N.	RANGE (E. OR W.) W.M.	W.R I.A.	COUNTY
NW ¼ SW ¼	12	1	3E	28	Clark

PARCEL # 89866000

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

1/4 1/4	SECTION	TOWNSHIP N.	RANGE (E. OR W.) W.M.	W.R I.A.	COUNTY
N/A	N/A	N/A	N/A	28	Clark

PARCEL #

Area served by City of Camas for municipal supply.

N/A

CONTINUED LEGAL DESCRIPTION FOR PROPERTY ON WHICH WATER IS TO BE USED

N/A

PROVISIONS

All conditions and requirements contained in reports of examination or permits previously issued apply to this certificate unless specifically noted below.

The water appropriated under this application will be used for public water supply. The State Board of Health rules require public water supply owners to obtain written approval from the Office of Water Supply, Department of Health, 1112 SE Quince Street, PO Box 47890, Olympia, Washington 98504-7890, *prior to any new construction* or alterations of a public water supply system.

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Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable

(continued on page 3)

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Given under my hand and the seal of this office at Olympia, Washington, this 5th *day of* February, *2008.*

DEPARTMENT OF ECOLOGY STATE OF WASHINGTON

Jay Manning, Director
Department of Ecology

OK

By Thomas Loranger
Thomas Loranger, Section Manager

1651

Provisions Continued

times, to the records of water use that are kept to meet the above conditions, and to inspect at reasonable times any measuring device used to meet the above conditions.

All wells constructed in the State shall meet the construction requirements of Chapter 173-160 WAC entitled "Minimum Standards for the Construction and Maintenance of Wells" and Chapter 18-104 RCW entitled "Water Well Construction, Act (1971)."

In accordance with Chapter 173-160 WAC, wells shall not be located within certain minimum distances of potential sources of contamination. These minimum distances shall comply with local health regulations, as appropriate. In general, wells shall be located at least 100 feet from sources of contamination. Wells shall not be located within 1,000 feet of a solid waste landfill.

Nothing in this approval shall be construed as lessening or enlarging any water rights represented by Water Right Claim No's 121022 & 121023. The water use authorized under this filing (fill in with water right no.) shall be considered supplemental to any water rights confirmed for said claim as a result of a general adjudication through Superior Court, should adjudication be undertaken.

Hall, Tammy (ECY)

From: Hall, Tammy (ECY)
Sent: Monday, October 08, 2018 11:09 AM
To: Bennett, Rose (ECY)
Cc: 'Jill Van Hulle'; 'sadams@cityofcamas.us'
Subject: New Streamlined CRA-City of Camas G2-30019

Good morning Rose

This application requests 1,000 gpm for municipal supply.

Would you please put me down for 25 hours of review time.

	Project Manager/ Primary Point of Contact	Billing Contact
Name	Sam Adams, Utilities Manager	Same
Address	1620 SE 8th Ave Camas, WA 98607	
Telephone	360-817-7003	
Fax		
Email	sadams@cityofcamas.us	

TAMMY HALL, L.HG.--HYDROGEOLOGIST
WA DEPT OF ECOLOGY--WATER RESOURCES PROGRAM--SOUTHWEST REGIONAL OFFICE
PO BOX 47775 | OLYMPIA, WA 98504-7775
v 360-407-6099 | f 407-6305 | tammy.hall@ecy.wa.gov

City of Camas
WASHINGTON

Public Works Department

RECEIVED
SEP 24 2018
WA State Department
of Ecology (SWRO)

September 19, 2018

Tammy Hall
Department of Ecology
Southwest Regional Office
PO Box 47775
Olympia, WA 98504-7775

RE: Streamlined CRA Request for City of Camas Well 17 (G2-30019)

Dear Ms. Hall:

The City of Camas would like to move forward with the processing of our *Application for Water Right G2-30019*. This request is associated with our Well 17 which is currently being drilled under the Preliminary Permit you issued. As you are already aware the issuance of new water rights in the Lacamas Creek watershed is regulated protect flows. Our current water right permitting approach is to provide Ecology with an appropriate mitigation offset for the water we will be withdrawing from Well 17.

We wish to use the Streamlined Cost Reimbursement Process, and enter into a contract with Ecology to oversee the processing of our new application.

Our consultant Pacific Groundwater Group's (PGG) preliminary evaluation of Well 17 indicates that a relatively small portion (less than 10%) of our projected surface water capture from the well will affect stream flows in the Lacamas Creek drainage above the confluence with the Lacamas Lake impoundment and the balance of the capture is to the impoundment itself. We understand that mitigation for this site, as for all new applications in WRIA 28, needs to be provided in a manner consistent with the recommendation of the WRIA 27/28 Planning Group, and embodied in the provisions of WAC 173-528.

Under the Streamlined CRA approach PGG will prepare a Report of Examination (ROE) for your review. The ROE will address impairment, mitigations and consistency with WAC 173-528.

For contracting purposes please use the following information:

	Project Manager/ Primary Point of Contact	Billing Contact
Name	Sam Adams, Utilities Manager	Sam Adams
Address	1620 SE 8th Avenue, Camas, WA 98607	Same
Telephone	(360) 817-7003	
Email	sadams@cityofcamas.us	

Feel free to contact me at (360) 817-7003, or you may speak directly with Jill Van Hulle at (360) 413-1510.

Sincerely,

Sam Adams
Utilities Manager
City of Camas

Date: April 6, 2018

Teresa Hanson:

The following is in response to your April 6, 2018 request for delivery information on your Certified Mail™ item number 9171999991703776661108. The delivery record shows that this item was delivered on April 2, 2018 at 11:22 am in CAMAS, WA 98607. The scanned image of the recipient information is provided below.

Signature of Recipient :



Address of Recipient : 616 NE 4th

Thank you for selecting the Postal Service for your mailing needs.

If you require additional assistance, please contact your local Post Office or postal representative.

Sincerely,
United States Postal Service

Re. G2-30019

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

March 29, 2018

City of Camas
Attn: Eric Levison
616 NE 4th Ave
Camas WA 98607

Re: Preliminary Permit to Drill and Test a Well for Water Right Application G2-30019

Dear Mr. Levison:

Water Right Application G2-30019 requests 1,000 gallons per minute (gpm) and 1,200 acre-feet (ac-ft) per year for municipal supply. The proposed point of withdrawal is a well to be drilled in the SW ¼ NW ¼ of Section 34, T. 2 N., R. 3 E.W.M. of Clark County.

Under the authority of RCW 90.03.290, Ecology can issue a Preliminary Permit for a water right applicant to conduct studies, surveys, and investigations to gather information to assess a water right application. This Preliminary Permit allows temporary groundwater withdrawals for testing purposes only.

Ecology needs information that evaluates your proposed withdrawal before your application can be processed. Impacts to area users and surface water impacts need to be evaluated. Ecology reserves the right to ask for more information before making a final decision on the application, if necessary.

The requirements of this Preliminary Permit must be met within the deadline or Water Right Application G2-30019 will automatically be cancelled. This Preliminary Permit does not commit Ecology to approve the water right for your project. Other uses needing a water right permit are not allowed unless approved.

Ecology has determined the activities authorized under this Preliminary Permit are categorically exempt from SEPA review under WAC 197-11-800(17).

Please make sure that your consultant receives a copy of this Preliminary Permit to ensure compliance with all requirements. If adverse impacts to senior water right holders occur during any portion of the test, the test must be stopped immediately. Once testing is complete, the well must be capped so it does not pose a safety hazard.

This Preliminary Permit will remain in effect until April 1, 2020, unless revoked sooner by Ecology. The City of Camas will assume all expenses, risks, and liabilities incurred in response to this Preliminary Permit.

This Preliminary Permit is subject to existing rights and the following requirements:

Requirements for drilling new wells:

- ✓ All water wells constructed must meet the minimum standards for construction and maintenance. Chapter 18.104 RCW (Washington Water Well Construction Act of 1971) and Chapter 173-160 WAC (Minimum Standards for Construction and Maintenance of Water Wells) discuss well construction requirements.

> *Check with the County Health Department to see if well site approval is required before well construction.*

- ✓ Wells must be at least 100 feet away from potential sources of contamination, such as a sewer, septic tank, privy as specified in WAC 173-160-171. Wells must also be at least 1,000 feet away from solid waste landfills. These minimum distances must also comply with state and local health laws.

- ✓ The well must have a well-maintained access port. A backflow check-valve must also be installed. This valve will prevent water from flowing back into the well when pumping stops so data collected during recovery is accurate.

- ✓ The well driller must submit a well report for the new wells to Ecology within 30 days after drilling.

Requirements for test observation wells:

- ✓ At least one observation well must be monitored for drawdown, recovery and water quality during the aquifer test.

- ✓ Observation wells must be completed in the same aquifer as the pumping well and not be actively pumping during the test.

- ✓ Wells should be selected where they will best determine potential for impacts to surface water in the area, effects on nearby wells, and potential to cause seawater intrusion.

Requirements for pumping test:

The Washington State Department of Health (DOH) Water System Design Manual (DOH #331-123, June 99), Appendix E provides guidelines for designing and conducting aquifer tests (available at www.doh.wa.gov/ehp/dw). DOH guidelines are minimum requirements. Failure to follow correct methods may require the tests to be repeated.

- ✓ A Washington Licensed Hydrogeologist or Registered Engineer, specializing in groundwater evaluation, must supervise the test and perform data analysis.
- ✓ The well must be tested at a constant rate not less than the maximum design rate of the well.
- ✓ The test **must be designed to provide the following information:**
  - Distance and time drawdown response in the producing aquifer.
  - Aquifer transmissivity.
  - Aquifer storage coefficient and specific yield.
  - Effects on regulated surface water.
  - Effects to area users

Select accurate water level devices, such as transducers, or electric tape, to measure water levels. All watches and clocks used for timing should be synchronized so that each measurement can be referenced to the exact time since pumping began.

- ✓ The pumping portion of the test must be at least 24 hours long OR until the water level in the pumping well has been stable for at least four (4) hours, whichever occurs last.

Water levels are stable if they drop less than 0.1 foot in an hour while the well is pumping. Measuring points for water levels must be accurately located within 10 feet horizontally and 1 foot vertically.

- ✓ Water pumped during the test should be discharged so it will not recharge the drawdown cone or influence monitoring during the test.

- ✓ Recovery data must be collected from all wells until the water level in the pumped well nears pre-pumping conditions and the water-level recovery rate is less than 0.1 foot per hour.

- ✓ Data collected must be corrected for influences of barometric pressure, if applicable.

> *Ecology recommends measuring water levels in the test and observation well every hour at least 48 hours before the start of the aquifer test. This will help evaluate aquifer response to external stresses such as precipitation and well interference. Barometric pressure should also be monitored on similar schedule, particularly for confined aquifers, so corrections for barometric influences can be made.*

For water quality sampling, water samples must be collected from the pumping well and observation wells and tested for chlorides and conductivity at a laboratory accredited by the Department of Ecology. Water samples must be collected as follows:

- ✓ From the pumping well:
  - During the first 30 minutes of pumping.
  - About mid-way through pumping.
  - During the last 15 minutes of pumping.

- ✓ From the observation wells:
  - Before the pump test starts.
  - Immediately after all recovery data is collected and the well has recovered to its static water level.

Please be aware that the state or county health department may require additional testing prior to the approval of your project. If your project involves a public water system, please check with the appropriate health agency to determine what additional testing is required before you conduct the test.

Requirements for reporting:

City of Camas must file a report with Ecology when aquifer testing is complete. This information must provide Ecology with the information needed to evaluate results of the study. Ecology may request any of this information in an electronic format.

The report should contain the following information:

- ✓ Maps showing locations of wells used in pump test (pumping and observation wells) and surface water bodies.

- ✓ Pumping well information.
  - o Construction diagrams.
  - o Well report
  - o Lithology description of units.
  - o Pump intake depth.
  - o Wellhead elevation and way measured.
  - o Identification of measuring point.

- ✓ Monitoring well information.
  - o Well reports (if available).
  - o Well information and way it was determined (if no well report).
  - o Wellhead elevations and way measured.
  - o Total well depth and way determined.
  - o Screened interval and way determined.
  - o Identification of measuring point.

All water level and water quality data must be presented in both tabular form and on data plots.

- ✓ Distances between pumping well and observation well(s).

- ✓ Testing information.
  - o Pumping rates.
  - o Duration of pumping and recovery.
  - o Water level information.
  - o Raw data and corrected measurements.
  - o Corrections made for tidal influences (if any).
  - o Discussion of the methods and calculations used to determine aquifer characteristics.
  - o Copies of the all field data sheets related to the testing.

- ✓ Hydrogeology information.
  - o Hydrogeologic cross-sections.
  - o Description of the hydrogeologic system.
  - o Copies of all laboratory data sheets.

YOUR RIGHT TO APPEAL

You have a right to appeal this Preliminary Permit to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of this Preliminary Permit. The appeal process is governed by Chapter 43.21B RCW and Chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2).

To appeal you must do all of the following within 30 days of the date of receipt of this Preliminary Permit:

- File your appeal and a copy of this with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this Preliminary Permit on Ecology in paper form - by mail or in person. (See addresses below.) E-mail is not accepted.

You must also comply with other applicable requirements in Chapter 43.21B RCW and Chapter 371-08 WAC.

ADDRESS AND LOCATION INFORMATION

Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503 **Pollution Control Hearings Board** 1111 Israel RD SW STE 301 Tumwater, WA 98501	**Department of Ecology** Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608 **Pollution Control Hearings Board** PO Box 40903 Olympia, WA 98504-0903

Michael Gallagher, Section Manger
Department of Ecology, SWRO
PO Box 47775
Lacey, WA 98504-7775

If you have any questions regarding this Preliminary Permit please contact Tammy Hall at (360) 407-6099.

Sincerely,

Joseph J. Witczak

Michael J. Gallagher, Section Manager
SWRO Water Resources Program

cc: Jill Van Hulle, Pacific Groundwater Group

By Certified Mail: 91 7199 9991 7037 7666 1108

Hall, Tammy (ECY)

From: Jill Van Hulle <jill@PGWG.COM>
Sent: Wednesday, March 21, 2018 2:57 PM
To: Hall, Tammy (ECY)
Cc: Dan Matlock; Sam Adams (SAdams@cityofcamas.us); Carroll, Sheri (ECY)
Subject: City of Camas - Request for Preliminary Permit and to Amend Application G2-30019
Attachments: Amend Camas Application.pdf; G2-30019_Camas application.pdf; Fig1_Site_Plan_V2.pdf

Hi Tammy, it's been a couple of months since we met with your regarding the City of Camas' plans to construct a new well (Well 17) near Lacamas Lake. As we discussed the City has a new well site in mind - just over a mile south and east from the originally designated site. We would like to modify the application that was filed in 2001 (G2-30019) with the new site AND request a **Preliminary Permit to Drill and Test** as soon as possible.

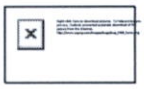
It does not appear that the original application was ever published so I will let the City know to be expecting that – and if you guys could loop me on that notice, I'd appreciate it.

A hard copy of this will be in the mail as well.

Thanks, and let me know if you need anything!

Jill

Jill Van Hulle | Water Resource Specialist
Pacific Groundwater Group | Water Resource & Environmental Consulting
(360) 413-1510 | jill@pgwg.com | www.pgwg.com



PACIFIC groundwater GROUP

RECEIVED
MAR 28 2018
WA State Department
of Ecology (SWRO)

March 21, 2018

Tammy Hall
Dept. of Ecology SWRO
PO Box 47775
Olympia, WA 98504

Re: Amendment of Application G2-30019

Dear Tammy

The intent of this letter is to request a modification in the *Point of Withdrawal* for pending application G2-30019 AND to request the issuance of a **Preliminary Permit** to drill and test at the new site.

Application G2-30019 was filed on September 4, 2001 in the amount of 1,000 gpm and projected annual quantity of 1,200 acre-feet per year. The intent was to construct up to two 12-inch production wells at a site immediately north of Lacamas Lake in the NE ¼ NW ¼ of Section 28, T. 2N. R. 3 E.W.M.

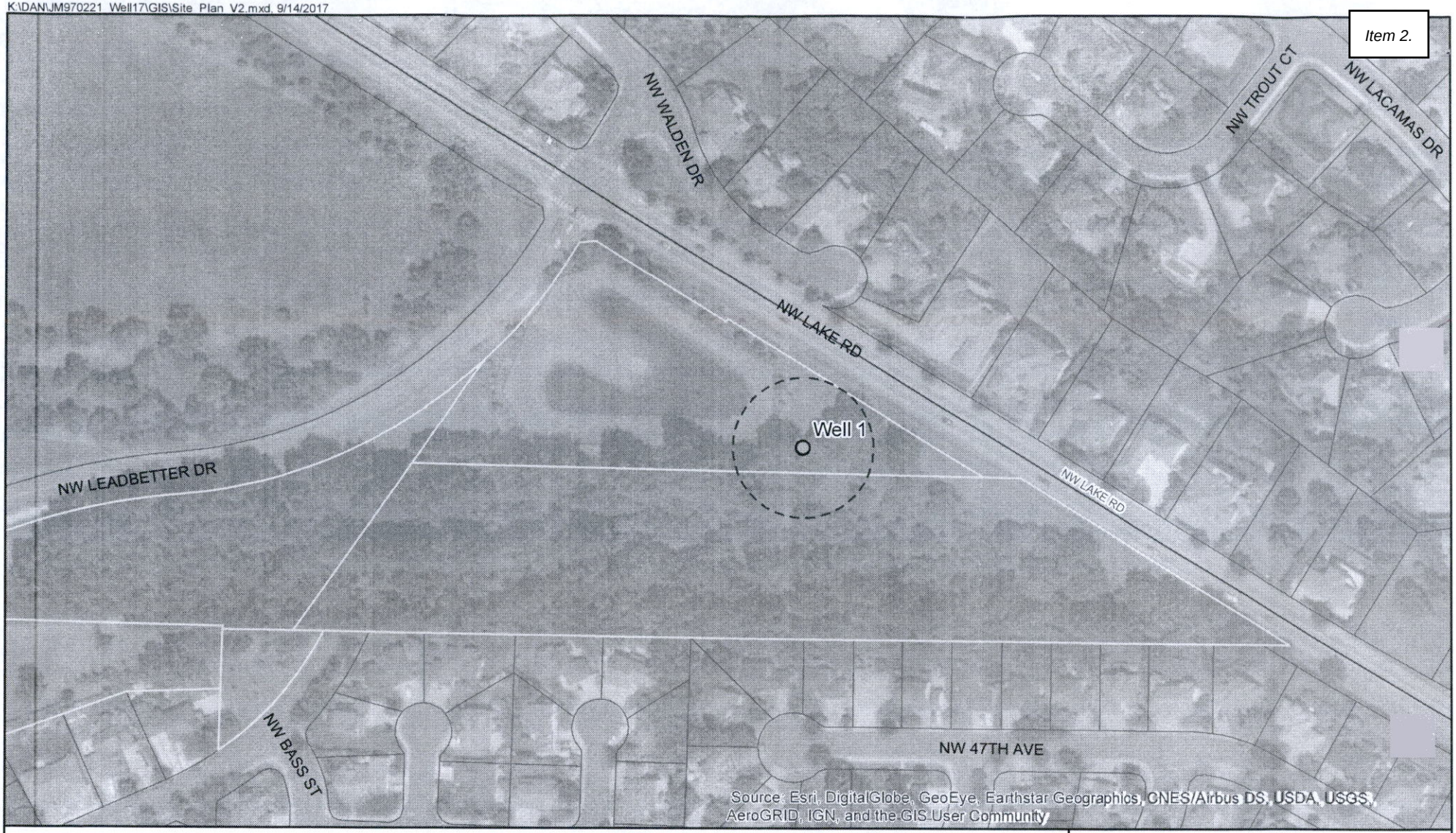
Since the time the application was filed we have reassessed our infrastructure needs and selected a new site for this well (Well 17) approximately a mile to the southeast of the original site within the SW ¼ NW ¼ of Section 34, T. 2 N., R. 3 E.W.M.

We would like to publish and secure the Preliminary Permit as soon as possible.

Sincerely,
Pacific Groundwater Group

Jill Van Hulle
Water Resources Specialist

K:\DAN\JM970221_Well17\GIS\Site_Plan_V2.mxd, 9/14/2017



Proposed Well 17 Location
100-ft Sanitary Control Area
City Properties

N

0 Feet 200

Figure 1
Camas
Well 17 Site

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
P.O. Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

October 1, 2001

City of Camas
Attn Eric Levison
616 NE 4th Avenue
Camas WA 98607

Re: Water Right Application No. G2-30019

This letter is to acknowledge that the Washington State Department of Ecology received your water right application. We have assigned your application the number indicated above. Please include this number in future correspondence regarding your application with the Department of Ecology.

When we begin actively evaluating applications in your area, we will prepare a public notice and send it to you with publication instructions. It will be sometime before we are able to begin working in your area. In the meantime, please notify Ecology of changes such as address, property ownership, or variations in your proposed water use plans.

The availability of water in Washington state is a serious problem. Much of the water in our state has already been appropriated. The competition for water has escalated with our state's increasing population, conflicting water policy issues, and grave declines in salmon and other fish populations. A new watershed management law brings us a step closer to addressing some of these issues. It sets into motion a locally based process to address water quantity, quality, and habitat issues. Watershed management will help meet challenges for getting water to people, industries, farms, and fish.

In some areas of the state, we are continuing to evaluate applications within watersheds where we have previously gathered information and completed watershed assessments. We are also continuing to process water right permit or change applications that are intended to address public health and safety emergencies, the natural environment, or are for nonconsumptive withdrawals. All other applications are grouped by watershed and processed according to the date of submittal, and when we have enough information and staff resources to make decisions.

If you would like further information on your application, please contact the Southwest Regional Office at (360) 407-0240.

Sincerely,

J. Mike Harris

J. Mike Harris
Water Resources Supervisor
Southwest Regional Office

JMH:th (applet.doc)

DEPARTMENT OF ECOLOGY
State of Washington

STATE OF WASHINGTON
FINAL
REPORT OF EXAMINATION
FOR WATER RIGHT APPLICATION

File NR G2-30756
WR DOC ID #6802639

PRIORITY DATE	WATER RIGHT APPLICATION NUMBER
January 8, 2020	G2-30756

NAME AND MAILING ADDRESS	SITE ADDRESS (IF DIFFERENT)
CITY OF CAMAS 1620 SE 8TH AVE CAMAS, WA 98607	

Total Rate and Quantity Authorized for Withdrawal

WITHDRAWAL RATE (gpm)	ANNUAL QUANTITY (ac-ft/yr)
6,700	11,090

gpm = Gallons per Minute; ac-ft/yr = Acre-feet per Year

Attention: The annual quantity and instantaneous rate of withdrawal from the Lower Washougal Wellfield authorized under G2-30756 are non-additive to the associated rights listed below.

Purpose

PURPOSE	WITHDRAWAL RATE ADDITIVE	WITHDRAWAL RATE NON-ADDITIVE	WITHDRAWAL RATE UNITS	ANNUAL QUANTITY (AF/YR) ADDITIVE	ANNUAL QUANTITY (AF/YR) NON-ADDITIVE	PERIOD OF USE (mm/dd)
Municipal		6,700	GPM		11,090	01/01-12/31

PUBLIC WATER SYSTEM INFORMATION	
WATER SYSTEM NAME and ID	CONNECTIONS
Camas Municipal Water Sewer System 108002	Unspecified

SPECIAL REMARKS:
Exercise of the non-additive quantities authorized by G2-30756 attributable to the primary authorizations under G2-30144, G2-30145, G2-30146, and G2-30147.

Associated Water Rights

DOCUMENT NUMBER	INSTANTANEOUS RATE (gpm)	ANNUAL QUANTITY (ac-ft/yr)	REMARKS
G2-CV1-2P159	900	320	Annual appropriations for these water rights and the City of Camas' surface water certificates 711 and 712 were capped at 6,300 ac-ft/yr under water right decisions G2-00501 and G2-24400.
G2-CV1-2P160	900	230	
C-85-A	1,200	118	
C-6635-A	1,500	2,400	
C-6636-A	600	920	
G2-00501C	1,000	530	
G2-24400C	900	530	
G2-30144	500	2,150	Withdrawals authorized under these four water rights are mitigated by reduced diversions from the City's Boulder Creek and Jones Creek surface water sources.
G2-30145	1,000	880	
G2-30146	1,000	880	
G2-30147	1,000	880	
Total Associated Rights	10,500	11,090	Total annual quantity accounts for 6,300 af/yr cap noted above.

Source Location

COUNTY	WATERBODY	TRIBUTARY TO	WATER RESOURCE INVENTORY AREA
Clark	Groundwater		WRIA 28

SOURCE NAME	PARCEL	WELL TAG	TOWNSHIP	RANGE	SECTION	QQ Q	LATITUDE (N)	LONGITUDE (W)
Well 5	87266000	AFP623	1N	3E	12	SW SE	45.5806	122.3834
Well 6	89927000	AFP624	1N	3E	12	NE SW	45.5834	122.3841
Well 7	89891000	AFP628	1N	3E	12	NW SW	45.5843	122.3885
Well 8	89888000	AFP629	1N	3E	12	NE SW	45.5843	122.3880
Well 10	89866000	AGP495	1N	3E	12	NW SW	45.5845	122.3904
Well 11	89892000	AHM259	1N	3E	12	NW SW	45.5840	122.3894
Well 12	89892000	AHM266	1N	3E	12	NW SW	45.5844	122.3895
Well 14	91045003	BAM409	1N	3E	12	NW SE	45.5837	122.3817

QQ Q = ¼ Quarter Quarter

Datum: NAD83/WGS84

Place of Use

Area served by Camas Municipal Sewer and Water System. The place of use of this water right is the service area described in the most recent Water System Plan approved by the Washington State Department of Health. RCW 90.03.386 may have the effect of revising the place of use of this water right if the criteria in section RCW 90.03.386(2) are met.

Proposed Works
Eight existing wells and one proposed well in the Lower Washougal Wellfield: Well 5: 8-inch diameter well to 71 feet below ground surface (bgs) Well 6: 16-inch diameter well to 85 feet bgs Well 7: 14-inch diameter well to 84 feet bgs Well 8: 14-inch diameter well to 87 feet bgs Well 10: 16-inch diameter well to 88 feet bgs Well 11: 16-inch diameter well to 105 feet bgs Well 12: 16-inch diameter well to 101 feet bgs Well 14: 20-inch diameter well to 85 feet bgs Proposed Well 18: Assumed 20-inch casing to about 100 feet bgs

Development Schedule

BEGIN PROJECT BY THIS DATE	COMPLETE PROJECT BY THIS DATE	PUT WATER TO FULL USE BY THIS DATE
Started	December 31, 2026	December 31, 2031

Attention: These dates represent deadlines that must be met or risk cancellation of this authorization. Submittal of formal documentation for each stage is required. Extensions may be requested.

Measurement of Water Use

HOW OFTEN MUST WATER USE BE MEASURED AND RECORDED?	Weekly
HOW OFTEN MUST WATER USE DATA BE REPORTED TO ECOLOGY?	Annually by January 31
WHAT QUANTITY SHOULD BE REPORTED?	Total annual quantity in acre-feet
WHAT RATE SHOULD BE REPORTED?	Annual peak rate of withdrawal in gpm

Provisions

Measurements, Monitoring, Metering, and Reporting

An approved measuring device must be installed and maintained for each of the sources identified by this water right in accordance with the rule "Requirements for Measuring and Reporting Water Use", chapter 173-173 WAC, which describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition the Department of Ecology (Ecology) for modifications to some of the requirements.

Recorded water use data shall be submitted electronically by January 31 each year. To set up an Internet reporting account, contact the Regional Office. If you do not have Internet access, you can still submit hard copies by contacting the Regional Office for forms to submit your water use data.

Department of Health Requirements

Prior to any new construction or alterations of a public water supply system, the State Board of Health rules require public water supply owners to obtain written approval from the Office of Drinking Water of the Washington State Department of Health. Please contact the Office of Drinking Water at Southwest Drinking Water Operations: 243 Israel Road S.E., PO Box 47823, Tumwater, WA 98504-7823, (360) 236-3030.

Water Use Efficiency
Use of water under this authorization will be contingent upon the water right holder's maintenance of efficient water delivery systems and use of up-to-date water conservation practices consistent with established regulation requirements and facility capabilities.

Relationship with Other Water Rights and Mitigation
Exercise of the non-additive quantities authorized by G2-30756 is attributable to the primary authorizations under G2-30144, G2-30145, G2-30146, and G2-30147.

Proof of Appropriation
Consistent with the development schedule given in this report (unless extended by Ecology), the water right holder must file a Notice of Proof of Appropriation (PA) of Water with Ecology. The PA documents the project is complete and all the water needed has been put to full beneficial use (perfected). In order to verify the extent of water use under this permit, an inspection of water use is typically required, known as a "proof exam". After filing the PA, the water right holder's next step is to hire a Certified Water Rights Examiner (CWRE) to conduct this proof exam. A list of CWREs is provided to the water right holder upon filing the PA with Ecology. The final water right document, a water right certificate, then may issue based upon the findings of the CWRE. Statutory county and state filing fees may apply prior to certificate issuance.

Schedule and Inspections
Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable times, to the project location, and to inspect at reasonable times, records of water use, wells, diversions, measuring devices and associated distribution systems for compliance with water law.

Findings of Fact and Order

Upon reviewing the investigator's report, I find all facts, relevant and material to the subject application, have been thoroughly investigated.

Therefore, I ORDER **APPROVAL** of Application No. G2-30756, subject to existing rights and the provisions specified above.

Your Right To Appeal

You have a right to appeal this Order to the Pollution Control Hearings Board (PCHB) within 30 days of the date of receipt of this Order. The appeal process is governed by chapter 43.21B RCW and chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2).

To appeal, you must do the following within 30 days of the date of receipt of the Order:

- File your appeal and a copy of this Order with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this Order to Ecology in paper form - by mail or in person (see addresses below). E-mail is not accepted.

You must also comply with other applicable requirements in chapter 43.21B RCW and chapter 371-08 WAC.

Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503	**Department of Ecology** Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608
Pollution Control Hearings Board 1111 Israel RD SW, Ste 301 Tumwater, WA 98501	**Pollution Control Hearings Board** PO Box 40903 Olympia, WA 98504-0903

For additional information, visit the Environmental Hearings Office Website: http://www.eho.wa.gov. To find laws and agency rules, visit the Washington State Legislature Website: http://www1.leg.wa.gov/CodeReviser.

Authorizing Signature

Signed at Lacey, Washington, this 2nd day of June, 2022.

Michael J. Gallagher

Michael J Gallagher, Section Manager
Water Resources Program/Southwest Regional Office
Department of Ecology

INVESTIGATOR'S REPORT

Water Right Application No.: G2-30756 (City of Camas)
Investigators: Joseph Morrice, LHG; Burt G. Clothier, LHG, RG
Reviewed by: Tammy Hall, L.HG.

BACKGROUND

This report serves as the written findings of fact concerning Water Right Application Number G2-30756.

On January 8, 2020 the City of Camas (City) filed an application for a new water right permit with the Washington State Department of Ecology (Ecology). The application requested authority to withdraw 6,700 gallons per minute (gpm) and an unspecified annual quantity from the City's Lower Washougal Wellfield (LWWF), non-additive to existing rights. The City also requested authorization for an additional point of withdrawal (well) in the LWWF; however, the requested new well (Well 18) will be authorized adding a point of withdrawal to one or more existing water rights (e.g., G2-0004C and G2-CV1-2P160) through a showing of compliance with RCW 90.44.100(3).

The LWWF consists of 8 existing wells near the confluence of the Washougal River and the Columbia River in the S½ of Section 12, Township 1N, Range 2E W.M. The City holds eleven water rights for the wellfield. Ten of the water rights each authorize withdrawals from a single well in the LWWF. The eleventh water right authorizes additional instantaneous withdrawals from one well (Well 8) and additional annual withdrawals from all existing wells in the wellfield except for Well 14. Combined, these rights authorize withdrawal of 10,500 gpm and 11,090 acre-feet per year (ac-ft/yr).

The purpose of the requested water right is to provide the City more flexibility in managing pumping from the wellfield, which is constrained by the instantaneous and annual limits associated with each water right and well. Additionally, the City's 2019 Water System Plan identified the need for additional supply to meet projected growth through 2035.

On February 17, 2022 the City requested via email that the application be amended to request a water right of 6,700 gpm, non-additive to existing rights for the LWWF. Over the near future this would help alleviate the City's constraints on managing the wellfield by allowing production to be shifted between wells, maximizing available withdrawals under the City's water rights. Projected long-term deficits in the annual quantity will likely require additional permitting of a new appropriation.

Table 1. Summary of Requested Water Right, as Amended

Applicant Name	City of Camas
Priority Date	1/8/2020
County	Clark
WRIA	27 – Salmon/Washougal
Water Source	Groundwater
Place of Use	The City of Camas service area as defined in the most recent Water System Plan.

Purpose	Instantaneous Rate (gpm)	Annual Quantity (ac-ft/yr)	Begin Season	End Season
Municipal	6,700	11,090	1/1	12/31

Source Name	Parcel	Well Tag	Township	Range	Section	QQ Q	Latitude (N)	Longitude (W)
Well 5	87266000	AFP623	1N	3E	12	SW SE	45.5806	122.3834
Well 6	89927000	AFP624	1N	3E	12	NE SW	45.5834	122.3841
Well 7	89891000	AFP628	1N	3E	12	NW SW	45.5843	122.3885
Well 8	89888000	AFP629	1N	3E	12	NE SW	45.5843	122.3880
Well 10	89866000	AGP495	1N	3E	12	NW SW	45.5845	122.3904
Well 11	89892000	AHM259	1N	3E	12	NW SW	45.5840	122.3894
Well 12	89892000	AHM266	1N	3E	12	NW SW	45.5844	122.3895
Well 14	91045003	BAM409	1N	3E	12	NW SE	45.5837	122.3817

WRIA = Water Resource Inventory Area; gpm = Gallons per Minute; ac-ft/yr = Acre-feet per Year; QQ Q = ¼ Quarter Quarter Datum: NAD83/WGS84

Cost Reimbursement

Under RCW 90.03.265 (1)(a) "any applicant for a new withdrawal or a change, transfer, or amendment of a water right pending before the department may initiate a cost-reimbursement agreement with the department to provide expedited review of the application. A cost-reimbursement agreement may be initiated under this section if the applicant agrees to pay for, or as part of a cooperative effort agrees to pay for, the cost of processing his or her application and all other applications from the same source of supply which must be acted upon before the applicant's request because they were filed prior to the date of when the applicant filed."

This application is being processed under a cost reimbursement agreement between the applicant and the Department of Ecology. This report has been prepared by Pacific Groundwater Group (PGG), a subsidiary of Mott MacDonald, and reviewed by Tammy Hall with the Department of Ecology's Water Resources Program.

Senior and Competing Applications

Under RCW 90.03.265 (1)(b) "the requirement to pay for the cost of other applications under (a) of this subsection does not apply to an application for a new appropriation that would not diminish the water available to earlier pending applicants for new appropriations from the same source of supply."

This new appropriation request is only for instantaneous and annual quantities non-additive to existing certificates and permits within the LWWF, no additional instantaneous or annual quantities will be approved. As such, this application can be processed without the risk of impacting the outcome of other applications.

INVESTIGATION

Investigation of this application included, but was not limited to, research and review of the following:

Carollo, 2019. City of Camas, Water System Plan Update, October 2019.
Ecology files of the water rights and well logs referenced in this report

Ecology, 2008. Hydrogeologic Investigation for the City of Camas Water Right Applications: G2-30144, G2-30145, G2-30146, and G2-30147. Memo from John Pearch, LHG to Tom Loranger.
Hartford and McFarland, 1989. Lithology, Thickness, and Extent of Hydrogeologic Units Underlying the East Portland Area, Oregon. USGS Water Resources Investigations Report 88-4110.
Hogenson and Foxworthy, 1965. Ground Water in the East Portland Area. USGS Water Supply Paper 1793.
McFarland and Morgan, 1997. Description of the Ground-Water Flow System in the Portland Basin, Oregon and Washington. USGS Water Supply Paper 2470-A.
Mundorff, 1964. Geology and Ground-Water Conditions of Clark County, Washington, with a Description of a Major Alluvial Aquifer along the Columbia River. USGS Water Supply Paper 1600.
PGG, 2003. Hydrogeologic Evaluation for City of Camas Replacement Wells 10, 11, and 12, Prepared for the City of Camas.
PGG, 2004. City of Camas Water Supply Alternatives Investigation, Prepared for City of Camas, Prepared by Pacific Groundwater Group.
PGG, 2006. Hydrogeologic Evaluation for City of Camas Replacement Well 13, Prepared for the City of Camas.
Swanson, McFarland, Gonthier, and Wilkinson, 1993. A Description of the Hydrogeologic Units in the Portland Basin, Oregon and Washington. USGS Water Resources Investigations Report 90-4196.

Proposed Use and Basis of Water Demand

Site Description

The LWWF is on a strip of land between the confluence of the Columbia and the Washougal Rivers. The distance between the two rivers is roughly one-half mile near LWWF with ground surface elevations about 20 to 40 feet above the elevation of the rivers. The City relies on the LWWF, two other water wells (Well 9 and Well 13), and two surface water diversions on Jones Creek and Boulder Creek to provide municipal supply to a residential population of about 26,000 people within the City's service area.

The City's water sources are within the Washougal River basin. The basin is in parts of Skamania and Clark counties. The headwaters are in the foothills of the Cascade Range at elevations up to 4,000 feet. Major tributaries include Lacamas Creek and the Little Washougal River. Lacamas Creek enters the river immediately downstream of the LWWF and the Little Washougal River enters the river about 5 miles upstream. Jones Creek and Boulder Creek, the City's surface water sources, both discharge to the Little Washougal River. The Washougal River discharges into the Columbia River, near the City of Camas at an average elevation of about 10 feet above mean sea level (msl).

Population is generally concentrated in the lower Washougal floodplain (e.g., the Cities of Camas and Washougal) and the lower reaches of the Little Washougal River and Lacamas Creek. The climate is characterized by mild, cool, wet winters and moderately dry warm summers. The Columbia River and the Pacific Ocean affect the weather patterns and help moderate temperatures year-round.

Topographic relief influences the distribution of precipitation, with average values of 35 inches per year west of Camas at the Portland Airport increasing to 110 inches per year in the upper elevations of the Washougal watershed.

Water System Description

The City of Camas water system serves about 26,000 people within their service area. The City's surface water and groundwater sources and service area are shown on Figure 1. The City currently operates 10 wells and two surface water diversions. Eight wells are in the LWWF (Well 5, Well 6, Well 7, Well 8, Well 10, Well 11, Well 12, and Well 14). Well 13 is located across the Washougal River from the LWWF, near the confluence of the river and Lacamas Creek and Well 9 is located about 3 miles northwest of the LWWF.

The eight LWWF wells range in depth from 70 to 110 feet below ground surface (bgs) and range in capacity from 500 to 1,350 gpm. The combined LWWF capacity is about 7,800 gpm or 11.23 million gallons per day (mgd), slightly less than the combined authorized withdrawal of 8,500 gpm. The City plans on system upgrades to increase the capacities of Well 11 and Well 12 and installing a new adjacent well (Well 18) under a Showing of Compliance with RCW 90.03(100) to allow full exercise of the water rights.

The City maintains emergency interties with the neighboring Cities of Washougal and Vancouver. However, due to system pressure relationships, the interties can only deliver water from Camas to the neighboring City except in very extreme circumstances and these connections do not represent practical sources of water for Camas.

History of Water Use

The City's has diverted water from Jones Creek since 1913 and from Boulder Creek since 1931 for municipal supply. The City drilled Wells 1 and 2 in 1936 and added Well 3 in 1945. These wells are all located in the LWWF. The system continued to expand with the addition of Wells 5 through 8 and 14 in the LWWF plus Wells 4 and 9 outside the wellfield. Wells 1, 2, 3 and 4 were subsequently replaced with Wells 10, 11, 12 and 13.

The City hasn't diverted any water from the two surface water sources since 2011 and intends to only use these sources during winter months. City staff provided monthly pumping and surface water diversion data obtained from their SCADA system. Table 2 presents average monthly and annual groundwater pumping rates and surface water diversion rates.

Table 2 – Annual Surface Water and Groundwater Production

YEAR	SURFACE WATER (ac-ft/yr)	GROUNDWATER (ac-ft/yr)	TOTAL (ac-ft/yr)
1997	1,597	1,418	3,015
1998	1,544	2,149	3,693
1999	1,541	2,136	3,677
2000	Data Unavailable		
2001	Data Unavailable		
2002	1,363	2,610	3,973
2003	1,183	3,474	4,657
2004	1,251	3,272	4,523
2005	864	3,390	4,254

2006	837	3,758	4,595
2007	855	3,260	4,115
2008	679	3,485	4,164
2009	306	3,800	4,106
2010	311	3,511	3,822
2011	51	3,935	3,986
2012	0	4,084	4,084
2013	0	4,156	4,156
2014	0	4,432	4,432
2015	0	4,765	4,765
2016	0	4,605	4,605
2017	0	4,578	4,578
2018	0	4,623	4,623
2019	0	4,437	4,437
2020	0	4,721	4,721

Proposed Use

The City's WSP identified the need for additional supply to meet future demands (Carollo, 2019). The WSP estimated population and water demand growth under low, medium and high growth projections to assess future instantaneous and annual supply needs. The WSP evaluated the instantaneous capacity requirements for the LWWF by subtracting Qi's allocated to non-LWWF sources from projected maximum daily demand (MDD) over a planning horizon (through 2035). Table 3 summarizes the annual demand data (under medium growth projections) and shows that the allocated LWWF Qi will be exceeded in 2030. The shortfall in instantaneous capacity could reach about 1,700 gpm in 2035.

Table 3 – Projected Maximum Day Demands and Water Right Authority, Medium Growth Scenario

YEAR	INSTANTANEOUS DEMAND (gpm)	AUTHORIZED Qi[1] (gpm)	SURPLUS / (DEFICIT) (gpm)
2021	8,188	10,475	2,287
2022	8,458	10,475	2,017
2023	8,729	10,475	1,746
2024	9,000	10,475	1,475
2025	9,271	10,475	1,204
2026	9,563	10,475	912
2027	9,854	10,475	621
2028	10,146	10,475	329
2029	10,438	10,475	37

[1] Includes rights associated with the LWWF and wells PW9 and PW13 but does not include undeveloped rights G2-30146 and G2-30147, which authorize an additional 1,000 gpm each. Water rights for the surface water diversions are not included, because diversions are not permitted during periods of maximum system demand (i.e., summer).

2030	10,729	10,475	(254)
2031	11,021	10,475	(546)
2032	11,313	10,475	(838)
2033	11,604	10,475	(1,129)
2034	11,896	10,475	(1,421)
2035	12,188	10,475	(1,713)

Other Rights Associated with Project or Place of Use

The City currently maintains a water rights portfolio of 11 certificates and four permits. Accounted together based on their stated amounts, these would allow for instantaneous withdrawal of 14,045 gpm and total annual withdrawal of 13,596 ac-ft/yr. Several factors alter the total annual allocation. In 1980 Ecology established an annual withdrawal limit of 5,750 ac-ft/yr for all (surface-water and groundwater) rights issued prior to 1979. This was increased to a maximum allocation of 6,300 ac-ft/yr with the recognition of groundwater claims for Wells 1 and 2. At that time, combined instantaneous and annual withdrawals authorized for the LWWF were 7,000 gpm and 5,048 ac-ft/yr.

This maximum allocation from the LWWF was increased again in 2008, when Ecology issued Permits G2-30144 and G2-30145 that added an allocation of 1,500 gpm and 3,030 ac-ft/yr to LWWF sources along with authorizing expansion of the wellfield with new Well 14. Addition of these two permits allowed the City to pump the LWWF at combined instantaneous and annual rates of up to 8,500 gpm and 8,078 ac-ft/yr.

Also, in 2008 Ecology issued additional permits to further expand the LWWF to new wells at Parker's Landing (G2-30146) and the Wastewater Treatment Plant (G2-30147). Neither of these permits have yet been developed due to current engineering and property constraints. Combining these permits with the others issued for the LWWF increases the total LWWF Qi to 10,500 gpm and the Qa to 9,838 ac-ft/yr.

The extended wellfield, as defined by the City's water right approvals, includes Wells 5 through 8, 10, 11, 12, 14, and the WWTP and Parkers Landing well sites.

Table 4 - City of Camas Water Rights

DOCUMENT NUMBER	PRIORITY DATE	INSTANTANEOUS RATE (gpm)	ANNUAL QUANTITY (ac-ft/yr)	COMMENTS
CS2-SWC712	8/22/1923	1,120	1,820	Boulder Creek
CS2-SWC711	9/5/1930	450	730	Jones Creek
G2-CV1-2P159	6/11/1974	900	320	Well 10 (replaced PW1)
G2-CV1-2P160	6/11/1974	900	230	Well 11 (replaced PW3)
C-85-A	7/21/1945	1,200	118	Well 12 (replaced PW2)
C-4072-A	2/12/1959	1,325	1,208	Well 13 (replaced PW4)
C-6635-A	3/22/1968	1,500	2,400	Well 6
C-6636-A	3/22/1968	600	920	Well 5
G2-00501C	3/22/1971	1,000	530	Well 7
G2-24400C	8/13/1986	900	530	Well 8
G2-30144	8/21/2003	500 (Well 8 only)	2,150	Wells 5 – 8, 10, 11, and 13

G2-27384	8/13/1986	650	210 N	Well 9
G2-30145	8/13/1986	1,000	880	Well 14
G2-30146	8/13/1986	1,000	880	Parkers Landing
G2-30147	8/13/1986	1,000	880	WWTP

gpm = Gallons per Minute; ac-ft/yr = Acre-feet per Year; N = non-additive

Hydrogeologic Evaluation

The geology of the project area has been studied and investigated by the United States Geological Survey (USGS; Mundorff, 1964; Hogenson and Foxworthy, 1965; Hartford and McFarland, 1989; Swanson and others, 1993; McFarland and Morgan, 1997) and various consultant reports for local governments (PGG, 2003, 2004, and 2006).

The City is located near the eastern edge of the Portland Basin near the Cascade foothills. The bottom of the basin is formed of volcanic rocks that rise to the east to form the Cascade Range. Sediments that fill the basin range are over 1,700 feet thick in the middle of the basin around the City of Vancouver, but dip up and thin toward the Camas area and are absent in the northern portion of the study area where bedrock is exposed. These sediments include river alluvium (deposited during both recent and Pleistocene times) underlain by deposits of the Troutdale formation. In the LWWF vicinity, the Troutdale formation is absent and alluvial deposits are underlain directly by relatively shallow bedrock.

Pleistocene Alluvial Deposits occur at or near the land surface throughout much of the City in the area that lies between the Washougal and Columbia Rivers and are largely overlain by river alluvium in the LWWF vicinity. During the late Pleistocene, the ancestral Columbia River deposited a great deltaic fan emanating to the west from the mouth of the Gorge during a series catastrophic events known as the “Missoula floods.” The resulting deposits are approximately 100 feet thick in the vicinity of the LWWF increasing to about 200 feet under the Columbia River channel. Sediment textures are typically described by drillers as boulders, cobbles, sand and gravel with some limited cemented zones. In places, the Pleistocene Alluvial Deposits are overlain by finer-grained recent alluvial deposits.

Saturated portions of the Pleistocene Alluvial Deposits form the Pleistocene Alluvial Aquifer (PAA). The PAA is highly productive, with local supply wells typically producing between 500 and 1,500 gpm. Testing at the City’s LWWF indicates an aquifer transmissivity of approximately 1,000,000 gallons per day per foot (gpd/ft) and a storage coefficient of about 0.05 (PGG, 2004). All of the City’s wells located within the floodplain are completed in the PAA. Relatively shallow bedrock limits the saturated thickness of the PAA, thus limiting available drawdowns and maximum yields of PAA wells.

Groundwater levels in the PAA show significant seasonal variation due to river stage variation and pumping withdrawals (by Camas, Washougal and Georgia Pacific). Seasonal water level variations are locally observed to range from 15 to over 35 feet. Water levels in the LWWF tend to rise to the Washougal River elevation during high-flow events in late spring when the Columbia River and lower Washougal River are at their highest. This suggests that the aquifer is replenished up to the river elevation during these events and that groundwater and surface water are hydraulically connected. In contrast, seasonal declines in groundwater levels near the river during the summer and fall months indicate that unsaturated conditions develop in the lower reaches of the system. These unsaturated conditions locally sever the direct hydraulic connection between the river and the PAA water table during portions of the summer and the fall (PGG, 2004 and 2013).

Despite the proximity of LWWF wells to the Washougal River, testing showed that only Well 4 exhibited groundwater under the influence of surface water from the Washougal River (PGG, 2004). The City has subsequently taken Well 4 out of service.

ANALYSIS

Under Washington State law (RCW 90.03.290), each of the following four criteria must be met for an application for a new water right permit to be approved:

- Water must be available for appropriation.
- Water withdrawal and use must not cause impairment of existing water rights.
- The proposed water use must be beneficial.
- Water use must not be detrimental to the public interest (public welfare).

Water Availability

For any new appropriation, water must be both physically and legally available.

Physical Availability

For water to be physically available for appropriation, water must be present in quantities and quality and on a sufficiently frequent basis to provide a reasonably reliable source for the requested beneficial use or uses. An analysis of physical availability is required for both surface water and groundwater applications.

The PAA tapped by the LWWF wells is highly transmissive and supports numerous high-production supply wells operated by the City, the City of Washougal, and Georgia-Pacific. The City has been withdrawing groundwater from the LWWF since the late 1930s without any reported loss of aquifer yield or need to curtail use due to physical unavailability of water. Given the requested water right is non-additive to existing water rights for the LWWF there will be no increase in instantaneous or annual production and water is physically available for the requested use.

Legal Availability

To meet the legal availability test, the proposed appropriation may not withdraw and use water that is already “spoken for”, such as water from sources that are protected by administrative rule or court order.

Under Chapter 173-528 WAC, the Washougal River is closed to new consumptive appropriations year-round, including appropriation of groundwater in hydraulic continuity with surface water. The LWWF wells are in hydraulic continuity with the Washougal River. The existing water rights for the LWWF either pre-date adoption of Chapter 173-528 WAC (G2-CV1-2P159, G2-CV1-2P160, C-85-A, C-6635-A, C-6636-A , G2-00501C, and G2-24400C) or were issued as mitigated water rights, mitigated by the City’s reduced seasonal diversions from Jones Creek and Boulder Creek. Given the requested water right is non-additive to these primary water rights there will be no increase in pumping from the LWWF and pumping effects on the Washougal River remain within those estimated to support the authorization of previous water rights. As such, water is legally available.

Impairment

In analyzing impairment, Ecology must make a determination as to whether existing water rights, including adopted instream flows, may be impaired by the withdrawal and proposed use.

The requested water right is non-additive to the City's existing rights for the LWWF and would not increase the instantaneous or annual withdrawals. The existing primary water rights all either pre-date the adoption of Chapter 173-528 WAC or are mitigated by the City's reduction in diversions from Jones Creek and Boulder Creek. Approval of the requested non-additive water right would allow the City to shift production between wells within the expanded LWWF, but not increase the total authorized instantaneous or annual quantities from the LWWF. Based on this, impairment of other water rights or instream flows is unlikely.

Beneficial Use

The proposed appropriation must be for a beneficial use of water.

Municipal supply is considered a beneficial use of water under RCW 90.54.020(1).

Public Interest

The withdrawal and associated use must not be detrimental to the public interest. At a minimum, the following are considered when making this assessment.

Notification to the Washington Department of Fish and Wildlife
Per RCW 90.03.280 and 77.57.020, Ecology must give notice to the Washington Department of Fish and Wildlife (WDFW) of applications to divert, withdraw, use, or store water.

WDFW was provided notice of this water right application on November 4, 2021. Steve Boessow responded in a letter dated March 15, 2022 stating that WDFW did not oppose the approval of this application.

State Environmental Policy Act (SEPA)
Under chapter 197-11 WAC, a water right application is subject to a SEPA threshold determination (i.e., an evaluation of whether there will be significant adverse environmental impacts) if any of the following conditions are met:

- It is a surface water right application for more than 1 cfs, unless that project is for agricultural irrigation, in which case the threshold is increased to 50 cfs, so long as that irrigation project will not receive public subsidies;
- It is a groundwater right application for more than 2,250 gpm;
- It is an application that, in combination with other water right applications for the same project, collectively exceed the amounts above;
- It is a part of a larger proposal that is subject to SEPA for other reasons (e.g., the need to obtain other permits that are not exempt from SEPA);
- It is part of a series of exempt actions that, together, trigger the need to do a threshold determination, as defined under WAC 197-11-305.

The subject application's requested groundwater withdrawal exceeds 2,250 gpm. Therefore, a SEPA threshold determination was completed. Acting as the lead agency, the City of Camas prepared a SEPA checklist for the water right change. The City of Camas issued a Determination of Non-Significance (DNS) on January 20, 2022.

Public Notice

RCW 90.03.280 requires that notice of a water right application be published once a week, for two consecutive weeks, in a newspaper of general circulation in the county or counties where the water is to be stored, diverted, and used. Notice of this application was published in the Camas-Washougal Post-Record, a weekly newspaper, on 2/13/20 and 2/20/20.

No protests to this water right application were received.

Other Public Interest Concerns

The Watershed Management Plan adopted for WRIA 27/28 in 2006 addresses a range of issues related to water resources in the Salmon/Washougal drainage, including water supply, stream flow management, water quality, and aquatic habitat. The Watershed Management Plan recommended development of rules to protect instream flows and guide water resources permitting decisions. Chapter 173-528 WAC – Water Resources Program for the Salmon-Washougal Basin, WRIA 28 – was adopted into rule in January 2009 and implements the instream flow closures recommended in the Watershed Management Plan. The proposed new groundwater right, non-additive to existing rights, is consistent with the requirements and intent of Chapter 173-528 WAC and is not detrimental to the public interest.

Conclusions

I find that:

- Water is physically and legally available.
- The appropriation will not impair existing rights.
- The proposed municipal use is a beneficial use.
- Approval of this application will not be detrimental to the public interest.

RECOMMENDATIONS

Based on the above investigation and conclusions, I recommend this request for a water right be **APPROVED** in the amounts and within the limitations listed below and subject to the provisions listed above.

Recommended Quantities, Purpose of Use, and Project Location

The rate and quantity of water recommended are maximum limits. The permit holder may only withdraw water at a rate and quantity within the specified limits that are reasonable and beneficial:

Table 5. Recommended Limits and Location

Maximum Instantaneous Rate (gpm)	6,700 (non-additive)
Maximum Annual Quantity (ac-ft/yr)	10,050 (non-additive)
Purpose of Use	Municipal
Points of Withdrawal	Well 5: SW¼, SE¼, S12, T1N, R3E W.M. Well 6: NE¼, SW¼, S12, T1N, R3E W.M. Well 7: NW¼, SW¼, S12, T1N, R3E W.M. Well 8: NE¼, SW¼, S12, T1N, R3E W.M. Well 10: NW¼, SW¼, S12, T1N, R3E W.M. Well 11: NW¼, SW¼, S12, T1N, R3E W.M. Well 12: NW¼, SE¼, S12, T1N, R3E W.M. Well 14: NW¼, SE¼, S12, T1N, R3E W.M.
Place of Use	As described in the City's most recent Water System Plan, dated May 1, 2019.



Burt G. Clothier, LHG, RG — *Date*: June 2, 2022

Tammy Hall, LHG — *Date*: June 2, 2022

To request ADA accommodation including materials in a format for the visually impaired, call Ecology Water Resources Program at 360-407-6872. Persons with impaired hearing may call Washington Relay Service at 711. Persons with speech disability may call TTY at 877-833-6341.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Southwest Region Office
PO Box 47775, Olympia, WA 98504-7775 • 360-407-6300

May 12, 2026

City of Camas
Attn: Rob Charles, PE
1620 SE 8th Ave
Camas, WA 98607

Email: rcharles@cityofcamas.us

Re: Proof of Appropriation Extension for Water Right No. G2-30144 & G2-30145

Dear City of Camas:

The Washington State Department of Ecology (Ecology) received your request to extend the date your project will be fully developed from August 1, 2025 to December 31, 2031. This is your first extension request to fully develop your project and therefore put (up to) the quantities of water on your permit to full beneficial use.

Per RCW 90.03.320, we approve permit extensions for "good cause shown" and "as may be reasonably necessary, having due regard to the good faith of the applicant and the public interests affected." For the reason(s) below, your permit extension request is approved:

- Changes in the project, while the project scope remains consistent with the original intent of the water right application – While the test wells have drilled, they are not productive or sufficient. Production has been shifted to the Lower Washougal Well Field under the non-additive quantities of water right permit G2-30756.

- Unforeseen financial and engineering problems – With the detection of PFAS is Well 13, funding and planning delays have resulted in significate redirection of Camas's resources. This has caused delays in development.

- Demonstrated effort to attain additional environmental studies – Camas has completed extensive testing and analysis within the Lower Washougal Wellfield to have a better understanding of the relationship between wells (i.e. existing and future), wellfield yield, hydrogeologic conditions, and hydraulic continuity between surface water and groundwater. This includes updating the regional groundwater model to better understand these conditions.

- Development of an updated water system plan – Camas is completing a Water System Plan Update (WSP) to be submitted to the Department of Health. The WSP will include changes to existing project and future plans.

The new deadline to fully develop your project is December 31, 2031. This is also the deadline to submit the enclosed Proof of Appropriation of Water form.

Please note that we expect you to follow all provisions on your permit and any underlying documentation until your use is certificated. Non-compliance may result in enforcement orders and/or penalties and may delay the certification of your water right permit.

Contact information

Please direct all questions about this letter and the enclosed Proof of Appropriation of Water form to:

Matthew Kogle
Staff Hydrogeologist – Permit Writer
Water Resources Program
Southwest Region Office

Phone: (360) 280-2983
Email: matthew.kogle@ecy.wa.gov

When you have fully developed your project, send the completed Proof of Appropriation of Water form to:

Department of Ecology – Southwest Region Office
Attn: Water Resources Program
P.O. Box 47775
Olympia, WA 98504-7775

Your right to appeal

You have a right to appeal this decision to the Pollution Control Hearings Board (PCHB) within 30 days of the date of receipt. The appeal process is governed by chapter 43.21B RCW and chapter 371-08 WAC. “Date of receipt” is defined in RCW 43.21B.001(2).

To appeal, you must do all of the following within 30 days of the date of receipt of this decision:

- File your notice of appeal and a copy of this decision with the PCHB (see filing information below). “Filing” means actual receipt by the PCHB during regular business hours as defined in WAC 371-08-305 and -335. “Notice of appeal” is defined in WAC 371-08-340.

- Serve a copy of your notice of appeal and this decision on the Department of Ecology by mail, in person, or by email (see addresses below).

You must also comply with other applicable requirements in chapter 43.21B RCW and chapter 371-08 WAC.

Filing an appeal

Filing with the PCHB
For the most current information regarding filing with the PCHB, visit: https://eluho.wa.gov/ or call: 360-664-9160.

Service on Ecology

Street Address:

Department of Ecology
Attn: Appeals Processing Desk
300 Desmond Drive SE
Lacey, WA 98503

Mailing Address:

Department of Ecology
Attn: Appeals Processing Desk
PO Box 47608
Olympia, WA 98504-7608

E-Mail Address:

ecologyappeals@ecy.wa.gov

More information

- **Pollution Control Hearings Board Website**
  https://eluho.wa.gov/
- **Chapter 43.21B RCW – Environmental Hearings Office – Pollution Control Hearings Board**
  http://apps.leg.wa.gov/RCW/default.aspx?cite=43.21B
- **Chapter 371-08 WAC – Practice And Procedure**
  http://apps.leg.wa.gov/WAC/default.aspx?cite=371-08
- **Chapter 34.05 RCW – Administrative Procedure Act**
  http://apps.leg.wa.gov/RCW/default.aspx?cite=34.05
- **Ecology's Laws, Rules & Rulemaking**
  https://www.ecology.wa.gov/About-us/How-we-operate/Laws-rules-rulemaking#ws

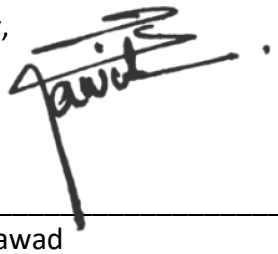
Americans with Disabilities Act information

Accommodation Requests

To request ADA accommodation including materials in a format for the visually impaired, call Ecology at 360-407-7668 or visit https://ecology.wa.gov/accessibility. People with impaired hearing may call Washington Relay Service at 711. People with speech disability may call TTY at 877-833-6341.

Signature

Sincerely,



Saboor Jawad
Section Manager
Water Resources Program
Southwest Region Office

Enclosures: **Proof of Appropriation of Water**
https://apps.ecology.wa.gov/publications/documents/ecy040126.pdf

cc: Burt Clothier, Strate Geoscience - burt@stratageosciences.com (email only)
City of Camas, Operations Center – publicworks@cityofcamas.us (email only)

Sent by Certified Mail: 9489 0090 0027 6340 7369 64

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Southwest Region Office
PO Box 47775, Olympia, WA 98504-7775 • 360-407-6300

May 12, 2026

City of Camas
Attn: Rob Charles, PE
1620 SE 8th Ave
Camas, WA 98607

Email: rcharles@cityofcamas.us

Re: Complete Construction Extension for Water Right No. G2-30146 & G2-30147

Dear City of Camas:

The Washington State Department of Ecology (Ecology) received your extension request to complete construction on your project. While Ecology's records indicate that construction has not started for these water right permits, further conversation with Camas indicated that test wells have been drilled under these water right permits. Furthermore, these water right permits are being exercised under non-additive quantities of water right permit G2-30756 within the Lower Washougal Well Field. Therefore, Ecology has determined that construction has begun for water right permits G2-30146 and G2-30147. This is your first request to extend the complete construction deadline.

Per RCW 90.03.320, we approve permit extensions for "good cause shown" and "as may be reasonably necessary, having due regard to the good faith of the applicant and the public interests affected." For the reason(s) below, your permit extension request is approved:

- Changes in the project, while the project scope remains consistent with the original intent of the water right application – While the test wells have drilled, they are not productive or sufficient. Production has been shifted to the Lower Washougal Well Field under the non-additive quantities of water right permit G2-30756.

- Unforeseen financial and engineering problems – With the detection of PFAS is Well 13, funding and planning delays have resulted in significate redirection of Camas's resources. This has caused delays in development.

- Demonstrated effort to attain additional environmental studies – Camas has completed extensive testing and analysis within the Lower Washougal Wellfield to have a better understanding of the relationship between wells (i.e. existing and future), wellfield yield,

hydrogeologic conditions and hydraulic continuity between surface water and groundwater. This includes updating the regional groundwater model to better understand these conditions.

- Development of an updated water system plan – Camas is completing a Water System Plan Update (WSP) to be submitted to the Department of Health. The WSP will include changes to existing project and future plans.

The new deadline to complete construction on your project is December 31, 2031. This is also the deadline to submit the enclosed Complete Construction Notice and Form 1 – Measuring Device Information.

As you develop your project, we expect you to follow all provisions on your permit and any underlying documentation. Non-compliance may result in enforcement orders and/or penalties and may delay the certification of your water right permit.

Contact information

Please direct all questions about this letter and the enclosed Complete Construction Notice and Form 1 – Measuring Device Information to:

Matthew Kogle
Staff Hydrogeologist – Permit Writer
Water Resources Program
Southwest Region Office

Phone: (360) 280-2983
Email: matthew.kogle@ecy.wa.gov

Your right to appeal

You have a right to appeal this decision to the Pollution Control Hearings Board (PCHB) within 30 days of the date of receipt. The appeal process is governed by chapter 43.21B RCW and chapter 371-08 WAC. “Date of receipt” is defined in RCW 43.21B.001(2).

To appeal, you must do all of the following within 30 days of the date of receipt of this decision:

- File your notice of appeal and a copy of this decision with the PCHB (see filing information below). “Filing” means actual receipt by the PCHB during regular business hours as defined in WAC 371-08-305 and -335. “Notice of appeal” is defined in WAC 371-08-340.

- Serve a copy of your notice of appeal and this decision on the Department of Ecology by mail, in person, or by email (see addresses below).

You must also comply with other applicable requirements in chapter 43.21B RCW and chapter 371-08 WAC.

Filing an appeal

Filing with the PCHB

For the most current information regarding filing with the PCHB, visit: https://eluho.wa.gov/ or call: 360-664-9160.

Service on EcologyStreet Address:

Department of Ecology
Attn: Appeals Processing Desk
300 Desmond Drive SE
Lacey, WA 98503

Mailing Address:

Department of Ecology
Attn: Appeals Processing Desk
PO Box 47608
Olympia, WA 98504-7608

E-Mail Address:

ecologyappeals@ecy.wa.gov

More information

- **Pollution Control Hearings Board Website**
  https://eluho.wa.gov/
- **Chapter 43.21B RCW – Environmental Hearings Office – Pollution Control Hearings Board**
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  https://www.ecology.wa.gov/About-us/How-we-operate/Laws-rules-rulemaking#ws

Americans with Disabilities Act information

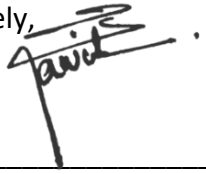
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hearing may call Washington Relay Service at 711. People with speech disability may call TTY at 877-833-6341.

Signature

Sincerely,



Saboor Jawad
Section Manager
Water Resources Program
Southwest Region Office

Enclosures: **Complete Construction Notice**
https://apps.ecology.wa.gov/publications/documents/ecy04030b.pdf

Measuring Device Information form
https://apps.ecology.wa.gov/publications/documents/ecy070170.pdf

cc: Burt Clothier, Strate Geoscience - burt@stratageosciences.com (email only)
City of Camas, Operations Center – publicworks@cityofcamas.us (email only)

Sent by Certified Mail: 9489 0090 0027 6340 7369 40

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Southwest Region Office
PO Box 47775, Olympia, WA 98504-7775 • 360-407-6300

May 12, 2026

City of Camas
Attn: Rob Charles, PE
1620 SE 8th Ave
Camas, WA 98607

Email: rcharles@cityofcamas.us

Re: Complete Construction Extension for Water Right No. G2-30756

Dear City of Camas:

The Washington State Department of Ecology (Ecology) received your extension request to complete construction on your project from December 31, 2026 to December 31, 2031. This is your first request to extend the complete construction deadline.

Per RCW 90.03.320, we approve permit extensions for "good cause shown" and "as may be reasonably necessary, having due regard to the good faith of the applicant and the public interests affected." For the reason(s) below, your permit extension request is approved:

- Unforeseen financial and engineering problems – With the detection of PFAS is Well 13, funding and planning delays have resulted in significate redirection of Camas's resources. This has caused delays in development.

- Demonstrated effort to attain additional environmental studies – Camas has completed extensive testing and analysis within the Lower Washougal Wellfield to have a better understanding of the relationship between wells (i.e. existing and future), wellfield yield, hydrogeologic conditions, and hydraulic continuity between surface water and groundwater. This includes updating the regional groundwater model to better understand these conditions.

- Development of an updated water system plan – Camas is completing a Water System Plan Update (WSP) to be submitted to the Department of Health. The WSP will include changes to existing project and future plans.

The new deadline to complete construction on your project is December 31, 2031. This is also the deadline to submit the enclosed Complete Construction Notice and Form 1 – Measuring Device Information.

As you develop your project, we expect you to follow all provisions on your permit and any underlying documentation. Non-compliance may result in enforcement orders and/or penalties and may delay the certification of your water right permit.

Contact information

Please direct all questions about this letter and the enclosed Complete Construction Notice and Form 1 – Measuring Device Information to:

Matthew Kogle
Staff Hydrogeologist – Permit Writer
Water Resources Program
Southwest Region Office

Phone: (360) 280-2983
Email: matthew.kogle@ecy.wa.gov

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Olympia, WA 98504-7608

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ecologyappeals@ecy.wa.gov

More information

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- **Chapter 371-08 WAC – Practice And Procedure**
  http://apps.leg.wa.gov/WAC/default.aspx?cite=371-08
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- **Ecology's Laws, Rules & Rulemaking**
  https://www.ecology.wa.gov/About-us/How-we-operate/Laws-rules-rulemaking#ws

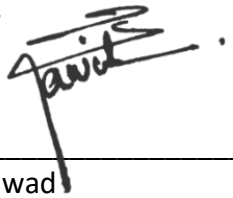
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Signature

Sincerely,



Saboor Jawad
Section Manager
Water Resources Program
Southwest Region Office

Enclosures: **Complete Construction Notice**
https://apps.ecology.wa.gov/publications/documents/ecy04030b.pdf

Measuring Device Information form
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cc: Burt Clothier, Strate Geoscience - burt@stratageosciences.com (email only)
City of Camas, Operations Center – publicworks@cityofcamas.us (email only)

Sent by Certified Mail: 9489 0090 0027 6340 7369 57

APPENDIX T

WATER RIGHTS SELF-ASSESSMENT

Water Right Self-Assessment Form for Water System Plans

331-372 • 3/19/2026

All water right permits, claims, and certificates must be evaluated in a water right self-assessment for all sources used to supply the water system. The self-assessment is used to compare the parameters and other limitations of existing water rights against current and forecasted water production, as described in your water system plan, to determine whether the rights are adequate to serve your system's current and future water needs. This evaluation is for planning purposes and **does not constitute an official tentative determination of extent and validity** of water right permits, certificates, and claims. Tentative determinations of extent and validity occur when Ecology makes certain water right decisions, such as on water right change applications.

You must account for **all** sources of supply and total quantities of water withdrawn from the source. If you purchase water from another purveyor through a non-emergency intertie, you must complete the INTERTIES section of the self-assessment. All parts of the form must be filled out for each source. If information is missing it could result in delays of the water system plan approval process.

A Note on Permit-Exempt Wells

If you're seeking DOH approval of a new Group A or Group B water system using a permit-exempt well, you must complete the self-assessment, although certain fields will not apply. Talk to your DOH regional planner about using the Water Right Self-Assessment form for a Small Water System Management Program instead of this version.

Local governments must ensure that an adequate potable water supply is available from the permit-exempt well before issuing a building permit. Before developing a permit-exempt well, check with your local authorities on their criteria for establishing an adequate potable water supply for your planned public water system.

Water Right Parameters

Below is a brief description of the parameters associated with a typical water right. For the self-assessment, you only need to describe the last two bulleted items if they apply to your water rights.

- **Source Type**—refers to whether the source is surface water or groundwater.
- **Source Location**—this refers to the location of points of groundwater withdrawal or surface water diversion for each right.
- **Purpose of Use**—refers to the type of use, such as municipal water supply, community domestic, industrial or agricultural purposes.
- **Place of Use**—describes where water can be put to beneficial use under the right. Under the 2003 Municipal Water Law, RCW 90.03.386, the place of use for a water right held for municipal water supply purposes may be the system's service area as identified in an **approved** water system plan or small water system management program. Attach written

description and/or a map for water rights original place of use if service area is located in Mason, Thurston, Pierce, and Kitsap counties. To see the original place of use of a water right, use Ecology's Water Right Tracking System to look up the water right document using Ecology's Water Right Tracking System website.
    - See Ecology Policy 2030 for information on how Ecology administers the Municipal Water Law.
- **Period of Use**—refers to time-of-year limitations in which the water right may be put to use. If any water right has a time-of-year limitation, please include this information in the INTERRUPTIBLE WATER RIGHTS section.
- **Provisions or Limiting Conditions**—refers to any provisions or conditions placed on the water right. If a water right has a limiting condition or other provision, such as a collection and reporting requirement, other than a time-of year limitation, include this information in the ADDITIONAL COMMENTS section at the bottom of the self-assessment and in the water system plan narrative.

See Ecology Policy 20-11-065 for more information on water right terminology. If you have questions about your water rights, please contact the Ecology regional office in your area.

Completing the Water Right Self-Assessment Form

The self-assessment is a Word document to allow users to make changes or to expand the document. You may use another format, if preferred, as long as all required information is included. Below is a description of all fields and how to complete them. This form is divided into four different sections. Each section is described in the headings below.

See the column identifiers (A, B, C, etc) at the bottom of each column for guidance in completing the necessary calculations.

Water Right Permit, Certificate, or Claim Number: This number is assigned by Ecology when a permit application is filed. It's listed at the top of the permit or certificate. For water right claims, this is the registration number stamped in the lower left hand corner of the claim form.

WFI Source #: Identify the individual sources (e.g. well #1, well #2) as defined on the DOH Water Facilities Inventory form. If a **water right** is associated with multiple sources, list all sources in the same row in this column. If a **source** is associated with multiple water rights, identify each water right on a separate row.

Point of Withdrawal or Diversion Location: For wells, identify the well tag #. For wells and diversions please list the quarter-quarter section; township, range, or other more specific location identification information. If there are multiple points of withdrawal or diversion for single water right, list them all on the same line for that water right (do not list the water right on multiple lines with each unique point of withdrawal or diversion).

If you have any source(s) that is not currently being used (categorized as standby, back-up, or emergency), and the source has an associated water right that is not listed in column #1, please include the source and water right information in the ADDITIONAL COMMENTS section. This will identify that the source is still intended for a beneficial use under RCW 90.03.015(4). See Ecology Policy 20-11-065.

EXISTING WATER RIGHTS SECTION *(olive green color, top section)*

This section refers to existing water rights. It does not include any water right applications that have been submitted to Ecology.

Primary Qi (Instantaneous Quantity): This is also known as instantaneous flow rate. It's the amount of water allowed to be taken under the right from the source during a period of peak operation. For surface water, this is generally expressed in terms of cubic feet per second (cfs). For groundwater, this is generally expressed in terms of gallons per minute (gpm). One cfs equals 448.8 gpm. Please indicate the units of measurement you are using for each source. If there are situations where the flow rate will be limited (e.g. limitations established on the source when other sources are utilized), please note them in the ADDITIONAL COMMENTS section in the form and in the WSP narrative.

Non-Additive Qi: This term was formally known as "supplemental." Your water rights may use the old terminology. See Ecology Policy 20-11-065 for more information. Not all water rights have non-additive quantities. If a water right has non-additive Qi quantities, include the non-additive quantity in this field. This is generally listed in the "quantity, type of use, period of use" section on both permits and certificates. *Non-additive quantities should not be included in the primary Qi totals.*

Primary Qa (Annual Quantity): This is the amount of water that can be taken from the source under the right on an annual basis. This is different than the consumptive use limitation listed on the water right, if applicable (see WAC 173-500-050 and Ecology POL-1020 for further definition of consumptive use). It's usually expressed in terms of acre-feet. An acre-foot is the amount of water necessary to submerge an acre of land to a depth of one foot. One acre-foot equals 43,560 cubic feet or 325,851 gallons of water. If a Qa is not listed on the water right please write "N/A".

Non-Additive Qa: This term was formerly known as "supplemental." Your water rights may use the old terminology. See Ecology Policy 20-11-065 for more information. Not all water rights have non-additive quantities. If a water right has non-additive Qa quantities, include the non-additive quantity in this field. This is generally listed in the "quantity, type of use, period of use" section on both permits and certificates. *Non-additive quantities should not be included in the primary Qa totals.*

CURRENT SOURCE PRODUCTION SECTION *(light green color, top section)*

This section refers to how much water is withdrawn from the source under each water right for the most recent full calendar year. You will need to determine any excess or deficiency for each water right after calculating how much water was withdrawn compared to how much water is allowed under each water right. If demand has decreased over past years, you may wish to include historic maximum production information in the ADDITIONAL COMMENTS section. This will provide a more complete picture of the use of your water rights.

Use the water use data and demand projections from your water system plan to define current and projected water needs. You can determine if you'll need additional water rights based on the comparison of existing water rights, current water production, and projected 10- and 20-year needs.

Total Qi (Instantaneous Quantity): This refers to the total maximum instantaneous flow rate withdrawn from the source under each water right during the most recent calendar year. For surface water, this is expressed in terms of cubic feet per second (cfs). For groundwater, this is expressed in terms of gallons per minute (gpm). One cfs equals 448.8 gpm.

Current Excess or Deficiency (Qi): Please calculate the excess or deficiency for each water right after comparing the total amount withdrawn against each water right. Please use parentheses for deficient amounts.

Total Qa (Annual Quantity): This refers to the total volume of water withdrawn from each source under each water right during the most recent calendar year. It's usually expressed in acre-feet.

Current Excess or Deficiency (Qa): Please calculate the excess or deficiency for each water right after comparing the total amount withdrawn against each water right. Please use parentheses for deficient amounts.

10-YEAR FORECASTED SOURCE PRODUCTION SECTION *(light blue color, top section)*

This section refers to how much water you project to withdraw from each source in ten years as determined in your water system plan. Please complete this section in the same manner (using the same units of measurement) as the current source production section using your 10-year forecasted amounts.

20-YEAR FORECASTED SOURCE PRODUCTION SECTION *(darker blue color, top section)*

This section refers to how much water you project to withdraw from each source in twenty years as determined in your water system plan. Please complete this section in the same manner (using the same units of measurement) as the current source production section using your 20-year forecasted amounts. If you are unable to provide 20-year forecasts for each source, you may choose to include the combined 20-year total at the bottom.

PENDING WATER RIGHTS SECTION *(second section of form)*

Please complete this section for any water right applications that have been submitted to Ecology. Please include the application number, whether it's a new or a change application, the date submitted, and the total quantities requested.

INTERTIES SECTION *(third section of form)*

This section must be completed by purveyors who purchase any amount of wholesale water. If your system sells water to another public water system, include the quantity sold in the CURRENT SOURCE PRODUCTION section.

Purchasers of wholesale water must account for all water obtained through the intertie for non-emergency supply purposes. This is to ensure that all sources of supply are considered when evaluating whether new water rights are needed within 20 years.

Please identify the maximum quantity of water, expressed in the same manner as the above sections, allowed under each intertie contract. If there are limiting conditions or temporary agreements that effect the long-term use of the intertie, you must account for such limiting conditions when evaluating the current and forecasted water supply needs in your water system plan.

Finally, purchasers of wholesale water are responsible for ensuring that the underlying water right (held by the purveyor selling water) are adequate for such use. You should confirm that the selling system has accounted for the wholesale area in their water system plan to ensure that the water right authorizes the distribution of water through the intertie.

INTERRUPTIBLE WATER RIGHTS SECTION *(bottom section of form)*

This section refers to water rights that have an annual time-of-year interruption. Please complete this section for any water right listed in the above fields that has a time-of-year interruption. Please include the water right number, describe the limitation, and the time period of interruption. Purveyors with interruptible rights should develop a water shortage response plan as part of their water system plan to describe how demand will be met during periods of interruption through aggressive demand-side conservation, fixing leaks or other means.

ADDITIONAL COMMENTS SECTION *(bottom section of form)*

If the system has any source that is not currently being used on a regular basis (such a source may be categorized as stand-by, back-up, emergency), you should identify the source in this section if the source has an associated water right that is not listed in the above sections. The purpose is to identify that such water rights are still intended for a future beneficial use as required under RCW 90.03.015(4). See Page 2, Item 9 (b) in Ecology Policy 2030. For these water rights, please briefly describe the future intended use of the source and when you expect to utilize the water right. This does not refer to sources categorized as seasonal sources.

You should also include any other comments in this section that will explain aspects of your water right portfolio that are not identified above.

Washington State Department of HEALTH

To request this document in another format, call 1-800-525-0127. Deaf or hard of hearing customers, please call 711 (Washington Relay) or email doh.information@doh.wa.gov. If in need of translation services, call 1-800-525-0127.

Water Right Self-Assessment Form for Water System Plan

Mouse-over any link for more information. Click on any link for more detailed instructions.

Water Right Permit, Certificate, or Claim # *If water right is interruptible, identify limitation in yellow section below	WFI Source # If a source has multiple water rights, list each water right on separate line	Point of Withdrawal or Diversion Location Well tag #; quarter-quarter section; and township, range, section	Existing Water Rights Qi= Instantaneous Flow Rate Allowed (GPM or CFS) Qa= Annual Volume Allowed (Acre-Feet/Year) This includes wholesale water sold				Current Source Production – Most Recent Calendar Year Qi = Max Instantaneous Flow Rate Withdrawn (GPM or CFS) Qa = Annual Volume Withdrawn (Acre-Feet/Year) This includes wholesale water sold				10-Year Forecasted Source Production (determined from WSP) This includes wholesale water sold				20-Year Forecasted Source Production (determined from WSP) This includes wholesale water sold			
			Primary Qi Maximum Rate Allowed	Non-Additive Qi Maximum Rate Allowed	Primary Qa Maximum Volume Allowed	Non-Additive Qa Maximum Volume Allowed	Total Qi Maximum Instantaneous Flow Rate Withdrawn	Current Excess or (Deficiency) Qi	Total Qa Maximum Annual Volume Withdrawn	Current Excess or (Deficiency) Qa	Total Qi Maximum Instantaneous Flow Rate in 10 Years	10-Year Forecasted Excess or (Deficiency) Qi	Total Qa Maximum Annual Volume in 10 Years	10-Year Forecasted Excess or (Deficiency) Qa	Total Qi Maximum Instantaneous Flow Rate in 20 Years	20-Year Forecasted Excess or (Deficiency) Qi	Total Qa Maximum Annual Volume in 20 Years	20-Year Forecasted Excess or (Deficiency) Qa
C-712 CS2-SWC 712	S01: Boulder Creek		1,120 (2.5 cfs)[1]		977													
C-711 CS2-SWC 711	S02: Jones Creek		450 (1 cfs)[1]		393													
G 6636-A G2-*09325C	SO6: Well 5		600		920[5]		675	-75	305	615								
G 6635-A G2-*09325C	S07: Well 6		1,500		2,400[5]		1,200	300	421	1,979								
G2-00501	S08: Well 7		1,000		530[6]		950	50	606	-76								
G2-24400	S09: Well 8		900		530[6]		1,250	-350	511	19								
G2-27384	SO6: Well 9		650			210	575	75	196									
G2-CV1-2P159	S15: Well 10		900		320		900	0	450	-120								
G2-CV1-2P160	S14: Well 12		1,200		230[6]		1,000	200	811	-581								
C-85-A G2-*0004C	S13: Well 11		900		118		1,000	-100	498	-380								
G2-GWC4079 G2-*05130C	S16: Well 13		1,325		1,208[6]		1,350	-25	855	353								
G2-30144	Lower Washougal Wellfield		500 (At Well 8)		2,150 (All 8 wells)													
G2-30145	S17: Well 14		1,000		880		850	150	556	334								
G2-30146	Parkers Landing		1,000		880													
G2-30147	Treatment Plant Well		1,000		880													
G2-30756	Umbrella Wellfield		6,700		11,090 (All 8 wells)													
	TOTALS =		14,045[2] 12,475[3]		11,090[2]		9,750	2,725	5,210	5,880	10,490	1,985	8,070	3,020	14,080	-1,605	10,910	180
Column Identifiers for Calculations:			A		B		C	=A-C	D	=B-D	E	=A-E	F	=B-F	G	=A-G	H	=B-H

PENDING WATER RIGHT APPLICATIONS: Identify any water right applications that have been submitted to Ecology.

Application Number	New or Change Application?	Date Submitted	Quantities Requested			
			Primary Qi	Non-Additive Qi	Primary Qa	Non-Additive Qa
G2-30528	New		17,213 gpm		13,555 AFY	

INTERTIES: Systems receiving wholesale water complete this section. Wholesaling systems must include water sold through intertie in the current and forecasted source production columns above.

Name of Wholesaling System Providing Water	Quantities Allowed In Contract		Expiration Date of Contract	Currently Purchased Current quantity purchased through intertie				10-Year Forecasted Purchase Forecasted quantity purchased through intertie				20-Year Forecasted Purchase Forecasted quantity purchased through intertie			
	Maximum Qi Instantaneous Flow Rate	Maximum Qa Annual Volume		Maximum Qi Instantaneous Flow Rate	Current Excess or (Deficiency) Qi	Maximum Qa Annual Volume	Current Excess or (Deficiency) Qa	Maximum Qi 10-Year Forecast	Future Excess or (Deficiency) Qi	Maximum Qa 10-Year Forecast	Future Excess or (Deficiency) Qa	Maximum Qi 20-Year Forecast	Future Excess or (Deficiency) Qi	Maximum Qa 20-Year Forecast	Future Excess or (Deficiency) Qa
1															
2															
3															
TOTALS =															
Column Identifiers for Calculations:	A	B		C	=A-C	D	=B-D	E	=A-E	F	=B-F	G	=A-G	H	=B-H

INTERRUPTIBLE WATER RIGHTS: Identify limitations on any water rights listed above that are interruptible.

Water Right #	Conditions of Interruption	Time Period of Interruption
C-712 CS2-SWC 712	Surface water diversion unavailable during this period to maintain instream flow.	May 15th – October 31st
C-711 CS2-SWC 711	Surface water diversion unavailable during this period to maintain instream flow.	May 15th – October 31st
3		

ADDITIONAL COMMENTS:

[1] S01 Boulder Creek and S02 Jones Creek surface water diversions cease between May 15th and October 31st of each year as required by G2-30144.

[2] Due to permit and certificate restrictions, the total Qi and Qa do not equal the sum of quantities for each column.

[3] Total Qi available between May 15th and October 31st comes from ground water supplies only and is equal to total Qi of 14,045 gpm minus 1,570 gpm of surface water rights from Boulder Creek and Jones Creek.

[4] Installation of one future well in the LWWF is included under this permit.

[5] The Permit and Report of Examination preceding this certificate limited water rights to "the total quantity withdrawn or diverted from all sources is not to exceed 3,300 AFY.

[6] The Permit and Report of Examination preceding this certificate limited water rights to "the total quantity withdrawn or diverted from all sources is not to exceed 5,750 AFY.

APPENDIX U

WELLHEAD PROTECTION PLAN

CITY OF CAMAS
WELLHEAD PROTECTION PLAN UPDATE

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July 2026

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CITY OF CAMAS
WELLHEAD PROTECTION PLAN UPDATE

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Prepared for:

City of Camas
616 NE Fourth Ave
Camas, Washington 98607
360-817-1563
www.cityofcamas.us

Prepared by:

Strata Geosciences, LLC
851 Poplar Place S
Seattle, Washington 98144
206.329.0138
www.stratageosciences.com

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Camas WHP plan (July2026) draft.docx

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SIGNATURE

This report, and Strata Geosciences' work contributing to this report, were reviewed by the undersigned and approved for release.

DRAFT

Burt G. Clothier
Principal Hydrogeologist
Washington State Hydrogeologist No. 140

Ashley Parkhurst
Staff Engineer

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1.0 INTRODUCTION

Strata Geosciences, LLC (Strata) has prepared this Wellhead Protection Plan (WHPP) update for the City of Camas (City) to summarize the hydrogeology, wellhead protection area (WHPA) delineations, and contaminant risks to groundwater supplies. Information presented in this report supports an update of the City's Water System Plan (WSP) currently being prepared for the City by Carollo Engineers. The purpose of this report is to help the City better manage its groundwater supply and to better understand the contaminant risks posed to these sources. Elements of the report were developed following the Washington State Department of Health (DOH) guidelines for Wellhead Protection Programs (DOH, 2017).

The study area for this investigation focuses on the WHPAs for the City's nine shallow supply wells that lie in close proximity to the lower Washougal River (Figure 1-1). This includes the Lower Washougal Wellfield (LWWF), comprised of eight wells to the south of the railroad track, and Well 13 on the north bank of the Washougal River. The City also operates one deeper supply well (Well 9) in the Lacamas Lake area to the northwest of downtown Camas that is not included in the study area. This well is used primarily for supply during peak demand. Well construction and land use conditions limit the susceptibility and vulnerability of this source; therefore, it was not reviewed as part of this investigation.

1.1 REPORT ORGANIZATION

This report is organized into seven sections:

Section 1: Introduction. This section contains background information on the report.

Section 2: Hydrogeologic Framework. This section presents the regional and local hydrogeologic features that are pertinent to the City's groundwater supplies. It describes the deposits that form aquifers and aquitards and describes the movement of groundwater through these deposits.

Section 3: Wellhead Protection Area Delineations. This section discusses the methods used to delineate the WHPAs and presents the results of the analysis. Time-related capture zones are presented for the Lower Washougal Wellfield area.

Section 4: Contaminant Source Inventory. This section presents an inventory of confirmed and potential sources of contamination, particularly those that lie within the wellhead capture zones. An evaluation of risks associated with these sources is also presented.

Section 5: Wellhead Management Strategies and Implementation. This section presents options for management strategies to provide safeguards against contamination of groundwater sources.

Section 6: Spill and Incident Response Planning. This section presents the local and regional agencies responsible for emergency incident/spill responses.

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2.0 HYDROGEOLOGIC FRAMEWORK

The hydrogeologic setting of the Camas area has been extensively studied by Strata staff under our predecessor companies Pacific Groundwater Group (PGG) and Mott MacDonald. Previous findings are summarized below.

2.1 GEOLOGY AND HYDROGEOLOGY

The Cities of Camas and Washougal are located near the eastern edge of the Portland Basin near the Cascade foothills. The bottom of the basin is formed of volcanic rocks that rise to the east to form the Cascade Range. Sediments that fill the Portland Basin are over 1,700 feet thick in the middle of the basin, around the City of Vancouver, but dip upwards and thin toward the Camas/Washougal area and are absent in the northern portion of the study area where bedrock is exposed. These sediments include Recent Alluvium and Pleistocene Alluvial Deposits at the surface, which are underlain by deposits of the Troutdale formation.

2.1.1 Recent and Pleistocene Alluvial Deposits

Alluvial deposits are sediments laid down by flowing streams (including channel deposits, overbank deposits, terraces, and deltas). Alluvial deposits exposed on the land surface within the study area include recent alluvium and Pleistocene (ice-age) cataclysmic flood deposits. Recent Alluvium was laid down by the Columbia and Washougal Rivers, with sedimentary textures ranging from silt to sand to gravel (including mixtures of multiple textures). Where exposed on the land surface, recent alluvium overlies the (older) Pleistocene Alluvial Deposits, and the two are mapped as a combined unit on Figure 1-1.

During the late Pleistocene, the ancestral Columbia River deposited a great deltaic fan emanating to the west from the mouth of the Gorge (near the eastern Clark County boundary) during a series of catastrophic events known as the Missoula floods. The resulting Pleistocene Alluvial Deposits crop out throughout much of the area that lies between the Washougal and Columbia Rivers (Figure 1-1). These deposits are approximately 100 feet thick in the vicinity of the City's LWWF. The sediments can reach thicknesses of up to 200 feet under the Columbia River channel. Sediment textures are typically described by drillers as boulders, cobbles, sand and gravel with some limited cemented zones and silty zones (potentially associated with paleosols).

2.1.2 Troutdale Formation

The Troutdale formation underlies the Pleistocene Alluvial Deposits in much of Clark County. The formation is exposed on the land surface in most of the northeastern and northwestern portions of the City (Figure 1-1) and underlies alluvial deposits in the southern portions. This formation is absent where older rocks are exposed at the surface and is inferred to be absent in the western portions of the study area where bedrock occurs at shallow depths. It is comprised of unconsolidated and semi-consolidated clay, silt, sand, and gravel. Throughout most of Clark County, the Troutdale formation contains three coarse-grained units that are separated by finer-grained confining units. The coarse units are:

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- The Upper Troutdale unit – variably cemented gravel in a matrix of sand and silt;
- The Lower Troutdale unit – relatively discontinuous occurrence of fine sand; and,
- The Sand and Gravel Aquifer (SGA) – a deeper sand and gravel unit.

Troutdale deposits underlying the combined floodplains of the Washougal and Columbia Rivers are difficult to differentiate. In this location, the Troutdale deposits are comprised of variably cemented, variably silty sands and gravels. Because this area is so close to the course of the ancestral Columbia River and the mouth of the Gorge, all of the Troutdale sediments deposited by the river are expected to be relatively coarse textured. This makes the upper and lower units difficult to distinguish in this area. Therefore, no attempt is made to distinguish between the various units of the Troutdale formation.

2.1.3 Older Rocks (Bedrock)

Older bedrock crops out in the north-central portion of the study area and in localized areas along the western portion of the study area (Figure 1-1). The older rocks range from Miocene to Eocene age. They are primarily igneous in origin and include andesite, basalt, granodiorite, pyroclastics (breccias, tuff, and agglomerate), conglomerate, and shale. The rocks are generally hard and compact because of Miocene deformation. The older rocks have relatively low permeability and are not considered an import source of supply for municipal purposes.

2.2 REGIONAL AQUIFERS

Two principal aquifers occur in the vicinity of the City: the Pleistocene Alluvial Aquifer (PAA) and the SGA. The Upper Troutdale Aquifer (UTA) and Lower Troutdale Aquifer (LTA) are also present in the Camas area but are not currently utilized by City wells. The four aquifers are discussed in order of occurrence below.

2.2.1 Pleistocene Alluvial Aquifer

The PAA is a shallow water-table aquifer that occurs within the Pleistocene Alluvial Deposits. The aquifer is very permeable and serves as a source of supply to most of the production wells in the lowland (i.e. LWWF vicinity) including industrial wells owned by Georgia Pacific and municipal wells owned by the Cities of Camas and Washougal. Groundwater in the PAA in the vicinity of the LWWF area occurs under unconfined conditions. The aquifer is recharged by local infiltration of precipitation, and induced recharge from the incised Columbia and Washougal rivers. Due to its limited geographic extent, limited saturated thickness, and susceptibility to contamination introduced at ground surface, the PAA is not considered an important water source for the purposes of municipal water supply in the upland portion of the Camas area (i.e. north of Prune Hill and west of Lacamas Lake).

The capacity of lowland wells completed in the PAA has been historically limited by its saturated thickness and the amount of available drawdown; however, recently this limitation is reducing due to water level rise associated with reduced Georgia Pacific pumping. Well capacities typically exceed 1,000 gallons per minute (gpm) and specific capacities (the ratio of pumping rate to pumping

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drawdown) typically range between 250 and 500 gallons per minute per foot of drawdown (gpm/ft). Testing at the City's wellfield indicates a transmissivity of approximately 1,000,000 gallons per day per foot of drawdown (gpd/ft) and a storage coefficient of about 0.05 (dimensionless). Previous PGG studies indicate that aquifer productivity may decline in an easterly direction. Specific capacity at the City of Washougal's Hathaway Wellfield (located approximately 2.5 miles to the east) ranges between about 50 to 65 gpm/ft, or about 10 to 20 percent of the values observed near the City's LWWF.

2.2.2 Upper Troutdale Aquifer

The UTA is the uppermost, regionally occurring aquifer in the Camas upland vicinity. The UTA is typically composed of a heterogeneous distribution of variably cemented sand and gravel. Much of the water-bearing material encountered in test wells drilled on the west side of Lacamas Lake is composed of fine to medium sand. Where the PAA is largely absent, the UTA is more vulnerable to contamination at the land surface and is likely in hydraulic continuity with Lacamas Lake. The UTA is unconfined where it occurs close to the land surface; however, due to cementation within the aquifer, it is often considered to be semi-confined.

On the regional scale, productive wells completed in the UTA often indicate moderate transmissivity in the early-time portions of pumping tests (e.g., during the first four hours) suggestive of sustainable pumping rates on the order of 400 to 500 gpm. However, in pumping tests that are conducted for longer periods, later time data indicate steeper rates of drawdown consistent with significantly lower transmissivity. This has been observed in test data for Camas Well 9 and in other wells in the Lacamas basin. This consistent pattern suggests that the UTA consists of moderate transmissivity lenses, hosted within a lower transmissivity matrix. The lower transmissivity of the bulk aquifer matrix, combined with limited saturated thickness in the Well 17 vicinity, limits expected well yields.

The UTA is not identified in the lowland in sediments underlying the PAA. Instead, underlying sediments are interpreted to represent the SGA (described below).

2.2.3 Lower Troutdale Aquifer

Within the Portland Basin, the LTA is typically a relatively homogeneous sandstone. However, in the Camas area, the LTA is a more heterogeneous mix of sand and gravel, similar to the UTA. This coarser facies is associated with the higher-energy depositional environment of the Columbia River that occurs in proximity to the Columbia River Gorge. In the uplands west of Lacamas Lake, the LTA includes both a coarse facies and sandstone. Materials encountered in the lower portions of the City's Well 17, located west of Lacamas Lake, were interpreted to represent the LTA. The LTA is not identified in the lowland in sediments underlying the PAA. Instead, underlying sediments are interpreted as representing the SGA (described below).

Hydraulic properties of the LTA are expected to be similar to the UTA, however with more available drawdown. Some production wells completed in the sandstone unit within the LTA (e.g. the Vanport Manufacturing Well) are able to produce over 400 gpm, presumably due to transmissivity associated with heavy fracturing of the sandstone.

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2.2.4 Sand and Gravel Aquifer

The SGA occurs within the Troutdale formation and is the next significant aquifer underlying the PAA in the Camas lowland area. The SGA functions as a confined aquifer due to the cemented and silty zones within the Troutdale formation. The aquifer has not been extensively developed for supply in the vicinity of the City but is an important source of supply within other portions of the county. Although specific capacities for SGA wells are considerably lower than the specific capacities of the PAA wells, SGA supply wells can have substantially larger amounts of available drawdown such that even wells with moderately low specific capacities (e.g., 5 gpm/ft) can achieve production capacities in excess of 500 gpm.

2.3 AQUIFER SUSCEPTIBILITY AND VULNERABILITY

The sensitivity of the City's groundwater sources to potential contamination was evaluated by assessing the relative susceptibility and vulnerability of the LWWF. Aquifer susceptibility refers to the estimated ease of contaminant transport from the land surface to the aquifer. Vulnerability accounts for the potential of contaminant releases at the land surface.

Some of the primary factors influencing aquifer susceptibility are the thickness and permeability of the sediments overlying the aquifer. Shallow aquifers are typically more susceptible to surficial contaminants than deeper aquifers. Evaluation of recent water level data from the LWWF supply wells shows typical depths to groundwater in the aquifer as shallow as 20 feet below land surface (Mott MacDonald, 2024). Aquifers overlain by highly permeable sediments such as sand and gravel are also at higher risk than aquifers overlain by lower permeability sediments such as silt or clay. In the vicinity of the LWWF, coarse grained soils typically extend from ground surface to the water table. While some fine-grained or low-permeability zones are noted above the shallow water table in drilling logs, in many cases they are absent in the logs of neighboring wells. Therefore, no laterally extensive low permeability layers appear to exist between land surface and the underlying PAA. The combination of a shallow depth to water and the relatively high permeability of the overlying sediments indicate the PAA has relatively high susceptibility to contamination.

Several natural mechanisms exist for attenuation of pollutant loading to the alluvial aquifer. While these mechanisms are probably benefiting groundwater quality under current conditions, they do not reduce the aquifer's susceptibility rating. Percolation of recharge through the unsaturated zone (from the land surface to the water table) supports some reduction of selected contaminants via: (1) adsorption to particulates, oxides, and organic carbon in surficial soils; (2) precipitation in aerated zones; and (3) biodegradation. However, the course texture of the sediments and general lack of organic matter suggests that the unsaturated zone offers minor contaminant attenuation relative to more silty, organic soils. Dilution via mixing with uncontaminated recharge in the unsaturated zone and the alluvial aquifer also serves to reduce contaminant concentrations. Because it is nearly certain that some contaminant loading occurs at the land surface (e.g., from known contaminated sites, urban runoff and septic systems), the fact that historic drinking water quality monitoring has detected minimal contamination at or above National Primary Drinking Water Regulations (NPDWR) criteria (Section 4.6) supports the value of these two processes. However, lack of contaminant detection in the City's wells does not mean that contamination is not reaching the water table in adjacent areas, as evidenced by the detections of per- and polyfluoroalkyl substances (PFAS) in Camas and

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Washougal source wells. It is important to understand that these natural attenuation processes are not likely to offer sufficient protection against a significant contaminant spill or release at the land surface, particularly for contaminants with maximum contaminant levels (MCLs) at the part-per-trillion (ppt; nanograms per liter [ng/L]) level and minimal natural attenuation (e.g., PFAS).

Aquifer vulnerability is typically expressed as a risk factor, calculated by combining the aquifer susceptibility discussed above, with an evaluation of the availability of contaminants at land surface and the likelihood of a contaminant release. In general, aquifer susceptibility is a function of stratigraphy and hydrogeology and cannot be substantially modified. The potential for contaminant release on the other hand is controllable and can be reduced in areas where susceptible aquifers are utilized as a major source of potable water. One of the primary purposes of a water system's WHPP is to evaluate the susceptibility of the systems aquifer(s), and the potential sources of contamination within the systems capture zones. Additional attention to potential contamination sources is recommended within the capture zones of high susceptibility aquifers, to reduce the likelihood of a contaminant release. This is especially true for potential contaminant sources within the shorter duration capture zones, such as the 1-year capture zone shown in Figure 2-1. In the case of Camas, the PAA should be considered highly vulnerable to potential contamination. While active, confirmed sources of groundwater contamination are limited, potential sources of contamination are discussed in Sections 4.4 and 4.5.

3.0 WELLHEAD PROTECTION AREA DELINEATIONS

The following sections describe the model used to delineate the City's WHPAs and capture zone analysis.

3.1 WHPA MODEL

The capture zone for the LWWF was estimated using the groundwater flow model MODFLOW, a finite difference numerical model originally developed by the U.S. Geologic Survey (McDonald and Harbaugh, 1988). A capture zone is the area that supplies groundwater recharge to a pumping well or wellfield. In natural systems, capture zones are not circular but elongated, with most of the capture occurring from areas that lie hydraulically up-gradient of the well. Each capture zone has a stagnation point, the furthermost point of capture down-gradient of the well. A time-related capture zone is the area in the aquifer that supplies groundwater recharge to a pumping well within a specified time period. Time-related capture zones provide a basis for developing monitoring plans, land-use inventories, and data collection plans. They are used in conjunction with the results of the aquifer vulnerability assessment.

The groundwater flow model developed for the Lower Washougal and Columbia River lowlands depicts the two major aquifers in the study area (PAA and SGA), the occurrence of bedrock, the Columbia and Washougal rivers, recharge from precipitation, and groundwater inflow from areas outside the model domain (PGG, 2004; 2007; 2011). The model simulates three-dimensional flow in its two layers (one for each aquifer). The model was calibrated to observe summer drawdowns in the City's Washougal Wellfield vicinity, summer seepage losses from the Washougal River, and groundwater level responses to tidal fluctuations and runoff events in the Columbia River.

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The calibrated model was used to perform predictive simulations which included evaluation of capture zones for the LWWF. The simulations assumed that the City would exercise all of their water rights and operation of the two proposed future wells (Treatment Plant and Parkers Landing)[1]. In addition, a high-end pumping was assumed for the Georgia Pacific wellfield (37.5 million gallons per day [mgd] based on 2016 information). This assumption provides for a fairly conservative assessment of the capture zone extent. Revision of these model assumptions is currently underway as part the Well 13 project with Carollo and may provide for an updated WHPA delineation later in 2026.

3.2 CAPTURE ZONE ANALYSIS

Estimated capture zones for 6-month, 1-year, and 5-year times of travel for the LWWF area, and the estimated capture zone for a 6-month time of travel for Well 13, are shown on Figure 1-1. The Camas Shoreline Master Program (City of Camas, 2015) states that the WHPA bounded by the 10-year time-of-travel will be considered a critical aquifer recharge area (CARA). All groundwater in the recharge area is younger than 10 years, therefore there is no need for a 10-year time-of-travel delineation (PGG, 2016). To account for the uncertainties associated with temporal variations in capture zones, a buffer area surrounding the WHPAs is defined as the CARA and shown on the attached figures. This includes areas that were not included in the simulated steady state capture zone analysis, but likely will contribute recharge during certain times of the year given variations in pumping, river elevation, and natural recharge. The Lower Washougal Wellfield WHPA is defined as the CARA and includes the 6-month, 1-year, 5-year capture zones and the supplemental CARA area. The LWWF groundwater flow model was also used to estimate WHPA capture zones for the City of Washougal (Murray Smith & Associates, Inc, 2012). Model predictions show the Washougal capture zones are set within the Camas capture zones, and that 5-year capture zones for both wellfields extend all the way to the eastern end of the CARA (Figure 1-1). Uncertainties inherent in the existing groundwater model dictate that estimated boundaries between the two capture zones are approximate, and that capture zones estimated for the two cities are closely geographically related.

The WHPA capture zones used in this report were originally presented in the City's 2016 Wellhead Protection Assessment Report (PGG, 2016). The shape and extent of these capture zones are influenced by pumping at the Georgia Pacific wellfield, and aquifer boundaries including the Washougal and Columbia Rivers and older bedrock exposures to the north. Capture for Well 13 is primarily to the northeast, extending to the approximate boundary where the PAA is pinched out by older bedrock. Capture zones for the remaining Lower Washougal wells extends to the east, between the Columbia and Washougal rivers. Evaluation of mass-balance calculations for the groundwater flow model indicate that the majority of water captured by the LWWF originates as flow within the PAA, that otherwise would have discharged to the Columbia and Washougal rivers.

The estimated capture zones were generated using a steady-state groundwater flow model, meaning that only the long-term average rates of withdrawal were simulated. Variations in pumping, recharge and boundary conditions such as river stage are not simulated in a steady state model. As a result, Figure 1-1 shows the average positions of the capture zones, not the temporal variations in the

[1] Based on test well drilling results these future wells will likely be constructed within the wellfield rather than at the originally proposed locations.

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capture areas. Increased pumping during peak use months will result in variations of the predicted capture zones beyond the long-term average estimates shown in Figure 1-1.

4.0 CONTAMINANT SOURCE INVENTORY

4.1 INTRODUCTION

Contaminant source inventories are included as part of WHPPs to identify potential sources of groundwater contamination to WHPAs associated with public sources of water supply. Although rarely achieved in practice, contaminant source inventories should be updated every two years[2]. In addition, DOH recommends updating the modeling or delineation of the WHPAs every 5 years, or as part of the 10-year Water System Plan cycle. The City's most recent contaminant source inventory was prepared in 2023 and was included in the LWWF Additional Yield Assessment (Mott MacDonald, 2024).

This section presents an inventory of confirmed and potential sources of contamination primarily within the City's WHPA, as well as consideration of land uses that may pose potential risk to groundwater quality. The facilities presented in the following sections were field evaluated by Carollo Engineers in April 2026 and the edits have been incorporated in the associated tables (Strata, 2026). This information can be factored into site selection for possible new production wells along with interpretation of water quality observed in existing wells. This section also includes a summary of water quality encountered in production wells operated by the cities of Camas and Washougal and provides suggestions for groundwater quality monitoring opportunities.

4.2 SEARCH AREA

The search area for this contaminant source inventory includes the City's 2016 WHPA, a "Western Search Area," and the consideration of several sites immediately east of the WHPA. These areas are shown in Figure 4-1.

Patterns of groundwater flow to the west of the Washougal River are not well understood, and the City's Well 13 may capture groundwater flowing towards the river from the west. In addition, reduced Georgia Pacific groundwater withdrawals and possible future redistribution of LWWF pumping (under the City's "umbrella water right") could alter the 2016 WHPA delineations. In order not to rule out possible contaminant sources to the west of the CARA, a Western Search Area was added from the west side of the Washougal River as far west as the Crown Zellerback Power Ditch (Figure 1-1). Ultimately, improved hydrogeologic characterization of this area may be warranted to better understand whether contaminated sites may pose a risk to City water supply.

[2] WAC 246-290-135 states that "an inventory, including identification of site locations and owners/operators, of all known and potential groundwater contamination sources located within the defined WHPA(s) having the potential to contaminate the source water of the well(s) or spring(s) shall be updated every two years".

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4.3 DATA SOURCES

Potential contaminant risks in the vicinity of the LWWF were investigated and mapped using data from the following sources:

- Clark County's (2025) *parcel database*, which contains information on land use and zoning.
- Data on file with Clark County, the City of Camas, and the City of Washougal regarding the locations of septic systems and infiltration facilities (dry wells and infiltration galleries) (Clark County, 2024; City of Camas, n.d.; City of Washougal, 2024).
- Washington State Department of Ecology (Ecology) *Facility/Site database*, which includes State Cleanup Sites, federal Superfund sites, hazardous waste generators, solid waste facilities and underground storage tanks (USTs).
- Ecology's *cleanup and tank search*, which includes confirmed and suspected contaminated sites, leaking and regulated USTs, brownfield sites, and Voluntary Cleanup Program (VCP) wait lists.
- Ecology's *Environmental Information Management (EIM) database*, which includes environmental monitoring physical, chemical, and biological data reported from sources such as Ecology-funded monitoring, cleanup sites, and municipal stormwater.
- A custom data report from DOH's *Sentry database*, which provides drinking water source and distribution sampling results reported by the Cities of Camas and Washougal (along with new PFAS sampling results recently provided by the City of Washougal).
- The U.S. Environmental Protection Agency (EPA) PFAS Industry Sectors Analytical tool, which presents Enforcement and Compliance History Online (ECHO) data filtered to industries identified by EPA as users or manufacturers of PFAS (EPA, 2025a).
- A custom records request from Lightbox Environmental Data Resources (EDR) using a 1-mile radius of Public Supply Well 13 in Camas, WA. A review of the EDR databases was originally presented in the Camas Well 13 PFAS Historic Contaminant Sources Inventory Review (Mott MacDonald, 2025).

The information from these data sources was classified and mapped to assess whether existing and potential contaminant sources were located within the Search Area[3].

4.4 SITES POSING POTENTIAL RISK

Information from Ecology's Facility/Site database were reviewed to identify facilities and sites within the Search Area that could be classified as a posing potential threat to groundwater contamination. The EDR databases and EPA PFAS Analytical Tool were used to augment the data retrieved from Ecology's databases for facilities with PFAS-specific risks to groundwater quality. The EIM database were reviewed to confirm sites with known contamination and the DOH's database of

[3] Some locations from Ecology's Facility/Site database were adjusted in Figure 4-1 based on facility address, parcel information, and imagery.

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drinking water results were reviewed to confirm local PFAS sampling occurrence and detections. Potential threats are associated with the use or storage of hazardous materials including the presence of USTs. A higher level of concern is associated with sites with known contaminant releases. While only a subset of sites with known releases are confirmed to have contaminated groundwater, other sites (e.g., associated with soil contamination) have the potential to contaminate groundwater through downward percolation of infiltrated recharge to the underlying PAA.

Table 4-1a summarizes known sites of potential environmental concern within the Search Area. Sites of potential environmental concern include both sites with and without confirmed or suspected releases of contamination to groundwater or soils. All sites with a cleanup status have a known or interpreted release, and Table 4-1b provides additional information about associated contaminant releases and current cleanup status (e.g., "awaiting cleanup", "cleanup underway", and "no further action" required). Figure 4-1 displays the location of each of these sites and indicates through the location symbols which types of activities or risk are associated with each site. Each site marker has three pie slices which indicate the type of activities associated with the site as follows:

- Cleanup Site (State Cleanup or Voluntary Cleanup)
- Underground Storage Tanks (UST) / Leaking Underground Storage Tanks (LUST)
- Hazardous Material Generator or Handler
- Release to Groundwater, Surface Water, or Soils

A red halo around any site indicates a documented contaminant release to soils, groundwater or surface water that has yet to be remediated. A yellow halo indicates that a prior release has been remediated and the site has been issued a No Further Action status by the Ecology. Any combination of the indicators is possible. Site markers without any halos or filled-in pie slices indicate the facility is tracked in the Ecology Facility/Site database, and the facility type is considered to have risk to soils or receiving water bodies, but the facility is not a cleanup site, a hazardous materials handler, nor does it have registered USTs.

Table 4-2 indicates four sites with contaminant exceedances in groundwater in or near the Search Area where contaminant concentrations are reported in Ecology's EIM database. Table 4-2 additionally shows reported contaminant exceedances in soil and sediment reported at the four sites. There are some differences in the groundwater exceedances identified in the data uploaded to EIM for the two sites within the WHPA, Hambleton Bros Log Yard (6-month capture zone) and Chevron Bulk Plant Camas (6-month capture zone), compared to the Ecology Facility/Site database (Table 4-1b). Likewise, there is no EIM data available for the two sites with confirmed groundwater concentrations in the Ecology Facility/Site database (Table 4-1b): Columbia Rock Concrete Products Inc (6-month capture zone) and Hi Way Fuel (5-year capture zone). The available EIM soil and sediment data for four sites and identified exceedances are summarized in Table 4-2. All four sites have a No Further Action cleanup status. Figure 4-1 identifies the locations of monitoring wells that showed contaminant exceedances at the four sites with the following symbol:

- Monitoring Well with Contaminant Detection in EIM Database (No Further Action)

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Sites posing potential and known contaminant risks are discussed by subarea below. A brief discussion of each known release site and groundwater exceedance site, along with their current status, is provided in Appendix A.

Forty-five sites of potential environmental concern to the water supply were identified within the WHPA, and an additional 21 sites of potential concern were identified in the Western Search Area (Table 4-1a). These sites are discussed in the sections below that are relevant to the onsite activities posing potential contamination risks.

4.4.1 Underground Storage Tanks

Contamination in soil and groundwater can be caused by leaking USTs (LUSTs). The most common causes of leaks are corrosion, fitting failures, improper installation or poor maintenance, impact damage, and overfilling (IIG, 2026; Karalekas, 2026). Although USTs usually contain flammable motor fuels or heating oils, they may contain other compounds used by industry, government, or business. Leakage from USTs and associated piping can often occur without detection. Even relatively small amounts of hazardous compounds can adversely impact groundwater quality. Once released from an UST, some contaminants can rapidly migrate to groundwater, a problem that is especially serious in areas with permeable soils, such as the sand and gravel comprising the PAA.

Of the many materials stored in USTs, solvents are considered the most toxic. However, petroleum products may pose a greater total risk because of the prevalence of tanks containing petroleum products. In addition, petroleum products contain many potential contaminants, including three EPA priority pollutants: benzene, toluene, and ethylbenzene. Benzene is a known human carcinogen.

Figure 4-1 shows the locations of USTs in the Search Area. Most of them lie within areas zoned industrial and commercial. These sites were identified from the Ecology's UST site data. This discussion does not imply UST leakage; LUSTs are discussed in the following paragraph. Table 4-1a shows that 9 of the 14 UST sites within the WHPA and 8 of the 13 UST sites within the Western Search Area have reported tank status that is either closed-in-place or removed, indicating the USTs are no longer present or actively used. Of the 10 active UST sites, there are only three large facilities (>15,000 gallons total volume) in operation within the WHPA and three within the Western Search Area (Table 4-1a). These include:

- Camas Washougal Port (6-month capture zone);
- Jimbo's Deli Mart 2 (6-month capture zone);
- Hi Way Fuel (5-year capture zone);
- Camas Foodmart (Western Search Area);
- Safeway Fuel 1000 (Western Search Area); and
- Quick Stop Mart (Western Search Area).

There are four LUSTs identified in Ecology's database located within the WHPA and seven within the Western Search Area (Table 4-1a). Nine of the 11 LUST sites have received No Further Action

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notices from Ecology. Two sites: Philpot and Hi Way Fuel, both located within the WHPA, have initiated their cleanup efforts. Further details about these sites are provided in Appendix A.

4.4.2 Hazardous Materials

The commercial use of chemicals poses a potential threat to groundwater quality since the chemicals can be accidentally spilled or disposed of improperly. The likelihood of such releases from spills can be reduced by proper methods of handling, spill prevention measures, and emergency response strategies. Improper disposal is likely the most common pathway for chemicals to be released into the environment. The following Ecology facility activity classifications were included as hazardous materials sites in this assessment:

Table 4-3: Hazardous Site Activity Code Definitions

Activity Code	Definition
HWG	Facilities that generate dangerous waste. They may be classified as very small, small, medium or large quantity generators (VSQG, SQG, MQG, or LQG) depending on the quantity of hazardous waste generated.
HWOTHER	Facilities that are required to have an EPA/State ID number but who do not generate and/or manage hazardous waste (XQG generator status). This includes transporters, used oil recyclers, and dangerous waste fuel marketers and burners.
HWP	Under Chapter 173-307 Washington Administrative Code (WAC), facilities that report under Section 313 of the Emergency Planning/Community Right-To-Know Act (EPCRA), or that generate more than 2,640 pounds of hazardous waste per year, must prepare Pollution Prevention Plans.
HWTSDF	Facilities that treat, store, or dispose of hazardous waste.
TIER2	Businesses that store 10,000 pounds or more of a hazardous chemical or 500 pounds or less, depending on the chemical, of an extremely hazardous chemical on site at any one time must report annually. Reports are sent to the State Emergency Response Commission [represented by Ecology], Local Emergency Planning Committees, and local fire departments for emergency planning. [product, not waste]
TRI	Facilities in specific industries that manufacture, process or use more than the threshold amount of one or more of 600 listed toxic chemicals. Most threshold amounts are 10,000 or 25,000 pounds per year. Some chemicals have much lower thresholds.

The Ecology Facility/Site database indicates that there are 25 sites within the WHPA and 9 additional sites within the Western Search Area that fall into one of the above hazardous waste classifications. Of these only 13, three of which are in the Western Search Area, have an active status (see below) and, the rest are inactive. Inactive status indicates that the sites do not have current permitting, and therefore, are not actively overseen by Ecology.

Table 4-4: Active Hazardous Materials Sites

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FSID	Facility Name	WHPZ	Activity Code
93671	City Of Camas Well 13	6-Month	TIER2
11338232	Columbia Storage Inc 2nd St	6-Month	TIER2
37125488	Columbia Warehouse	6-Month	TIER2
3264254	TARR Inc Washougal	6-Month	TIER2
88277363	Tidland Corp	6-Month	HWG (Other)
994431	Camas City Well 11 & 12	6-Month	TIER2
42373	City Of Camas Well 14	6-Month	TIER2
43057	City Of Washougal Lower Well Field	6-Month	TIER2
99999862	Walgreens 1085	1-Year	HWG (VSQG)
74959167	Camas STP	CARA	TIER 2
66765272	Georgia Pacific Consumer Products	Western Search Area	TIER2, HWP, TRI, HWG (SQG)
89994319	Verizon Northwest Inc Camas Co	Western Search Area	TIER2
8343024	Safeway Fuel 1000	Western Search Area	HWG (VSQG)

The Facility/Site database does not indicate whether sites listed are large or small hazardous waste generators. The hazardous waste generator (HWG) status presented in Table 4-4 were retrieved from EPA's ECHO facility search (https://echo.epa.gov/).

4.4.3 Cleanup Sites

The following subsections describe state cleanup sites that are located within the WHPA, Western Search Area, and east of the CARA, based on available information from Ecology.

4.4.3.1 Lower Washougal Wellfield WHPA

Ten of the 47 sites of potential environmental concern in the WHPA have known contaminant releases and are listed as State Cleanup Sites (Table 4-1b), as follows:

- Four sites (5, 13, 21, 25) have confirmed results below cleanup levels for all sampled media and have been issued a No Further Action status by Ecology.
- Six sites (4, 6, 11, 29, 35, 36) have confirmed or suspected contamination of groundwater and/or soil. Of these:
  - Two sites (11 and 29) have been issued a No Further Action status by Ecology.
  - Three sites (4, 29, 36) are associated with LUSTs.
  - Two sites are listed by Ecology as Awaiting Cleanup:

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- Site 6 (Facility ID 5016308, Columbia Rock Concrete Products, Inc.) has confirmed EPA Priority metals contamination in groundwater and is within the 6-month capture zone. Impacts to soil and groundwater were first detected in 2001 and the site was placed on the national priorities list in 2007. As of 2016, Ecology reported that it had had no plans for taking action on the site in the immediate future (Appendix A).
- Site 35 (Facility ID 94778244, Asher Engine Service Facility) has suspected soil and groundwater contamination and is located within the 5-year capture zone.

The use and storage of solvents poses a threat to groundwater quality. Solvents are persistent, both soluble and insoluble in water, and highly mobile. A small release of solvents to groundwater can cause a large groundwater plume. There are two cleanup sites (21 and 35) with solvents suspected or confirmed in soil or groundwater in Ecology's database located within the WHPA (Table 4-1b).

4.4.3.2 Western Search Area

Of the 22 sites of potential environmental concern that were identified in the Western Search Area, 12 have known contaminant releases and are listed as State Cleanup Sites (Table 4-1b). Seven of the 12 release sites (47, 48, 49, 52, 53, 58, 59) are associated with LUSTs, all of which have confirmed petroleum product detections in soil, including three with Petroleum product concentrations confirmed above cleanup levels by Ecology. Of the 12 sites, nine are listed as No Further Action, two (Sites 46 and 56) have cleanup underway, and one (Site 54) is awaiting cleanup, as summarized on Table 4-1b. Sites requiring cleanup include:

- Site 46 (Facility ID 66765272, Georgia Pacific Consumer Products) has suspected soil contamination, including for solvents, petroleum products, and reactive wastes.
- Site 54 (Facility ID 9620, Residence Heating Oil Tank) has non-halogenated solvent and petroleum product contamination confirmed in soil and suspected in groundwater.
- Site 56 (Facility ID 5458, Greseth Property) has confirmed petroleum product contamination of soil.

No contaminant exceedances in groundwater are reported in Ecology's EIM database within the Western Search Area.

4.4.3.3 East of the Critical Aquifer Recharge Area

Table 4-2 indicates two sites with contaminant exceedances in groundwater near the eastern boundary of the WHPA that have been reported to Ecology's EIM database. Both locations, ARCO 6008 and George Schmid & Sons, Inc, are listed as State Cleanup Sites that have been issued a No Further Action status by the Ecology and are associated with LUSTs. Reported groundwater exceedances include petroleum products, metals, and PAHs. The two LUST sites are included in this report due to their proximity to the 5-year capture zone (Figure 4-1) and the confirmed impact to groundwater.

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4.5 CURRENT ZONING AND LAND USE

Current zoning and land use information from Clark County's database were reviewed to evaluate zoning areas and specific parcels in the LWWF vicinity that could pose a risk to groundwater now or in the future. The following zoning categories were mapped (Figure 4-2):

- Industrial
- Commercial
- Residential
- Parks

The most common allowed land use within the WHPA is residential followed by commercial and industrial. Areas zoned as commercial and industrial are most likely to comprise threats to groundwater quality. Most of the allowed commercial and industrial use is concentrated along SR-14, the southern terminus of SR-500, the railroad corridors, SE 3rd and 6th Avenues, and E. Street. The Western Search Area is nearly evenly divided between industrial (in the south), commercial, and residential (in the north).

A GIS analysis was used to identify land uses descriptions within each parcel where associated activities could pose a risk to groundwater within the Search Area. Parcels where such land uses were identified were designated "parcels of concern" and are interpreted to represent potential sources of contamination. [Note: whereas "parcels of concern" are based on land use, "sites of concern" (discussed above) are based on registered handling of hazardous waste and suspected or known contaminant releases.] Table 4-5 provides a list of land uses and categories that are considered potential concerns and counts of these parcels within WHPA and Western Search Area. The land uses are divided into 7 generalized use groupings based on similar activities, including: A) uses related to automobiles, boats and fuel; B) potential biohazards; C) manufacturing; D) dry cleaners; E) electrical infrastructure; M) medical; and O) "other" uses[4]. Appendix B provides a detailed list of ownership and land-use description associated with these parcels. Parcels of concern are also mapped on Figure 4-2.

The WHPA contains 81 parcels of concern, and the Western Search Area contains 75 parcels of concern. Evaluation by sub-area shows:

- The WHPA 6-month capture zone contains 38 parcels of concern distributed among all categories besides biohazards and dry cleaners, with larger proportions of automobile-related, manufacturing, and "other" uses.
- The WHPA 1-year capture zone contains 14 parcels of concern, comprised mostly of automobile-related and "other" uses.

[4] "Biohazards" include: cemeteries, crematories, feedlots, biofiltration, and sewage infrastructure. "Electrical infrastructure" includes: boosters, transformers and stations. "Medical" also includes dental and veterinary. "Manufacturing" includes chemical, wood, machinery, paper, plastic. "Other" includes storage, parking, quarries, sand/gravel pits and crushing operations.

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- The WHPA 5-year capture zone contains 20 parcels of concern, comprised mostly of automobile-related uses.
- The WHPA supplemental CARA zone contains 9 parcels of concern, distributed between biohazards and "other" uses.
- The Western Search Area contains 75 parcels of concern, distributed between all categories with a larger proportion of automobile-related uses and just one dry cleaner and one electrical facility.

In addition to the zoning categories and parcels of concern discussed above, the following land uses and activities should be considered as potential sources of contamination:

- On-site septic systems
- Stormwater
- Unused and improperly constructed wells
- Agriculture, golf courses, and parks
- Burlington Northern Santa Fe Railway
- Users and Potential Sources of PFAS

4.5.1 On-Site Septic Systems

On-site septic systems pose a risk to groundwater where they are relatively high in density and/or where hazardous waste is discharged to them. Potential contaminants from septic systems include pathogenic organisms (bacteria and parasites), toxic substances including PFAS, and nitrogen compounds (EPA, 2026a; Palmerton, 2023).

The extent to which pathogens are transported in the subsurface away from a septic drain field depends on the type of pathogen and the chemical and physical conditions in the subsurface. In general, if a septic system is properly sited, constructed, and maintained, the impact to water quality will be limited (EPA, 2026b). Household hazardous chemicals such as cleaners, polishes, waxes, and paints can be transported to groundwater via a septic system. Some products contain toxic and persistent chemicals that can cause low-level contamination when coupled with a high density of septic systems. Homeowners can improperly apply or dispose of chemicals because they do not understand the threat they pose to groundwater quality. A variety of in-home materials (such as food packaging, cookware, cosmetics and dust generated from upholstery) can supply PFAS to domestic septic systems (Kaboggoza, 2026). Other organic compounds (such as pharmaceuticals, personal care products and organophosphate flame retardants) can also be associated with domestic wastewater (EPA, 2026b; EPA, 2026c). In some areas, business and commercial facilities still use on-site septic systems for sewage disposal. Business, commercial, and industrial operations that utilize on-site systems need to take special precautions to avoid contamination of their wastewater.

Ammonia and nitrate are highly soluble in water and can be expected in detectable quantities wherever portions of an aquifer are affected by septic system discharges. Septic systems are a source of nitrates in groundwater throughout Clark County. Nitrate is regulated, since ingestion can result in

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methemoglobinemia, or "blue baby" syndrome (Knobeloch, 2000). Other sources of nitrate include fertilizers, feedlots, and natural mineral deposits. Background concentrations of nitrates in groundwater are typically less than 1 milligram of nitrogen per liter (mg-N/L) (EPA, 2026d). The MCL for nitrate is 10 mg-N/L.

Although significant portions of the urban areas are served by sewer systems, many residents still rely on septic systems. Clark County maintains GIS coverage of on-site septic system locations, locations that are based on information provided by the Clark County Public Health Department. The locations of the septic systems are plotted on Figure 4-1. This figure indicates that the LWWF WHPA has only one identified septic system within the 6-month capture zone, four systems within the 1-year capture zone, 26 systems within the 5-year capture zone, and none in the supplemental CARA. Overall, 29 septic systems fall within the WHPA. There is one additional septic system identified in the Western Search Area, within the Georgia Pacific facility.

4.5.2 Stormwater

Stormwater (i.e., urban runoff) is produced when rainfall or other precipitation accumulates faster than it can evaporate, be used by plants, or infiltrate to the subsurface. Urban areas, particularly industrial, commercial, and high-density residential development areas, produce more runoff than rural areas because they have more impermeable surfaces, such as rooftops, driveways, streets, and highways (Ecology, n.d.). These surfaces not only promote runoff, but they also reduce the infiltration that recharges groundwater supplies. Even grass lawns can produce more runoff than forests and pasture. Most of the stormwater infiltration and bioswale areas are concentrated along SR-14 and E. Street (Figure 4-3).

Concern over potential groundwater contamination from stormwater has been recognized by several governmental agencies in western Washington. Stormwater typically contains pollutants, such as sediment, nutrients, bacteria, oils and grease, metals, and other toxicants. Many of these contaminants come from air pollution, motor vehicles, application of pesticides and fertilizers, soil erosion, and pet feces. Stormwater runoff from highways and roads can introduce contaminants such as heavy metals, organic priority pollutants, pesticides, coliform bacteria, and 6PPD-quinone into the groundwater system (Ecology, n.d.). Roofing materials have also been identified as a diffuse source of metals in runoff, particularly zinc (Good, 1993). Concentrated sources of stormwater contamination may also occur if undiluted pollutants (e.g., fertilizer, gasoline) are accidentally spilled or intentionally released and enter storm drains.

Stormwater contamination has primarily been a concern for surface water pollution because urban runoff is typically directed to streams, lakes, and other water bodies with fish and other aquatic life that are highly sensitive to common stormwater contaminants. However, in areas where coarse-grained Pleistocene Alluvial Deposits occur at the land surface (i.e. portions of Vancouver, Camas and Washougal), dry wells are commonly used to infiltrate stormwater into the subsurface, which creates the potential for groundwater contamination. Specific sites with potential/known stormwater contamination risks and general assessment of stormwater impacts to groundwater via dry wells and infiltration facilities are discussed below.

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Information from Ecology, Clark County's GIS coverage of dry wells, and prior communications with City Staff were reviewed to evaluate stormwater-related site features and land uses in the LWWF vicinity that could pose a risk to groundwater now or in the future.

4.5.2.1 Stormwater Risks at Ecology Sites of Potential Environmental Concern

Ecology considers sites to be a risk to stormwater if they have any of the following site interaction types noted in Ecology's Facility/Site database: Underground Injection Control, Fruit Packer General Permit (GP), Municipal SW GP (any phase), WSDOT Municipal SW GP, Construction SW GP, or Industrial SW GP. As shown on Table 4-1a, there are eight sites located within the WHPA and one within the Western Search Area that have been identified as posing a potential stormwater risk to groundwater. These sites include:

- Triangle Resources (6-month capture zone);
- Columbia Storage Inc 2nd St (6-month capture zone);
- Hambleton Bros Log Yard (6-month capture zone);
- Goodwill – Washougal (6-month capture zone);
- Washougal City Westside Wellfield Well 12 (6-month capture zone);
- Rockwood Terrace (1-year capture zone);
- Washougal School District Bus Garage (5-year capture zone);
- SE 8th & SE Tampa Development (CARA);
- Camas City Municipal SW (Western Search Area).

Sites with only Construction SW GP interactions have not been included in Table 4-1a due to their temporary nature.

4.5.2.2 Consideration of Dry Wells and Infiltration Facilities

Impervious surfaces in the commercial and industrial areas along SR-14, the southern terminus of SR-500, the railroad, and 3rd Avenue contribute substantial amounts of runoff in the Camas study area. In 2012, the Washington State Department of Transportation (WSDOT) installed a large stormwater infiltration facility between SE 11th Avenue and SR-14, near the City's wastewater treatment plant (Figure 4-3) in order to infiltrate road runoff. The City (along with PGG) communicated with WSDOT during the construction phase the need to protect water quality in the underlying PAA. The infiltration facility is located within the CARA boundary. The operation and performance of this facility should be evaluated if the City pursues new groundwater sources in this area in the future.

Sam Adams, former Utilities Manager at Camas Public Works provided the following information about the City's stormwater facilities (reproduced from PGG, 2016). This information should be confirmed by follow-up conversations but indicates that all of the stormwater runoff in Camas flows to catchment basins, drainage ditches, biofiltration swales, exfiltration ponds or sedimentation ponds. Catchment basins and other surface stormwater facilities filter out some pollutants before the

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water enters the subsurface or surface water environment. Near the LWWF area, most stormwater is captured via catchment basins and then routed to the Washougal River via outfall pipes. The City's stormwater discharges are regulated under the Federal National Pollutant Discharge Elimination System (NPDES) Phase II permitting process (Permit Number WAR045004). The permitting process requires that the City provide annual reports and updates to their stormwater management plan (SWMP). A Reporting Violation was issued for Permit WAR045004 on March 31, 2025 for a late/missing submittal. According to the City, there are no current dry wells associated with the City of Camas stormwater system. Dry wells previously used in the area of Oak Park and Goot Park in southeast Camas were abandoned and replaced with new stormwater collections systems in the mid 1990's (PGG, 2016).

Dry wells currently included in the Clark County GIS are shown on Figure 4-3. The GIS coverage shows 19 dry wells within the 6-month capture zone, 12 dry wells within the 1-year capture zone, 69 wells within the 5-year capture zone, and no dry wells within the supplemental CARA. Overall, 100 dry wells fall within the WHPA. There are five additional dry wells identified in the Western Search Area along the Crown Zellerback Power Ditch near NE Dallas Street. Several dry wells within the 6-month capture zone are close to the City's Well 5, but all other City production wells do not have immediately adjacent dry wells. A large portion of dry wells within the 5-year capture zone are located along E Street. These features are likely the City's abandoned and replaced dry wells and are incorrectly attributed in the County's database. The City should review this dataset with the County and make appropriate modifications to reflect current conditions.

4.5.3 Unused and Improperly Constructed Wells

Well casings can provide a conduit between the ground surface and underlying aquifers. Improperly constructed or abandoned wells pose several potential problems. In wells with no surface seal, contaminants introduced near the wellhead can move downward outside the casing to underlying aquifers (Scherer, 2021). Many older wells that were constructed before the implementation of the State's minimum well standards in WAC 173-160 (pre-1971) have no surface seal. Unused wells that have not been properly abandoned are left uncapped in many cases, posing a special risk because contaminants can be introduced directly into the aquifer. Unused wells also pose a risk when they are damaged during site redevelopment. Any of these situations can provide a conduit for contaminant movement.

Among the private wells in the Camas vicinity, a portion were constructed prior to adoption of Ecology's drilling standards in 1971 and therefore have a higher likelihood of improper construction. There is no inventory on the number or location of these wells; however, many of them may have been abandoned properly following the State's standards. Furthermore, public water supplies have served most of the LWWF area since the 1930's and therefore few private wells are likely to occur in this area.

4.5.4 Agriculture, Golf Courses, and Parks

Fertilizers, pesticides, and herbicides are applied to residential lawns, commercial landscaping, agricultural lands, and landscaped areas adjacent to roads. If optimally applied, these chemicals pose little threat to groundwater, however, applications are commonly not made correctly and groundwater contamination can result if fertilizers are applied in exceedance of the agronomic uptake rate (Pitz,

2014). Excess nitrate from fertilizer will be recharged to the underlying groundwater system. Frimpter and others (1990) estimated that an average of 9 pounds of nitrate-N leached annually to groundwater from each 5,000-squarefoot lawn. Landscaping activities can also be the source of pesticides and herbicides such as ethylene dibromide (EDB), 1,2-dibromo-3-chloropropane (DBCP), and dicamba.

There are no agricultural parcels within the WHPA and park turf is not a significant concern (Figure 4-2). Most of the parks within the 6-month capture zone are natural areas with the exception of Goot Park, which has managed turf. The City should coordinate with the parks department to confirm these designations and discuss the use of chemicals at Goot Park given its proximity to the City's Well 14 (although groundwater beneath Goot Park is more likely to be captured by the City of Washougal's "Lower Wellfield," comprised of five production wells located immediately east of Camas Well 14).

Residential lawns and other landscaping occur throughout the WHPA. These are potential sources of nitrogen, pesticides, and herbicides to the groundwater. The risk of groundwater contamination by these contaminants is high in the PAA because the aquifer is unconfined and groundwater is relatively shallow.

4.5.5 Burlington Northern Santa Fe Railway

In 2001, about 32 to 45 Burlington Northern Santa Fe (BNSF) freight trains were reported to pass through the Washougal area on a daily basis (pers. comm. Read Fay, BNSF), with roughly 25% of the containers potentially containing hazardous materials (including petrochemicals). Movement of crude oil by rail in Washington State began in 2012 and has continued to increase since that time (Ecology, 2025a)

During the 1-year period between July 1, 2024 and June 30, 2025, rail was responsible for 18 percent of reported crude oil movement through Washington, equal to over 38 million barrels (Ecology, 2025a). In the same period, receiving facilities reported that 49,879 rail cars transported crude oil through route segment 2, which follows the Columbia River corridor from the Tri-Cities to Vancouver, Washington. This averages to approximately 959.2 oil tank cars travelling on the rail segment per week with an average tank car volume of 681 barrels. The 2025 Quarter 2 total volume transported by rail through segment 2 was 11,684 tank cars carrying an estimated 7.95 million barrels (Ecology, 2025a), a 42 percent reduction in volume from the 20,037 tank cars carrying 13.7 million barrels reported to have passed through the same segment in 2017 Quarter 2 (Ecology, 2017).

Derailment of rail cars with hazardous materials is a serious potential contaminant source for the WHPA since the BNSF tracks run directly over the source aquifer. Road crossings at rail tracks are of highest concern since there is increased risk of accidents at these locations. There are three railroad crossings within the WHPA and one within the Western Search Area (Figure 4-1). Two of the crossings are public with warning lights and rail guard (6th Street and 3rd Street) and one is private with only a stop sign. The private crossing leads to the main entrance for the Columbia Rock Concrete site at 1615 SE 6th Avenue and is within the WHPA 6-month capture zone. Rail collision with large trucks entering or leaving the concrete facility increases the possibility of derailment at this location and is considered a potential risk for the wellfield.

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As noted in the 2016 WHPP report (PGG, 2016), the maximum speed of BNSF freight trains was reported to not exceed 45 to 50 miles per hour (pers. comm. Read Fay, BNSF). These low speeds and the durability of the tank cars minimize the possibility of a spill in the unlikely event of a derailment. The most recent crude oil spill from a train occurred in Whatcom County in December 2020 and 28,962 gallons were released to the environment (Ecology, 2021) BNSF maintains a spill response plan working with local fire departments, emergency response, and Ecology.

4.5.6 PFAS Regulation and Potential Sources

PFAS is a group of thousands of compounds that have been designated as contaminants of emerging concern. On April 10, 2024, EPA announced the final NPDWRs and MCL goals (MCLGs) for six PFAS compounds (Table 4-6). Public water systems were given three years (by 2027) to complete initial monitoring, followed by ongoing compliance monitoring, and five years (by 2029) to implement solutions that reduce these PFAS if monitoring shows that drinking water levels exceed these MCLs. Beginning in 2029, public water systems that have PFAS in drinking water which violates one or more of these MCLs must take action to reduce levels of these PFAS in their drinking water and must provide notification to the public of the violation (EPA, 2025b). Compliance with MCLs is determined by running annual averages at the sampling point. On May 8, 2024, EPA designated PFOA and PFOS, including their salts and structural isomers, as hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (EPA, 2024). Ecology has concluded that PFAS fall under the Model Toxics Control Act (MTCA) and is applying the federal MCLs as well as calculated cleanup levels for other media (Ecology, 2025b).

Table 4-6: Final EPA MCLs and MCLGs

Compound	Final MCLG	Final MCL (enforceable levels)
PFOA	Zero	4.0 ng/L (ppt)
PFOS	Zero	4.0 ng/L (ppt)
PFHxS	10 ng/L (ppt)	10 ng/L (ppt)
PFNA	10 ng/L (ppt)	10 ng/L (ppt)
HFPO-DA (GenX)	10 ng/L (ppt)	10 ng/L (ppt)
Mixtures containing 2 or more of PFHxS, PFNA, HFPO-DA, and PFBS	1 (unitless) Hazard Index	1 (unitless) Hazard Index

On May 14, 2025 EPA announced its intent to extend the compliance deadlines for PFOA and PFOS to 2031 and rescind the regulations and reconsider the regulatory determinations for PFHxS, PFNA, HFPO-DA (GenX), and the Hazard Index for mixtures of these three plus PFBS (EPA, 2025c).

In 2021, the Washington State Board of Health adopted State Action Levels (SALs) for five PFAS (Table 4-7). SALs are set to protect human health and are based on the best available science at the time.

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WAC 246- 290-315(8) states that upon federal adoption of a MCL, the MCL will supersede a less stringent SALs and associated requirements, including monitoring and public notice. The Washington State Board of Health adopted emergency rule CR-103E on June 12, 2024 to amend WAC 246-290-315 such that the criteria would apply on the effective date of the MCL as set in the federal standard, not the adoption date. This ruling extends the SALs and the associated requirements for Group A Public Water Supplies until 2029, or 2031, when the EPA MCL compliance becomes effective. The fourth emergency rule has been extended to October 16, 2025. The Board will consider additional emergency rule filings as needed, until a permanent rule is in place.

Table 4-7: Washington State Action Levels (SALs)

Compound	**2021 WA SALs**	**2025 WA SALs**
PFOA	10 ng/L (ppt)	4.0 ng/L (running annual average)
PFOS	15 ng/L (ppt)	4.0 ng/L (running annual average)
PFHxS	65 ng/L (ppt)	10 ng/L (running annual average)
PFNA	9 ng/L (ppt)	10 ng/L (running annual average)
PFBS	345 ng/L (ppt)	-
HFPO-DA (GenX)	-	10 ng/L (running annual average)
Hazard Index PFAS (HFPO-DA, PFBS, PFHxS, and PFNA)[5]	-	1 (unitless) Hazard Index

Detection of PFAS in the City's LWWF production wells suggests that there are sources of PFAS within the capture zones of the City's wells. The mobility of PFAS in groundwater varies by the specific compound, with branched, shorter-chain, and octanoic acid species being more mobile than their longer-chain and linear counterparts

Ecology indicates that the storage and use of aqueous film-forming foam (AFFF), a common type of firefighting foam, is a key suspected source of PFAS-contaminated drinking water in Washington with specific source areas that include military facilities, airports, and firefighting training facilities (Ecology, 2026). Other sources of PFAS to the environment include wastewater treatment plants, paper mills, refineries, landfills, biosolids facilities, manufacturing and semiconductor industries, auto garages, dry cleaners, concrete production sites, chemical and metal plating facilities, and residential septic systems. There are no confirmed PFAS releases in or around the WHPA; however, this does not preclude unidentified releases to groundwater.

In April 2025, Mott MacDonald completed a review of historical site data to identify potential sources of PFAS contamination (Mott MacDonald, 2025). The historical site list was reviewed in

[5] The PFAS Mixture Hazard Index (HI) is the sum of component hazard quotients (HQs), which are calculated by dividing the measured component PFAS concentration in water by the relevant health-based water concentration (HBWC) when expressed in the same units (shown in ng/L for simplification). The HBWC for PFHxS is 10 ng/L; the HBWC for HFPO-DA is 10 ng/L; the HBWC for PFNA is 10 ng/L; and the HBWC for PFBS is 2000 ng/L. Hazard Index = ([HFPO-DA$_{water}$ ng/L]/[10 ng/L]) + ([PFBS$_{water}$ ng/L]/[2000 ng/L]) + ([PFNA$_{water}$ ng/L]/[10 ng/L]) + ([PFHxS$_{water}$ ng/L]/[10 ng/L])

tandem with Ecology's facility site database (Table 4-1a and 4-1b) and EPA's PFAS Industry Sectors Analytical tool (EPA, 2025a) to develop a PFAS industry site risk ranking (Table 4-8). The 80 sites included in Table 4-8 are from Camas and Washougal and within 4 miles of Camas supply well 13; 13 sites are within the 6-month capture zone, 12 sites are within the 1-year capture zone, six sites within the 5-year capture zone, and four in the supplemental CARA (Figure 4-4). Overall, 35 PFAS industry sites are within the WHPA, ten of which have a recorded or likely release to the environment. There are 17 additional PFAS industry sites in the Western Search Area. Of the 52 PFAS industry sites within the WHPA and Western Search Area, 41 are included in Tables 4-1a and 4-1b. The 11 PFAS industry sites within the WHPA and Western Search Area and not included in Tables 4-1a and 4-1b are predominantly historical auto service stations and dry cleaners. There are 28 PFAS industry sites included in Table 4-8 that are outside of the WHPA and Western Search Area. Eleven of these 28 sites are within the industrial park northeast of Captain William Clark Park, south of Highway 14 in Washougal, and west of Steigerwald Lake National Wildlife Refuge (labeled "Columbia Industrial Park" in Table 4-8). The industries represented by these facilities includes textiles and leather, metal plating and machining, semiconductors and related devices, chemical manufacturing including surface active agents, waste management, and plastics and resins. Three sites (Camas-Washougal Fire Department [CWFD], Pendleton Woolen Mills, and ARCO #6008) are near the eastern boundary of the WHPA.

4.6 PUBLIC WATER SYSTEM MONITORING

Public water system sources are routinely sampled for water quality analysis and screening for drinking water contaminants. Strata obtained query results from DOH's Sentry database regarding exceedances of regulated drinking water parameters along with PFAS analyses from groundwater sources operated by the Cities of Camas and Washougal. Reported monitoring results were compared to NPDWRs and National Secondary Drinking Water Regulations (NSDWR). NPDWRs are legally enforceable primary standards and treatment techniques that apply to public water systems, and NSDWRs are non-enforceable guidelines regulating contaminants that may cause cosmetic or aesthetic effects in drinking water. Washington State groundwater quality criteria for use as drinking water are available in WAC 173-200-040 Table 1. State criteria for detected analytes generally agrees with NPDWR or NSDWR and is only referenced below if it is the stricter of the standards. In general, groundwater quality meets NPDWR and NSDWR, with the most recent exceedance occurring in 2005 for the City of Camas and in 2023 for the City of Washougal. However, recent detections of PFAS in both city's supply wells necessitate an investment in treatment infrastructure, scoping alternative sources, or both. The results of our review are reported below.

4.6.1 City of Camas Water Supply Wells

Water system monitoring results from the City of Camas water supply wells are available from October 1988 through August 2025. From the reported samplings, four exceedances of National Primary or Secondary Drinking Water Regulations have been identified in the Post-Treatment/Finished water:

- Iron (NSDWR: 0.3 mg/L): exceeded once in 2004 at a concentration of 0.4 mg/L.

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- Radium 228 (NPDWR MCL for Radium 226+228: 5 picocuries per liter [pCi/L]): exceeded once in 2005 at a concentration of 2.5 pCi/L.

EPA finalized the MCLs for PFAS (Section 4.5.6) in April 2024. PFAS sampling performed to date has detected 33 exceedances of the final MCLs for individual PFAS compounds in sampled Post-Treatment/Finished water. Specifically:

- PFOA (MCL: 4.0 ng/L): exceeded five times between August 2022 and July 2024 with a maximum concentration of 5.4 ng/L at City Well 5.
- PFOS (MCL: 4.0 ng/L): exceeded 28 times between March 2022 and July 2024 with a maximum concentration of 25 ng/L in August 2022 at City Well 13.
  - Three detections of PFOS at City Well 13 exceed the 2021 Washington SALs.

Seven detections of PFOS exceed the MCL within the past year (October 2024-October 2025) with a maximum concentration of 7.2 ng/L at City Well 9.

Table 4-9a summarizes the results of all known PFAS sampling efforts through September 2024 within the Camas supply and distribution network. Detections of PFBS, PFOA, and PFOS are the most frequent of the tested PFAS compounds.

4.6.2 City of Washougal Water Supply Wells

Water system monitoring results from the City of Washougal water supply wells are available from December 1993 through February 2025. From the reported samplings, one exceedance of National Primary or Secondary Drinking Water Regulations has been identified in the Post-Treatment/Finished water. Lead (0.028 mg/L) exceeded the NPDWR action level (0.01 mg/L) in July 2023 in a sample collected from 3600 Ast #24. The Lower Wellfield comprises the five production wells located immediately east of Camas Well 14 (Figure 1-1). The PFAS results from the City of Washougal's "Lower Wellfield", summarized in Table 4-9b, show detections of PFBS, PFHxA, PFHxS, and PFOA below the MCL, and PFOS detections above the MCL. None of the detections exceed the 2021 Washington SALs.

5.0 WELLHEAD MANAGEMENT STRATEGIES AND IMPLEMENTATION

The completion of wellhead protection planning provides no safeguards unless effective management strategies are implemented to prevent potential contamination of groundwater sources. The City does not have land-use regulatory control within all of its WHPAs. Therefore, the City should endeavor to keep and maintain close, cooperative ties with Clark County and the Cities of Washougal and Vancouver.

The City continues to interact with its neighbors, especially the City of Washougal which has overlapping WHPAs with the City of Camas, and regulating agencies to exchange information on

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groundwater protection activities. The City also monitors land use activities and groundwater conditions within the WHPA for its supply sources.

Implementation of some of the proposed management strategies presented below will be dependent on the availability of City resources. For this review, we have included strategies that are both completed, ongoing, or have yet to be implemented. The strategies shown in Table 5-1 below are organized by recommended priority.

Table 5-1: WHPP Management Strategies

Priority	Strategy
1	Maintain a Central Point of Contact
2	Track State Cleanup (MTCA) Sites
3	Obtain Notifications of Hazardous Materials Spills
4	Monitor Groundwater
5	Map Petroleum Pipelines and Develop Emergency Response Measures
6	Provide Current WHPA Maps to Controlling Jurisdictions
7	Send Notification Letters to Owners/Operators of Identified Contaminant Sources
8	Promote Protective Stormwater Management
9	Track Pesticide Use
10	Inventory of Historical Sites
11	Inventory Underground Storage Tanks
12	Track the State's Inventory of Dry Wells
13	Inventory Abandoned Wells
14	Encourage BMPs in Land Management Activities
15	Review Pending Land Use Permits
16	Develop Notification Process for Pending Land Use Permits in WHPA
17	Target Public Education Programs in the WHPA
18	Participate in Future Updates to CARA Regulations

5.1 MAINTAIN A CENTRAL POINT OF CONTACT

The City should maintain a central point of contact for issues related to their Wellhead Protection Program. For purposes of this WHPP, this central point of contact is referred to as the "Wellhead Protection Coordinator." The Wellhead Protection Coordinator will foster and promote ongoing interaction with jurisdictions inside the WHPA but outside the City limits and will provide a central resource for departments within the City.

5.2 TRACK STATE CLEANUP (MTCA) SITES

The City should continue to track the status of all contaminated sites within their WHPA. This includes checking the Ecology databases at least every six months to determine if any new sites have

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been added to the contaminated sites lists. For sites that have cleanup work in progress (see Section 4.4.3), notify the Ecology Site Manager that the site is in a WHPA, and request that Ecology notify the City when the site status is updated or changed. Review all available information regarding activities being conducted on the site until the cleanup action and confirm that all monitoring is being completed as directed. Maintain periodic communications with the Ecology site manager to efficiently track status and maintain awareness of the site's location within the WHPA.

5.3 OBTAIN NOTIFICATIONS OF HAZARDOUS MATERIALS SPILLS

Concurrent with tracking MTCA sites (Section 5.2), the City should request notification from Ecology for any spills that occur within the WHPA. This should also include similar coordination with the first-response emergency units (e.g., Camas Dire Department, National Response Center, State Emergency Management Division). The City should then follow up with Ecology on any cleanup action implemented following the spill.

5.4 MONITOR GROUNDWATER

The City should actively participate in the collection and analysis of groundwater quality and water level information. A Monitoring Program provides a means of identifying trends and detecting problems before they reach the wellhead. Monitoring data can support protective regulatory actions and allow proactive measures to be enacted before the City's water supply sources are impacted. In addition, the data collection and monitoring can assist with regional groundwater management since data provide the basis for making appropriate decisions for long-term protection of groundwater quality and quantity. The monitoring data should be reviewed and summarized annually to identify any potential problems and evaluate the effectiveness of the network.

5.5 MAP PETROLEUM PIPELINES AND DEVELOP EMERGENCY RESPONSE MEASURES

The Northwest Pipeline passes through Washougal before crossing the Columbia River into Troutdale, Oregon. The City should map the Northwest Pipeline and any other petroleum distribution lines within or near the City's WHPAs. The City should coordinate with state and local spill response organizations to develop emergency plans to be implemented in the advent of pipeline leaks or spills.

5.6 PROVIDE CURRENT WHPA MAPS TO CONTROLLING JURISDICTIONS

The City should provide the current electronic (GIS) and printed maps of their WHPAs to all land use authorities within the City's WHPAs on a periodic basis. These maps should also be provided to DOH, Clark County Public Health Department, and local fire departments or Districts.

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Fire departments are recommended since, as first responders, they should be aware of the proximity to water sources when responding to fires or spills or other incidents where contaminants are involved. The nature of the response may need to be changed depending on the need to contain or prevent disbursement of a contaminant in order to prevent compromising the water source.

5.7 SEND NOTIFICATION LETTERS TO OWNERS/OPERATORS OF IDENTIFIED CONTAMINANT SOURCES

In an effort to protect and coordinate spill response planning within the City's WHPA, the City should send notification letters to the owners and operators of sites with identified sources of contamination as described in Section 4.4. The notification letters should present a map of the WHPAs, a table of the site of concern, the system's susceptibility rating and population served, and briefly describe appropriate procedures in the event of a spill. The City should maintain documentation of the notifications in accordance with the Wellhead Protection Program Guidance Document (DOH, 2017).

5.8 PROMOTE PROTECTIVE STORMWATER MANAGEMENT

The City should continue to promote and enforce stormwater requirements that provide water quality protection in the WHPA, consistent with the 2024 Ecology Stormwater Management Manuals. Specifically, support development of the most protective criteria; such as 5 feet of separation between infiltration facilities and the water table, sufficient rigor in testing of potential infiltration pond locations, and mandatory treatment requirements within 1-year time-of-travel zones.

5.9 TRACK PESTICIDE USE

The City can monitor some of the state and county pesticide use within the WHPA by requesting annual reports from WSDOT and Washington State Department of Agriculture (WSDA) Pesticide Management Division. Roadside pesticide/herbicide use by WSDOT and WSDA are maintained in digital database formats that provide up-to-date information on the recently sprayed locations, and quantities and types of pesticides used. WSDOT's database is available on the web. This inventory may be used to guide future groundwater monitoring and WHP-related education programs. In addition, the City should encourage private land managers to use vegetation management practices which protect groundwater quality (Strategy 5.14).

5.10 INVENTORY OF HISTORICAL SITES

The City should locate and inventory sites that are historical sources of potential contamination. This includes maintaining a record of MTCA cleanup sites after receiving an NFA status from Ecology. Retain all available information regarding activities conducted on the site up to and including the cleanup action. Conduct additional reviews as research progress on contaminants of emerging concern and contaminant sources, including when new industries are linked to groundwater contaminants.

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5.11 INVENTORY UNDERGROUND STORAGE TANKS

The City should locate and inventory USTs. USTs registered with the Ecology have been included in the contaminant source inventory (Section 4.0). This includes checking the Ecology databases at least every six months to determine if new USTs have been registered.

5.12 TRACK THE STATE'S INVENTORY OF DRY WELLS

The City should locate and inventory dry wells. Owners of these dry wells should be notified of the potential liability such wells cause and be educated on the stormwater requirements that provide water quality protection in the WHPA. Dry wells that are currently included in the Clark County GIS should be reviewed for accuracy.

5.13 INVENTORY ABANDONED WELLS

The City should locate and inventory abandoned (unused) wells. Owners of these wells should be notified of the potential liability such wells cause and be educated on the state's requirements for well decommissioning once a well is longer in use. This effort could be time consuming since the available information for many of the wells is limited to a driller's log, which, particularly for older wells, can be of variable quality. Wells located within the 1-year WHPA should be prioritized as time allows, and notification sent to owners regarding the well decommissioning requirements and the availability of technical assistance from Ecology or Clark County Public Health Department.

5.14 ENCOURAGE BMPS IN LAND MANAGEMENT ACTIVITIES

The City should engage with County and City planning departments to encourage that planners require developers use best management practices (BMPs) that reduce the potential for contaminants to enter the groundwater system.

5.15 REVIEW PENDING LAND USE PERMITS

Concurrent with encouraging BMPs in land management activities (Section 5.14), the City should track and review all pending land development projects within its WHPA. Review should include communication with the permit project manager and submission of comments to the permitting agency as necessary on mitigation and BMPs appropriate to protection of water quantity and quality.

5.16 DEVELOP NOTIFICATION PROCESS FOR PENDING LAND USE PERMITS IN WHPA

The City should maintain a point of contact within the City of Washougal and Clark County to ensure an opportunity to comment on pending land use activities within those jurisdictions and develop a process that ensures the City will be notified of all pending land use permitting actions.

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5.17 TARGET PUBLIC EDUCATION PROGRAMS IN THE WHPA

The City should continue to educate residents, particularly on groundwater quality issues. Customers within the WHPA should be targeted for distribution of literature regarding:

- Septic tank maintenance: Comply with the existing state regulations on septic tank use (WAC 246-272A), which requires the owner to inspect and maintain the system, and notify the Clark County Public Health Department of any repairs, alterations, or expansions
- Home heating oil tank maintenance and proper decommissioning
- Residential use of herbicides and pesticides: Encourage "waterwise" native vegetations planting and integrated pest management, rather than chemical applications
- Hazardous material use, disposal, and storage

In addition to City-run programs, the City should strive to participate in and support small-quantity waste disposal programs and support Clark County and other local municipal governments in developing and creating public education programs concerning groundwater.

5.18 PARTICIPATE IN FUTURE UPDATES TO CARA REGULATIONS

With adoption of Clark County Code 40.410, Clark County specified activities that are prohibited or require permits depending on the activity location within CARAs. Other municipalities with jurisdiction over land use within the City of Camas WHPAs should be reminded to consult the CARA ordinance, and the City should track and comment on any future proposed changes to the CARA ordinance.

6.0 SPILL AND INCIDENT RESPONSE AND PLANNING

As part of the wellhead protection program, the City must develop a spill and incident response plan. The City should summarize its spill response procedures, continue to coordinate it spill response planning with local emergency responders, the Department of Ecology's Spill Operations Section, the Emergency Management Division of the Washington Military Department, the local health department, Clark County, and any local emergency planning committee (at minimum) and contact first responders and regulators to provide input into the completed plan.

This section outlines spill response procedures and capability for jurisdictions within the WHPA. Spill events can be large or small and can consist of materials that can range from inert to highly toxic. Spills can occur under conditions and locations which are easily contained, or not, so that surface water or groundwater are under immediate threat. This range of possibilities has prompted a spill response (and emergency response) system which is nationwide in scope (National Response System), yet one which is designed to handle the more common, small scale (yet potentially dangerous) spills. This plan takes into account this range of systems.

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The ability of the City to affect the protocols and procedures of the national and state response systems is limited. Also, the majority of spills are small and require local response. Therefore, for the purposes of this WHPP, focus is given to local response capabilities and needs associated with these local response systems.

6.1 NATIONAL, STATE, AND LOCAL SPILL RESPONSE PLANS

Spill response planning has been ongoing throughout Clark County and within Washington State for many years. As a result, there are many plans in existence, each focusing on a specific geographical area or type of substance. In addition, parties involved in the storage and transportation of hazardous materials have been required to develop contingency plans. Each of these contingency plans should be consistent with each other and fit within the context of the response plans listed and described below. The following spill response plans are in effect in Washington State and cover inland, or non-marine areas, such as wellhead protection areas and aquifer recharge areas:

- National Oil and Hazardous Substances Pollution and Contingency Plan (National Contingency Plan; NCP), prepared by the EPA
- Oil and Hazardous Substance Pollution Contingency Plan for Federal Region 10 (RCP), prepared by Region 10 of the EPA
- Washington Statewide Master Oil and Hazardous Substance Spill Prevention and Contingency Plan, prepared by Ecology
- Local Emergency Response Plans prepared by city and county governments

6.2 SPILL RESPONSE ORGANIZATIONS

Depending on the magnitude of the spill event, numerous organizations at all levels of government, some voluntary organizations, and the private sector may have a role in spill response and cleanup. Each of the plans mentioned above describes the relationship and roles of these organizations in terms of the specific area of concern. Some of the organizations listed below might be, depending on the size and nature of the release, involved in a spill response in the City's WHPA. Spill response plans stress that spill response procedures be effectively executed. For that to be accomplished, each party must be fully aware of their specific roles and responsibilities. Moreover, there must be an understanding of the roles of other parties potentially involved in response activities, as well as effective coordination, cooperation, and communication among responding agencies, organizations, and individuals. The discussion below briefly summarizes the organizations that may be involved in spill response within the WHPA and describes their roles and responsibilities. The discussion below is organized in order from federal to local jurisdictions.

6.2.1 Federal Spill Response

The EPA has primary responsibility for all spills that occur on land. As directed by the NCP, the EPA is pre-designated as on-scene commander (OSC) for spills occurring under its jurisdiction. The OSC determines the status of the local spill response and determines whether, or how much, federal

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involvement is needed. The EPA may call on the following response teams to assist them in responding to a spill.

- National Response Team (NRT): The NRT consists of representatives from the various federal agencies (such as EPA, the US Coast Guard, Fish and Wildlife Service, etc.). It serves as the national body for planning and preparedness actions prior to a spill and as an emergency advisory center when a spill occurs.
- Regional Response Team (RRT): The RRT, consisting of representatives from selected federal and state agencies, performs functions similar to those performed nationally by the NRT. Essentially, the RRT is the regional body responsible for planning and preparedness before an oil spill occurs and provides advice to the OSC following such incidents.
- Technical Assistance Team (TAT): The TAT is a contractor used by the EPA Region 10 Office to provide technical oversight for spill response. Requests for the TAT are made via the EPA. Once on site, the TAT will report the situation to the EPA duty officer who then decides whether an EPA OSC needs to be on scene.
- Environmental Response Team (ERT): The ERT, based in Edison, New Jersey, is established to advise the OSC and RRT on environmental issues surrounding spill containment, cleanup, and damage assessment, with personnel expertise in areas such as treatment technology, biology, chemistry, hydrology, geology, and engineering.

6.2.2 State Spill Response

- Military Department Emergency Management Division (EMD): The state EMD is tasked with receiving and record verbal emergency toxic chemical release reports through its 24-hour duty officer system and making appropriate notifications. The EMD also assists and provides guidance to local emergency planning commissions for preparation of their emergency response plans.
- Department of Ecology: Ecology is the lead state agency for environmental pollution response within the State of Washington. As such, it serves as an advisor to the OSC and the Incident Commander (IC) for many spills occurring in state jurisdiction. Ecology is the state designated OSC for all oil spills in water. In the event of a spill occurring on a state highway, Ecology coordinates with the Washington State Patrol (State Patrol), which assumes responsibility as IC. In addition, Ecology acts as the lead agency responsible for cleanup activities.
- Ecology Spill Response Team: The Ecology Spill Response Team consists of Ecology regional office personnel. This team is responsible for determining the source, cause, and responsible party, as well as initiating enforcement action as appropriate. Additional responsibilities include ensuring containment, cleanup, and disposal are carried out adequately. The team coordinates its actions with other state, federal, and local agencies.
- State Patrol: The State Patrol acts as the designated IC Agency for incidents on interstate and state highways, and other roads and jurisdictions as delegated. When a spill occurs

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on a state highway, Ecology joins the Unified Command and acts as the lead agency for cleanup response.

- Washington Department of Fish and Wildlife (WDFW): The WDFW is a state agency with trustee responsibilities for fish and wildlife, and associated habitats. The WDFW Oil Spill Team (OST) provides round-the-clock oil spill response capability to address the needs of fish and wildlife resources. The OST also provides extensive technical support to the State's oil spill planning and preparedness efforts.
- Department of Transportation (DOT): The Washington State DOT may provide traffic control, equipment, and personnel for non-hazardous cleanup activities on and interstate highways. The DOT may provide and mobilize the necessary equipment in a major spills incident.

6.2.3 Local Response

Local governments have a duty to be prepared for all disaster emergencies. The Clark Regional Emergency Services Agency (CRESA) is charged with establishing Local Emergency Planning Committees (LEPC) to facilitate the local planning efforts.

LEPCs have the responsibility to create local emergency response plans. General requirements for local response plans are contained in Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986. Generally, local agencies, particularly fire services and law enforcement agencies, can be activated to provide emergency response services when there is a threat to life and property. Emergency response services may include: fire and explosion controls investigation and documentation, perimeter control, evacuation, traffic controls, and initial containment or even removal depending on the nature of the incident.

The "first responders" for the majority of spills are these local entities. They provide for immediate protection of health, property, and the environment. It is this group of responders who determine the need for additional assistance and mobilization of the additional resources provided by the state and federal government.

Local spill response within the WHPAs is within the jurisdiction of the Camas Fire Department (CFD) for incident response. Within the City, the CFD has been appointed IC for hazardous material incidents, except upon State and Interstate roadways, where the State Patrol will assume the role of IC upon arrival at the scene.

The Clark County Hazardous Materials Emergency Response Plan (HMERP) is the guide for coordinating all resources, both public and private toward preparedness, response, recovery and mitigation efforts for hazardous material emergencies.

6.2.4 The Responsible Party

The primary responsibility for assessing, responding to, and containing an oil spill or discharge falls upon the individual, agency, and/or company responsible for the spill incident. The responsible party (RP), whether there is an approved contingency plan or not, is responsible for containment and cleanup of the spill, disposal of contaminated debris, restoration of the environment, and

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payment of damages. State law (Chapter 70.105D RCW) and federal law (40 CFR 300, the NCP) specifically require that the removal of a discharge of oil or hazardous substance should be immediate.

6.3 SPILL RESPONSE CONTACT INFORMATION

A spill of any magnitude within the WHPA, must be reported to Ecology's Southwest Regional Office:

- Ecology (24 hour) **1-800-OILS-911 (645-7911)**
  or 206-594-0000 (during business hours)

https://ecology.wa.gov/footer-pages/report-an-environmental-issue/report-a-spill

If necessary, contact local first responders and other government agencies and request their assistance:

- Police 911
- Fire/Ambulance 911
- Clark County Public Health (564) 397-8000

If a spill cannot be contained, Safety Kleen, a cleanup contractor in Clackamas, Oregon should be contacted:

- Safety Kleen (503) 655-5798

If a spill can be contained, it should be pumped into a containment tank. If there are no containment tanks on site, United Rentals can be contacted to provide one:

- United Rentals (360) 574-5455

In the case of a railway spill, BNSF railways General Director of Hazardous Material Safety should be notified (in addition to first responders and agencies above):

- Patrick Brady office: (817) 352-3652
  mobile: (817) 821-1325

6.4 WHPA NOTIFICATION LETTERS

To help protect and coordinate spill response planning within the community surrounding the City's WHPAs, the City should send notification letters (example letters included in Appendix C) to contaminant source site owners, emergency responders, and governmental and regulatory agencies. The notification letters should present a map of the WHPAs (similar to Figure 4-1), a table of the site of concern (similar to Table 4-1a) and briefly describe appropriate procedures in the event of a spill. Notification letters for business/site owners should be sent all 69 sites ranked in Table 4-1a.

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Notification letters for emergency responders should be sent to the following entities:

- Parcels of Concern within WHPA (Appendix B)
- Owners of Environmental Sites of Potential Concern within WHPA (Table 4-1a)
- Local Fire and Police Departments
- Ecology Southwest Regional Office
- Washington State Department of Health Southwest Regional Office
- Clark County Public Health
- BNSF railways

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7.0 LIMITATIONS

Work for this project was performed for the exclusive use of the City of Camas (Client), and this report was prepared consistent with generally accepted environmental and hydrogeologic practices of professionals in the same locality and involving similar conditions, at the time the work was performed. No other warranty, express or implied, is made by Strata Geosciences' (Strata). All deliverables prepared by Strata for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Strata. Strata's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others. Strata accepts no responsibility for any error or omission which is due to an error or omission in data supplied to us by other parties.

8.0 REFERENCES

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TABLES

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Table 4-1a: Sites of Potential Environmental Concern within Wellhead Protection Capture Zones

Map ID	Facility Name	Facility ID	WHPZ	Ecology Active Status	Release	Storm Water Risk	UST	LUST	Total "Current" Operational Tank Volume (gallons)	Solid Waste	Hazardous Materials	Cleanup Site	Cleanup Status[1]
1	Camas Police Department	22289	6-Month Well 13	Active						Y			
2	Camas City Well 4	81347684	6-Month Well 13	Inactive							Y		
3	City of Camas Well 13	93671	6-Month Well 13	Active							Y		
4	Philpot	12088	6-Month	Active	Y		Y	Y	500 - Closing 500 - Exempt			Y	Cleanup Started
5	Camas Washougal Port (The Port Sider Store on the Marina	92847997	6-Month	Active	Y		Y	Y	1,040 - Unregistered 16,000 - Operational			Y	NFA
6	Columbia Rock Concrete Products Inc	5016308	6-Month	Active	Y							Y	Awaiting Cleanup
7	Concrete Products Of Oregon LLC	70983458	6-Month	Active			Y		Removed 1996		Y		
8	Triangle Resources	3153967	6-Month	Active		Y				Y			
9	Columbia Storage Inc 2nd St	11338232	6-Month	Active		Y					Y		
10	Columbia Warehouse	37125488	6-Month	Active			Y		Removed or Closed in Place 1996		Y		
11	Hambleton Bros Log Yard	4399598 87338713	6-Month	Active	Y	Y	Y		Removed 1996			Y	NFA
13	Northwest Pipeline Gp Washougal M/S	14447751	6-Month	Active	Y						Y	Y	NFA
14	Jimbos Deli Mart 2	86429735	6-Month	Active			Y		35000				
15	Tarr Inc Washougal	3264254	6-Month	Active							Y		
12	Tidland Corp	88277363 7282918	6-Month	Active			Y		Removed 1996		Y		
16	Goodwill - Washougal	100001039	6-Month	Active		Y							
17	Camas City Well 11 & 12	994431	6-Month	Active							Y		
18	City of Camas Well 14	42373	6-Month	Active							Y		
19	City of Washougal Lower Well Field	43057	6-Month	Active							Y		
20	Washougal City Westside Wellfield Well 12	6975	6-Month	Active		Y							
21	Chevron Bulk Plant Camas	1043	6-Month	Active	Y							Y	NFA
22	Camas City Well 3	9810684	6-Month	Inactive							Y		
23	Us Doe Bpa Camas Substation	3811629	6-Month	Inactive							Y		
24	Clark Public Utility Dist C St	5352681	6-Month	Inactive			Y		Removed 1996				
25	Clark PUD Transformer Release J Street	100003734	1-Year	Active	Y							Y	NFA
26	Lacamas Dry Cleaners	49143	1-Year	Active									
27	Walgreens 1085	99999862	1-Year	Active							Y		
28	Rockwood Terrace	73627	1-Year	Active		Y							
29	Goodyear Tire Camas	85837922	1-Year	Inactive	Y		Y	Y	Removed 1999 & 2001			Y	NFA
30	Washougal Electric & Sheet Metal Inc	16327542	1-Year	Inactive			Y		Removed 1996				
31	Schucks Auto Supply Camus	52218486	1-Year	Inactive							Y		
32	All Seasons Auto Centers Inc Camas	18768638	1-Year	Inactive							Y		
33	Brass Lamp Motor Inn	64124152	1-Year	Inactive							Y		
34	Helland Brothers SS	69936158	1-Year	Inactive							Y		
35	Asher Engine Service (East County Auto)	94778244	5-Year	Active	Y						Y	Y	Awaiting Cleanup
36	Hi Way Fuel	22538744	5-Year	Active	Y		Y	Y	Removed 1996 56,000 - Operational			Y	Cleanup Started
37	Washougal Shell	57872946	5-Year	Inactive			Y		Removed 1996		Y		
38	Washougal School Dist Bus Garage	48371594	5-Year	Inactive		Y	Y		Removed 1996 Unknown - Exempt				
39	Overton Mfg Inc	49392144	5-Year	Inactive							Y		
40	Napa Washougal	79581825	5-Year	Inactive							Y		
41	Clark County Pub Wks Washougal Site	95756539	5-Year	Inactive			Y		Removed 1996				
42	Camas STP	74959167	CARA	Active						Y	Y		
43	Gk Construction & Equipment Rentals	4168647	CARA	Active							Y		
44	SE 8th & SE Tampa Development	99999682	CARA	Active		Y							
45	Camas City Operations Center	38772238	CARA	Inactive							Y		
46	Georgia Pacific Consumer Products	66765272	Western Search Area	Active	Y						Y	Y	Cleanup Started
47	Camas Foodmart (Browns Chevron)	18732618	Western Search Area	Active	Y		Y	Y	Removed 1996 111-1,100 - Exempt 32,000 - Operational		Y	Y	NFA
48	Camas City Shops	8698751 45416761	Western Search Area	Active	Y		Y	Y	Removed 1996		Y	Y	NFA
49	Verizon Northwest Inc Camas Co (GTE Northwest Inc)	89994319	Western Search Area	Active	Y		Y	Y	Removed 1996 500 - Operational		Y	Y	NFA
50	Safeway Fuel 1000	8343024	Western Search Area	Active			Y		40000		Y		
51	Westlie Ford Mercury Inc	61664371	Western Search Area	Active			Y		500 - Unregister 30 Day Notice 2014		Y		

Table 4-1a: Sites of Potential Environmental Concern within Wellhead Protection Capture Zones

Map ID	Facility Name	Facility ID	WHPZ	Ecology Active Status	Release	Storm Water Risk	UST	LUST	Total "Current" Operational Tank Volume (gallons)	Solid Waste	Hazardous Materials	Cleanup Site	Cleanup Status[1]
52	Camas Gas Services Inc (Browns Arco)	97188815	Western Search Area	Active	Y		Y	Y	Removed 1996			Y	NFA
53	Quick Stop Mart (Camas Mart)	33881994	Western Search Area	Active	Y		Y	Y	Removed 1996 and 1999 15,000 - Operational			Y	NFA
54	Residence Heating Oil Tank	9620	Western Search Area	Active	Y							Y	Awaiting Cleanup
55	Haag & Shaw Excavating	82973453	Western Search Area	Active	Y		Y		Removed 1996			Y	NFA
56	Greseth Property	5458	Western Search Area	Active	Y							Y	Cleanup Started
57	Camas Cemetary Association	39618925	Western Search Area	Active			Y		Removed or Closed in Place 1996				
58	P & L Investments	41313725	Western Search Area	Inactive	Y		Y	Y	Removed 2000			Y	NFA
59	Helen Brothers Service	65648254	Western Search Area	Inactive	Y		Y	Y	Removed 2000			Y	NFA
60	Camas City Minicipal SW	930	Western Search Area	Active		Y							
61	Camas City Old Sewage Treatment Plant	53821114	Western Search Area	Inactive							Y		
62	Camas Public Library	53186612	Western Search Area	Inactive			Y		Removed 1996				
63	Town & Country Stores Inc	44713844	Western Search Area	Inactive			Y		Removed 1996				
64	QWEST Camas N Rptr Bldg	43889368	Western Search Area	Inactive							Y		
65	Imperial Cleaners	78239817	Western Search Area	Inactive							Y		
66	First Christian Church HOT	100003126	Western Search Area	Inactive	Y							Y	NFA

Notes:
CARA = extended CARA
NFA = No Further Action
Y = Yes, site contains Ecology interaction type

Table 4-1b: Cleanup Sites and Associated Contaminants

Map ID	Facility Name	Facility ID	WHPZ	Cleanup Status[1]	Nature of Contaminants at Cleanup Sites[2]																
					Arsenic	Asbestos	Benzene	Dioxins/Furans	Halogenated Solvents	Non-Halogenated Solvents	Halogenated Organic Compounds	Other Non-Halogenated Organics	Lead	Metals - EPA Priority Pollutant	Metals - Other	PAH	PCB	Petroleum- Diesel	Petroleum - Gasoline	Petroleum Products - Unspecified	Phenolic Compounds	Reactive Wastes
4	Philpot	12088	6-Month	Cleanup Started														S(gw) C (s)	S (gw) S(s)			
5	Camas Washougal Port (The Port Sider Store on the Marina)	92847997	6-Month	NFA			B (s)					B (s)							RB (s)			
6	Columbia Rock Concrete Products Inc	5016308	6-Month	Awaiting Cleanup										C (gw) S (s)						S (gw) C (s)		
11	Hambleton Bros Log Yard	4399598 87338713	6-Month	NFA										B (gw) RB (sw) RA (s)		RB (sw) RA (s)	RA (s)	RA (gw) RA (s)		RB (sw) RA (s)	RB (sw)	
13	Northwest Pipeline Gp Washougal M/S	14447751	6-Month	NFA	B (s)									RB (s)								
21	Chevron Bulk Plant Camas	1043	6-Month	NFA						RB (gw) RB (s)	RB (gw)			RB (s)						RB (gw) RB (s)		
25	Clark PUD Transformer Release J Street	100003734	1-Year	NFA													B (s)	B (s)		B (s)		
29	Goodyear Tire Camas	85837922	1-Year	NFA							R (s)									C (s)		
35	Asher Engine Service (East County Auto)	94778244	5-Year	Awaiting Cleanup			S (gw) S (s)		S (gw) S (s)	S (gw) S (s)		S (gw) S (s)	S (gw) S (s)		S (gw) S (s)	S (gw) S (s)	S (gw) S (s)	S (gw) S (s)	S (gw) S (s)	S (gw) S (s)		
36	Hi Way Fuel	22538744	5-Year	Cleanup Started																C (gw) C (s)		
46	Georgia Pacific Consumer Products	66765272	Western Search Area	Cleanup Started		S (s)	S (s)	S (s)		S (s)			S (s)		S (s)	S (s)	S (s)			S (s)		S (s)
47	Camas Foodmart (Browns Chevron)	18732618	Western Search Area	NFA															C (s)	C (s)		
48	Camas City Shops	8698751 45416761	Western Search Area	NFA			B (s)					B (s)	B (s)					B (s)	RB (s)			
49	Verizon Northwest Inc Camas Co (GTE Northwest Inc)	89994319	Western Search Area	NFA														B (s)		B (s)		
52	Camas Gas Services Inc (Browns Arco)	97188815	Western Search Area	NFA			B (s)					B (s)	B (s)						C (s)			
53	Quick Stop Mart (Camas Mart)	33881994	Western Search Area	NFA			B (s)					B (s)	B (s)						B (s)	B (s)		
54	Residence Heating Oil Tank	9620	Western Search Area	Awaiting Cleanup						S (gw) C (s)										S (gw) C (s)		
55	Haag & Shaw Excavating	82973453	Western Search Area	NFA														RB (s)				
56	Greseth Property	5458	Western Search Area	Cleanup Started																C (s)		
58	P & L Investments	41313725	Western Search Area	NFA															C (s)			
59	Helen Brothers Service	65648254	Western Search Area	NFA			B (s)					B (s)						B (s)	B (s)	B (s)		
66	First Christian Church HOT	100003126	Western Search Area	NFA														RB (s)				

Notes:
Nature of Contaminants and Impacted Media at Cleanup Sites (as provided on Ecology's online Site Summary Report).
NFA = No Further Action

B Below Cleanup Level
C Confirmed Above Cleanup Level
S Suspected
R Remediated
RA Remediated-Above Cleanup Level
RB Remediated-Below Cleanup Level
(gw) Groundwater
(sw) Surface Water
(s) Soil

Table 4-2: Sites with EIM Contaminant Detections in Monitoring Wells and Nature of Site Exceedances

Map ID (See Fig. 4-1)	EIM Study ID	EIM Study Name	Facility ID	WHPZ	Cleanup Status[1]	Location ID	Most Recent Exceedance	Most Recent Sample Date	Clean Confirmation Sample	Nature of Contaminants in EIM Reported Detections											
										Benzene	Halogenated Solvents	Non Halogenated Solvents	Non-Halogenated Organics - Phenolic Compounds	Metals - EPA Priority Pollutant	Metals - Other	PAH	PCB	Petroleum- Diesel	Petroleum - Gasoline	Petroleum - Other	Petroleum - Other, Volatile
11	G1400032	Former Hambleton Brothers Log Yard	4399598	6-Month	NFA	G1400032-MW-07	4/17/2015	4/17/2015	N					GW				GW		GW	
						Freshwater Sediment	9/7/2011	9/7/2011	N				Sed	Sed		Sed					
						Soil	10/28/2011	8/26/2014	Y			S		S		S	S			S	
21	AO02TCPSR-3991	Former Chevron Bulk Terminal No. 207407	1043	6-Month	NFA	AO3991_MW5	6/30/2011	12/7/2015	Y									GW		GW	
						AO3991_MW6	6/3/2013	12/7/2015	Y									GW		GW	
						AO3991_MW9	6/30/2011	6/1/2015	Y											GW	
						AO3991_MW10	3/25/2011	6/2/2015	Y											GW	
						AO3991_MW12	3/25/2011	12/7/2015	Y									GW		GW	
						AO3991_MW13	3/15/2007	6/24/2008	Y									GW		GW	
						Soil	9/21/2014	9/21/2014	N							S		S	S	S	S
n/a	VCSW1182	ARCO 6008 (KT KANSO AM/PM), Washougal, WA	46212644	Eastern	NFA	SW1182MW_3	4/17/2013	4/17/2013	N					GW							
						VCSW1182SB_3	1/28/2011	1/28/2011	N					GW						GW	
						Soil	4/8/2013	3/4/2014	Y	S		S									
n/a	VCSW1430	George Schmid & Sons, Inc. 32nd Street Property, Washougal, WA	53281319	Eastern	NFA	VCSW1430-GP09	4/20/2012	4/20/2012	N									GW		GW	
						VCSW1430-GP10	4/20/2012	4/20/2012	N					GW							
						VCSW1430-GP13	4/20/2012	4/20/2012	N					GW	GW						
						VCSW1430-GP18	10/14/2013	10/14/2013	N									GW			
						VCSW1430-GP21	10/14/2013	10/14/2013	N							GW		GW			
						VCSW1430-MW01	1/12/2015	1/12/2015	N						GW			GW			
						VCSW1430-MW03	3/18/2014	9/16/2015	Y											GW	
						VCSW1430-MW04	10/6/2014	1/12/2015	Y					GW							
						Soil	2/19/2015	2/20/2015	N			S		S		S	S	S	S		

Abbreviations:
NFA = No Further Action
GW = Groundwater
Sed = Freshwater Sediment
S = Soil

Table 4-5: Parcel-of-Concerns, Categories, and Occurrence

Parcel Land-Use Description	Zoning Category	Land-Use Concern	Generalized Use Grouping for Land-Uses of Concern	Number of Parcels				
				6-Month Capture Zone	1-Year Capture Zone	5-Year Capture Zone	CARA	Western Search Area
Agricultural Buildings	Residential			1	1	1	0	0
Auto Body Shop	Commercial	High Concern	Auto-Boats-Fuel	0	0	0	0	1
Banks & Credit Unions	Commercial			1	2	2	0	4
Boats And Marine Accessories.	Commercial	Concern	Auto-Boats-Fuel	1	0	0	0	0
Cemeteries	Commercial	High Concern	Biohazards (cemeteries, crematories, feedlots, biofiltration, sewage infrastructure)	0	0	0	0	2
Churches, Synagogues, Temples, Sunday School Bldgs	Commercial			4	1	13	0	22
Communication Bldgs & Related Structures	Commercial			1	0	0	0	1
Community Center	Commercial			0	0	0	1	0
Community Shop Cntr W/ 1 Or More Anchors	Commercial			0	6	0	0	0
Convalescent Or Nursing Home	Commercial			0	0	0	0	1
Convenience Store - W/ Pumps & Tanks	Commercial	High Concern	Auto-Boats-Fuel	2	0	1	0	3
Convenience Store - W/O Pumps & Tanks	Commercial			0	0	1	0	0
Drive Through Car Wash	Commercial	Concern	Auto-Boats-Fuel	0	2	2	0	0
Dry Cleaners, Laundries (1 Tenant - Free Standg Bl	Commercial	High Concern	Dry Cleaners	0	0	0	0	1
Electric Power Boosters, Transformers, Stations, R	Commercial	Concern	Electrical Infrastructure	1	0	0	0	1
Electric Power Operating, Maint., And Repair Build	Commercial	Concern	Electrical Infrastructure	2	0	0	0	0
Espresso Stand	Commercial			0	0	0	0	1
Fast Food Rest & Other Drive Through Food Service	Commercial			4	6	0	0	3
Fleet Operation Centers & Storage	Commercial	Concern	Auto-Boats-Fuel	0	0	4	0	0
Flex Space	Commercial			1	10	0	1	0
Funeral Services And Crematories.	Commercial	High Concern	Biohazards (cemeteries, crematories, feedlots, biofiltration, sewage infrastructure)	0	0	0	0	4
Gas Storage Tanks, Pumping, Distribution, Pipeline	Industrial	Concern	Auto-Boats-Fuel	1	0	0	0	0
General Repair & Service Garages	Commercial	Concern	Auto-Boats-Fuel	0	1	4	1	2
Government Buildings	Commercial			0	0	1	0	0
Government Offices And Courts	Commercial			1	0	0	1	8
Granges, Lodges, & Meeting Halls	Commercial			1	0	0	0	0
Health Clinics: Medical / Dental / Other	Commercial	Concern	Medical	2	0	0	0	16
Highway Construction And Repair Contractors.	Commercial	Concern	Other	1	0	0	0	0
Large Grocery Store	Commercial			0	0	0	0	2
Law Enforcement (Except Jails[085 And 086]).	Commercial			1	0	0	0	0
Libraries.	Commercial			0	0	0	0	1
Lodging - Economy	Commercial			0	2	0	0	1
Lodging - Limited Service	Commercial			2	0	0	0	0
Manufactured Or Mobile Home Assessed With Land	Residential			0	2	7	0	1
Manufactured Or Mobile Home Not Assessed With Land	Residential			0	0	45	0	0
Marinas.	Commercial	Concern	Auto-Boats-Fuel	9	0	0	0	0
Medical & Dental Laboratories	Commercial	Concern	Medical	1	0	0	0	0
Medium Retail Building (Btwn 10,000 S.F. & 40,000	Commercial			2	0	0	0	0
Mfg - Lumber & Wood Products	Industrial	High Concern	Manufacturing	2	0	0	0	1
Mfg - Machinery	Industrial	Concern	Manufacturing	4	0	0	0	0
Mfg - Miscellaneous	Industrial	Concern	Manufacturing	2	0	0	0	0
Mfg - Paper Products	Industrial	High Concern	Manufacturing	0	0	0	0	5
Mhp / Court (Use For The Land Pid'S Of The Mh Cour	Commercial			0	0	2	0	0
Minimal Strg Bldgs, Equip, Sheds, Open Pole Bldgs	Residential	High Concern	Other	0	0	1	0	1
Misc. Bldg. With Office Functionality	Commercial			1	0	0	0	2
Miscellaneous Improvement On Its Own Pid	Residential			0	1	0	0	2
Motor Vehicle Dealers, New Cars And Small Trucks,	Commercial	Concern	Auto-Boats-Fuel	4	0	0	0	0
Motor Vehicle Dealers, Used Cars And Small Trucks.	Commercial	Concern	Auto-Boats-Fuel	0	0	1	0	0
Movie Theaters.	Commercial			0	0	0	0	2
Multi- Family 10 To 14 Units	Residential			1	0	4	0	4
Multi-Family 100 Or More Units	Residential			2	1	0	0	0
Multi-Family 15 To 19 Units	Residential			0	1	0	0	3

Table 4-5: Parcel-of-Concerns, Categories, and Occurrence

Parcel Land-Use Description	Zoning Category	Land-Use Concern	Generalized Use Grouping for Land-Uses of Concern	Number of Parcels				
				6-Month Capture Zone	1-Year Capture Zone	5-Year Capture Zone	CARA	Western Search Area
Multi-Family 20 To 29 Units	Residential			2	1	2	1	0
Multi-Family 30 To 49 Units	Residential			0	0	0	0	4
Multi-Family 5 To 9 Units	Residential			6	0	8	1	2
Multi-Family 50 To 99 Units	Residential			0	1	0	0	0
Neighborhood Strip Center With No Anchor	Commercial			3	3	0	1	0
Nurseries And/Or Commercial Greenhouses	Commercial			1	0	0	0	0
Office Bldg: Leasing Class B & C	Commercial			2	0	0	0	15
Parking Lot: Gravel, For Adjoining Building	Industrial	High Concern	Auto-Boats-Fuel	0	0	0	0	16
Parking Lot: Paved, For Adjoining Building	Industrial	Concern	Auto-Boats-Fuel	0	0	0	0	8
Parking Lots & Parking Structures	Commercial	Concern	Auto-Boats-Fuel	0	0	0	0	2
Parks With Playgrounds, Ball Fields, And Picnic Ar	Residential			18	0	1	1	4
Post Office, Mail Handling Facilities	Commercial			1	0	0	0	1
Prime Commercial Pad Site - Vacant	Commercial			0	0	0	0	1
Prime Developable Ground	Commercial			14	1	8	0	1
Private - Daycare Center & Preschool	Commercial			0	1	0	1	0
Pumping Station / City Well	Commercial			2	0	0	0	0
Railroad Right-Of-Way	Industrial			0	0	0	0	3
Restaurants, Cafes	Commercial			5	1	1	0	7
Retail Services	Residential			0	0	0	0	1
Retirement Residences & Alf'S (Asst Living Facilit	Residential			0	0	1	0	0
Rock Quarry, Crushing, Sand And Gravel Pits.	Commercial	Concern	Other	2	0	0	0	0
Self Service Car Wash (Wand Type)	Commercial	Concern	Auto-Boats-Fuel	0	3	0	0	0
Self Storage / Mini Warehouse	Commercial			14	9	2	1	0
Serv Station W/ Tanks & Pumps Or Card Lock Station	Commercial	Concern	Auto-Boats-Fuel	0	0	1	0	0
Service Repair Shop	Commercial	Concern	Auto-Boats-Fuel	0	1	5	0	6
Sewage Related Bldg Or Structure	Commercial	Concern	Biohazards (cemeteries, crematories, feedlots, biofiltration, sewage infrastructure)	0	0	0	5	0
Sfr Converted To Duplex	Residential			1	1	1	0	0
Sfr Converted To Office Functionality	Commercial			1	1	0	0	8
Sfr Convtd To 3-4 Units, With Kit, Bath & Ext Entr	Residential			0	0	0	0	5
Sfr On Comm Land Chgd To Comm Use Othr Than Office	Commercial			0	7	3	0	5
Sfr Unit Not Sharing Structure With Other Uses	Residential			252	137	871	89	304
Sfr Unit Sharing A Common Wall, W/Lot Ownership	Residential			15	0	20	0	4
Sfr Unit Sharing Premises With Other Major Use	Residential			0	0	0	0	1
Sfr With A Shared Major Use On Commercial Land.	Commercial			0	0	1	0	0
Sfr With Auxiliary Unit	Residential			1	0	0	0	0
Single Family Condominium Unit	Residential			0	0	44	14	9
Single Family Residence On Commercial Land	Residential			4	1	9	0	8
Small Retail Building (<10,000 S.F.)	Commercial			2	3	6	0	32
Social, Charitable Or Community Use Bldgs	Commercial			1	0	2	0	3
Storage Warehouse	Commercial	High Concern	Other	3	5	0	3	6
Taverns And Bars, Drink, And Dance Establishments.	Commercial			0	1	1	0	3
Tidelands	Commercial			0	0	0	23	2
Tire, Batteries, Parts And Accessories Dealers	Commercial	Concern	Auto-Boats-Fuel	1	1	1	0	0
Traditional Duplex	Residential			12	10	40	21	13
Triplex Or Fourplex	Residential			3	2	19	4	3
Unattached Parking For Profit	Commercial			0	0	0	0	1
Unused Buildings Other Than Residential.	Commercial			0	0	1	2	0
Unused Land Because Of Terrain.	Industrial			1	0	0	0	0
Unused Land Timbered.	Residential			1	0	2	0	3
Unused Or Vacant Land - No Improvements	Commercial			44	6	42	8	39
Unused Platted Land.	Commercial			14	4	2	6	6

Table 4-5: Parcel-of-Concerns, Categories, and Occurrence

Parcel Land-Use Description	Zoning Category	Land-Use Concern	Generalized Use Grouping for Land-Uses of Concern	Number of Parcels				
				6-Month Capture Zone	1-Year Capture Zone	5-Year Capture Zone	CARA	Western Search Area
Vacant	Residential			0	0	0	1	1
Veterinarians / Small Animal Hospitals.	Commercial	Concern	Medical	0	1	0	0	0
Warehouse Buildings 201-209	Commercial			0	0	1	0	0
Water Towers & Reservoirs	Industrial			9	0	0	0	0
Wedding Chapels, Dance Halls, Ballrooms	Commercial			1	0	0	0	0
Zero Value Property For Various Reasons	Residential			6	3	20	6	1

Notes:
See Appendix C for detailed descriptions of parcels of concern
“Biohazards” include: cemeteries, crematories, feedlots, biofiltration and sewage infrastructure. “Electrical infrastructure” includes: boosters, transformers and stations. “Medical” also includes dental and veterinary. “Manufacturing” includes chemical, wood, machinery, paper, plastic. “Other” includes storage, parking, quarries, sand/gravel pits and crushing operations
CARA = extended CARA

Table 4-8: PFAS Industry Sites

PFAS Site Ranking	Map ID	Facility Name	Facility ID	WHPZ	Risk Active Status	Distance from Well 13 (Miles)	Historic Site Review Assigned Color	PFAS Industrial Sites - Historical Activities Related to PFAS Contamination																		
								Paper Mills and Products	Lumber Processing	Textiles and Leather	Metal Plating, Finishing, Machining	Electronics Industry	Chemical Manufacturing	Chemical Storage	General Warehouse and Storage	Auto Stations/Garages	Car Wash	Dry Cleaning Facilities	Concrete Production	Waste Management; Water Treatment	Airports	Fire Stations; Fire Protection	Plastics and Resins	Spills and Reported Releases
1	6	Columbia Rock Concrete Products Inc	5016308	6-Month	Active	0.3	5-Amber												Y					Y
2	46	Georgia Pacific Consumer Products	66765272	Western Search Area	Active	0.6	1-Red	Y					Y							Y				Y
3	1	Camas Police Department	22289	6-Month Well 13	Active	0.4	6-Amber													Y				Y
4	45	Camas City Operations Center	38772238	CARA	Active	0.5								M		Y								Y
5	43	Gk Construction & Equipment Rentals	4168647	CARA	Active	0.5								M		Y								Y
6	7	Concrete Products Of Oregon LLC (Jensen Precast Camas)	70983458	6-Month	Active	0.3	5-Amber												Y					
7	8	Triangle Resources	3153967	6-Month	Active	0.5			Y											Y				
8	55	Haag & Shaw Excavating	82973453	Western Search Area	Active	0.4										Y								
9	42	Camas STP	74959167	CARA	Active	0.6														Y				Y
10	12	Tidland Corporation	7282918 88277363	6-Month	Active	0.7	24-Amber				Y			Y										
11	48	Camas City Shops	8698751 45416761	Western Search Area	Active	0.6	14-Amber								Y	M								
12	47	Camas Foodmart (Browns Chevron)	18732618	Western Search Area	Active	0.5	7-Amber									Y								
13	11	Hambleton Bros Lumber Co Inc	87338713 4399598	6-Month	Inactive	0.7	32-Amber		Y					Y										
14	51	Westlie Ford Mercury Inc	61664371	Western Search Area	Inactive	0.6	13-Amber							M										Y
15		Imperial Dry Cleaners & Laundry		Western Search Area	Active	0.6	15-Amber											Y						
16		2500 NE 3rd Ave		CARA	Inactive	0.6	16-Amber															M		Y
17	53	Quick Stop Mart (Camas Mart)	33881994	Western Search Area	Active	0.6	17-Amber									Y								
18	30	Washougal Electric & Sheet Metal Inc	16327542	1-Year	Inactive	1.3	37-Amber				Y	Y		Y										
19	52	Camas Gas Services Inc (Browns Arco)	97188815	Western Search Area	Inactive	0.5	8-Amber									Y								
20	65	Imperial Cleaners	78239817	Western Search Area	Inactive	0.5	10-Amber											Y						
21	23	Us Doe Bpa Camas Substation	3811629	6-Month	Active	0.7						Y												
22		Straubs Swank Memorial Chapel		Western Search Area	Inactive	0.5	11-Amber									Y								
23		Camas Shell		Western Search Area	Inactive	0.5	9-Amber									Y								
24	49	Verizon Northwest Inc Camas Co (GTE Northwest Inc)	89994319	Western Search Area	Active	0.6								M										
25		M&M Car Wash		1-Year	Active	1.1	36-Amber										Y							M
26	61	Camas City Old Sewage Treatment Plant	53821114	Western Search Area	Inactive	0.6														Y				
27		Ulbrich Stan & Sue		Western Search Area	Inactive	0.6	18-Amber											Y						
28	39	Overton Mfg Inc	49392144	5-Year	Inactive	1.8					Y			Y		Y								
29		Camas Chevron Service		Western Search Area	Inactive	0.6	21-Amber									Y								
30	10	Columbia Warehouse (Iron Gate Storage)	37125488	6-Month	Active	1.0	30-Amber								Y									

Table 4-8: PFAS Industry Sites

PFAS Site Ranking	Map ID	Facility Name	Facility ID	WHPZ	Risk Active Status	Distance from Well 13 (Miles)	Historic Site Review Assigned Color	PFAS Industrial Sites - Historical Activities Related to PFAS Contamination																		
								Paper Mills and Products	Lumber Processing	Textiles and Leather	Metal Plating, Finishing, Machining	Electronics Industry	Chemical Manufacturing	Chemical Storage	General Warehouse and Storage	Auto Stations/Garages	Car Wash	Dry Cleaning Facilities	Concrete Production	Waste Management; Water Treatment	Airports	Fire Stations; Fire Protection	Plastics and Resins	Spills and Reported Releases
31	15	Tarr Inc Washougal (Iron Gate Storage)	3264254	6-Month	Active	1.0	30-Amber								Y										
32	59	Helen Brothers Service (CEASARS UNION 76)	65648254	Western Search Area	Inactive	0.7	23-Amber									Y									
33	36	Hi Way Fuel	22538744	5-Year	Active	1.8										Y	Y								
34	13	Northwest Pipeline Gp Washougal M/S	14447751	6-Month	Active	0.7	25-Amber							M											
35	26	Lacamas Dry Cleaners	49143	1-Year	Active	1.1	34-Amber											Y							
36	35	Asher Engine Service (East County Auto)	94778244	5-Year	Active	1.8	47-Amber									Y									Y
37	27	Walgreens 1085	99999862	1-Year	Active	1.1	35-Amber						Y												
38	9	Columbia Storage Inc 2nd St	11338232	6-Month	Inactive	0.8									Y										
39		Camas Transmission (Racers Division)		1-Year	Active	1.2	40-Amber									Y									
40	32	All Seasons Auto Centers Inc Camas	18768638	1-Year	Active	1.2	39-Amber									Y									
41	29	Goodyear Tire Camas	85837922	1-Year	Active	1.2	39-Amber									Y									
42	31	Schucks Auto Supply Camus	52218486	1-Year	Active	1.2	39-Amber									Y									
43		Stanford Cleaners		6-Month	Inactive	1.0	27-Amber											Y							
44		Cavalier Cleaning Corp of Washington		W Camas	Inactive	1.0	29-Amber											Y							
45	21	Chevron Bulk Plant Camas	1043	6-Month	Inactive	0.5	12-Amber							M											
46		Orbit Industries, LLC	1052	Columbia Industrial Park	Unknown	2.7					Y			Y							M				
47		Intech Enterprises	17695 92774682	Columbia Industrial Park	Active	2.7					Y									Y					
48	38	Washougal School Dist Bus Garage	48371594	5-Year	Active	1.7										Y									
49	64	QWEST Camas N Rptr Bldg	43889368	Western Search Area	Inactive	0.6								M											
50		Burlington Environmental LLC (Clean Earth; Stericycle)	1018	Columbia Industrial Park	Active	2.9								Y						Y					
51		Noble William E & J W		W Camas	Inactive	1.2	38-Amber									Y									
52	25	Clark PUD Transformer Release J Street	100003734	1-Year	Inactive	1.2						Y													
53		Hansens One Stop Service		1-Year	Inactive	1.2	41-Amber									Y									
54		Dolinsky Joseph		1-Year	Inactive	1.3	42-Amber									Y									
55		CWFD - A St Station		Beyond CARA	Active	1.9																Y			
56	33	Brass Lamp Motor Inn	64124152	1-Year	Inactive	1.3									Y										
57		Freeman Rick		W Camas	Inactive	1.4	43-Amber									Y									
58	37	Washougal Shell	57872946	5-Year	Inactive	1.4	45-Amber									Y									
59		Miller Manufacturing	23944	Columbia Industrial Park	Inactive	2.8				Y													Y		
60		Lake Store James E Pidgeon	86115375	N Camas	Inactive	1.4	44-Amber									Y									
61		Pendleton Woolen Mills	1020 15438643	Beyond CARA	Active	2.2	49-Amber			Y															
62		East County Fire and Rescue Station 91		N Camas	Active	2.7																Y			
63	40	Napa Washougal	79581825	5-Year	Inactive	1.9										Y									
64		Grove Field Port of Camas		N Camas	Active	2.8															Y				

Table 4-8: PFAS Industry Sites

PFAS Site Ranking	Map ID	Facility Name	Facility ID	WHPZ	Risk Active Status	Distance from Well 13 (Miles)	Historic Site Review Assigned Color	PFAS Industrial Sites - Historical Activities Related to PFAS Contamination																		
								Paper Mills and Products	Lumber Processing	Textiles and Leather	Metal Plating, Finishing, Machining	Electronics Industry	Chemical Manufacturing	Chemical Storage	General Warehouse and Storage	Auto Stations/Garages	Car Wash	Dry Cleaning Facilities	Concrete Production	Waste Management; Water Treatment	Airports	Fire Stations; Fire Protection	Plastics and Resins	Spills and Reported Releases
65		ARCO #6008 (KT KANSO AM/PM)	46212644	Beyond CARA	Active	1.9	48-Amber							M		Gas Only									
66		Linear Technology Corp (Analog Devices, Inc.)	29115524	NW Camas	Active	3.0						Y													
67		Northwest Paper Box Manufacturers	99998131	NW Camas	Active	3.0		Y																	
68		East County Fire and Rescue Station 93		N Washougal	Active	3.2																Y			
69		CWFD Station 42		NW Camas	Active	3.2																Y			
70		nLight Inc Camas	98835	W Camas	Active	3.2						Y													
71		Kemira Chemicals Inc Washougal Plan	68766465	Columbia Industrial Park	Active	3.3							Y												
72		Fiber Web Washougal Inc (Fitesa Washougal)		Columbia Industrial Park	Active	3.5				Y															
73		City of Washougal Wastewater Treatment Plant	100002147 20657 5618	Columbia Industrial Park	Active	3.5														Y					
74		Norwesco	19457 74135527	Columbia Industrial Park	Active	3.6																	Y		
75		Piller Aimmco Grant St	3811	Columbia Industrial Park	Active	3.6																	Y		
76		Wafer Tech LLC (TSMC Washington)	12734887	NW Camas	Active	3.7						Y													
77		Landa Inc	9810176	NW Camas	Inactive	3.0					Y														
78		Betz Dearborn Washougal		Columbia Industrial Park	Inactive	3.0							Y												
79		Saint Gobain Crystals and Detectors	74582235	Columbia Industrial Park	Inactive	3.1						Y													
80		Sigma Design	83917959	NW Camas	Inactive	3.2						Y													

Notes:

Beyond CARA = east of the defined CARA

Columbia Industrial Park = The industrial park northeast of Captain William Clark Park, south of Highway 14 in Washougal, and west of Steigerwald Lake National Wildlife Refuge

M = the site may or may have performed the listed activity

N = North

NW = Northwest

PFAS = Per- and polyfluoroalkyl substances

WHPZ = Wellhead Protection Zone

Y = Yes, site is or was known to perform the listed activity

Table 4-9a: Summary of Available PFAS Results Through CY 2025, City of Camas

Sampling Location	DOH Source No.	Testing Date	Result Summary
SOURCE			
City Well No. 5	06	3/22/2022	PFBS, PFOA, *PFOS*
		8/5/2022	(PFBA), PFBS, *PFOA*, *PFOS*
		11/9/2022	(PFBA), PFBS, (PFHxA), *PFOA*, *PFOS*, (PFPeA)
		4/4/2023	PFBS, *PFOS*
		7/3/2024	PFBS, *PFOA*, *PFOS*, (PFHxA)
City Well No. 6	07	4/4/2023	Not Detected
		9/27/2023	PFBS, (PFHpA), (PFHxA), PFOA, *PFOS*, (PFPeA)
City Well No. 7	08	4/4/2023	Not Detected
		9/27/2023	Not Detected
City Well No. 8	09	9/27/2023	Not Detected
City Well No. 9	11	3/22/2023	Not Detected
		9/27/2023	Not Detected
		8/6/2025	Not Detected
City Well No. 10	15	9/27/2023	Not Detected
City Well No. 11	13	4/4/2023	Not Detected
		9/27/2023	PFOA, PFOS
City Well No. 12	14	9/27/2023	Not Detected
City Well No. 13	16	8/5/2022	PFBS, PFOA, **PFOS**
		12/5/2022	PFOA, **PFOS**
		3/23/2023	PFOS
		5/4/2023	PFOS
		6/8/2023	*PFOS*
		6/13/2023	PFOA, *PFOS*
		6/22/2023	PFOA, *PFOS*
		7/13/2023	PFBS, *PFOA*, **PFOS**
		10/25/2023	PFBS, *PFOA*, *PFOS*
		12/5/2023	PFBS, PFOA, *PFOS*
		3/28/2024	Not Detected
		7/3/2024	*PFOS*
City Well No. 14	17	7/13/2023	PFBS, PFOA, *PFOS*
		9/27/2023	Not Detected
		7/11/2024	Not Detected
DISTRIBUTION SYSTEM			
Jones Creek	01	9/27/2023	Not Detected
Well Field East (City Wells No. 6 or 14)	18	3/22/2022	PFOS
		11/9/2022	PFBS, PFOA, *PFOS*
		7/13/2023	PFBS, PFOA, *PFOS* [detections from Well No. 14]
		9/27/2023	PFBS, (PFHpA), (PFHxA), PFOA, *PFOS*, (PFPeA) [detections only in Well No. 6]
Oak Park Well Field (City Wells No. 7, 8, 10, 11, or 12)	19	3/22/2022	PFOS
		11/9/2022	PFOA, *PFOS*
		4/4/2023	*PFOS*
		7/13/2023	PFBS, PFOA, PFOS
		9/27/2023	PFOA, PFOS [detections only in Well No. 11]
		9/10/2024	PFOS
5711 SE Strong Road		8/23/2023	PFOS
27200 Robinson Road		9/11/2023	PFOS
Deer Haven		9/11/2023	PFOA, *PFOS*
Crown Park		9/11/2023	PFOA, *PFOS*
NE Sitka Dr		9/11/2023	PFOS
NW Woodburn Drive		10/5/2023	PFOA, *PFOS*
1620 SE 8th Ave		10/5/2023	PFOA, *PFOS*
2822 NW 18th Ave		10/5/2023	PFOA, *PFOS*
North Chestnut Street		10/5/2023	*PFOS*
4542 NW Rae Ct		10/5/2023	PFOA, *PFOS*
Stone Leaf		10/5/2023	Not Detected
Columbia River Bank Pearl		11/1/2023	Not Detected
Washougal River (Goot Park)		11/1/2023	Not Detected

Formatting Notes:
PFAS - below EPA MCL
PFAS - above EPA MCL, below Washington SAL
PFAS - above Washington SAL
(PFAS) - detected but no standard established

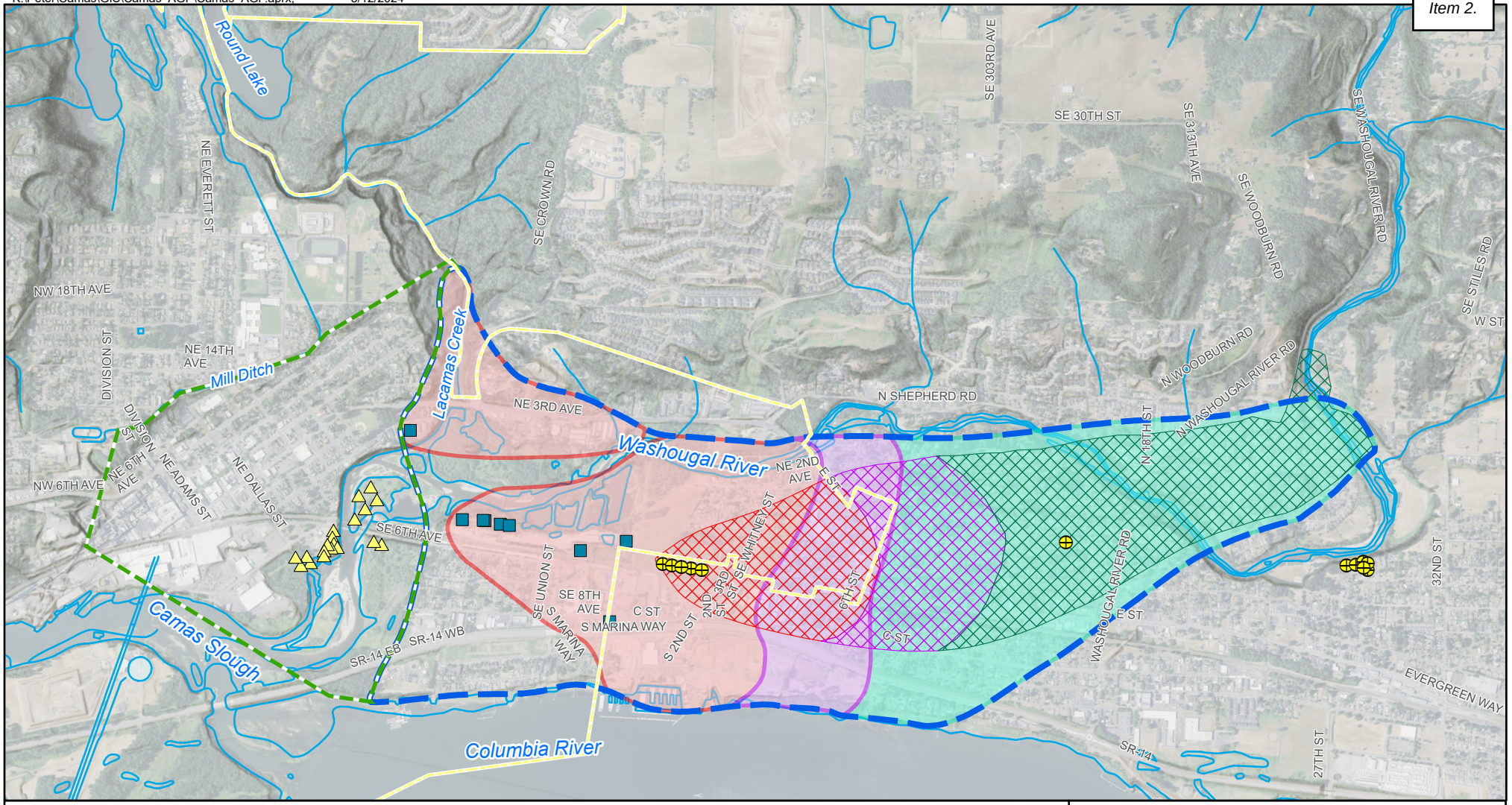
Table 4-9b: Summary of Available PFAS Results Through CY 2025, City of Washougal

Sampling Location	DOH Source No.	Testing Date	Result Summary
PRE-TREATMENT			
City Well No. 6	Unknown	late 2023	PFOA, *PFOS*
City Well No. 7	Unknown	late 2023	PFOA, *PFOS*
Unknown	04	4/16/2024	PFBS, PFOA, *PFOS*
		7/16/2024	PFOA, PFOS
		2/18/2025	Not Detected
Unknown	05	4/18/2024	PFOA, *PFOS*
		7/16/2024	PFBS, (PFHxA), PFOA, PFOS
Unknown	06	2/1/2024	PFOA, *PFOS*
		7/16/2024	PFHxS, (PFHxA), PFOA, *PFOS*
Unknown	07	2/1/2024	*PFOS*
		7/16/2024	Not Detected
Unknown	11	4/16/2024	PFBS, PFOA, *PFOS*
		7/16/2024	Not Detected
Unknown	13	4/16/2024	PFBS, (PFHxA), *PFOA*, *PFOS*
		7/16/2024	Not Detected
POST-TREATMENT			
Unknown	04	10/8/2024	Not Detected
Unknown	05	4/18/2024	PFOS
		7/16/2024	Not Detected
		10/8/2024	PFOS
		2/18/2025	PFBS, PFOA, *PFOS*
Unknown	06	2/1/2024	PFOA, *PFOS*
		7/16/2024	Not Detected
		10/8/2024	PFOS
		2/18/2025	PFBS, PFOA, *PFOS*
Unknown	07	2/1/2024	*PFOS*
		7/16/2024	Not Detected
		10/8/2024	PFOS
		2/18/2025	PFBS, PFOA, *PFOS*
Unknown	11	4/16/2024	PFBS, (PFHxA), PFOA, *PFOS*
		7/16/2024	PFBS, PFHxS, PFOA, *PFOS*
		10/8/2024	PFBS, PFOA, *PFOS*
		2/18/2025	PFBS, (PFHxA), PFOA, *PFOS*
Unknown	13	4/16/2024	PFBS, (PFHxA), PFOA, *PFOS*
		7/16/2024	PFBS, PFHxS, PFOA, *PFOS*
		10/8/2024	PFBS, (PFHxA), PFOA, *PFOS*
		2/18/2025	PFBS, PFOA, *PFOS*

Formatting Notes:
PFAS - below EPA MCL
PFAS - above EPA MCL, below Washington SAL
PFAS - above Washington SAL
(PFAS) - detected but no standard established

FIGURES

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Camas Wellhead Protection Capture Zones

- 6 Month Capture Zone
- 1 Year Capture Zone
- 5 Year Capture Zone
- Critical Aquifer Recharge Area (CARA)

Washougal Wellhead Protection Capture Zones

- 6-Months
- 1-Year
- 5-Year

- Camas Supply Wells
- Washougal Supply Wells
- Georgia Pacific Supply Wells
- Western Search Area
- City Boundary

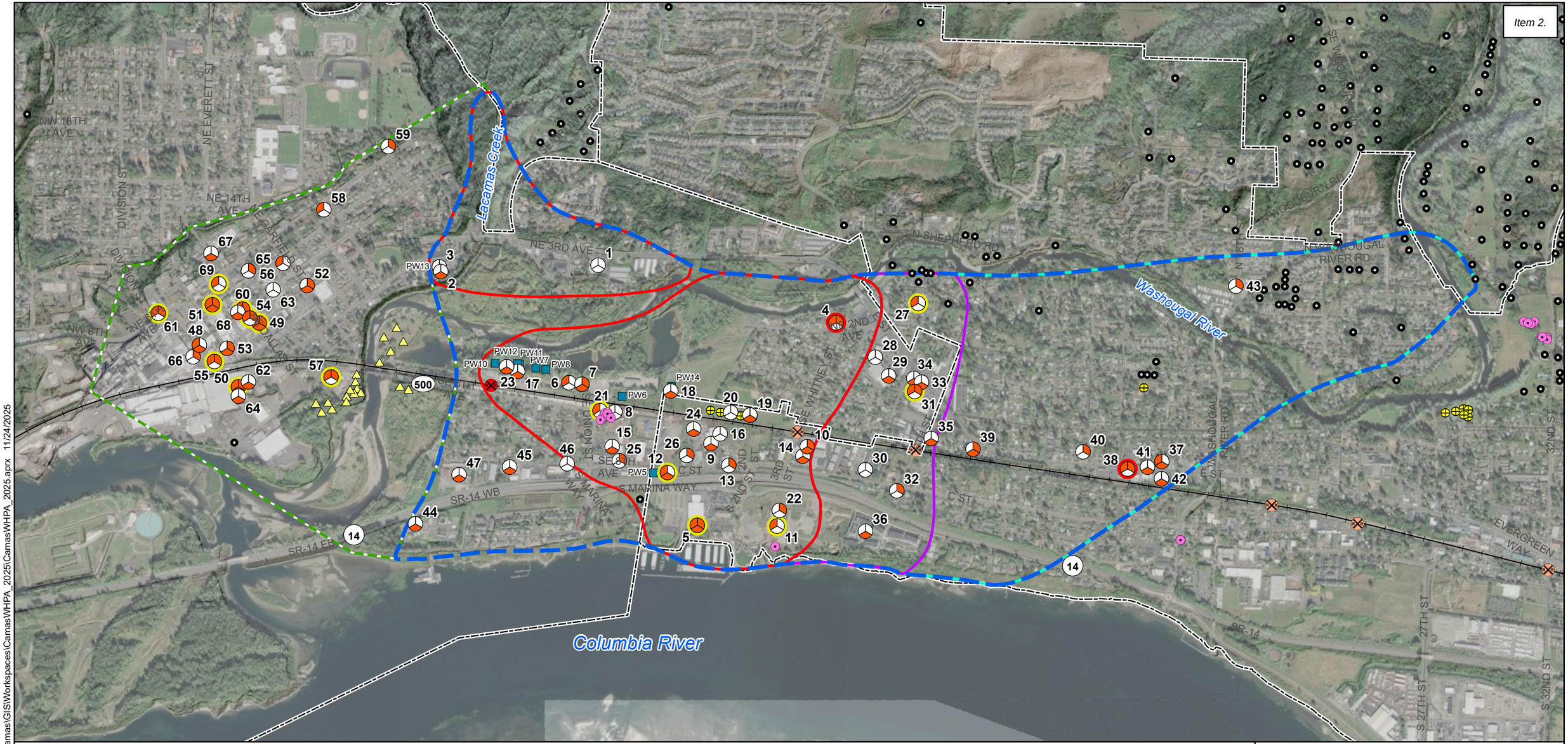
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0 Feet 2,000

Figure 1-1 Contaminant Source Inventory - Search Areas

WHPA 2025

Strata Geosciences



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- Camas Supply Wells
- Washougal Supply Wells
- Georgia Pacific Supply Wells
- 6 Month Capture Zone
- 1 Year Capture Zone
- 5 Year Capture Zone
- Critical Aquifer Recharge Area (CARA)
- Western Search Area
- City Limits
- Railroad Crossing (Public)
- Railroad Crossing (Private)
- BNSF Railroad
- Septics (from County 2025)
- Prior Contaminant Detections in Groundwater

DOE Sites of Concern

- Known Release
- NFA
- Table ID → Cleanup Site: 11
- UST/LUST
- Hazardous Materials

Refer to Section 7.4, Tables 7-1a and 7-1b, and Appendix C for description.

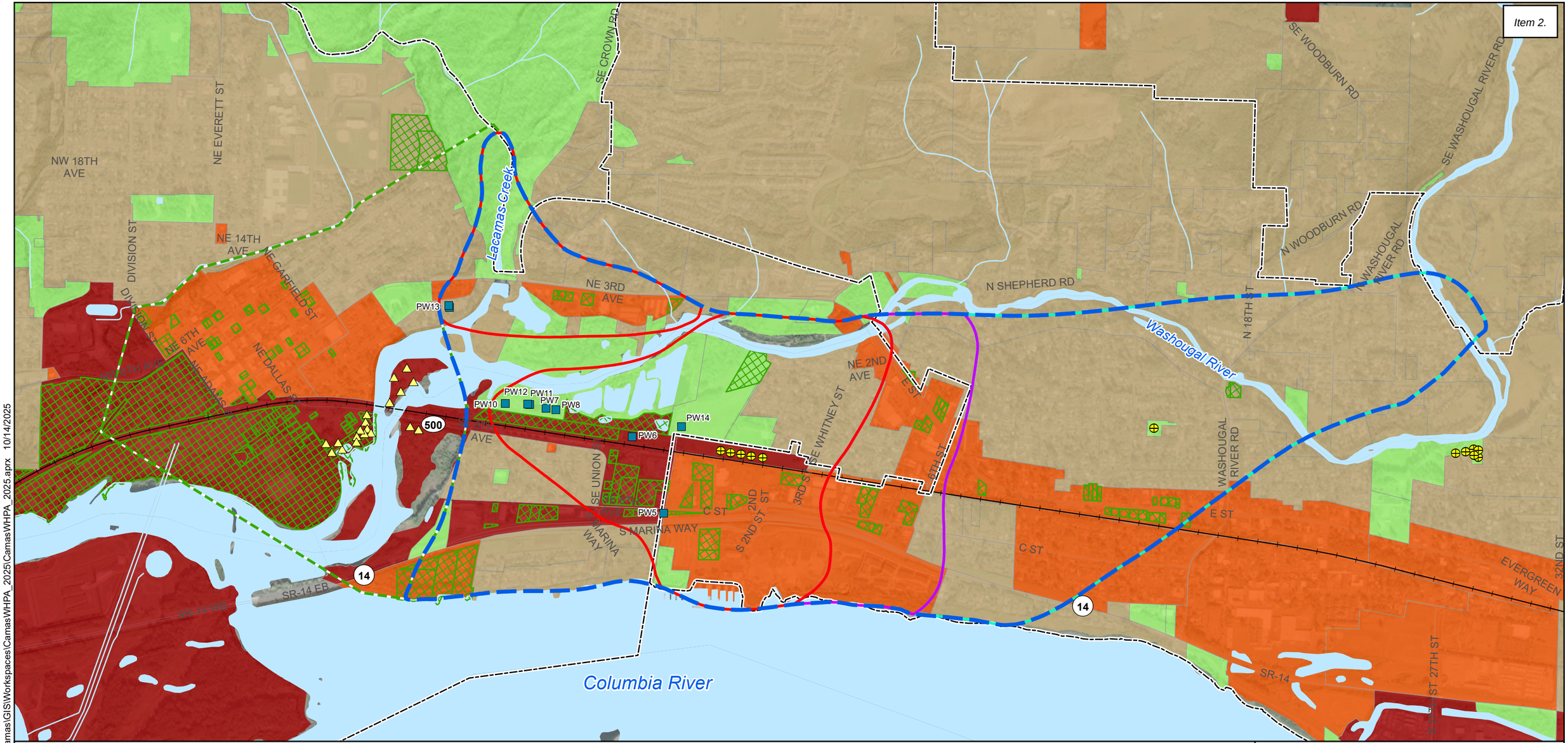
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Figure 4-1
Potential Contaminant Sources of Concern

WHPA 2025

Strata Geosciences 1771



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- Camas Supply Wells
- Washougal Supply Wells
- Georgia Pacific Supply Wells
- 6 Month Capture Zone
- 1 Year Capture Zone
- 5 Year Capture Zone
- Critical Aquifer Recharge Area (CARA)
- Western Search Area
- BNSF Railroad
- City Limits
- Land Uses of Concern

Zoning Categories

- Industrial
- Commercial
- Residential
- Parks

0 Feet 1,000

N

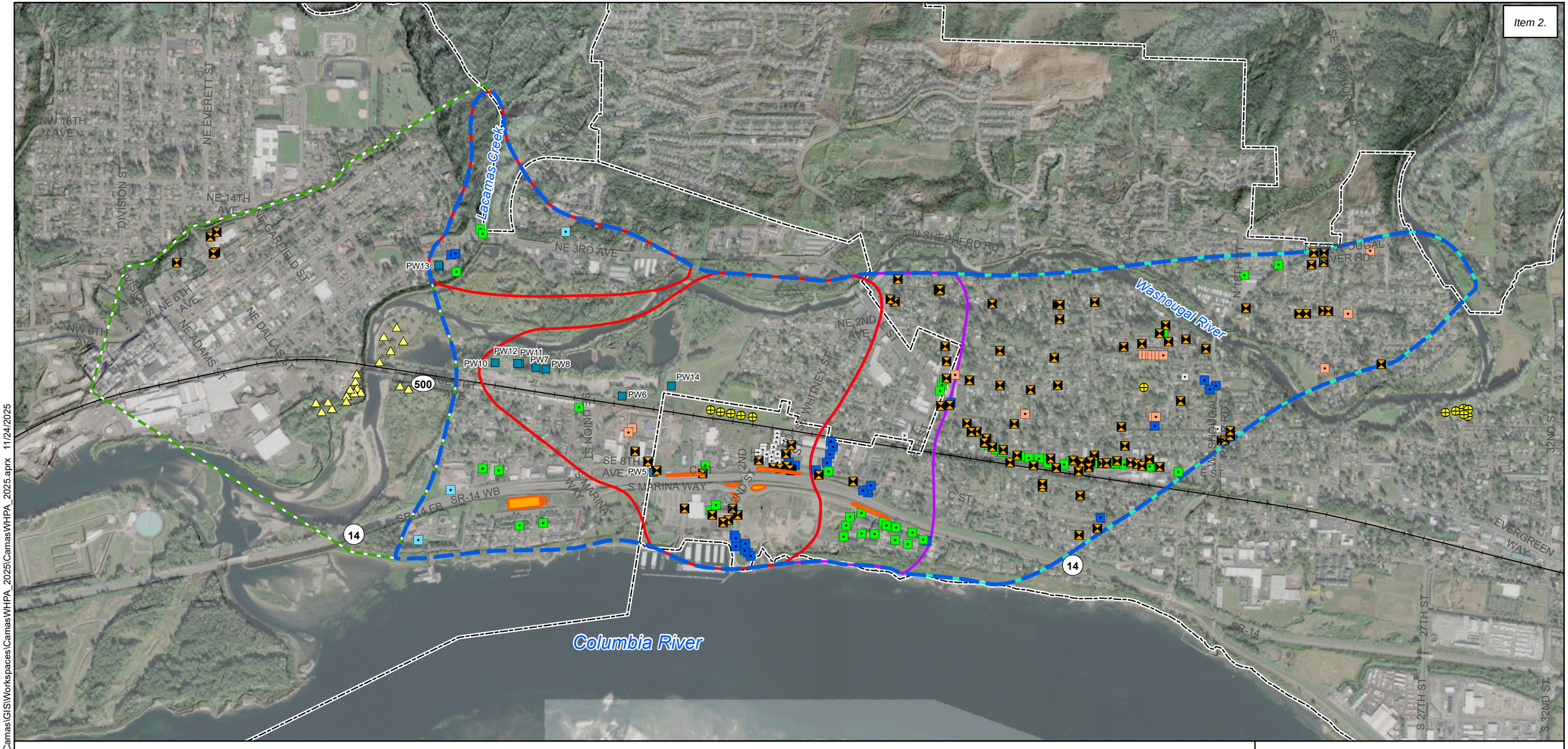
Figure 4-2

Zoning Categories and Parcels of Concern

WHPA 2025

Strata Geosciences

1772



- Camas Supply Wells
- Washougal Supply Wells
- Georgia Pacific Supply Wells
- 6 Month Capture Zone
- 1 Year Capture Zone
- 5 Year Capture Zone
- Critical Aquifer Recharge Area (CARA)
- Western Search Area
- City Limits
- BNSF Railroad
- WSDOT Infiltration Areas
- Drywell
- Bioretention Facility/Swale
- Detention Pond
- Permeable Pavement
- Rain Garden
- Other Infiltration Facility

0 Feet 1,000

N

Figure 4-3
Stormwater Infiltration and Management Areas

WHPA 2025

Strata Geosciences

1773

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Supply Wells
Owner
- Camas Supply Wells
- Washougal Supply Wells
- Georgia Pacific Supply Wells
- Critical Aquifer Recharge Area
- 6 Month Capture Zone
- 1 Year Capture Zone
- 5 Year Capture Zone
- Western Search Area
- City Limits
- BNSF Railroad
- Arterials - base, surfgeo
- Pfas_Facilities

0 Feet 1,000

N

Figure 4-4
PFAS Facilities

WHPA 2025

Strata Geosciences 1774

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APPENDIX A
ENVIRONMENTAL SITES INFORMATION

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1.0 ENVIRONMENTAL SITES INFORMATION

The following 22 sites are indicated as confirmed release sites in Table 4-1a and Table 4-1b. Mapped environmental sites within the Lower Washougal Wellfield Wellhead Protection Area (WHPA) (sites detailed in 1.1) are of primary concern to the City of Camas supply wells. The remaining sites (detailed in 1.2) are within the Western Search Area and should be considered a secondary concern to existing City of Camas supply wells.

Two additional sites with EIM-reported groundwater exceedances near the Eastern border of the CARA are included in 1.3.

Copies of Cleanup Site reports and documents reviewed for this report can be obtained from the Seattle office of Strata Geosciences by contacting Burt Clothier.

1.1 ENVIRONMENTAL SITES WITHIN THE LWWF WELLHEAD PROTECTION AREA

1.1.1 Philpot (FSID 12088, CSID 14631, Map ID=4)

The Philpot residential site is located at 301 NE 2nd Avenue. A 675-gallon UST containing fuel and a 350-gallon Heating Oil Tank (HOT) were decommissioned via removal in 2016. At the time of removal, the soil surrounding the UST and HOT were tested for gasoline and diesel respectively. Results indicated a petroleum release had occurred at the site and the Washington DOE was notified. Excavation of the area was performed following tank removal and follow-up NWTPH-Dx analysis indicated that petroleum impacts remained in the eastern wall and base of the excavation in levels as high as 9,520 mg/Kg. The MTCA Method A cleanup level for diesel in soil is 2,000 mg/Kg. In addition to the confirmed diesel contamination in the soil, it is suspected that there is remaining gasoline products in soil and both petroleum products are also suspected in groundwater. An Early Notice Letter for the site was delivered to the site owner in August 2018, and the site is listed as Cleanup Started. Currently at the site, one 500 gallon unleaded gasoline UST is listed as closure in progress and one 500 gallon tank of hazardous substance is listed as Exempt-Operational.

1.1.2 Camas Washougal Port (FSID 92847997, CSID 11089, Map ID=5)

The Camas Washougal Port (Port Sider Store on the Marina) site is located at 24 South A Street in Washougal and conducted cleanup for a leaking underground storage tank. Initial site characterization and cleanup work for benzene, non-halogenated organics, and gasoline began in 1990 with additional investigative work performed in 2011. Soil concentrations have been confirmed below cleanup levels, and the site was issued a No Further Action by Ecology in 2012. The site remains a Class 4 Facility under WAC 173-180.

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1.1.3 Columbia Rock Concrete Products (FSID 5016308, CSID 1548, Map ID=6)

The Columbia Rock Concrete Products site is located at 1615 SE 6th Avenue, and has documented soil and groundwater contamination based on a 2001 investigation. The site is located immediately adjacent to several of the City's water supply wells. Operations at the site includes production of concrete moldings (primarily Jersey barriers and sound wall barriers). A site hazard assessment was completed by Clark County Public Health in 2007, with the site receiving a ranking of "2" indicating that it poses a serious threat to human health and the environment. Results of a Phase II Environmental Assessment completed in 2001 found impacts to soil and groundwater. Contaminants of concern (above MTCA Cleanup Levels) identified during the Phase II assessment are petroleum products (diesel, gasoline, and heavy range oils) in soils and metals (arsenic, chromium, lead and barium) in groundwater. The concentration of metals in groundwater were reported as:

- Arsenic = 73.1 µg/L (MTCA Level A = 5 µg/L)
- Chromium = 641 µg/L (MTCA Level A = 50 µg/L)
- Lead = 498 µg/L (MTCA Level A = 15 µg/L)
- Barium = 5880 µg/L (MTCA Level B = 3200 µg/L)

The site was placed on the national priorities list in 2007 and is awaiting a remedial assessment (RA). No other information or action has taken place at the site since these activities and Ecology has no plans for taking action in the immediate future (personal communication with Kirsten Alvarez at Ecology 10/31/16).

1.1.4 Hambleton Bros Log Yard (FSID 4399598, CSID 2482, Map ID=11)

The Hambleton Bros. Log Yard is a historic lumber mill along the Columbia River located at 335 South A Street, now managed by the Port of Camas-Washougal. The mill, including chemical storage and aggregate recycling, operated on the property from approximately 1948 to 2010. Wood-treating activities were reported to not be conducted on the Hambleton Site. The site was purchased by the Port of Camas-Washougal in 2012. Site investigations and interim actions have taken place at the site since 2002 and a Focused Site Assessment was conducted in 2011 to evaluate the nature and extent of contamination at the site. Site investigations indicate contaminants above MTCA Method A cleanup levels (CULs) in groundwater, soil, log pond surface water, and log pond sediments. Contaminants found above CULs included:

- Groundwater: Petroleum hydrocarbons and arsenic.
- Soils (near log pond, mill area, and recycling center): Petroleum hydrocarbons, metals (arsenic, lead, and mercury), cPAHs, and PCBs.
- Log Pond Surface Water: metals, petroleum hydrocarbons, VOCs and PAHs
- Log Pond Sediments: VOCs and petroleum hydrocarbons

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- Four sediment samples were also collected from the Columbia River were found to all be below Ecology's Freshwater criteria.

A cleanup action plan (CAP) was developed for the site in 2013 and implemented in 2014. Components of the CAP included dewatering the log pond, consolidating impacted soils into the empty pond, site grading, and capping of the log pond, former mill area and recycling area. Institutional controls to restrict future site use were also included. A No Further Action status was granted to the Port in 2015; however, the Port is required to continue groundwater compliance monitoring at MW-7 for petroleum hydrocarbons on an 18-month schedule until groundwater CULs are achieved. The most recent groundwater sampling results from MW-7 that are accessible on Ecology's Cleanup Page for the site were collected in April 2024, at which time both Diesel Range Organics and Lube Oil range organics were not detected.

The Port completed over-excavation of unsuitable soils and replacement with structural fill for the construction of the Hyas Point Phase 1a and 1b developments that impacted the protective gravel and geotextile cap that was part of the cleanup action. The excavation began on August 7, 2024 and was completed on November 21, 2024. On September 11, 2024, one UST was discovered while excavating the organic-rich soil north of the cap area in an area previously noted as not being environmentally contaminated. The UST was inadvertently damaged by the excavator upon discovery. The UST was not active at the time of discovery and was void of any liquid product, however, approximately five gallons of water was observed draining from the damaged UST upon discovery. PID readings of up to 65 parts per million were observed within the UST. On September 25, 2024, visually stained soils and a degraded hydrocarbon odor were observed to a depth of approximately 10 feet below ground surface (bgs). One confirmation sample taken from within the excavation exceeded 2013 Washington DOE Cleanup Action Levels for diesel range organics, residual range organics, 1,2-dibromomethane, and methylene chloride.

1.1.5 Northwest Pipeline Gp Washougal M/S (FSID 14447751, CSID 420, Map ID=13)

The Northwest Pipeline GP Washougal Meter Station (M/S) site is located at 30 C Street, Washougal. This site was participating in the VCP program for soil and mercury contaminants in soils. Early remedial action performed in 1991 consisted of removal of three drums of soil in a 14-square foot area. Further site assessment work was performed in 2006 and 2007 with collection of 75 surface and subsurface soils samples. Additional soils were excavated in 2007 and confirmation samples were below cleanup levels. The site was issued a No Further Action status by Ecology in 2012.

1.1.6 Chevron Bulk Plant / Former Chevron Bulk Terminal No. 207407 (FSID 1043, CSID 3783, Map ID=21)

The Chevron Bulk Plant site is a decommissioned bulk fuel facility with historic releases of contaminants to soil and groundwater located at SE 6th Avenue and SE Union Avenue. Chevron sold the property in November 1994 to Triangle Resources (FSID 3153967) who uses the property for wood recycling. The site is located in close proximity to City Well 6. A Site Hazardous Assessment (SHA) was originally completed for the site in 1995, and at that time Ecology assigned a ranking of "2" to

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this site, indicating the site posed a serious threat to human health and the environment. Early investigative work conducted during the 1990's included soil borings and sampling, installation of groundwater monitoring wells, and remedial excavation of a sump containing an oil/water mixture and 830 cubic yards of impacted soils. Contaminants of concern at the site include petroleum products in soil and groundwater and priority pollutant metal (lead) in soil. In 2003, Chevron entered an agreed order with Ecology to conduct a formal Remedial Investigation, Risk Assessment, and Feasibility Study (RI/RA/FS) under MTCA and to implement any corrective actions identified in the RI/RA/FS.

Additional soil borings and monitoring wells were installed between 2004 and 2014. Of the soil samples collected in September 2014:

- SB-4-15 exceeded for Gasoline Range Organics and Extractable Petroleum Hydrocarbons (>C10-C12, >C12-C16, >C16-C21)
- SB-5-16 exceeded for 2-methylnaphthalene (PAH), Gasoline Range Organics, Extractable Petroleum Hydrocarbons (>C10-C12, >C12-C16, >C16-C21, >C21-34), and Volatile Petroleum Hydrocarbons (>C8-C10)
- SB-6-19 exceeded for Gasoline Range Organics, Extractable Petroleum Hydrocarbons (>C10-C12, >C12-C16, >C16-C21, >C21-34), and Volatile Petroleum Hydrocarbons (>C8-C10)

Groundwater samples collected at the site between 2006 and June 2013 regularly exceeded for Diesel Range Organics and Heavy Fuel Oil. Follow-up sampling occurred through December 2015. The highest detection of Diesel Range Organics after June 2013 was 120 µg/L in June 2015. There were no detections of Heavy Fuel Oil during the follow-up sampling.

The RI was completed in 2015 following more than eight quarters of groundwater sampling showing Total Petroleum Hydrocarbon (TPH) contamination below MTCA Method A groundwater cleanup levels (CULs). Ecology held a public comment period between December 23, 2018 and January 23, 2019 during which no comments were received. The site status was changed to No Further Action by Ecology in 2019, and Ecology will finalize the Remedial Investigation and Cleanup Action Plan reports and remove the site from the Hazardous Sites List.

1.1.7 Clark PUD Transformer Release J Street (FSID 100003734, CSID 17230, Map ID=25)

The Clark PUD Transformer Release J Street is located at 455 J Street, Washougal. Clark County Public Utilities Department (PUD) reported a release of 5-10 gallons of non-PCB mineral oil from a transformer to soil in June 2021. The impacted soil was removed in two mobilizations between June and August of 2021. Soil confirmation samples were collected from the excavation in August 2021 that were below the MTCA Method A cleanup level (4,000 mg/Kg), and remaining detections of diesel were deemed likely to be present to either pre-existing impact or roadway runoff. The site was classified as No Further Action by Ecology in 2022.

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1.1.8 Goodyear Tire Camas (FSID 85837922, CSID 6772, Map ID=29)

The Goodyear Tire (Schuck's Auto Supply) site is located at 3440 3rd Avenue and participated in a voluntary cleanup for a leaking underground storage tank. The site was cleaned up in 1999 and five USTs totaling 6,275 gallons and storing diesel, unleaded gasoline, and waste oil were removed in 1999 and 2001. The site was subsequently classified as No Further Action by Ecology in 2001. The location is currently an O'Reilly Auto Parts that offers some automotive services, including battery, motor oil, transmission fluid, and gear oil recycling and brake drum and rotor resurfacing.

1.1.9 Asher Engine Service / East County Auto (FSID 94778244, CSID 15034, Map ID=35)

The Asher Engine Service / East County Auto site is an automotive repair and maintenance facility located at 1405 E St, Washougal that is suspected to have soil and groundwater contamination. The site is located near the boundary of the 5-Year capture zone. An initial investigation was conducted in 2019 following a previous remediation and recommendation for No Further Action, following a complaint received from an adjacent property. A pipe appearing to lead from the automotive shop and discharging petroleum hydrocarbon-sheening fluid into a low-lying area between parcels was observed. An accumulation of water with significant petroleum hydrocarbon sheen on its surface was also observed. An Early Notice Letter for the site was delivered to the site owner in September 2019, and the site is listed as Awaiting Cleanup.

1.1.10 Hi-Way Fuel (FSID 22538744, CSID 8323, Map ID=36)

The Hi-Way Fuel site is a gas station with repair shop located at 1250 E Street in Washougal. Initial site characterization work began in 1996 for a leaking underground storage tank. During this time, five older tanks were removed and impacted soils excavated to the extent possible. Four new tanks were installed, increasing the capacity by 21,000 gallons, and pipes were upgraded to newer standards at that time. Some contaminated soils were left in place, but there is no information in current Ecology files indicating confirmed groundwater contamination (personal communication with Aaren Fiedler at Ecology 10/31/16). However, Ecology's online Cleanup Site report indicates confirmed petroleum contamination above cleanup levels in soil and groundwater at this site. Ecology sent a status update request letter to the owner in 2011, but there was no response. No other action has taken place at the site since these activities and Ecology has no plans for taking action in the immediate future (personal communication with Aaren Fiedler at Ecology 10/31/16).

1.2 ENVIRONMENTAL SITES WITHIN THE WESTERN SEARCH AREA

1.2.1 Georgia-Pacific Consumer Products (FSID 66765272, CSID 15156, Map ID=46) and Georgia-Pacific Camas Business Center (FSID 78452582, CSID 2961)

The Georgia-Pacific Consumer Products site includes two locations under Agreed Order 18201.

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The pulp and paper mill is located at 401 NE Adams Street. The mill began operations in the late 1880 and, while pulping operations have ceased, it still makes paper products from purchased pulp. Due to historic land use and industrial practices, soil is contaminated with total petroleum hydrocarbons (TPH) from diesel, gasoline, and oil. Other likely contaminants in soil, groundwater, and/or sediments include:

- Polycyclic aromatic hydrocarbons (PAHs) and carcinogenic PAHs
- Benzene, toluene, ethylbenzene, and xylenes (BTEX)
- Polychlorinated biphenyls (PCBs)
- Metals (lead and chromium)
- Corrosive wastes
- Asbestos
- Dioxins and furans

This facility has an industrial operating permit for industrial fugitive air emissions under WAC 173-401. The listed Program ID on the Ecology Facility is S0110005 and the submitted monitoring data could not be verified.

This facility is additionally tracked under the following EPA Regulatory Programs and Reports: Air Emissions Inventory (EIS) [ID 4986811], Toxics Release Inventory (TRI) [ID 98607JMSRVNE4TH], Clean Air Act (CAA) [ID WASWC000530112514], Clean Water Act (CWA) [ID WA0000256], Resource Conservation and Recovery Act (RCRA) [ID WAD009042896], and Greenhouse Gas Reporting Program (GHGRP) [ID 1005998]. The Facility Register Service (FRS) ID for Georgia Pacific Consumer Products related to these EPA programs is 110000564586. The most recent CAA compliance violation was disclosed by the facility in October 2018. The most recent RCRA violations were issued in May 2024. The facility has had an identified a CWA violation in all 12 of the prior 12 quarters (July 2022-September 2025). TRI tracked releases and transfers dropped off substantially after 2018; after 2020, only releases of 1,3-Dichloro-2-propanol were reported, totaling 19 pounds in 2023 and 20 pounds in 2024. Between January 1 and June 21, 2025, 546 kilograms of hazardous waste were shipped by the facility.

The Camas Business Center (CBC) is located north of the main mill site, at 906 NW Drake Street. This site was used for the manufacturing of chemicals for the paper making process and operated from the 1950s until 1997. Research involved pesticides including dimethyl sulfoxide, energy production, crop yields, and synthetic pulp production. There was also an electrical substation on the western side of the CBC until 2004. During a 2016 Environmental Site Assessment, one surface sample exceeded MTCA cleanup levels for lead (345 mg/kg), two boring samples exceeded MTCA cleanup levels for tetrachloroethylene (PCE) (2.95 mg/Kg and 0.25 mg/Kg), and one boring sample exceeded MTCA cleanup levels for methylene chloride (0.75 mg/Kg). Other soil samples collected in the vicinity were below MTCA cleanup levels for PCE and methylene chloride. Five monitoring wells exist at the CBC, though data is not available through Ecology's EIM database. In the March 2021 sampling event, results were below MTCA cleanup levels except for trichloroethylene (TCE),

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which exceeded the MTCA cleanup level [5 µg/L] at MW-3 (8.2 µg/L). Methylene chloride was not detected in groundwater.

Current Ecology files indicate that cleanup has started at the site. Georgia-Pacific submitted a revised draft Remedial Investigation Work Plan in August 2025 as required under Agreed Order 18201. It defines the investigation of environmental contamination at this site, including:

- A historical site review
- Identification of gaps in data that need to be addressed
- A sampling and analysis plan, that includes a quality assurance project plan

1.2.2 Camas Foodmart (Browns Chevron) (FSID 18732618, CSID 8218, Map ID=47)

The Browns Chevron 60092647 site is a gas station located at 501 NE 3rd Avenue. Notification and reports of a LUST were conducted in 1990 and 1991. Ecology's online Cleanup Site report indicates soil contamination above cleanup levels for gasoline and other petroleum products. Current Ecology files indicate independent action was taken to upgrade three tanks in 1991 and the site status was changed to No Further Action by Ecology in 1995. Five tanks were listed as having been removed from the site in 1996. One exempt, single wall steel tank storing an unknown substance is listed as associated with the property.

1.2.3 Camas City Shops (FSID 8698751, CSID 7811, Map ID=48)

The Camas City Shops is an auto repair property located at 234 E 1st Avenue, within the Georgia Pacific Camas Mill and across the Washougal River from the Lower Camas Washougal wellfield. The discovery of a LUST occurred in 1992 and site characterization began in 2011. Ecology's online Cleanup Site report indicates soil contamination below cleanup levels for diesel, benzene, and lead and remediated-below cleanup levels gasoline contamination. Current Ecology files indicate independent action was taken to remove four USTs and the site status was changed to No Further Action by Ecology in 2012 following a Site Hazard Assessment.

1.2.4 Verizon Northwest Inc Camas Co (GTE Northwest Inc) (FSID 89994319, CSID 11002, Map ID=49)

The GTE Northwest Inc site is a telephone communications and storage property located at 330 NE 5th Avenue. Notification of a LUST was submitted in 1989. Current Ecology files indicate independent action was taken to remove two tanks in 1996 and upgrade one 500-gallon emergency power generation tank in 1998. Initial site characterization work was performed in 2011. Ecology's online Cleanup Site report indicates soil contamination below cleanup levels for diesel and other petroleum products. The site status was changed to No Further Action by Ecology in 2012 following a Site Hazard Assessment. The site has additionally been categorized as a Tier 2 Hazardous Materials Site since 1987 (Program ID WAD988467478) and was listed as a hazardous waste generator in 1989. The Facility Register Service (FRS) ID for Verizon Northwest Inc Camas Co is 110005349710, which reflects that the RCRA identifier is inactive.

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1.2.5 Camas Gas Services Inc (Browns Arco) (FSID 97188815, CSID 11271, Map ID=52)

The Browns Arco site is a gas station located at 435 NE 3rd Avenue. Notification of a LUST was submitted in 1995. Initial site characterization work was performed in 2011. Ecology's online Cleanup Site report indicates soil contamination below cleanup levels for benzene, and other non-halogenated organics and soil contamination above cleanup levels for gasoline. Current Ecology files indicate independent action was taken to remove three USTs and the site status was changed to No Further Action by Ecology in 2012 following a Site Hazard Assessment.

1.2.6 Quick Stop Mart (Camas Mart) (FSID 33881994, CSID 8776, Map ID=53)

The Camas Mart site is gas station located at 207 NE 3rd Avenue, north of the Georgia Pacific Camas Mill. Notification of a LUST was submitted in 1996. Current Ecology files indicate independent action was taken to remove four leaded and unleaded gasoline tanks in 1996, upgrade two unleaded gasoline tanks totaling 15,000 gallons in 1998, and remove an additional waste oil tank in 1999. Initial site characterization work was performed in 2011. Ecology's online Cleanup Site report indicates soil contamination below cleanup levels for benzene, lead, gasoline and other petroleum products, and other non-halogenated organics. The site status was changed to No Further Action by Ecology in 2012 following a Site Hazard Assessment.

1.2.7 726 NE 5th Ave Camas (FSID 9620, CSID 11792, Map ID=54)

The site is a residence located at 726 NE 5th Avenue with a heating oil tank (HOT) of unknown volume. An initial investigation was completed in 2011. Ecology's online Cleanup Site report indicates soil contamination above cleanup levels for non-halogenated solvents and other non-halogenated petroleum products, both of which are also suspected in groundwater. An Early Notice Letter for the site was delivered to the site owner in February 2012, and the site is listed as Awaiting Cleanup.

1.2.8 Haag & Shaw Excavating (FSID 82973453, CSID 12835, Map ID=55)

The Haag & Shaw Excavating site is a general contracting business specializing in demo, underground, site work, excavation, paving utilities, concrete, and asphalt recycling located at 636 SE 3rd Avenue. Above-ground storage tanks and heavy machinery are visible on permeable to semi-permeable surfaces from the street. One 2,000 gallon gasoline UST and one 2,000 gallon diesel UST were decommissioned and removed from the site in 1991. A site discovery report was submitted in 2014 following a geophysical study of the property during which diesel was detected in soil samples collected from borings at 2-feet below ground surface (bgs). The impacted areas were over excavated and confirmation samples were below the MTCA Method A cleanup level for diesel in soil. Groundwater was not encountered during the excavations or boring advancements to 10-feet bgs. The site status was changed to No Further Action by Ecology in 2015.

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1.2.9 Greseth Property (FSID 5458, CSID 12121, Map ID=56)

The Greseth Property site is a residential property located at 1034 NE 6th Avenue. A LUST notification and decommissioning report was submitted to Ecology in 2013. The tank was pumped, cleaned, and backfilled with inert material. Assessment samples taken at the time of decommissioning indicate that soils at the south end of the tank had been impacted with diesel-range organics at up to 28,600 mg/kg and chrysene. Impacted soils were conservatively estimated at 11 cubic yards. Ecology's MTCATPH11.1 spreadsheet model for protection of the ground water resource was completed to conclude that the impacted soil plume was unlikely to present an unacceptable health risk by leaching to ground water with subsequent ingestion pathway.

A Remedial Investigation Report response to comments requesting site closure was submitted to Ecology in 2014. Ecology terminated the VCP Agreement in 2014 following the property owner's decision to conduct the heating oil storage tank cleanup under the direction of the Pollution Liability Insurance Agency. Ecology's online Cleanup Site report indicates soil contamination above the cleanup level for other non-halogenated organics and that cleanup has started at the site.

1.2.10 P & L Investments (FSID 41313725, CSID 6034, Map ID=58)

The P & L Investments site is storefront located at 440 NE 4th Avenue. Notification of a LUST was submitted in 1995. Initial site characterization work was performed in 2011. Ecology's online Cleanup Site report indicates soil contamination above the cleanup level for gasoline. Current Ecology files indicate standard voluntary cleanup action was taken to remove one UST in 2000 that had contained leaded gasoline and the site status was changed to No Further Action by Ecology in 2003.

1.2.11 Helen Brothers Service (FSID 65648254, CSID 10060, Map ID=59)

The Helen Brothers Service site was located at 135 NE 6th Avenue, north of the Georgia Pacific Camas Mill. Notification of a LUST was submitted in 1995. Ecology's online Cleanup Site report indicates soil contamination above cleanup levels for gasoline. Current Ecology files indicate independent action was taken to remove five tanks in 2000 that had contained diesel, leaded and unleaded gasoline, and waste oil. The site status was changed to No Further Action by Ecology in 2012.

1.2.12 First Christian Church HOT (FSID 100003126, CSID 17135, Map ID = 66)

The First Christian Church HOT site is the location of the former Camas First Christian Church located at 4004 NE 6th Avenue. A historical decommissioning permit notes the removal of an underground HOT from the property in 1995 without the collection of confirmation samples. A geophysical survey was completed in September 2023, which located a soil disturbance consistent with a former tank excavation along the eastern side of the church structure. Soil samples were collected and petroleum contamination was encountered at a depth of 8 feet bgs with a maximum diesel-range petroleum concentration of 28,900 mg/Kg. An excavation was performed in March 2024 and diesel-range petroleum was not detected above laboratory reporting limits in any of the confirmation

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samples collected. Groundwater was not encountered during excavation. The site was classified as No Further Action by Ecology in 2024.

1.3 ENVIRONMENTAL SITES WITH GROUNDWATER EXCEEDANCES EAST OF THE CARA

1.3.1 ARCO 6008 / KT KANSO AM/PM (FSID 46212644, CSID 9311)

The ARCO 6008 site is a service station located at 212 15th Street in Washougal. The site is located just beyond the eastern boundary of the 5-Year capture zone. Four 10,000 gallons double-walled fiberglass unleaded gasoline USTs are located on the north side of the site, one of which has been temporarily closed since January 2024. The endorsements for all four USTs expire on June 30, 2026. The site was entered into the Ecology LUST database in January 1990 when petroleum impacted soil was encountered during UST decommissioning and replacement activities. The site was cleaned up under the Voluntary Cleanup Program, and Ecology's online Cleanup Site report indicates soil contamination below cleanup levels for benzene, lead, diesel, gasoline, and other non-halogenated organics. The site was cleaned up under the Voluntary Cleanup Program, and the site status was changed to No Further Action by Ecology in 2014.

In 2011, a groundwater sample from SB-3 exceeded the MCL for lead (15 µg/L) and MTCA Method A for Heavy Fuel Oil (500 µg/L). The most recent groundwater sampling results available on Ecology's EIM database were collected during a site investigation in April 2013, at which time MW-3 exceeded the MCL for lead [15 µg/L] with a result of 22.5 µg/L and lead was detected below the MCL at MW-2 (12.7 µg/L). The most recent soil samples were taken in March 2014. Lead was detected in two samples collected at 3.5 feet bgs (1.49-3.99 mg/Kg), below all available MTCA criteria.

The site was additionally categorized as a Tier 2 Hazardous Materials Site in 1988 (Program ID WAD988517272) and was listed as a hazardous waste generator from 1993 to 2006. The Facility Register Service (FRS) ID for Arco 6008 is 110005383717, which reflects that the RCRA identifier is inactive.

1.3.2 George Schmid & Sons, Inc. (FSID 53281319, CSID 12445)

The George Schmid & Sons, Inc. site is located at 1411 32nd Street in Washougal. The site is located just beyond the northeastern boundary of the 5-Year capture zone. The site consists of a total of 17 acres, which include the former operational area of the property (approximately 5 acres) and the lower pasture area (approximately 12 acres), which is bordered by the Washougal River. Light industrial use of the property started in the 1950s. On-site operations included heavy equipment maintenance and repair, power washing, sandblasting, equipment storage, and administrative business operations. All structures, including aboveground storage tanks (ASTs) and USTs, were removed from the Property by 2010. The site was cleaned up under the Voluntary Cleanup Program, and Ecology's online Cleanup Site report indicates remediated soil contamination below cleanup levels for PAHs, diesel, gasoline, and petroleum products, and remediated groundwater contamination above cleanup

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levels for arsenic, lead, diesel, and other petroleum products. The site status was changed to No Further Action by Ecology in 2016. The site is not Schmid Family Park.

Groundwater samples collected at the site between 2012 and June 2015 exceeded cleanup levels for Arsenic, Barium, Chromium, Iron, Lead, Manganese, PAHs, Diesel Range Organics, and Lube Oil. Follow-up sampling for Diesel Range Organics and Lube Oil occurred in April and September 2015. There were no exceedances during the follow-up sampling.

The site was additionally categorized as a Tier 2 Hazardous Materials Site from 2003 to 2010 (Program ID CRK000054050). The Facility Register Service (FRS) ID for George Schmid & Sons, Inc. is 110015458128 and does not contain information.

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APPENDIX B
PARCELS OF CONCERN

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Parcel Serial Number	Owner Name	Owner Address	Site Address	Legal Description	Land-Use Description	Zoning	WHPZ
71355005	SNOWDEN VETERINARY HOLDINGS LLC	833 K ST, WASHOUGAL, WA, 98671	401 6TH ST, WASHOUGAL, 98671	LOT 2 SP2-554 1.04A	VETERINARIANS / SMALL ANIMAL HOSPITALS.	CH	1-Year
71734000	KIRKLAND PREMIER CAR WASH LLC	2370 E THIRD LOOP #100, VANCOUVER, WA, 98661	510 C ST, WASHOUGAL, 98671	#577 OF RICHARD OUGH DLC .25A	DRIVE THROUGH CAR WASH	CH	1-Year
73134114	SAUER DEVELOPMENT GROUP LLC	26300 NE 16TH ST, CAMAS, WA, 98607	455 C ST, WASHOUGAL, 98671	#114 DAVID C PARKER DLC .48A	STORAGE WAREHOUSE	CH	1-Year
73134116	SAUER DEVELOPMENT GROUP LLC	26300 NE 16TH ST, CAMAS, WA, 98607	453 C ST, WASHOUGAL, 98671	#116 DAVID C PARKER DLC 1.11A	STORAGE WAREHOUSE	CH	1-Year
73134155	DASSA MANAGEMENT LLC	1001 NE 152ND AVE, VANCOUVER, WA, 98684	450 C ST, WASHOUGAL, 98671	#155 DAVID C PARKER DLC .38A	SERVICE REPAIR SHOP	CH	1-Year
75357048	TIMBER RIDGE CAR WASH LLC	24324 NE 14TH ST, CAMAS, WA, 98607	469 E ST, WASHOUGAL, 98671	R B JOHNSTON TTS LOT 12 BLK 2	DRIVE THROUGH CAR WASH	CV	1-Year
75357049	TIMBER RIDGE CAR WASH LLC	24324 NE 14TH ST, CAMAS, WA, 98607		R B JOHNSTON TT LOT 12 BLK 2 (SEE 075357-048-050 LAND AV)	SELF SERVICE CAR WASH (WAND TYPE)	CV	1-Year
75357050	TIMBER RIDGE CAR WASH LLC	24324 NE 14TH ST, CAMAS, WA, 98607	469 E ST, WASHOUGAL, 98671	R B JOHNSTON TRACTS LOT 13 BLK 2	SELF SERVICE CAR WASH (WAND TYPE)	CV	1-Year
75357051	TIMBER RIDGE CAR WASH LLC	24324 NE 14TH ST, CAMAS, WA, 98607		R B JOHNSTON TRACTS LOT 14 BLK 2	SELF SERVICE CAR WASH (WAND TYPE)	CV	1-Year
91045552	FRENCH GORDON B II & FRENCH PATRICIA J TRUSTEES	1639 BROOKHOLLOW DR, HIDEAWAY, TX, 75771		GOOTS ADDN WEIR PARK LOT 4	STORAGE WAREHOUSE	RC	1-Year
91045554	FRENCH GORDON B II & FRENCH PATRICIA J TRUSTEES	1639 BROOKHOLLOW DR, HIDEAWAY, TX, 75771	3439 NE 3RD AVE, CAMAS, 98607	GOOTS ADDN WEIR PARK LOT 5	STORAGE WAREHOUSE	RC	1-Year
91045556	FRENCH GORDON B II & FRENCH PATRICIA J TRUSTEES	1639 BROOKHOLLOW DR, HIDEAWAY, TX, 75771	3501 NE 3RD AVE, CAMAS, 98607	GOOTS ADDN WEIR PARK LOT 6	STORAGE WAREHOUSE	RC	1-Year
91045652	O-R CAMAS LLC	PO BOX 9167, SPRINGFIELD, MO, 65801	3440 NE 3RD AVE, CAMAS, 98607	WEIR PARK LOTS 3 & 4 BLK 5	TIRE, BATTERIES, PARTS AND ACCESSORIES DEALERS	RC	1-Year
91045666	FOUNTAIN ROBERT & FOUNTAIN NANCY	PO BOX 737, WASHOUGAL, WA, 98671	114 NE WEIR ST, CAMAS, 98607	WEIR PARK LOT 16 BLK 5	GENERAL REPAIR & SERVICE GARAGES	RC	1-Year
71360000	HIGGINSON BLAINE & HIGGINSON BRIAN	984 WASHOUGAL RIVER RD, WASHOUGAL, WA, 98671	984 WASHOUGAL RIVER RD, WASHOUGAL, 98671	#19C OF RICHARD OUGH DLC .50A	SERVICE REPAIR SHOP	R1-10	5-Year
71364000	HIGGINSON BLAINE & HIGGINSON BRIAN	984 WASHOUGAL RIVER RD, WASHOUGAL, WA, 98671		#32 OF RICHARD OUGH DLC .18A	MINIMAL STRG BLDGS, EQUIP, SHEDS, OPEN POLE BLDGS	R1-10	5-Year
71528000	SNK PROPERTIES LLC	1700 MAIN ST #136, WASHOUGAL, WA, 98671	1434 E ST, WASHOUGAL, 98671	#275, 276, 803 RICHARD OUGH DLC	GENERAL REPAIR & SERVICE GARAGES	CC	5-Year
71543000	BROTHERS NORTHWEST INVESTMENTS LLC	20615 NE 212TH AVE, BATTLE GROUND, WA, 98604	1423 E ST, WASHOUGAL, 98671	#293 OF RICHARD OUGH DLC	SERVICE REPAIR SHOP	CC	5-Year
71559000	MALFAIT RONALD SCOTT	31914 SE 17TH ST, WASHOUGAL, WA, 98671		#315 OF RICHARD OUGH DLC	DRIVE THROUGH CAR WASH	CC	5-Year

Parcel Serial Number	Owner Name	Owner Address	Site Address	Legal Description	Land-Use Description	Zoning	WHPZ
71592000	MALFAIT RONALD SCOTT	31914 SE 17TH ST, WASHOUGAL, WA, 98671		#367 OF RICHARD OUGH DLC	DRIVE THROUGH CAR WASH	CC	5-Year
71622000	WASHOUGAL SCHOOL DIST #112	4855 EVERGREEN WAY, WASHOUGAL, WA, 98671		#420 OF RICHARD OUGH DLC	FLEET OPERATION CENTERS & STORAGE	CC	5-Year
71666000	MALFAIT RONALD SCOTT	31914 SE 17TH ST, WASHOUGAL, WA, 98671	1138 E ST, WASHOUGAL, 98671	#473 OF RICHARD OUGH DLC	GENERAL REPAIR & SERVICE GARAGES	CC	5-Year
71678002	BROTHERS NORTHWEST INVESTMENTS LLC	20615 NE 212TH AVE, BATTLE GROUND, WA, 98604	1351 E ST, WASHOUGAL, 98671	#487 OF RICHARD OUGH DLC .23A	MOTOR VEHICLE DEALERS, USED CARS AND SMALL TRUCKS.	CC	5-Year
71680000	MALFAIT RONALD SCOTT	31914 SE 17TH ST, WASHOUGAL, WA, 98671	1250 E ST, WASHOUGAL, 98671	#489 OF RICHARD OUGH DLC .22A	CONVENIENCE STORE - W/ PUMPS & TANKS	CC	5-Year
71683000	COLUMBIA ELECTRIC INC	PO BOX 900, WASHOUGAL, WA, 98671	1338 E ST, WASHOUGAL, 98671	#496 OF RICHARD OUGH DLC .21A	SERVICE REPAIR SHOP	CC	5-Year
71706000	MALFAIT RONALD SCOTT	31914 SE 17TH ST, WASHOUGAL, WA, 98671	1204 E ST, WASHOUGAL, 98671	#530 OF RICHARD OUGH DLC .25A	TIRE, BATTERIES, PARTS AND ACCESSORIES DEALERS	CC	5-Year
71717002	KITCHEN PAUL & KITCHEN SARA	1315 E ST, WASHOUGAL, WA, 98671	1315 E ST, WASHOUGAL, 98671	#553 OF RICHARD OUGH DLC .12A	SERVICE REPAIR SHOP	CC	5-Year
71792000	HATTEN RANDALL & HATTEN BRENDA	3567 CEDAR CT, WASHOUGAL, WA, 98671	1320 E ST, WASHOUGAL, 98671	#662 OF RICHARD OUGH DLC .31A	SERVICE REPAIR SHOP	CC	5-Year
71832000	BROTHERS NORTHWEST INVESTMENTS LLC	20615 NE 212TH AVE, BATTLE GROUND, WA, 98604	1405 E ST, WASHOUGAL, 98671	#714 RICHARD OUGH DLC .23A	GENERAL REPAIR & SERVICE GARAGES	CC	5-Year
71909000	MALFAIT RONALD SCOTT	31914 SE 17TH ST, WASHOUGAL, WA, 98671		#802 RICHARD OUGH DLC .12A	SERV STATION W/ TANKS & PUMPS OR CARD LOCK STATION	CC	5-Year
75358010	WASHOUGAL SCHOOL DIST #112	4855 EVERGREEN WAY, WASHOUGAL, WA, 98671	971 E ST, WASHOUGAL, 98671	ELLS SUB-DIV LOT 1	FLEET OPERATION CENTERS & STORAGE	CC	5-Year
75359586	SRBC PARTNERS LLC	13900 NW 53RD AVE, VANCOUVER, WA, 98685	730 E ST, WASHOUGAL, 98671	MIDLAND ACRE REPLT BLKS 1-5 & TTA #2 LTS 24 - 26 BLK 1	GENERAL REPAIR & SERVICE GARAGES	CC	5-Year
75359644	WASHOUGAL SCHOOL DIST #112	4855 EVERGREEN WAY, WASHOUGAL, WA, 98671	995 E ST, WASHOUGAL, 98671	MIDLAND ACRES REPLAT BLKS 1-5 & TT A #1 LOT 2 BLK A	FLEET OPERATION CENTERS & STORAGE	CC	5-Year
75359646	WASHOUGAL SCHOOL DIST #112	4855 EVERGREEN WAY, WASHOUGAL, WA, 98671		MIDLAND ACRE REPLAT BLKS 1-5 & TT A #2 LOT 2 BLK A	FLEET OPERATION CENTERS & STORAGE	CC	5-Year
73134007	NORTHWEST PIPELINE	PO BOX 2400 MD 46-4, TULSA, OK, 74102	30 C ST, WASHOUGAL, 98671	#7 DAVID PARKER DLC 0.45A (TCO 6-164)	GAS STORAGE TANKS, PUMPING, DISTRIBUTION, PIPELINE	CH	6-Month
73134022	S&A OIL INC	1523 NW 33RD WAY, CAMAS, WA, 98607	165 C ST, WASHOUGAL, 98671	#22 DAVID C PARKER DLC .55A M/L	CONVENIENCE STORE - W/ PUMPS & TANKS	CH	6-Month
73134025	BRG LLC	2375 SE 8TH AVE, CAMAS, WA, 98607		#2 LOT 1 SP3-341 1.87A	HIGHWAY CONSTRUCTION AND REPAIR CONTRACTORS.	CH	6-Month
73134047	S&A OIL INC	1523 NW 33RD WAY, CAMAS, WA, 98607	133 C ST, WASHOUGAL, 98671	#47 DAVID C PARKER DLC .23A	CONVENIENCE STORE - W/ PUMPS & TANKS	CH	6-Month
73134157	PORT OF CAMAS WASHOUGAL	24 S A ST, WASHOUGAL, WA, 98671		#157 DAVID PARKER DLC .92A	MARINAS.	CH	6-Month

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73134161	PORT OF CAMAS WASHOUGAL	24 S A ST, WASHOUGAL, WA, 98671	40 S MARINA WAY, WASHOUGAL, 98671	#161 DAVID C PARKER DLC 1.79A	MOTOR VEHICLE DEALERS, NEW CARS AND SMALL TRUCKS,	CH	6-Month
73134170	PORT OF CAMAS WASHOUGAL	24 S A ST, WASHOUGAL, WA, 98671		#170 DAVID C PARKER DLC	ELECTRIC POWER OPERATING, MAINT., AND REPAIR BUILD	CH	6-Month
73134182	LNI INVESTMENTS LLC	281 C STREET STE 112, WASHOUGAL, WA, 98671	281 C ST, WASHOUGAL, 98671	#184A & #189 DAVID PARKER DLC 1.01A	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	CH	6-Month
73139075	PORT OF CAMAS WASHOUGAL	24 S A ST, WASHOUGAL, WA, 98671	24 S A ST, WASHOUGAL, 98671	PARKERSVILLE LOTS 4 & 5 BLK 9	MARINAS.	CH	6-Month
73139077	PORT OF CAMAS WASHOUGAL	24 S A ST, WASHOUGAL, WA, 98671		PARKERSVILLE LOTS 6 & 7 BLK 9	MARINAS.	CH	6-Month
73139079	PORT OF CAMAS WASHOUGAL	24 S A ST, WASHOUGAL, WA, 98671		PARKERSVILLE LOTS 8 9 10 BLOCK 9	MARINAS.	CH	6-Month
73139080	PORT OF CAMAS WASHOUGAL	24 S A ST, WASHOUGAL, WA, 98671	115 S 1ST ST, WASHOUGAL, 98671	PARKERSVILLE LOTS 1, 2, 3, 4, 5 BLK 10	BOATS AND MARINE ACCESSORIES.	CH	6-Month
73139085	PORT OF CAMAS WASHOUGAL	24 S A ST, WASHOUGAL, WA, 98671		PARKERSVILLE LOTS 6 & 7 BLK 10	MARINAS.	CH	6-Month
73139087	PORT OF CAMAS WASHOUGAL	24 S A ST, WASHOUGAL, WA, 98671		PARKERSVILLE LOTS 8 & 9 BLK 10	MARINAS.	CH	6-Month
73139089	PORT OF CAMAS WASHOUGAL	24 S A ST, WASHOUGAL, WA, 98671		PARKERSVILLE LOT 10 BLK 10	MARINAS.	CH	6-Month
73139090	PORT OF CAMAS WASHOUGAL	24 S A ST, WASHOUGAL, WA, 98671		#223 PARKERSVILLE BLK 13 .84	MARINAS.	CH	6-Month
87021000	BRG LLC	2375 SE 8TH AVE, CAMAS, WA, 98607	2375 SE 8TH AVE, CAMAS, 98607	#1 LOT 1 SP3-341 3.12A	TIRE, BATTERIES, PARTS AND ACCESSORIES DEALERS	HI	6-Month
87053000	SAUER DEVELOPMENT GROUP LLC	26300 NE 16TH ST, CAMAS, WA, 98607		ORCHARD HOME WASHOUGAL #4 LOT 2 1.91A	MFG - MACHINERY	HI	6-Month
87054000	SAUER DEVELOPMENT GROUP LLC	26300 NE 16TH ST, CAMAS, WA, 98607		ORCHARD HOME WASHOUGAL #5 LOT 2 .23A	MFG - MACHINERY	HI	6-Month
87055000	SAUER DEVELOPMENT GROUP LLC	26300 NE 16TH ST, CAMAS, WA, 98607	2305 SE 8TH AVE, CAMAS, 98607	ORCHARD HOME WASHOUGAL #6 LOT 2 1.69A	STORAGE WAREHOUSE	HI	6-Month
87216000	C B I LLC	829 NW VIEW RIDGE CT, CAMAS, WA, 98607		ORCHARD HOME ADDN #3 LOT 8 #8 LOT 9 .26A	MFG - MISCELLANEOUS	LI	6-Month
87260000	C B I LLC	829 NW VIEW RIDGE CT, CAMAS, WA, 98607	2380 SE 8TH AVE, CAMAS, 98607	ORCHARD HOME WASHOUGAL #2 LOT 9 .17A	MFG - MISCELLANEOUS	LI	6-Month
88610000	SAUER DEVELOPMENT GROUP LLC	26300 NE 16TH ST, CAMAS, WA, 98607		OAK PARK ADDN WASHOUGAL LOTS 3 & 4 BLK 8	STORAGE WAREHOUSE	HI	6-Month
88630000	SAUER DEVELOPMENT GROUP LLC	26300 NE 16TH ST, CAMAS, WA, 98607	754 SE UNION ST, CAMAS, 98607	OAK PARK ADDN WASHOUGAL LOT 6 BLK 8	MFG - MACHINERY	HI	6-Month
88640000	SAUER DEVELOPMENT GROUP LLC	26300 NE 16TH ST, CAMAS, WA, 98607	2205 SE 8TH AVE, CAMAS, 98607	OAK PARK ADDN WASHOUGAL LOTS 7 & 8 BLK 8	MFG - MACHINERY	HI	6-Month

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88650000	ZIEGLER JOHN K ETAL	1235 NORTH LOOP WEST, SUITE 205, HOUSTON, TX, 77008		OAK PARK ADDN WASHOUGAL LOT 1 BLK 9	MFG - LUMBER & WOOD PRODUCTS	HI	6-Month
88660000	ZIEGLER JOHN K ETAL	1235 NORTH LOOP WEST, SUITE 205, HOUSTON, TX, 77008		OAK PARK ADDN WASHOUGAL LOTS 2 & 3 BLK 9	MFG - LUMBER & WOOD PRODUCTS	HI	6-Month
89861000	DLJ PROPERTIES CAMAS LLC	9895 DOUBLE R BLVD, RENO, NV, 89521	1635 SE 6TH AVE, CAMAS, 98607	#32 OF DAVID C PARKER DLC 4.98A	ROCK QUARRY, CRUSHING, SAND AND GRAVEL PITS.	HI	6-Month
89934000	INTERFAITH TREASURE HOUSE	89 C ST, WASHOUGAL, WA, 98671	91 C ST, WASHOUGAL, 98671	#194 DAVID C PARKER DLC 1.22A	STORAGE WAREHOUSE	CH	6-Month
91045163	CITY OF CAMAS	613 NE 4TH AVE, CAMAS, WA, 98607	175 SE YALE ST, CAMAS, 98607	#163 DAVID C PARKER DLC 4.39A	ELECTRIC POWER BOOSTERS, TRANSFORMERS, STATIONS, R	SU	6-Month
127950000	CLARK PUBLIC UTILITIES	PO BOX 8900, VANCOUVER, WA, 98668	345 1ST ST, WASHOUGAL, 98671	#115 DAVID C PARKER DLC 1.32A	ELECTRIC POWER OPERATING, MAINT., AND REPAIR BUILD	CH	6-Month
700120000	ENCON NORTHWEST LLC	9895 DOUBLE R BLVD, RENO, NV, 89521	1635 SE 6TH AVE, CAMAS, 98607	BNSF LEASE BF31374	ROCK QUARRY, CRUSHING, SAND AND GRAVEL PITS.	HI	6-Month
986035425	PORT OF CAMAS WASHOUGAL	24 S A ST, WASHOUGAL, WA, 98671		#224 PARKERSVILLE BLK 13 0.53A	MARINAS.	CH	6-Month
87451000	OREGON MOTOR SERVICES LLC	8503 SE 132ND AVE, HAPPY VALLEY, OR, 97086	1846 NE 3RD AVE, CAMAS, 98607	RIVER VIEW ADDN TO CAMAS #3 LOT 8	MOTOR VEHICLE DEALERS, NEW CARS AND SMALL TRUCKS,	RC	6-Month Well 13
87452000	OREGON MOTOR SERVICES LLC	8503 SE 132ND AVE, HAPPY VALLEY, OR, 97086		RIVER VIEW ADDN TO CAMAS #4 LOT 8 & #3 LOT 9	MOTOR VEHICLE DEALERS, NEW CARS AND SMALL TRUCKS,	RC	6-Month Well 13
87460000	OREGON MOTOR SERVICES LLC	8503 SE 132ND AVE, HAPPY VALLEY, OR, 97086	1904 NE 3RD AVE, CAMAS, 98607	RIVER VIEW ADDN TO CAMAS #1 LOT 9	MOTOR VEHICLE DEALERS, NEW CARS AND SMALL TRUCKS,	RC	6-Month Well 13
87500000	2016 NE 3RD LLC	2016 NE 3RD AVE, CAMAS, WA, 98607	2016 NE 3RD AVE, CAMAS, 98607	RIVER VIEW ADD TO CAMAS #1 #4 LOT 10 #2 LOT 11	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	RC	6-Month Well 13
89882000	BRAMBLE ACRES LLC	4206 NE 261ST AVE, CAMAS, WA, 98607	2459 NE 3RD LOOP, CAMAS, 98607	#64 DAVID C PARKER DLC .50A	MEDICAL & DENTAL LABORATORIES	RC	6-Month Well 13
87120000	KINSCO LLC	10500 NE 51ST CIR, VANCOUVER, WA, 98682	1718 SE 8TH AVE, CAMAS, 98607	ORCHARD HOME WASHOUGAL B OF LOT 4 .14A	STORAGE WAREHOUSE	LI	CARA
87124000	CITY OF CAMAS	616 NE 4TH AVE, CAMAS, WA, 98607		ORCHARD HOME WASHOUGAL G,H,& I LOT 4 .17A	SEWAGE RELATED BLDG OR STRUCTURE	LI	CARA
87180000	HIT DEVELOPMENT LLC	2470 NE 2ND ST, BEND, OR, 97701	1840 SE 8TH AVE, CAMAS, 98607	ORCHARD HOME WASHOUGAL #2 LOT 5 .82A	GENERAL REPAIR & SERVICE GARAGES	LI	CARA
87181000	P&E INVESTMENTS LLC	1900 SE 8TH AVE, CAMAS, WA, 98607	1900 SE 8TH AVE, CAMAS, 98607	ORCHARD HOME WASHOUGAL #3 LOT 5 .44A	STORAGE WAREHOUSE	LI	CARA
87200000	MCELROY PROPERTY MANAGEMENT LLC	PO BOX 908, CAMAS, WA, 98607	1910 SE 8TH AVE, CAMAS, 98607	ORCHARD HOME WASHOUGAL #1 LOT 6 .95A	STORAGE WAREHOUSE	LI	CARA
87360000	CITY OF CAMAS	616 NE 4TH AVE, CAMAS, WA, 98607	1129 SE POLK ST, CAMAS, 98607	ORCHARD HOME WASHOUGAL #1 LOT 16 3.02A	SEWAGE RELATED BLDG OR STRUCTURE	RC	CARA
87365000	CITY OF CAMAS	616 NE 4TH AVE, CAMAS, WA, 98607		ORCHARD HOME WASHOUGAL #2 LOT 16	SEWAGE RELATED BLDG OR STRUCTURE	RC	CARA

Parcel Serial Number	Owner Name	Owner Address	Site Address	Legal Description	Land-Use Description	Zoning	WHPZ
89869000	CITY OF CAMAS	1303 SE 12TH, CAMAS, WA, 98607		#40 OF DAVID C PARKER DLC 3.3A	SEWAGE RELATED BLDG OR STRUCTURE	RC	CARA
89924000	CITY OF CAMAS	616 NE 4TH AVE, CAMAS, WA, 98607		#183A DAVID C PARKER DLC 1 A M/L	SEWAGE RELATED BLDG OR STRUCTURE	RC	CARA
76695000	RODRIGUEZ TYRONE	339 SE EVERETT RD, CAMAS, WA, 98607	410 NE 2ND AVE, CAMAS, 98607	CAMAS LOT 8 BLK 4	GENERAL REPAIR & SERVICE GARAGES	HI	Western Search Area
76880000	MELTON ROBERT S & MELTON JANET L	5120 NW COLUMBIA ST, VANCOUVER, WA, 98663	732 NE 2ND AVE, CAMAS, 98607	CAMAS LOT 5 BLK 7	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	MX	Western Search Area
77355000	SAFEWAY INC	250 PARKCENTER BLVD, BOISE, ID, 83726		SAFEWAY SP LOT 3 4-341	CONVENIENCE STORE - W/ PUMPS & TANKS	DC	Western Search Area
77760000	DIERICKX PROPERTIES LLC	2947 NW IVY LN, CAMAS, WA, 98607		CAMAS LOTS 5 & 6 BLK 18	FUNERAL SERVICES AND CREMATORIES.	DC	Western Search Area
77770000	FMG BODY SHOP LLC	314 NE BIRCH ST, CAMAS, WA, 98607	318 NE 3RD AVE, CAMAS, 98607	CAMAS LOTS 1,2,7 & 8 BLK 18	AUTO BODY SHOP	DC	Western Search Area
77785000	DICKERSON RANDY S	1900 SE 97TH AVE, VANCOUVER, WA, 98664		CAMAS #3 LOT 2 #2 LOTS 3 & 4 BLK 19	SERVICE REPAIR SHOP	HI	Western Search Area
77830000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348	339 NE ADAMS ST, CAMAS, 98607	CAMAS #1 BLOCK 20	MFG - PAPER PRODUCTS	HI	Western Search Area
77860000	ESHGHI MAHSA	207 NE 3RD AVENUE, CAMAS, WA, 98607	207 NE 3RD AVE, CAMAS, 98607	CAMAS #1 LOT 1 & 2 BLK 22	CONVENIENCE STORE - W/ PUMPS & TANKS	DC	Western Search Area
78000000	DIERICKX PROPERTIES LLC	2947 NW IVY LN, CAMAS, WA, 98607	325 NE 3RD AVE, CAMAS, 98607	CAMAS #1 LOTS 3 & 4 BLK 23	FUNERAL SERVICES AND CREMATORIES.	DC	Western Search Area
78090000	COLUMBIA RIVER LAND LLC	1104 NE 152ND AVE, VANCOUVER, WA, 98684	501 NE 3RD AVE, CAMAS, 98607	CAMAS LOTS 1 & 2 BLK 25	CONVENIENCE STORE - W/ PUMPS & TANKS	DC	Western Search Area
78105000	CITY OF CAMAS	616 NE 4TH AVE, CAMAS, WA, 98607	533 NE 3RD AVE, CAMAS, 98607	CAMAS LOT 4 BLK 25	PARKING LOTS & PARKING STRUCTURES	DC	Western Search Area
78150000	CITY OF CAMAS	616 NE 4TH AVE, CAMAS, WA, 98607	605 NE 3RD AVE, CAMAS, 98607	CAMAS LOT 2 BLK 26	SERVICE REPAIR SHOP	DC	Western Search Area
78560000	BROWN CATH-A-LEENE ANN	410 NE GARFIELD ST, CAMAS, WA, 98607	410 NE GARFIELD ST, CAMAS, 98607	CAMAS LOT 1 & 2 BLK 33	FUNERAL SERVICES AND CREMATORIES.	DC	Western Search Area
78600000	BROWN CATH-A-LEENE ANN	410 NE GARFIELD ST, CAMAS, WA, 98607	436 NE GARFIELD ST, CAMAS, 98607	CAMAS #1 LOT 7 & 8 BLK 33	FUNERAL SERVICES AND CREMATORIES.	DC	Western Search Area
78630000	CHRISTENSEN JEREMY D & CHRISTENSEN INGRID L	1911 NW 22ND AVE, CAMAS, WA, 98607	713 NE 4TH AVE, CAMAS, 98607	CAMAS LOT 2 BLK 34	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	DC	Western Search Area
78956000	CORNERSTORE CAMAS LLC	515 NW SALTZMAN RD #70, PORTLAND, OR, 97229	450 NE BIRCH ST, CAMAS, 98607	CAMAS LOT 8 BLK 38	DRY CLEANERS, LAUNDRIES (1 TENANT - FREE STANDG BL	DC	Western Search Area
79040000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		CAMAS BLOCK 42	PARKING LOT: PAVED, FOR ADJOINING BUILDING	DC	Western Search Area
79050000	ALP 3 LLC	16420 SE MCGILLIVRAY, SUITE 103, VANCOUVER, WA, 98683	518 NE BIRCH ST, CAMAS, 98607	CAMAS #1 LOT 1 BLK 43	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	DC	Western Search Area

Parcel Serial Number	Owner Name	Owner Address	Site Address	Legal Description	Land-Use Description	Zoning	WHPZ
79051000	ALP 3 LLC	16420 SE MCGILLIVRAY, SUITE 103, VANCOUVER, WA, 98683		CAMAS #2 LOT 1 BLK 43	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	DC	Western Search Area
79070000	ALP 3 LLC	16420 SE MCGILLIVRAY, SUITE 103, VANCOUVER, WA, 98683		CAMAS LOT 2 BLK 43	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	DC	Western Search Area
79080000	ALP 3 LLC	16420 SE MCGILLIVRAY, SUITE 103, VANCOUVER, WA, 98683	327 NE 5TH AVE UNIT A, CAMAS, 98607	CAMAS LOT 3 BLK 43	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	DC	Western Search Area
79115000	ALP 3 LLC	16420 SE MCGILLIVRAY, SUITE 103, VANCOUVER, WA, 98683	518 NE BIRCH ST, CAMAS, 98607	CAMAS #2 LOT 7 & 8 BLK 43	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	DC	Western Search Area
79140000	CASCADIA DEVELOPMENT PARTNERS LLC	610 ESTHER ST STE 202, VANCOUVER, WA, 98660	435 NE 5TH AVE, CAMAS, 98607	CAMAS LOTS 3 & 4 BLK 44	GENERAL REPAIR & SERVICE GARAGES	DC	Western Search Area
79194000	NWOH HOLDINGS LLC	531 NE EVERETT ST, CAMAS, WA, 98607	531 NE EVERETT ST, CAMAS, 98607	CAMAS LOT 5 & #1 LOT 6 BLK 45	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	DC	Western Search Area
79197000	NWOH HOLDINGS LLC	531 NE EVERETT ST, CAMAS, WA, 98607	522 NE 6TH AVE, CAMAS, 98607	CAMAS #2 LOT 6 BLK 45	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	DC	Western Search Area
79230000	GESSFORD PROPERTY LLC	906 N SHEPHERD RD, WASHOUGAL, WA, 98671	518 NE EVERETT ST, CAMAS, 98607	CAMAS LOTS 1 & 2 BLK 46	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	DC	Western Search Area
79340000	ALLEN TREVOR W & ALLEN LISA R TRUSTEES	4475 NW EMILY WAY, CAMAS, WA, 98607	736 NE 6TH AVE, CAMAS, 98607	CAMAS LOT 5 BLK 47	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	DC	Western Search Area
79805002	BRESTER PROPERTIES LLC	403 NE 6TH AVE, CAMAS, WA, 98607	411 NE 6TH AVE, CAMAS, 98607	BENZ NEVIN PAYNE CONDOMINIUMS UNIT 1	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	DC	Western Search Area
79805004	BRESTER PROPERTIES LLC	411 NE 6TH AVE, CAMAS, WA, 98607	403 NE 6TH AVE, CAMAS, 98607	BENZ NEVIN PAYNE CONDOMINIUMS UNIT 2	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	DC	Western Search Area
79805006	BRESTER PROPERTIES LLC	411 NE 6TH AVE, CAMAS, WA, 98607	405 NE 6TH AVE, CAMAS, 98607	BENZ NEVIN PAYNE CONDOMINIUMS UNIT 3	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	DC	Western Search Area
79880000	IMP GROUP LLC	4525 NE 126TH CIR, VANCOUVER, WA, 98686	329 NE 6TH AVE, CAMAS, 98607	CAMAS LOT 3 BLK 58	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	DC	Western Search Area
79885000	IMP GROUP LLC	4525 NE 126TH CIR, VANCOUVER, WA, 98686		CAMAS LOT 4 BLK 58	HEALTH CLINICS: MEDICAL / DENTAL / OTHER	DC	Western Search Area
79980000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348	133 NE 6TH AVE, CAMAS, 98607	CAMAS LOTS 1-8 BLK 60	STORAGE WAREHOUSE	DC	Western Search Area
81760000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		PROSPECT PLACE ADDN CAMAS LOT 8	PARKING LOT: PAVED, FOR ADJOINING BUILDING	DC	Western Search Area
81770000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		PROSPECT PLACE ADDN CAMAS LOTS 9 & 10	PARKING LOTS & PARKING STRUCTURES	DC	Western Search Area
82531000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		#2 OF T M COFFEY BNTY CL 3.41A	PARKING LOT: PAVED, FOR ADJOINING BUILDING	DC	Western Search Area
82532000	CLARK PUBLIC UTILITIES	PO BOX 8900, VANCOUVER, WA, 98668	750 DIVISION ST, CAMAS, 98607	#3 OF TM COFFEY BNTY CL .43A	ELECTRIC POWER BOOSTERS, TRANSFORMERS, STATIONS, R	DC	Western Search Area

Parcel Serial Number	Owner Name	Owner Address	Site Address	Legal Description	Land-Use Description	Zoning	WHPZ
88980000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		OVERLOOK ADDN CAMAS #1 LOTS 5 THRU 10 BLK 4	PARKING LOT: PAVED, FOR ADJOINING BUILDING	HI	Western Search Area
88990000	JAMES RIVER II INC	PO BOX 105681, ATLANTA, GA, 30348		OVERLOOK ADDN CAMAS #2 LOTS 5 THRU 8 BLK 4	MFG - PAPER PRODUCTS	HI	Western Search Area
89020000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348	112 E 1ST AVE, CAMAS, 98607	OVERLOOK ADDN CAMAS LOTS 1 & 2 BLK 5	MINIMAL STRG BLDGS, EQUIP, SHEDS, OPEN POLE BLDGS	HI	Western Search Area
89030000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		OVERLOOK ADDN CAMAS LOT 3 BLK 5	SERVICE REPAIR SHOP	HI	Western Search Area
89040000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348	234 E 1ST AVE, CAMAS, 98607	OVERLOOK ADDN CAMAS LOT 4 BLK 5	SERVICE REPAIR SHOP	HI	Western Search Area
89060000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		OVERLOOK ADDN CAMAS LOTS 7 & 8 BLK 5 & #224 MAXON DLC	MFG - PAPER PRODUCTS	HI	Western Search Area
89070000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348	234 E 1ST AVE, CAMAS, 98607	OVERLOOK ADDN CAMAS LOT 1 BLK 6	SERVICE REPAIR SHOP	HI	Western Search Area
89080000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		OVERLOOK ADDN CAMAS LOT 2 BLK 6	PARKING LOT: GRAVEL, FOR ADJOINING BUILDING	HI	Western Search Area
89090000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		OVERLOOK ADDN CAMAS LOT 3 BLK 6	PARKING LOT: GRAVEL, FOR ADJOINING BUILDING	HI	Western Search Area
89100000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348	117 SE CEDAR ST, CAMAS, 98607	OVERLOOK ADDN CAMAS #1 LOT 4 BLK 6	PARKING LOT: PAVED, FOR ADJOINING BUILDING	HI	Western Search Area
89105000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348	336 E 1ST AVE, CAMAS, 98607	OVERLOOK ADDN CAMAS #2 LOT 4 BLK 6	PARKING LOT: GRAVEL, FOR ADJOINING BUILDING	HI	Western Search Area
89110000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		OVERLOOK ADDN CAMAS LOT 5 BLK 6	PARKING LOT: PAVED, FOR ADJOINING BUILDING	HI	Western Search Area
89115000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		OVERLOOK ADDN CAMAS LOTS 6 & 7 BLK 6	STORAGE WAREHOUSE	HI	Western Search Area
89120000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348	129 SE CEDAR ST, CAMAS, 98607	OVERLOOK ADDN CAMAS LOT 8 BLK 6	PARKING LOT: GRAVEL, FOR ADJOINING BUILDING	HI	Western Search Area
89140000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348	416 E 1ST AVE, CAMAS, 98607	OVERLOOK ADDN CAMAS LOTS 1 & 2 BLK 7	PARKING LOT: GRAVEL, FOR ADJOINING BUILDING	HI	Western Search Area
89150000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		OVERLOOK ADDN CAMAS LOTS 3 & 4 BLK 7	PARKING LOT: GRAVEL, FOR ADJOINING BUILDING	HI	Western Search Area
89170000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348	124 SE CEDAR ST, CAMAS, 98607	OVERLOOK ADDN CAMAS LOT 6 BLK 7	PARKING LOT: GRAVEL, FOR ADJOINING BUILDING	HI	Western Search Area
89171000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		OVERLOOK ADDN CAMAS LOT 5 BLK 7	PARKING LOT: GRAVEL, FOR ADJOINING BUILDING	HI	Western Search Area
89550000	RIVERVIEW SAVINGS BANK	PO BOX 872290, VANCOUVER, WA, 98687	202 SE DALLAS ST, CAMAS, 98607	OVERLOOK ADDN CAMAS LOT 1 BLK 17	STORAGE WAREHOUSE	HI	Western Search Area
89610000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		OVERLOOK ADDN CAMAS LOT 1 BLK 18	PARKING LOT: GRAVEL, FOR ADJOINING BUILDING	HI	Western Search Area
89615000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348	203 SE DALLAS ST, CAMAS, 98607	OVERLOOK ADDN CAMAS #1 LOT 2 BLK 18	PARKING LOT: PAVED, FOR ADJOINING BUILDING	HI	Western Search Area

Parcel Serial Number	Owner Name	Owner Address	Site Address	Legal Description	Land-Use Description	Zoning	WHPZ
89616000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348	428 SE 2ND AVE, CAMAS, 98607	OVERLOOK ADDN CAMAS #2 LOT 2 BLK 18	PARKING LOT: PAVED, FOR ADJOINING BUILDING	HI	Western Search Area
89620000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		OVERLOOK ADDN CAMAS LOT 3 BLK 18	PARKING LOT: GRAVEL, FOR ADJOINING BUILDING	HI	Western Search Area
89630000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		OVERLOOK ADDN CAMAS LOTS 4 & 5 BLK 18	PARKING LOT: GRAVEL, FOR ADJOINING BUILDING	HI	Western Search Area
89640000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		OVERLOOK ADDN CAMAS LOTS 6,7 & 8 BLK 18	PARKING LOT: GRAVEL, FOR ADJOINING BUILDING	HI	Western Search Area
89730000	JHTM PROPERTIES LLC	636 SE 3RD AVE, CAMAS, WA, 98607		OVERLOOK ADDN CAMAS #1 LOTS 2 & 3 BLK 20	PARKING LOT: GRAVEL, FOR ADJOINING BUILDING	HI	Western Search Area
89740000	JHTM PROPERTIES LLC	636 SE 3RD AVE, CAMAS, WA, 98607	636 SE 3RD AVE, CAMAS, 98607	OVERLOOK ADDN CAMAS #2 LOTS 2 & 3 BLK 20	SERVICE REPAIR SHOP	HI	Western Search Area
89750000	JHTM PROPERTIES LLC	636 SE 3RD AVE, CAMAS, WA, 98607		OVERLOOK ADDN CAMAS LOT 4 BLK 20	PARKING LOT: GRAVEL, FOR ADJOINING BUILDING	HI	Western Search Area
89760000	JHTM PROPERTIES LLC	636 SE 3RD AVE, CAMAS, WA, 98607		OVERLOOK ADDN CAMAS LOT 5 BLK 20	PARKING LOT: GRAVEL, FOR ADJOINING BUILDING	HI	Western Search Area
89770000	H & R PROPERTIES LLC	81 ROCKWOOD DR, STEVENSON, WA, 98648	325 SE FRANKLIN ST, CAMAS, 98607	OVERLOOK ADDN CAMAS LOT 6 BLK 20	STORAGE WAREHOUSE	HI	Western Search Area
89790000	JHTM PROPERTIES LLC	636 SE 3RD AVE, CAMAS, WA, 98607		OVERLOOK ADDN CAMAS LOT 8 BLK 20	PARKING LOT: GRAVEL, FOR ADJOINING BUILDING	HI	Western Search Area
90939000	CITY OF CAMAS	616 NE 4TH AVE, CAMAS, WA, 98607		#65, 73 & 79 OF HJG MAXON DLC 2.30A	CEMETERIES	R-7.5	Western Search Area
90967000	JHTM PROPERTIES LLC	636 SE 3RD AVE, CAMAS, WA, 98607	606 SE 3RD AVE, CAMAS, 98607	#153 HJG MAXON DLC .17A	STORAGE WAREHOUSE	HI	Western Search Area
91044013	GEORGIA-PACIFIC CORPORATION	PO BOX 105681, ATLANTA, GA, 30348		#275 MAXON COFFEY DLCS SEC 10-1-2 OVERLOOK & CAMAS (BLDG)	MFG - LUMBER & WOOD PRODUCTS	HI	Western Search Area
91044015	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348	273 NE ADAMS ST, CAMAS, 98607	#275 MAXON COFFEY DLCS SEC 10-1-2 OVERLOOK & CAMAS 189.27A (SEE 91044027	MFG - PAPER PRODUCTS	HI	Western Search Area
91044019	CITY OF CAMAS	616 NE 4TH AVE, CAMAS, WA, 98607	630 NE OAK ST, CAMAS, 98607	#281A HJG MAXON DLC 6.53 A	CEMETERIES	R-7.5	Western Search Area
91044034	JHTM PROPERTIES LLC	636 SE 3RD AVE, CAMAS, WA, 98607		#295 HJG MAXON DLC .03A	STORAGE WAREHOUSE	HI	Western Search Area
700525000	FORT JAMES CAMAS LLC	PO BOX 105681, ATLANTA, GA, 30348		BN RR LEASE #500,086	MFG - PAPER PRODUCTS	HI	Western Search Area

APPENDIX C
EXAMPLE NOTIFICATION LETTERS

DRAFT

DATE

Recipient [Fire/Police Departments] name
Recipient company
Recipient address 1
Recipient address 2

Re: City of Camas Wellhead Protection Plan

Dear Emergency Responder:

The City of Camas has developed an updated Wellhead Protection Plan to help maintain drinking water quality for our City residents. The Plan is based on Washington Department of Health WAC 246-290-135(3) regulations. As part of the Plan, maps were prepared that show the areas around each city drinking water well where a chemical spill on the ground may cause contamination of the well/aquifer. These areas are Wellhead Protection Areas (WHPAs).

As part of this Plan, the City must provide wellhead protection information to agencies responsible for incident/spill response procedures. It is important that you are aware of where potential contaminant releases could adversely impact the quality of our community's drinking water supply.

A map of the WHPAs and adjacent transportation routes is enclosed for your review. Also enclosed is a table providing the facility ID, name, and location for each potential contaminant source. An acknowledgement of receipt of this information or a response from your office as part of our wellhead protection plan documentation would be appreciated. Please note that the City has sent notices to each of these properties informing them of their location within the WHPA boundary.

In the event of a spill or contaminant release, we would ask that you immediately notify us and the Department of Ecology, so that we can take appropriate measures to deal with the problem.

Thank you for assisting us in protecting our water supply and groundwater resources. If you have any questions, please contact me at (###) ###-####.

Sincerely,

Name
Title
City of Camas

DRAFT

DATE

Department of Ecology
Recipient company
Recipient address 1
Recipient address 2

Re: City of Camas Wellhead Protection Plan

Dear Department of Ecology:

The City of Camas has developed an updated Wellhead Protection Plan to help maintain drinking water quality for our City residents. The Plan is based on Washington Department of Health WAC 246-290-135(3) regulations. As part of the Plan, maps were prepared that show the areas around each city drinking water well where a chemical spill on the ground may cause contamination of the well/aquifer. These areas are Wellhead Protection Areas (WHPAs).

The enclosed map depicts the WHPA boundary, source wells, and identified potential contaminant sources. Also enclosed is a table providing the facility ID, name, and location for each potential contaminant source. Please review the map and use it as a reference when inspecting and permitting the storage, use, and disposal of hazardous material within our WHPAs.

Please note that the City has sent notices to each of these properties informing them of their location within the WHPA boundary. The City has also sent similar letters to businesses with land uses that could potentially contaminate groundwater quality.

Thank you for assisting us in protecting our water supply and groundwater resources. If you have any questions, please contact me at (###) ###-####.

Sincerely,

Name
Title
City of Camas

DRAFT

DATE

Recipient [local business or cleanup site] name
Recipient company
Recipient address 1
Recipient address 2

Re: City of Camas Wellhead Protection Plan

To Whom It May Concern:

The City of Camas has developed an updated Wellhead Protection Plan to help maintain drinking water quality for our county residents. The Plan is based on Washington Department of Health WAC 246-290-135(3) regulations. As part of the Plan, maps were prepared that show the areas around each PUD drinking water well where a chemical spill on the ground may cause contamination of the well/aquifer. These areas are Wellhead Protection Areas (WHPAs). The Plan also requires an inventory of potential sources of groundwater contamination within these WHPAs.

The primary purpose of this letter is to notify you that your facility is located within one of our WHPAs. Since your business or the activities conducted at your facility may involve the use or storage of chemicals (e.g., gasoline, underground storage tanks, hazardous waste, etc.) that could adversely impact the drinking water supply in the event of a spill. If a chemical spill occurs, immediately notify the Department of Ecology and relevant first responders (for specific guidance see https://ecology.wa.gov/footer-pages/report-an-envi-ronmental-issue/report-a-spill), followed by the City of Camas.

Thank you for assisting us in protecting our water supply and groundwater resources. If you have any questions, please contact me at (###) ###-####.

Sincerely,

Name
Title
City of Camas

DRAFT

APPENDIX V

TM 1 - HYDRAULIC MODEL DEVELOPMENT AND CALIBRATION

2026 Water System Plan Update



TECHNICAL MEMORANDUM 1

Hydraulic Model Development and Calibration

DRAFT / September 2025

carollo

2026 Water System Plan Update

TECHNICAL MEMORANDUM 1

Hydraulic Model Development and Calibration

DRAFT / September 2025

This document is released for the purpose of information exchange review and planning only under the authority of Matthew Huang, September 29, 2025, State of Washington PW No. 54002.

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Abbreviations

ADD	average day demand
AWWA	American Water Works Association
BPS	booster pump station
Carollo	Carollo Engineers
City	City of Camas
DEM	digital elevation model
DS	downstream
DSL	distribution system leakage
EPS	extended period stimulation
FCV	flow control valve
GIS	geographic information system
GME	Green Mountain Estates
gpm	gallons per minute
HGL	hydraulic grade line
HP	horsepower
LPH	Lower Prune Hill
MDD	maximum day demand
MG	million gallons
mgd	million gallons per day
MSL	mean sea level
PM	project memorandum
PRV	pressure reducing valve
psi	pounds per square inch
PSV	pressure sustaining valve
SCADA	supervisory control and data acquisition
TM	technical memorandum
UPH	Upper Prune Hill
USGS	United States Geological Survey
WSPU	Water System Plan Update

TM 1 HYDRAULIC MODEL DEVELOPMENT AND CALIBRATION

1.1 Hydraulic Model Development

This section of the technical memorandum (TM) summarizes the process used to update and calibrate the hydraulic computer model of the City of Camas' (City) water distribution system as part of the City's 2026 Water System Plan Update (WSPU). Included in this TM are summaries of model development, demand allocation, and calibration results.

1.2 Previous Hydraulic Model

Prior to this project, the City maintained a hydraulic model of their distribution system in InfoWater by Innovyze. Recently, Innovyze was acquired by AutoDesk, and its services were updated. The City's hydraulic model has since been converted and utilizes the most current InfoWater Pro software. The most recent recalibration of the City's hydraulic model was completed in 2013 and as part of the last water system plan update, calibration was verified by utilizing data collected from hydrant flow tests.

1.3 Elements of the Hydraulic Model

A hydraulic model is comprised of elements that represent water system assets and include junctions, pipes, tanks and reservoirs, pumps, and control valves. The following provides a brief overview of the various elements of the hydraulic model and the required input parameters associated with each:

- **Elevation.** Each modeled element is assigned an elevation which is used as a reference point when calculating system pressure and hydraulic grade line. Carollo Engineers (Carollo) decided to utilize United States Geological Survey (USGS) Data, available as a standard one-meter resolution digital elevation model (DEM) as the model elevation source. The one-meter DEM (converted to feet for use in the hydraulic model) was developed exclusively from high resolution light detection and ranging datasets collected between March 2016 and May 2017 as part of the USGS 3D elevation program. The DEM elevation values reference the North American Vertical Datum of 1988.
- **Junctions.** Locations where pipe sizes change, where pipelines intersect, change in material, open valves, or where water demands are applied are represented by junctions in the hydraulic model. Required inputs for junctions include service elevation and water demands. Demand nodes were delineated within InfoWater Pro as junctions that were in the respective pressure zone and not linked to a transmission main or facility. Note that hydrants and standpipes are modeled as junctions with a one-to-one relationship.
- **Pipes.** Water mains are represented as pipes in the hydraulic model. Input parameters for pipes include length, roughness (Hazen-Williams C factor), diameter, and whether or not the pipe is a check valve (i.e., does not allow reverse flow). Existing pipes in the hydraulic model were compared to the most recent water main GIS layer provided by the City. Any missing pipes were hand drawn into the hydraulic model. For modeling purposes, any small diameter dead-end pipe (4-inches in diameter and

less) with no hydrant connections were not added to the City's model. Additionally, pipes for facilities (i.e., reservoirs, pump stations), were noted in InfoWater Pro as facility pipes to differentiate between distribution system piping and facility yard piping. This notation will allow for future updates to the model to focus on GIS updates and not facilities.

- **Tanks.** Water tanks are included in the hydraulic model as either cylindrical tanks or variable area tanks, depending on the complexity of the tank geometry. Required input parameters for cylindrical tanks include bottom elevation, maximum level, initial level, and diameter. For modeling purposes, any rectangular tanks were recalculated to be circular tanks. The volume was divided by the depth to obtain the area of the tank and then an equivalent circular diameter tank was calculated.
- **Reservoirs.** For water distribution system modeling, fixed head reservoirs are used to represent a water source with a constant hydraulic grade line (HGL). Typically, fixed head reservoirs are used to represent water sources, such as groundwater wells or water treatment facilities.
- **Pumps**. Pumps are included in the hydraulic model as links. Input parameters for pumps include pump curves, operational controls, and elevation.
- **Control Valves.** Several different valves, such as gate valves, check valves, butterfly valves, pressure sustaining valves (PSV), flow control valves (FCV), and pressure reducing valves (PRV) are represented as links in the hydraulic model. Input parameters for control valves include diameter, operational controls, and other settings.

1.4 Demand Allocation

Allocation of water demands to appropriate nodes in the hydraulic model was completed by Carollo. Demands were allocated based on 2024 water billing dataset provided by the City, which contained billed consumption by month in million gallons (MG) for each parcel connected to the City's distribution system. Annual average demands from the dataset were then allocated into the hydraulic model by assigning each billed parcel to the nearest model "demand" junction in geographic information system (GIS). Excel was utilized to then return consumption volumes for each model junction, and those values were pasted into the model demand set.

The billed consumption for 2024 amounted to approximately 4.03 million gallons per day (mgd). Distribution system leakage (DSL) amounted to 0.64 mgd in 2024 or 14 percent of total water production. DSL is the water lost from the distribution system that includes apparent (theft, meter inaccuracy, data collection errors) and real losses (water main breaks, reservoir overflows, leaky valves, etc.). Annual average production in 2024 from all the City's supply sources was 4.67 mgd. DSL was uniformly distributed across the City's system to match consumption and production values.

After allocating demands, the hydraulic model was calibrated to mimic actual operations. A description of the calibration process and details for the City's distribution system is discussed later in this TM.

1.5 Distribution System Components

The City owns and operates a multi-source municipal water system (Washington State Department of Health System Number 108002), which includes supply, treatment, storage, and distribution of potable water to residential and commercial customers. Carollo updated the City's hydraulic model utilizing GIS geodatabases, pump curves, record drawings, and other facility data provided by the City.

The following sections describe the methodology used to update the hydraulic model.

1.5.1 Water Supply

Water is supplied to the Camas water system from one slow sand filtration plant treating raw water from the City's two surface water diversions and 10 groundwater wells. All supply sources were modeled as a fixed head reservoir and a flow control valve which opens/closes at a set flow rate based on tank levels. Table 1.1 summarizes the City's water supply sources.

Table 1.1 Water Supply Summary(1)

Model ID	Name	Status	Modeled Capacity (gpm)
SLOW_SAND_PLANT	Slow Sand Filtration Plant	Inactive(1)	1,570
BOULDER	Boulder Creek Intake	Inactive(1)	1,120
JONES	Jones Creek Intake	Inactive(1)	450
WELL-5	Well 5	Active	675
WELL-6	Well 6	Active	1,200
WELL-7	Well 7	Active	950
WELL-8	Well 8	Active	1,250
WELL-9	Well 9	Active	575
WELL-10	Well 10	Active	900
WELL-11	Well 11	Active	1,000
WELL-12	Well 12	Active	1,000
WELL-13	Well 13	Active	1,350
WELL-14	Well 14	Active	850

Notes:
(1) During the period of extended period stimulation (EPS) and fire flow calibration, the plant was offline and for purposes of hydraulic analysis it is assumed that under maximum day demand conditions (typically occur during summer months), the plant is unable to divert water from its surface water supplies.
gpm - gallons per minute.

1.5.2 Pressure Zones

The City's water system is divided into 26 distinct pressure zones. Table 1.2 lists the HGL of each pressure zone, which range from 285 feet to 852 feet above mean sea level (MSL). Carollo updated pressure zones using closed valves, pipes and PRV settings provided in the City's PRV Study (Grey & Osborne, 2024). A shapefile containing these updated pressure zone boundaries will be provided for City review and to assist with model review. The ground elevations within the service area range from 21 feet to 757 feet above MSL.

Table 1.2 Pressure Zones

Zone ID[1] (feet)	Supplying Pressure Zone	Open or Closed?	Minimum Elevation[2][3] (feet)	Maximum Elevation[2][3] (feet)
285 – Downtown	343 – Butler (Transmission)	Open	21	159
343 – Butler (Transmission)	N/A	Open	51	234
455 – LPH	N/A	Open	96	409
542 – Gregg	N/A	Open	225	440
544 – Lacamas	N/A	Open	190	456
440 - Lacamas Shores	544 – Lacamas	Open	212	358
852 – UPH	N/A	Open	428	757
542 – Spyglass	852 - UPH	Open	353	485
547	852 – UPH	Open	285	426
550	455 - LPH	Closed	361	409
581	852 – UPH	Open	334	460
612	852 – UPH	Open	404	488
625	852 – UPH	Open	399	549
674	852 – UPH	Open	382	530
675	852 – UPH	Open	460	523
687	852 – UPH	Open	428	524
694	852 – UPH	Open	510	544
695 - Green Mountain Estates	542 – Gregg / 544 - Lacamas	Closed	456	534
697	852 – UPH	Open	421	636
697 – East	852 – UPH	Open	526	557
710	852 – UPH	Open	471	575
711	852 – UPH	Open	502	574
734	852 – UPH	Open	480	634
745	852 – UPH	Open	529	603
782	852 – UPH	Open	610	662
800	852 – UPH	Open	506	633

Notes
(1) Zone ID is based on hydraulic grade line (HGL).
(2) Elevation data based on interpolation of 2-ft contours.
(3) Location of service connections based on model node location.
LPH - Lower Prune Hill; UPH - Upper Prune Hill.

1.5.3 Pipe Network

The modeled water distribution system consists of over 159 miles of pipelines ranging from 6-inch to 24-inches in diameter. Table 1.31.3 provides a breakdown by diameter of the modeled distribution system. As shown in Table 1.3, nearly 64 percent of the City's modeled water distribution system consists of 8-inch through 12-inch diameter water mains. Almost 21 percent of the modeled system is 6-inches in diameter. The remaining 15 percent of the system is 14-inches in diameter and larger.

Table 1.3 Modeled Pipeline Summary(1)

Diameter (inches)	Length		Percent of Modeled System
	(feet)	(miles)	
6	180,065	34.1	21%
8	365,424	69.2	43%
10	20,264	3.8	2%
12	162,810	30.8	19%
14	32,881	6.2	4%
16	13,278	2.5	2%
18	50,251	9.5	6%
20	57	0.01	<1%
24	16,272	3.1	2%
Total	**841,303**	**159.2**	**100%**

Notes:
(1) Source: Hydraulic Model.

1.5.4 Storage Reservoirs

Water distribution systems rely on stored water to help equalize daily fluctuations between supply and demand, to supply sufficient water for firefighting, and to meet demands during an emergency or an unplanned outage of a major source of supply. The hydraulic model includes 7 storage reservoirs with volumes ranging from 0.1 to 2.4 MG. Detailed information for each of the City's storage reservoirs is summarized in Table 1.4.

Table 1.4 Modeled Reservoir Summary

Tank ID	Name	Capacity (MG)	Diameter (feet)	Height (feet)	Base Elevation (feet)	Maximum Level (feet)
BUTLER	Butler Reservoir	1.15	113.0	15.0	328.0	343.0
LOWER_PRUNE_RES2	Lower Prune Hill Reservoir #2	1.5	105.0	23.0	432.0	455.0
GREGG	Gregg Reservoir	0.1	15.5	72	470.0	542.0
LACAMAS	Lacamas Reservoir	2.0	84.2	48.0	496.0	544.0
18TH_AVE	18th Avenue (Anderson) Reservoir	2.0	95.0	44.0	500.0	544.0
UPPER_PRUNE_RES	Upper Prune Hill Reservoir	2.4	77.5	68.0	748.0	816.0
UPPER_PRUNE_STD	Upper Prune Hill Standpipe	0.75	36.0	100.0	752.0	852.0

Notes:
(1) Source: City of Camas 2019 Water System Plan Update.

1.5.5 Booster Pump Stations

The hydraulic model includes 10 booster pump stations with 28 individual pumps. Pump stations were modeled as multiple point curves based on the pump curves or design points based on pump design flow and total dynamic head that the City provided. The hydraulic characteristics for each pump are summarized in Table 1.5.

Table 1.5 Modeled Booster Pump Summary

Name	From Zone	To Zone	Pump Information			
			Pump ID	Status	Power (HP)	Design Capacity (gpm)
Angelo BPS	343 – Butler (Transmission)	455 – LPH	ANGELO-1	Active	75	1,000
			ANGELO-2	Active	75	1,000
			ANGELO-3	Active	75	1,000
			ANGELO-4	Active	75	1,000
Butler BPS	343 – Butler (Transmission)	455 – LPH	BUTLER-1	Active	50	800
			BUTLER-2	Active	60	600
Crown Road BPS	343 – Butler (Transmission)	542 – Gregg	CROWN_RD-1	Active	75	800
			CROWN_RD-2	Active	75	800
Forest Home BPS	285 - Downtown	455 – LPH	FOREST_HOME-PMP	Active	50	1,000
Green Mountain Estates BPS	544 – Lacamas	695 – GME	GME_1	Active	15	180
			GME_2	Active	15	180
			GME_3	Active	15	180
			GME_4	Active	60	650
			GME_5	Active	60	650
Gregg BPS	455 – LPH	542 – Gregg	GREGG-1	Active	100	1,500
			GREGG-2	Active	100	1,500
			GREGG-3	Active	15	500
Lacamas BPS	455 – LPH	544 – Lacamas	LACAMAS-1	Active	25	500
			LACAMAS-2	Active	25	500
			LACAMAS-3	Active	100	1,500
Lower Prune Hill BPS	455 – LPH	852 – UPH	LPH-1	Active	150	1,000
			LPH-2	Active	150	1,000
			LPH-3	Active	100	750
Upper Prune Hill BPS	852 – UPH	852 – UPH	UPH-1	Active	20	750
			UPH-2	Active	20	750
			UPH-3	Active	40	1,400
			UPH-4	Active	40	1,400
Francis Road BPS	455 – LPH	550	FRANCIS_RD-1	Active	7.5	80

Notes:
(1) Source: City of Camas 2019 Water System Plan Update.
BPS - booster pump station; GME - Green Mountain Estates; HP - horsepower.

1.5.6 Control Valves

The City's distribution system includes 39 PRV stations with 71 individual valves, which convey and regulate water between zones and/or storage tanks. PRVs are hydraulically operated valves that modulate open and closed to maintain the downstream pressure setpoint, allowing distribution systems to transfer water from upper pressure zones to lower pressure zones without exceeding design pressures in the lower zones or dropping the pressures of the higher zone. Typically, PRV stations are configured with several valves in parallel, each with a different downstream pressure setpoint for redundancy. All PRVs listed in the table below were modeled, but for modeling purposes if a PRV station had more than one valve, only the largest diameter PRV was simulated (smaller diameter PRV was closed). Pressure reducing valves were adjusted to match field recorded data or reported setpoints and hydraulic grade lines from City provided documents flow control valves are another control valve that limit flow to a specified flowrate. Valves for all supply sources are modeled as FCVs. PSV are also another type of control valve that maintains a set pressure on the suction or discharge of the valve depending on the control configuration. Several of the City's booster pump stations have pump control valves that modulate open and closed for the pump to operate on its curve. In these instances, a pressure sustaining valve was modeled at a specified setpoint to match station flow to values typically seen in historical supervisory control and data acquisition (SCADA) data.

A system valve station typically consists of several valves that are standby, or backup. In addition to independent PRV stations, many pump stations have a bypass PRV that enables water to flow to a lower zone during an emergency. Pump station bypass PRV's were not modeled as part of this project.

The details for each of the City's PRV's are summarized in Table 1.6 and PSV's summarized in Table 1.7

Table 1.6 Pressure Reducing Valves

PRV Station	PRV Model ID	Size (inches)	Downstream Zone	Downstream Setting (psi)	Upstream Pressure (psi)
NW McIntosh	PRV-1	6	697	27	120
	PRV-2	2	697	32	120
NW Payne Rd. and SE 201st Ave.	PRV-3	8	544	Closed	Closed
	PRV-4	4	544	Closed	Closed
NW 16th Ave. and Klickitat	PRV-5	10	697	12	105
	PRV-6	4	697	22	105
NW Ivy and Fargo	PRV-7	4	734	45	90
NW 22nd and Fargo	PRV-8	4	697E	65	130
NW 19th Ave. and Fargo	PRV-9	6	687	70	157
NE 21st and Everett	PRV-10	8	343	45	110
NE 19th and Everett	PRV-11	6	343	40	110
2349 NW 32nd Circle	PRV-12	8	680	25	120
	PRV-13	2	680	30	120
NW Brady Rd. and Deer Creek	PRV-14	8	547	25	105
	PRV-15	3	547	30	105

PRV Station	PRV Model ID	Size (inches)	Downstream Zone	Downstream Setting (psi)	Upstream Pressure (psi)
NW Parker St. and Linear	PRV-16	8	544	Closed	Closed
NW Astor and 36th (Applewood)	PRV-17	8	612	55	90
	PRV-18	2	612	65	90
NW 43rd and Sierra	PRV-19	8	544	30	190
NW 23rd Ave. and Fargo	PRV-20	4	734	45	130
2666 NW Logan St. off NW 28th	PRV-21	6	782	50	90
	PRV-22	2	782	55	90
2929 NW 31st and NW Dahlia Dr.	PRV-23	6	544	Closed	Closed
	PRV-24	2	544	Closed	Closed
NW 29th Ave. and NW Astor St.	PRV-25	2	800	58	90
	PRV-26	6	800	53	90
NW Sierra Dr. and NW 38th Ave.	PRV-27	6	711	35	115
	PRV-28	2	711	40	115
Currawong Ct. and NW 40th Ave.	PRV-29	6	711	75	145
	PRV-30	2	711	80	145
NW 23rd Ave. and Iris	PRV-31	8	656	58	130
	PRV-32	2	656	63	130
NW Julia St.	PRV-33	8	544	Closed	Closed
	PRV-34	2	544	Closed	Closed
NW Fern Ridge Dr.	PRV-35	2	547	40	110
	PRV-36	8	547	35	110
NE 6th and NE Hayes St	PRV-37	4	343	68	94
	PRV-38	12	343	58	94
East End Walden	PRV-41	2	442	37	84
	PRV-42	6	442	32	84
West End Walden	PRV-43	1.5	442	72	118
	PRV-44	6	442	67	118
NE 6th and Joy	PRV-45	6	343	55	92
Goot Park	PRV-46	3	343	115	138
	PRV-47	10	343	110	138
Lake Ridge Lower	PRV-48	2	581	55	98
	PRV-49	6	581	50	98
Lake Ridge Middle	PRV-50	2	675	63	91
	PRV-51	6	675	58	91
Lake Ridge Upper	PRV-52	2	745	68	123
	PRV-53	6	745	63	123

PRV Station	PRV Model ID	Size (inches)	Downstream Zone	Downstream Setting (psi)	Upstream Pressure (psi)
702 NW View Ridge St. (Dovehill) Upper	PRV-54	2	542S	30	100
	PRV-55	6	542S	25	100
NW 7th and Valley (Dovehill) View Ridge Lower	PRV-56	2	542S	40	110
	PRV-57	6	542S	35	110
NW Fargo and 27th (Drewf's Farm Upper)	PRV-58	2	734	Open	63
	PRV-59	6	734	Open	63
905 NW 30th Ave. and NW Ivy Ln. (Drewf's Farm Lower)	PRV-60	2	710	60	130
	PRV-61	6	710	55	130
NW Ivy and Ostenson Canyon	PRV-62	2	694	65	140
	PRV-63	6	694	60	140
NW 24th Ave and NW Brady Rd	PRV-64	6	625	70	124
	PRV-65	2	625	75	124
2011 NW Larkspur St	PRV-66	6	625	45	132
	PRV-67	2	625	50	132
Wellfield East	PRV-69	12	343	100	125
	PRV-70	4	343	Closed	Closed
NE 277th and NE 14th St.	PRV_SSP	6	542	78	140
	V9093	3	542	88	140

Notes:
psi - pounds per square inch.

Table 1.7 Pressure Sustaining Valves

PSV Station	PSV Model ID	Size (inches)	Pressure Setpoint (psi)
Angelo BPS	PSV-ANGELO	8	140
Crown Rd. BPS	PSV-CROWNRD	8	180
Gregg BPS	PSV-GREGG	12	140
Lower Prune Hill BPS	PSV-LPH	6	250

1.5.7 Facility Controls

Facility controls are set for pumps and control valves for supply sources to match actual distribution system conditions. Input from City operations staff and review of SCADA data were used to determine setpoints. Typically, pumps are set with controls to turn on and off at specified tank levels, and PRVs and FCVs may be similarly set to open and close to maintain specified tank levels. For modeling purposes, pumps supplying "closed" zones were modeled having a variable speed control set to maintain a downstream junction pressure setpoint. The specific controls developed are summarized in the tables below. Booster pump station controls are summarized in Table 1.8 noting on/off settings and controlling facility. Supply source controls are summarized in Table 1.9 defining on/off settings, controlling facility and flow setpoint. Controls for miscellaneous facilities like pipes and tank altitude valves are provided in Table 1.10, respectively.

Table 1.8 Pump Station Controls

Pump	On Setting	Off Setting	Control Location
ANGELO-1	Level < 22 feet	Level > 22.5 feet	LPH Reservoir
ANGELO-2	Level < 21 feet	Level > 22 feet	LPH Reservoir
ANGELO-3	Level < 21 feet	Level > 21.5 feet	LPH Reservoir
ANGELO-4	Level < 20.5 feet	Level > 21 feet	LPH Reservoir
BUTLER-1	None	None	None
BUTLER-2	None	None	None
CROWN_RD-1	Level < 57 feet	Level > 66 feet	Gregg Reservoir
CROWN_RD-2	Level < 54 feet	Level > 61 feet	Gregg Reservoir
FOREST_HOME_PMP	00:00	10:00	Time
FRANCIS_RD_PMP	80 psi	None	DS Junction
GREGG-1	None	None	None
GREGG-2	None	None	None
GREGG-3	Level < 59 feet (Pump Setting = 0.82)	Level > 66 feet	Gregg Reservoir
GME_1	140 psi	None	DS Junction
GME_2	None	None	None
GME_3	None	None	None
GME_4	None	None	None
GME_5	None	None	None
LACAMAS-1	Level < 30 feet	Level > 32 feet	Lacamas Reservoir
LACAMAS-2	Level < 32 feet	Level > 34 feet	Lacamas Reservoir
LACAMAS-3	Level < 40 feet	Level > 44 feet	Lacamas Reservoir
LPH-1	Level < 60 feet	Level > 92 feet	On = UPH 2.4 MG Reservoir Off = UPH Standpipe
LPH-2	Level < 52 feet	Level > 86 feet	On = UPH 2.4 MG Reservoir Off = UPH Standpipe
LPH-3	Level < 58 feet	Level > 89 feet	On = UPH 2.4 MG Reservoir Off = UPH Standpipe
UPH-1	Level < 88 feet	Level > 92 feet	UPH Standpipe
UPH-2	Level < 86 feet	Level > 90 feet	UPH Standpipe
UPH-3	Level < 84 feet	Level > 88 feet	UPH Standpipe
UPH-4	Level < 80 feet	Level > 86 feet	UPH Standpipe

Notes:
(1) Source: Hydraulic Model.
DS – downstream.

Table 1.9 Supply Source Controls

Supply Source	On Setting	Off Setting	Control Location	Flow Setting (gpm)
Well_5	00:00	10:00	Time	650
Well_6	None	None	None	0
Well_7	None	None	None	0
Well_8	Level < 13 feet	Level > 13.25 feet	Butler Reservoir	1,250
Well_9	Level < 41 feet	Level > 43 feet	Lacamas Reservoir	575
Well_10	Level < 13 feet	Level > 13.1 feet	Butler Reservoir	900
Well_11	None	None	None	0
Well_12	Level < 13.9 feet	Level > 14 feet	Butler Reservoir	1,000
Well_13	Level < 13.7 feet	Level > 14 feet	Butler Reservoir	1,350
Well_14	Level < 13.2 feet	Level > 13.4 feet	Butler Reservoir	850

Table 1.10 Miscellaneous Controls

Facility Name	On Setting	Off Setting	Control Location	Flow Setting (gpm)
UPH Res Altitude Valve	Level < 58 feet	Level > 62.1 feet	UPH 2.4 MG Reservoir	1,800
P419 (18th Ave Res Inlet/Outlet Pipe)	Lacamas Pump 3 = OFF Lacamas Level > 44 feet	Lacamas Pump 3 = ON Lacamas Level < 40 feet	None	N/A

1.6 Hydraulic Model Calibration Process

This section of the report builds upon the previous project memorandum (PM) developed for this project and is described below:

- **PM - Summary of Hydrant Field Testing** – This document was developed to capture hydrant testing activities and data gathered to support the steady state calibration of the City's distribution system.

This section summarizes the overall methodology employed to calibrate the City's water system hydraulic models and the calibration results, including a detailed description of each of the major components of the model calibration process. The hydraulic model was calibrated in accordance with American Water Works Association (AWWA) Manual on Distribution Network Analysis of Water Utilities (AWWA M-32). Both an extended period simulation calibration and a steady state fire flow calibration were performed for the water system.

1.6.1 Model Scenarios

The scenarios created in the model for calibration and hydraulic analysis purposes are described below and include the following:

- **Extended Period Simulation (EPS) Calibration** - This scenario is for a 24-hour period, simulating system operation and demand conditions for the selected day of calibration. Controls for the facilities were developed and/or updated as part of the EPS model calibration to mimic typical system operations. Demands for the day of EPS calibration are summarized below in Table 1.11.

- **Steady State Fire Flow Scenarios** -– There were 10 hydrant flow tests performed across the City's system that the hydraulic model was calibrated to. Each hydrant test has two separate model scenarios, a static demand and fire flow demand. Each scenario has its own scenario with different demand sets and control sets based on the demand and operations on the day the test was performed. Demands for the days of fire flow calibration are summarized below in Table 1.11.
- **Average Day Demand (ADD)** - A total of five individual ADD scenarios were created. . Each individual scenario utilizes an ADD demand set developed using medium scenario projections for existing (2025), 2031, 2036, 2046, and buildout planning years. Demand sets for the 2031, 2036, and 2046 planning years will be used for hydraulic analysis. Modeled ADD for each planning year is summarized below in Table 1.12.
- **Maximum Day Demand (MDD)** - A total of five individual MDD scenarios were created. Each individual scenario utilizes an MDD demand set developed using medium scenario projections for existing (2025), 2031, 2036, 2046, and buildout planning years. Demand sets for the 2031, 2036, and 2046 planning years will be used for hydraulic analysis. Modeled MDD for each planning year is summarized below in Table 1.12.

The EPS Calibration and the Steady State Fire Flow scenarios are included in the model as a reference to the calibration of the model which is described in Section 6.5.5 of this report and should not be used to perform analysis on the system. Rather, the ADD and MDD scenarios should be used for analysis.

Table 1.11 Calibration Scenario Demand Summary

EPS Calibration Demands (gpm)	Demand Basis	Fire Flow Calibration Demand Set 1 (gpm)	Demand Basis	Fire Flow Calibration Demand Set 2 (gpm)	Demand Basis
3,079	10/11/2024	3,218	05/15/2025	2,978	05/16/2025

Table 1.12 ADD and MDD Demand Summary

Planning Year	ADD (gpm)	MDD (gpm)
Existing (2025)	3,243	6,373
2031	3,972	7,994
2036	4,576	9,208
2046	5,805	11,686
Buildout	10,986	22,727

1.6.2 Operational Considerations

During calibration, it is necessary to adjust the operation of facilities to meet the demand, pressures, and/or reservoir levels of the water system. Pump stations were turned on or off based on downstream pressures or reservoir levels. Supply sources were adjusted to meet scenario demands and cycle the storage reservoirs. The City has the flexibility to alternate supply source operations to evenly distribute wear on the pumps and turn pumps on/off to meet demand conditions for each day as needed. Therefore, the facility controls for supply sources summarized in section 6.3.7 capture the operational statuses for wells on the selected day of EPS calibration. Furthermore, for future planning scenarios where demands increase significantly, additional supply sources and pump station capacities will be required. Control settings and flows for future capacities are not summarized in this report, rather the supply and pump station capacity improvements will be captured in Chapter 9 of the 2026 WSPU.

1.6.3 Diurnal Pattern Development

As part of the EPS calibration process, diurnal patterns were developed for individual pressure zones (where applicable) for the water system. In one case, several of the City's larger pressure zones could not be isolated to create individual diurnal patterns and were combined to develop a grouped zone diurnal pattern. These individual and grouped diurnal patterns were developed based on the selected calibration date. They were applied to each of the respective hydraulic models for use in EPS model simulations. For individual diurnal patterns, see Appendix 1A. Due to limitations in compiling SCADA data for various facilities, the diurnal patterns developed are only representative of a single day. The City maintains a system integrator to generate queries which helps automate compiling SCADA into an excel spreadsheet format. However, for facilities that did not yet have a query created, hourly instantaneous data points were manually recorded using pencil and paper. If more comprehensive SCADA data is available in the future, the diurnal patterns can be refined to be more representative of typical conditions, and the group zone diurnal pattern can be further isolated to create individual diurnal patterns.

1.6.4 Model Calibration Data Collection

Carollo coordinated with City staff regarding SCADA and field data needs that were required to calibrate the hydraulic model. The required calibration data included site maps for specific fire flow test locations, pressure logger locations, and included a list of the SCADA data needs, durations, time intervals, and units. This section summarizes the data collection process that was conducted and how the data will be used to support calibration efforts.

- **SCADA Data Gathering for EPS Model Calibration**: For the EPS data gathering period, Carollo coordinated with City staff to obtain 1 minute data for SCADA points within the distribution system, including flow, and pressure data and reservoir levels. These data, spanning the period from July 2024 to October 2024, were primarily used to generate the diurnal pattern and for EPS model calibration. As discussed in Section 6.5.3, there were difficulties in obtaining SCADA data for certain facilities without a SCADA query. For the locations with no queries, the trends and cleanliness of data were observed during the period of temporary pressure logger deployment. Upon identifying October 11, 2024, as the date with most representative system condition trends, instantaneous data recordings for these facilities were manually recorded using pencil and paper.
- **Temporary Pressure Logger Installation for EPS Calibration:** In addition to the data obtained from the SCADA system from the major system facilities, Carollo also provided temporary pressure loggers that were connected to hydrants to capture pressure fluctuations at key points within the distribution system. The data obtained from the temporary loggers consisted of 1-minute pressure data. The pressure loggers were installed by City staff in the distribution system for a one-week period during October of 2024.
- **Hydrant Flow Testing for Fire Flow (Steady State) Calibration:** Field testing for fire flow calibration took place on May 15 and 16 of 2025. Carollo coordinated with City staff to conduct 10 hydrant flow tests across the distribution system. Specific details related to hydrant flow testing activities are detailed in Table 1.13.
- **SCADA Data Gathering for Fire Flow (Steady State) Calibration:** For the fire flow calibration data gathering period, Carollo coordinated with City staff to obtain 1 minute SCADA data for all pump statuses and reservoir levels within the distribution system during the hydrant flow testing period (May 15 and May 16 of 2025). This data was used to identify boundary conditions in the distribution

system (pump on/off status, reservoir level, etc.) at the time of each hydrant flow test. These boundary conditions were then matched in the model to calibrate each fire flow location. City operations staff provided pump statuses for all booster pump stations without SCADA queries.

1.6.5 Model Calibration Methodology and Results

The purpose of a water system hydraulic model is to estimate, or predict, how the water distribution system will respond under a given set of conditions. One way to assess the accuracy of the hydraulic model is to create a set of known conditions in the water system and then compare the results observed in the field against the results of the hydraulic model simulation using the same conditions. Flow tests conducted in the field on the water system can yield a profound tool in verifying data used in the hydraulic model and a greater understanding of how the water system operates.

Field testing can indicate errors in the data used to develop the hydraulic model or show that a condition might exist in the field not otherwise known. Valves, which are reported as being open, may be closed (or vice versa), an obstruction could exist in a pipeline, or pressure settings for a PRV may be slightly different than noted. Field testing can also correct erroneous model data such as incorrect pipe diameters or incorrect connectivity.

Data obtained from the field tests can be used to determine appropriate roughness coefficients for certain groups of pipe or areas in the City's distribution system, as roughness coefficients can vary with age and pipe material. Other parameters can also be adjusted to generate a calibrated model.

The calibration process for the City's water distribution system hydraulic model consisted of two parts, a macro (EPS) calibration and a fire flow test (Steady State) calibration. The EPS and fire flow calibrations are summarized for each system individually in the following sections.

1.6.5.1 Extended Period Simulation Calibration

The purpose of extended period simulation calibration is to demonstrate the hydraulic model's ability to accurately mimic the real-world operations of the distribution system facilities, including pressure fluctuations, tank fill/drain cycles, PRV station operation, and pump station operations. The primary varied parameters for this calibration were operational controls, with other parameters also being adjusted as calibration results were generated.

The first step in the EPS calibration process is the selection of a calibration day. The selected date of calibration was October 11, 2024. The calibration date was chosen based on SCADA data cleanliness, as well as being a day which field installed pressure loggers were deployed in the distribution system.

The billing data that was allocated in the hydraulic model was scaled to match the demands for the calibration day as noted in the following sections.

The EPS calibration compared model simulated supply source and pump station flows, pump station discharge and suction pressures, and tank levels to the field measured data. In addition, model simulated pressures at the pressure logger locations were compared to the actual field pressures and flows recorded during the calibration day. Model results and SCADA are compared for the City's distribution system for all the monitored facilities and are presented in Appendix 1B.

To assess calibration accuracy, different comparisons can be made. As it is not possible to calibrate while optimizing for all hydraulic variables, considering multiple calibration points together is instructive. One variable may visibly align (match) between SCADA observed and model simulated, while another variable may not match. For example, the value or magnitude may match, but the timing may not. For example, booster pump or well supply setpoints in the model may accurately simulate the normal low water level and normal high-water level of a storage tank, but the model simulated timing (occurrence) of the low and high-water levels may not match SCADA data. Thus, observing a trend over time – as evaluating an average value or a trend – can provide clarity into model calibration accuracy.

In several instances, model simulated results do not match SCADA data due to known circumstances. One reason for known discrepancies is incomplete or unavailable SCADA data for certain facilities, which prevents the ability to fully match system conditions. Having incomplete SCADA data for certain facilities, also prevented the development of diurnals for certain pressure zones as discussed previously. Another reason is that some of the available SCADA data is comprised of instantaneous readings in 1-hour increments, which prevents the ability to determine when pumps turn on and off. These circumstances contribute to model simulated results not matching SCADA data for various facilities and areas of the systems.

Graphs summarizing the EPS model calibration results are presented in the following figures. The calibration graphs include a dashed interior line that represents equivalent average SCADA and average simulated model values with confidence bands. The confidence bands represent a targeted deviation between SCADA and model values. For tanks, this confidence band is +/- 2 feet (ft), for pumps, +/- 10 percent gpm and for pressure +/- 5 pounds per square inch (psi). Select calibration points located outside of the confidence band are labelled for reference.

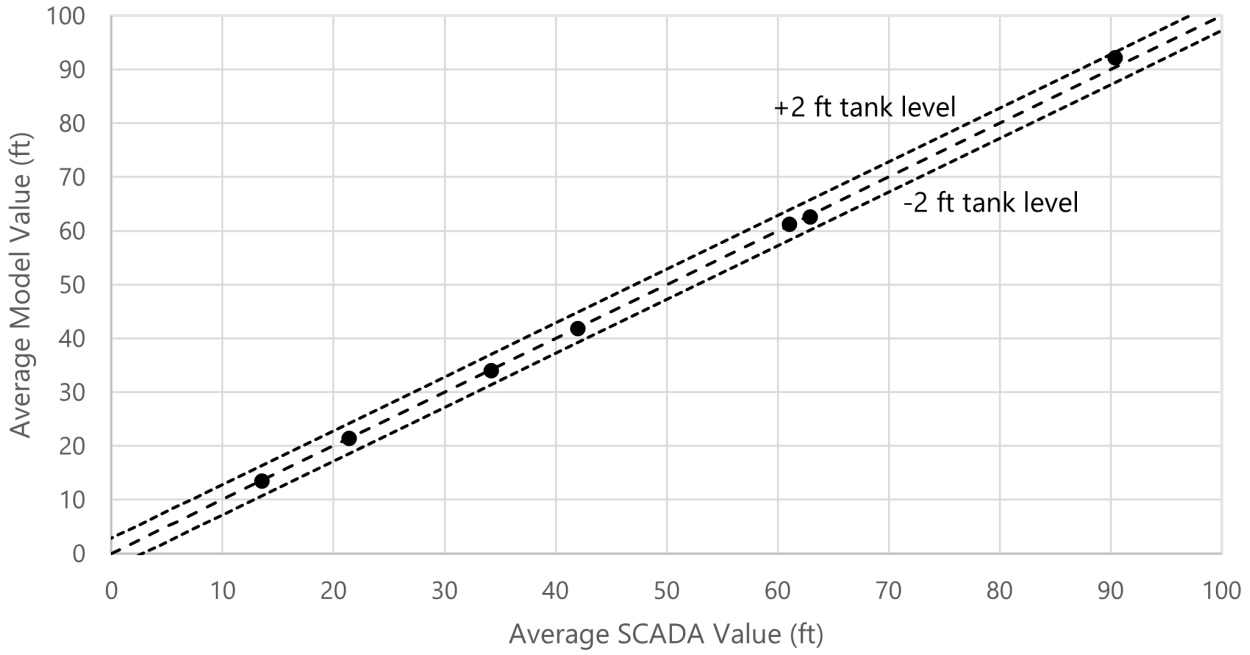


Figure 1.1 EPS Tank Calibration Accuracy Graph

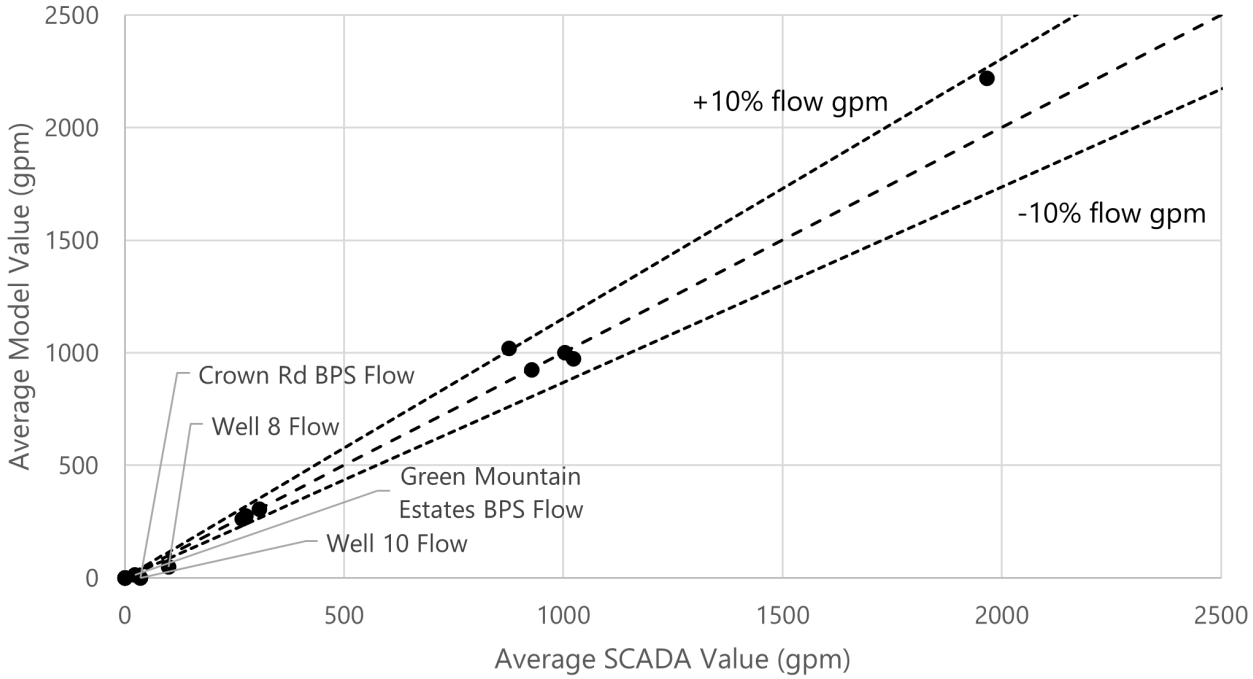


Figure 1.2 EPS Pump Calibration Accuracy Graph

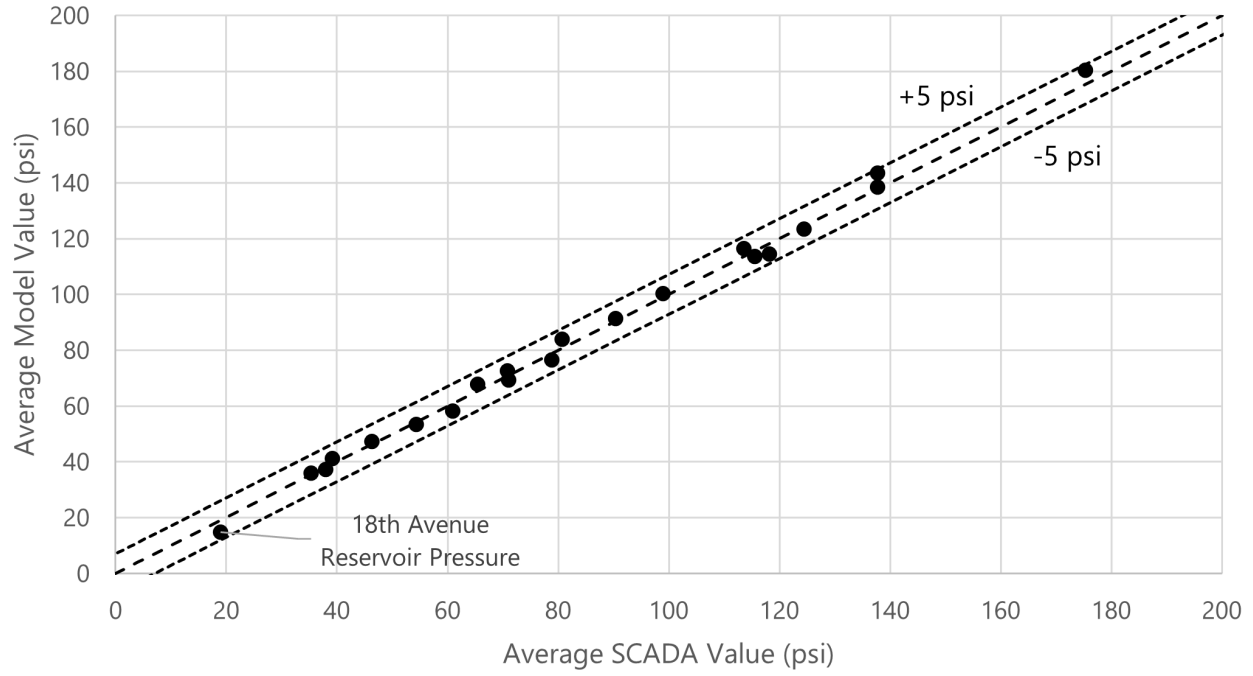


Figure 1.3 EPS Pressure Calibration Accuracy Graph

The graphs above indicate that tank levels and system pressures have an optimal calibration. Percent variance between modeled and SCADA values for tank levels are less than 2 percent and for pressures all but one of the calibration locations are within a 5 percent tolerance between modeled and SCADA values. The one exception is the 18th Avenue Reservoir pressure point; it was determined that this SCADA point is monitoring pressure based on tank level at the reservoir site. Since the tank level calibrated well at the 18th Avenue site, the pressure was determined to be negligible. Pumps generally calibrated well, with most calibration points falling within an acceptable tolerance between modeled and SCADA. The points with greater than 10% variance between modeled and SCADA are noted in Figure 1.3 with a callout. Well 8 and 10 were both supply sources that showed a high variance between modeled and SCADA data. This can likely be attributed to the total runtime of these respective wells during each hour of the calibration day. SCADA data for Well 8 showed the well was operational twice during the day but only ran for approximately 45 minutes each time. Likewise for Well 10, SCADA data showed the well operated for only 30 minutes on the day of calibration. Since model results were only reported in hourly timesteps, it is likely that these wells turned on/off in the model between the hour. The two booster pump stations that showed a higher were Crown Road and GME. In a discussion with City operations staff, it was discovered that Crown Road has a complex control strategy with another booster pump station (New Gregg BPS) that serves the 542 – Gregg Zone. To prevent model convergence issues, New Gregg BPS was modeled as the lead source of supply to this zone, with Crown Road BPS serving as the backup. Since New Gregg BPS was able to keep up with demand, Crown Road did not run in the EPS calibration scenario even though SCADA data showed it was operational. GME BPS showed high variance due to the way in which it was modeled. In reality, GME is equipped with a surge tank that maintains discharge pressure to prevent over cycling of pumps. The GME pumps kick on when pressure in the surge tanks drops (surge tank is emptying). However, the surge tank was not modeled and instead GME pumps were modeled as variable speed pumps with downstream pressure controls. The difference between the modeled field controls were the cause for significant difference in magnitude for maximum flows.

The results of each individual calibration location are presented in Appendix 1B. The minimum/maximum and general trends of modeled values are comparable and within acceptable tolerances to those seen in SCADA data with exceptions to the calibration locations noted above. Although, the timing of facilities turning on/off and peaks observed in system pressures are slightly variable at some calibration points. An example of this can be a well turning off in the model one hour later than what is observed in SCADA. As previously noted, finetuning diurnal patterns could improve timing of modeled simulated results.

1.6.5.2 Fire Flow Calibration

The purpose of fire flow calibration is demonstrating the model's ability to accurately replicate the performance of the distribution system during extreme demand conditions, such as when fire hydrants are being operated. The primary varied parameter for this calibration is pipeline roughness coefficient, although other parameters were also adjusted as calibration results are generated.

Hazen-Williams roughness coefficients, or C-factors, have industry accepted value ranges based on pipeline material, diameter, and age. Characteristics specific to City's water distribution system such as water quality, temperature, construction methodologies, material suppliers, and other factors may result in roughness coefficients that differ from the average of the industry accepted ranges. Fire flow calibration refines the initial estimation of the value of roughness coefficients that best indicate the conditions of the City's distribution system.

During average day flows, roughness coefficients have a relatively small effect on the operation of the distribution system. However, as the flows increase in the system on higher demand days, velocity within pipelines increases and roughness coefficients contribute more to overall system headloss. Fire flow tests artificially create high demand events to generate more headloss, allowing a better estimation of the pipeline roughness coefficients.

Fire flow tests stress the distribution system by creating a differential between the HGL at the point of hydrant flow and the system HGL at neighboring hydrants. This HGL differential increases the effect of the roughness coefficients on system losses and allows adjustments to the model to match model pressures to field pressures within an acceptable tolerance. As the model is adjusted to match system pressures, roughness coefficients should be adjusted only within a tolerance of industry accepted roughness coefficient ranges. If a model is unable to match the calibration results within the acceptable range of roughness coefficient values for a given pipeline material and age, there may be cause for further investigation. Often, a previously unknown field condition may be discovered. Examples of such conditions, which typically arise during hydraulic model calibration, include closed valves, partially closed or malfunctioning valves, extreme corrosion within pipelines, connectivity, and diameter errors in GIS layers or record drawings, and diurnal patterns of large water users.

A separate hydraulic model scenario was created for each flow test for both the static and the dynamic, or flowing, condition for each of the 10 fire flow calibration scenarios. The flow observed at each fire flow hydrant was assigned as a demand to the model node at the location of the hydrant. Residual pressures were then read at each hydrant location while the hydrant was flowing. To assess model result accuracies, the modeled static and residual pressures were compared to the field measured static and residual pressure, and then a percent different between the two values were calculated. Model results were considered acceptable if the pressure drops fell within a 10 percent tolerance or a 10 psi value. Specific details pertaining to each hydrant test are provided in Table 1.13. Furthermore, a summary of the fire flow calibration results is presented in Table 1.14.

Table 1.13 Hydrant Test Locations

Test Site	Pressure Zone	Flow Hydrant ID	Pressure Hydrant 1 ID	Pressure Hydrant 2 ID	Location
1	343 – Downtown	WH200146	WH200144	WH200143	SE 12th Ave
2	343 - Downtown	WH200779	WH200776	WH200777	E 1st Ave / NE Joy St
3	343 – Transmission	WH200802	WH200801	WH200914	NE Garfield St
4	455 – LPH	WH200708	WH200709	WH200992	NW 7th Ave / NW Greeley St
5	852 – UPH	WH200237	WH200236	WH200246	NW 31st Ave / NW Sierra Dr
6	544 – Lacamas	WH200299	WH200298	WH200300	NW 46th Ave / NW Howard St
7	544 – Lacamas	WH200504	WH200503	WH200500	N Alder St / N 96th Ave
8	542 – Gregg	WH200424	WH200423	WH200425	NE Quince Way
9	695 - GME	WH200964	WH200965	WH200963	N 91st Ave
10	697 Zone	WH200860	WH200098	WH200097	NW Deerfern St / NW 14th Ave

Table 1.14 Steady State Fire Flow Calibration Summary

Test Site	Pressure Zone	Field Measured Data(1)			Model Simulated Data		Percent Difference	
		Hydrant Flow (gpm)	Hydrant Pressure (psi)		Hydrant Pressure (psi)			
			Static	Residual	Static	Residual	Static	Residual
1	343 - Downtown	1,100	116	70	116	69	<1%	2%
			115	70	115	69	<-1%	<1%
2	343 -Downtown	1,350	100	80	101	81	<-1%	-1%
			100	83	99	85	1%	2%
3	343 – Transmission	850	54	40	56	39	-3%	3%
			50	35	50	35	<-1%	<1%
4	455 – LPH	1,300	118	99	115	97	3%	2%
			134	120	134	123	<-1%	-2%
5	852 – UPH	1,190	71	64	69	62	4%	3%
			75	72	76	70	-2%	3%
6	544 – Lacamas	1,350	100	82	97	80	3%	3%
			87	66	85	68	2%	-3%
7	544 – Lacamas	1,300	104	84	104	85	<1%	<-1%
			118	101	118	100	<1%	1%
8	542 – Gregg	600	38	28	30	27	22%	4%
			35	24	34	31	3%	-31%
9	695 – GME	950	74	50	75	50	-2%	-1%
			86	62	86	61	<1%	2%
10	697 Zone	1,250	70	67	73	65	-5%	3%
			80	72	80	70	<1%	3%

As shown in Table 1.14, the comparison of model results to observed field data is within a 5 percent tolerance for nine of the fire flow calibration locations, which indicates an excellent calibration at these locations. The remaining fire flow calibration location exceeded the acceptable 10 percent tolerance. This is likely due to elevations being inaccurate in the DEM file. The area this test was conducted in was a recently developed area and it was assumed that significant grading likely lowered the ground elevation, though there was available data that could confirm this assumption. Additionally, there may have been a pipe in that was modeled as a larger diameter reducing headloss at the test location. Pipe diameters will be verified with the City, and any discrepancies will be addressed before recalibrating the model at this location. Detailed comparisons of model results to observed field data are included in Appendix 1C.

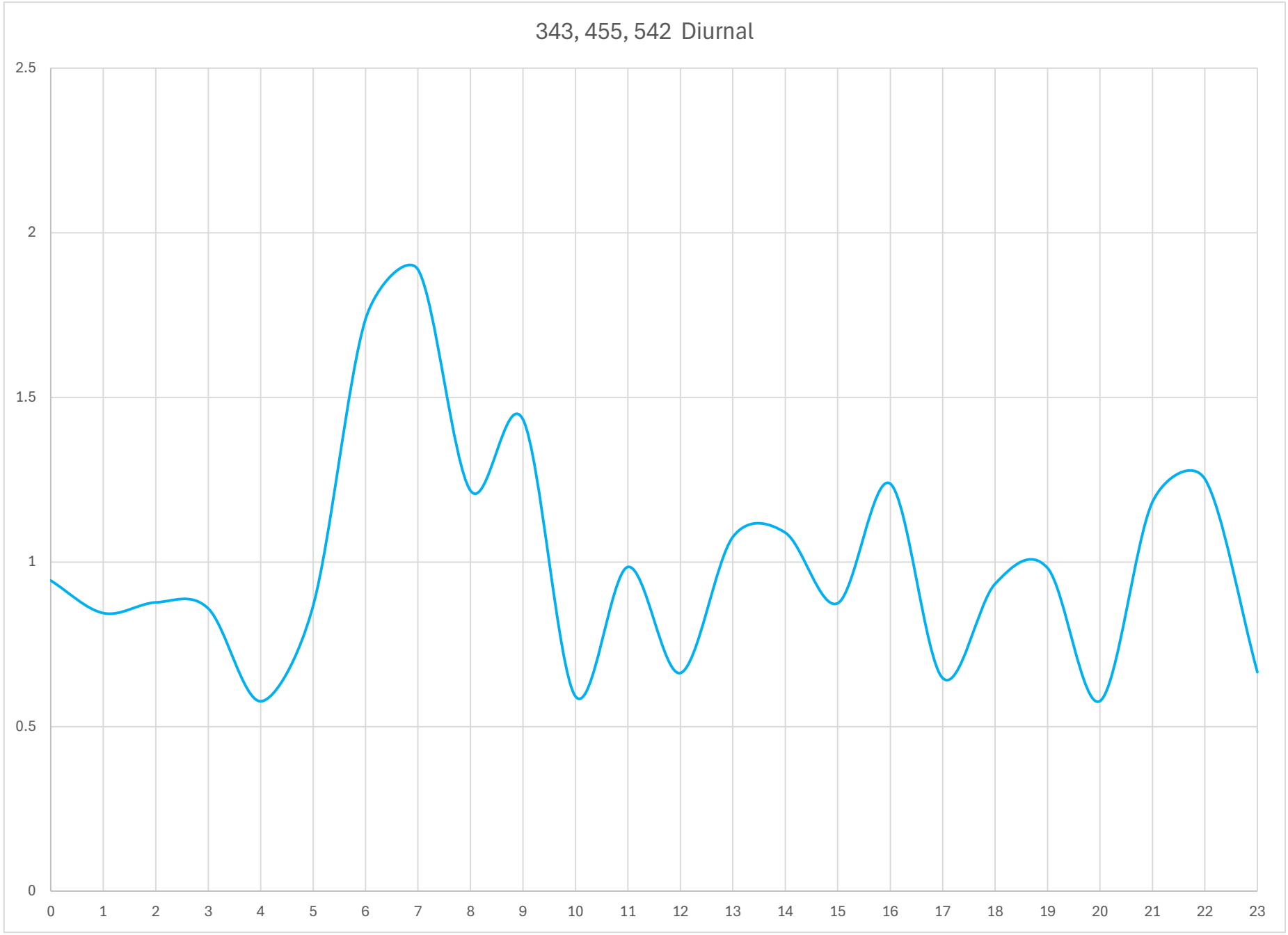
1.7 Calibration Summary

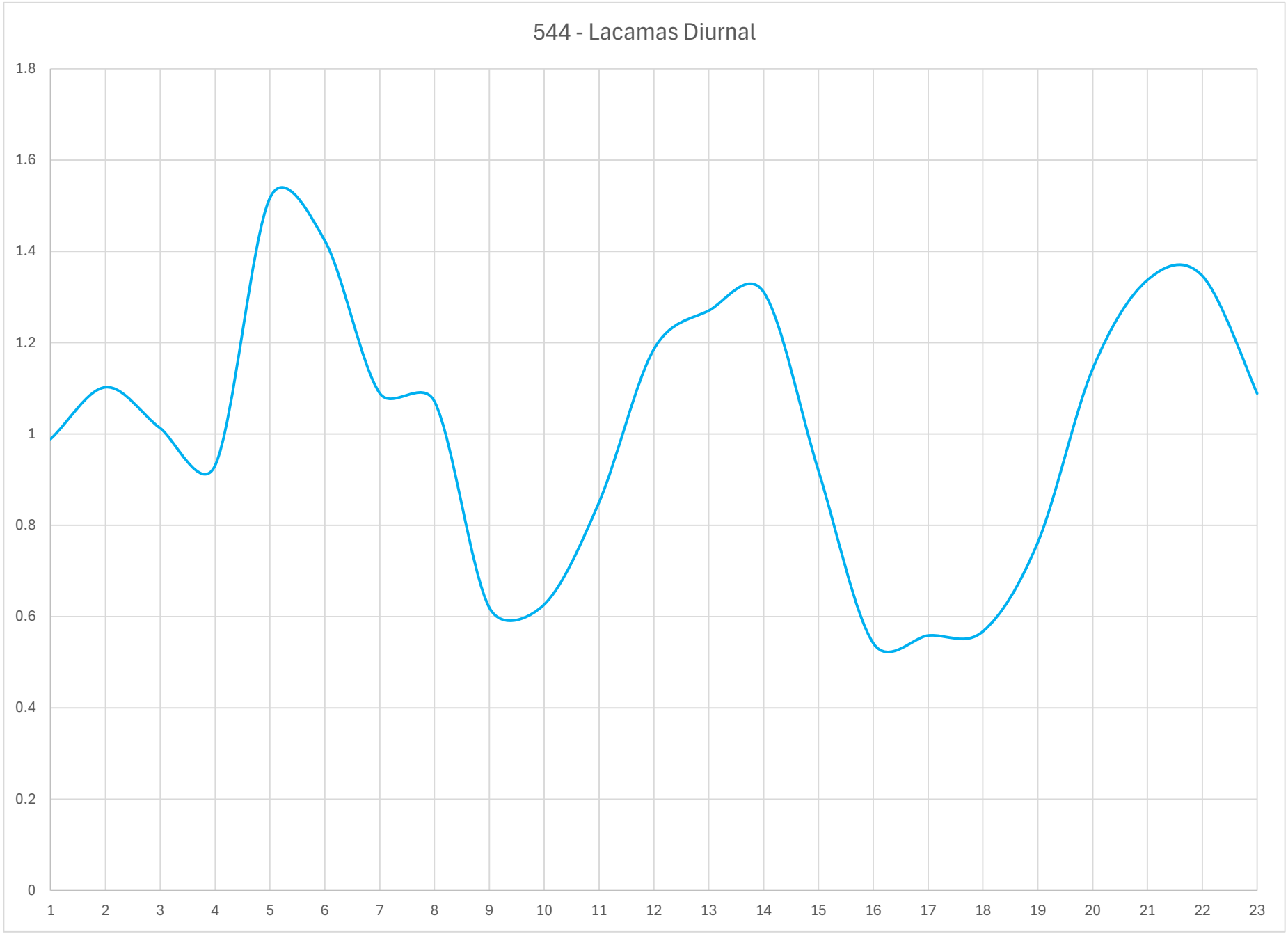
The calibration results indicate that the City's hydraulic model generally predicts conditions similar to those observed in the field.

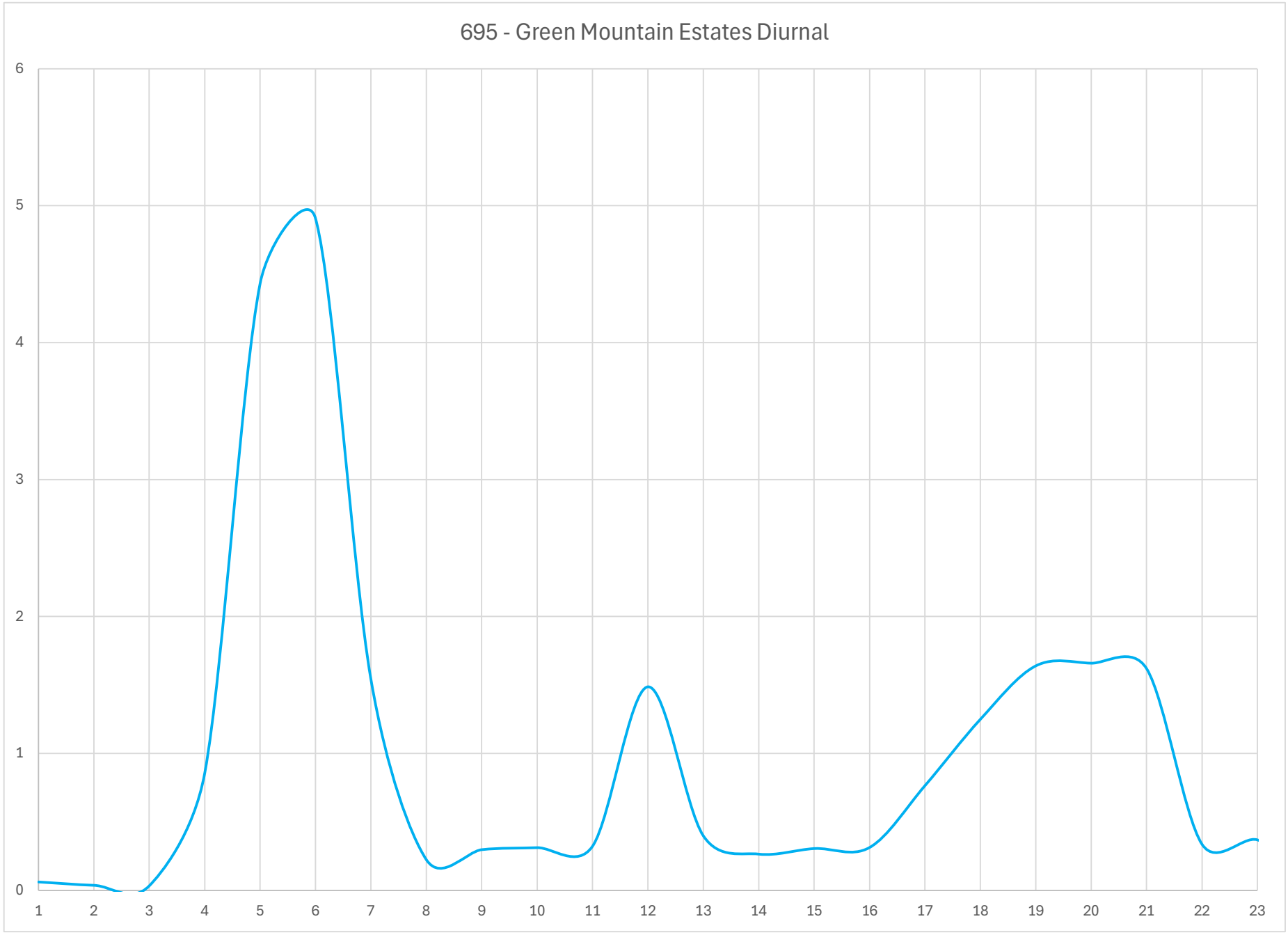
Based on the results presented in this report, it can be concluded that the model is calibrated to extended period conditions and fire flow conditions. The models provide a reliable representation of the City's distribution system and system operations to a level suitable for hydraulic system analysis.

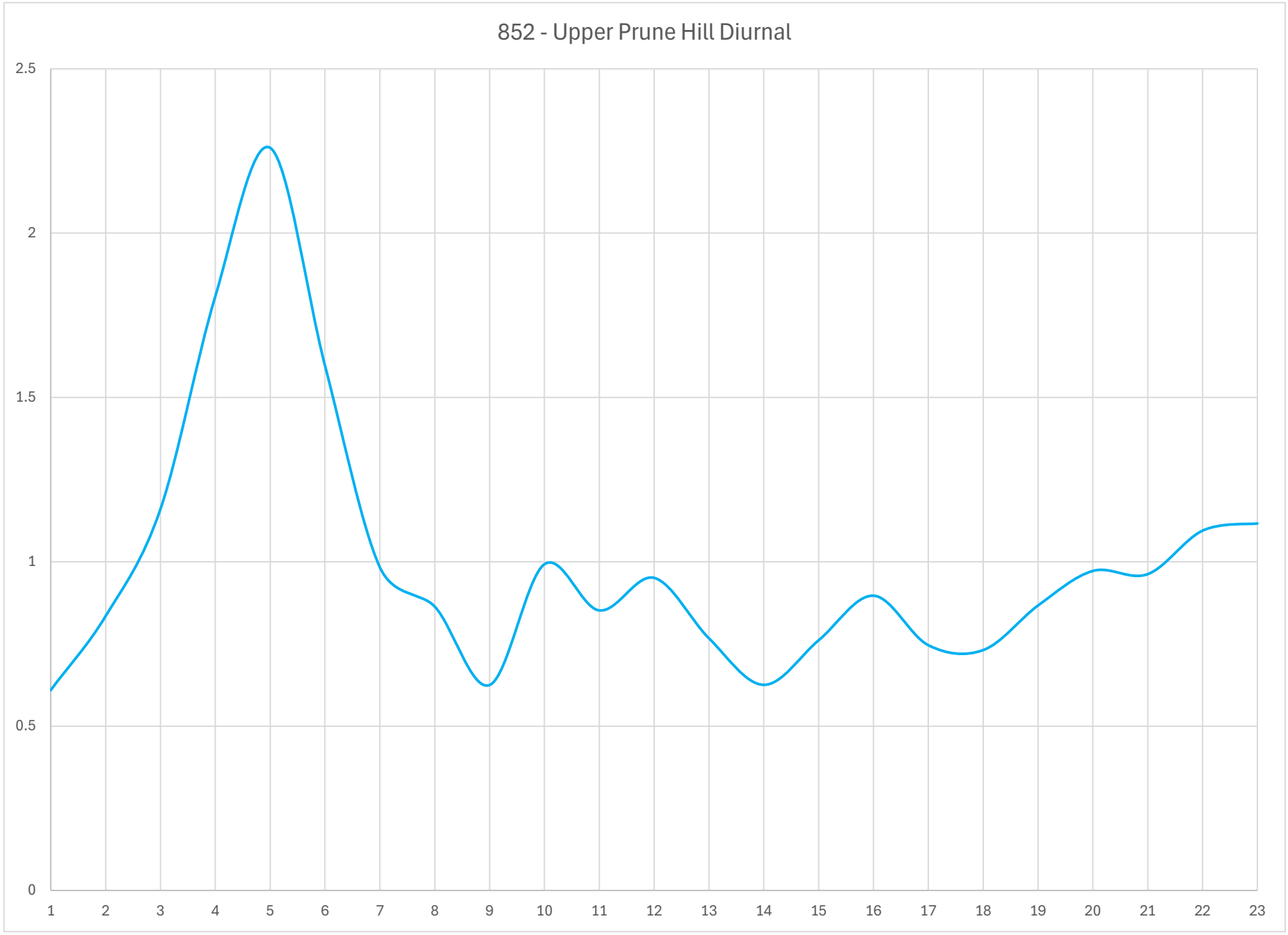
APPENDIX 1A

DIURNAL PATTERNS


343, 455, 542 Diurnal
2.5
2
1.5
1
0.5
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23


544 - Lacamas Diurnal
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23


695 - Green Mountain Estates Diurnal
6
5
4
3
2
1
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23


852 - Upper Prune Hill Diurnal
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
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16
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21
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23

APPENDIX 1B

EPS CALIBRATION

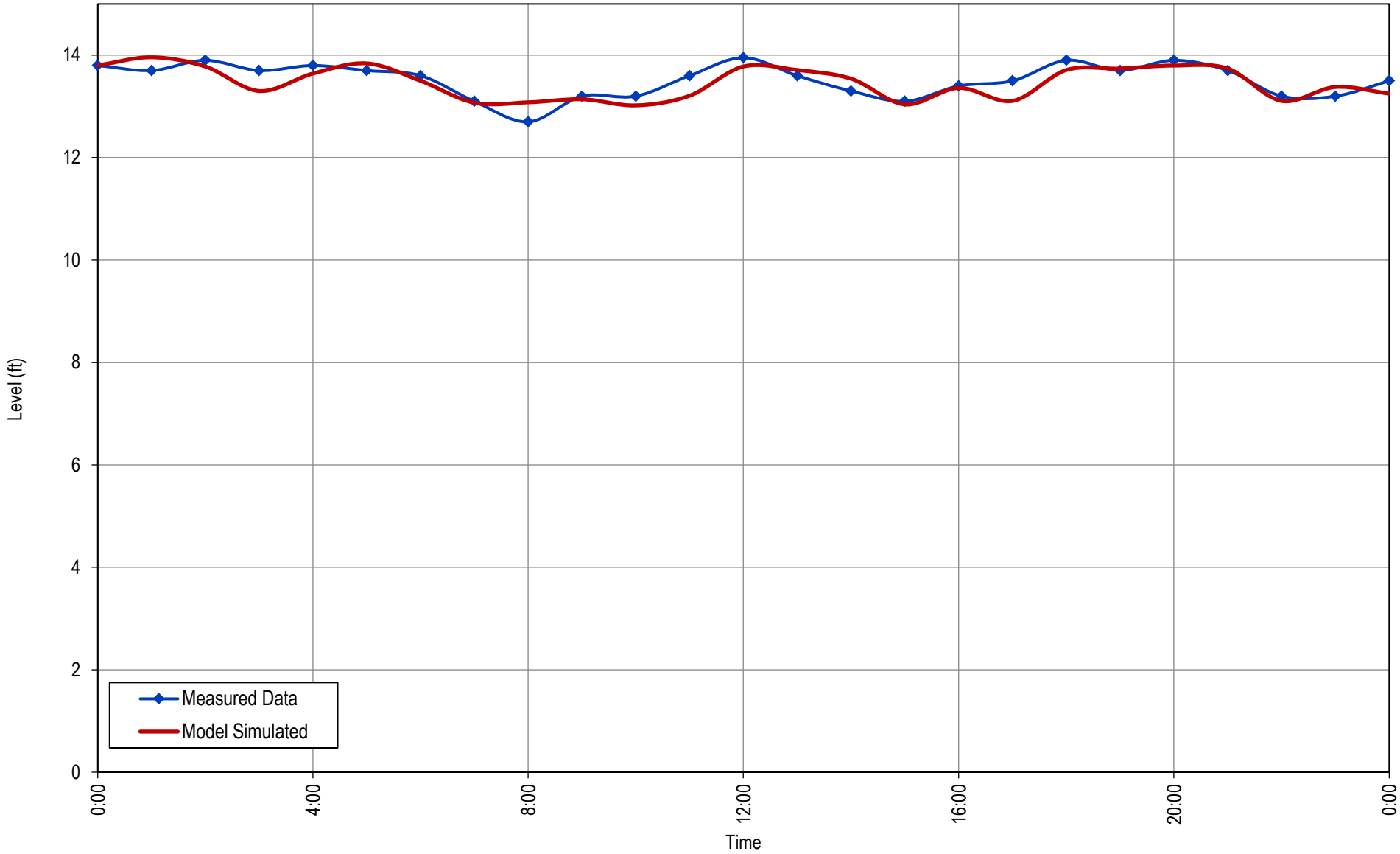
2026 Water System Plan Update
City of Camas
Project Type — Water Distribution System Model Calibration
Project Status — DRAFT
Date — SEPTEMBER 2025
SCADA Data Start Date — **10/11/2024**
Selected Calibration Day = — **10/11/2024**

#	Model Node ID	Cal Point	Units
1	BUTLER	Butler Level	ft
2	LOWER_PRUNE_RES2	Lower Prune Hill Level	ft
3	GREGG	Gregg Level	ft
4	LACAMAS	Lacamas Level	ft
5	18TH_AVE	Anderson Level (18th Ave Reservoir)	ft
6	UPPER_PRUNE_RES	Upper Prune Hill 2.4 MG Level	ft
7	UPPER_PRUNE_STD	Upper Prune Hill Standpipe Level	ft
8	P895	Lower Prune Hill BPS Flow	gpm
9	P2-865	Angelo BPS Flow	gpm
10	P1-910	Butler PRV Flow	gpm
11	P2-656	Lacamas BPS Flow	gpm
12	PS-114	Slow Sand Plant Flow	gpm
13	FCV-52	Well 5 Flow	gpm
14	FCV-62	Well 6 Flow	gpm
15	FCV-72	Well 7 Flow	gpm
16	FCV-82	Well 8 Flow	gpm
17	FCV-92	Well 9 Flow	gpm
18	V-90212	Well 10 Flow	gpm
19	V-90222	Well 11 Flow	gpm
20	V-90232	Well 12 Flow	gpm
21	FCV-42	Well 13 Flow	gpm
22	FCV-142	Well 14 Flow	gpm
23	P665	Green Mountain Estates BPS Flow	gpm
24	P893	Crown Rd BPS Flow	gpm
25	J4-805	Upper Prune Hill Discharge Pressure	psi
26	J1193	Lower Prune Hill Discharge Pressure	psi
27	J1-856	Angelo Discharge Pressure	psi
28	J1-802	Angelo Suction Pressure	psi
29	J2-216	Forest Home Discharge Pressure	psi
30	J1-144	Forest Home Suction Pressure	psi
31	J201	18th Avenue Reservoir Pressure	psi
32	J75	Butler 542 Zone Pressure	psi
33	J4-624	Lacamas Discharge Pressure	psi
34	J2-655	Lacamas Suction Pressure	psi
35	J1191	Crown Road Discharge Pressure	psi
36	J1-402	Crown Road Suction Pressure	psi
37	J355	Green Mountain Estates Suction Pressure	psi
38	J377	Green Mountain Estates Discharge Pressure	psi
39	JS-110	PIT 701 Upstream Pressure	psi
40	JS-111	PIT 702 Downstream Pressure	psi
41	J79	18th Avenue Reservoir (Logger 35)	psi
42	J1-100	Downtown (Logger 37)	psi

43	J1-58	Oak Park, across Ops Center (Logger 49)	psi
44	J1-151	Helen Baller Elementary (Logger 50)	psi
45	J3-388	Dorothy Fox Elementary (Logger 58)	psi
46	J-5062	Union HS (Logger 68)	psi
47	J4-105	Green Mountain Estates (Logger 69)	psi

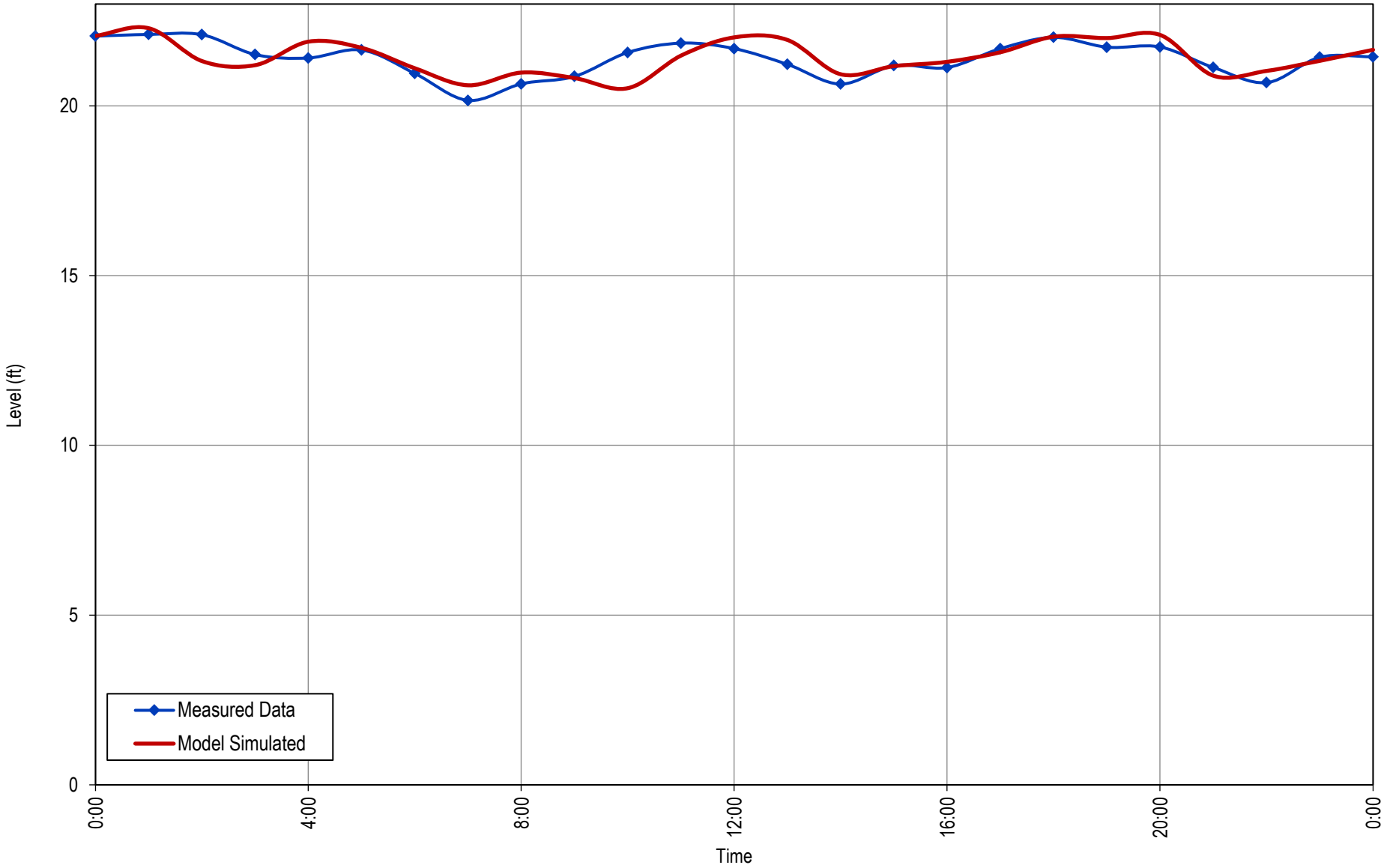
2026 Water System Plan Update

EPS CALIBRATION - BUTLER LEVEL



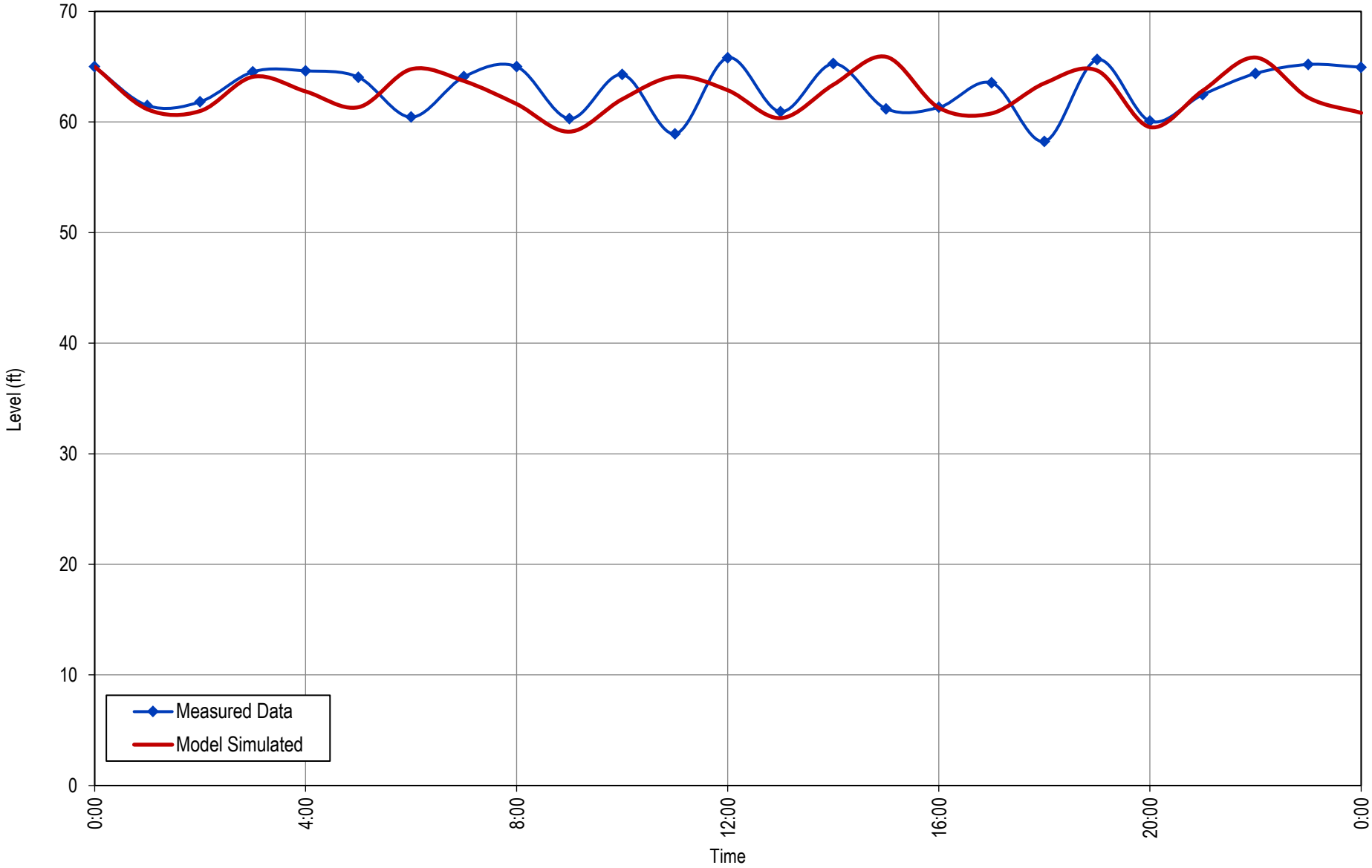
2026 Water System Plan Update

EPS CALIBRATION - LOWER PRUNE HILL LEVEL



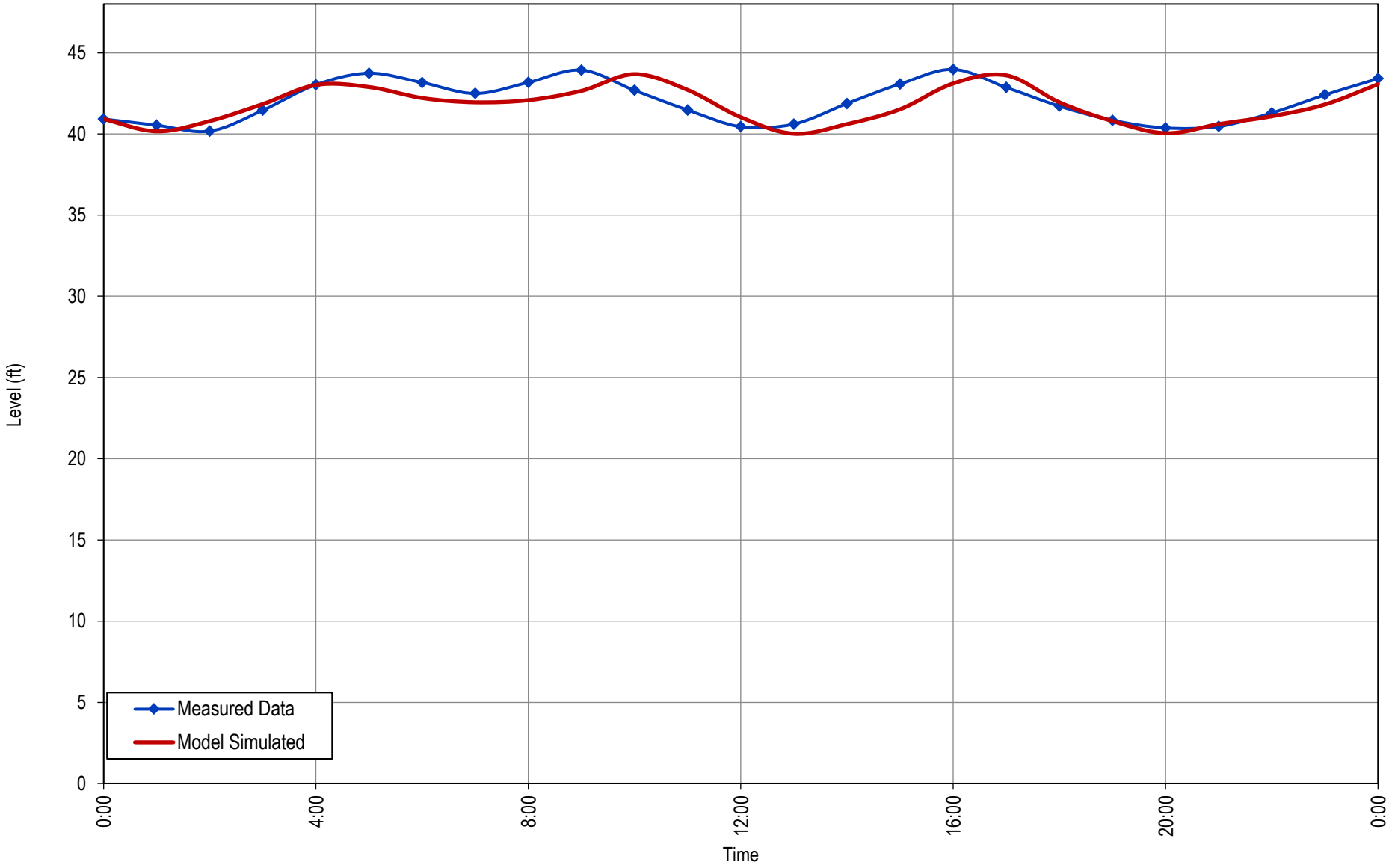
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EPS CALIBRATION - GREGG LEVEL



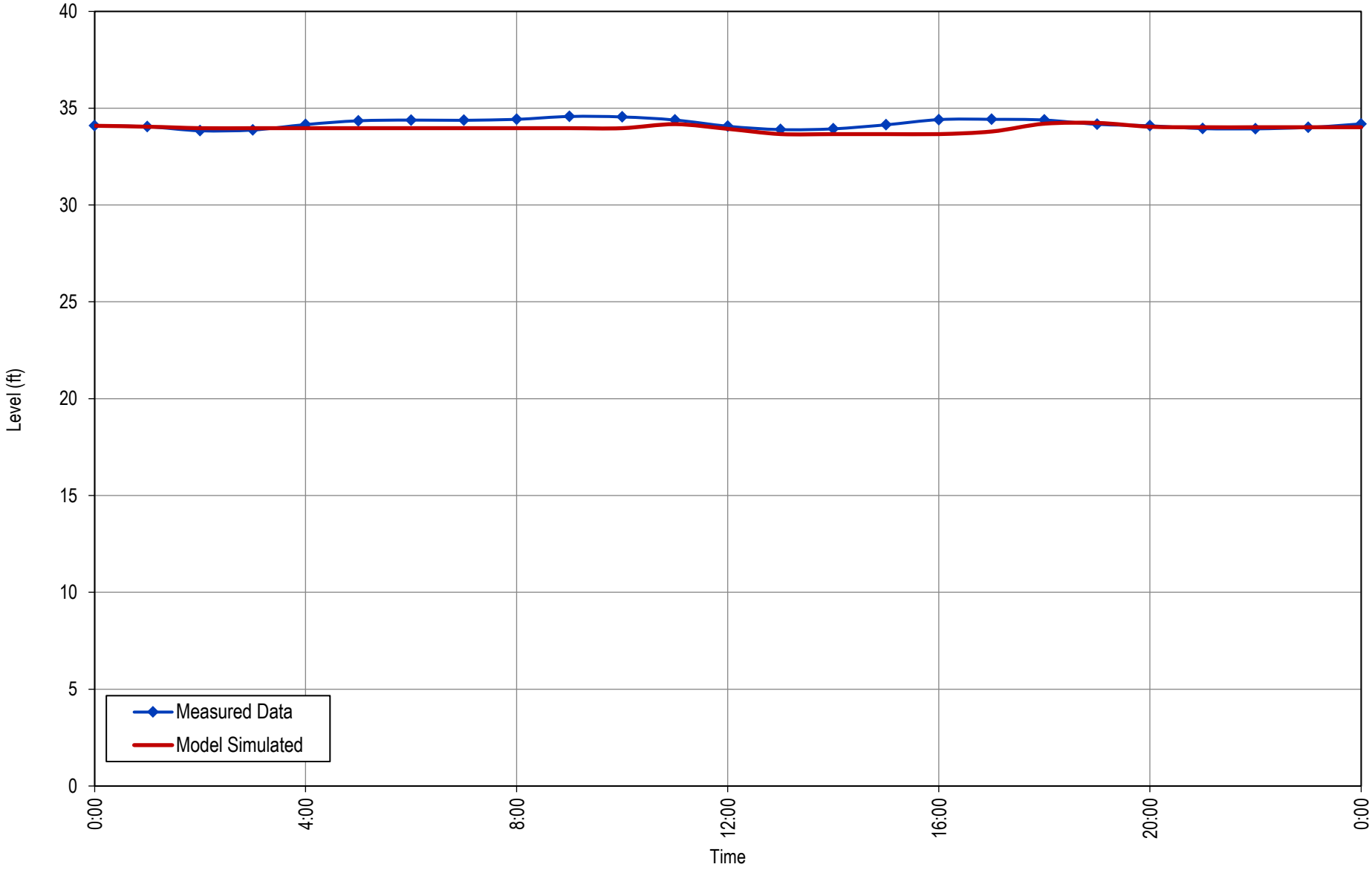
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EPS CALIBRATION - LACAMAS LEVEL



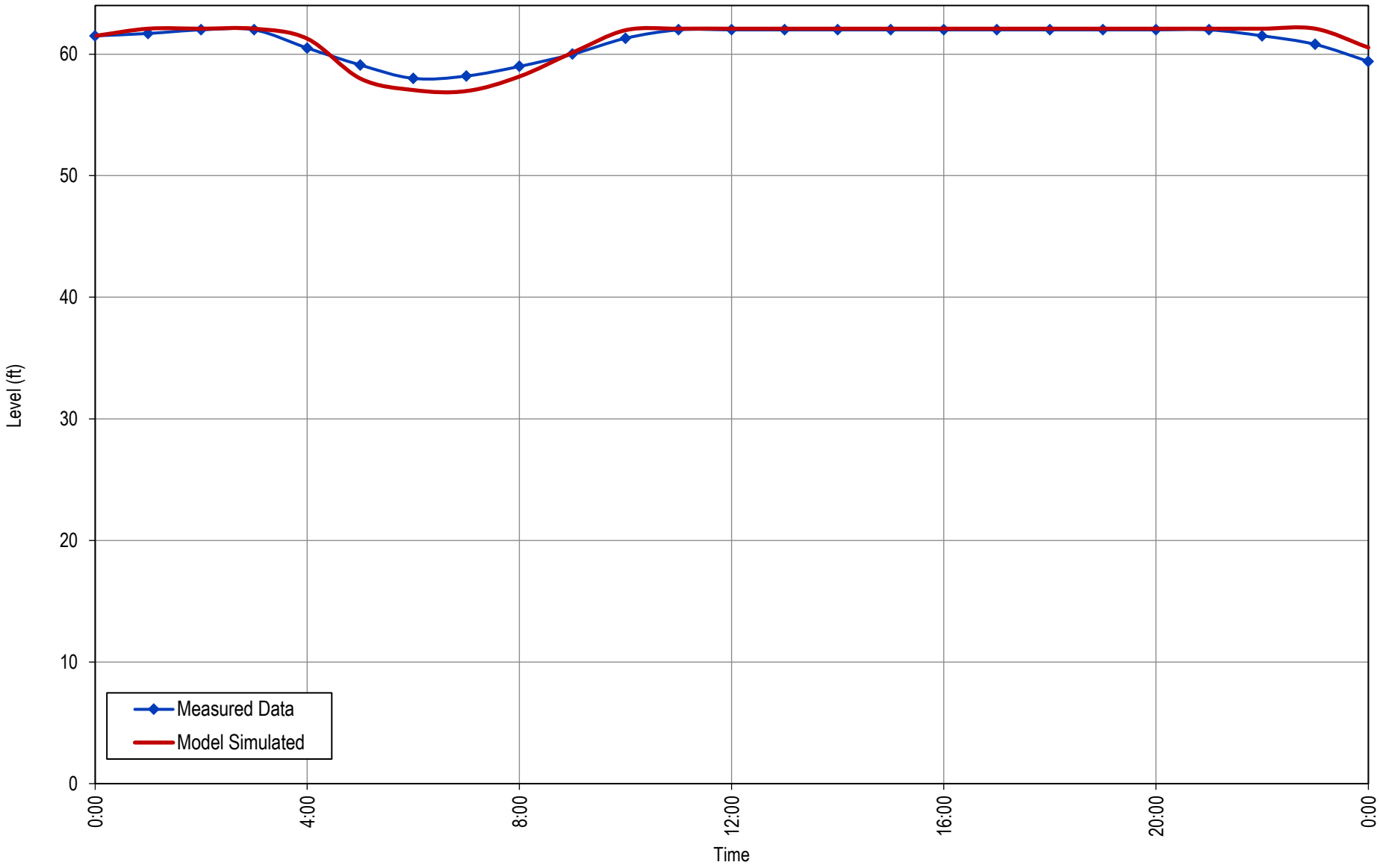
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EPS CALIBRATION - ANDERSON LEVEL (18TH AVE RESERVOIR)



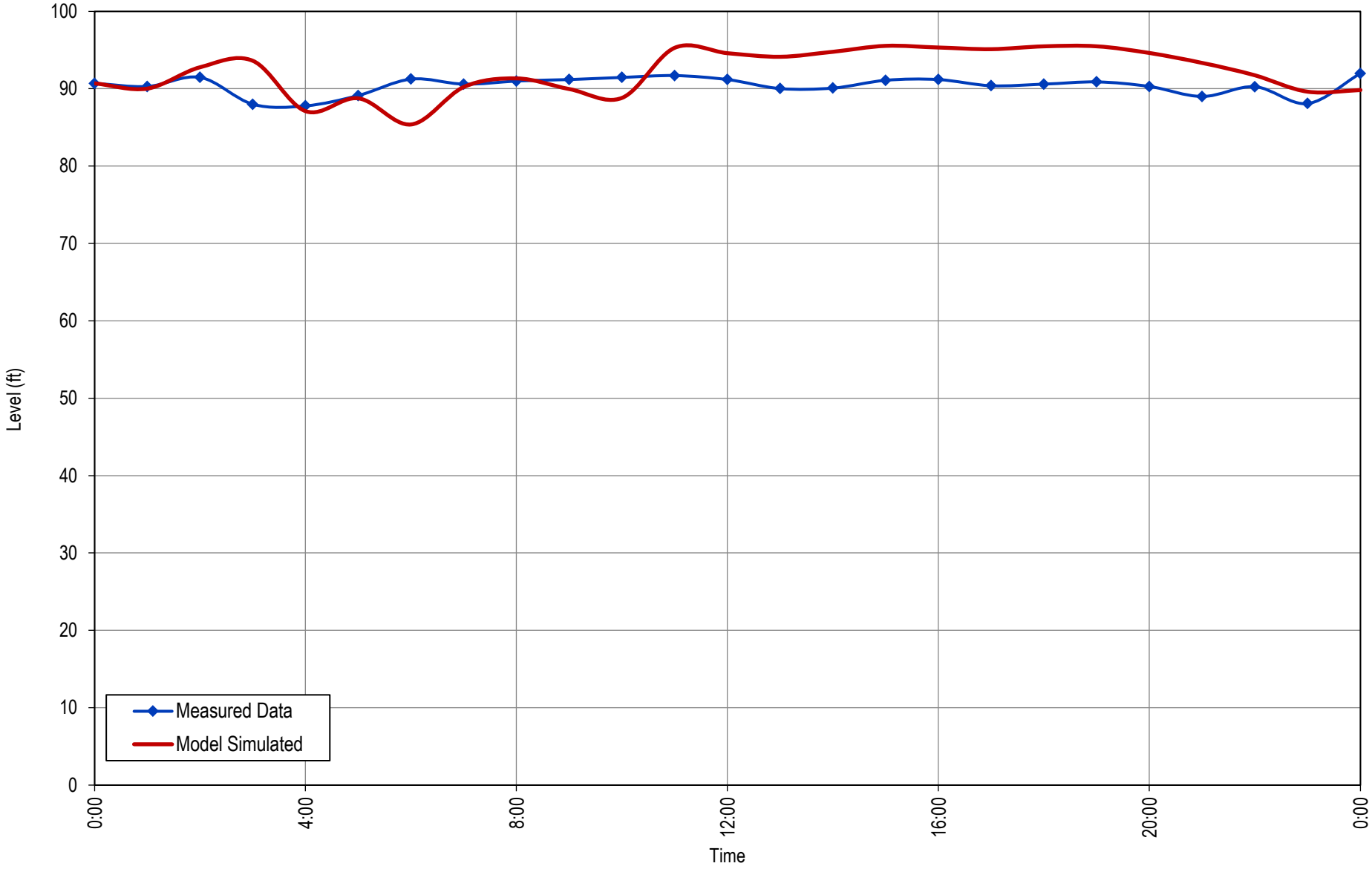
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EPS CALIBRATION - UPPER PRUNE HILL 2.4 MG LEVEL



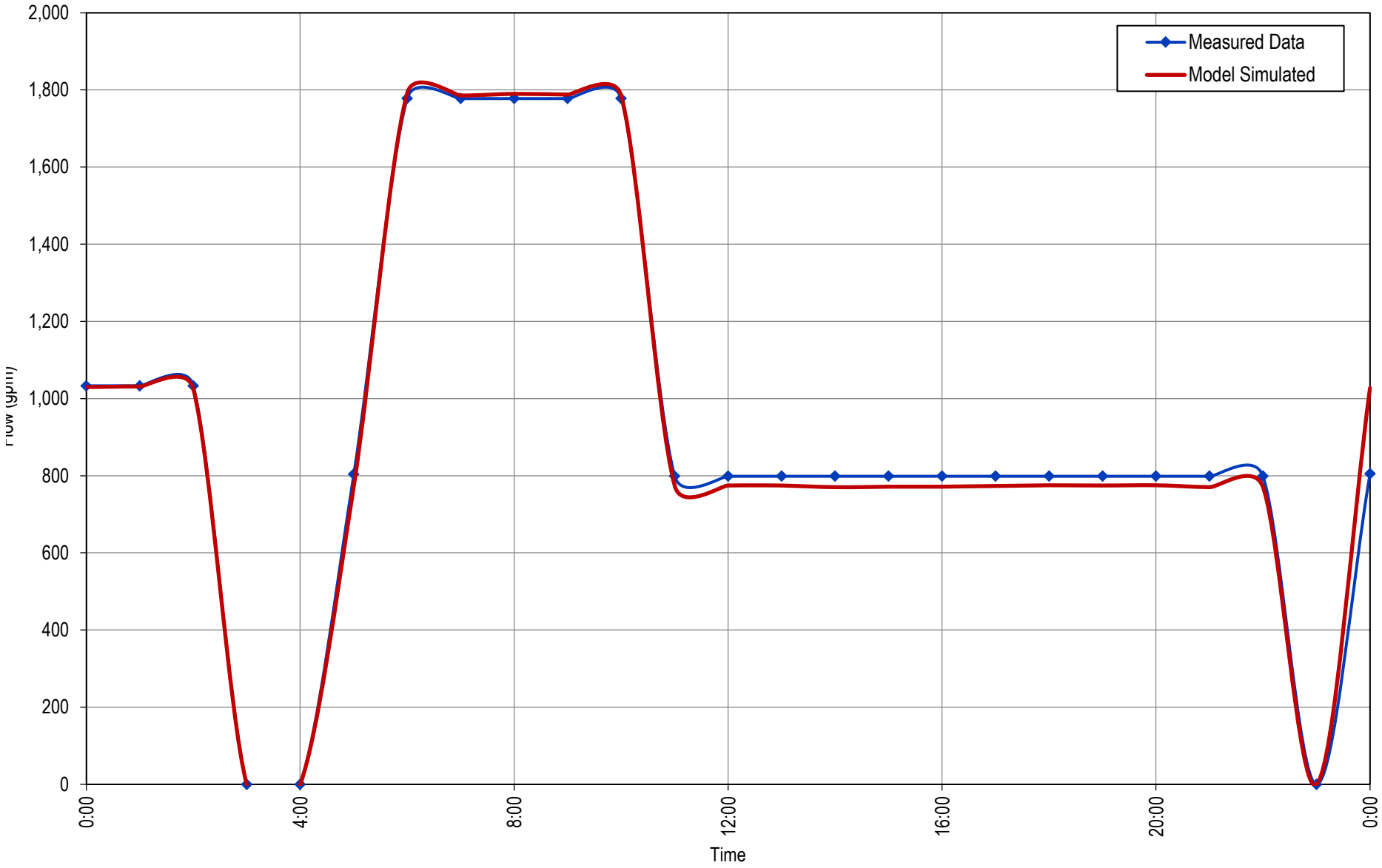
2026 Water System Plan Update

EPS CALIBRATION - UPPER PRUNE HILL STANDPIPE LEVEL



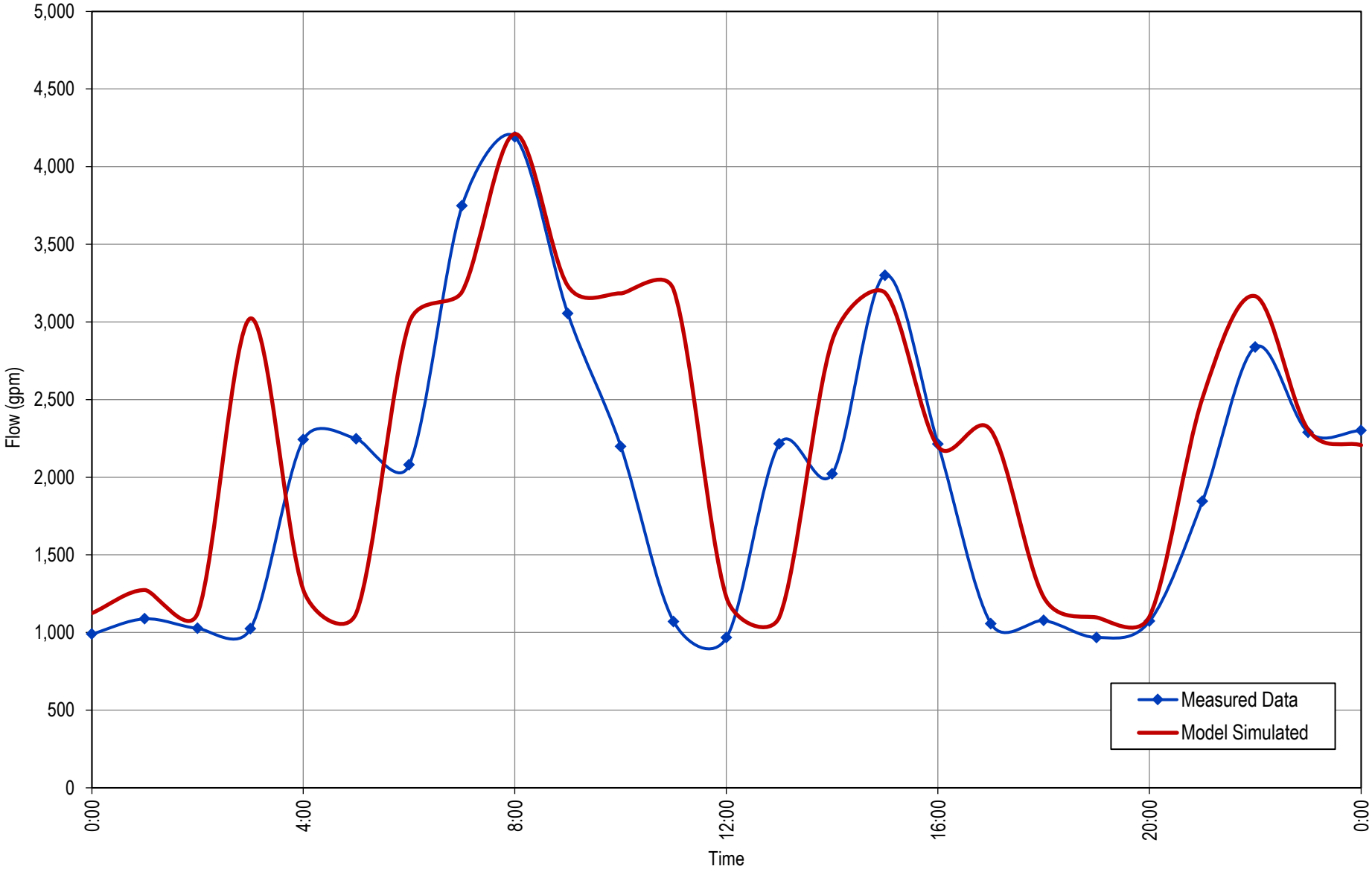
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EPS CALIBRATION - LOWER PRUNE HILL BPS FLOW



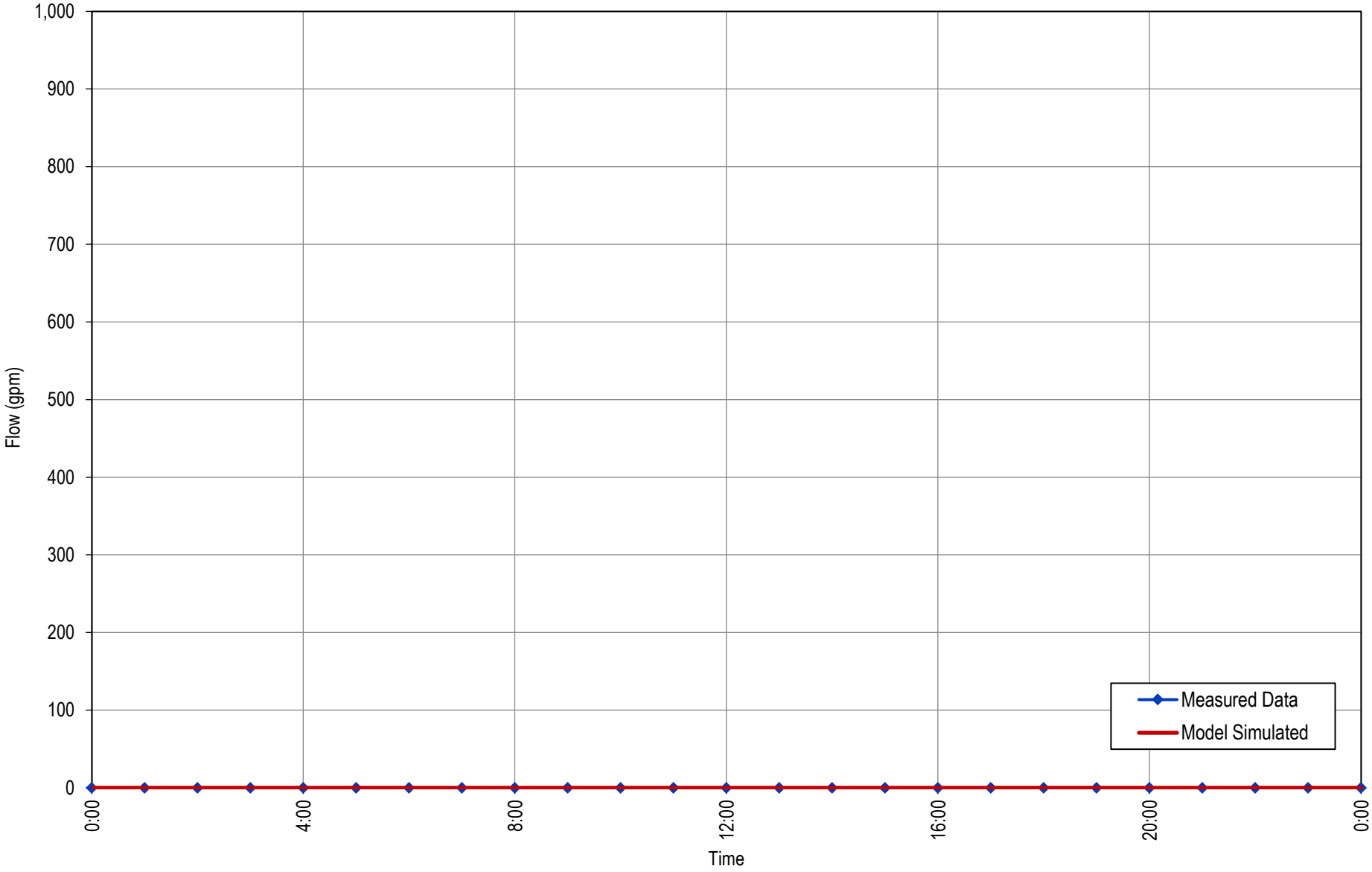
2026 Water System Plan Update

EPS CALIBRATION - ANGELO BPS FLOW



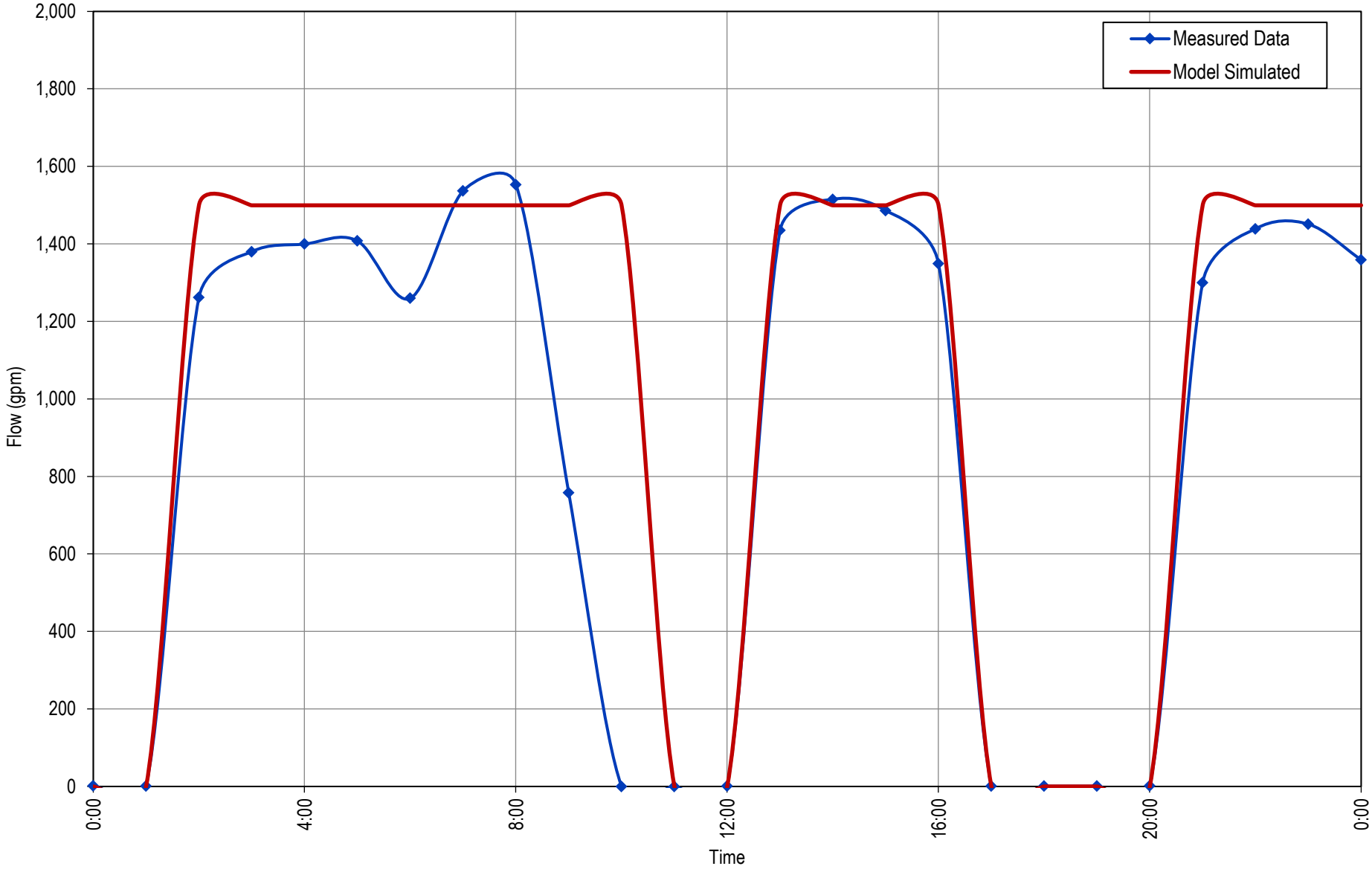
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EPS CALIBRATION - BUTLER PRV FLOW



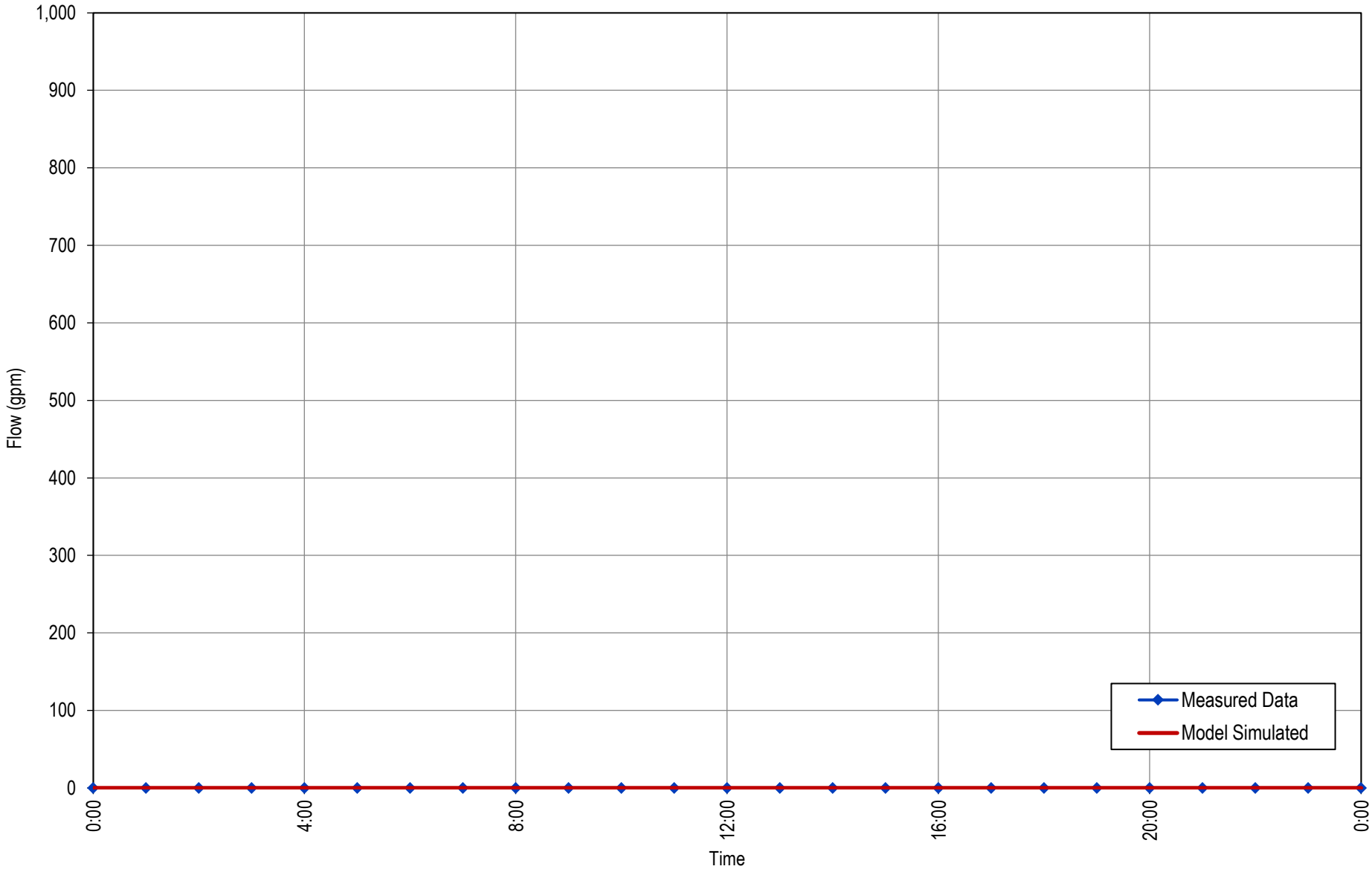
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EPS CALIBRATION - LACAMAS BPS FLOW



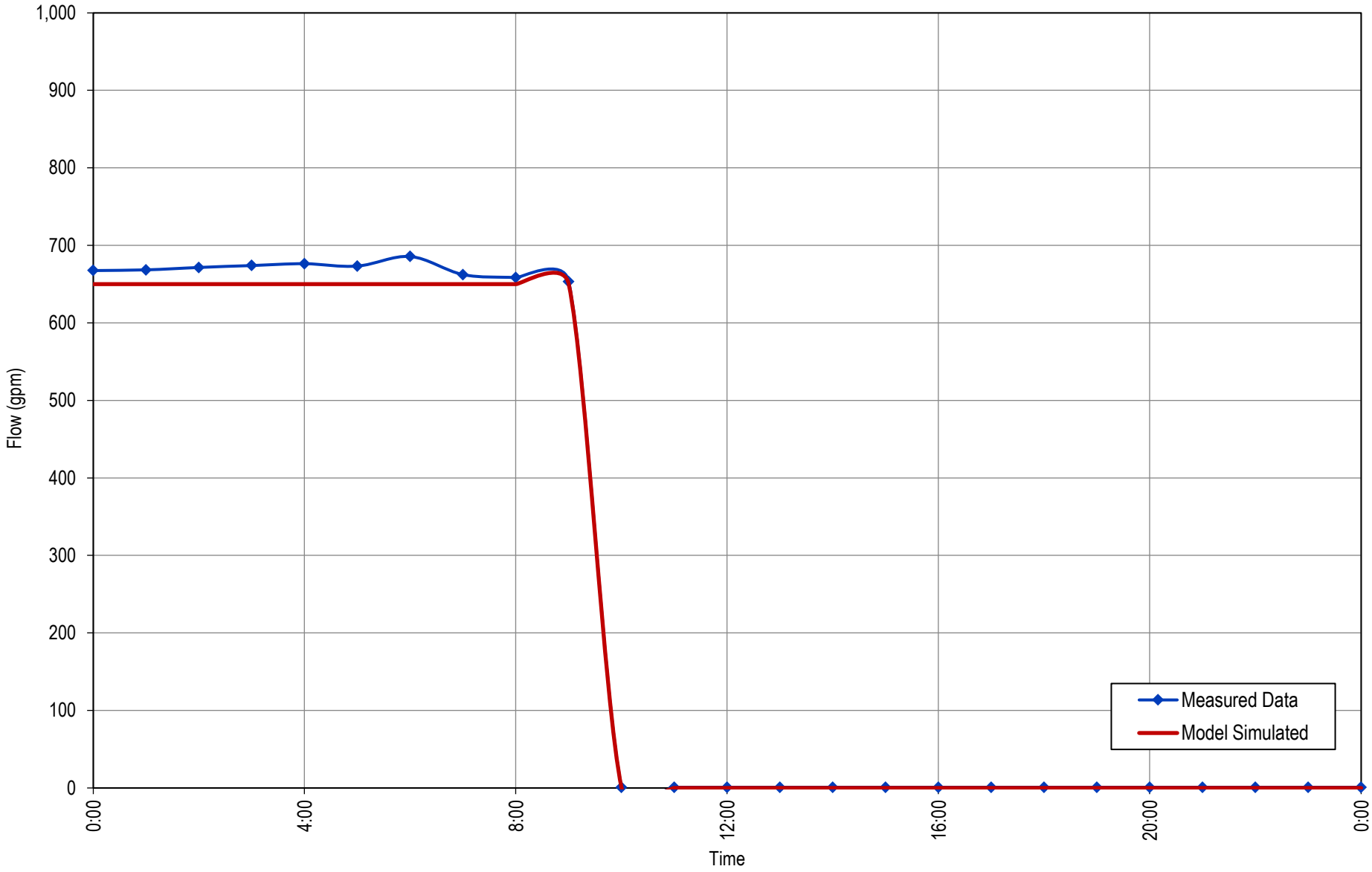
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EPS CALIBRATION - SLOW SAND PLANT FLOW



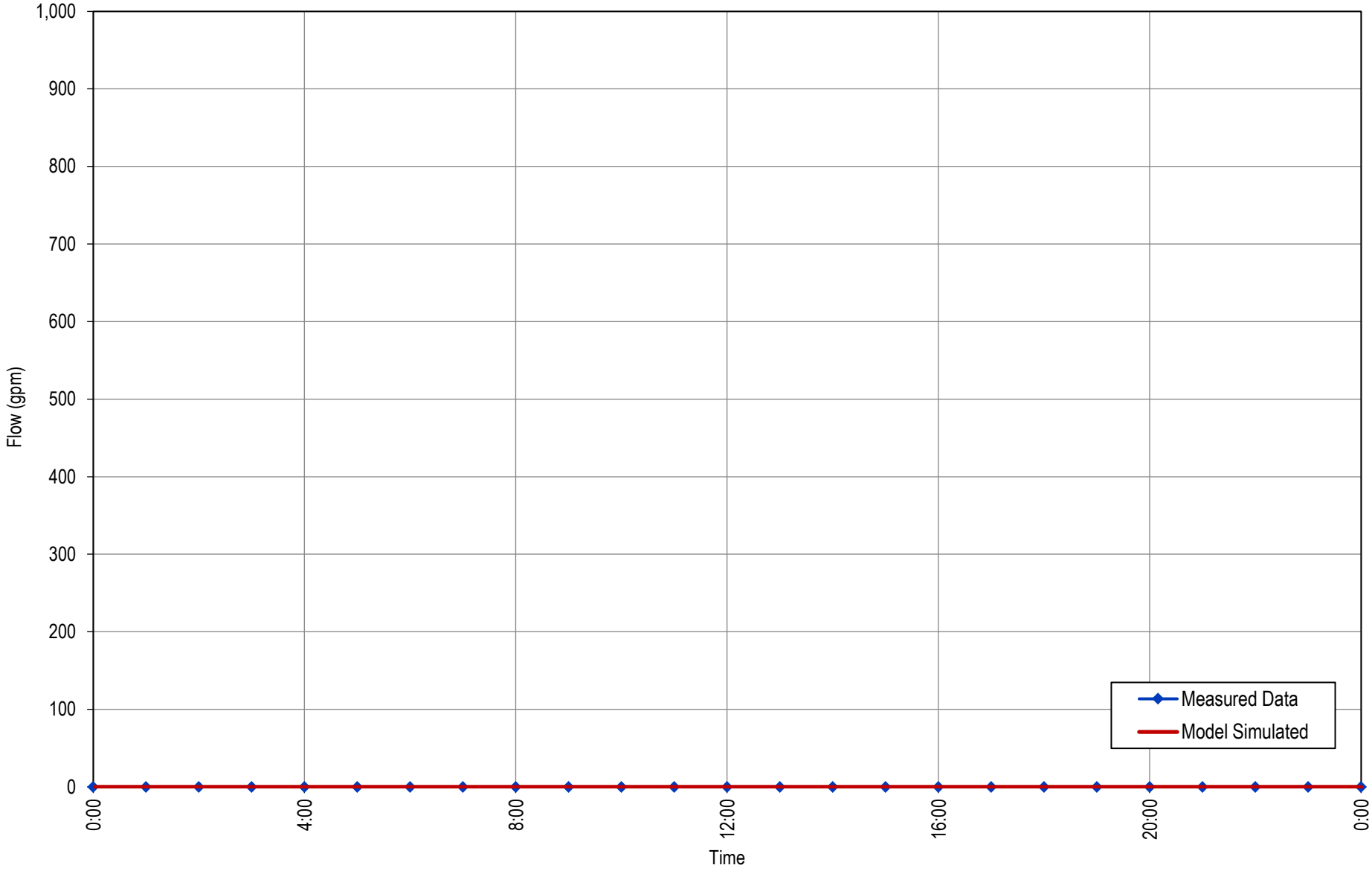
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EPS CALIBRATION - WELL 5 FLOW



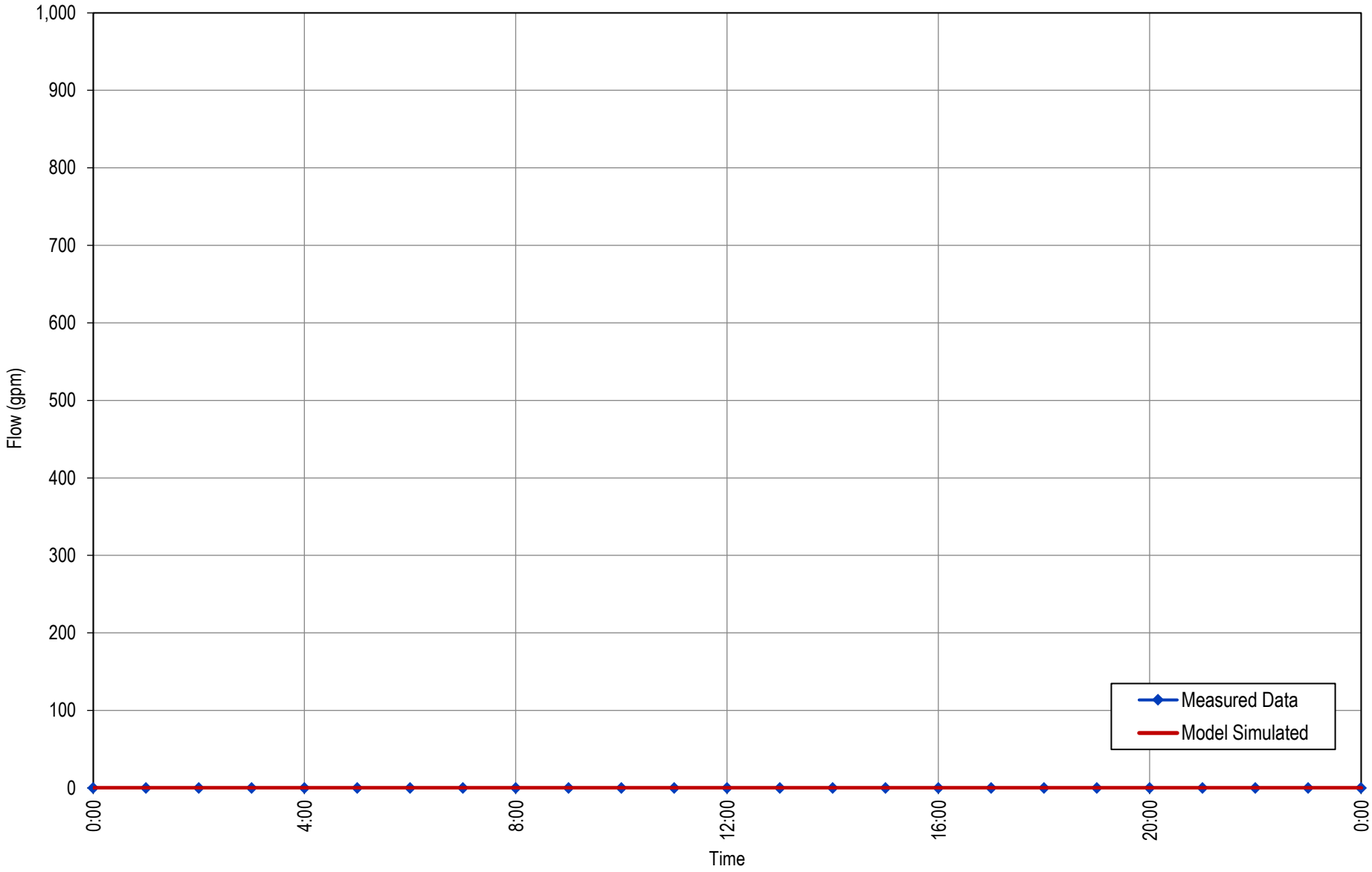
2026 Water System Plan Update

EPS CALIBRATION - WELL 6 FLOW



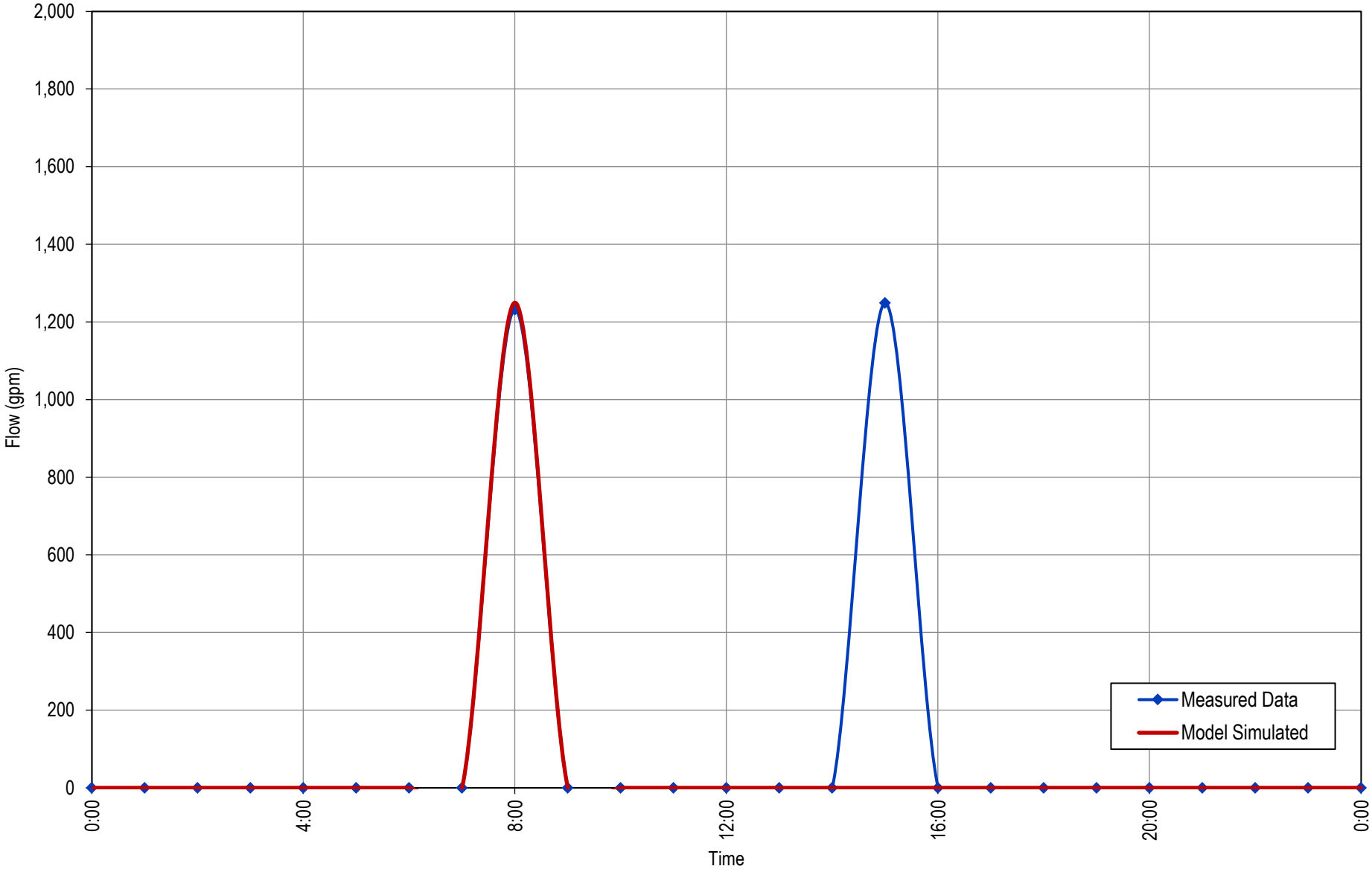
2026 Water System Plan Update

EPS CALIBRATION - WELL 7 FLOW



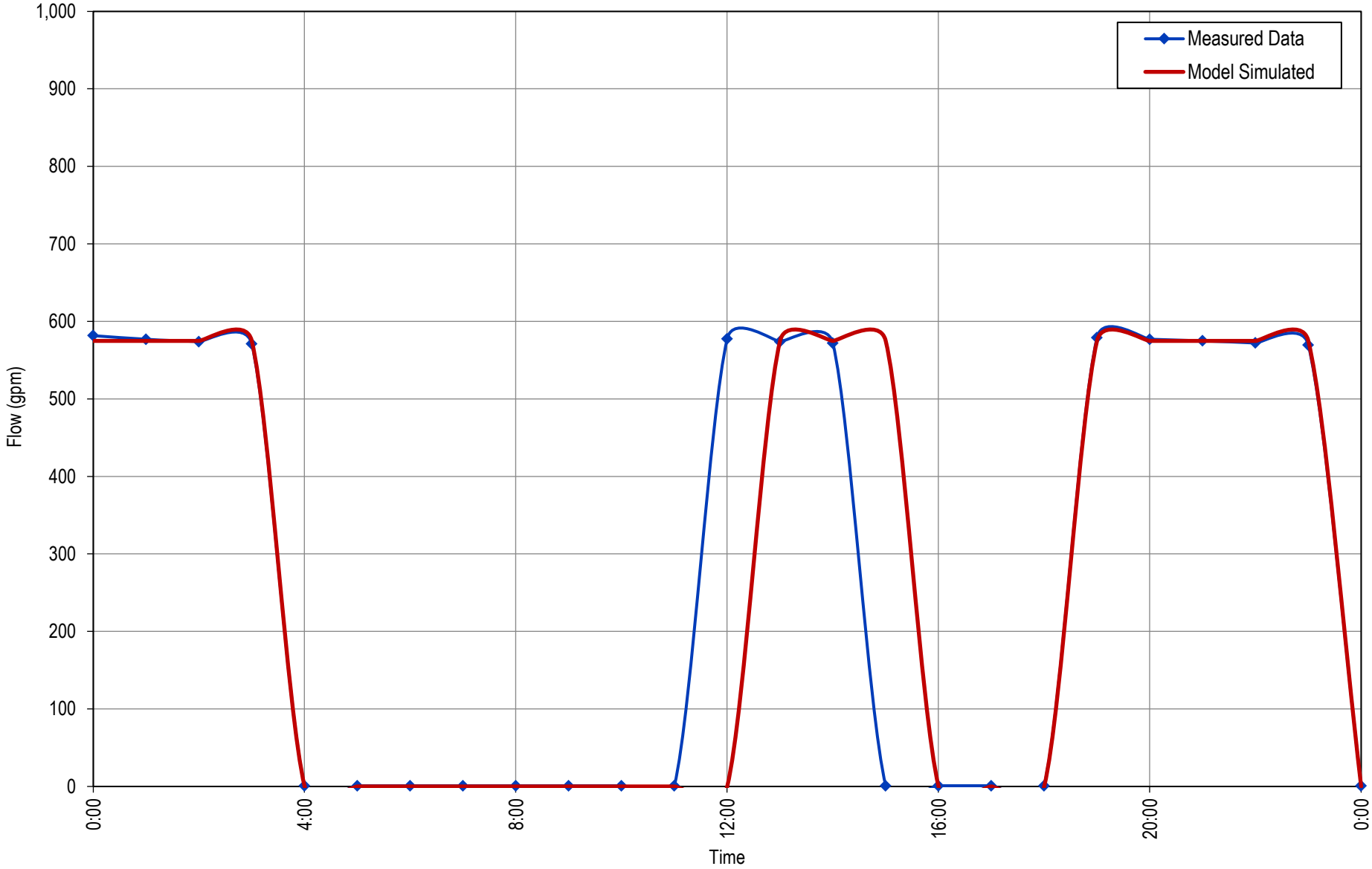
2026 Water System Plan Update

EPS CALIBRATION - WELL 8 FLOW



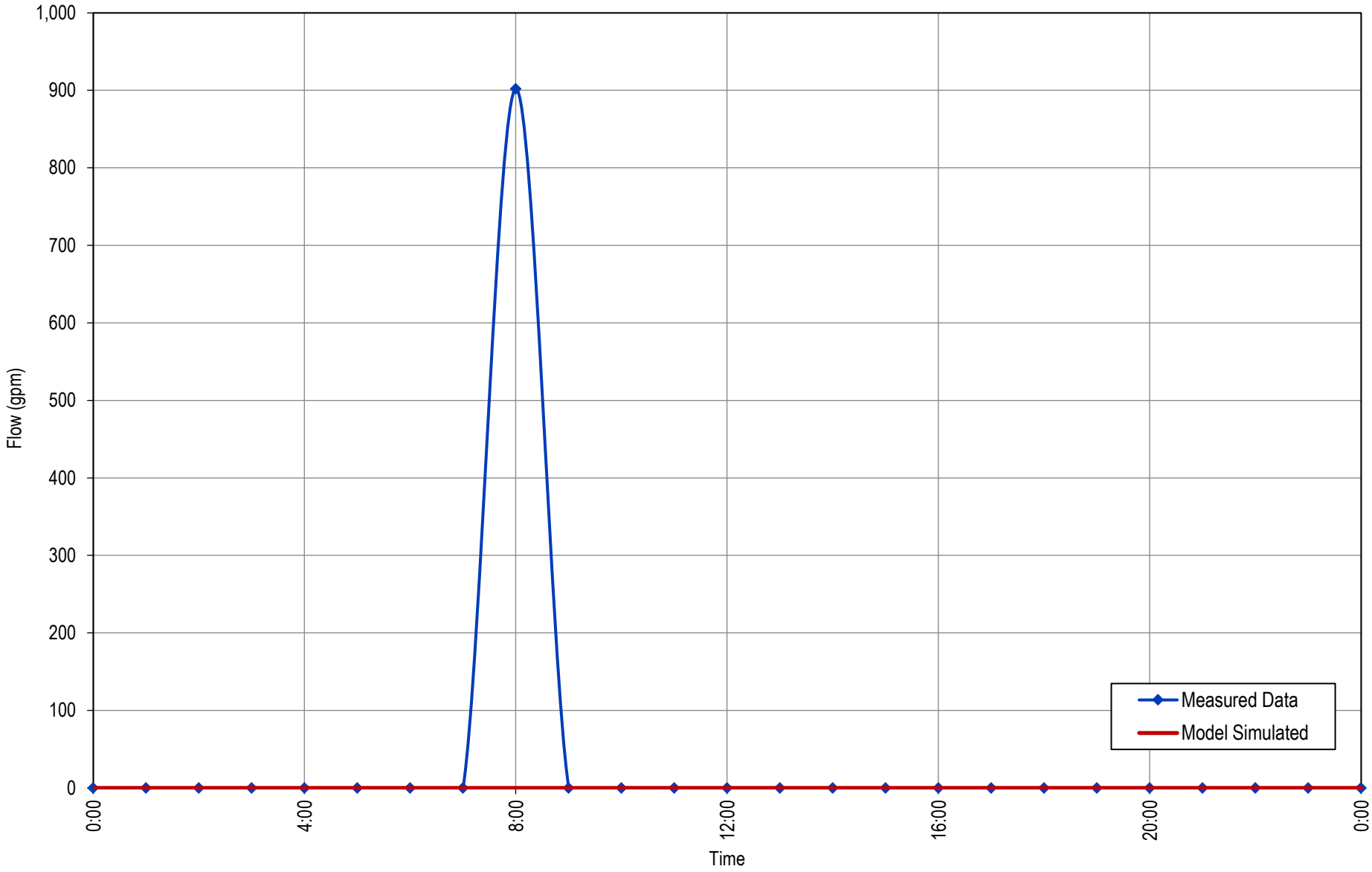
2026 Water System Plan Update

EPS CALIBRATION - WELL 9 FLOW



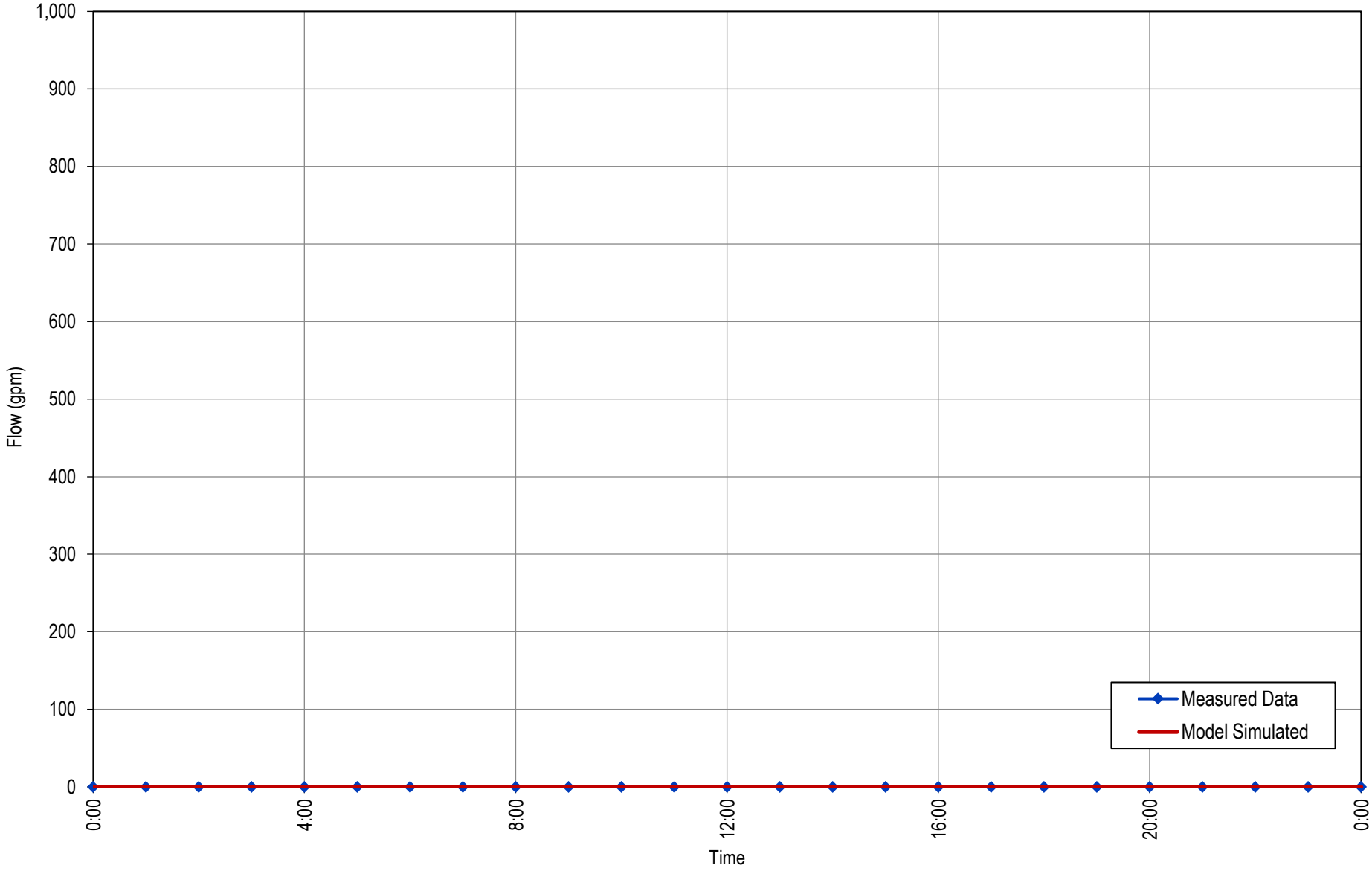
2026 Water System Plan Update

EPS CALIBRATION - WELL 10 FLOW



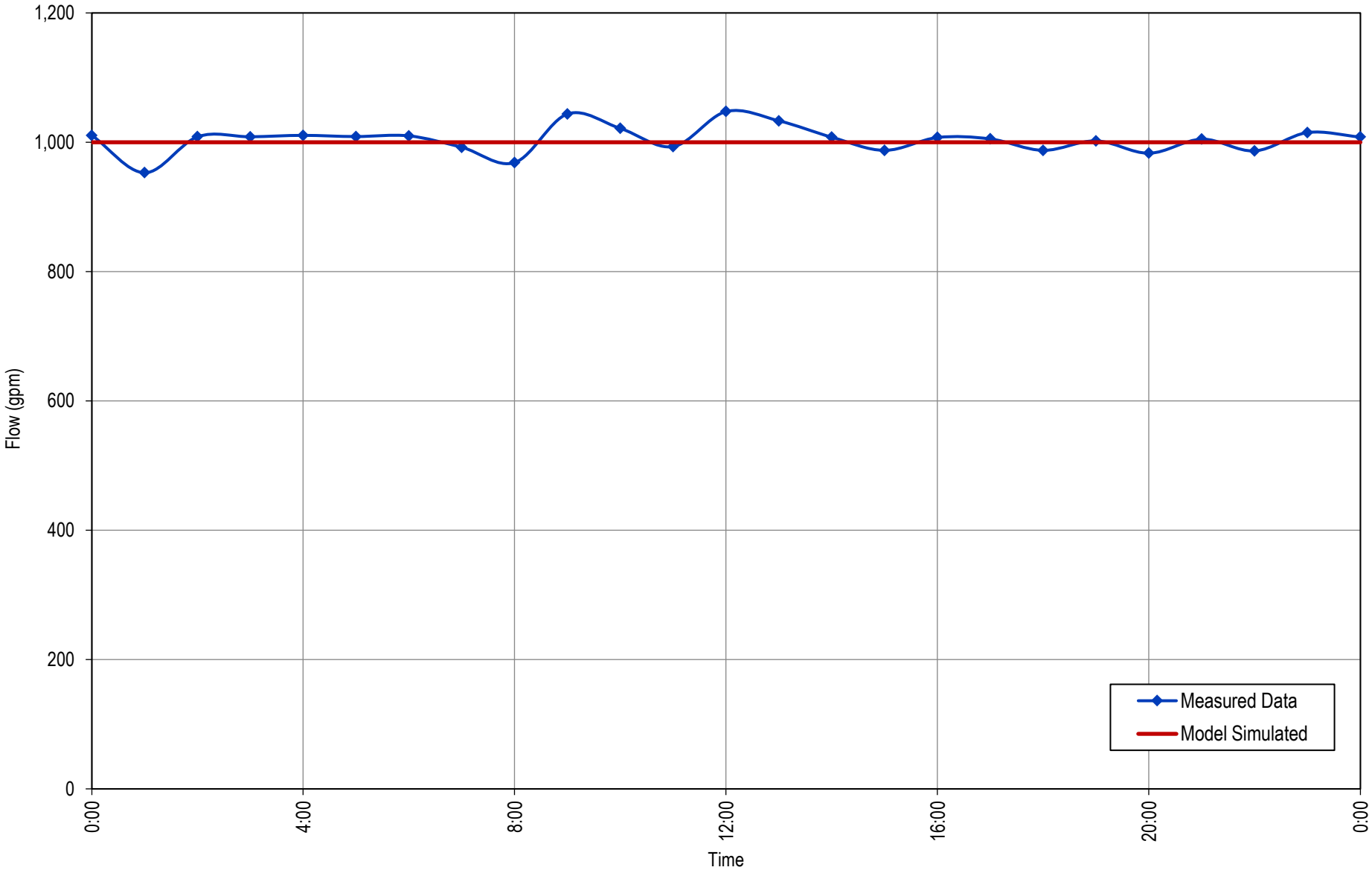
2026 Water System Plan Update

EPS CALIBRATION - WELL 11 FLOW



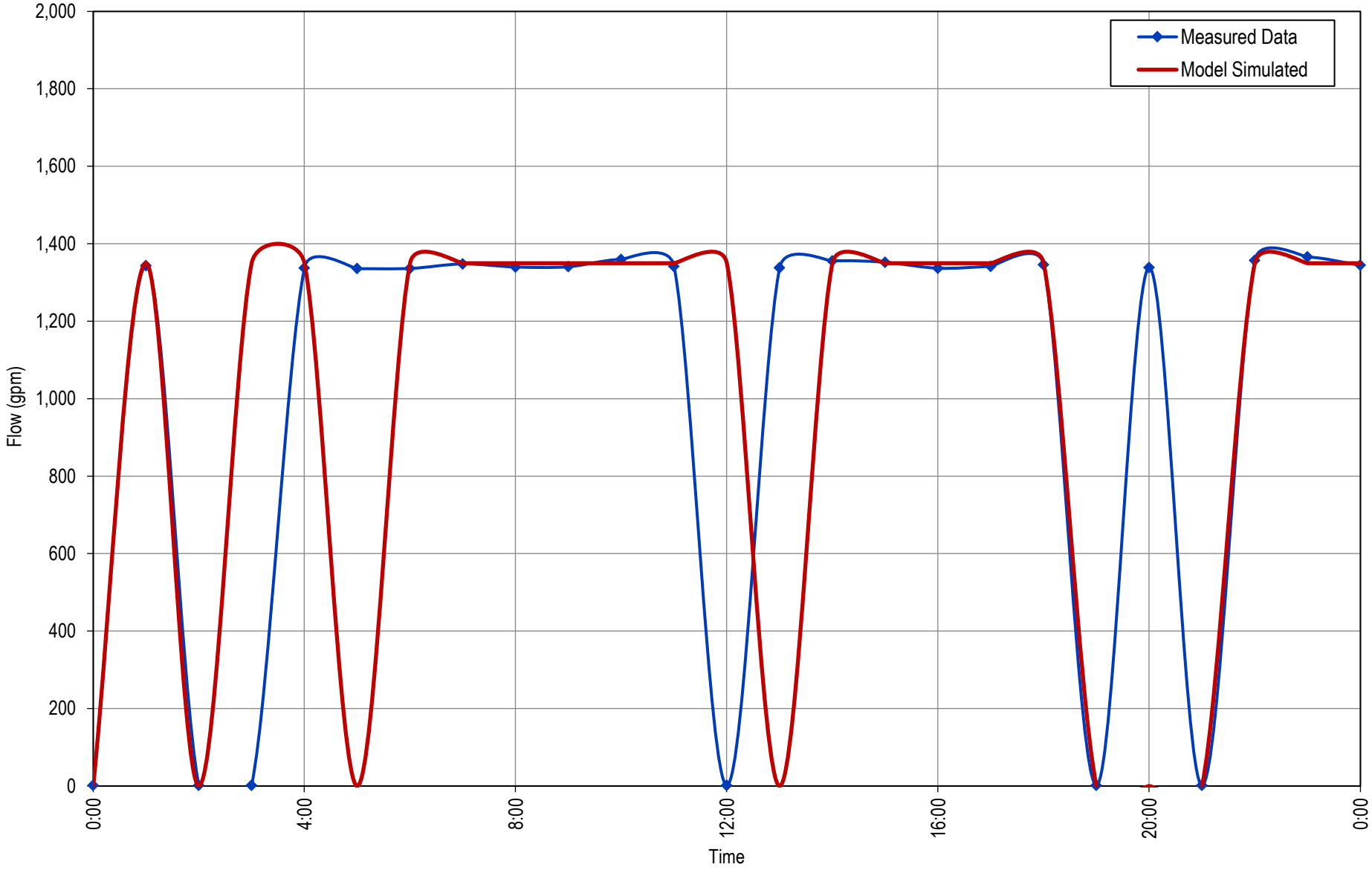
2026 Water System Plan Update

EPS CALIBRATION - WELL 12 FLOW



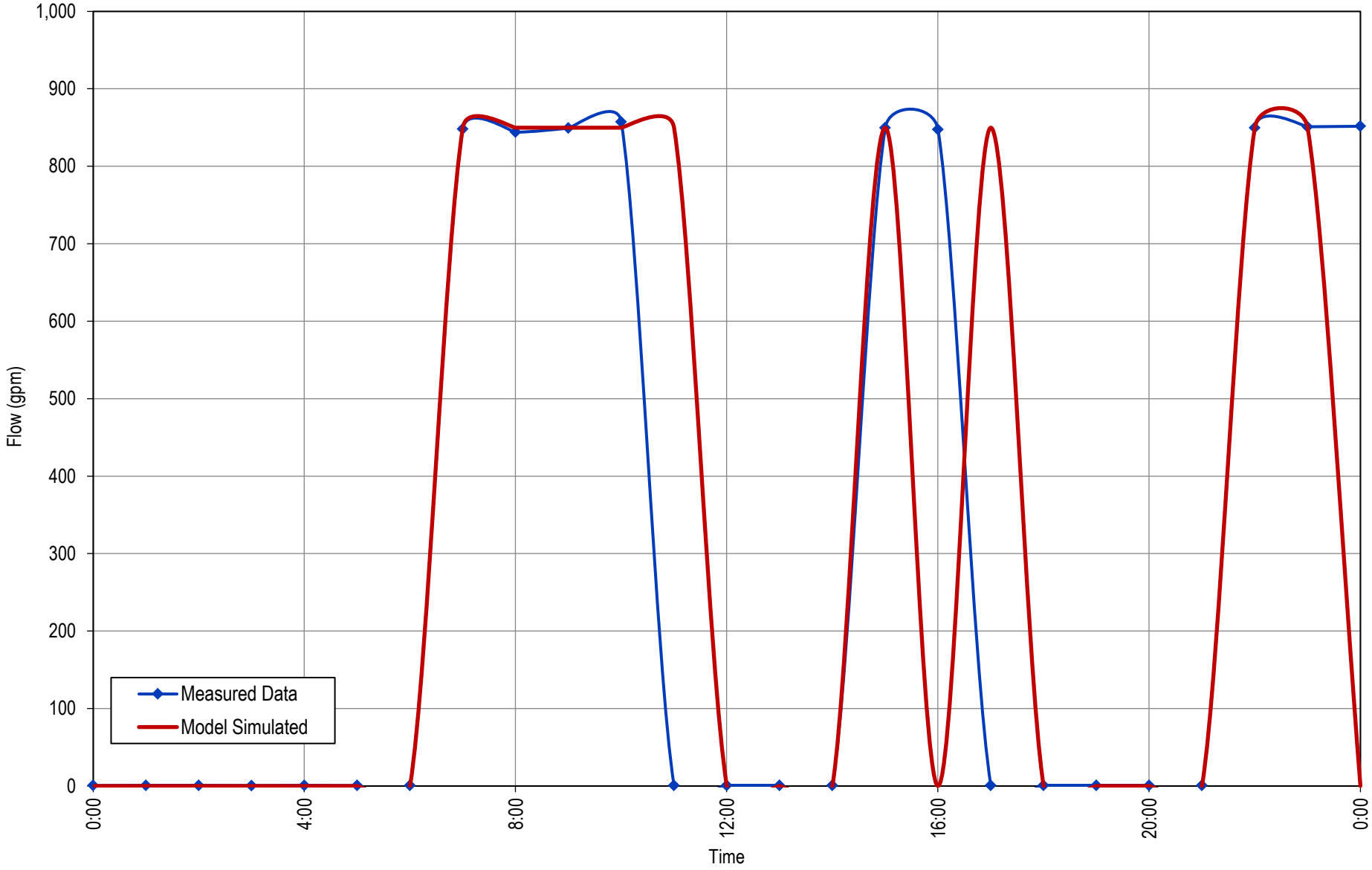
2026 Water System Plan Update

EPS CALIBRATION - WELL 13 FLOW



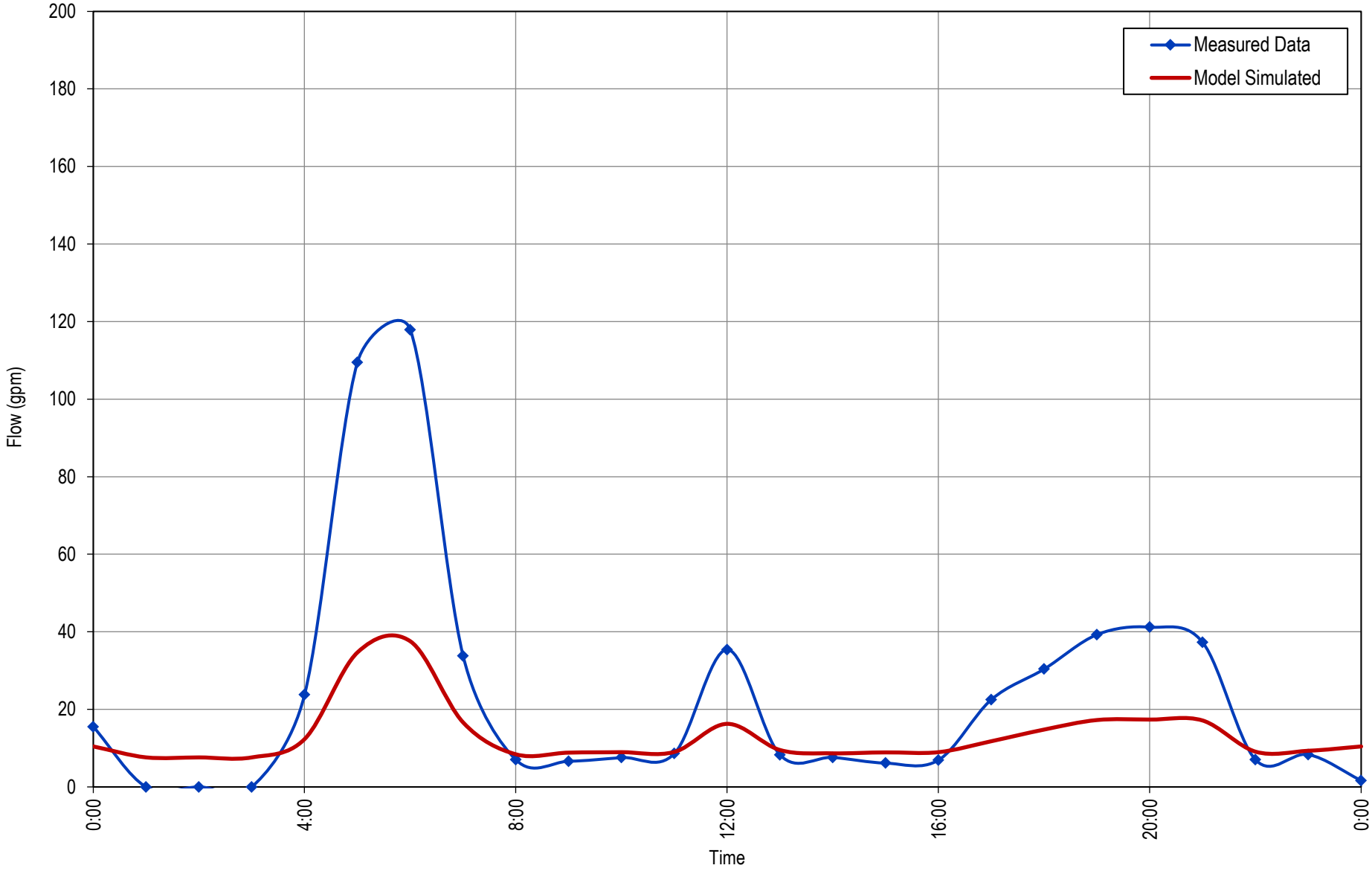
2026 Water System Plan Update

EPS CALIBRATION - WELL 14 FLOW



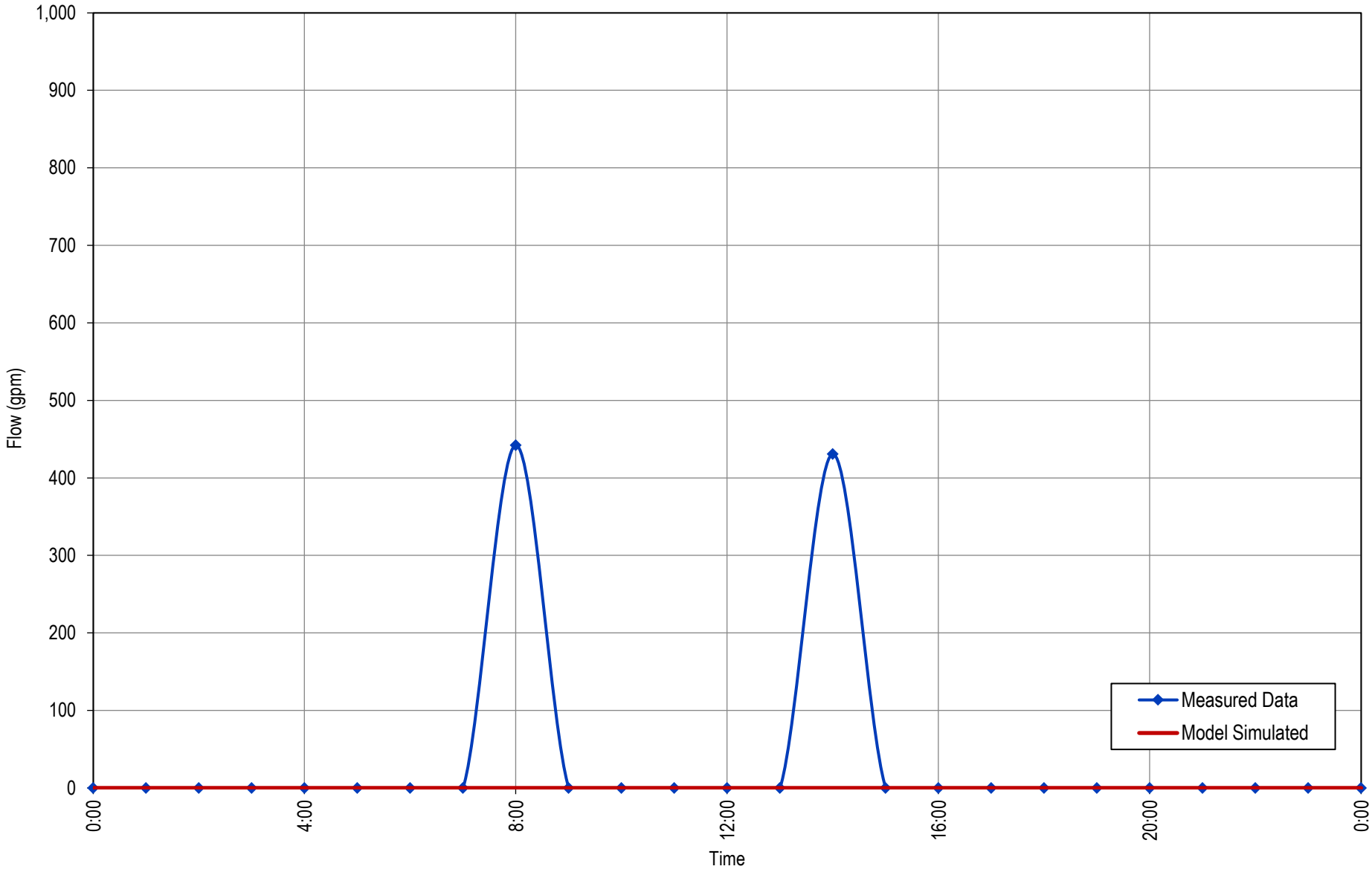
2026 Water System Plan Update

EPS CALIBRATION - GREEN MOUNTAIN ESTATES BPS FLOW



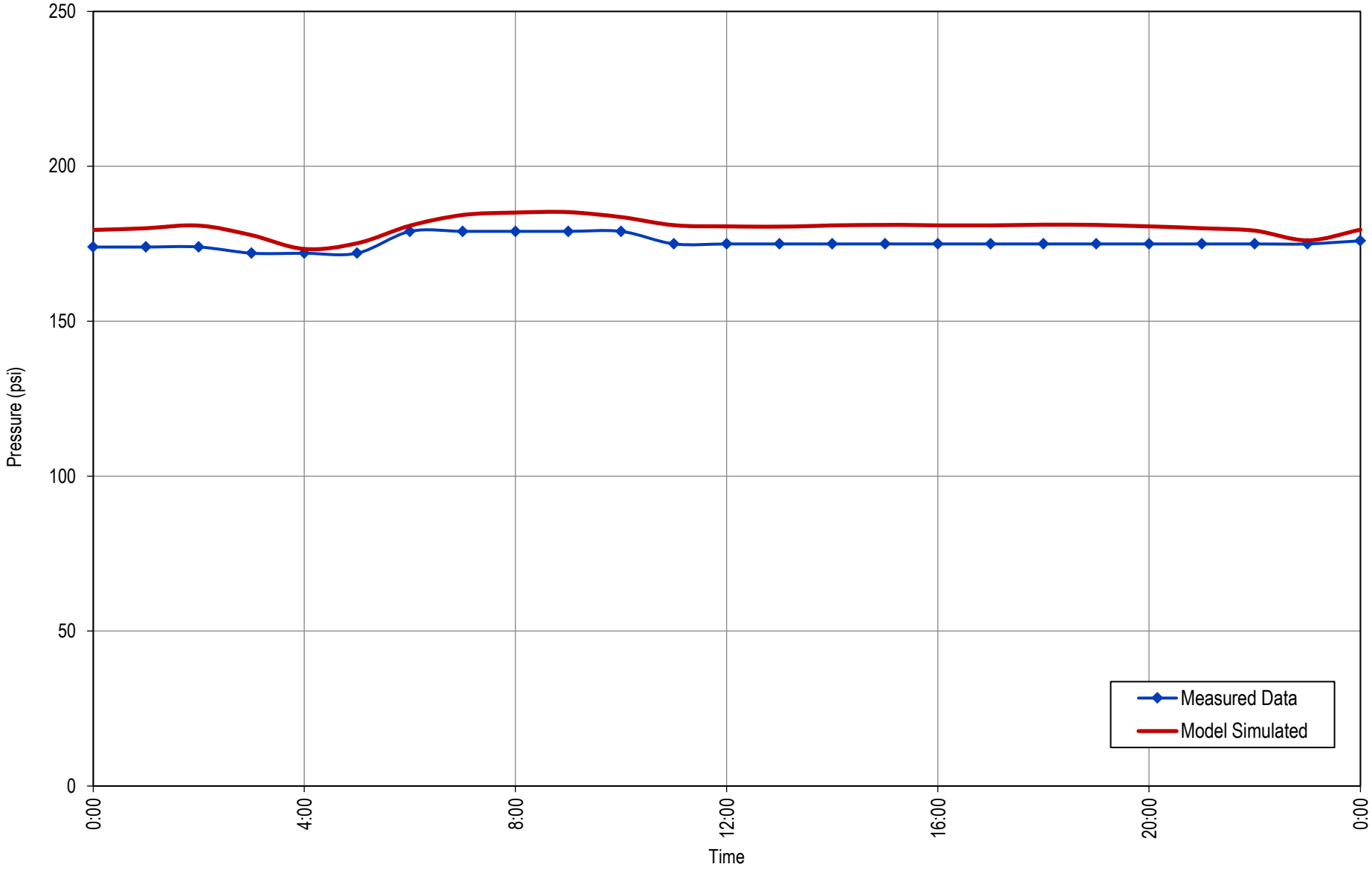
2026 Water System Plan Update

EPS CALIBRATION - CROWN RD BPS FLOW



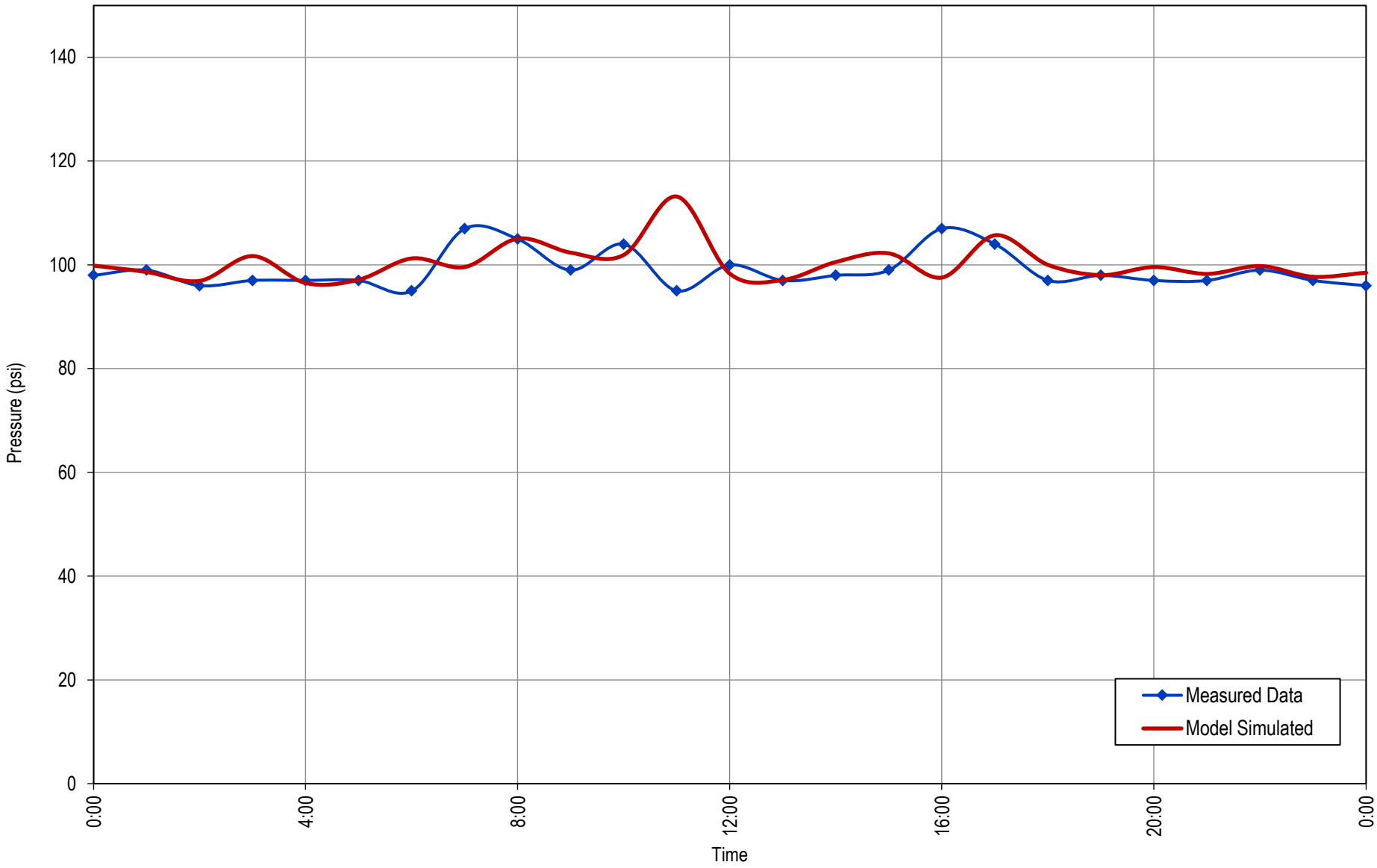
2026 Water System Plan Update

EPS CALIBRATION - LOWER PRUNE HILL DISCHARGE PRESSURE



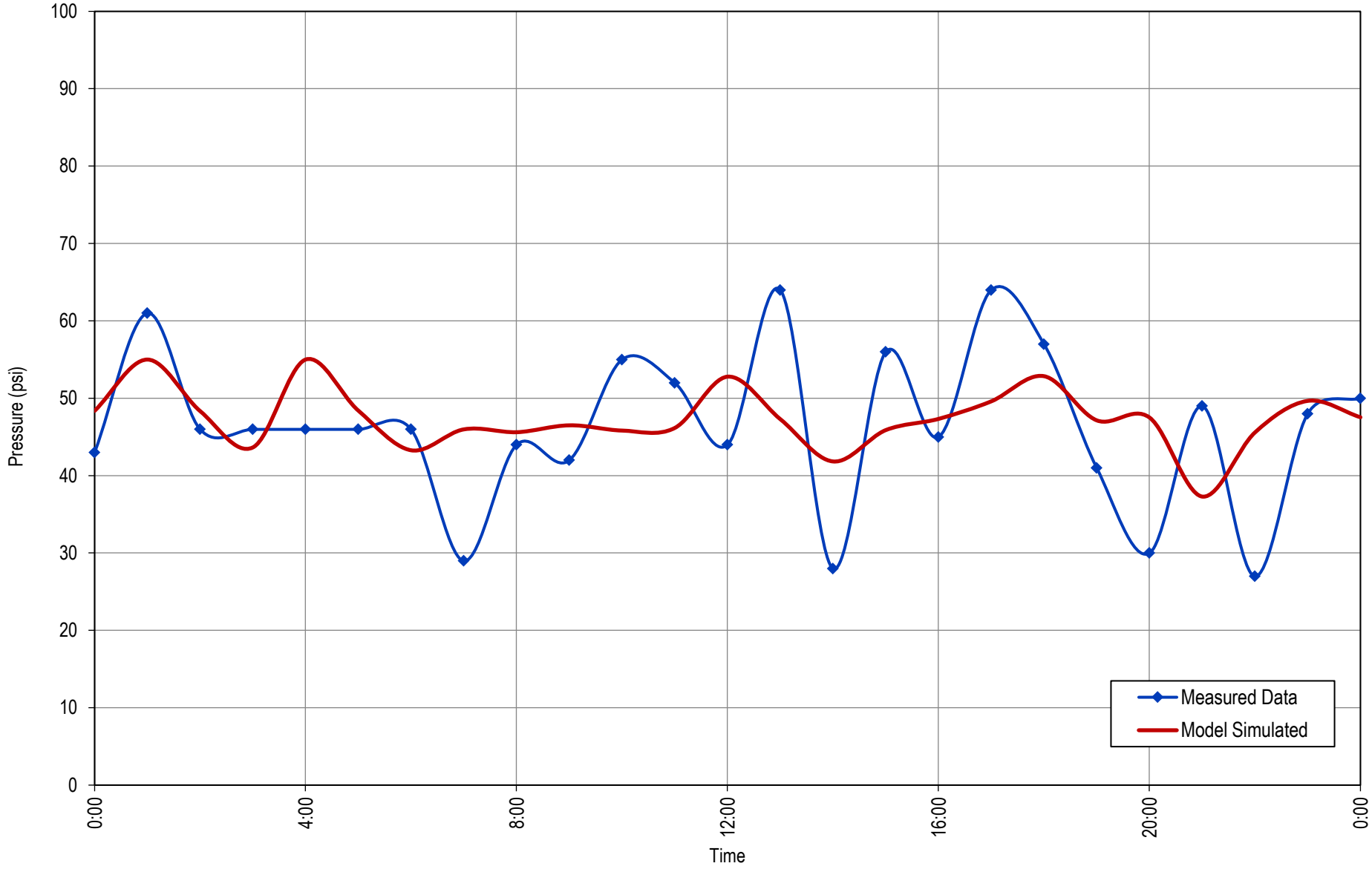
2026 Water System Plan Update

EPS CALIBRATION - ANGELO DISCHARGE PRESSURE



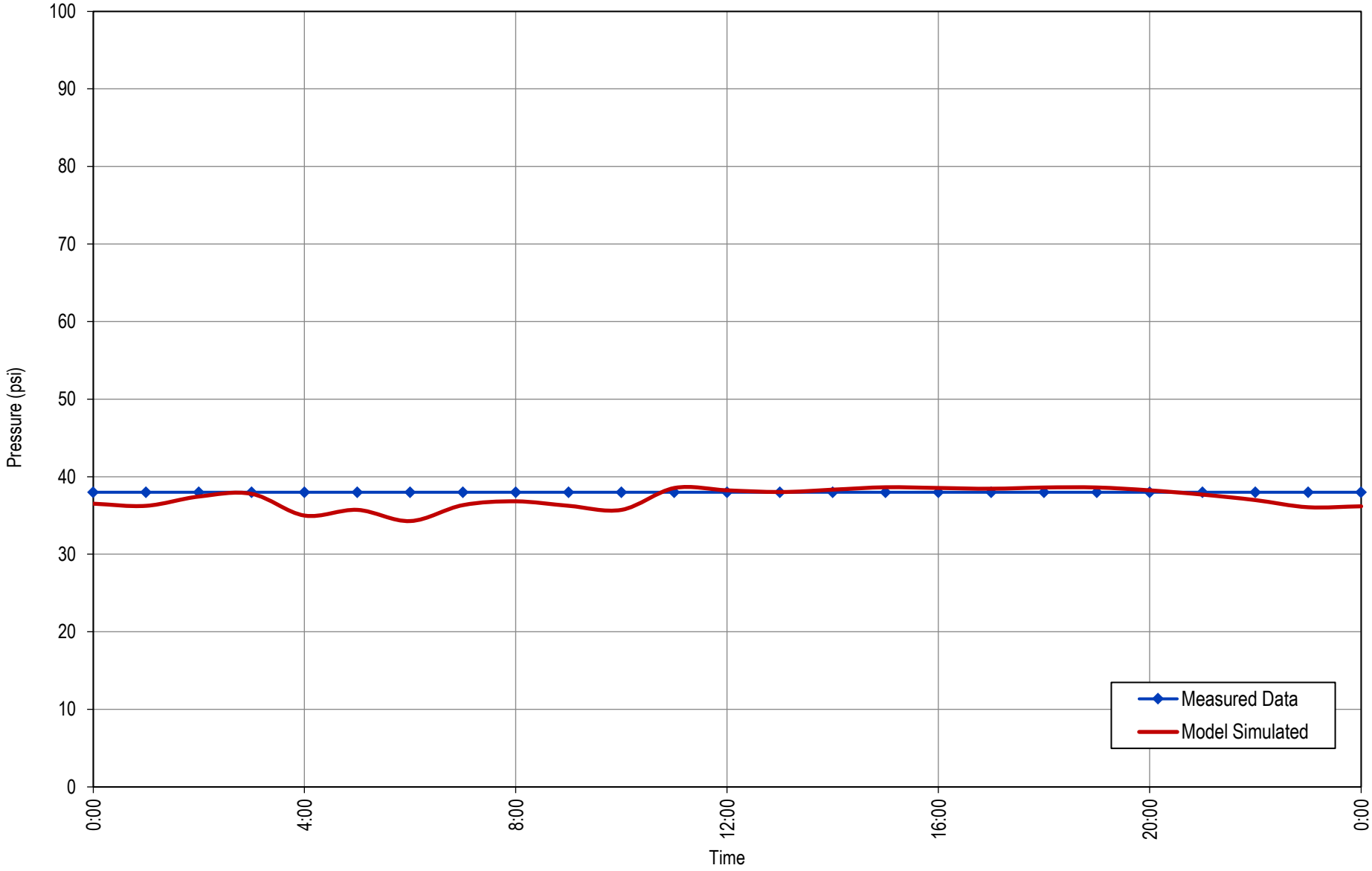
2026 Water System Plan Update

EPS CALIBRATION - ANGELO SUCTION PRESSURE



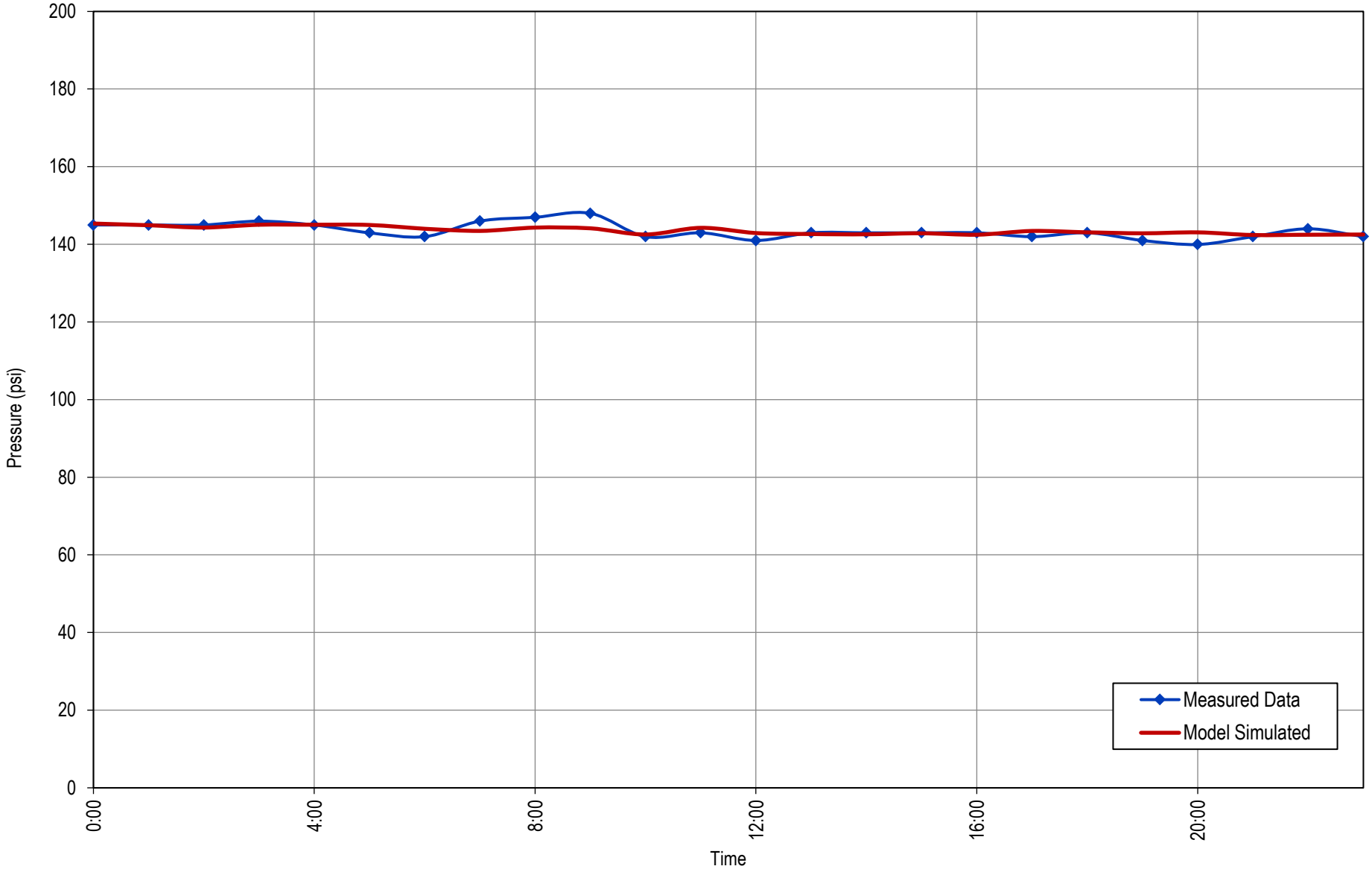
2026 Water System Plan Update

EPS CALIBRATION - UPPER PRUNE HILL DISCHARGE PRESSURE



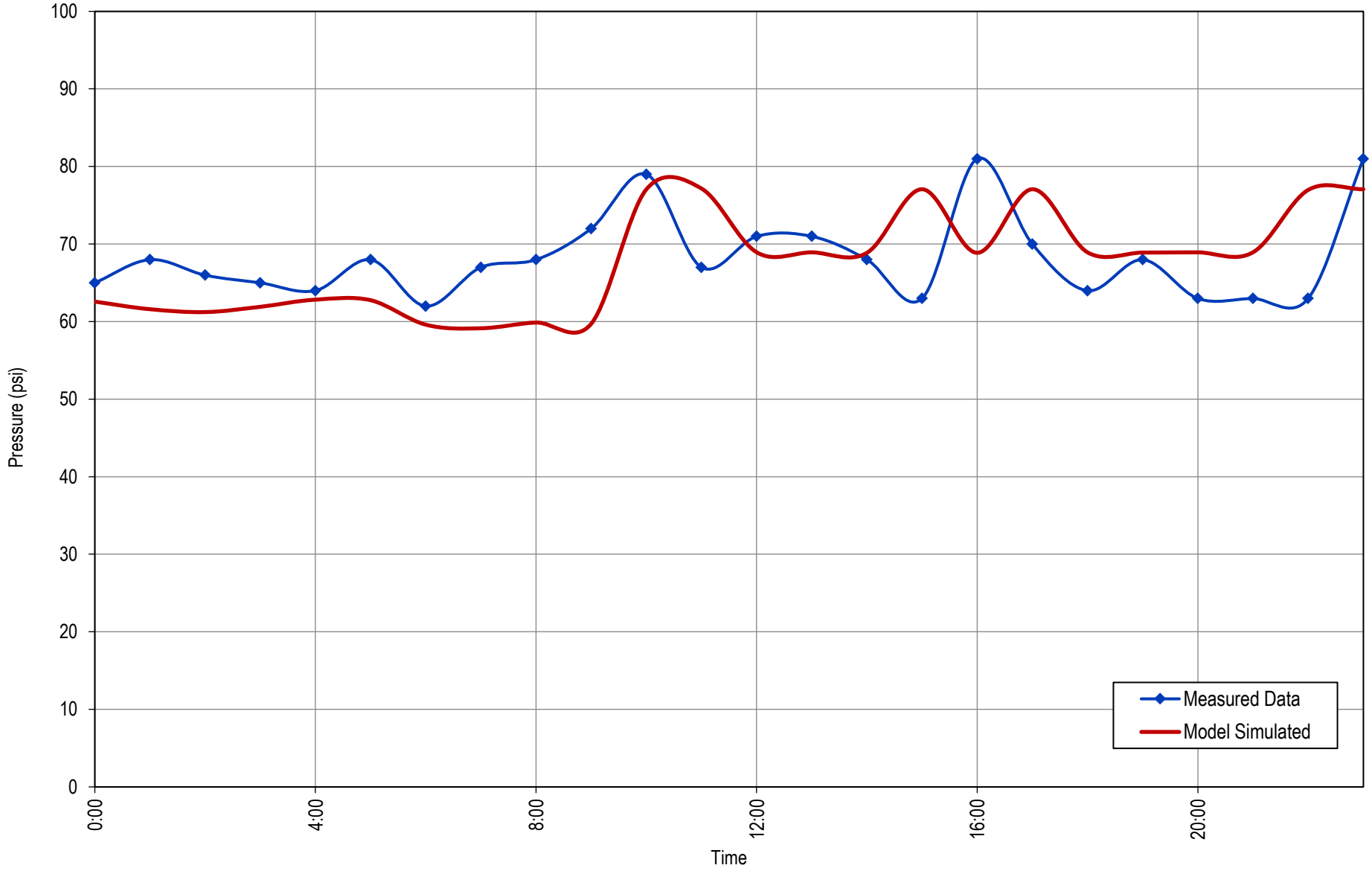
2026 Water System Plan Update

EPS CALIBRATION - FOREST HOME DISCHARGE PRESSURE



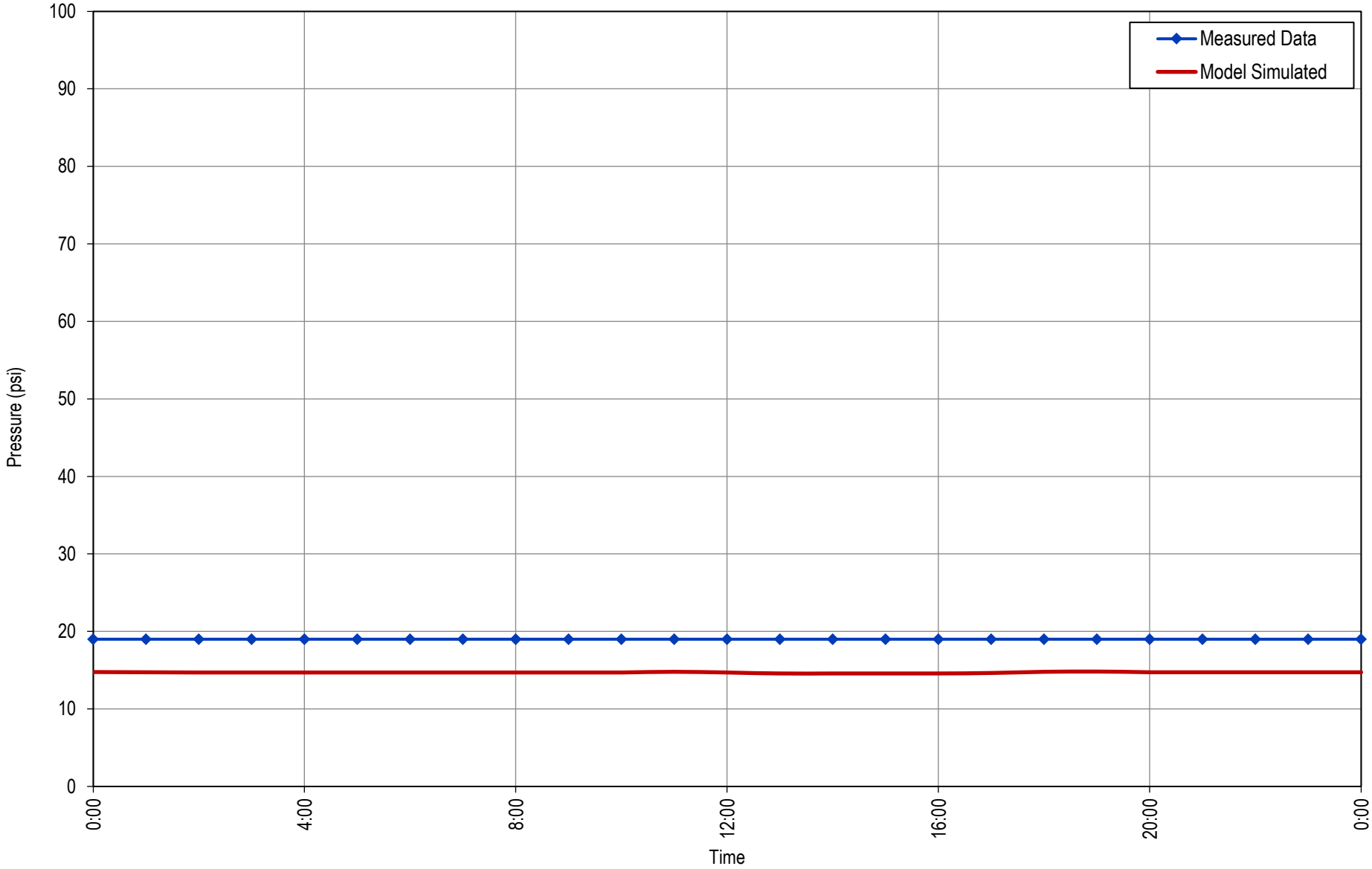
2026 Water System Plan Update

EPS CALIBRATION - FOREST HOME SUCTION PRESSURE



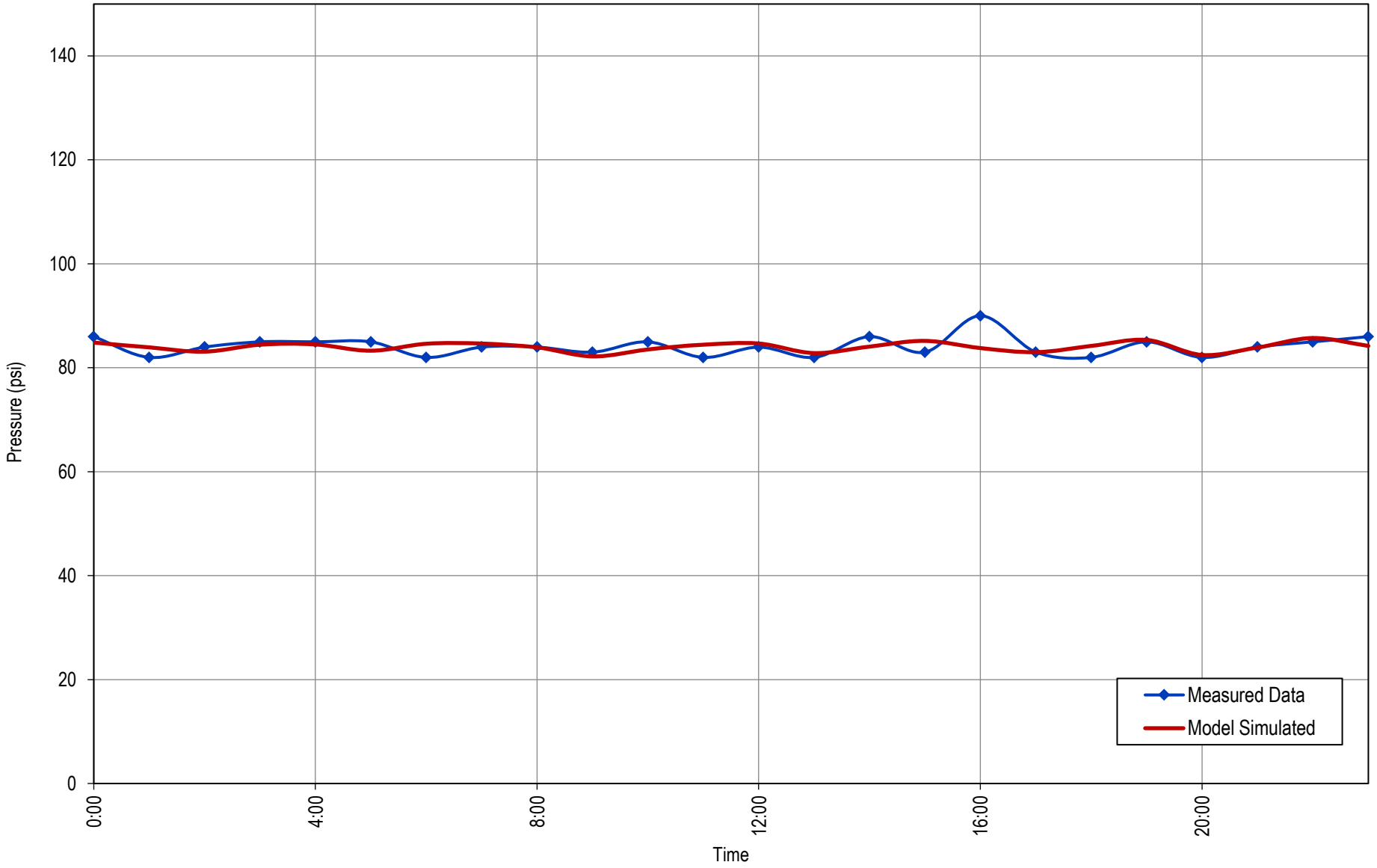
2026 Water System Plan Update

EPS CALIBRATION - 18TH AVENUE RESERVOIR PRESSURE



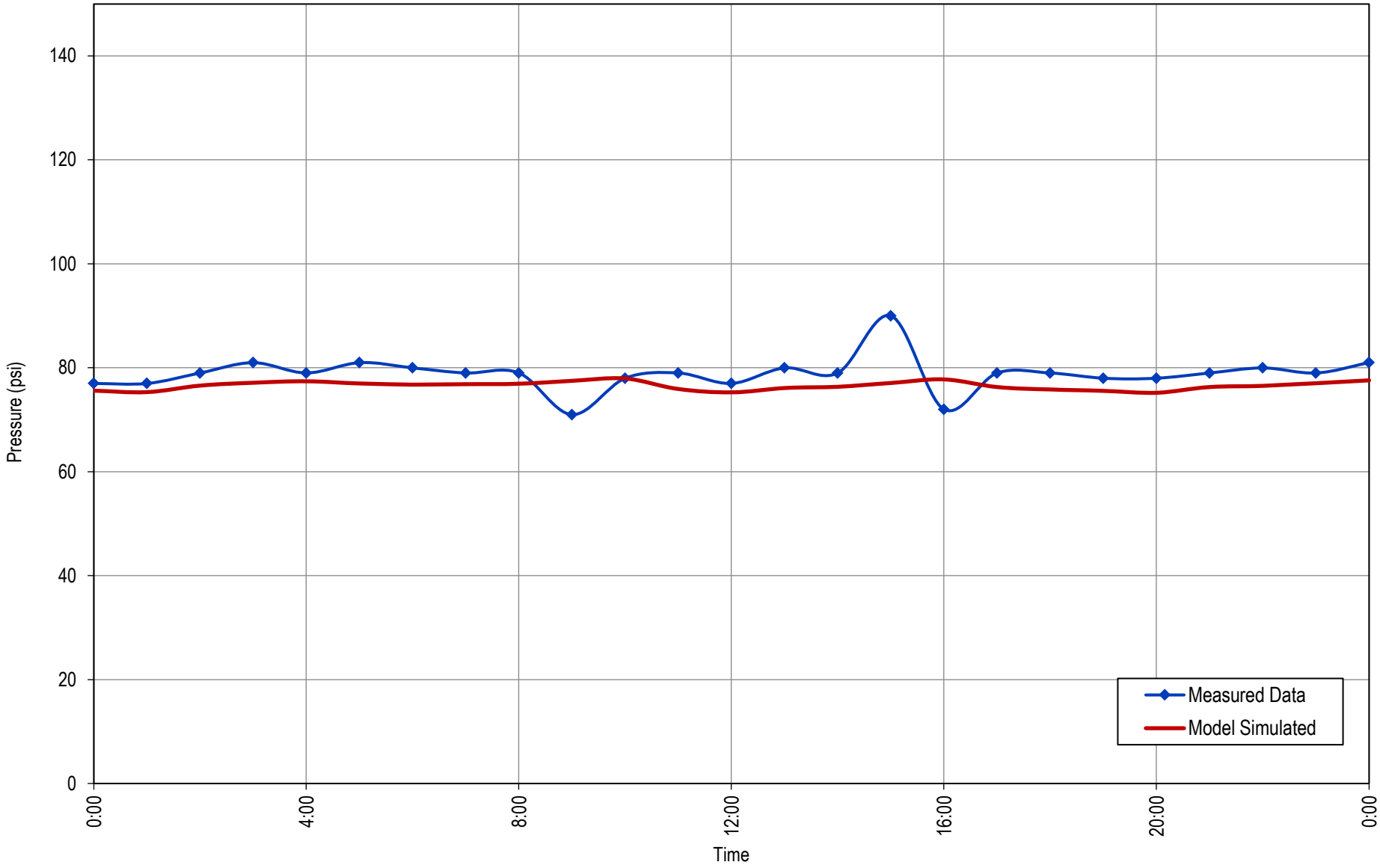
2026 Water System Plan Update

EPS CALIBRATION - BUTLER 542 ZONE PRESSURE



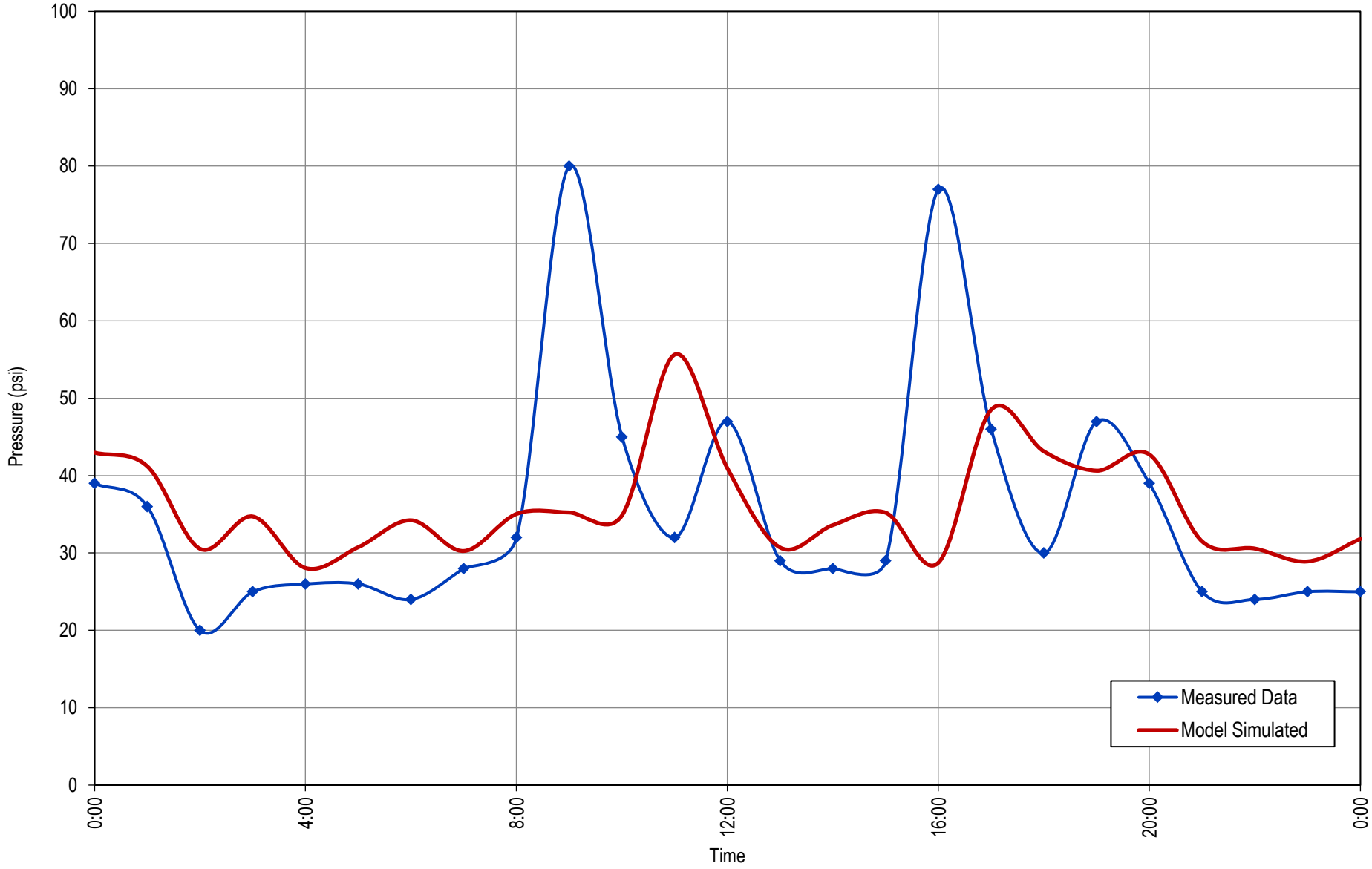
2026 Water System Plan Update

EPS CALIBRATION - LACAMAS DISCHARGE PRESSURE



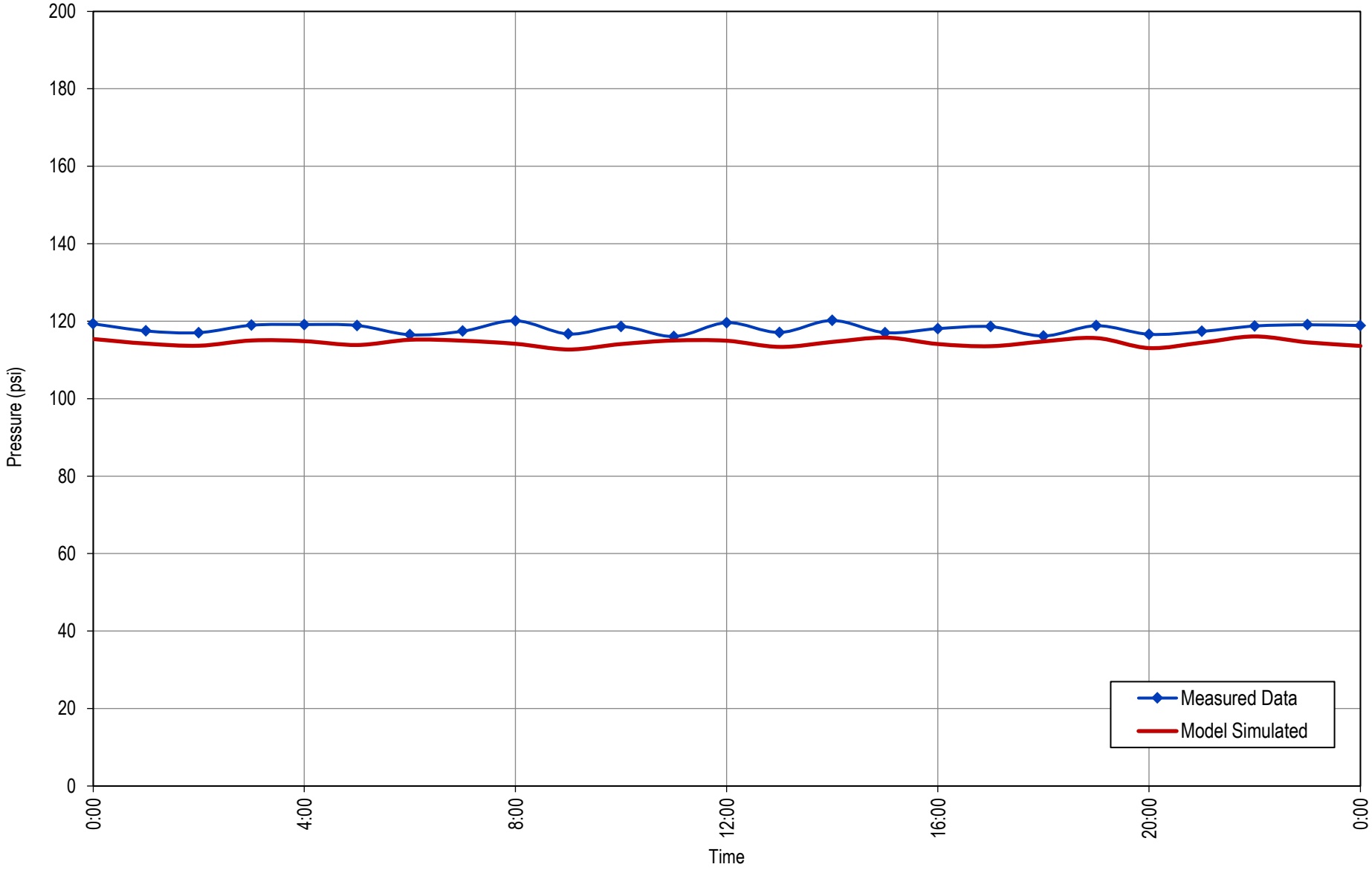
2026 Water System Plan Update

EPS CALIBRATION - LACAMAS SUCTION PRESSURE



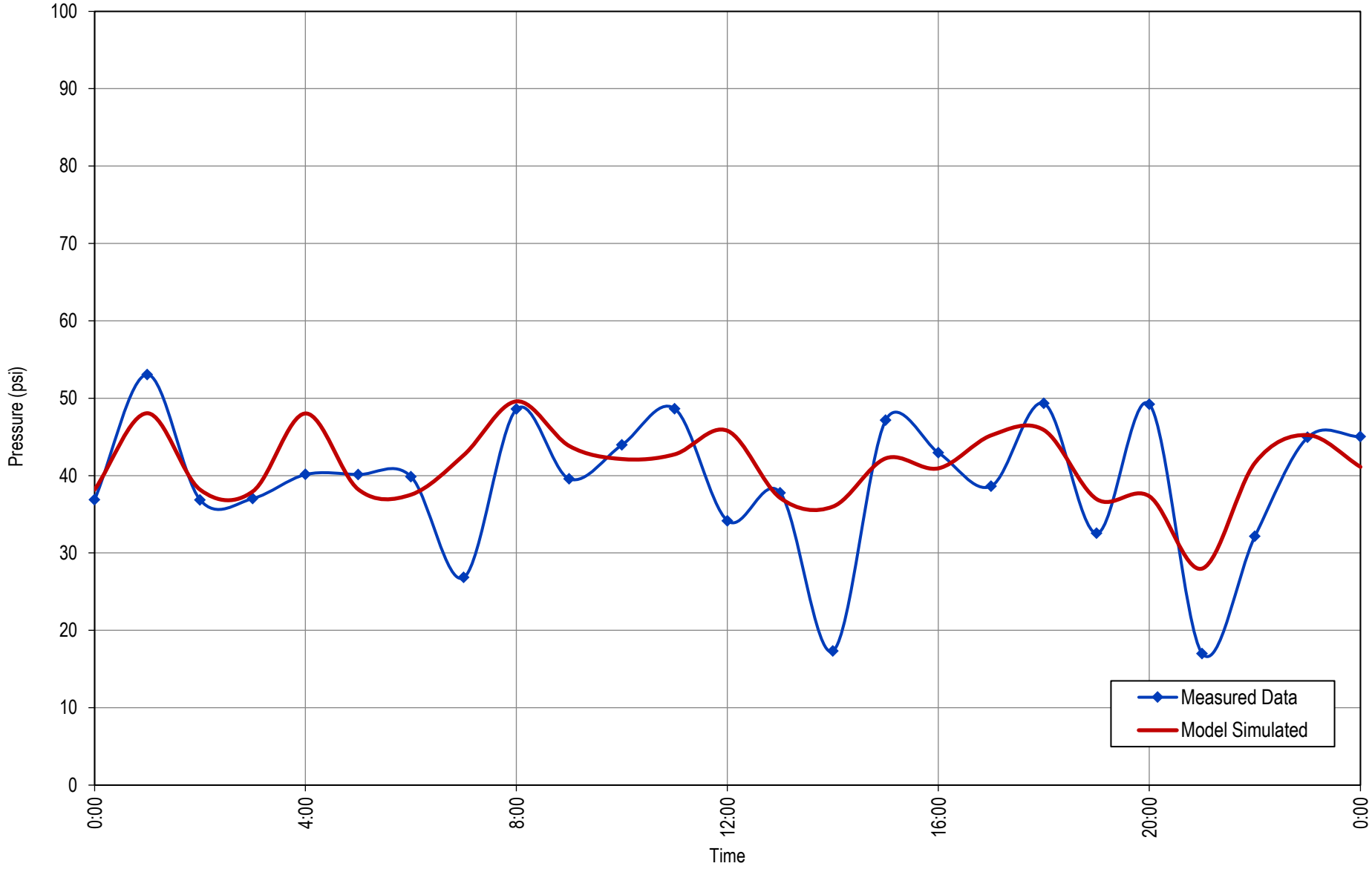
2026 Water System Plan Update

EPS CALIBRATION - CROWN ROAD DISCHARGE PRESSURE



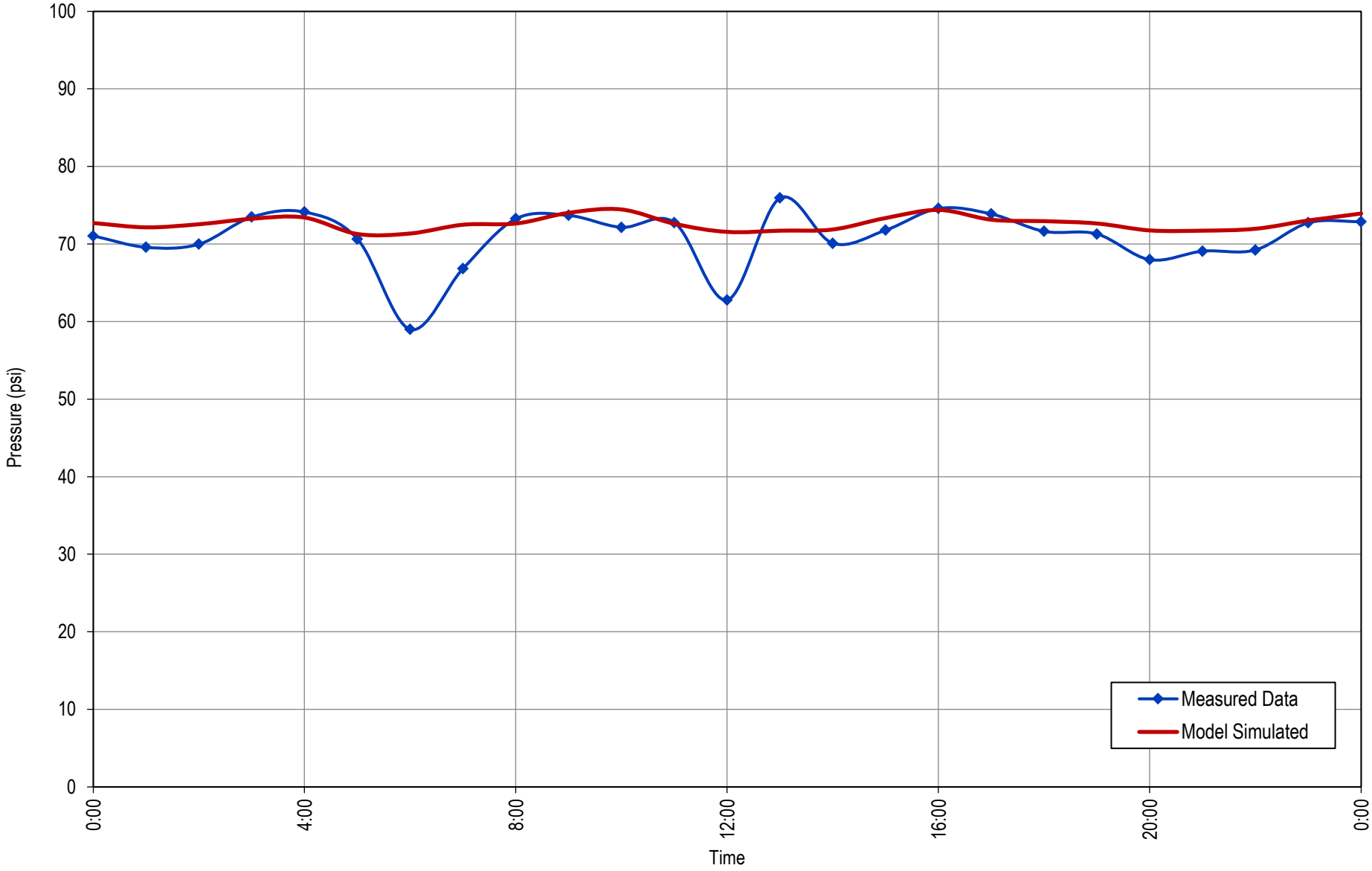
2026 Water System Plan Update

EPS CALIBRATION - CROWN ROAD SUCTION PRESSURE



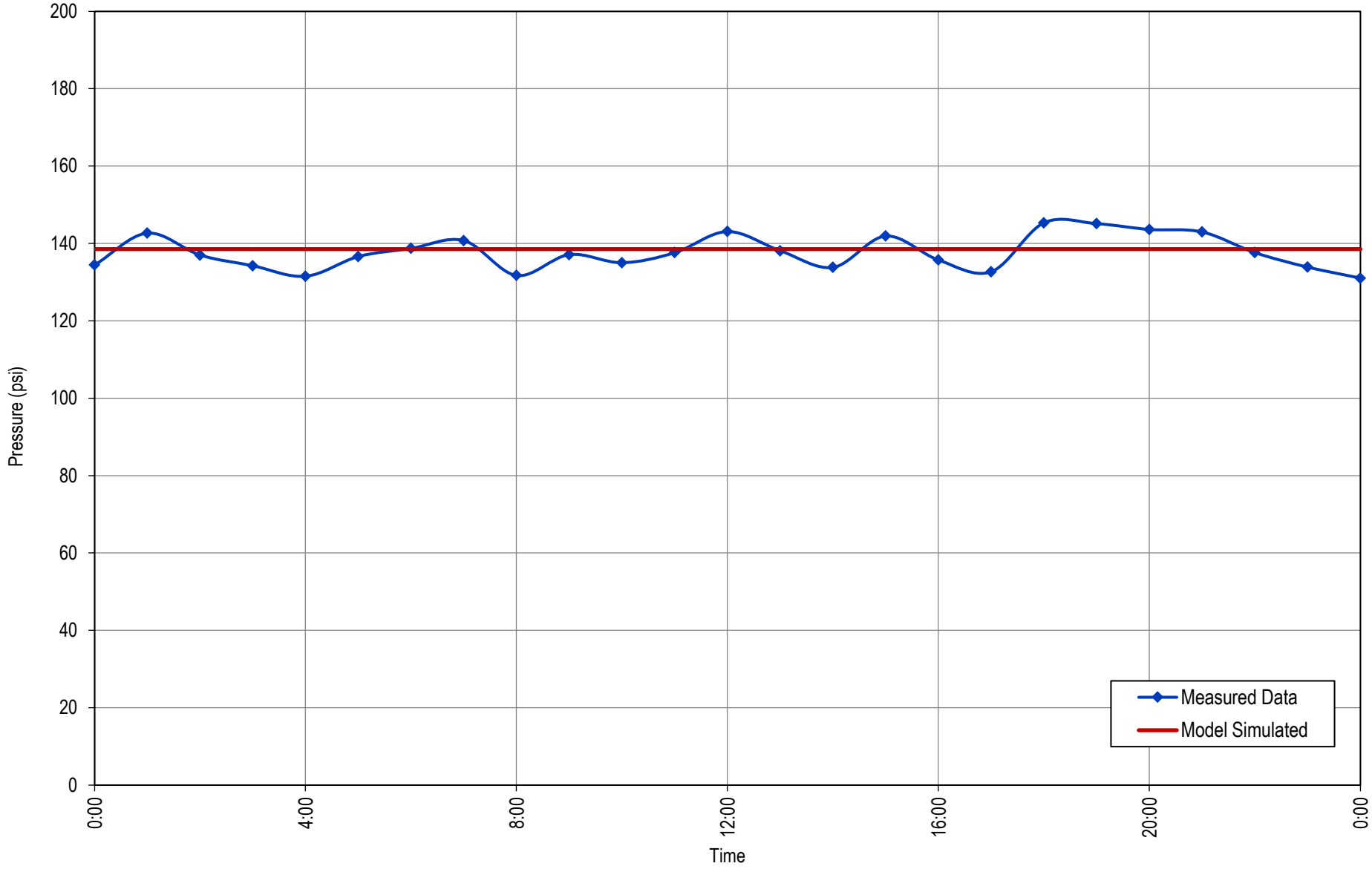
2026 Water System Plan Update

EPS CALIBRATION - GREEN MOUNTAIN ESTATES SUCTION PRESSURE



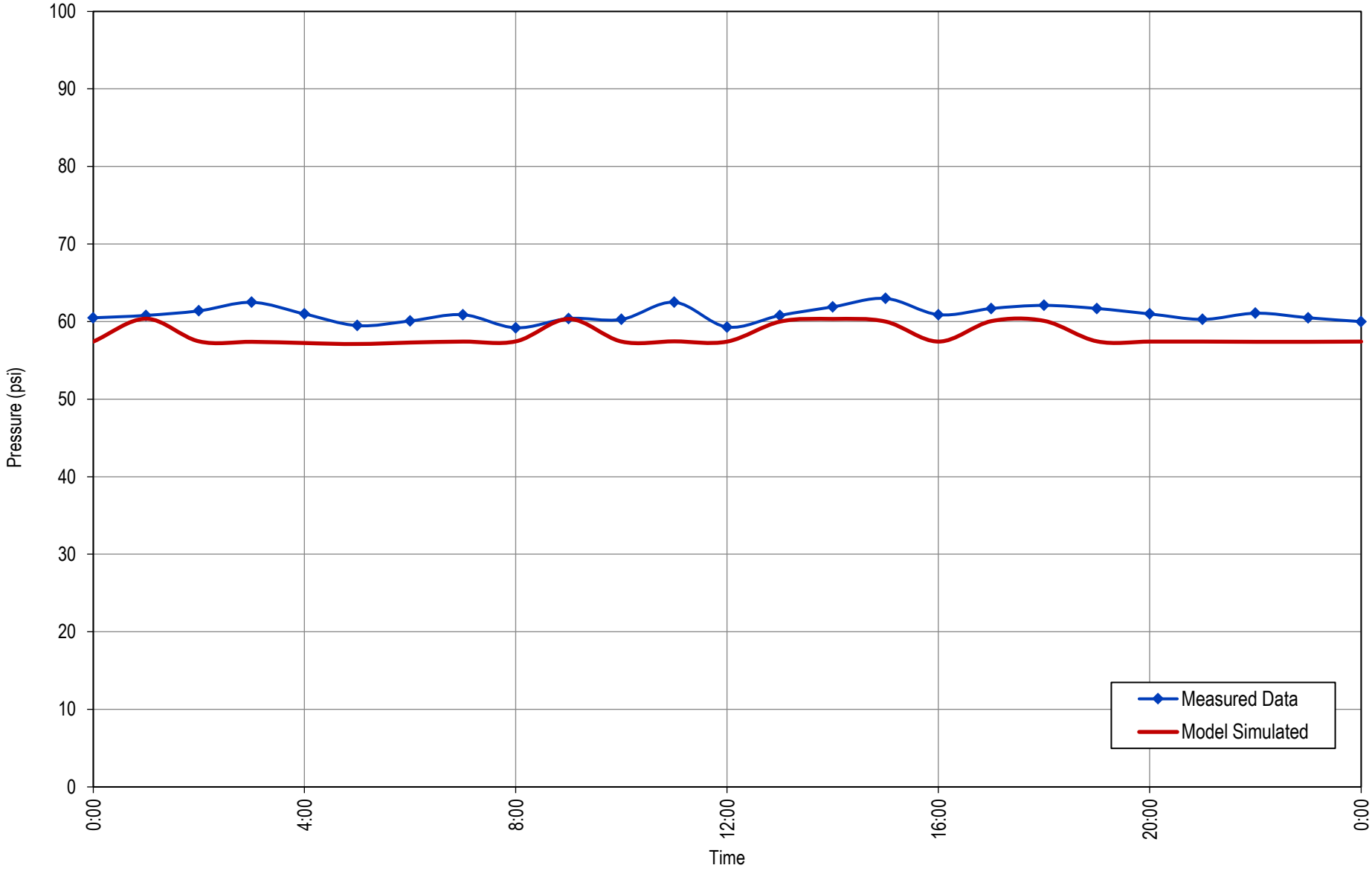
2026 Water System Plan Update

EPS CALIBRATION - GREEN MOUNTAIN ESTATES DISCHARGE PRESSURE



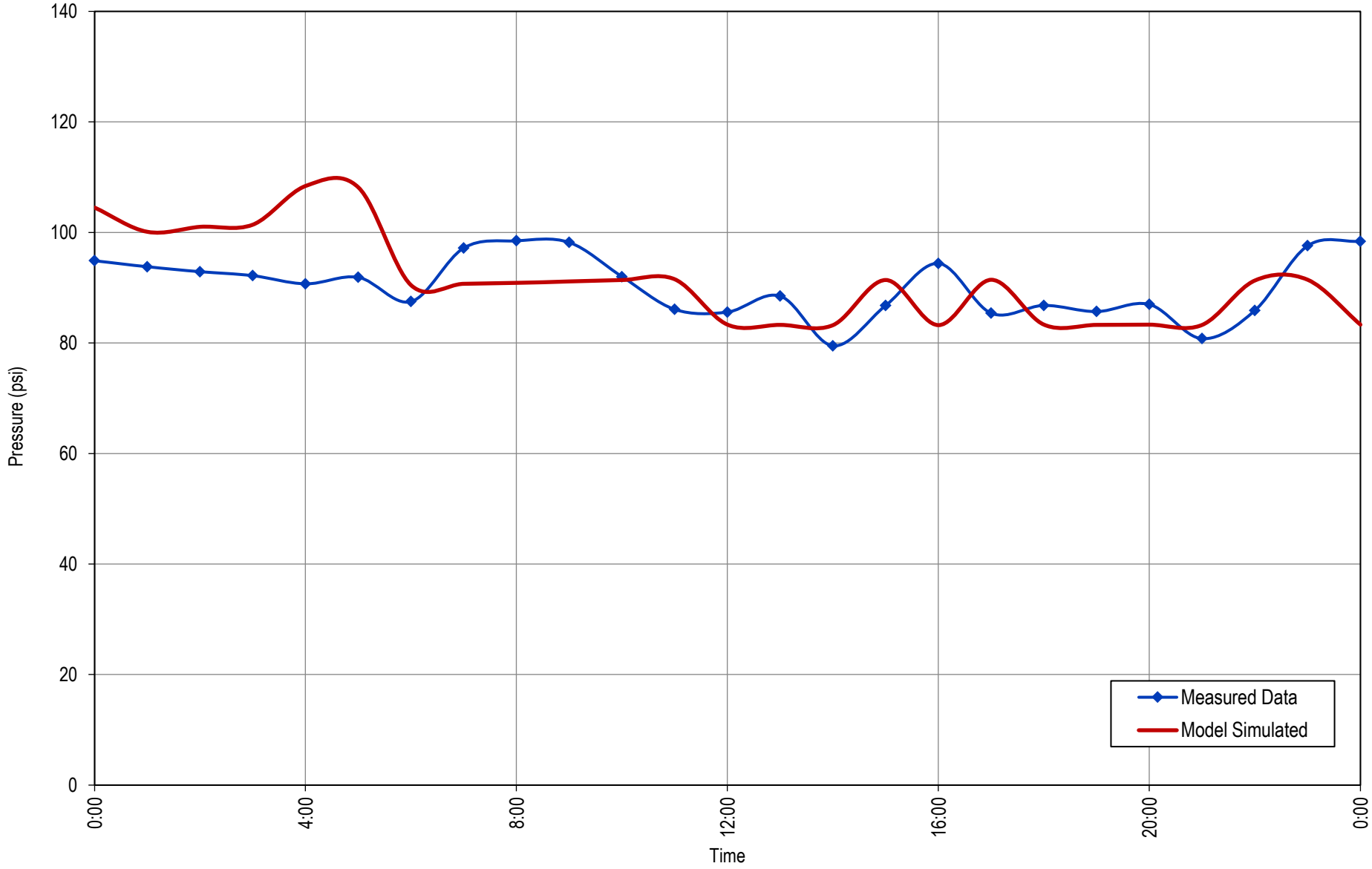
2026 Water System Plan Update

EPS CALIBRATION - 18TH AVENUE RESERVOIR (LOGGER 35)



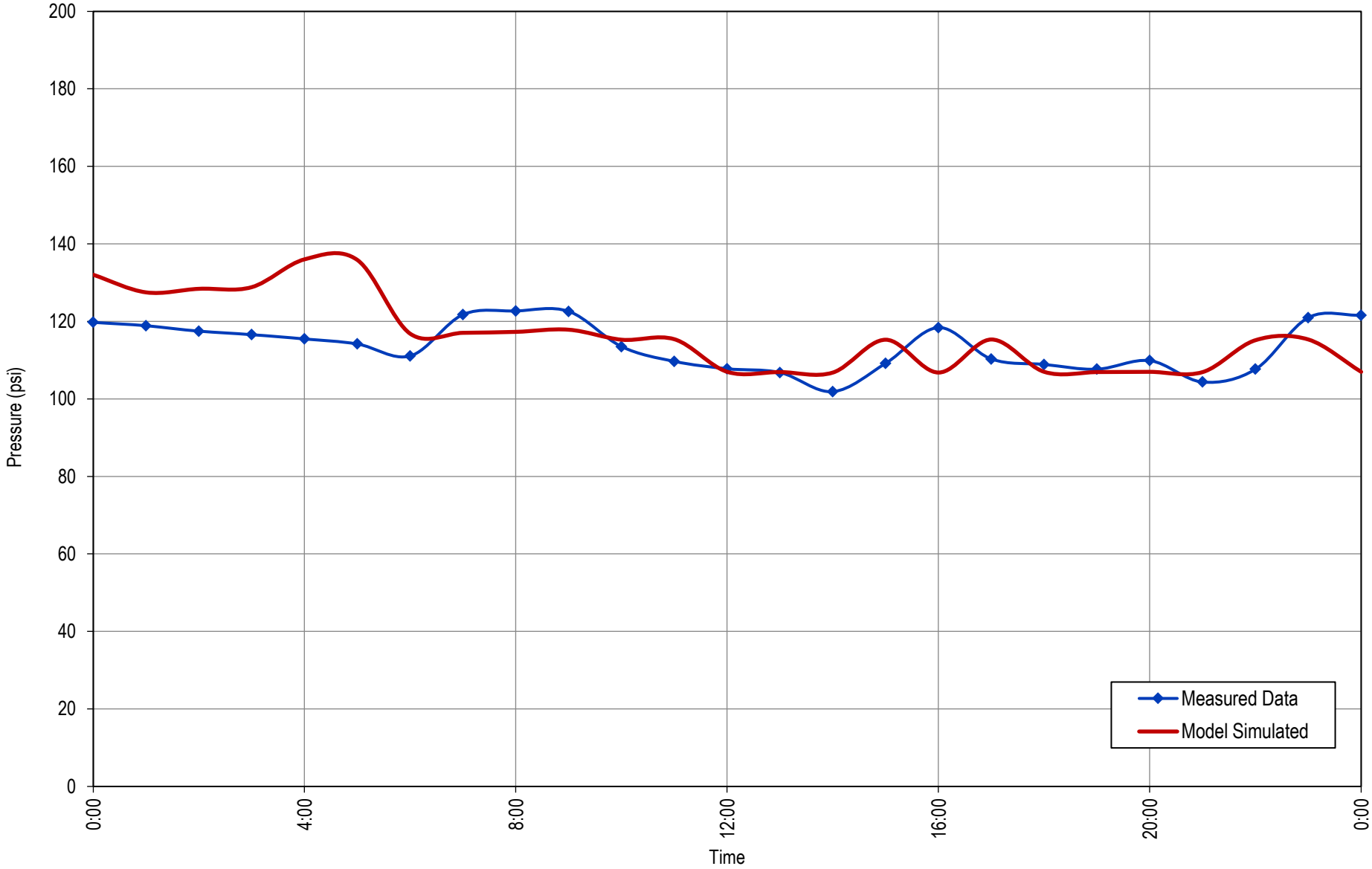
2026 Water System Plan Update

EPS CALIBRATION - DOWNTOWN (LOGGER 37)



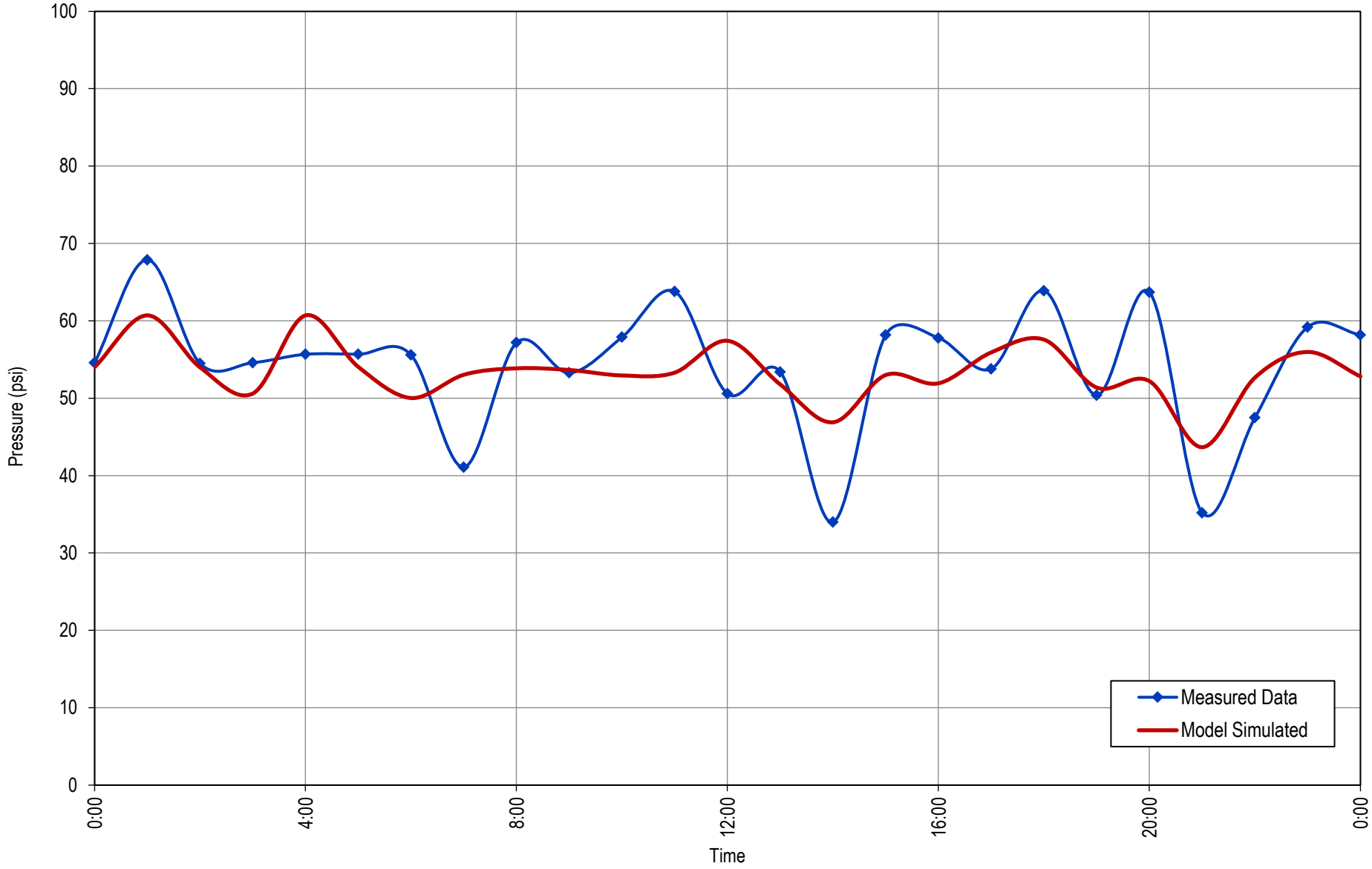
2026 Water System Plan Update

EPS CALIBRATION - OAK PARK, ACROSS OPS CENTER (LOGGER 49)



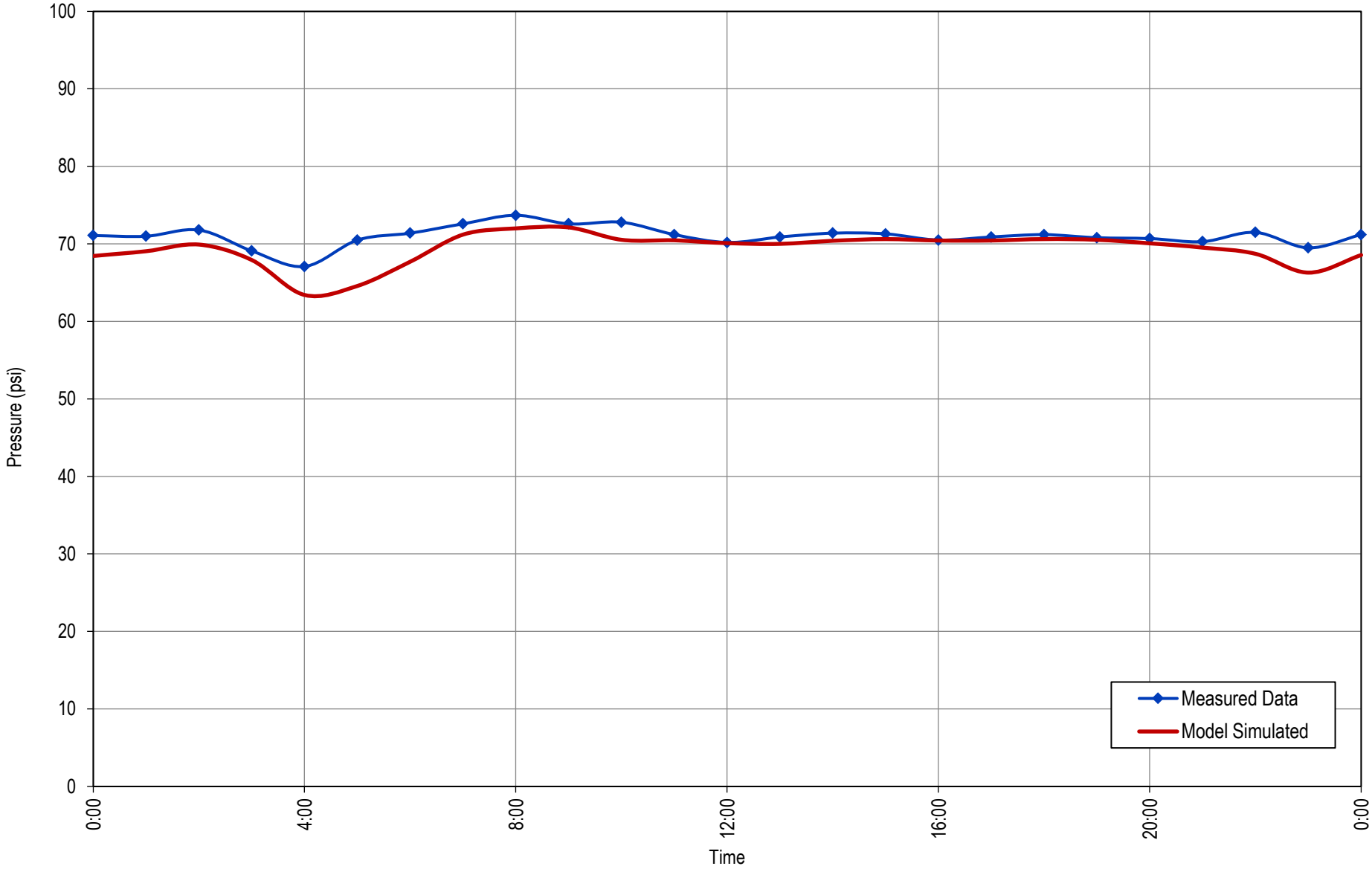
2026 Water System Plan Update

EPS CALIBRATION - HELEN BALLER ELEMENTARY (LOGGER 50)



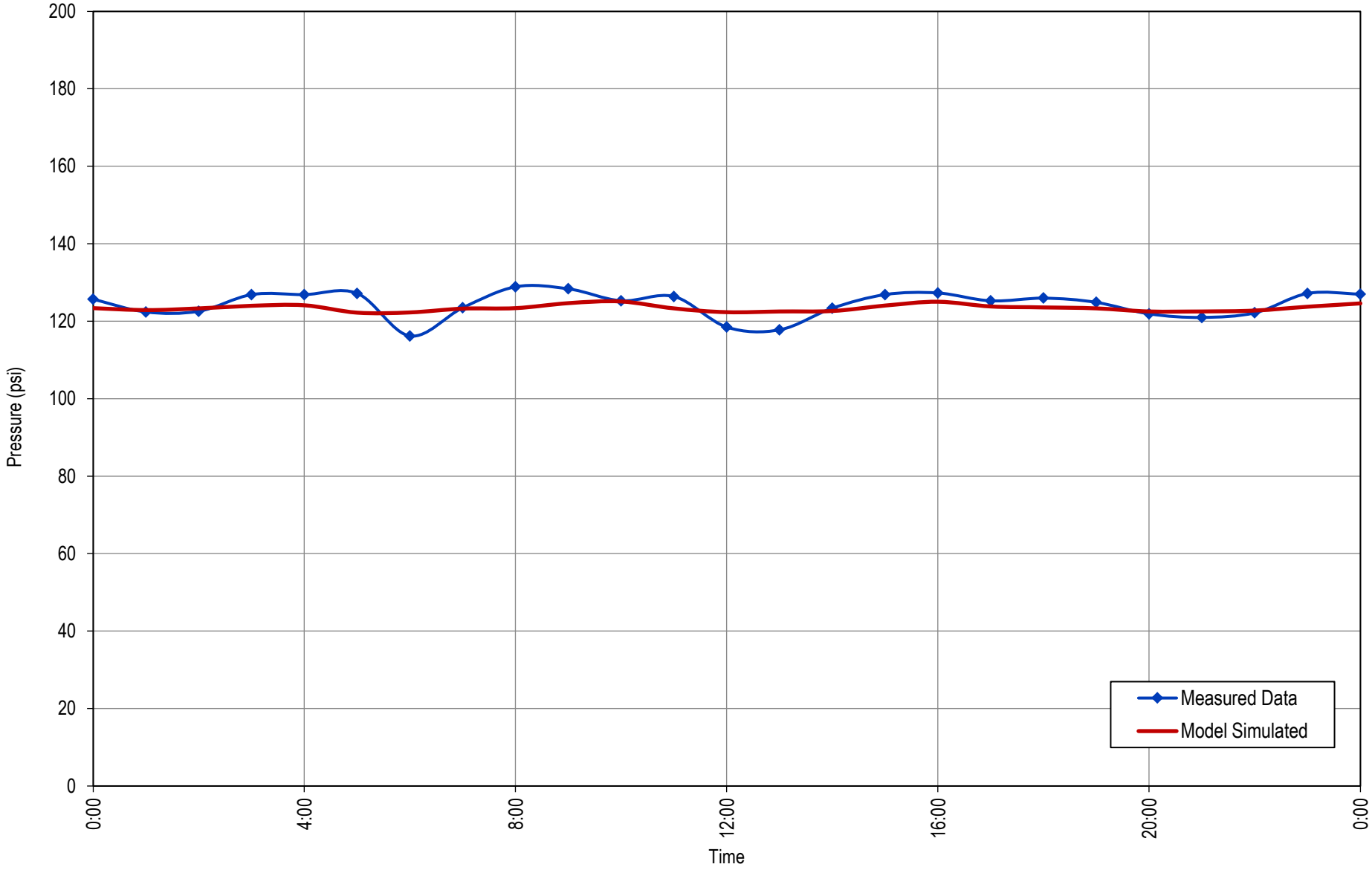
2026 Water System Plan Update

EPS CALIBRATION - DOROTHY FOX ELEMENTARY (LOGGER 58)



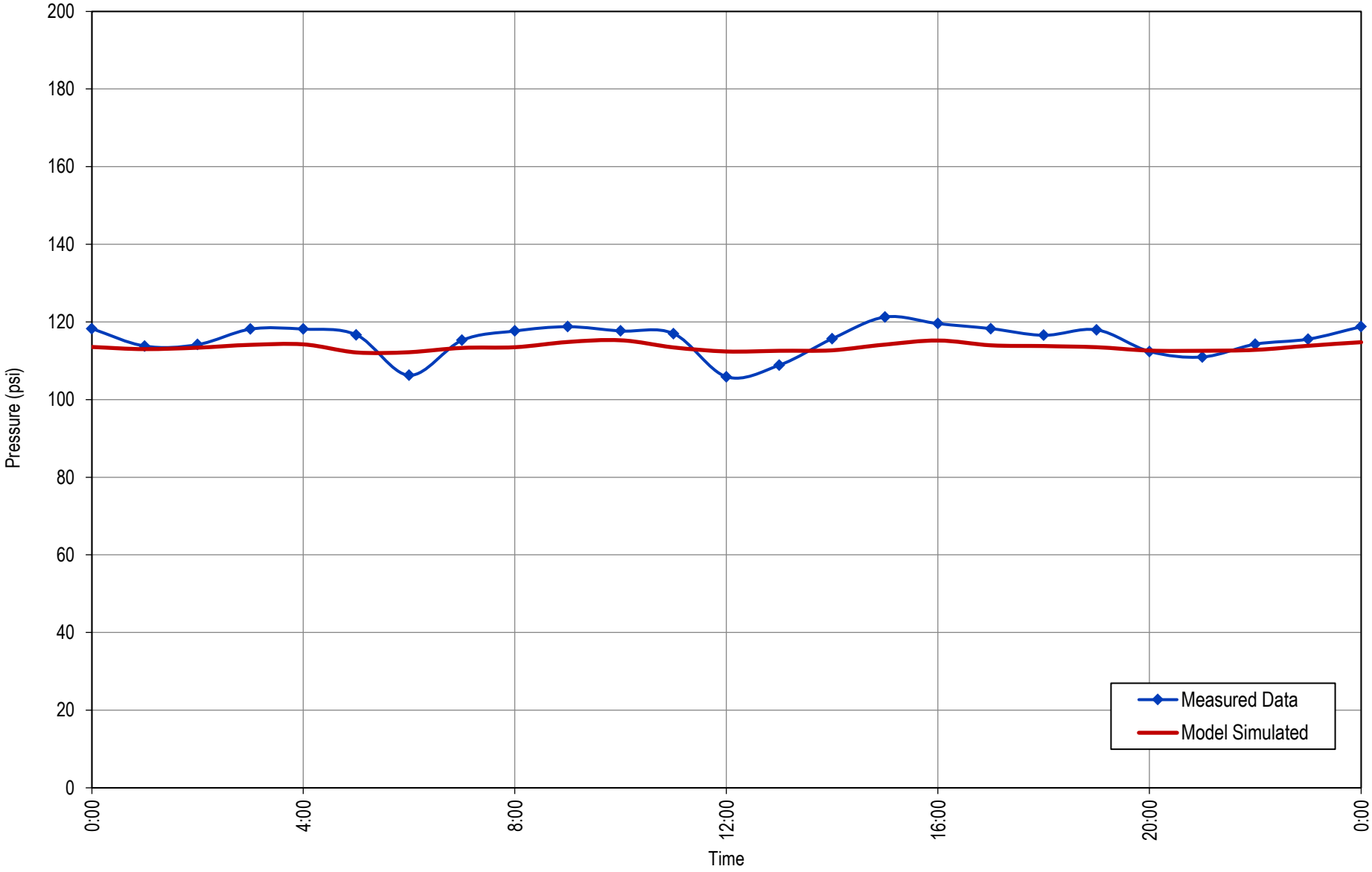
2026 Water System Plan Update

EPS CALIBRATION - UNION HS (LOGGER 68)



2026 Water System Plan Update

EPS CALIBRATION - GREEN MOUNTAIN ESTATES (LOGGER 69)



APPENDIX 1C

FF CALIBRATION RESULTS

Project Details

Client City of Camas
Project Name 2026 Water System Plan Update
Status Draft
Date September 2025

Hydrant Test Field Data/Model Junctions										Field Results						Model Results				Comparison						
Test No.	Pressure Zone	Date	Time	Duration (mins)	Location	Hydrant	Hydrant Number	Model Junction ID	Junction Elevation (ft)	Flow (gpm)	Post-Static Pressure (psi)	Static Pressure (psi)	Static HGL (FT)	Residual Pressure (psi)	Residual HGL (ft)	Static Pressure (psi)	Static HGL (FT)	Residual Pressure (psi)	Residual HGL (ft)	Static Pressure Diff (psi)	Res. Pressure Diff (psi)	Static Pressure Error (%)	Residual Pressure Error (%)	Pressure Drop (psi)		
																								Measured	Modeled	Diff
1	343 Downtown	May 15, 2025	14:40	1	SE 12th Ave	F1	WH200146	J1-1012	33.81	1100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
						P1	WH200144	J1-1013	33.8	--	116	116	302	70	196	116	301	69	192	0.4	1.5	0.3%	2.1%	46	47	-1
						P2	WH200143	J1393	34.77	--	116	115	300	70	196	115	301	69	195	-0.2	0.6	-0.2%	0.9%	45	46	-1
2	343 Downtown	May 15, 2025	9:00	2	E 1st Ave / NE Joy St	F1	WH200779	J1-93	66.68	1350	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
						P1	WH200776	J1207	68.3	--	100	100	299	80	253	101	301	81	256	-0.9	-1.1	-0.9%	-1.4%	20	20	0
						P2	WH200777	J1-91	73.59	--	100	100	305	83	265	99	301	85	269	1.4	-1.7	1.4%	-2.0%	17	14	3
3	343 Cemetery	May 15, 2025	9:39	1	NE Garfield St	F1	WH200802	J1-794	216.99	850	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
						P1	WH200801	J1-152	210.9	--	56	54	336	40	303	56	339	39	300	-1.6	1.2	-3.0%	3.1%	14	17	-3
						P2	WH200914	J1-158	223.3	--	50	50	339	35	304	50	339	35	304	-0.1	0.3	-0.2%	0.7%	15	15	0
4	455 LPH	May 15, 2025	10:37	2	NW 7th Ave / NW Greeley St	F1	WH200708	J2-220	176.97	1300	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
						P1	WH200709	J2-225	188.19	--	120	118	461	99	417	115	453	97	412	3.2	2.1	2.7%	2.1%	19	18	1
						P2	WH200992	J2-213	143.04	--	134	134	453	120	420	134	454	123	427	-0.5	-2.8	-0.4%	-2.3%	14	12	2
5	852 UPH	May 15, 2025	11:03	2	NW 31st Ave / NW Sierra Dr	F1	WH200237	J3-322	678.51	1190	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
						P1	WH200236	J3-338	676.63	--	70	71	841	64	824	69	835	62	820	2.5	1.9	3.5%	2.9%	7	6	1
						P2	WH200246	J3-318	659.15	--	75	75	832	72	825	76	835	70	820	-1.1	2.2	-1.5%	3.1%	3	6	-3
6	544 Lacamas	May 15, 2025	12:45	2	NW 46th Ave / NW Howard St	F1	WH200299	J4-2008	315.05	1350	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
						P1	WH200298	J1195	306.82	--	100	100	538	82	496	97	531	80	491	3.1	2.1	3.1%	2.6%	18	17	1
						P2	WH200300	J4-2003	334.14	--	87	87	535	66	487	85	531	68	491	1.9	-1.9	2.2%	-2.9%	21	17	4
7	544 Lacamas	May 15, 2025	13:15	1	N Alder St / N 96th Ave	F1	WH200504	J285	286.35	1300	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
						P1	WH200503	J281	290.66	--	104	104	531	84	485	104	530	85	486	0.2	-0.7	0.2%	-0.9%	20	19	1
						P2	WH200500	J295	258.24	--	114	118	531	101	492	118	530	100	489	0.2	1.3	0.2%	1.3%	17	18	-1
8	542 Gregg	May 15, 2025	14:10	1	NE Quince Way	F1	WH200424	J779	443.31	600	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
						P1	WH200423	J791	462.25	--	40	38	550	28	527	30	530	27	525	**8.5**	1.0	**22.3%**	3.5%	10	2	**8**
						P2	WH200425	J751	452.22	--	35	35	533	24	508	34	530	31	525	1.1	**-7.4**	3.3%	**-31.0%**	11	2	**9**
9	GME	May 15, 2025	1:45	1	N 91st Ave	F1	WH200964	J1203	505.64	950	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
						P1	WH200965	J1199	518.06	--	110	74	689	50	634	75	692	50	634	-1.2	-0.3	-1.7%	-0.6%	24	25	-1
						P2	WH200963	J1201	494.15	--	109	86	693	62	637	86	692	61	634	0.4	1.3	0.5%	2.0%	24	25	-1
10	697	May 16, 2025	8:10	2	NW Deefern St. / NW 14th Ave.	F1	WH200860	J3-602	501.47	1250	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
						P1	WH200098	J3-573	497.37	--	75	70	659	67	652	73	667	65	648	-3.3	1.8	-4.7%	2.7%	3	8	**-5**
						P2	WH200097	J1205	482.52	--	81	80	667	72	649	80	667	70	643	0.3	2.4	0.3%	3.3%	8	10	-2

APPENDIX W

CIP PROJECTS

City of Camas
Water System Plan
Capital Improvement Plan

Project ID: D-01
Project Title: NW 7th Avenue Fire Flow Improvements
Priority: 0-10 years

Facility Type: Distribution System
Pressure Zone: 285 - Downtown
Project Status (Completed?): No

Go to CIP Summary Table

Project Description:

Project Description: To address fire flow deficiencies along NW 7th Avenue, replace approximately 1,300 linear feet of 6-inch diameter cast iron pipeline to 12-inch pipeline.

Reasoning Fire flow deficiency

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 50%	Total Cost
Pipeline: 12-inch	1,300	LF	$ -	$ -	$ -	$ -	$ -
Total Anticipated Project Cost							$ -

Notes on Cost Estimation:

Costs for this project have been incorporated into the pipe replacement program.

Go to Assumptions Tab

Cost Allocation:

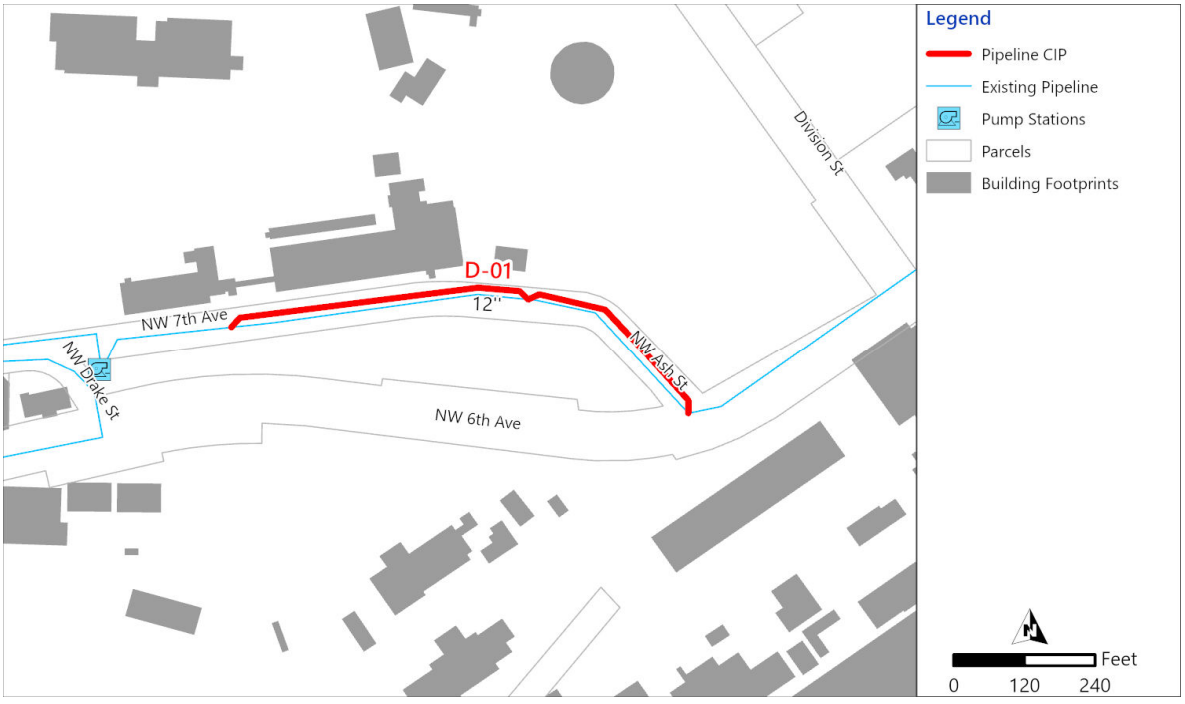
Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ -

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	-	0-10 years	$ -
Total Anticipated Project Cost			$ -

Project Location Map:

Go to Maps Tab



City of Camas
Water System Plan
Capital Improvement Plan

Project ID: D-02
Project Title: NE Dallas Street Fire Flow Improvements
Priority: 0-10 years
Facility Type: Distribution System
Pressure Zone: 285 - Downtown
Project Status (Completed?): No

Go to CIP Summary Table

Project Description:

Project Description: To address fire flow deficiencies along NE Dallas Street the following improvements are recommended:
1) Construct approximately 500 LF of 8-inch diameter pipeline along NE Everett Street between NE 4th and NE 6th Avenue
2) Replace approximately 250 LF of 6-inch diameter cast iron pipeline along NE 6th Ave with 8-inch pipeline.
3) Replace approximately 400 LF of 6-inch diameter cast iron pipeline along NE Dallas Street between NE 6th Ave and View Crest Terrace with 8-inch pipeline.

Reasoning Fire flow deficiency

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 50%	Total Cost
Pipeline: 8-inch	1,150	LF	$ -	$ -	$ -	$ -	$ -
Total Anticipated Project Cost							$ -

Notes on Cost Estimation:

Costs for this project have been incorporated into the pipe replacement program.

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ -

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	-	0-10 years	$ -
Total Anticipated Project Cost			$ -

Project Location Map:

Go to Maps Tab



City of Camas
Water System Plan
Capital Improvement Plan

Project ID: D-03
Project Title: 1st Avenue Fire Flow Improvements
Facility Type: Distribution System
Pressure Zone: 285 - Downtown

Go to CIP Summary Table

Priority: 0-10 years
Project Status (Completed?): No

Project Description:

Project Description: To address fire flow deficiencies, upsize approximately 1,150 LF of 6-inch cast iron pipeline along E 1st Ave between SE Garfield Street and SE King Street with 8-inch pipeline.

Reasoning Fire flow deficiency

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 50%	Total Cost
Pipeline: 8-inch	1,150	LF	$ -	$ -	$ -	$ -	$ -
Total Anticipated Project Cost							$ -

Notes on Cost Estimation:

Costs for this project have been incorporated into the pipe replacement program.

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ -

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	-	0-10 years	$ -
Total Anticipated Project Cost			$ -

Project Location Map:

Go to Maps Tab



City of Camas
Water System Plan
Capital Improvement Plan

Project ID: D-04
Project Title: Operations Center/WWTF Fire Flow Improvements
Priority: 0-10 years
Facility Type: Distribution System
Pressure Zone: 285 - Downtown
Project Status (Completed?): No

Go to CIP Summary Table

Project Description:

Project Description: To address fire flow deficiencies near the City's operations center and WWTF the following improvements are recommended:
1) Replace approximately 450 LF of 6-inch cast iron pipeline along SE 8th Avenue with 8-inch pipeline.
2) Replace approximately 400 LF of 6-inch cast iron pipeline along SE Polk Street with 8-inch pipeline.

Reasoning Fire flow deficiency

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 50%	Total Cost
Pipeline: 8-inch	850	LF	$ -	$ -	$ -	$ -	$ -
Total Anticipated Project Cost							$ -

Notes on Cost Estimation:

Costs for this project have been incorporated into the pipe replacement program.

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ -

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	-	0-10 years	$ -
Total Anticipated Project Cost			$ -

Project Location Map:

Go to Maps Tab



City of Camas
Water System Plan
Capital Improvement Plan

Project ID: D-05
Project Title: NW Fargo Street Fire Flow Improvements
Priority: 0-10 years
Facility Type: Distribution System
Pressure Zone: 697/734
Project Status (Completed?): No

Go to CIP Summary Table

Project Description:

Project Description: To address fire flow deficiencies in the NW Fargo Street area the following improvements are recommended:
1) Replace approximately 450 LF of 6-inch cast iron pipeline along NW Fargo Street between NW 23rd Street/Fargo PRV and NW 22nd Avenue with 8-inch pipeline.
2) Replace approximately 1,250 LF of 6-inch cast iron pipeline along NW Fargo Loop with 8-inch pipeline.

Reasoning Fire flow deficiency

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 50%	Total Cost
Pipeline: 8-inch	1,700	LF	$ -	$ -	$ -	$ -	$ -
Total Anticipated Project Cost							$ -

Notes on Cost Estimation:

Costs for this project have been incorporated into the pipe replacement program.

Go to Assumptions Tab

Cost Allocation:

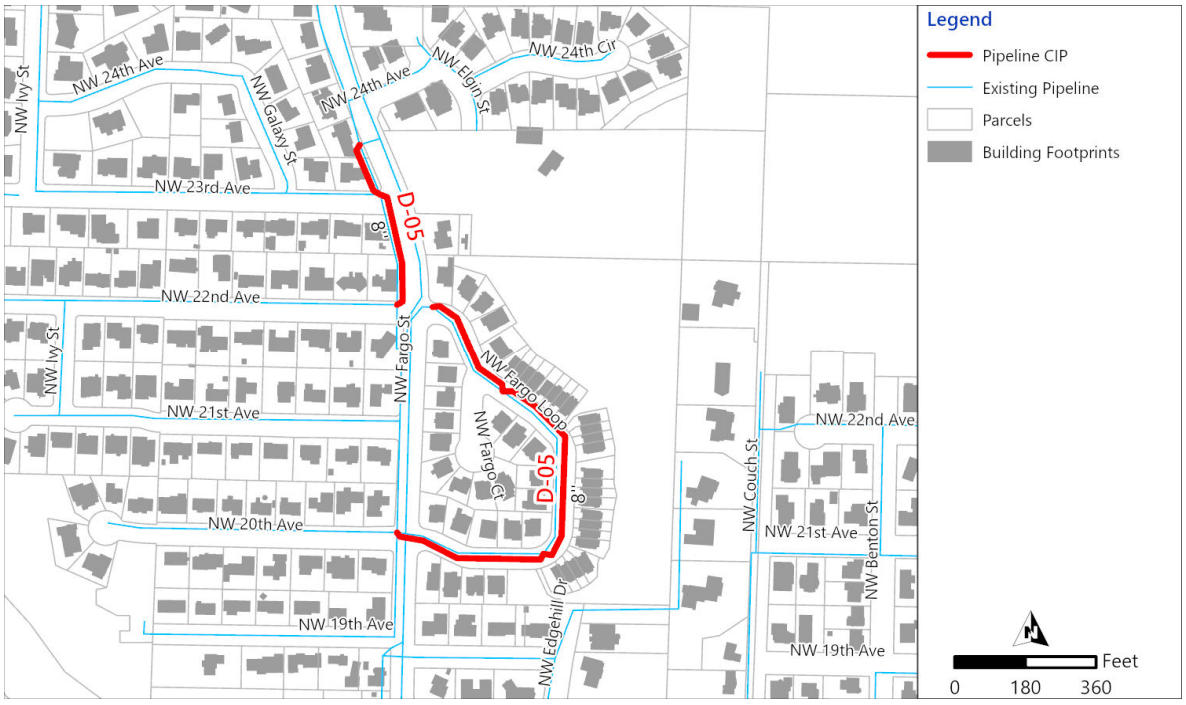
Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ -

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	-	0-10 years	$ -
Total Anticipated Project Cost			$ -

Project Location Map:

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City of Camas
Water System Plan
Capital Improvement Plan

Project ID: D-06
Project Title: Upper Prune Hill Fire Flow Improvements
Priority: 0-10 years
Facility Type: Distribution System
Pressure Zone: 852
Project Status (Completed?): No

Go to CIP Summary Table

Project Description:

Project Description: To improve fire flows near the Upper Prune Hill Reservoirs, the following improvements are recommended.
1) Upsize approximately 1,100 feet of existing 12-inch pipeline from along NW 18th Avenue from NW Cascade Street to Upper Prune Hill Reservoir with 16-inch pipeline.
2) Upsize approximately 450 feet of 8-inch pipeline along NW Cascade Street to 12-inch pipeline.
3) Construct approximately 250 feet of 8-inch pipeline along the walking path between NW 12th Circle and NW Astor Street.

Reasoning Fire flow deficiency

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 50%	Total Cost
Pipeline: 8-inch	250	LF	$ 236	$ 60,000	$ 20,000	$ 40,000	$ 120,000
Pipeline: 12-inch	450	LF	$ 300	$ 140,000	$ 40,000	$ 100,000	$ 280,000
Pipeline: 16-inch	1,100	LF	$ 404	$ 440,000	$ 130,000	$ 280,000	$ 850,000
Total Anticipated Project Cost							$ 1,250,000

Notes on Cost Estimation:

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Cost Allocation:

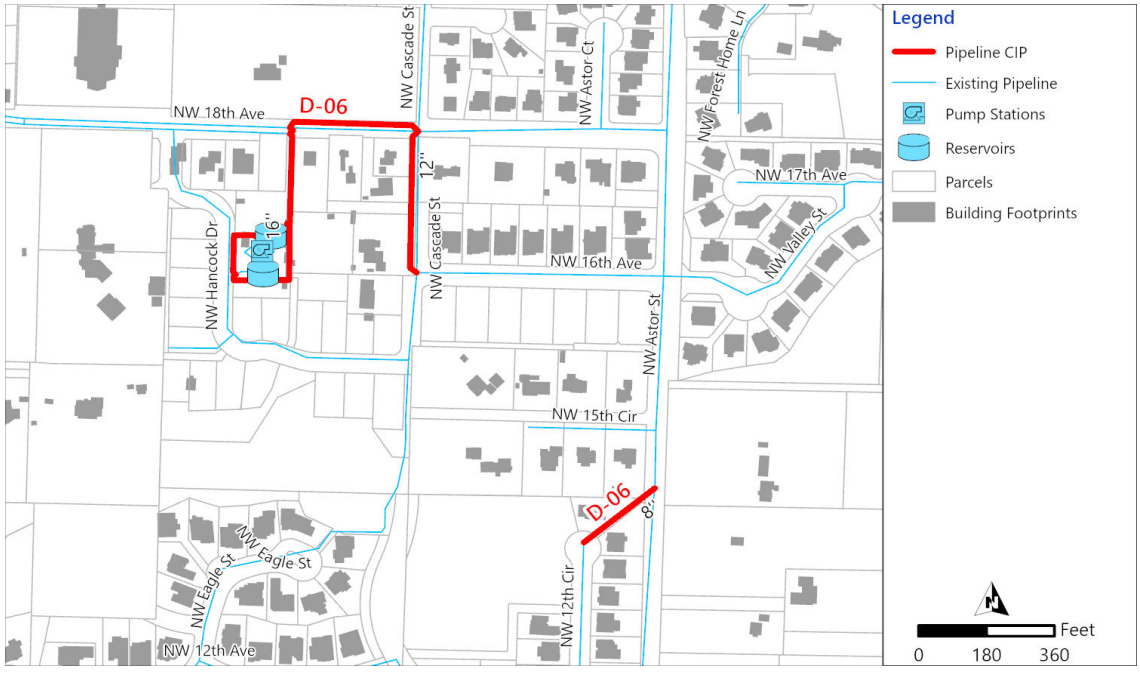
Project Type	Percent	Cost
Growth:	50%	$ 625,000
Upgrade:	50%	$ 625,000
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 1,250,000

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	2034	0-10 years	$ 1,250,000
Total Anticipated Project Cost			$ 1,250,000

Project Location Map:

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City of Camas
Water System Plan
Capital Improvement Plan

Project ID: D-07
Project Title: Sierra Lane PRV Station
Facility Type: Distribution System
Pressure Zone: 455

Go to CIP Summary Table

Priority: 0-10 years
Project Status (Completed?): No

Project Description:

Project Description: To address fire flow deficiencies near the top of NW Sierra Lane, a PRV station is recommended to allow fire flow from the 542_S zone to the 455 zone.

Reasoning Fire flow deficiency

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 50%	Total Cost
PRV	1	No.	$ 400,000	$ 400,000	$ 120,000	$ 260,000	$ 780,000
Total Anticipated Project Cost							$ 780,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 780,000
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 780,000

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	2034	0-10 years	$ 780,000
Total Anticipated Project Cost			$ 780,000

Project Location Map:

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City of Camas
Water System Plan
Capital Improvement Plan

Project ID: D-08
Project Title: SE 5th Street and SE Everett Rd Fire Flow Improvements
Priority: 0-10 years
Facility Type: Distribution System
Pressure Zone: 542
Project Status (Completed?): No

Go to CIP Summary Table

Project Description:

Project Description: To improve fire flows along SE Everett Road and SE 5th Street the following improvements are recommended:
1) Upsize approximately 1,200 LF of 10-inch pipeline along SE Everett Street between SE 5th Street and the proposed North Shore roundabout with 12-inch pipeline.
2) Construct approximately 50 LF of 8-inch pipeline along SE 5th Street to connect to the 12-inch pipeline on SE Everett Street.

Reasoning: Fire flow deficiency

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 50%	Total Cost
Pipeline: 8-inch	50	LF	$ 236	$ 10,000	$ -	$ -	$ 10,000
Pipeline: 12-inch	1,200	LF	$ 300	$ 360,000	$ 110,000	$ 230,000	$ 700,000
Total Anticipated Project Cost							$ 710,000

Notes on Cost Estimation:

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Cost Allocation:

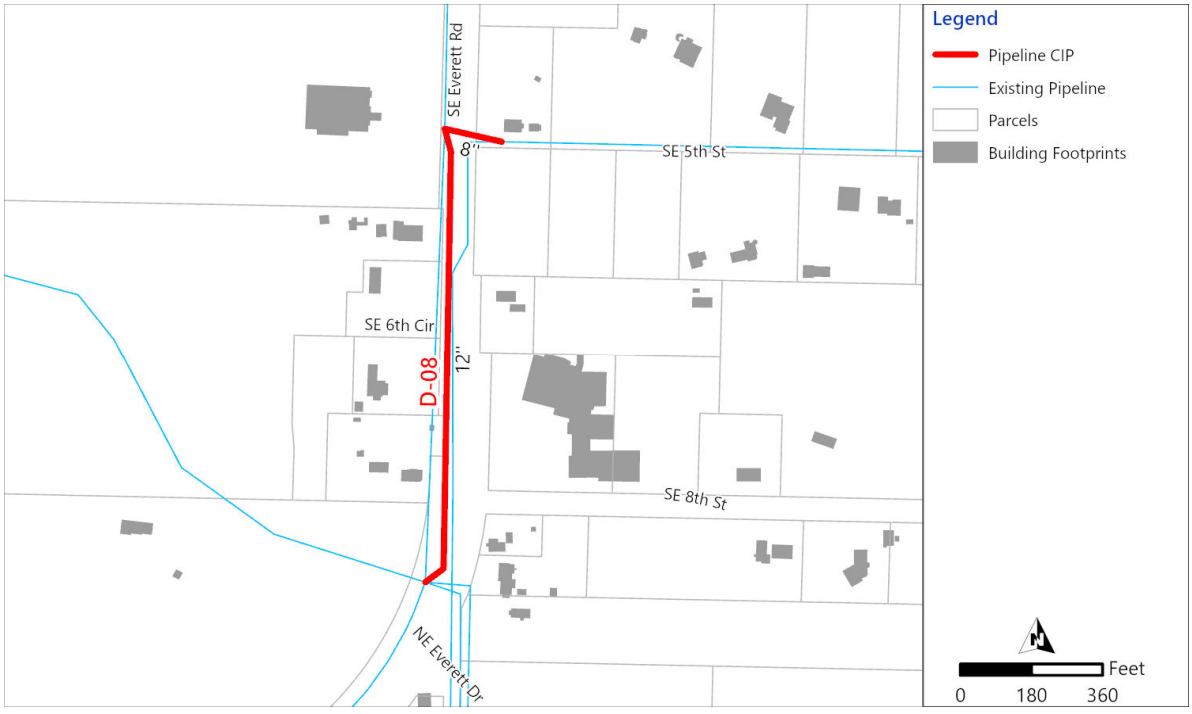
Project Type	Percent	Cost
Growth:	100%	$ 710,000
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 710,000

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	2034	0-10 years	$ 710,000
Total Anticipated Project Cost			$ 710,000

Project Location Map:

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City of Camas
Water System Plan
Capital Improvement Plan

Project ID: D-09
Project Title: SE 283rd Avenue Fire Flow Improvements
Priority: 0-10 years
Facility Type: Distribution System
Pressure Zone: 542
Project Status (Completed?): No

Go to CIP Summary Table

Project Description:

Project Description: To address fire flow deficiencies along SE 283rd Avenue, replace approximately 2,700 LF of 8-inch pipeline between SE 7th Street and SE Nourse Road with 12-inch pipeline.

Reasoning Fire flow deficiency

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 50%	Total Cost
Pipeline: 12-inch	2,700	LF	$ 300	$ 810,000	$ 240,000	$ 550,000	$ 1,600,000
Total Anticipated Project Cost							$ 1,600,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 1,600,000
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 1,600,000

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	2034	0-10 years	$ 1,600,000
Total Anticipated Project Cost			$ 1,600,000

Project Location Map:

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City of Camas
Water System Plan
Capital Improvement Plan

Project ID: D-10
Project Title: NE 6th Avenue and NE Nevada Street Fire Flow Improvements
Priority: 0-10 years
Facility Type: Distribution System
Pressure Zone: 285-Downtown/343
Project Status (Completed?): No

Go to CIP Summary Table

Project Description:

Project Description: To address fire flow deficiencies in the NW Fargo Street area the following improvements are recommended:
1) Replace approximately 1,700 LF of 6-inch cast iron pipeline along NE 6th Avenue with 8-inch pipeline.
2) Replace approximately 1,900 LF of 6-inch cast iron pipeline along NE Nevada Street with 8-inch pipeline.
Reasoning Fire flow deficiency

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 50%	Total Cost
Pipeline: 8-inch	3,600	LF	$ -	$ -	$ -	$ -	$ -
Total Anticipated Project Cost							$ -

Notes on Cost Estimation:

Costs for this project have been incorporated into the pipe replacement program.

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Cost Allocation:

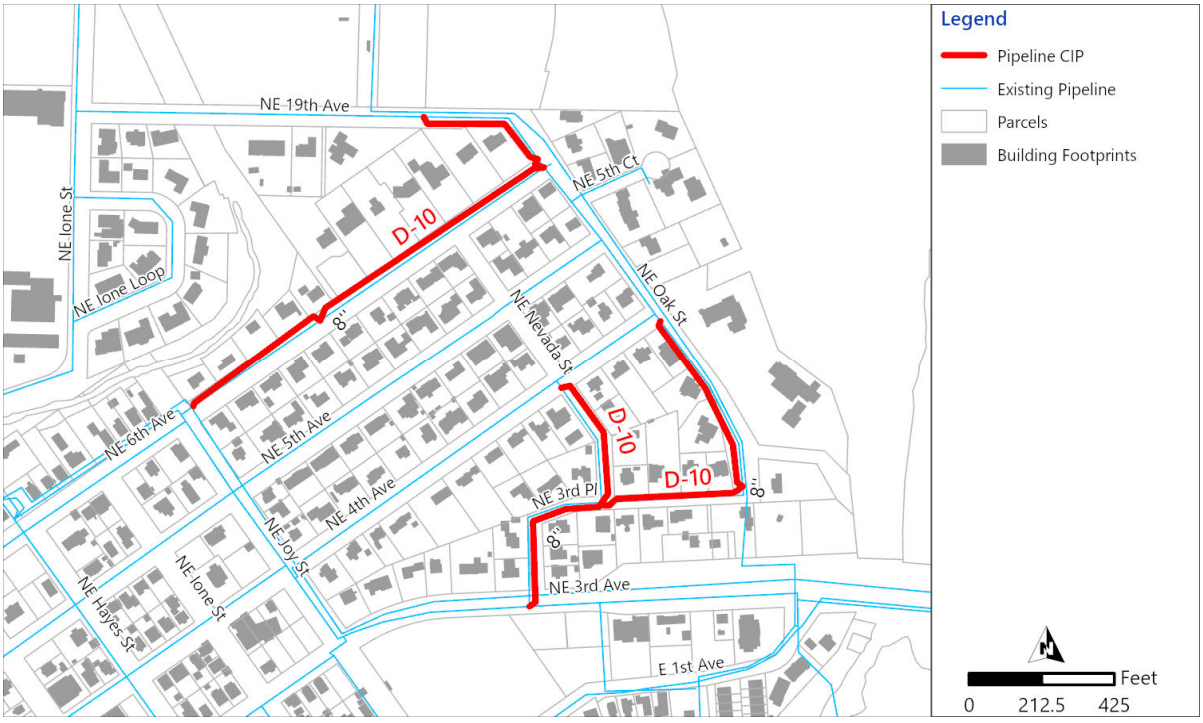
Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ -

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	-	0-10 years	$ -
Total Anticipated Project Cost			$ -

Project Location Map:

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City of Camas
Water System Plan
Capital Improvement Plan

Project ID: T-01
Project Title: North Shore Transmission Pipeline
Facility Type: Transmission Pipeline
Pressure Zone: 542

Go to CIP Summary Table

Priority: 0-10 years
Project Status (Completed?): No

Project Description:

Project Description: To serve future development and demands expected in the North Shore area, it is recommended to construct a transmission pipeline network. The transmission pipeline network shall consist of the following segments:
Segment 1 - 1,600 LF of 12-inch pipeline along NE 3rd Avenue between NE Everett Street and N Benton Drive
Segment 2 - 13,200 LF of 24-inch pipeline along the proposed North Shore Boulevard between the proposed roundabout at NE Everett Street and N Benton Drive.
Segment 3 - 4,200 LF of 24-inch pipeline along SE 15th Street between the recommended Gregg Reservoir and the proposed roundabout at NE Everett Street.

Reasoning Demand growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 50%	Total Cost
Segment 1: Pipeline: 12-inch	1,600	LF	$ 300	$ 480,000	$ 140,000	$ 310,000	$ 930,000
Segment 2: Pipeline: 24-inch	13,200	LF	$ 575	$ 7,600,000	$ 2,300,000	$ 5,000,000	$ 14,900,000
Segment 3: Pipeline: 24-inch	4,200	LF	$ 575	$ 2,400,000	$ 720,000	$ 1,580,000	$ 4,700,000
Total Anticipated Project Cost							$ 20,530,000

Notes on Cost Estimation:

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Cost Allocation:

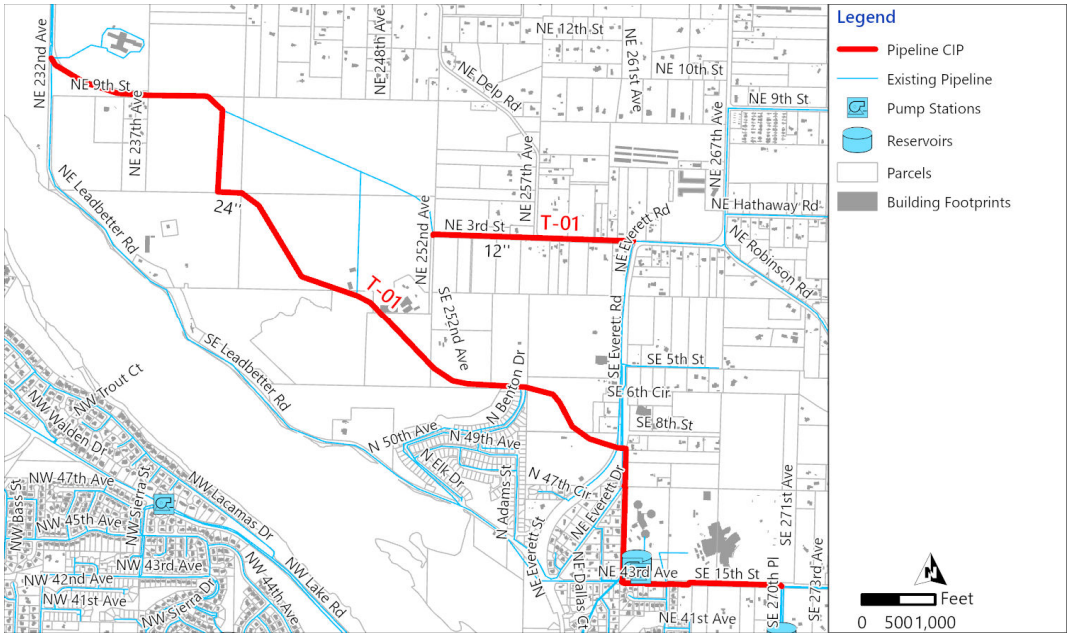
Project Type	Percent	Cost
Growth:	100%	$ 20,530,000
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 20,530,000

Project Timing:

Project Element	Timing	Priority	Cost
Segment 1	2032	0-10 years	$ 930,000
Segment 2	2032	0-10 years	$ 14,900,000
Segment 3	2032	0-10 years	$ 4,700,000
Total Anticipated Project Cost			$ 20,530,000

Project Location Map:

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City of Camas
Water System Plan
Capital Improvement Plan

Project ID: T-02
Project Title: Angelo Discharge Pipeline
Facility Type: Transmission Pipeline
Pressure Zone: 455

Go to CIP Summary Table

Priority: 10-20 years
Project Status (Completed?): No

Project Description:

Project Description: The discharge piping for Angelo Pump Station in the distribution network is undersized for future demands, resulting in high head loss and discharge pressures. Approximately 3,350 linear feet of 16-inch pipeline is recommended between Angelo PS and the Lower Prune Hill Reservoirs.

Reasoning Demand growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 50%	Total Cost
Pipeline: 16-inch	3,350	LF	$ 404	$ 1,400,000	$ 420,000	$ 880,000	$ 2,700,000
Total Anticipated Project Cost							$ 2,700,000

Notes on Cost Estimation:

To distribute project costs across multiple fiscal years, it is expected design of this pipeline will occur in 2037 with construction to occur in 2038. Design is assumed to be 10% of the total project cost.

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Cost Allocation:

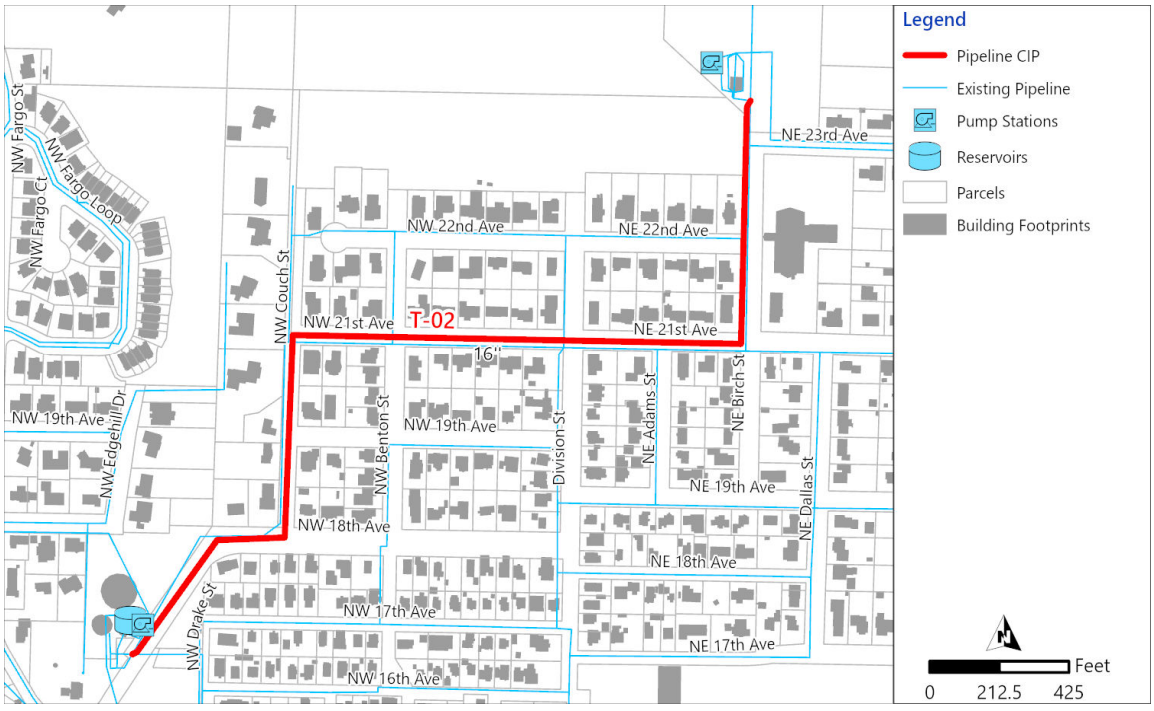
Project Type	Percent	Cost
Growth:	100%	$ 2,700,000
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 2,700,000

Project Timing:

Project Element	Timing	Priority	Cost
Design	2037	10-20 years	$ 270,000
Construction	2038	10-20 years	$ 2,430,000
Total Anticipated Project Cost			$ 2,700,000

Project Location Map:

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City of Camas
Water System Plan
Capital Improvement Plan

Project ID: R-01
Project Title: Pipeline R&R Program
Facility Type: Annual Programs
Pressure Zone: System-wide

Go to CIP Summary Table

Priority: Annual
Project Status (Completed?): No

Project Description:

Project Description: During the duration of this WSP planning period, the City should consider implementing a pipeline replacement program to address localized issues or to participate in joint projects that cost-effectively replace aging pipeline. The City currently has approximately 32 miles of cast iron or steel pipeline in its distribution system, mostly centralized in the downtown area that have or are approaching the end of their useful life. Small diameter mains (less than 6-inch) should also be upsized to 8-inch to meet current City standards. This pipelineline replacement program recommends replacing 1% (~1.5 miles) of pipeline per year.

Reasoning Replace aging infrastructure

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 50%	Total Cost
Pipeline: 8-inch	119,700	LF	$ 236	$ 28,200,000	$ 8,500,000	$ 18,300,000	$ 55,000,000
Pipeline: 12-inch	33,500	LF	$ 300	$ 10,100,000	$ 3,000,000	$ 6,600,000	$ 19,700,000
Pipeline: 16-inch	11,900	LF	$ 404	$ 4,800,000	$ 1,400,000	$ 3,100,000	$ 9,300,000
Total Anticipated Project Cost							$ 84,000,000

Notes on Cost Estimation:

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Cost Allocation:

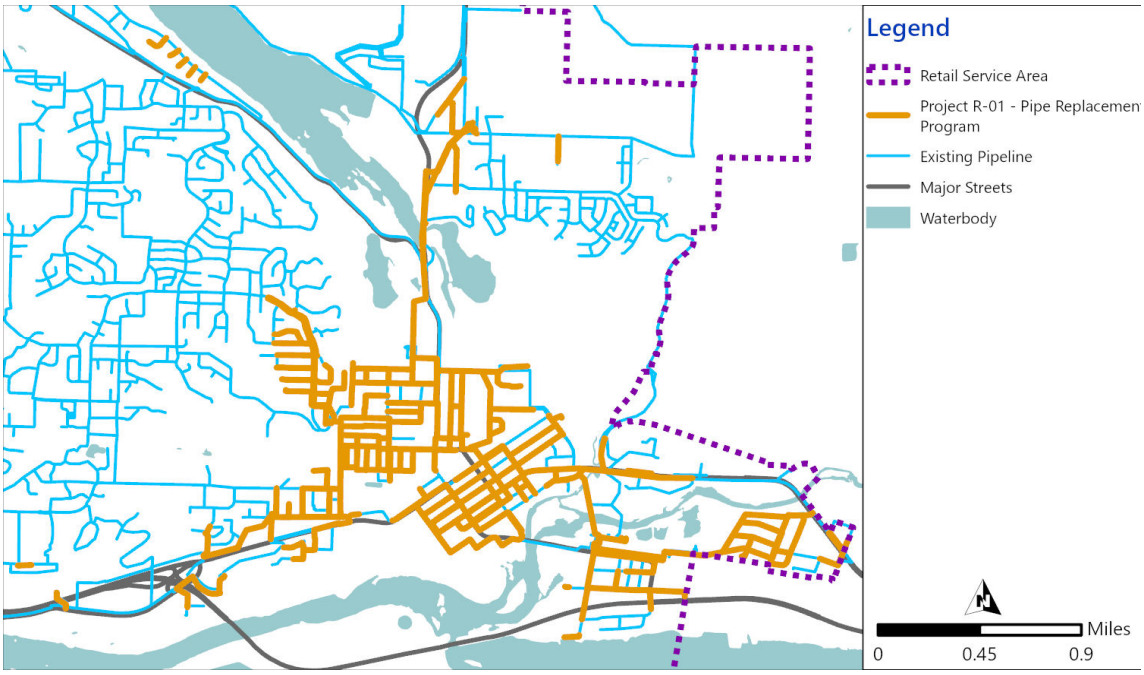
Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
Repair & Replacement:	100%	$ 84,000,000
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 84,000,000

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	-	Annual	$ 84,000,000
Total Anticipated Project Cost			$ 84,000,000

Project Location Map:

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City of Camas
Water System Plan
Capital Improvement Plan

Project ID: R-02
Project Title: Miscellaneous Facility Projects
Facility Type: Annual Programs
Pressure Zone: System-wide

Go to CIP Summary Table

Priority: Annual
Project Status (Completed?): No

Project Description:

Project Description: Miscellaneous Facility Projects

Reasoning Repair and Replacement

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 50%	Total Cost
Miscellaneous	40	No.	$ 75,000	$ 3,000,000	$ -	$ -	$ 3,000,000
Total Anticipated Project Cost							$ 3,000,000

Notes on Cost Estimation:

Total cost for the entire 20 year period is $3M. The City typically completes two projects per year totaling $150K.

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Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
Repair & Replacement:	100%	$ 3,000,000
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 3,000,000

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	-	Annual	$ 3,000,000
Total Anticipated Project Cost			$ 3,000,000

Project Location Map:

Go to Maps Tab

City of Camas
Water System Plan
Capital Improvement Plan

Project ID: PS-01
Project Title: 544 Zone Pumping Improvements
Facility Type: Pump Station
Pressure Zone: 544

Go to CIP Summary Table

Priority: 0-10 years
Project Status (Completed?): In Design

Project Description:

Project Description: Lake Road PS and 343 zone transmission pipeline are recommended to increase pumping capacity into the 544 zone. The new PS will pump directly from the 343 zone into the 544 zone alleviating reliance on Angelo PS. To best align the construction of the transmission pipeline with future water system needs and ongoing projects within the City, it is recommended the transmission pipeline be divided into the following segments:
Segment 1 - 6,000 LF of 36-inch diameter pipeline from the intersection of E 1st Avenue/NE 3rd Avenue to the intersection of NE Everett Street/NE 22nd Avenue.
Segment 2 - 3,600 LF of 30-inch pipeline from the intersection of NE Everett Street/NE 22nd Avenue to Lacamas Lodge.
Segment 3 - 6,250 LF of 30-inch pipeline along NW Lake Road between Lacamas Lodge and NW Sierra Street.
Segment 4 - 1,350 LF of 24-inch pipeline along NW Sierra Street between NW Lake Road and NW 43rd Avenue.

Reasoning Demand growth

Anticipated Project Cost:

Project Element	Total Cost
Pump Station	$ 7,300,000
Segment 1: Pipeline: 36-inch	$ 13,200,000
Segment 2: Pipeline: 30-inch	$ 5,800,000
Segment 3: Pipeline: 30-inch	$ 10,200,000
Segment 4: Pipeline: 24-inch	$ 1,400,000
Total Anticipated Project Cost	$ 37,900,000

Notes on Cost Estimation:

Pump station cost provided from Lake Road PS Class 4 estimate prepared by Carollo. Pipe cost developed using unit costs and assumes 10% ELA for construction management services (project is currently in design).

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Cost Allocation:

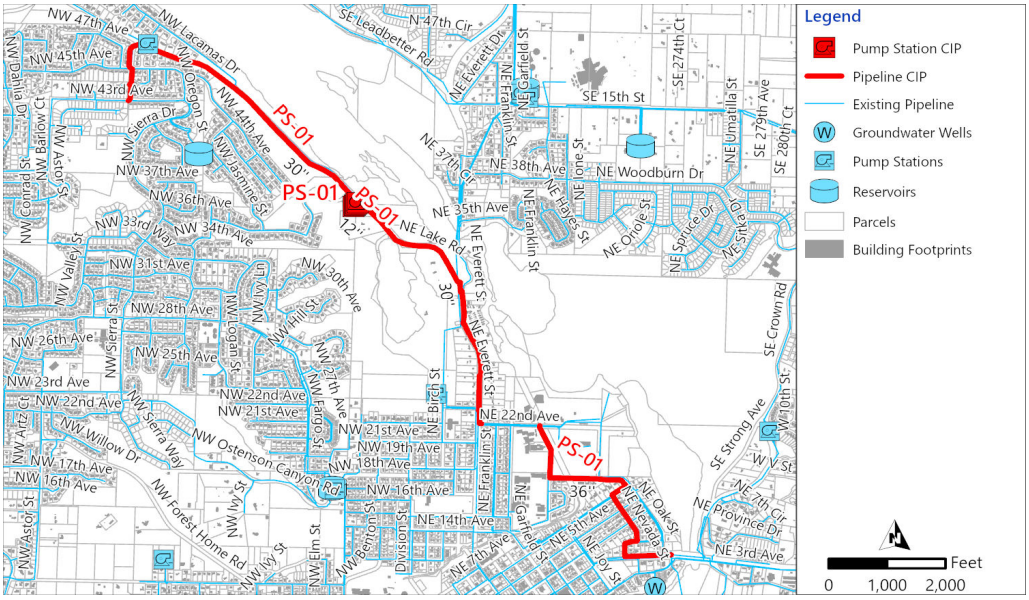
Project Type	Percent	Cost
Growth:	100%	$ 37,900,000
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 37,900,000

Project Timing:

Project Element	Timing	Priority	Cost
Segment 1 Construction	2027-2028	0-10 years	$ 13,200,000
Segment 2-4 Design	2031	0-10 years	$ 1,740,000
Segment 2-4 Construction	2032-2033	0-10 years	$ 15,660,000
PS Design	2032	0-10 years	$ 730,000
PS Construction	2033-2034	0-10 years	$ 6,570,000
Total Anticipated Project Cost			$ 37,900,000

Project Location Map:

Go to Maps Tab



City of Camas
Water System Plan
Capital Improvement Plan

Project ID: PS-02
Project Title: 542 Zone Pumping Improvements
Facility Type: Pump Station
Pressure Zone: 542

Go to CIP Summary Table

Priority: 10-20 years
Project Status (Completed?): No

Project Description:

Project Description: To reduce reliance on New Gregg PS and address pumping capacity deficiencies it is recommended to add a 800 gpm pump in the remaining empty can at Crown Road PS.

Reasoning Demand growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 55%	Total Cost
Pump Station	1	No.	$ 350,000	$ 350,000	$ 110,000	$ 260,000	$ 720,000
Total Anticipated Project Cost							$ 720,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 720,000
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 720,000

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	2045	10-20 years	$ 720,000
Total Anticipated Project Cost			$ 720,000

Project Location Map:

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City of Camas
Water System Plan
Capital Improvement Plan

Project ID: PS-03
Project Title: Francis Road Pump Station Improvements
Priority: 0-10 years
Facility Type: Pump Station
Pressure Zone: Francis Road
Project Status (Completed?): No

Go to CIP Summary Table

Project Description:

Project Description: To address fire flow deficiencies and low pressures in the neighboring areas, it is recommended to replace Francis Road PS and expand the service area to increase pressures to high elevation customers. Additionally, to supply sufficient fire flow a 1,000 gpm fire pump is recommended at the site. To meet the City's reliability criteria an on-site generator is included as part of this project.

Reasoning Fire flow and low pressures

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 55%	Total Cost
Pump Station	1	No.	$ 1,230,000	$ 1,200,000	$ 360,000	$ 840,000	$ 2,400,000
Generators	1	No.	$ 500,000	$ 500,000	$ 150,000	$ 350,000	$ 1,000,000

Total Anticipated Project Cost	$ 3,400,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 3,400,000
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 3,400,000

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	2035	0-10 years	$ 3,400,000
Total Anticipated Project Cost			$ 3,400,000

Project Location Map:

Go to Maps Tab



City of Camas
Water System Plan
Capital Improvement Plan

Project ID: ST-01
Project Title: 343 Zone Storage
Facility Type: Storage
Pressure Zone: 343
Priority: 0-10 years
Project Status (Completed?): In Design

Go to CIP Summary Table

Project Description:

Project Description: Minimum of 1.84 MG of usable storage in the elevated reservoir at the Cemetery site to address a storage deficit and replace the aging Butler Reservoir. Once complete this reservoir will provide sufficient storage for the entirety of the planning period while Butler Reservoir is decommissioned. The elevated reservoir was the selected alternative and memorialized in Gray & Osborne's New 343 Reservoir Alternatives Analysis report in September 2025.

Reasoning Storage needs

Anticipated Project Cost:

Project Element	Total Cost
New Storage Reservoir	$ 25,700,000

Total Anticipated Project Cost	$ 25,700,000

Notes on Cost Estimation:

Total estimated cost is from Gray and Osborne (G&O) 343 New Reservoir Alternatives Analysis, Sept 2025

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	36%	$ 9,252,000
Upgrade:	64%	$ 16,448,000
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 25,700,000

Project Timing:

Project Element	Timing	Priority	Cost
Construction	2030-2031	0-10 years	$ 25,700,000
Total Anticipated Project Cost			$ 25,700,000

Project Location Map:

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City of Camas
Water System Plan
Capital Improvement Plan

Project ID: ST-02
Project Title: 542 Zone Storage
Facility Type: Storage
Pressure Zone: 542

Go to CIP Summary Table

Priority: 0-10 years
Project Status (Completed?): No

Project Description:

Project Description: 1.5 MG reservoir at the Gregg Standpipeline site is recommended to address the storage deficit in the 542 zone. Approximately 3,800 feet of 24-inch transmission pipeline will be needed from Crown Road pump station to the new reservoir. The transmission pipeline will alleviate hydraulic bottlenecks, allowing more pumps at Crown Road pump station to operate simultaneously and fill the new reservoir.

Reasoning Storage needs

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 50%	Total Cost
Reservoir	1.5	MG	$ 10	$ 15,000,000	$ 4,500,000	$ 9,800,000	$ 29,300,000
Pipeline: 24-inch	3,800	LF	$ 575	$ 2,200,000	$ 660,000	$ 1,440,000	$ 4,300,000

Total Anticipated Project Cost	$ 33,600,000

Notes on Cost Estimation:

To reduce annual CIP cost, the pipe portion of this project can be completed a year prior to the reservoir (estimated completion in 2032).

Go to Assumptions Tab

Cost Allocation:

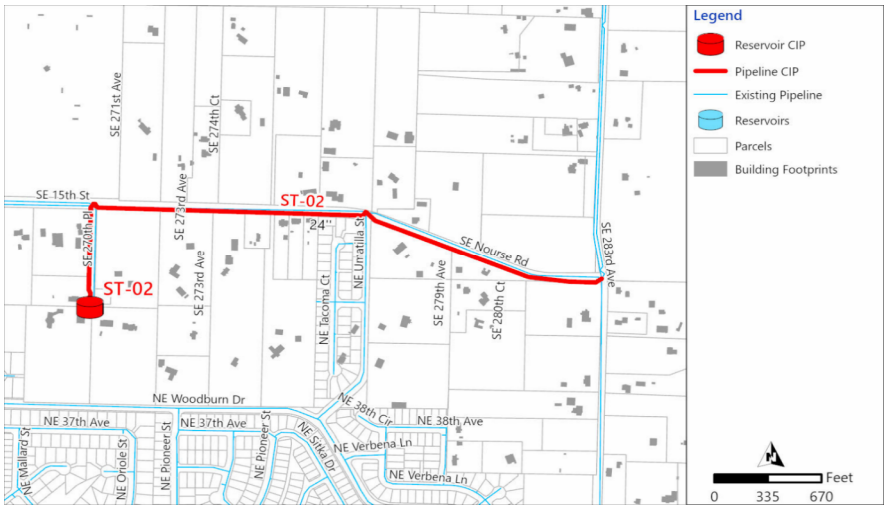
Project Type	Percent	Cost
Growth:	22%	$ 7,224,000
Upgrade:	79%	$ 26,376,000
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 33,600,000

Project Timing:

Project Element	Timing	Priority	Cost
Pipeline Design	2029	0-10 years	$ 430,000
Pipeline Construction	2030	0-10 years	$ 3,870,000
Reservoir Design	2034	0-10 years	$ 2,930,000
Reservoir Construction	2035-2036	0-10 years	$ 26,370,000
Total Anticipated Project Cost			$ 33,600,000

Project Location Map:

Go to Maps Tab



City of Camas
Water System Plan
Capital Improvement Plan

Project ID: ST-03
Project Title: 544 Zone Storage
Facility Type: Storage
Pressure Zone: 544

Go to CIP Summary Table

Priority: 10-20 years
Project Status (Completed?): No

Project Description:

Project Description: 0.75 MG reservoir at the 18th Avenue site is recommended to address the storage deficit in the 544 zone.

Reasoning Storage needs

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 50%	Total Cost
Reservoir	0.75	MG	$ 3	$ 2,300,000	$ 690,000	$ 1,510,000	$ 4,500,000
Total Anticipated Project Cost							$ 4,500,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 4,500,000
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 4,500,000

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	2045	10-20 years	$ 4,500,000
Total Anticipated Project Cost			$ 4,500,000

Project Location Map:

Go to Maps Tab



City of Camas
Water System Plan
Capital Improvement Plan

Project ID: S-01
Project Title: Well 8, 11, 12 Expansion + PFAS Treatment
Priority: 0-10 years
Facility Type: Supply and Treatment
Pressure Zone: N/A
Project Status (Completed?): No

Go to CIP Summary Table

Project Description:

Project Description: The City will need to increase supply capacity to serve projected future demands. The City's water supply strategy identified capacity upgrades in the Lower Washougal Wellfield can be acheived by upsizing the well screen and pump at Well 8 and upsizing pumps at Well 11 and 12. Additionally, treatment will be needed for wells with PFAS detections exceeding regulatory limits. This project will consist of well upgrades, initial PFAS treatment capacity of 2,725 gpm, an intermediate reservoir/PS, chemical facility upgrades, and standby power. Details regarding this project are further discussed in the LWWF PFAS Treatment Alternatives Analysis (Carollo 2026).

Reasoning Supply capacity needs

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 55%	Total Cost
Well Upgrades	1	LS	$ 3,819,400	$ 3,800,000	$ 1,100,000	$ 2,600,000	$ 7,500,000
PFAS Treatment	1	LS	$ 6,112,600	$ 6,100,000	$ 1,800,000	$ 4,400,000	$ 12,300,000
Reservoir/PS	1	LS	$ 6,668,000	$ 6,700,000	$ 2,000,000	$ 4,800,000	$ 13,500,000
Chemical Facilities	1	LS	$ 2,692,308	$ 2,700,000	$ 810,000	$ 1,890,000	$ 5,400,000
Standby Power	1	LS	$ 769,231	$ 770,000	$ 230,000	$ 600,000	$ 1,600,000

Total Anticipated Project Cost	$ 40,300,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	13%	$ 5,239,000
Upgrade:	87%	$ 35,061,000
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 40,300,000

Project Timing:

Project Element	Timing	Priority	Cost
Design	2027	0-10 years	$ 4,030,000
Construction	2028-2030	0-10 years	$ 36,270,000
Total Anticipated Project Cost			$ 40,300,000

Project Location Map:

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City of Camas
Water System Plan
Capital Improvement Plan

Project ID: S-02
Project Title: Well 18 Development
Facility Type: Supply and Treatment
Pressure Zone: N/A

Go to CIP Summary Table

Priority: 10-20 years
Project Status (Completed?): No

Project Description:

Project Description: Increase production capacity in the Lower Washougal Wellfield by approximately 2,000 gpm to meet future demands by developing Well 18. Development of Well 18 would include the drilling, equipping (building and mechanical equipment), and installation of an on-site generator for reliability. As water quality for the new well is unknown, it is assumed for planning purposes that PFAS treatment will be needed.

Reasoning Supply capacity needs

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 55%	Total Cost
Well 18 Drilling	1	LS	$ 150,000	$ 150,000	$ 50,000	$ 110,000	$ 310,000
Well 18 Equipping	1	LS	$ 1,750,000	$ 1,800,000	$ 540,000	$ 1,260,000	$ 3,600,000
PFAS Treatment	1	LS	$ 2,310,000	$ 2,300,000	$ 690,000	$ 1,610,000	$ 4,600,000
Generators	1	No.	$ 500,000	$ 500,000	$ 150,000	$ 350,000	$ 1,000,000
Total Anticipated Project Cost							$ 9,510,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 9,510,000
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 9,510,000

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	2037	10-20 years	$ 9,510,000
Total Anticipated Project Cost			$ 9,510,000

Project Location Map:

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City of Camas
Water System Plan
Capital Improvement Plan

Project ID: S-03
Project Title: Well 13B Development
Facility Type: Supply and Treatment
Pressure Zone: N/A

Go to CIP Summary Table

Priority: 10-20 years
Project Status (Completed?): No

Project Description:

Project Description: Increase production capacity in the Lower Washougal Wellfield by approximately 1,000 gpm to meet future demands by Well 13B. The location of this well is assumed to be at the Well 13 site or nearby at Louis Bloch Park. Development of this well would include the drilling, equipping (building and mechanical equipment), and installation of an on-site generator for reliability. As water quality for the new well is unknown, it is assumed for planning purposes that PFAS treatment will be needed.

Reasoning Supply capacity needs

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 55%	Total Cost
Well 13B Drilling	1	LS	$ 150,000	$ 150,000	$ 50,000	$ 110,000	$ 310,000
Well 13B Equipping	1	LS	$ 1,375,000	$ 1,400,000	$ 420,000	$ 980,000	$ 2,800,000
PFAS Treatment	1	LS	$ 2,310,000	$ 2,300,000	$ 690,000	$ 1,610,000	$ 4,600,000
Generators	1	No.	$ 500,000	$ 500,000	$ 150,000	$ 350,000	$ 1,000,000
Total Anticipated Project Cost							$ 8,710,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 8,710,000
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 8,710,000

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	2044	10-20 years	$ 8,710,000
Total Anticipated Project Cost			$ 8,710,000

Project Location Map:

Go to Maps Tab



City of Camas
Water System Plan
Capital Improvement Plan

Project ID: S-04
Project Title: Well 19 Development
Facility Type: Supply and Treatment
Pressure Zone: N/A

Go to CIP Summary Table

Priority: 10-20 years
Project Status (Completed?): No

Project Description:

Project Description: Increase production capacity in the Lower Washougal Wellfield by approximately 1,000 gpm to meet future demands by developing Well 19. Development of this well would include the drilling, equipping (building and mechanical equipment), and installation of an on-site generator for reliability. As water quality for the new well is unknown, it is assumed for planning purposes that PFAS treatment will be needed.

Reasoning Supply capacity needs

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 55%	Total Cost
Well Drilling	1	LS	$ 150,000	$ 150,000	$ 50,000	$ 110,000	$ 310,000
Well Equipping	1	LS	$ 1,375,000	$ 1,400,000	$ 420,000	$ 980,000	$ 2,800,000
PFAS Treatment	1	LS	$ 2,310,000	$ 2,300,000	$ 690,000	$ 1,610,000	$ 4,600,000
Generators	1	No.	$ 500,000	$ 500,000	$ 150,000	$ 350,000	$ 1,000,000

Total Anticipated Project Cost	$ 8,710,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 8,710,000
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 8,710,000

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	2046	10-20 years	$ 8,710,000
Total Anticipated Project Cost			$ 8,710,000

Project Location Map:

Go to Maps Tab



City of Camas
Water System Plan
Capital Improvement Plan

Project ID: S-05
Project Title: LWWF PFAS Treatment Facility Expansion Phase 1
Priority: 0-10 years
Facility Type: Supply and Treatment
Pressure Zone: N/A
Project Status (Completed?): No

Go to CIP Summary Table

Project Description:

Project Description: Expand the capacity at the LWWF PFAS Treatment Facility (~2,400 gpm) to treat additional wells that may become impacted by PFAS in the future. The Phase 1 expansion will increase the initial capacity of the treatment facility to approximately 5,125 gpm

Reasoning Future PFAS regulatory compliance

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 55%	Total Cost
PFAS Treatment	1	LS	$ 4,620,000	$ 4,600,000	$ 1,400,000	$ 3,300,000	$ 9,300,000

Total Anticipated Project Cost	$ 9,300,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 9,300,000
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 9,300,000

Project Timing:

Project Element	Timing	Priority	Cost
Design	2032	0-10 years	$ 930,000
Construction	2033-2034	0-10 years	$ 8,370,000
Total Anticipated Project Cost			$ 9,300,000

Project Location Map:

Go to Maps Tab

City of Camas
Water System Plan
Capital Improvement Plan

Project ID: S-06
Project Title: LWWF PFAS Treatment Facility Expansion Phase 2
Priority: 10-20 years
Facility Type: Supply and Treatment
Pressure Zone: N/A
Project Status (Completed?): No

Go to CIP Summary Table

Project Description:

Project Description: Expand the capacity at the LWWF PFAS Treatment Facility (~2,400 gpm) to treat additional wells that may become impacted by PFAS in the future. The Phase 2 expansion will increase the initial capacity of the treatment facility to approximately 7,525 gpm

Reasoning Future PFAS regulatory compliance

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 55%	Total Cost
PFAS Treatment	1	LS	$ 4,620,000	$ 4,600,000	$ 1,400,000	$ 3,300,000	$ 9,300,000

Total Anticipated Project Cost	$ 9,300,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 9,300,000
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 9,300,000

Project Timing:

Project Element	Timing	Priority	Cost
Design	2036	0-10 years	$ 930,000
Construction	2037-2038	10-20 years	$ 8,370,000
Total Anticipated Project Cost			$ 9,300,000

Project Location Map:

Go to Maps Tab

City of Camas
Water System Plan
Capital Improvement Plan

Project ID: S-07
Project Title: LWWF PFAS Treatment Facility Expansion Phase 3
Priority: 10-20 years
Facility Type: Supply and Treatment
Pressure Zone: N/A
Project Status (Completed?): No

Go to CIP Summary Table

Project Description:

Project Description: Expand the capacity at the LWWF PFAS Treatment Facility (~2,400 gpm) to treat additional wells that may become impacted by PFAS in the future. The Phase 3 expansion will increase the capacity of the treatment facility to the initial buildout capacity of 9,925 gpm. Future expansions from initial buildout to ultimate buildout will occur as future wells in the LWWF are drilled and developed.

Reasoning Future PFAS regulatory compliance

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 55%	Total Cost
PFAS Treatment	1	LS	$ 4,620,000	$ 4,600,000	$ 1,400,000	$ 3,300,000	$ 9,300,000
Total Anticipated Project Cost							$ 9,300,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 9,300,000
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	0%	$ -
Total Anticipated Project Cost	100%	$ 9,300,000

Project Timing:

Project Element	Timing	Priority	Cost
Design	2040	0-10 years	$ 930,000
Construction	2041-2042	10-20 years	$ 8,370,000
Total Anticipated Project Cost			$ 9,300,000

Project Location Map:

Go to Maps Tab

City of Camas
Water System Plan
Capital Improvement Plan

Project ID: G-01
Project Title: 2036 Water System Plan Update
Facility Type: General
Pressure Zone: System-wide

Go to CIP Summary Table

Priority: 0-10 years
Project Status (Completed?): No

Project Description:

Project Description: Update Water System Plan every 10-years.

Reasoning Regulatory requirements

Anticipated Project Cost:

Project Element	Total Cost
Water System Plan	$ 525,000
Total Anticipated Project Cost	$ 525,000

Notes on Cost Estimation:

Total cost includes 5% factor applied to direct costs for the City to administer the project.

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	100%	$ 525,000
Total Anticipated Project Cost	100%	$ 525,000

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	2035-2036	0-10 years	$ 525,000
Total Anticipated Project Cost			$ 525,000

Project Location Map:

Go to Maps Tab

City of Camas
Water System Plan
Capital Improvement Plan

Project ID: G-02
Project Title: 2046 Water System Plan Update
Facility Type: General
Pressure Zone: System-wide

Go to CIP Summary Table

Priority: 10-20 years
Project Status (Completed?): No

Project Description:

Project Description: Update Water System Plan every 10-years.

Reasoning Regulatory requirements

Anticipated Project Cost:

Project Element	Total Cost
Water System Plan	$ 525,000
Total Anticipated Project Cost	$ 525,000

Notes on Cost Estimation:

Total cost includes 5% factor applied to direct costs for the City to administer the project.

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	100%	$ 525,000
Total Anticipated Project Cost	100%	$ 525,000

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	2045-2046	10-20 years	$ 525,000
Total Anticipated Project Cost			$ 525,000

Project Location Map:

Go to Maps Tab

City of Camas
Water System Plan
Capital Improvement Plan

Project ID: G-03
Project Title: Water Rights Investigation
Facility Type: General
Pressure Zone: System-wide

Go to CIP Summary Table

Priority: 0-10 years
Project Status (Completed?): No

Project Description:

Project Description: Conduct a study to evaluate the transfer or acquisition of additional groundwater rights in the Lower Washougal Wellfield.

Reasoning General Study

Anticipated Project Cost:

Project Element	Total Cost
General Fund for Studies	$ 290,000
Total Anticipated Project Cost	$ 290,000

Notes on Cost Estimation:

Total cost includes 5% factor applied to direct costs for the City to administer the project.

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	100%	$ 290,000
Total Anticipated Project Cost	100%	$ 290,000

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	2027-2028	0-10 years	$ 290,000
Total Anticipated Project Cost			$ 290,000

Project Location Map:

Go to Maps Tab

City of Camas
Water System Plan
Capital Improvement Plan

Project ID: G-04
Project Title: Pipeline Replacement Prioritization Study
Priority: 0-10 years
Facility Type: General
Pressure Zone: System-wide
Project Status (Completed?): No

Go to CIP Summary Table

Project Description:

Project Description: Conduct a study to develop a prioritization schedule for cast iron and steel pipelines identified in the pipeline replacement program.

Reasoning General Study

Anticipated Project Cost:

Project Element	Total Cost
General Fund for Studies	$ 160,000
Total Anticipated Project Cost	$ 160,000

Notes on Cost Estimation:

Total cost includes 5% factor applied to direct costs for the City to administer the project.

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
Repair & Replacement:	0%	$ -
General:	100%	$ 160,000
Total Anticipated Project Cost	100%	$ 160,000

Project Timing:

Project Element	Timing	Priority	Cost
Entire Project	2034	0-10 years	$ 160,000
Total Anticipated Project Cost			$ 160,000

Project Location Map:

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APPENDIX X

ENGINEERING DESIGN AND CONSTRUCTION STANDARDS

Section IV

Engineering Design Standards and Submittal Requirements

Section Index

- **Submittal Requirements**
- **Design Standards**
- **Small Wireless Facilities**
- **As-Built Submittal Requirements**
- **Plan Review Checklists**
- **Donated Infrastructure Quantity Tracking (Pending)**

ENGINEERING DESIGN SUBMITTAL REQUIREMENTS

Drawing submittals

Drawings shall be submitted on standard 24” x 36” bond paper for engineering review and approval. Each sheet shall be numbered and titled. Each sheet shall have a minimum text height of 0.10 inches.

Cover Sheet

Minimum information required shall include a vicinity map, site map, project title, sheet index, owner/developer address and phone number, revision block, engineers stamp, city signature block (locate in lower right corner). General notes and legend may also be shown on this sheet.

Existing Conditions Sheet

All pertinent as-built and existing utility information on and adjacent to the project shall be noted on this sheet. Existing utilities shall include: all manhole rim and invert flow line elevations, existing street lighting, gas mains, valves and services, water mains, valves and services, sanitary mains and services, electrical, TV, phone lines, power pole locations, utility risers and transformers, curb lines, catch basins, driveways, sidewalks, curb ramps and sign locations. All existing wells, septic drain fields, irrigation systems, and any other private or public service lines or easements shall be shown on this sheet. All sensitive lands, archeological sites, wetlands, stream courses and buffers including existing contours shall be shown.

Grading and Erosion Sediment Control Sheet (see design stds for grading/ESC)

Information shown shall include a legend showing shaded or hatched cut and fill locations and erosion control BMP’s. Existing contours screened back and proposed contours shall be shown including any grading associated with the storm water facilities. Locations of stripping stockpiles, building envelopes, and areas to be protected from damage shall be shown. Grading and Erosion control notes shall also be shown on this sheet. A table listing the total cubic yards of cut, fill, and strippings shall also be shown.

Street and Storm Plan Sheet (see design stds for street and storm)

Information shown shall include the proposed storm system including manhole locations, catch basin locations and types. The rim, grate and pipe invert in and out elevations shall be listed to the hundredth of a foot. All pipe runs and catch basin lateral lines shall list pipe size, length, slope, and pipe material. The required street information shall include street centerline stationing and centerline curve information including radius, length, and central angle. Centerline tangent bearings shall be listed. All high and low points shall be identified. Curb return information shall include radius, length, and central angle. Sidewalk and curb ramp locations shall be shown. Street and Storm construction notes shall be included on this sheet.

Water and Sewer Plan Sheet (see design stds for water and sewers)

Information shown shall include the proposed water and sewer system and service line locations. Water and Sewer main line lengths, sizes, material types, and where appropriate, slopes shall be listed. Sewer manhole rim and pipe invert elevations in and out shall be listed to the hundredth of a foot. All water and sewer system appurtenances including AARV's, cleanouts, blowoffs, hydrants, valves and PRV's shall be called out on the plans. The water and sewer construction notes shall be included on this sheet.

Street and Storm Profile Sheet

Profile sheets shall include the street centerline proposed vertical alignment and vertical curve information including PVI station and elevation, high and low point station and elevation, vertical curve length, begin and end stationing, grades in and out of the vertical curve, algebraic differences, and "K" values shall be listed. Proposed finished grade and existing ground lines shall be shown. Where curb elevations left and right are not the same due to shed sections or cul-de-sacs, the left and right top of curb profiles shall also be shown on the profile sheet. Street intersections shall be identified. The proposed storm system shall be shown including manhole and catch basin stations and elevations of all pipe inverts, rims and grates. All pipe runs and laterals shall have line sizes, pipe diameters, slopes and materials labeled or noted. All proposed and existing utility crossings shall be shown.

Water and Sewer Profile Sheet

The proposed finished grade and existing ground lines shall be shown. Street intersections shall be identified. The proposed water system shall be shown including blowoff, hydrant, valve, PRV and AARV locations and minimum depth of cover requirements. The proposed sewer system shall be shown including stations and elevations of all manholes, pipe inverts, rims and cleanouts. All pipe runs and laterals shall have line sizes, pipe diameters, slopes and materials labeled or noted. All proposed and existing utility crossings shall be shown.

Detail Sheets

The detail sheets shall show specific city standard details for water, sewer, and storm system appurtenances as proposed on the engineering drawings. The typical street width sections and structural section requirements shall also be shown. Other detail sheets may include street intersection details, stormwater detention and treatment facility details, trail location, section and construction details, sanitary sewer pump station facility details, landscaping layout, irrigation and planting detail and or street signage and striping details.

Miscellaneous

Based on submittal review the engineering department may require additional information to provide a complete understanding of the project. These requirements are provided as a minimum for a timely review.

ENGINEERING DESIGN STANDARDS FOR GRADING/ESC PLAN

Drawing submittals

Each sheet shall be clearly labeled as “Grading” or “Grading/Erosion Control”.

Subdivisions & Short Plats (see engineering design submittal requirements)

The required minimum information to be shown on the grading plan shall include existing 2-foot contour intervals screened back with listed elevations. The proposed finished grade 2-foot contour intervals with listed elevations shall also be shown. Sod stripping stockpile locations, proposed street and lot layout configurations, a quantities table listing the total cut, fill and stripping amounts, hatching or shading of the cut and fill locations, any tree removal or preservation and the grading notes shall also be shown.

The required minimum information to be shown on the erosion control plan shall include inlet protection on all proposed catch basins on site and any adjacent existing catch basins off site, sediment trap locations, silt fence locations, gravel construction entrance locations. The details of the required erosion control measures shall be shown. All stream courses and buffer areas shall be identified and protected.

If an NPDES, HPA, FPA, or an Erosion Control Bond are required for the project there shall be a note to that requirement along with the erosion control and grading notes.

ENGINEERING DESIGN STANDARDS FOR STREETS

Drawing submittals

Each sheet shall be clearly labeled as “Street” or “Street/Storm”.

Subdivisions and Short Plats

- Design of the proposed streets shall incorporate the recommendations of the traffic study if one was required and shall meet the requirements of the current AASHTO A Policy on Geometric Design for Highways and Streets manual and the current MUTCD manual.

- Neighborhood Traffic Management (NTM) elements may be required on the existing or proposed streets based on projected traffic volumes.

- The pavement design and structural section shall be based on the soil type and the recommendations of the geotechnical report, but shall not be less than the current City standard minimum.

- Alleys, half-street improvements, and private streets shall meet the minimum City standard structural section.

Commercial, multifamily or Industrial

- The City engineer will give specific recommendations on pavement design, width, geometric requirements, safety, and pavement markings based on the submitted proposal.

TABLE 1 - GUIDELINES FOR GEOMETRY OF PRIVATE ROADWAY

ITEM	ALLEY PRIVATE	ACCESS TO FOUR OR LESS DWELLING UNITS (LESS THAN OR EQUAL TO 150' IN LENGTH) PRIVATE STREET 'A' [3]	ACCESS TO FIVE OR MORE DWELLING UNITS (LESS THAN OR EQUAL TO 100' IN LENGTH) PRIVATE STREET 'B'	ACCESS TO FIVE OR MORE DWELLING UNITS (GREATER THAN 100' AND NOT OVER 300' IN LENGTH) PRIVATE STREET 'C'	ACCESS TO FIVE OR MORE DWELLING UNITS (GREATER THAN 300' IN LENGTH) PRIVATE STREET 'D'
TRACT WIDTH (PRIVATE)	20 FEET	20 FEET (TRACT OR EASEMENT)	30 FEET	42 FEET	48 FEET
STREET WIDTH	18 FEET [2]	12 FEET	20 FEET	28 FEET	28 FEET
CUL-DE-SAC TURNAROUND RADIUS	N/A	35 FEET	35 FEET	35 FEET	35 FEET
SIDEWALK / PLANTER WIDTH	N/A	OPTIONAL 5-FEET / NO PLANTER STRIP	ONE SIDE 5-FEET WITH 4- FOOT PLANTER STRIP	ONE SIDE 5-FEET WITH 4.5 FOOT PLANTER STRIP	BOTH SIDES 5-FEET WITH 4.5-FOOT PLANTER STRIP
BIKE LANES	N/A	N/A	N/A	N/A	N/A
MIN. CENTERLINE RADIUS	70 FEET	100 FEET	100 FEET	200 FEET	200 FEET
PARKING	NO PARKING BOTH SIDES	NO PARKING BOTH SIDES	NO PARKING BOTH SIDES	PARKING ONE SIDE ONLY	PARKING ONE SIDE ONLY
CLEAR ZONE*	1.5 FEET MIN.	1.5 FEET	1.5 FEET MIN.	1.5 FEET MIN.	1.5 FEET MIN.
ACCESS CONTROL	N/A	N/A[1]	N/A[1]	N/A[1]	N/A[1]
LIGHTING REQUIRED	NO	YES	YES	YES	YES

* LAG MANUAL, WSDOT DESIGN MANUAL
[1] POSSIBLE BY COUNCIL MANDATE LIMITING CERTAIN LOTS DURING DEVELOPMENT REVIEW
[2] OR GREATER IF REQUIRED BY FMO
[3] ROADWAYS IN EXCESS OF 150' IN LENGTH WITH FOUR OR FEWER DWELLING UNITS ARE SUBJECT TO ADDITIONAL REQUIREMENTS FROM THE FIRE MARSHALL

NOTES:

1. ACCESS TO TWO OR LESS LOTS MAY BE DESIGNED AND ESTABLISHED AS AN EASEMENT RATHER THAN A TRACT. GARBAGE AND RECYCLING CONTAINERS SHALL BE PLACED AT THE PUBLIC RIGHT-OF-WAY.
2. OFF-STREET PARKING:
    a. STANDARD SIZE SPACES: MINIMUM 9-FEET WIDE; MINIMUM 18-FEET LONG
    b. SMALL CAR SPACES: MINIMUM 8-FEET WIDE; MINIMUM 15-FEET LONG; MARKED 'COMPACTS ONLY'
    c. AISLE DIMENSIONS: ONE-WAY AISLE MINIMUM 15-FEET WIDE; TWO-WAY AISLE MINIMUM 24-FEET WIDE
    d. INGRESS AISLES SETBACK FROM BACK OF SIDEWALK: COLLECTORS MINIMUM 40-FEET; ARTERIALS MIMINUM 50-FEET
3. DEAD-END ROADS IN EXCESS OF 150-FEET, AS MEASURED FROM THE CENTERLINE OF THE ADJACENT ROAD, REQUIRE A DEAD-END TURNAROUND.
4. A DEAD-END TURNAROUND MAY BE REQUIRED ON ROADS LESS THAN 150-FEET WHEN ADJACENT ROAD IS A COLLECTOR OR ARTERIAL.
5. CONFIGURATION OF DEAD-END TURNAROUNDS SHALL BE PER STREET DETAIL ST36A 'DEAD-END TURNAROUND ON PRIVATE STREETS; OR AS APPROVED BY ENGINEERING AND THE FIRE MARSHAL.

FILE: R:\ENG_PWORKS\DETAILS

REVISED: 01/20/2023

Approved by:

TABLE 2 - GENERAL GUIDELINES FOR GEOMETRY OF ROADWAY

ITEM	COMMERCIAL/ INDUSTRIAL (PRIVATE)	2 LANE LOCAL SPRINKLERED[4]	2 LANE LOCAL - NEIGHBORHOOD	2 LANE[2] COLLECTOR / ARTERIAL	3 LANE COLLECTOR / ARTERIAL	5 LANE ARTERIAL
R.O.W. WIDTH	40 FEET (TRACT)	52 FEET	60 FEET	60 FEET	74 FEET	100 FEET
STREET WIDTH	24 FEET	28 FEET	36 FEET	36 FEET	46 FEET / INCLUDES 12 FOOT MEDIAN	74 FEET / INCLUDES 14 FOOT MEDIAN
CUL-DE-SAC RADIUS	N/A	35 FEET	35 FEET	N/A	N/A	N/A
SIDEWALK / PLANTER WIDTH	ONE SIDE 5-FEET WITH 4.5-FOOT PLANTER STRIP	BOTH SIDES 5-FEET WITH 4.5-FOOT & 7.5-FOOT PLANTER STRIPS	BOTH SIDES 5-FEET WITH 4.5-FOOT & 7.5-FOOT PLANTER STRIPS	BOTH SIDES 6-FEET WITH 4.5-FOOT & 5.5-FOOT PLANTER STRIPS	BOTH SIDES 6-FEET WITH 5.5-FOOT & 7.5 FOOT PLANTER STRIPS	BOTH SIDES 6-FEET WITH 4.5-FOOT & 6.5-FOOT PLANTER STRIPS
BIKE LANES	N/A	N/A	N/A	5-FEET	5-FEET	6-FEET
MIN. CENTERLINE RADIUS	42 FEET FIRE ACCESS	70 FEET	70 FEET	200 FEET	300 FEET[3]	300 FEET[3]
PARKING	NO PARKING BOTH SIDES	PARKING ONE SIDE ONLY	PARKING BOTH SIDES	NO PARKING BOTH SIDES	NO PARKING BOTH SIDES	NO PARKING BOTH SIDES
CLEAR ZONE*	1.5 FEET MIN.	1.5 FEET	1.5 FEET MIN.	1.5 FEET MIN.	1.5 FEET MIN.	AS DIRECTED
ACCESS CONTROL	YES	N/A[1]	N/A[1]	YES	YES	YES
LIGHTING REQUIRED	YES	YES	YES	YES	YES	YES
CURB RADII	30 FEET MIN.	25 FEET MIN.	25 FEET MIN.	35 FEET MIN. [5]	35 FEET MIN. [5]	35 FEET MIN. [5]
OFF-STREET PARKING SETBACKS	N/A	N/A	N/A	INGRESS AISLES 40' FROM BACK OF SIDEWALK	INGRESS AISLES 50' FROM BACK OF SIDEWALK	INGRESS AISLES 50' FROM BACK OF SIDEWALK

* LAG MANUAL, WSDOT DESIGN MANUAL
[1] POSSIBLE BY COUNCIL MANDATE LIMITING CERTAIN LOTS DURING DEVELOPMENT REVIEW
[2] LEFT TURN LANES REQUIRED AT INTERSECTIONS
[3] MUST MEET AASHTO GUIDELINES FOR SPEED AND SIGHT DISTANCE
[4] STREET SECTION REQUIRES APPROVAL FROM THE CITY ENGINEER.
[5] LARGER RADII MAY BE REQUIRED AT THE DIRECTION OF THE CITY ENGINEER

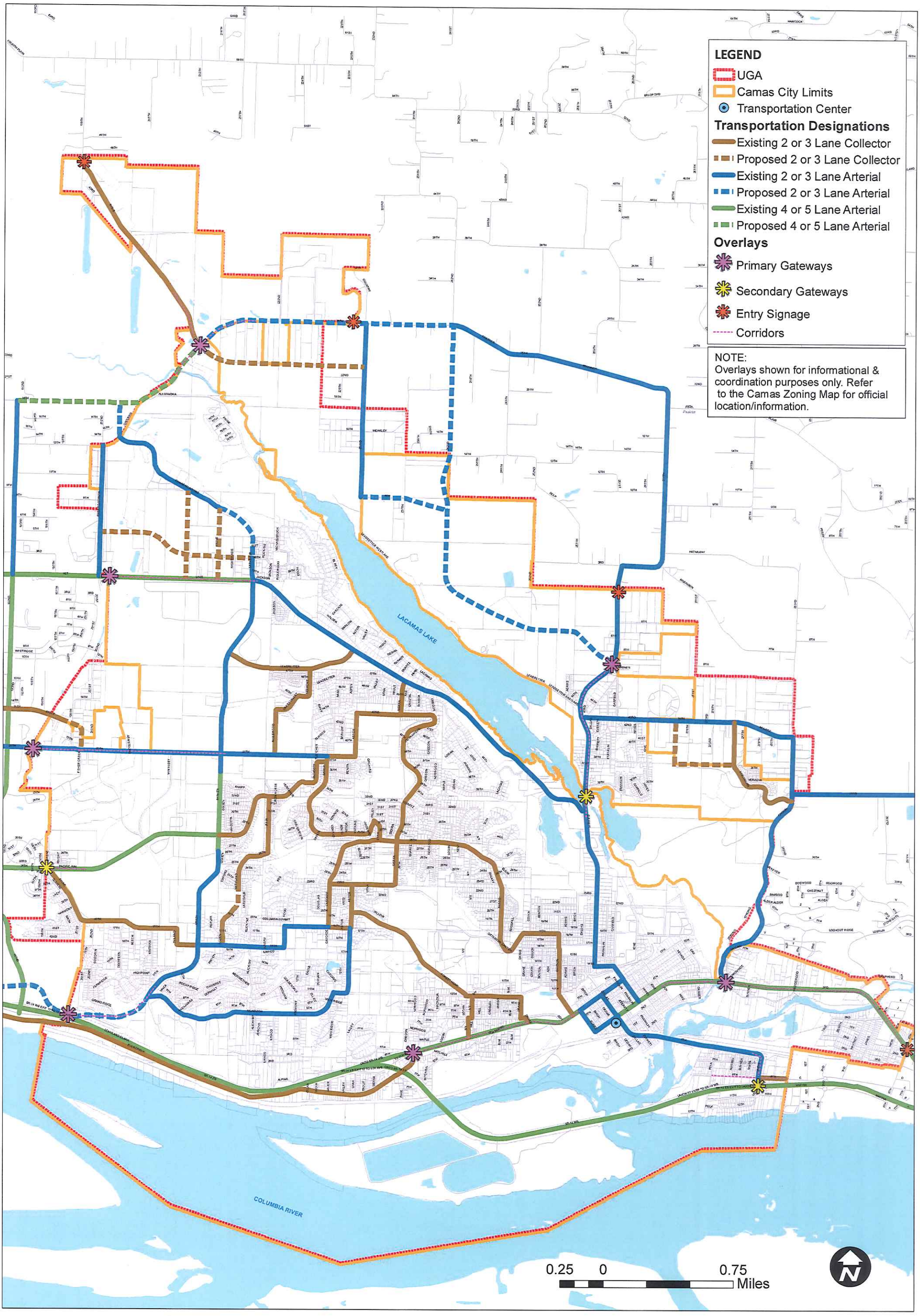
FOR INTERSECTION SPACING AND SETBACK, SEE ACCESS SPACING STANDARDS – TABLE 3 (NEXT PAGE)

TABLE 3 - ACCESS SPACING STANDARDS

RESOLUTION 17-005

ROADWAY CLASS	MINIMUM ACCESS SPACING***	MAXIMUM ACCESS SPACING	MINIMUM INTERSECTION & DRIVEWAY SETBACK	NEW RESIDENTIAL ACCESS PERMITTED
ARTERIAL	660-FEET	1,000-FEET****	300-FEET	NO**
COLLECTOR	330-FEET	600-FEET	110-FEET*	NO**
LOCAL	110-FEET	600-FEET	N/A	YES

* BASED ON TURN DESIGN SPEED OF 20 MPH
** TEMPORARY ACCESS MAY BE PERMITTED OR COMBINED FOR LANDLOCKED PARCELS
*** INCLUDES NON-RESIDENTIAL DRIVEWAYS
**** BLOCK LENGTHS IN EXCESS OF 600-FEET SHALL PROVIDE A MID-WAY PEDESTRIAN CONNECTION



CAMAS TRANSPORTATION COMPREHENSIVE PLAN MAP

CAMAS, WA I Ordinance 16-010 Adopted June 2016

2035 Camas
Your voice, Your vision, Your future

ENGINEERING DESIGN STANDARDS FOR ADA ACCESSIBILITY

Policy

It is City of Camas policy to provide appropriate pedestrian facilities along and across sections of City roadways. It is City of Camas, FHWA and WSDOT policy that pedestrian facilities be given full consideration in the planning and design of new construction and reconstruction projects.

Drawing submittals

Each sheet shall be clearly labeled as “Street” or “Street/Storm”.

The appropriate sidewalk and ADA Ramp details shall be included on a sheet labeled as “Details”, “Street Details” or “Accessibility Details.” Only City of Camas details from the most current Design Standard Manual (DSM) shall be used. In the case where the Camas DSM does not contain an appropriate detail, current WSDOT Standard Plan Details or site specific details may be used.

Accessibility Design

Design of proposed sidewalks shall meet the requirements of the USDOJ’s *ADA Standards for Accessible Design*; the USDOT’s current *ADA Standards for Transportation Facilities*; the FHWA’s current MUTCD; the current Americans with Disabilities Act requirements, the US Access Board’s current *Public Rights-of-Way Accessibility Guidelines* (PROWAG), and the current WSDOT Design Manual, Chapter 1510 and any referenced documents therein.

ADA Accessibility Triggers

All new construction, reconstruction, or alteration of existing transportation facilities shall be designed and constructed to be accessible and useable by those with disabilities. Existing facilities shall be retrofitted to be accessible when required per the WSDOT Design Manual, Chapter 1510.

The following are some examples that are considered alterations, which can potentially trigger the need to improve accessibility to meet ADA requirements:

- HMA overlay or inlay
- Traffic signal installation or retrofit
- Realignment of a roadway (vertical or horizontal)
- Sidewalk improvements
- Bridge replacement
- Concrete panel repair/replacement
- Raised channelization

The following are not considered alterations:

- Spot pavement repair
- Liquid asphalt sealing, chip seal, or crack sealing
- Lane restriping that does not alter the usability of the shoulder

Matching Facilities

In the case where a new development installation ends with a sidewalk and curb ramp at an intersection, a matching curb ramp installation shall be required at the other end of the crosswalk. A third ramp will not be required across from the second ramp.

Crosswalk Accessibility

Design consideration shall be made such that not only curb ramps meet ADA requirements, but street crossings shall also meet the above requirements. For retrofit situations where existing street crossings will be out of compliance with ADA requirements, an MEF submittal shall be required.

Design slopes

Designs shall not be based on design standard maximum limits. Allow for field adjustment based on actual conditions when specifying ramp lengths and slopes.

Maximum Extent Feasible (MEF)

Design deviation allowances will be considered on a case-by-case basis for retrofit situations, or when new construction meets existing facilities. The MEF memo shall be submitted to the City Engineer for approval when an element of a design will not meet the accessibility requirements. The MEF memo is required:

- Prior to Engineering plan approval.
- When unanticipated field issues arise during the construction phase.

Use of WSDOT's MEF Template or an abbreviated version with the following elements shall be used to formally request of deviation of the standards noted above:

- Project description;
- Existing pedestrian / road conditions;
- Applicable design standards that apply;
- Justification of design constraints;
- ***Cost is not a justification for not meeting accessibility criteria;***
- Proposal, including details;
- Stamped and signed by an Engineer.

ENGINEERING DESIGN STANDARDS FOR STORM SYSTEM

Drawing submittals

Each sheet shall be clearly labeled as “Street” or “Street/Storm”.

Subdivisions & Short Plats (see engineering design submittal requirements)

- For application construction standards, see *Section IV Engineering Details: Storm Detail SD1.*

- Design of the proposed stormwater treatment and detention system shall be in accordance with the latest edition of the Washington State Department of Ecology’s Stormwater Management Manual for Western Washington.

- All main line locations shall be located within the proposed or existing street right-of-way where ever possible, unless otherwise approved.

- All roof drainage shall be directed to the stormwater facility for detention, except as follows: Lots adjacent to streams, wetlands, and wetland/stream management zones are to be evaluated on the basis of aquifer recharge and fish and wildlife issues. When considered necessary roof drains, french drains, and foundation drains are to be directed, by approved means, back into the wetland or stream.

- If runoff from the proposed building envelope is not directed to the stormwater facility, an approved house connection plan for roof drains and foundation drains will be required. Method and location of discharge must have prior approval.

- When required along proposed roadways, based on site conditions, french drains shall be located behind sidewalks and shall be owned and maintained by the home owner or Homeowner’s Association.

- Spacing between catch basins shall be a maximum of 400-feet and shall be located at all intersections. Roadways in excess of 10% slope shall require a reduced spacing. Catch basins shall be tied into manholes at a minimum slope of 1%. Flow calculations may be required to analyze curb flow depths and widths.

- Spacing between manholes is to be a minimum of 400-feet; min. 48-inch dia.

- Stormwater main lines shall not be laid flatter that 0.4% slope. Slopes over 18% will require pipe anchors.

- Stormwater mains are to be 12-inch min. and laterals are to be 10-inch min.

- The stormwater design report shall include a project overview stating any assumptions made. Requests to deviate from the stormwater manual shall be fully stated and the reasons clearly outlined. The pervious and impervious acreage totals, site maps, soil maps, and full size basin maps showing the actual basin; even if beyond the project limits shall be included. Isopluvial charts for the 2, 10, and 100 year 24-hour storm events, runoff curve numbers, and downstream impact analysis shall be included.

ENGINEERING DESIGN STANDARDS FOR WATER SYSTEMS

Drawing submittals

Each sheet shall be clearly labeled as “Water” or “Water/Sewer”.

Subdivisions & Short Plats (see engineering design submittal requirements

- All main line locations shall be located within the proposed or existing street right of way where ever possible unless otherwise approved.
- Each lot shall have a water meter box location shown on the plan. Meter boxes shall be located in the right-of-way, near or at lot lines, in the planter strip or located behind the sidewalk in curb tight situations, and shall maintain 10-feet of horizontal separation from sewer services.
- Irrigation service meter box locations and backflow prevention devices shall be shown on the plan for all landscape islands, open space tracts or other areas as identified on the plan.
- Fire hydrant locations shall be shown on the plan and shall be located as nearly as possible at lot lines or as directed by the Fire Marshal.
- AARV’s, low point blowoffs, valve cluster locations and dead end blowoffs shall be called out on the plans and profile sheets.
- The system design may require sizing analysis for fire flow capacity, pressure zones and or pressure reducing valve vault locations upstream or downstream of the project site at the City’s discretion.
- Possible line upsizing may be required for future extensions at the City’s discretion. Upsizing will be based on the City’s latest *Water System Plan Update*.
- Any existing services not used or existing main lines that will be replaced or relocated may require abandonment and or removal at the City’s discretion.

Commercial, Multifamily, or Industrial

In addition to the above requirements, the following requirements may apply for these types of uses.

- Fire flow calculations/analysis for fire sprinkler systems.
- The locations of fire department connection (FDC) ports shall be shown.
- Separate domestic water main lines and fire system main lines may be required.
- Each unit of a duplex shall have its own water service.
- Multifamily units shall have one service for each building.
- Fire lines are to be shown for informational purposes only. NFPA 24 fire permit application is to be submitted to the Fire Marshal for review and approved, prior to construction.

ENGINEERING DESIGN STANDARDS FOR PRESSURE REDUCING VALVE STATIONS

When a water system PRV station is required as part of a residential development, the following minimum components shall be included with the PRV submittal.

1. An existing water system area plan shall be submitted by the developer's engineer. The area plan shall show the elevation and location of existing PRV's adjacent to the development site. High side and low side pressures shall be included. The plan shall also show the proposed development layout with elevation of all street intersections, lots, and other high and low points within the site.
2. The PRV station shall be a pre-assembled, pre-tested, and packaged system from G.C. Systems or approved equal.
3. The PRV station shall include a catch basin located adjacent to the station and tied to the stormwater system for the 3" pressure relief bypass flows.
4. There shall be a minimum 9" air gap from the bypass pipe to the catch basin. And acceptable bug screen shall be included on the end of the bypass pipe.
5. A vault drain or sump pump tied into the storm system will be required.
6. The valve vault access shall be a rated H-20, a spring assisted 36" x 72" double door, lockable, diamond plated hatch with safety grate, centered over the largest PRV.
7. The PRV station shall be located within the right-of-way in a widened planter strip or located outside of the right-of-way in an easement dedicated to the City.
8. The City of Camas reserves the right to determine the size of the PRV devices and the vault.
9. All interior piping shall be schedule 40, 306 stainless steel with flanges, and Victaulic coupling as required for disassembly.

ENGINEERING DESIGN STANDARDS FOR SANITARY SEWERS

Drawing submittals

Each sheet shall be clearly labeled as “Sewer” or “Water/Sewer”.

Subdivisions & Short Plats (see engineering design submittal requirements)

- For application construction standards, see *Section IV Engineering Details: Gravity Sewer Detail SG1; STEF Sewer Detail SF1; or STEP Sewer Detail SP1*.
- Detached units shall have their own sewer service and STEP or STEF or conventional gravity system as required.
- Duplex units may have up to two sewer services at the discretion of the engineering and public works departments.
- Multifamily units shall have one sewer lateral per building.
- All main line locations shall be located within the proposed or existing right of way where ever possible unless otherwise approved.
- Service lateral locations shall be located in the planter strip for STEP systems and 8-feet past the right of way line for gravity or STEF systems.
- Main line grades shall not be designed flatter than 0.5% slope. Slopes over 18% will require pipe anchors.
- AARV, cleanout, valve, odor control, and manholes shall be shown on the plan and profile sheets.
- The system design may require sizing analysis for line size and capacity. The system may also require a pump station based on the type of sewer system being proposed, the location of the project, or other factors. Future pump station upsizing may also be required.
- There may be downstream capacity analysis required for the project depending on project location and the type of sewer system proposed.
- Design shall take into account the capacity and grade to allow for desirable extension beyond the development.
- Additional odor control analysis and/or measures may be required.
- Septic tank sizing if required shall be based on the proposed use and in conformance with the CC&R’s. If pools are allowed then tank sizes may increase.

Commercial, Multifamily or Industrial

- Tank sizing submittal documentation and material submittals will be required.
- Material submittals, materials list and supplier information will be required prior to construction.
- Required as-built information shall include the depth of service, location of main lines, AARV’s, odor control, cleanouts, manholes, and valve locations.

ENGINEERING DESIGN STANDARDS FOR SANITARY SEWER PUMP STATIONS

For design of sanitary sewer pump stations, see ***'Sanitary Sewer Pump Station Design Manual'*** located under the Engineering Standards section of this document.

ENGINEERING DESIGN STANDARDS FOR COMMUNITY STEF TANKS

When a community STEF tank system is proposed for a residential development to retain sanitary sewer solids, the following minimum requirements shall apply.

1. The community tanks will only be allowed if lot sizes are 4,000 S.F. or less. For lots over 4,000 S.F. an individual 1,500 gallon minimum tank will be required on each individual lot.
2. The community tank(s) shall be a fiberglass reinforced single walled Xerxes tank or approved equal. The tank submittal shall include buoyancy calculations with minimum factor of safety of 1.5 for dead man sizing.
3. An approved odor control system is required for the tanks. If the development includes a pump station, a vent line from the tank(s) to the odor control system will be required. If no pump station is proposed, chemical injection, soil filter beds, or other odor control systems acceptable to the City shall be included in the design.
4. A minimum of one permanent ground water monitoring and dewatering well(s) acceptable to the City shall be included in the design and site construction.
5. An Orenco liquid level alarm, AMAHW or AMLAHW series, high level alarm and float system, or approved equal, will be required on each tank that contains bio tube filters. A 12” wide by 18” tall sign shall be included to read as follows:

   THIS BOX IS THE PROPERTY OF THE CITY OF CAMAS PUBLIC WORKS DEPARTMENT. IT IS TO BE OPENED BY AUTHORIZED PERSONNEL ONLY. ALARM – IF THE ALARM SOUNDS, PRESS THE RED LAMP COVER TO SILENCE, THEN CALL CAMAS OPERATIONS CENTER AT (360) 817-1563 (DAYS) OR (360) 737-0592 (NIGHTS, WEEKENDS OR HOLIDAYS).

   The sign and alarm panel shall be mounted at the tank location in accordance with the City requirements.
6. Tank sizing requirements shall be as determined by the City of Camas.
7. The tank(s) shall be located in such a fashion as to allow for the future excavation and replacement of the tank(s) if necessary. Building foundation, infrastructure main line utilities, and other facilities including streets and street intersections, stormwater facilities, retaining walls or other improvements shall not be located within the future excavation zone of the installed tank(s).
8. A water service with an approved backflow protection device is required at the tank location as directed by the City.
9. The tank location shall include an area light if no street light is within 50 feet.
10. The tank(s) shall be accessible for future solids pumping and maintenance.

ENGINEERING DESIGN STANDARDS FOR STREET LIGHTING

ALL INFORMATION IS INTENDED TO PRODUCE A LIGHTING DESIGN WITH LUMINANCE LEVELS AND LUMINANCE UNIFORMITY WHICH MEETS OR EXCEEDS THOSE IN THE I.E.S. "RECOMMENDED MAINTAINED LUMINANCE FOR ROADWAYS" FROM THE I.E.S. LIGHTING HANDBOOK. INSTALLATION OF ADDITIONAL LIGHTS MAY BE NECESSARY TO MEET THE INTENT OF THIS STANDARD.

1. WHERE THE AVERAGE RESIDENTIAL DENSITY IS GREATER THAN 12 DWELLING UNITS PER ACRE, USE COMMERCIAL OR INTERMEDIATE FOR LAND USE.
2. AVERAGE MAINTAINED LUMINANCE IS MEASURED IN FOOT CANDELAS PER SQUARE METER.
3. AT SIGNALIZED INTERSECTIONS, THE AVERAGE MAINTAINED LUMINANCE SHALL BE OF THE AVERAGE FOR THE TWO INTERSECTING STREETS.
4. LUMINANCE UNIFORMITY IS THE RATIO OF AVERAGE OR MAXIMUM MAINTAINED LUMINANCE TO MINIMUM LUMINANCE. LUMINANCE VALUES OUTSIDE THE ROADWAY SHALL NOT BE INCLUDED IN THE RATIO. ALL SIDEWALK AREAS AND THE AREA BETWEEN THE SIDEWALK AND THE STREET CURB SHALL BE INCLUDED WHEN DETERMINING THE MAINTAINED LUMINANCE.
5. ALL LIGHTING FIXTURES SHALL BE LIGHT EMITTING DIODE (LED). LIGHTING CIRCUITS SHALL BE 120 VOLTS.
6. THE MOUNTING HEIGHT OF THE FIXTURE IS MEASURED FROM THE ROADWAY SURFACE TO THE CENTER OF THE LIGHT SOURCE WITH THE FIXTURE LOCATED OVER THE BIKE LANE LINE OR SIX FEET FROM THE FACE OF CURB.
7. ALTERNATIVE LIGHTING LAYOUTS MAY BE SUBMITTED FOR REVIEW. WHERE LIGHTING IS REQUIRED ON BOTH SIDES, DESIGNS SHALL BE "OPPOSITE LIGHTING" ON MAJOR ROADWAYS 46 FEET OR GREATER IN WIDTH. THE USE OF STAGGERED LIGHTING SHALL ONLY BE USED WHERE "OPPOSITE LIGHTING" IS NOT PRACTICAL. LIGHTING LAYOUTS ON LOCAL RESIDENTIAL STREETS WITHIN A SUBDIVISION MAY VARY FROM SIDE TO SIDE.
8. COBRA STYLE LIGHT POLES ARE REQUIRED ON ALL COLLECTOR AND ARTERIAL ROADWAYS.
9. MAXIMUM POLE HEIGHT SHALL BE LIMITED TO 34 FEET.
10. LIGHTING LAYOUTS WILL REQUIRE APPROVAL AND POSSIBLE ADJUSTMENT TO MEET THE CITY OF CAMAS LIGHTING OBJECTIVES AND I.E.S. STANDARDS. THIS MAY INCLUDE ADJUSTMENT TO THE POLE SPACING AS LISTED AND MAY RESULT IN ADDITIONAL OR FEWER LIGHTS.
11. A LIGHTING DESIGN CONSISTENT WITH THESE REQUIREMENTS SHALL BE SUBMITTED FOR REVIEW AND APPROVAL BY THE CITY, PRIOR TO SUBMITTAL TO CLARK PUBLIC UTILITY DISTRICT (CPU) FOR APPROVAL.
12. STREET LIGHTS ON LOCAL AND NEIGHBORHOOD LEVEL STREETS SHALL BE LOCATED AT PROPERTY LINES.
13. THE STREET LIGHTS SHALL BE LOCATED IN THE PLANTER STRIP UNLESS OTHERWISE APPROVED BY THE CITY.

14. STREET LIGHT SPACING:

	ARTERIAL ROADWAY		COLLECTOR ROADWAY		NEIGHBORHOOD ROADWAY		LOCAL ROADWAY	
LAND USES	COMMERCIAL INDUSTRIAL	RESIDENTIAL	COMMERCIAL INDUSTRIAL	RESIDENTIAL	COMMERCIAL INDUSTRIAL	RESIDENTIAL	PUBLIC	PRIVATE
MAX. POLE SPACING (A)	170	160	130	160	150	170	N/A	N/A
MAX. POLE SPACING (B)	N/A	N/A	N/A	N/A	150	150	150	150

(A) STANDARD COBRA STYLE
(B) POLE TOP STYLE

15. PEDESTRIAN CROSSINGS AND VERTICAL SAG CURVES SHALL BE ILLUMINATED.

16. STREET LIGHTING IS REQUIRED ON ALL PRIVATE STREETS OVER 100 FEET IN LENGTH AND SERVING MORE THAN FIVE DWELLING UNITS.

17. PRIVATE STREETS WITH STREET LIGHTING SHALL HAVE A SEPARATE METER THAT THE HOME OWNERS ASSOCIATION WILL BE RESPONSIBLE FOR.

ENGINEERING AS-BUILT SUBMITTAL REQUIREMENTS

Drawing submittals

- Submitted on standard 24” x 36” bond paper for engineering review and approval.
- Each sheet shall be numbered and titled.
- Each sheet shall have a minimum text height of 0.10 inches.
- Each sheet shall be clearly labeled as “As-Built” or “Record Drawings” and dated.
- Shaded areas, satellite photography, or aerial photography is not acceptable due to reproducibility.
- Any hatched area shall be transparent or hatched at such a scale that it will not show as a black area after scanning.
- Upon engineering department review and approval, the “As-Builts” shall be submitted in a PDF digital format on a CD-ROM disc. CAD files shall be submitted as directed below.

Required Information

- As-Built elevations, if different than design, of all rims, pipe inverts in and out of manholes, catch basins, and outfalls shall be labeled next to the crossed out design elevation.
- Any change in the lot numbering or configurations from what was originally proposed or approved and shall conform to the final plat lot numbering.
- All as-built pipe lengths, depths and slopes shall be recorded next to the crossed out design information on the plan view sheet as well as on the appropriate profile and or detail sheet(s).
- Stormwater facility as-built verification note shall appear on the as-built sheet showing the facilities and indicate the following:
    - The engineer has performed an as-built inspection of the facilities
    - The constructed facilities meet the design criteria per the stormwater report for stormwater treatment and detention requirements for the site.
- Stormwater detention and treatment facilities shall show:
    - As-built elevations of all pipe inverts, control structures and orifices
    - Pond and swale lengths, depths, widths and slopes.
    - Overflow structures, pond berms and access roads as-built information for slopes, heights, widths, lengths and locations.
- Final as-built grading/topographical site plan shall be submitted with the as-built plans indicating the following:
    - Final finished grade contours and elevations over all lot areas.
    - Elevation of all lot corners shall be noted
    - Physical distance ties to the sanitary sewer service laterals that are marked with a 10 foot long 2x4 board. There shall be a minimum of two distances to each lateral from adjacent lot corners or arcs in the curb line.

GENERAL PLAN REVIEW CHECKLIST
ENGINEERING DEPARTMENT

Project/Development Name: _____
City Project Number: _____
Reviewer's Initials and Date: _____

Please mark completed items in the space provided. Mark N/A if not applicable. Items left blank are incomplete.

COVER SHEET AND GENERAL REVIEW

___ Project Name (Title) (Past Project Names if applicable)
___ Owner's / Developers Name, Address, & Phone Number
___ Engineer's Name, Address and Phone Number
___ Architect's Name, Address and Phone Number
___ City of Camas Approval Block (Locate in lower right hand corner of cover sheet)
___ Vicinity Map
___ Legend
___ General Notes
  ___Reference to Standard Specifications
    ___City of Camas
    ___WSDOT/APWA
___ North Arrow and Scale
___ Preliminary State of Washington Engineer's Stamp (Signed at final review)
___ Memo Stating the Total Linear Feet of Improvements
  ___Street
  ___Water
  ___Storm
  ___Sanitary
___ Sheet Index
___ Benchmark, Datum Elevations
___ Complies with Request for Utility Services (R.U.S.)
___ Complies with Council's Decision (Staff to Review Notice of Final Decision)
___ Submitted Four Full-Sized & One Half-Size Set of Plans (1st review only)

Comments: _____

_____

_____

GENERAL PLAN REVIEW CHECKLIST
ENGINEERING DEPARTMENT

Project/Development Name: _____
City Project Number: _____
Reviewer's Initials and Date: _____

Please mark completed items in the space provided. Mark N/A if not applicable. Items left blank are incomplete.

GRADING & EROSION CONTROL

___ Preliminary State of Washington Engineer's Stamp
___ North Arrow and Scale
___ Standard City of Camas Erosion Prevention & Sediment Control and Grading Detail Sheets
__ Construction Entrance __ Silt Fence __ Cut-off Ditches
__ Inlet Protection __ Slope Stability __ Temp. Sediment Ponds
__ Temp. Stockpile Area(s) Shown w/ Protection
___ Special Details Required
___ Easement(s) Required, Shown, Called Out
___ Property Lines / Adjoining Tax Lots Shown
___ Street Names (Names to be Assigned by Building Official)
___ Proposed Right of Way
___ Identify All Sensitive Areas (Wetlands and Buffers, Floodplains, Tree Resource Area, Streams, Creeks, Springs, etc.)
___ Existing and Finished Contours (**Finished Grade Slope No Greater than 2:1**)
___ Existing Area of Potential Slope Instability and Structures
___ Location of 100 Year Flood Plain & Shoreline Management Area Limits on the Site
___ Proposed Impervious Surfaces Other than Streets and Sidewalks
___ Drainage Flow Routes and Existing Discharge Points to and from Site
___ Edge of Pavement
___ Existing Trees, Trees to be Removed (w/ Diameter), Utility Poles, Wells, Septic Tanks, Drainage Structures, Fire Hydrants, Street Lights, Etc.)
___ Site Acreage
___ Area of Cut/Fill
___ Quantity of Cut/Fill
___ Wetland Area and Buffers – Cannot be Used for Treatment or Detention
___ Location of Buildable Lot Area
___ Testing Requirements / Frequency Matrix

Comments: _____

_____

_____

GENERAL PLAN REVIEW CHECKLIST
ENGINEERING DEPARTMENT

Project/Development Name: _____
City Project Number: _____
Reviewer's Initials and Date: _____

Please mark completed items in the space provided. Mark N/A if not applicable. Items left blank are incomplete.

SANITARY SEWER

___ Preliminary State of Washington Engineer's Stamp
___ North Arrow and Scale
___ Sewer: ___ STEP; ___ STEF; ___Gravity; ___ Combo
___ Standard City of Camas Sewer Detail Sheets
___ Special Details Required
___ Easement(s) Required, Shown, Called Out
___ Property Lines / Adjoining Tax Lots Shown
___ Street Names and Widths
___ Pipe size, Lengths, & Material meet City standards and are shown
___ Stationing
___ Existing and Proposed Utilities Shown
___ Existing and Possible Conflicts Shown (Structures, Trees, etc.)
___ Lateral Table
___Lateral Size ___Length ___Depth ___Pipe Material
___ Dimensioning (Lateral ends 8' from curb and cleanout at property line)
___ Manhole Spacing (max. 400' for gravity system)
___ Cleanout Spacing (max. 200' or every 90° of Bend for STEF system)
___ All manholes with Coated Lining Called Out (STEP/STEF/Gravity)
___ Special Manhole Frame or Cover Required
___ Separation from Water Utility (10' horizontal, 18" vertical)
___ Invert Elevations
___ Rim Elevations
___ Check Slopes
___ Minimum Design Slopes (0.004 for gravity and STEF mains)
___ Minimum Depth and Cover (6' for gravity and STEF, 5' for STEP mains)
___ Concrete Pipe Anchors for Main Lines (Slopes greater than 20%)
___ Service to Each Lot
___ Shown on Profile

Comments: _____

GENERAL PLAN REVIEW CHECKLIST
ENGINEERING DEPARTMENT

Project/Development Name: _____
City Project Number: _____
Reviewer's Initials and Date: _____

Please mark completed items in the space provided. Mark N/A if not applicable. Items left blank are incomplete.

STORMWATER

Plans

___ Preliminary State of Washington Engineer's Stamp
___ North Arrow and Scale
___ Standard City of Camas Stormwater Detail Sheets
___ Special Details Required
___ Property Lines / Adjoining Tax Lots Shown
___ Street Names and Widths
___ Pipe size, Lengths, & Material meet City standards and are shown. Mains 12" minimum and Laterals 10" minimum per CSDS*
___ Stationing
___ Existing and Proposed Utilities Shown
___ Existing and Possible Conflicts Shown (Structures, Trees, etc.)
___ Location and dimensions of proposed stormwater facilities, including typical cross sections of proposed facilities)
___ Stormwater Profile for all Systems in R.O.W.
___ Drainage Flow Routes and Existing Discharge Points to and from site
___ Check All Pipe Slopes and Invert Elevations. Mains 0.25% minimum and Laterals 0.3% minimum per CSDS*
___ All changes in pipe size, material, direction, or grade require a catch basin or manhole per CSDS*
___ Connections to Pipe Systems at Catch Basin or MH Only, min. slope 1%
___ If pipe cover is less than what is required in the on Details G2 & G3, provide minimum pipe cover for vehicular loads per manufacturer's specifications
___ Catch basins at low points, not to be located at base of ADA ramps
___ Catch basin spacing 400' max., located all intersections, reduced spacing on roads in excess of 10%
___ Manhole spacing 400' maximum
___ Concrete pipe anchors for main lines with slopes greater than 15%

*CSDS – Camas Stormwater Design Standards

GENERAL PLAN REVIEW CHECKLIST
ENGINEERING DEPARTMENT

STORMWATER Continued

WQ Treatment Facility

___ Detail of any flow control structures
___ Provide overflow structure in fine grained soils or if low percolation
___ Check if Oil/water Separator is required
___ Show sufficient dimensions on all stormwater facility(s) for construction
___ Provide typ. Swale Cross section
___ 4:1 slopes preferred for mowing (Max. 3:1) ___ Min. width 2'
___ 1'Freeboard on Ponds & Swales ___ 0.5%-4% slope
___ Minimum 6" topsoil mix for the swale grass if in permeable soils
___ Permeable soils require impermeable liner or 1 ft. clay liner under 6" topsoil layer in swale to be less than 2.4 in/hr to be field verified by design engineer prior to sodding or seeding.
___ List swale seeding specifications
___ Finish elevations on all outfall inverts, top of level spreader, top of grates
___ Energy Dissipater at end of outfall piping
___ If rip rap used, detail length, width, depth, and size
___ Debris barrier/grate for all pipes entering a closed pipe system
___ Retaining Walls – specify top and bottom of wall elevations, dimensions, type of material, backfill material, installation, wall section, footing drainage, etc.
___ Maintenance access to swale or pond from street (min.15' wide, less than 18% slope, min. 15' easement, access 12% or greater required to be paved, & around pond as needed)
___ Barrier or fencing around the stormwater facility, if safety is a concern, (fence type, height (max. 6'), gate opening (10' min), top rail on fence
___ Stenciling / medallions at all catch basins
___ Label Stormwater facility as tract of land, where applicable
___ Stormwater facilities in subdivisions and short plats are shown in separate tract/s, with access.
___ Stormwater facilities on commercial / industrial sites are accessible and a note is on the plans that states 'Facility is owned and maintained by the property owner and right-of-entry shall be granted to the City for inspection purposes.'
___ Types & Number of plantings around pond perimeter to be reviewed by Planning
___ Operating and Maintenance Manual for Storm Facilities (Ref. TIR)
___ Wetlands & Buffers (Sensitive areas labeled and shown)

GENERAL PLAN REVIEW CHECKLIST
ENGINEERING DEPARTMENT

STORMWATER Continued

___ Roof Downspout Connection:
- ___ To approved drainage structure; Include sizing on plans
- ___ To curb weep holes on crown streets or low side of shed streets

Infiltration Facility

___ Cross section of infiltration system
- ___ Drywells
- ___ Building roof drain
- ___ Perforated pipe trench
- ___ Infiltration pond

___ Check landscaping plan against stormwater facility (no trees in treatment area, etc.)

___ Design Infiltration Rate & Contractors design table for length of perf. pipe required per 1000 sq. feet of roof area

___ Pre-sedimentation manhole required for all drywells without water quality treatment

___ Verify that no wells or other facilities are adjacent to infiltration pond.

___ Provisions for roof drains for all lots.

Comments: _____

_____

_____

GENERAL PLAN REVIEW CHECKLIST
ENGINEERING DEPARTMENT

Project/Development Name: _____

City Project Number: _____

Reviewer's Initials and Date: _____

Please mark completed items in the space provided. Mark N/A if not applicable. Items left blank are incomplete.

Transportation Plan

___ Plan is consistent with traffic study recommendations and decision
___ Signing and striping Plan
___ Sight Distance Triangles and Calculations
___ Sight Distance Triangle Easements on all corner lots (label and Dimension)
___ Road Modifications
___ Pavement Design
___ Preliminary State of Washington Engineer's Stamp
___ North Arrow and Scale
___ Legend
___ Easement(s) Required, Shown, Called Out
___ Property Lines / Adjoining Tax Lots Shown
___ Street Names
___ Existing and proposed Right of Way
___ Stationing
___ Tangent Bearings
___ Statement of ownership, maintenance, and repair of all utilities at private streets
___ Curve Data (per CMC 17.19.040.B.12.c): Centerline Radius 300' minimum on Primary Arterials, and 200' minimum on Secondary Arterials)
___ Curb
  ___ Radii (35' minimum on Arterials and Collectors, 25' minimum on others)
  ___ Elevation at Radius Returns (½'s' ¼'s)
  ___ Elevations at Lot Lines
___ Dimensions
  ___ Streets
  ___ Driveways
  ___ Hammerheads, per Detail ST36
  ___ Temporary Turnarounds, per Detail ST36
  ___ Cul-de-sacs & Dead Ends, per Detail ST36 (Over 300' require approval)
___ Grades (per CMC 17.19.040.B.12.b): Arterials 6% max.; Collectors 10% max.; Others 12% max.)
___ Driveway locations shown on all corner lots – Access control issue
___ Sidewalks
  ___ Pedestrian Ramps (check alignment)
  ___ Connectivity
___ Turning lanes
___ Traffic Signals
___ Vertical Curves per AASHTO (see "Policy on Geometric Design of Highway & Streets", Exhibit 3-76, page 274)

GENERAL PLAN REVIEW CHECKLIST
ENGINEERING DEPARTMENT

Transportation Plan Continued

___ Intersection alignments and curb return minimums
___ K value Shown
___ Superelevation
___ Design Speed ____ mph; Posted speed ____ mph
___ Typical Street Section
___ Street Classification _____
___ ½ street improvement __ ½ street inlay __ resurfacing of ex.
___ Soil Classification _____
___ Crown Street 2% Min., 4% Max. Cross Slope
___ Shed Street 2% Min., Slopes in excess of 2% require prior approval, 6% Max. Cross Slope
___ Controlled Density Fill (CDF)
___ Center Line
___ Width of Right of Way
___ Width of Street
___ Public Utility Easement (P.U.E.)
___ Subgrade and pavement including depth and type
___ Curb Type
___ Sidewalk location, width, depth, compacted subgrade
___ Misc. Typical Sections
___ Standard Concrete Driveway
___ Concrete Vertical Curb
___ Concrete Curb and Gutter
___ ADA Curb Ramps
___ Ramp detectable warning detail
___ Barricade (Type III)
___ Sidewalk Cross Section
___ Mailbox Location
___ Letter for Road Modification from Engineer
___ Sign and Striping locations in accordance with MUTCD
___ Signs and Mailboxes located in planter strip (5' horizontal clearance; min. 7' vertical clearance).
___ Street configuration and lot numbering conforms to preliminary plat.
___ Bike lanes required
___ Traffic signal plan or loop & conduit installation for future.
___ Neighborhood Traffic Management Compliant

Comments: _____

_____

_____

GENERAL PLAN REVIEW CHECKLIST
ENGINEERING DEPARTMENT

Project/Development Name: _____
City Project Number: _____
Reviewer's Initials and Date: _____

Please mark completed items in the space provided. Mark N/A if not applicable. Items left blank are incomplete.

Water Plan

___ Preliminary State of Washington Engineer's Stamp
___ North Arrow and Scale
___ Standard City of Camas Water Detail Sheets
___ Special Details Required
___ Easement(s) Required, Shown, Called Out
___ Property Lines / Adjoining Tax Lots Shown
___ Street Names & Widths
___ Pipe Size, Lengths, & Material per Standards
___ 8" Minimum
___ Stationing
___ Existing and Proposed Utilities Shown/Conflicts
___ Existing and Possible Conflicts Shown (Structures, Trees, etc.)
___ Dimensioning (6' from North/East Curb)
___ Fire Hydrant w/ Fire Marshal's Approval
___400' Between Hydrants
___ 600' from Property Lines
___No Fire Hydrant on Dead End 6"
___ Valves: 3 on a Tee, 4 on a Cross, and Valves Every 600' (minimums)
___ Fittings / Blocks, Shown & Called Out
___ Pipe Deflection Checked for Pipe Sections
___ Blow-off (Standard or Construction)
___ Separation from Sanitary (10' Horizontal, 18" Vertical)
___ Encased in Concrete
___ Ductile Iron Sleeve, 10' Each Side of Crossing.
___ Water Depths and Crossings Shown on Profile
___ Water Meter Locations and Size
___ Irrigation Meter Locations, Size, and Backflow Prevention Device
___ G.P.M. Available
___ Cross-Connection Control for irrigation and business services
___ Service to Each Lot

GENERAL PLAN REVIEW CHECKLIST
ENGINEERING DEPARTMENT

Water Plan Continued

___ Verify Correct Locations, Size, & Type of Existing Water Facilities (Booster Stations, Reservoirs, etc.)
___ Engineered Vacuum Relief Locations for Large Water Mains
___ Air / Vacuum Relief Location Shown - High Point Typical
___ PRV Location / Settings

Comments:

GENERAL PLAN REVIEW CHECKLIST
ENGINEERING DEPARTMENT

Project/Development Name: _____

City Project Number: _____

Reviewer's Initials and Date: _____

Please mark completed items in the space provided. Mark N/A if not applicable. Items left blank are incomplete.

Donated Infrastructure Quantity Tracking Submittal Sheets

Vacant

Water Details

City of Camas Water Details ~ INDEX

Detail No.	Detail Name	Rev.	Rev. Date
W1	Water Notes	7	3/2/2022
W2	1" Water Service - New	11	7/6/2026
W3	1" Water Service - Replacement	9	1/3/2024
W4	H20 Rated 1" Water Service	1	6/11/2019
W5	1" Water Service - Infill Lot	3	7/6/2026
W6	2" Water Service	10	5/20/2024
W6A	2" Water Service For Irrigation	4	5/20/2024
W6B	1" Water Service For Irrigation	1	7/6/2026
W7a & b	3"-8" Water Service	4	3/24/2022
W8	2" Standard Blowoff	5	1/3/2024
W9	6" Low Point Blowoff - Ditch	2	1/1/2011
W10	6" Low Point Blowoff - Street	2	1/1/2011
W11	Fire Hydrant	8	1/3/2024
W12	Valve Box and Riser	4	10/21/2014
W13	Water Main Line and Valve	2	1/1/2011
W14	Pipe Joint Restraint	3	1/1/2011
W15	Thrust Blocks	3	1/1/2011
W16	2" Air/Vacuum Release Valve	7	1/3/2024
W17	2" Air/Vacuum Release Valve in 48" MANHOLE	4	1/3/2024
W17A	2" Air/Vacuum Release Valve in 48" Outside of Curb	2	1/3/2024
W17B	1" Air/Vacuum Release Valve	1	7/6/2026
W18	2" Pressure Relief Valve Assembly	3	1/3/2024
W19	4" Vacuum Relief Valve	2	1/1/2011
W20A	6"x2" PRV Station with 3" Relief	2	1/1/2011
W20B	6"x2" PRV Station with 3" Relief	3	10/21/2014
W21	Above Ground PRV Relief Drain	4	5/16/2019
W22	Water Quality Sampling Station	5	1/3/2024
W23A	Standard Double Check Detector Valve Assembly	3	10/21/2014
W23B	Standard Double Check Detector Valve Assembly	3	10/21/2014
W24	Reduced Pressure Backflow Assembly, 1” and 2”	1	10/2/2017
W25	Reduced Pressure Backflow Assembly, 2.5” & Larger	1	10/2/2017
W26	Water Locate Station Plan	1	3/28/2022
W26A	Locate Station For Water	1	3/28/2022
W27	Water Meter Manifold Assembly	2	1/3/2024
W27A	Water Meter Manifold Assembly	1	2/12/2026

WATER CONSTRUCTION NOTES:

1. ALL TRENCH EXCAVATION AND PIPE INSTALLATION SHALL CONFORM TO THE MOST CURRENT A.W.W.A. STANDARDS, AND THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 7-08.3(1) AND SECTION 7-08.3(2). ALL EXCESS MATERIAL FROM THE TRENCH EXCAVATION SHALL BE LOADED DIRECTLY INTO A DUMP TRUCK AND DISPOSED OF AT AN APPROVED SITE.

2. PIPE BEDDING AND PRE-COVER (PIPE ZONE) MATERIAL SHALL BE 5/8 INCH MINUS CRUSHED ROCK.

3. TRENCH BACKFILL MATERIAL SHALL BE 1-1/4 INCH MINUS CRUSHED ROCK.

4. TRENCH COMPACTION SHALL CONFORM TO THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 7-08.3(3). CONTRACTOR TO DETERMINE THE TYPE OF EQUIPMENT AND METHOD USED TO ACHIEVE THE REQUIRED COMPACTION AND BE APPROVED BY THE CITY OF CAMAS. EACH LIFT SHALL BE COMPACTED TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DENSITY AS DETERMINED BY THE A.A.S.H.T.O. T-180 TEST METHOD.

5. SETTLEMENT OF THE FINISHED SURFACE WITHIN THE WARRANTY PERIOD SHALL BE CONSIDERED TO BE A RESULT OF IMPROPER COMPACTION AND SHALL BE PROMPTLY REPAIRED BY THE CONTRACTOR AT NO EXPENSE TO THE CITY.

6. ALL VALVES 10 INCHES OR LESS IN DIAMETER SHALL BE A.W.W.A. APPROVED RESILIENT WEDGE GATE VALVES, BUBBLE TIGHT AT 200PSI, HAVE NON RISING STEMS, AND OPEN BY TURNING TO THE LEFT. PROVIDE A 2 INCH SQUARE NUT TO CONFORM TO A.W.W.A. C-504. ALL VALVES 12 INCHES OR LARGER IN DIAMETER SHALL BE A.W.W.A. APPROVED BUTTERFLY VALVES.

7. ALL WATER PIPE 12 INCHES OR LESS IN DIAMETER SHALL BE DUCTILE IRON CLASS 52 PIPE. ALL WATER PIPE 14 INCHES IN DIAMETER AND LARGER SHALL BE DUCTILE IRON CLASS 51 PIPE. RUBBER GASKET TYPE SHALL BE U.S. PIPE, TYTON OR APPROVED EQUAL. ALL FITTINGS SHALL BE DUCTILE IRON AND SHALL CONFORM TO THE A.W.W.A. STANDARD C-110.

8. ALL TEES, FLANGES, CAPS, BENDS AND OFFSETS, AS WELL AS ALL OTHER APPURTENANCES WHICH ARE SUBJECT TO UNBALANCED THRUST, SHALL BE PROPERLY BRACED BY ONE OF THE FOLLOWING METHODS:

   A. PRIMARY METHOD IS MECHANICAL JOINT RESTRAINT, AS SHOWN IN DETAIL W14 – USE "EBBA IRON SERIES 1100 MEGA LUG" MECHANICAL JOINT THRUST RESTRAINT OR APPROVED EQUAL. CONTRACTOR TO RESTRAIN THE MINIMUM REQUIRED PIPE LENGTH WITH "FIELD-LOK" GASKETS OR APPROVED EQUAL.

   B. ALTERNATE METHOD IS CONCRETE THRUST BLOCKING, AS SHOWN IN DETAIL W15 – BLOCKING SHALL BE 3000 PSI CONCRETE POURED IN PLACE. THRUST BLOCKING SHALL ONLY BE USED WHEN OTHER MEANS OF RESTRAINT CANNOT BE USED, OR EXISTING PIPE BEING CONNECTED IS NOT RESTRAINED.

9. ALL WATER MAINS SHALL BE TESTED AT 200PSI IN ACCORDANCE WITH SECTION 7-09.3(23) OF THE STANDARD SPECIFICATIONS. THE CITY SHALL BE NOTIFIED 48 HOURS IN ADVANCE OF ACCEPTANCE TESTING. MAXIMUM LENGTH OF PIPE TO BE TESTED AT ONE TIME IS 1000 FT.

10. CHLORINATION SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 7-09.3(24) OF THE STANDARD SPECIFICATIONS. CITY INSPECTOR WILL TAKE SAMPLES AND DELIVER TO LABORATORY FOR BACTERIA TESTING, NEGATIVE SAMPLE RESULTS SHALL BE CONFIRMED, PRIOR TO PRESSURE TESTING. DECHLORINATION OR DISPOSAL TO SANITARY MAIN MAY BE REQUIRED.

11. APPROPRIATE DISPOSAL AND OR DECHLORINATION OF FLUSHED WATER DURING BLOWOFF IS THE RESPONSIBILITY OF THE CONTRACTOR. METHOD USED SHALL BE APPROVED BY CITY AND OTHER REGULATING AUTHORITIES.

12. WATER MAIN TO HAVE A MINIMUM COVER OF 30 INCHES. WATER SERVICES TO HAVE A MINIMUM 24" OF COVER.

13. ALL EXISTING VALVES TO BE OPERATED BY CITY OF CAMAS WATER/SEWER DEPARTMENT PERSONNEL ONLY.

14. NO CONNECTIONS TO EXISTING WATER MAINS SHALL BE MADE PRIOR TO SATISFACTORY PRESSURE TESTING, DISINFECTION, AND THE CONFIRMATION OF A NEGATIVE BACTERIA TEST.

15. WATER MAINS SHALL BE LOOPED WHEREVER POSSIBLE.

16. WATER MAINS SHALL BE 8" DIAMETER MINIMUM LINE SIZE. LARGER LINE SIZES MAY BE REQUIRED.

17. SEE IRRIGATION CONSTRUCTION NOTES, DETAIL IR1, FOR APPROVED BACKFLOW PREVENTION DEVICES.

City of Camas WASHINGTON

WATER DETAIL

WATER CONSTRUCTION NOTES

Jon P. Carothers 3-2-22

DETAIL APPROVED BY DATE

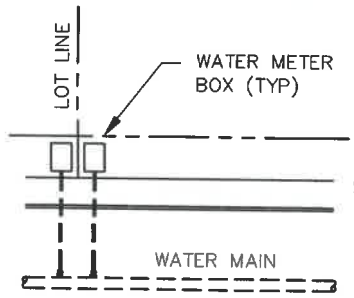
NOT TO SCALE

DETAIL NO. W1

REVISION: 7 DATE: 03/02/2022

1951

WTR-NOTES.DWG



PLAN VIEW LOCATION OF ADJOINING LOT METER BOXES

PROFILE VIEW

DUCTILE IRON MAIN

6" OR LARGER REQUIRES DIRECT TAP.
4" MAIN – DOUBLE STRAP SADDLE REQUIRED FOR SERVICE CONNECTION

NOTES:

1. METER BOX SHALL BE EITHER OLDCASTLE FIBRELYTE FL12BOX WITH NO MOUSE HOLES OR ARMORCAST ROTOCAST P6000485.
2. COVER SHALL BE OLDCASTLE FIBRELYTE FL12D "WATER" OR ARMORCAST A6000484–H9 WITH OFFSET AMR RADIO READ ANTENNA HOLE FOR NEPTUNE METER
3. INSTALL METER BOX OUTSIDE OF SIDEWALK OR IN PLANTER STRIP, EXCEPT WHERE NOTED IN PLANS.
4. SEE TRENCH SECTION DETAILS G2 OR G3 FOR BACKFILL REQUIREMENTS.
5. METER BOXES FOR ADJOINING LOTS SHALL BE WITHIN 2' OF LOT LINE WHERE POSSIBLE (SEE ABOVE LEFT).
6. WATER METER SHALL BE INSTALLED BY THE CITY.
7. TONING WIRE SHALL BE COPPERHEAD SUPERFLEX 12 AWG 45MIL BLUE HDPE INSULATION, NO SPLICES ALLOWED.
8. SEAL TONING WIRE SPLICE CONNECTIONS WITH COPPERHEAD 12 AWG SNAKEBITE LOCKING CONNECTORS (TYPICAL).
9. NEW WATER MAINS REQUIRE TONING WIRE TO A LOCATE STATION
10. TONING WIRE FROM MAIN TO SERVICE REQUIRES A SNAKEBITE LOCKING CONNECTOR
11. PREFERRED BRASS FITTINGS TO BE USED, IN ORDER:
    1. FORD
    2. AY MCDONALD

City of Camas WASHINGTON

WATER DETAIL

1" WATER SERVICE – NEW

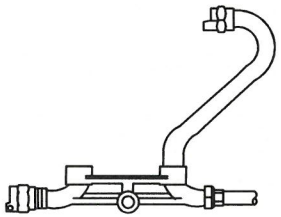
DETAIL APPROVED BY — DATE 7/6/2026

NOT TO SCALE

DETAIL NO. W2

REVISION: 11 DATE: 07/02/2026

S1.DWG



METER RISER
SEE NOTE 4

PROFILE VIEW

DUCTILE IRON MAIN

6" OR LARGER REQUIRES DIRECT TAP.
4" MAIN – DOUBLE STRAP SADDLE
REQUIRED FOR SERVICE CONNECTION

NOTES:

1. METER BOX SHALL BE OLDCASTLE FIBRELYTE FL12BOX WITH NO MOUSE HOLES OR ARMORCAST ROTOCAST P6000485.
2. COVER SHALL BE OLDCASTLE FIBRELYTE FL12D "WATER" OR ARMORCAST A6000484–H9 WITH OFFSET AMR RADIO READ ANTENNA HOLE FOR NEPTUNE METER
3. REPLACE ALL SERVICES WHICH MEET ANY OF THE FOLLOWING CONDITIONS:
   – METER BOX IS RELOCATED
   – SUBSTANDARD EITHER BY MATERIALS OR LACK OF COVER
4. IF SERVICE LINE TO HOUSE IS DEEP, HALF OF A METER RISER MAY BE REQUIRED.
5. SEE TRENCH SECTION DETAILS G2 OR G3 FOR BACKFILL REQUIREMENTS. WATER METER SHALL BE INSTALLED BY THE CITY.
6. TONING WIRE SHALL BE COPPERHEAD SUPERFLEX 12 AWG 45MIL BLUE HDPE INSULATION, NO SPLICES ALLOWED.
7. SEAL TONING WIRE SPLICE CONNECTIONS WITH COPPERHEAD 12 AWG SNAKEBITE LOCKING CONNECTORS (TYPICAL).
8. PREFERRED BRASS FITTINGS TO BE USED, IN ORDER:
   1. FORD
   2. AY MCDONALD

City of Camas WASHINGTON

WATER DETAIL

1" WATER SERVICE – REPLACEMENT

1/3/24

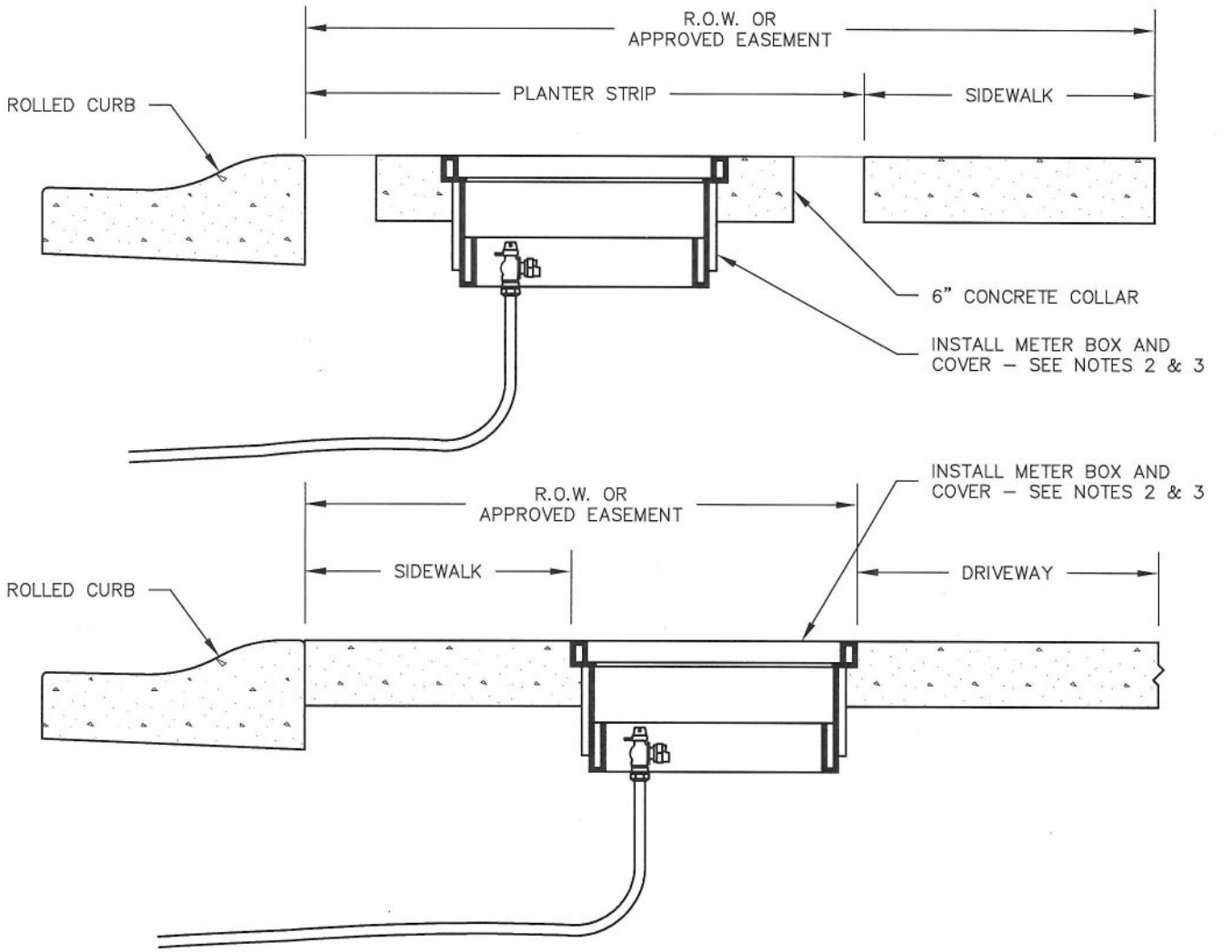
DETAIL APPROVED BY DATE

NOT TO SCALE

DETAIL NO. 1953

REVISION: 9 DATE: 01/02/2024

WTR–WS1.DWG



NOTES:
1. FOR INSTALLATIONS BEHIND ROLLED CURBS OR IN DRIVEWAYS WHERE H20 TRAFFIC RATING IS REQUIRED.
2. THE METER BOX SHALL BE SIGMA RAVEN HDPE STRAIGHT WALL BOX, BLACK, WITH NO MOUSE HOLES, M/N RMB132412–SW–B.
3. COVER SHALL BE SIGMA RAVEN POLYETHYLENE LID WITH OFFSET AMR RADIO READ ANTENNA HOLE FOR NEPTUNE METER, M/N N1324BLKWAT–TS.
4. BACKFILL AROUND METER BOX SHALL BE 5/8" MINUS CRUSHED SURFACING TOP COURSE. PLACE 2X6 WOOD SUPPORT ACROSS THE SHORT SIDE IN THE BASE OF BOX, PRIOR TO COMPACTION AROUND THE BOX, TO PREVENT INWARD BOWING.
4. METER BOX SHALL BE SET AT FINISH GRADE PRIOR TO CONCRETE BEING PLACED AROUND THE BOX.
5. METER BOXES SET IN PLANTER STRIPS AND IN HOT–MIX ASPHALT SHALL HAVE A 6 INCH CONCRETE COLLAR POURED AROUND THE METER BOX PRIOR TO PAVING.

City of Camas WASHINGTON

WATER DETAIL

H20 RATED 1" WATER METER BOX

Jan E. Cawthon 6-17-19

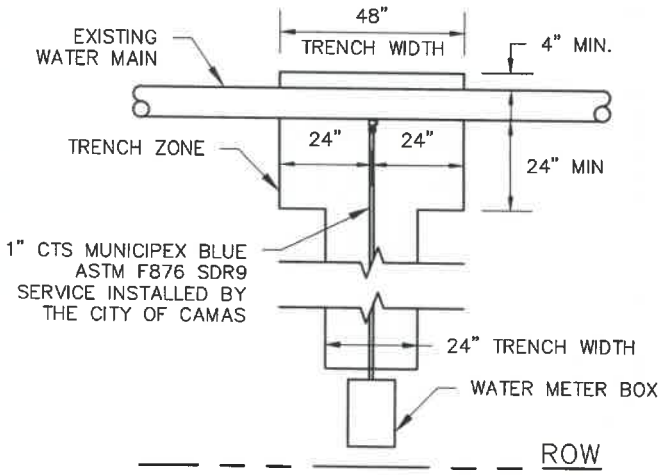
DETAIL APPROVED BY DATE

NOT TO SCALE

DETAIL NO. W4

REVISION: 1 DATE: 6/11/2019

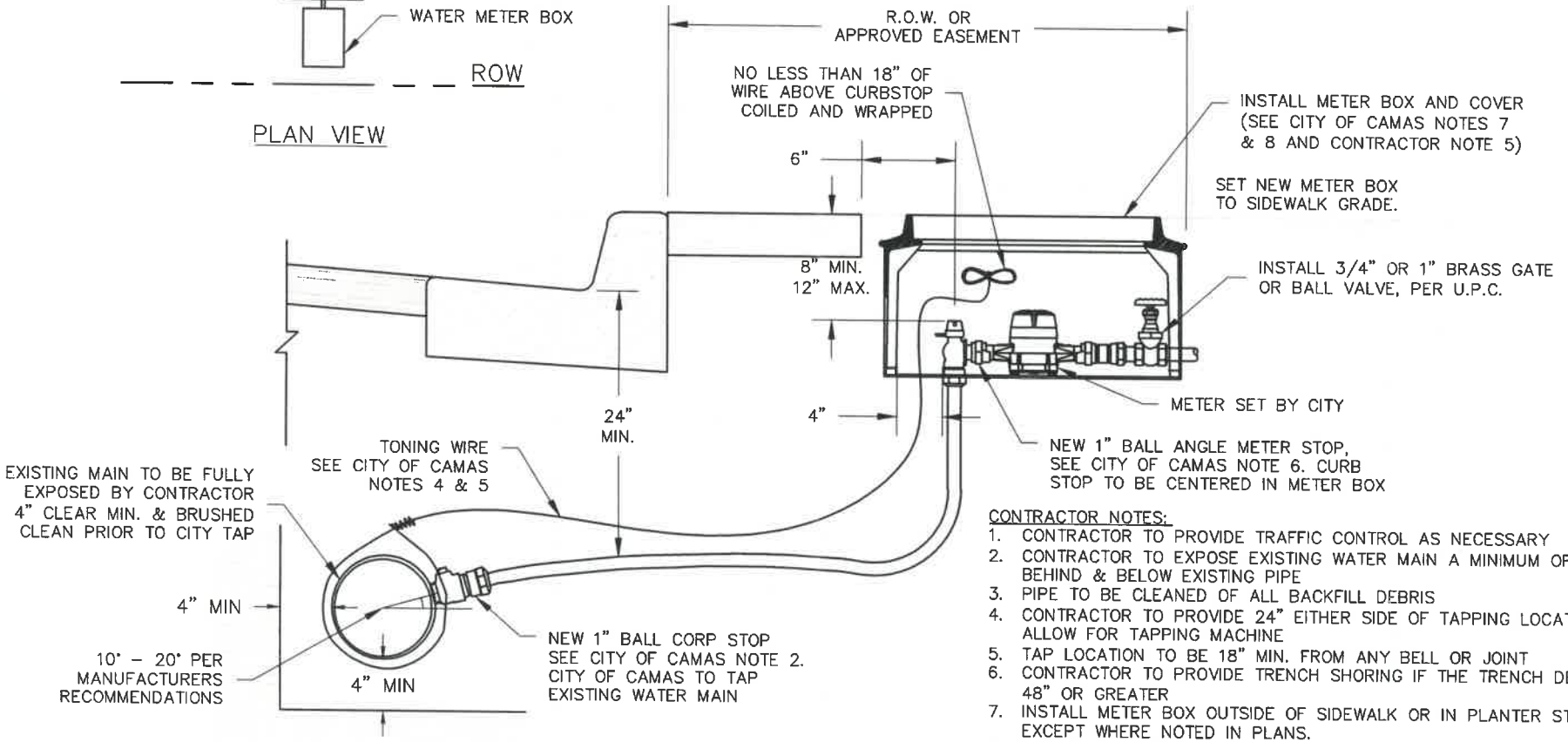
WTR–WS1 2019.DWG



PLAN VIEW

CITY OF CAMAS NOTES:

1. TAPPING OF THE EXISTING WATER MAIN IS TO BE PERFORMED BY THE CITY OF CAMAS.
2. CORP STOP SHALL BE 1" BALL CORP STOP, CC THREAD X COMPRESSION, WITH STIFFENER INSERT 6133T OR EQUIVALENT. PROVIDED AND INSTALLED BY THE CITY OF CAMAS
3. WATER SERVICE SHALL BE 1" CTS MUNICIPEX BLUE ASTM F876 SDR9, PROVIDED AND INSTALLED BY THE CITY OF CAMAS
4. TONING WIRE SHALL BE COPPERHEAD SUPERFLEX 12 AWG 45MIL BLUE HDPE INSULATION, NO SPLICES ALLOWED. PROVIDED AND INSTALLED BY THE CITY OF CAMAS.
5. SEAL TONING WIRE SPLICE CONNECTIONS WITH COPPERHEAD 12 AWG SNAKEBITE LOCKING CONNECTORS (TYP)
6. METER STOP SHALL BE 1" BALL ANGLE METER STOP, COMPRESSION X METER SWIVEL NUT, WITH STIFFENER INSERT 6133T OR EQUIVALENT. PROVIDED AND INSTALLED BY THE CITY OF CAMAS
7. METER BOX SHALL BE OLDCASTLE FIBRELYTE FL12BOX WITH NO MOUSE HOLES OR ARMORCAST ROTOCAST P6000485. CITY OF CAMAS TO PROVIDE METER BOX, CONTRACTOR TO INSTALL
8. COVER SHALL BE OLDCASTLE FIBRELYTE FL12D "WATER" OR ARMORCAST A6000484-H9 WITH OFFSET AMR RADIO READ ANTENNA HOLE FOR NEPTUNE METER. CITY OF CAMAS TO PROVIDE COVER, CONTRACTOR TO INSTALL.
9. WATER METER SHALL BE INSTALLED BY THE CITY OF CAMAS



PROFILE VIEW

CONTRACTOR NOTES:

1. CONTRACTOR TO PROVIDE TRAFFIC CONTROL AS NECESSARY
2. CONTRACTOR TO EXPOSE EXISTING WATER MAIN A MINIMUM OF 4" BEHIND & BELOW EXISTING PIPE
3. PIPE TO BE CLEANED OF ALL BACKFILL DEBRIS
4. CONTRACTOR TO PROVIDE 24" EITHER SIDE OF TAPPING LOCATION TO ALLOW FOR TAPPING MACHINE
5. TAP LOCATION TO BE 18" MIN. FROM ANY BELL OR JOINT
6. CONTRACTOR TO PROVIDE TRENCH SHORING IF THE TRENCH DEPTH IS 48" OR GREATER
7. INSTALL METER BOX OUTSIDE OF SIDEWALK OR IN PLANTER STRIP, EXCEPT WHERE NOTED IN PLANS.
8. SEE TRENCH SECTION DETAIL G2 FOR BACKFILL REQUIREMENTS.
9. SEE DETAIL G2A FOR LIMITS OF REQUIRED SURFACE RESTORATION

City of Camas WASHINGTON

WATER DETAIL

1" WATER SERVICE - INFILL LOT

DETAIL APPROVED BY 7/6/2026 DATE

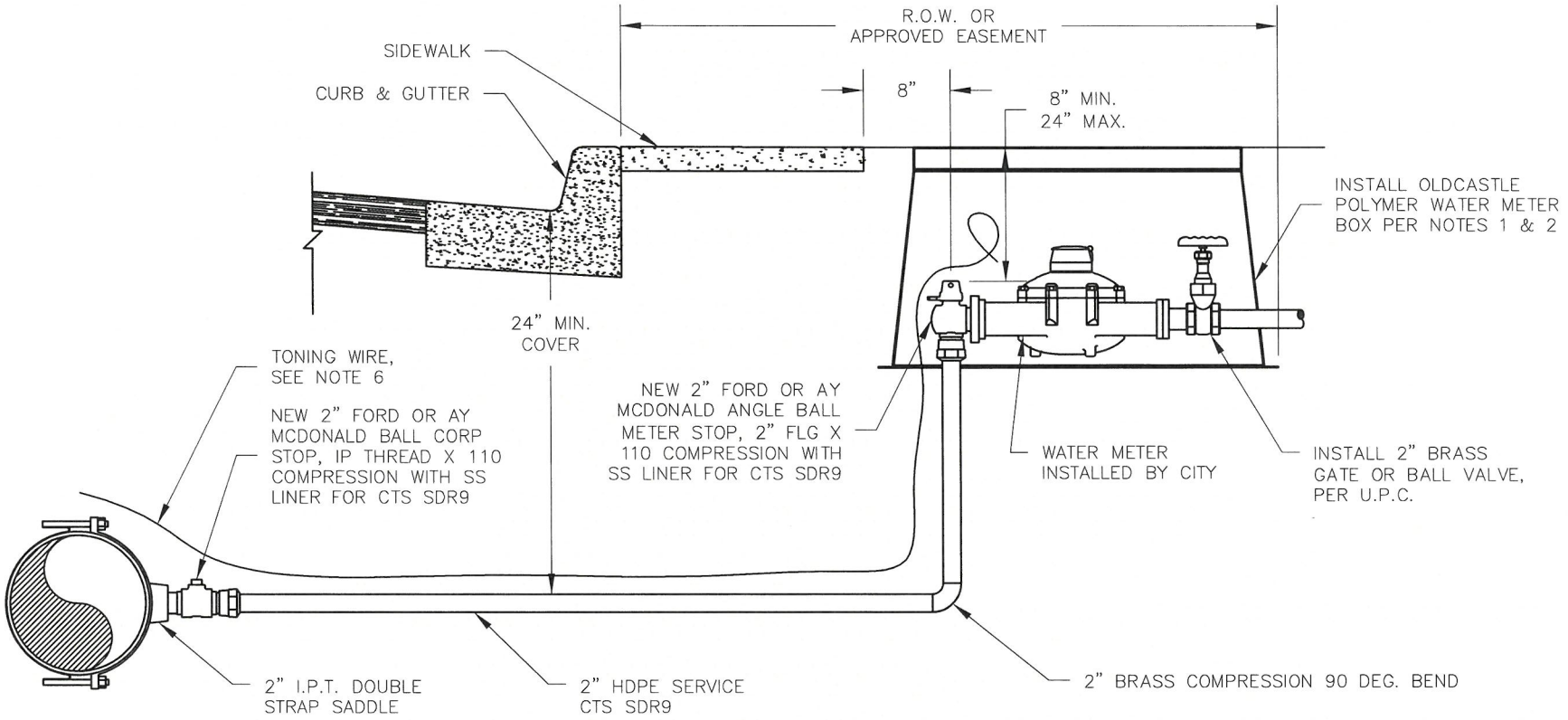
NOT TO SCALE

DETAIL NO. W5

REVISION: 3 DATE: 7/02/2026

S1.DWG

1955



NOTES:

1. METER BOX SHALL BE OLDCASTLE FIBRELYTE FL36BOX18. INSTALL FL36X6 OR FL36X8 BASE EXTENSIONS AS REQUIRED.
2. COVER SHALL BE OLDCASTLE FIBRELYTE FL36 P "WATER" WITH OFFSET AMR RADIO READ ANTENNA HOLE FOR NEPTUNE METER
3. REPLACE ALL SERVICES WHICH MEET ANY OF THE FOLLOWING CONDITIONS:
   - METER BOX IS RELOCATED
   - SUBSTANDARD EITHER BY MATERIALS OR LACK OF COVER
4. SEE TRENCH SECTION DETAILS G2 OR G3 FOR BACKFILL REQUIREMENTS.
5. AFTER FEES HAVE BEEN PAID WATER METER SHALL BE ORDERED AND INSTALLED BY THE CITY.
6. TONING WIRE IS REQUIRED AND SHALL BE COPPERHEAD SUPERFLEX 12 AWG 45MIL BLUE HDPE INSULATION, NO SPLICES ALLOWED.

City of Camas WASHINGTON

WATER DETAIL

2" WATER SERVICE

DETAIL APPROVED BY

5/20/24

DATE

NOT TO SCALE

DETAIL NO.

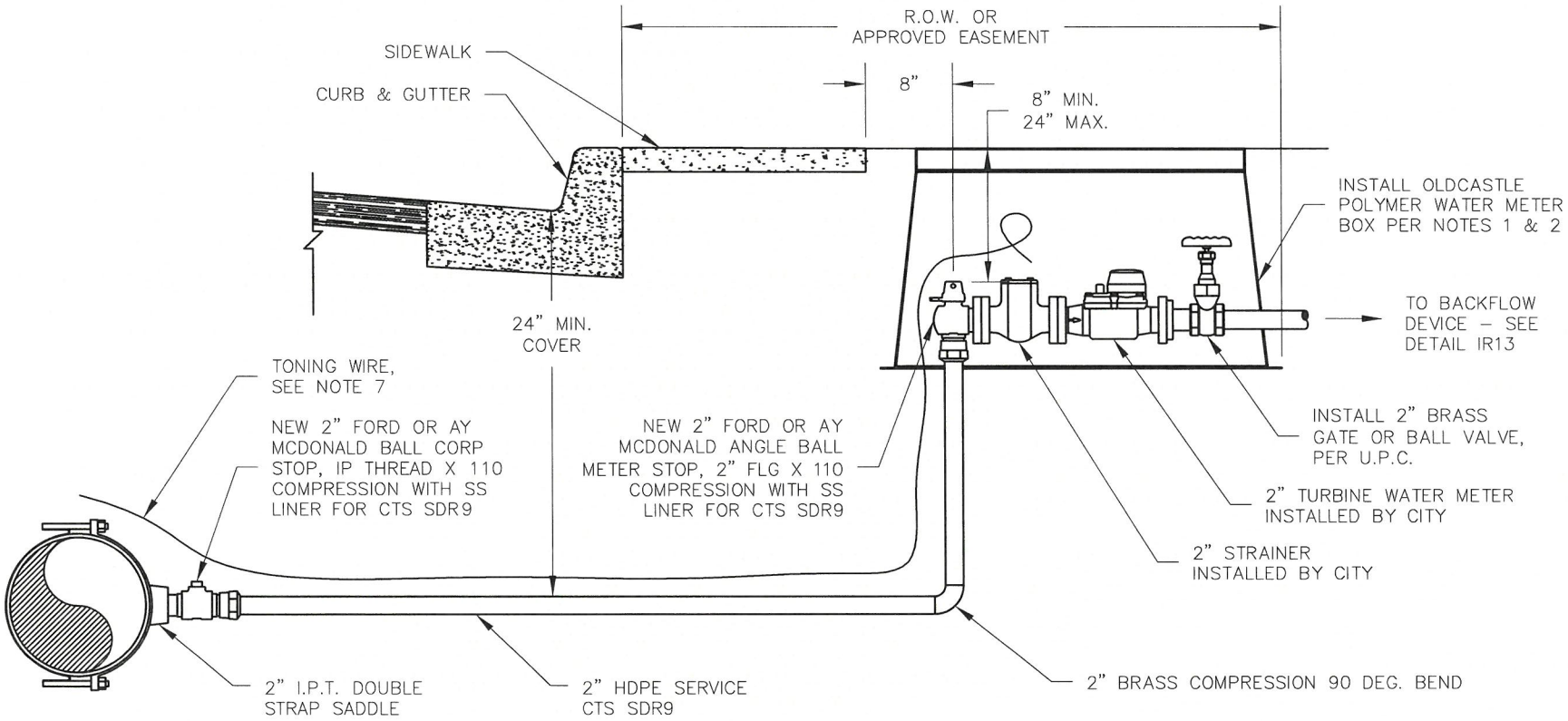
W6

REVISION: 10

DATE: 05/20/2024

1956

WTR-WS2.DWG



NOTES:

1. METER BOX SHALL BE OLDCASTLE FIBRELYTE FL36BOX18. INSTALL FL36X6 OR FL36X8 BASE EXTENSIONS AS REQUIRED.
2. COVER SHALL BE OLDCASTLE FIBRELYTE FL36 P "WATER" WITH OFFSET AMR RADIO READ ANTENNA HOLE FOR NEPTUNE METER
3. REPLACE ALL SERVICES WHICH MEET ANY OF THE FOLLOWING CONDITIONS:
   - METER BOX IS RELOCATED
   - SUBSTANDARD EITHER BY MATERIALS OR LACK OF COVER
4. SEE TRENCH SECTION DETAILS G2 OR G3 FOR BACKFILL REQUIREMENTS.
5. AFTER FEES HAVE BEEN PAID WATER METER SHALL BE ORDERED AND INSTALLED BY THE CITY.
6. 1–1/2" METER WILL REQUIRE A 2" X 1–1/2" REDUCER FITTING AND MAY REQUIRE ADDITIONAL METER BOX, OR SEPARATE VALVE BOX FOR GATE VALVE.
7. TONING WIRE IS REQUIRED AND SHALL BE COPPERHEAD SUPERFLEX 12 AWG 45MIL BLUE HDPE INSULATION, NO SPLICES ALLOWED.

City of Camas WASHINGTON

WATER DETAIL

2" WATER SERVICE FOR IRRIGATION

DETAIL APPROVED BY — DATE 5/20/24

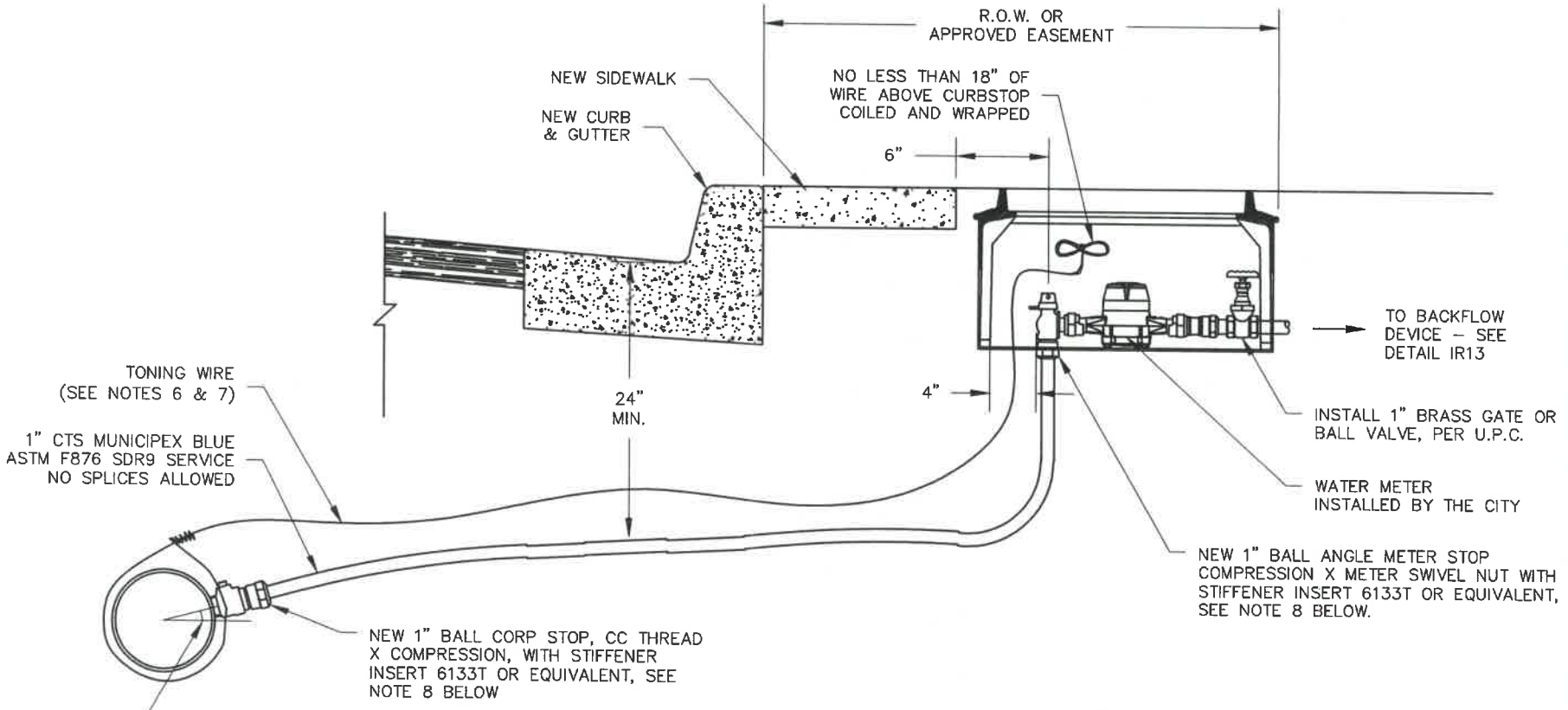
NOT TO SCALE

DETAIL NO. W6A

REVISION: 4 DATE: 05/20/2024

1957

WTR–WS2.DWG



NOTES:

1. METER BOX SHALL BE OLDCASTLE FIBRELYTE FL36BOX18. INSTALL FL36X6 OR FL36X8 BASE EXTENSIONS AS REQUIRED.
2. COVER SHALL BE OLDCASTLE FIBRELYTE FL36 P "WATER" WITH OFFSET AMR RADIO READ ANTENNA HOLE FOR NEPTUNE METER
3. REPLACE ALL SERVICES WHICH MEET ANY OF THE FOLLOWING CONDITIONS:
   - METER BOX IS RELOCATED
   - SUBSTANDARD EITHER BY MATERIALS OR LACK OF COVER
4. SEE TRENCH SECTION DETAILS G2 OR G3 FOR BACKFILL REQUIREMENTS.
5. AFTER FEES HAVE BEEN PAID WATER METER SHALL BE ORDERED AND INSTALLED BY THE CITY.
6. TONING WIRE IS REQUIRED AND SHALL BE COPPERHEAD SUPERFLEX 12 AWG 45MIL BLUE HDPE INSULATION, NO SPLICES ALLOWED.
7. SEAL TONING WIRE SPLICE CONNECTIONS WITH COPPERHEAD 12 AWG SNAKEBITE LOCKING CONNECTORS (TYPICAL).
8. PREFERRED BRASS FITTINGS TO BE USED, IN ORDER:
   1. FORD
   2. AY MCDONALD

City of Camas WASHINGTON

WATER DETAIL

1" WATER SERVICE FOR IRRIGATION

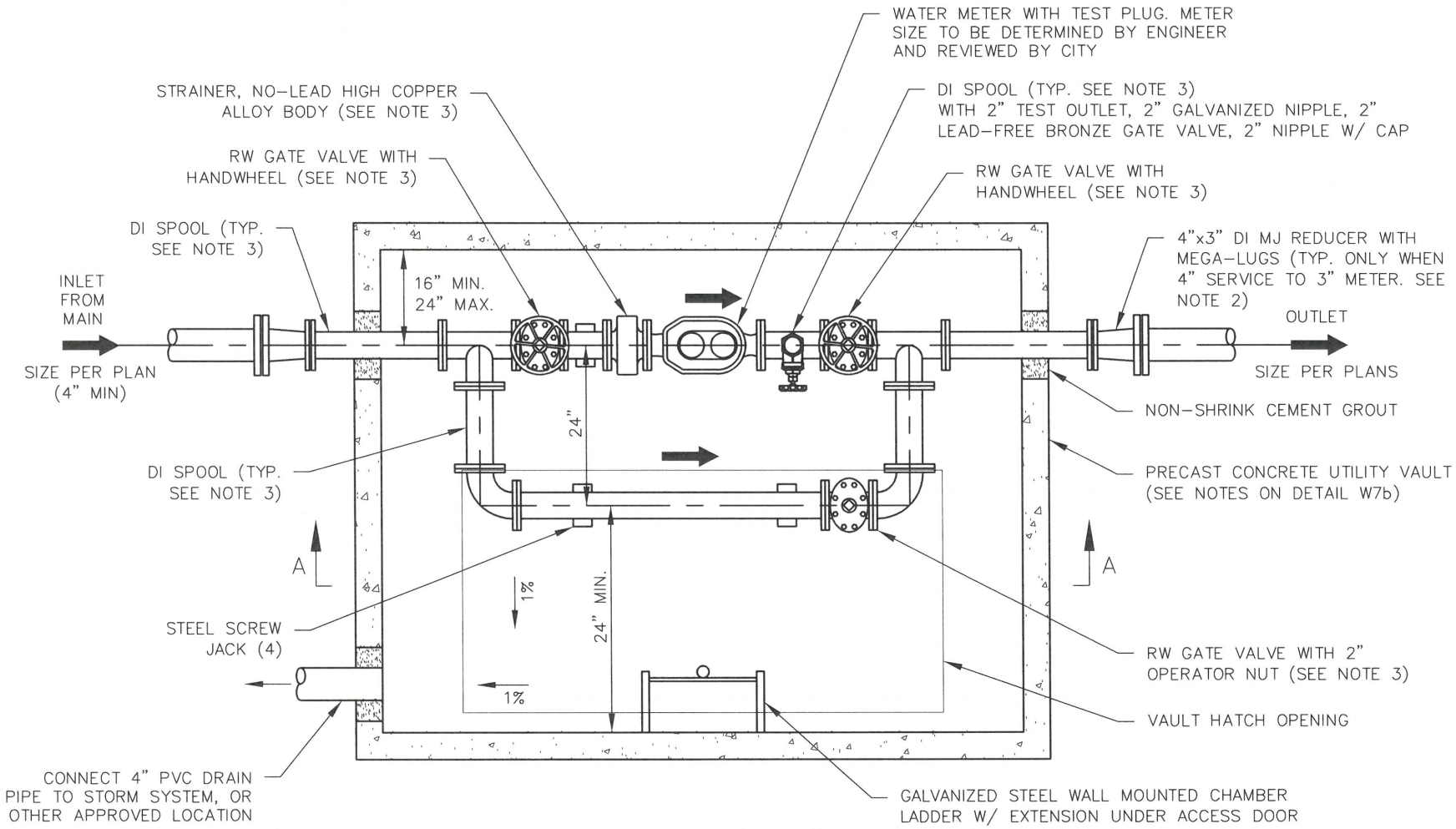
DETAIL APPROVED BY — DATE: 7/6/2026

NOT TO SCALE

DETAIL NO. W6B

REVISION: 1 DATE: 7/02/2026

S2.DWG



PLAN VIEW

WATER METER NOTES:

1. FOR NEW MAINS, INSTALL MAIN SIZE MJ x NEW SERVICE FL TEE (4" MIN). FOR EXISTING MAINS, LIVE TAP TO BE PERFORMED BY APPROVED TAPPING CONTRACTOR.
2. ALL COMPONENTS TO MATCH METER SIZE.
3. PROVIDE FLANGED CONNECTIONS FOR ALL JOINTS ON 3" DUCTILE IRON PIPE AND FITTINGS; FOR 4" AND BIGGER PROVIDE APPROVED JOINT RESTRAINT FOR ALL JOINTS.
4. CONSTRUCTION AND MAINTENANCE WITHIN VAULTS MAY BE SUBJECT TO CONFINED SPACE ENTRY PERMITTING REQUIREMENTS AND/OR SAFETY PRECAUTIONS.
5. WATER METER TO BE ORDERED, PAID, AND INSTALLED BY CONTRACTOR. BRAND AND TYPE TO BE APPROVED BY WATER DEPARTMENT.

City of Camas WASHINGTON

WATER DETAIL

3" – 8" WATER SERVICE

Jan E. Cantu 3-24-22

DETAIL APPROVED BY DATE

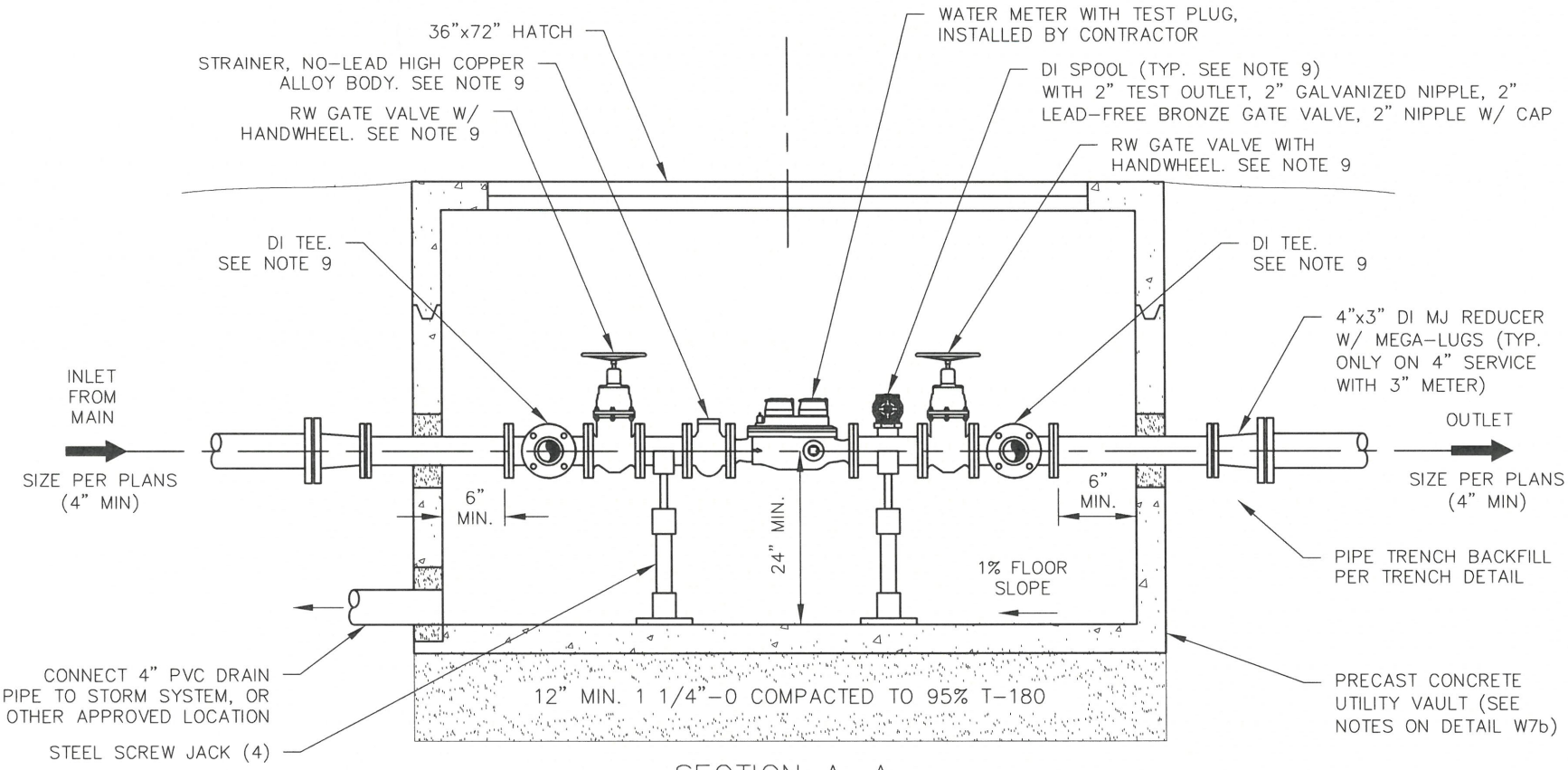
NOT TO SCALE

DETAIL NO. W7A

REVISION: 4 DATE: 03/22/2022

1959

WTR-WS3.DWG



SECTION A-A

(BY-PASS LINE REMOVED FOR CLARITY)

VAULT CONSTRUCTION NOTES:

1. VAULT SHALL BE PRE-APPROVED PRIOR TO INSTALLATION.
2. VAULTS SHALL HAVE A MINIMUM OF 3' CLEARANCE FROM ALL STRUCTURES.
3. APPROVED VAULT SHALL BE RATED FOR H20 LOADING AND INCLUDE AN EXTENSION LADDER, MINIMUM INSIDE DIMENSIONS 8'Lx6'Wx5'H.
4. VAULT SHALL BE SET FOR 1% SLOPE TO DRAIN.
5. ALL BACKFILL SHALL BE APPROVED GRANULAR MATERIAL.
6. HATCH SHALL BE AN H20 RATED, 36"x72" SPRING ASSISTED, HOT DIPPED GALVANIZED DIAMOND PLATE DOUBLE DOOR. FOR TRAFFIC INSTALLATIONS A 30" MANHOLE LID SHALL BE USED INSTEAD OF A HATCH.
7. SUMP PUMP MAY BE REQUIRED ON INSTALLATIONS WHERE DRAIN PIPE CANNOT BE CONNECTED TO ADEQUATE STORM DRAIN SYSTEM. THE APPROVED SUMP PUMP SHALL BE A COMMERCIAL GRADE WATER POWERED VENTURI DESIGN WITH BACKFLOW PREVENTION, SIZED TO PROVIDE 10GPM AT 10 FEET OF HEAD AT THE AVAILABLE SYSTEM WATER PRESSURE. BACKFLOW DEVICE SHALL BE CERTIFIED BY WASHINGTON STATE CERTIFIED BACKFLOW TESTER AFTER INSTALLATION AND PRIOR TO ACCEPTANCE. TEST RESULTS SHALL BE SENT TO CITY OF CAMAS WATER DEPARTMENT.
8. CONSTRUCTION AND MAINTENANCE WITHIN VAULTS MAY BE SUBJECT TO CONFINED SPACE ENTRY PERMITTING REQUIREMENTS AND/OR SAFETY PRECAUTIONS.
9. PROVIDE FLANGED CONECTIONS FOR ALL JOINTS 3" DI PIPE AND FITTINGS; FOR 4" AND BIGGER PROVIDE APPROVED JOINT RESTRAINTS.

City of Camas WASHINGTON

WATER DETAIL

3" – 8" WATER SERVICE

Jim C. Carothers 3-24-22

DETAIL APPROVED BY DATE

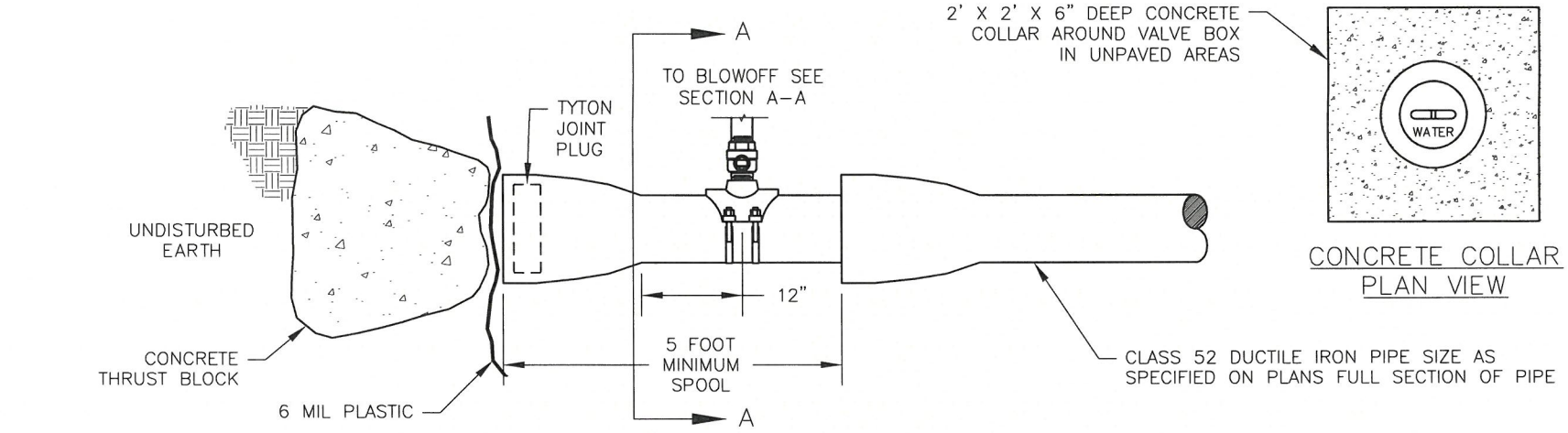
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REVISION: 4 DATE: 03/22/2022

DETAIL NO. W7B

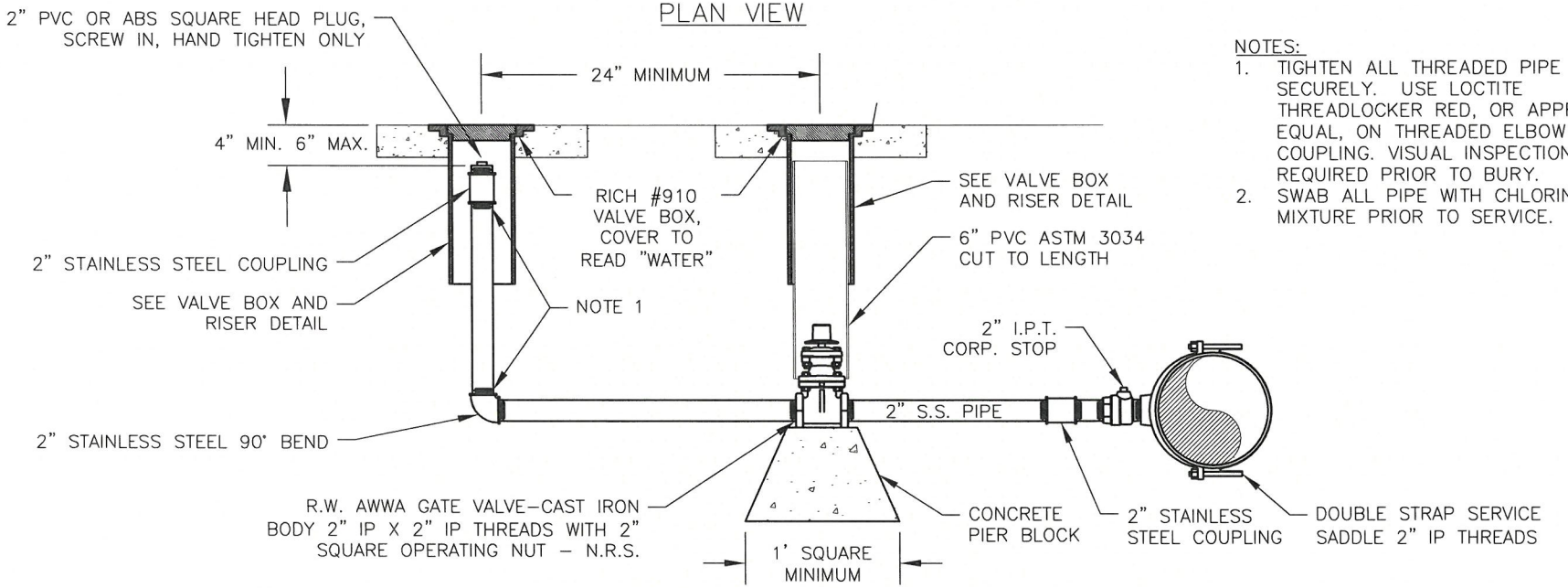
1960

WTR-WS3.DWG



PLAN VIEW

CONCRETE COLLAR PLAN VIEW



SECTION A–A

NOTES:
1. TIGHTEN ALL THREADED PIPE JOINTS SECURELY. USE LOCTITE THREADLOCKER RED, OR APPROVED EQUAL, ON THREADED ELBOW AND COUPLING. VISUAL INSPECTION REQUIRED PRIOR TO BURY.
2. SWAB ALL PIPE WITH CHLORINE MIXTURE PRIOR TO SERVICE.

City of Camas WASHINGTON

WATER DETAIL

2" STANDARD BLOWOFF

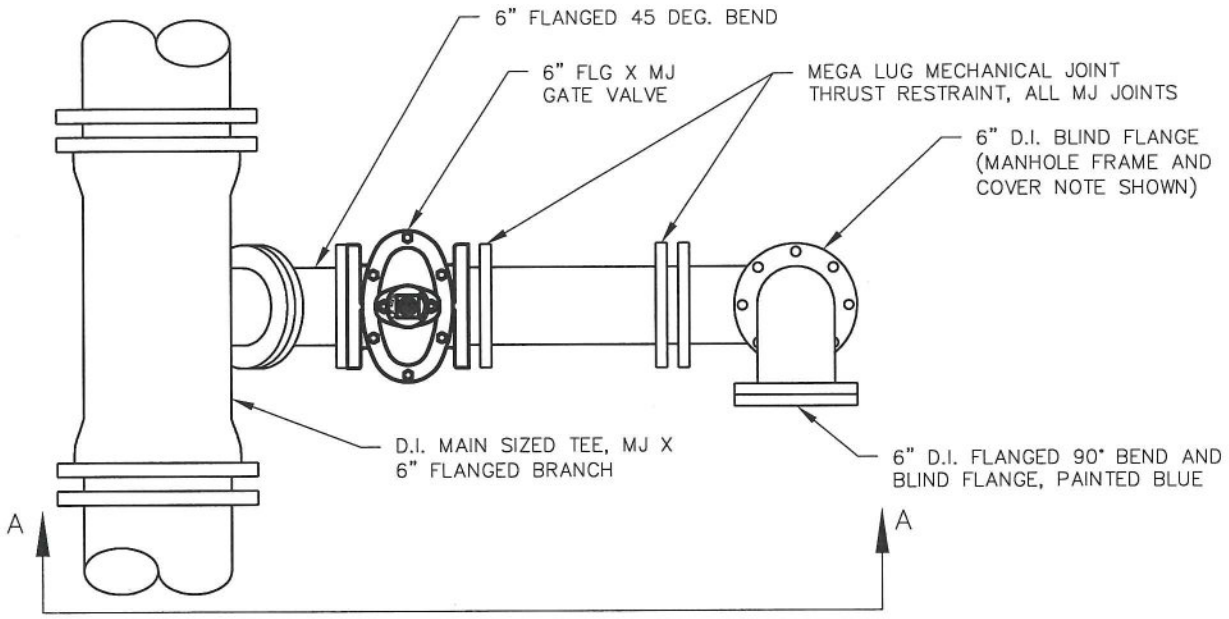
DETAIL APPROVED BY — DATE: 1/3/24

NOT TO SCALE

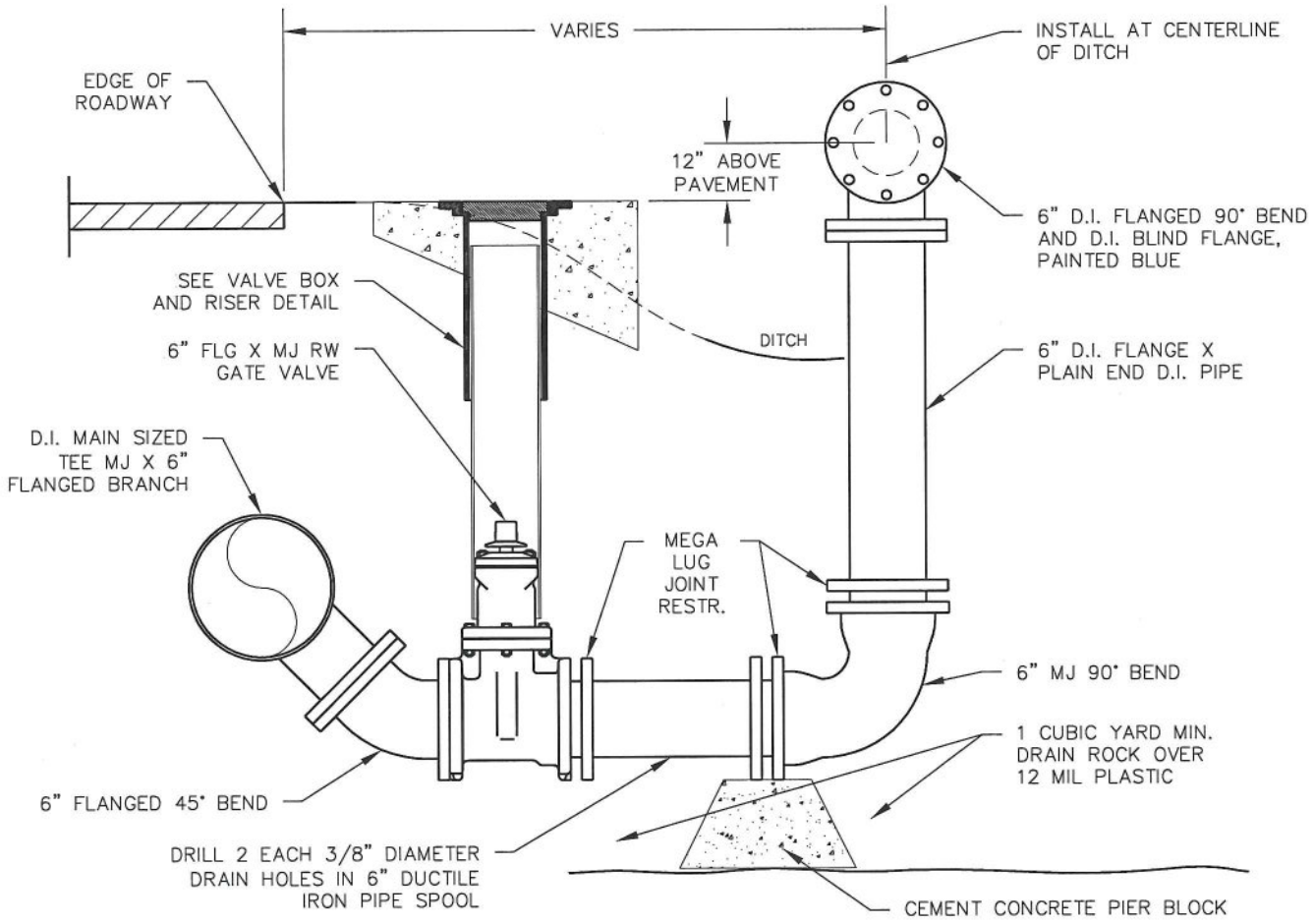
DETAIL NO. 1961

REVISION: 7 DATE: 01/02/2024

WTR–BLOWOFF.DWG



PLAN VIEW



SECTION VIEW A–A

REV. NO.	DATE	BY	APPR.
1	5/1/07	SCD	JC
2	1/1/11	SCD	JC

CITY OF CAMAS ~ WATER DETAIL

6" LOW POINT BLOW OFF – DITCH

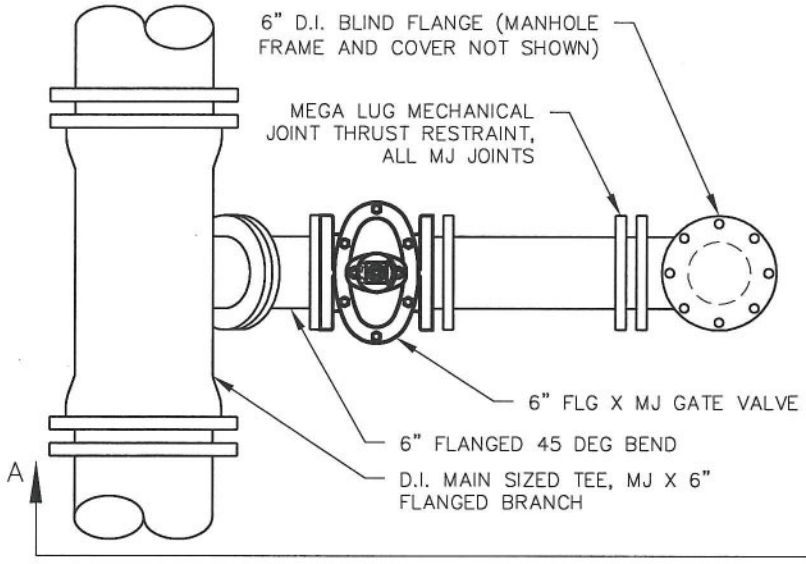
Jan E Carothers 1-4-11

DETAIL APPROVED BY DATE

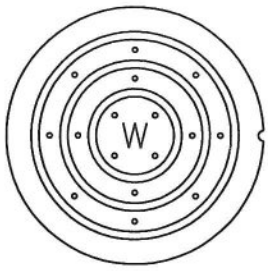
NOT TO SCALE

DETAIL NO. W9

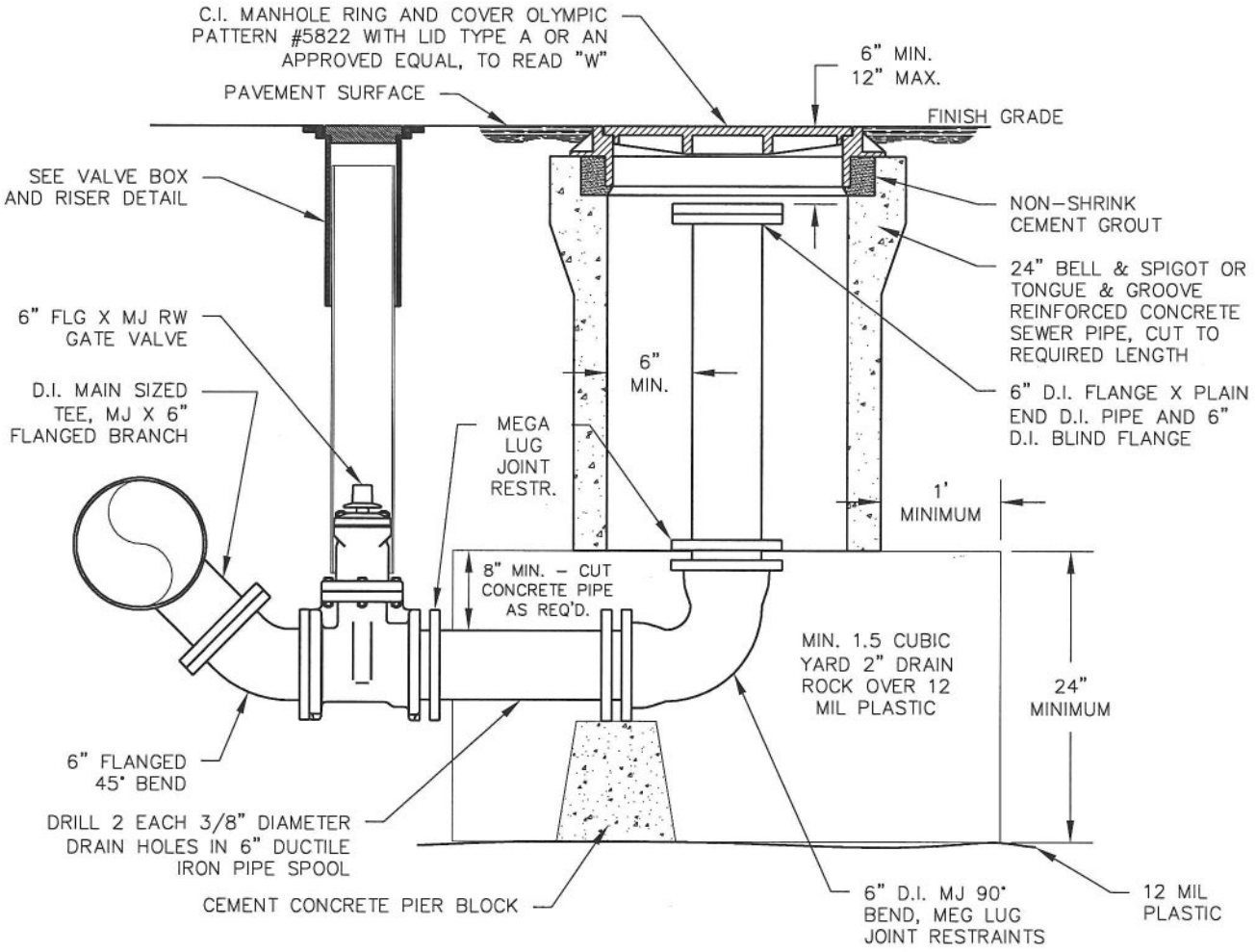
6BLOWOFF.DWG



PLAN VIEW



WATER COVER



SECTION VIEW A-A

REV. NO.	DATE	BY	APPR.
1	5/1/07	SCD	JC
2	1/1/11	SCD	JC

CITY OF CAMAS ~ WATER DETAIL

6" LOW POINT BLOW OFF - STREET

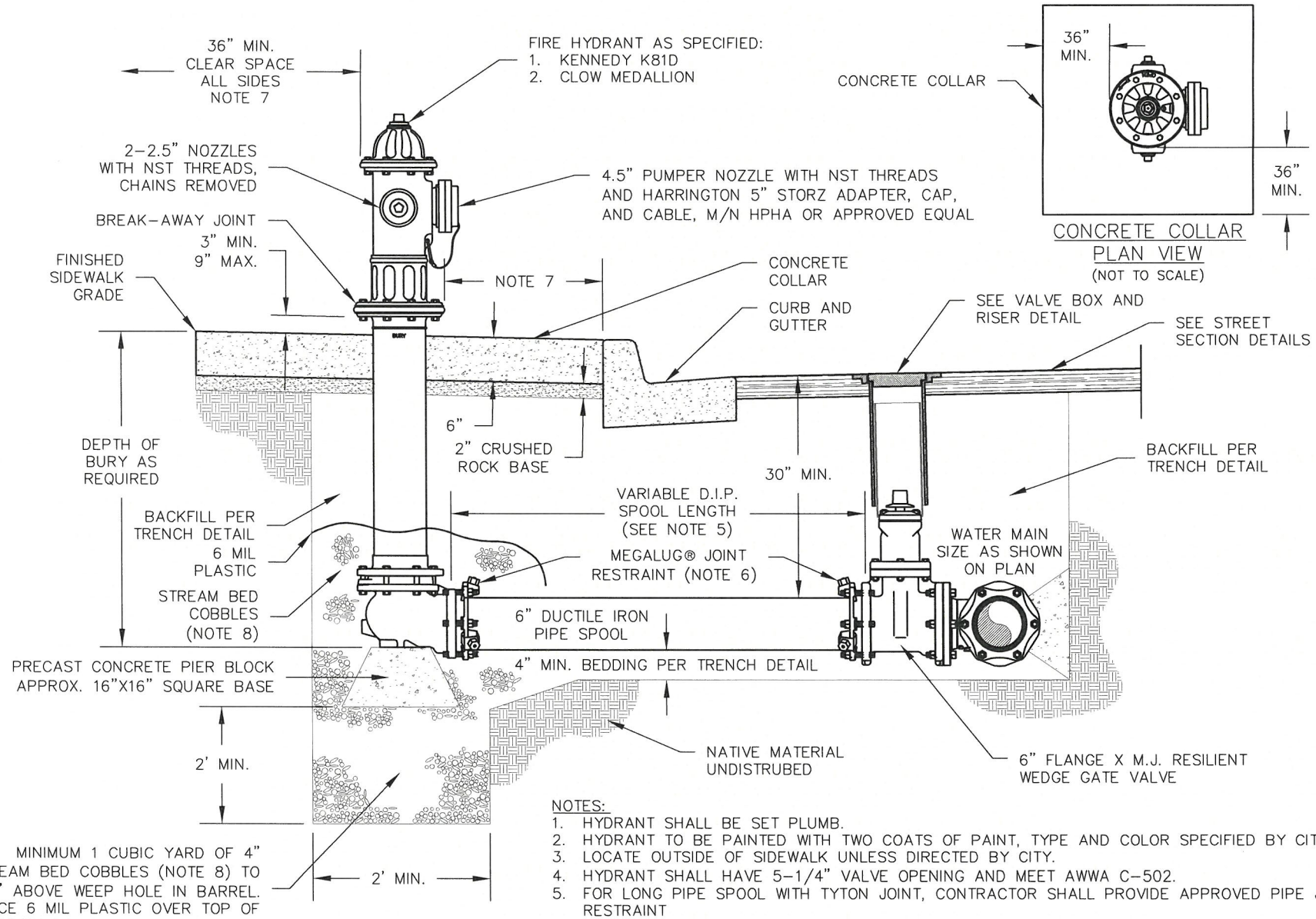
Jon P. Carothers 1-4-11

DETAIL APPROVED BY DATE

NOT TO SCALE

DETAIL NO. W10

6BLOWOFF.DWG



NOTES:

1. HYDRANT SHALL BE SET PLUMB.
2. HYDRANT TO BE PAINTED WITH TWO COATS OF PAINT, TYPE AND COLOR SPECIFIED BY CITY.
3. LOCATE OUTSIDE OF SIDEWALK UNLESS DIRECTED BY CITY.
4. HYDRANT SHALL HAVE 5–1/4" VALVE OPENING AND MEET AWWA C–502.
5. FOR LONG PIPE SPOOL WITH TYTON JOINT, CONTRACTOR SHALL PROVIDE APPROVED PIPE JOINT RESTRAINT
6. EBAA IRON SERIES 1100 MEGALUG®MECHANICAL JOINT THRUST RESTRAINT.
7. 36" MINIMUM CLEARANCE ON ALL SIDES (MAY INCLUDE SIDEWALK), 20" MINIMUM ONLY ON CURB SIDE
8. 4 INCH STREAM BED COBBLES PER WSDOT SPEC WSDOT 9–03.11(2)

City of Camas WASHINGTON

WATER DETAIL

FIRE HYDRANT

DETAIL APPROVED BY

1/3/24

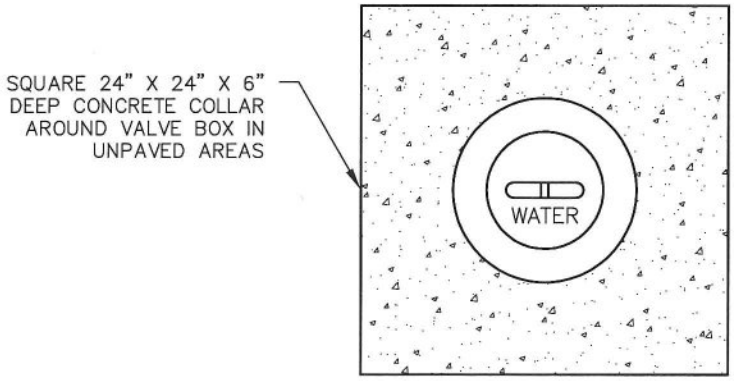
DATE

NOT TO SCALE

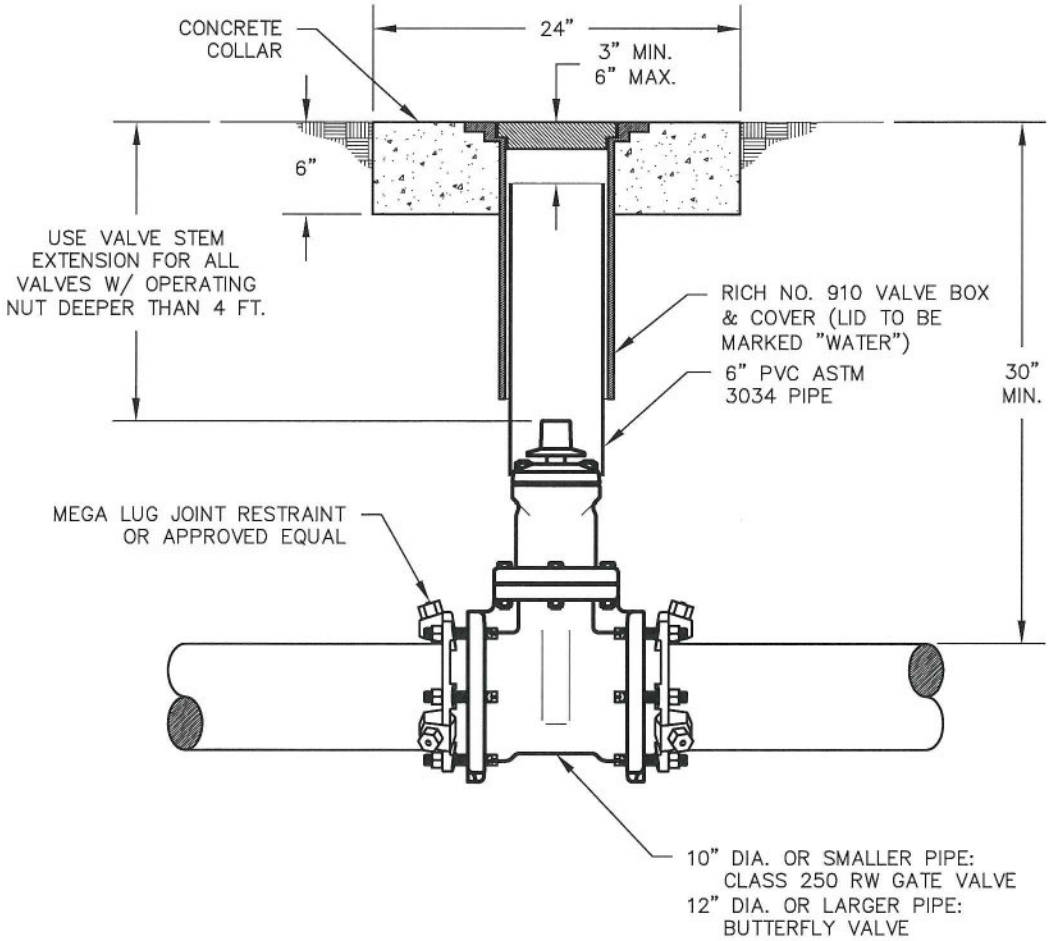
DETAIL NO. 1964

REVISION: 8 DATE: 01/02/2024

WTR–FHYD.DWG



CONCRETE COLLAR PLAN VIEW



REV. NO.	DATE	BY	APPR.
1	7/17/06	SCD	RES1076
2	5/1/07	SCD	JC
3	1/1/11	SCD	JC
4	10/21/14	SCD	JC

CITY OF CAMAS ~ WATER DETAIL

VALVE BOX AND RISER

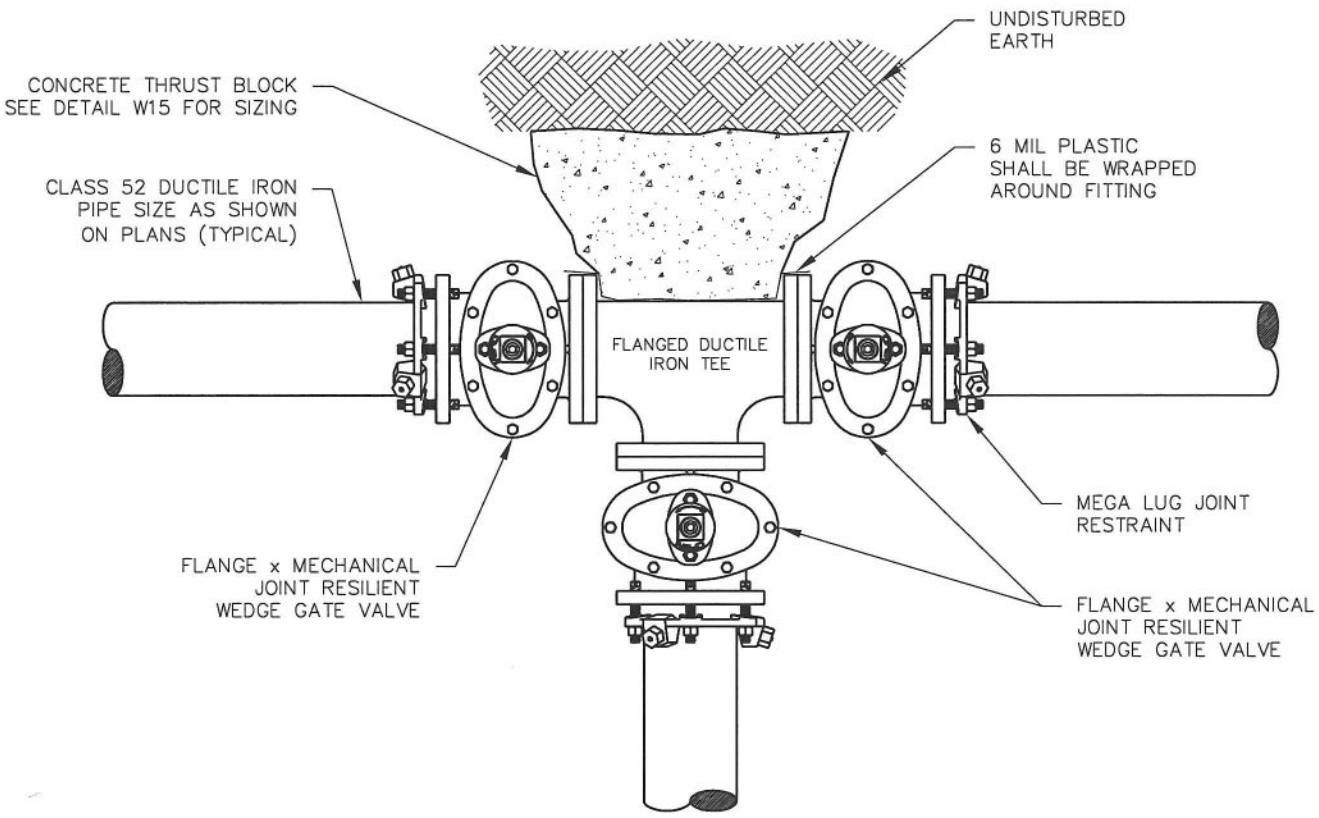
10-21-14

DETAIL APPROVED BY DATE

NOT TO SCALE

DETAIL NO. W12

RISER.DWG



NOTES:
1. VALVES TO BE INSTALLED AT ALL BRANCHES. FOR LONG MAIN LINE RUNS, INLINE VALVE SPACING NOT TO EXCEED 500'. LOOP WATER SYSTEM WHEREVER POSSIBLE. KEEP DEAD ENDS TO A MINIMUM.
2. MECHANICAL THRUST RESTRAINT MAY BE USED DUE TO UNSTABLE SOILS OR THE ENGINEER'S DISCRETION.
3. SEE DETAIL W15 FOR THRUST BLOCK REQUIREMENTS.

REV. NO.	DATE	BY	APPR.
1	5/1/07	SCD	JC
2	1/1/11	SCD	JC

CITY OF CAMAS ~ WATER DETAIL

WATER MAIN LINE AND VALVE

Jan E. Castleton 1-4-11

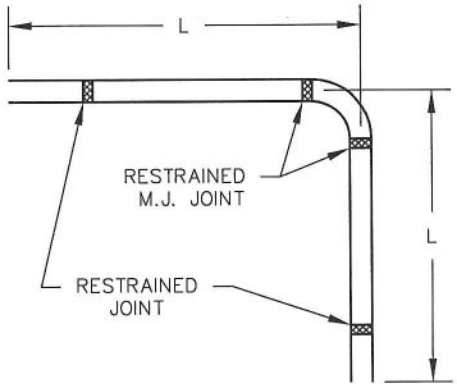
DETAIL APPROVED BY DATE

NOT TO SCALE

DETAIL NO. W13

VALVE.DWG

FOR HORIZONTAL BENDS:



MINIMUM REQUIRED PIPE LENGTHS FOR RESTRAINED JOINTS

BEND IN DEGREES	PIPE DIAMETER 6"	8"	10"	12"
90°	25'	33'	39'	45'
45°	10'	13'	16'	19'
22 1/2°	5'	6'	8'	9'
11 1/2°	3'	3'	4'	4'

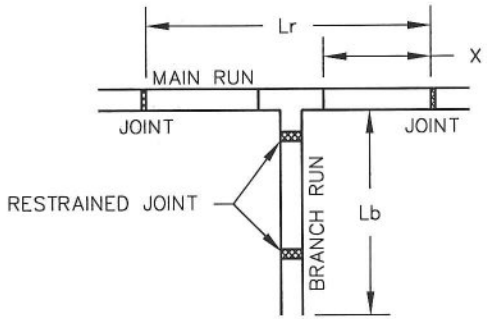
NOTE: CHART USES WORKING PRESSURE OF 200 PSI

FOR PRESSURES OTHER THAN 200 PSI USE:

$$\frac{(L) \times (\text{PRESSURE})}{200}$$

NOTE:
FIELD–LOCK GASKETS ARE APPROVED FOR RESTRAINED JOINT INSTALLATION.

FOR TEES:



MINIMUM REQUIRED PIPE LENGTHS FOR RESTRAINED JOINTS

FOR 6" TEES USE FORMULA
Lb= 50 – 1.63 (Lr)

WHERE:
Lb= THE MINIMUM REQUIREDRESTRAINED PIPE (IN FEET)ON THE BRANCH LINE
Lr= THE TOTAL LENGTH (IN FEET) BETWEEN THE FIRST JOINTS ON EITHER SIDE OF THE TEE ON THE MAIN RUN.

NOTE:
CONDITIONS TO BE FIELD VERIFIED BY ENGINEER.

IF (X) IS LESS THAN 5 FEET THEN PIPE MUST BE RESTRAINED TWO FULL LENGTHS.

FOR 8" TEE USE FORMULA
Lb= 64 – 1.65(Lr)

FOR 12" TEE USE FORMULA
Lb= 90 –1.67(Lr)

REV. NO.	DATE	BY	APPR.
1	7/17/06	SCD	RES1071
2	5/1/07	SCD	JC
3	1/1/11	SCD	JC

CITY OF CAMAS ~ WATER DETAIL
PIPE JOINT RESTRAINT

Jan E. Cawthon 1-4-11
DETAIL APPROVED BY DATE

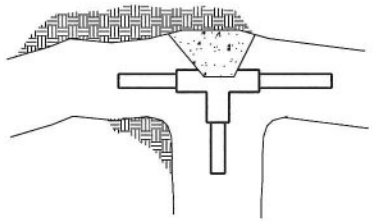
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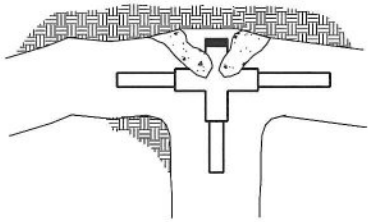
DETAIL NO.
W14

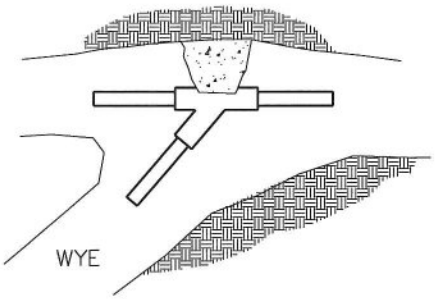
R–THRUST.DWG

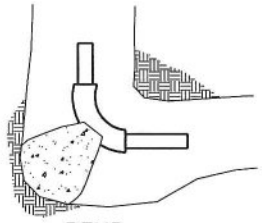
FITTING SIZE	TEE, WYE, PLUG OR CAP	90° BEND PLUGGED CROSS	TEE PLUGGED ON RUN		45° BEND	22 1/2° BEND	11 1/2° BEND
			A1	A2			
4	1.0	1.4	1.9	1.4	1.0	--	--
6	2.1	3.0	4.3	3.0	1.6	1.0	--
8	3.8	5.3	7.6	5.4	2.9	1.5	1.0
10	5.9	8.4	11.8	8.4	4.6	2.4	1.2
12	8.5	12.0	17.0	12.0	6.6	3.4	1.7
14	11.5	16.3	23.0	16.3	8.9	4.6	2.3
16	15.0	21.3	30.0	21.3	11.6	6.0	3.0
18	19.0	27.0	38.0	27.0	14.6	7.6	3.8
20	23.5	33.3	47.0	33.3	18.1	9.4	4.7
24	34.0	48.0	68.0	48.0	26.2	13.6	6.8

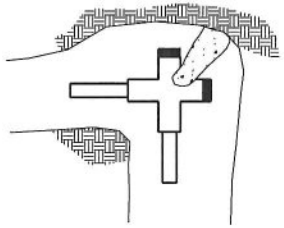
NOTES:
1. CONCRETE THRUST BLOCKING TO BE POURED AGAINST UNDISTURBED EARTH
2. KEEP CONCRETE CLEAR OF JOINTS AND ACCESSORIES.
3. THE REQUIRED THRUST BEARING AREAS FOR SPECIAL CONNECTIONS ARE SHOWN ENCIRCLED ON THE PLANS. e.g. (15) INDICATES 15 SQUARE FEET BEARING AREA REQUIRED.
4. IF NOT SHOWN ON PLANS THE REQUIRED BEARING AREAS AT FITTINGS SHALL BE AS INDICATED IN TABLE, ADJUSTED IF NECESSARY, TO CONFORM TO THE TEST PRESSURE(S) AND ALLOWED SOIL BEARING STRESS(ES) STATED IN THE SPECIAL SPECIFICATIONS.
5. BEARING AREAS AND SPECIAL BLOCKING DETAILS SHOWN ON PLANS TAKE PRECEDENCE OVER BEARING AREAS AND BLOCKING DETAILS SHOWN ON THIS STANDARD DETAIL.
6. ALL FITTINGS SHALL BE WRAPPED IN 6 MIL PLASTIC PRIOR TO THRUST BLOCK PLACEMENT MAKING SURE THE BOLTS AND NUTS ARE PROTECTED.
7. THRUST BLOCKS SHALL BE GIVEN 72 HOURS TO SET UP PRIOR TO PRESSURIZING LINE OR AS DIRECTED BY CITY INSPECTOR.

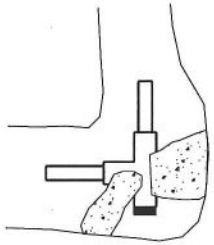

TEE

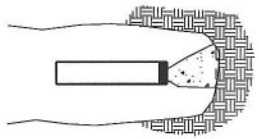

PLUGGED CROSS


WYE


BEND


PLUGGED CROSS


PLUGGED TEE


PLUG OR CAP

NOTES:
1. ABOVE BEARING AREAS BASED ON TEST PRESSURE OF 150 PSI AND AN ALLOWABLE SOIL BEARING STRESS OF 2,000 LBS. PER SQUARE FOOT.
2. TO COMPUTE BEARING AREAS FOR DIFFERENT TEST PRESSURES AND SOIL BEARING STRESSES USE THE FOLLOWING EQUATION:
   BEARING AREA=(TEST PRESSURE/150)x(2000/SOIL BEARING STRESS)x(TABLE VALUE)
3. EACH AREA IS 1/2 OF REQUIRED TOTAL AREA

REV. NO.	DATE	BY	APPR.
1	7/17/06	SCD	RES1071
2	5/1/07	SCD	JC
3	1/1/11	SCD	JC

CITY OF CAMAS ~ WATER DETAIL

THRUST BLOCKS

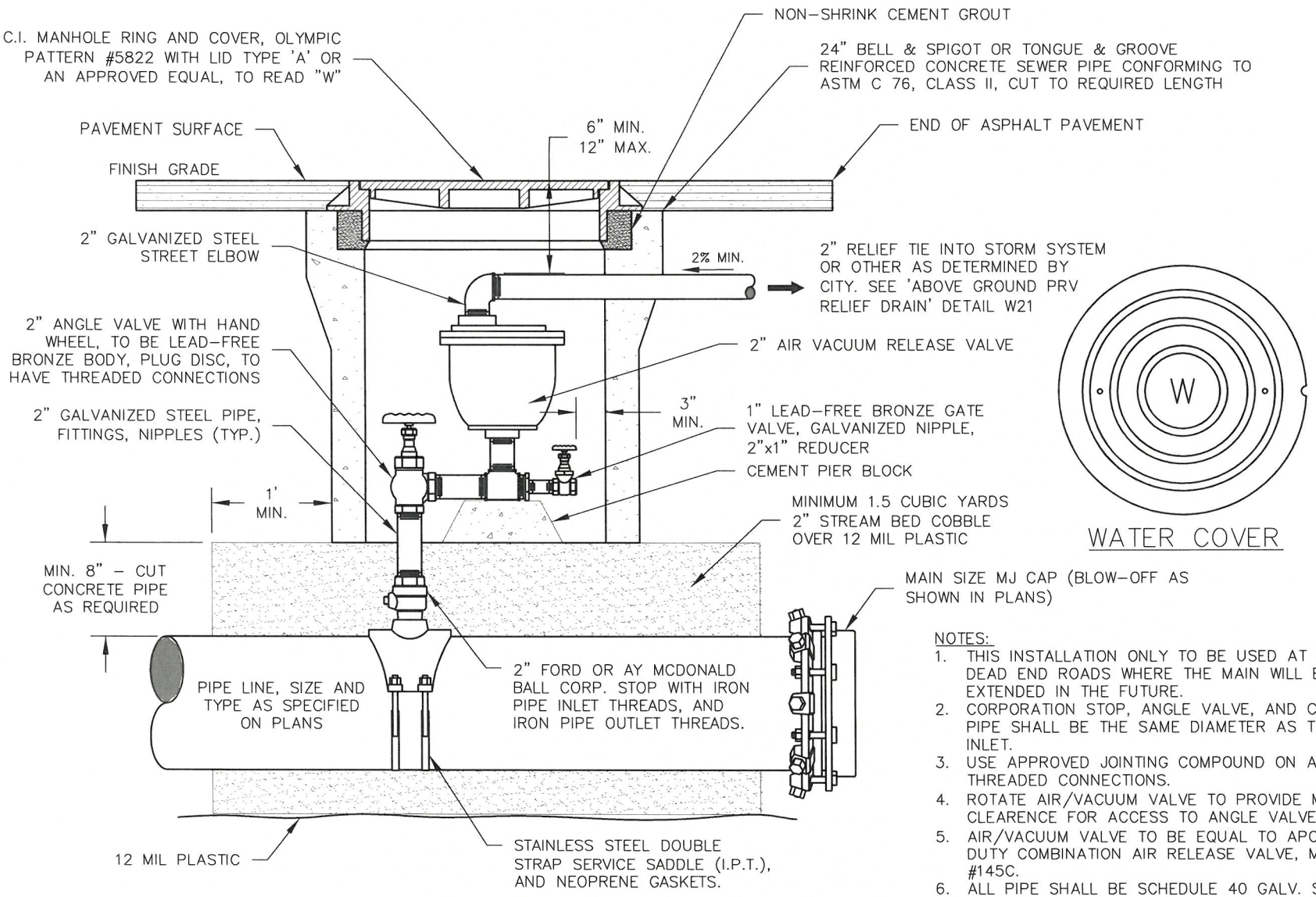
Jan E Carothers 1-4-11

DETAIL APPROVED BY DATE

NOT TO SCALE

DETAIL NO. W15

– THRUST.DWG



WATER COVER

NOTES:

1. THIS INSTALLATION ONLY TO BE USED AT HIGH-POINT DEAD END ROADS WHERE THE MAIN WILL BE EXTENDED IN THE FUTURE.
2. CORPORATION STOP, ANGLE VALVE, AND CONNECTING PIPE SHALL BE THE SAME DIAMETER AS THE AIR INLET.
3. USE APPROVED JOINTING COMPOUND ON ALL THREADED CONNECTIONS.
4. ROTATE AIR/VACUUM VALVE TO PROVIDE MAXIMUM CLEARENCE FOR ACCESS TO ANGLE VALVE.
5. AIR/VACUUM VALVE TO BE EQUAL TO APCO HEAVY DUTY COMBINATION AIR RELEASE VALVE, MODEL #145C.
6. ALL PIPE SHALL BE SCHEDULE 40 GALV. STEEL PIPE CONFORMING TO ASTM A 120.
7. DETAILS SHOWN ON THE PLANS TAKE PRECEDENCE OVER THIS STANDARD DETAIL.
8. AIR/VAC ASSEMBLY MAY BE LOCATED ADJACENT TO MAIN LOCATION AT THE DISCRETION OF ENGINEER.

City of Camas WASHINGTON

WATER DETAIL

2" AIR/VACUUM RELEASE VALVE

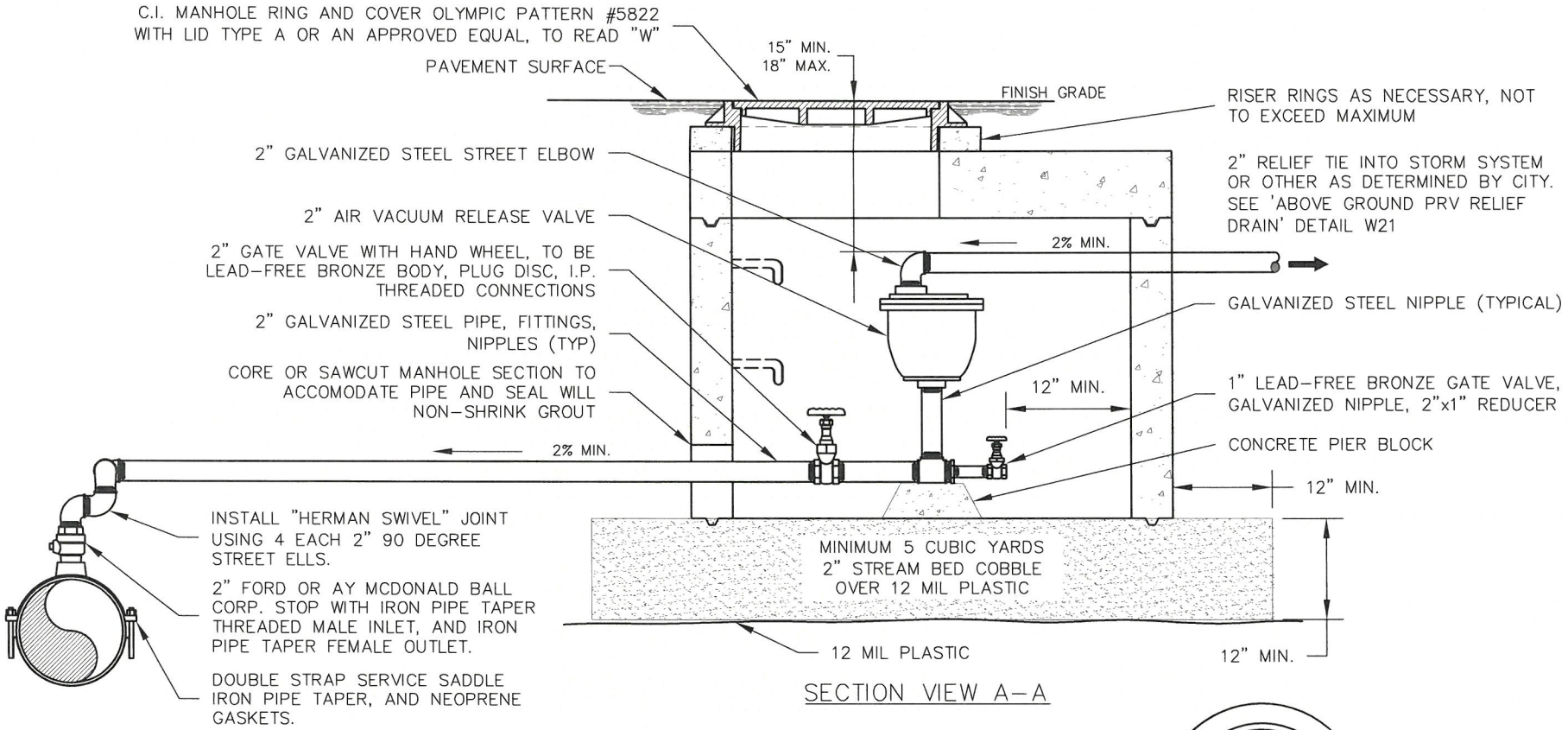
DETAIL APPROVED BY 1/3/24 DATE

NOT TO SCALE

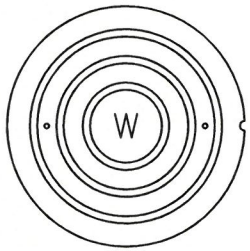
DETAIL NO. 1969

REVISION: 7 DATE: 01/02/2024

WTR-2VACVLV.DWG



SECTION VIEW A-A



WATER COVER

WATER NOTES:

1. MANHOLE SECTION SHALL BE LOCATED WITHIN ONE TRAVEL LANE WITH MANHOLE FRAME CENTERED IN THE TRAVEL LANE.
2. CORPORATION STOP, GATE VALVE, AND CONNECTING PIPE SHALL BE THE SAME DIAMETER AS THE AIR INLET.
3. USE APPROVED JOINTING COMPOUND ON ALL THREADED CONNECTIONS.
4. LOCATE AIR/VACUUM VALVE TO PROVIDE MAXIMUM CLEARANCE FOR ACCESS TO GATE VALVE.
5. AIR/VACUUM VALVE TO BE EQUAL TO APCO HEAVY DUTY COMBINATION AIR RELEASE VALVE, MODEL #145C.
6. ALL PIPE SHALL BE SCHEDULE 40 GALVANIZED STEEL PIPE CONFORMING TO ASTM A 120.
7. DETAILS SHOWN ON THE PLANS TAKE PRECEDENCE OVER THIS STANDARD DETAIL.
8. AIR/VAC ASSEMBLY MAY BE LOCATED ADJACENT TO MAIN LOCATION AT THE DISCRETION OF ENGINEER.
9. MANHOLES SHALL CONFORM TO ASTM C-478.
10. NON-SHRINK GROUT SHALL BE USED BETWEEN FRAME, RISER RINGS, AND MANHOLE.
11. 3" TALL FRAME IS STANDARD, 7" TALL FRAME (NOT SHOWN) IS OPTIONAL.
12. ANY COMBINATION OF RISER RING THICKNESS, GROUT, AND FRAME SHALL BE USED TO ACHIEVE THE 12" MAXIMUM DEPTH FROM FINISH GRADE TO TOP OF CONE OR FLAT TOP.

City of Camas WASHINGTON

WATER DETAIL

2" AIR/VACUUM RELEASE VALVE IN 48" MANHOLE

Kurt Bourguin 1/3/24

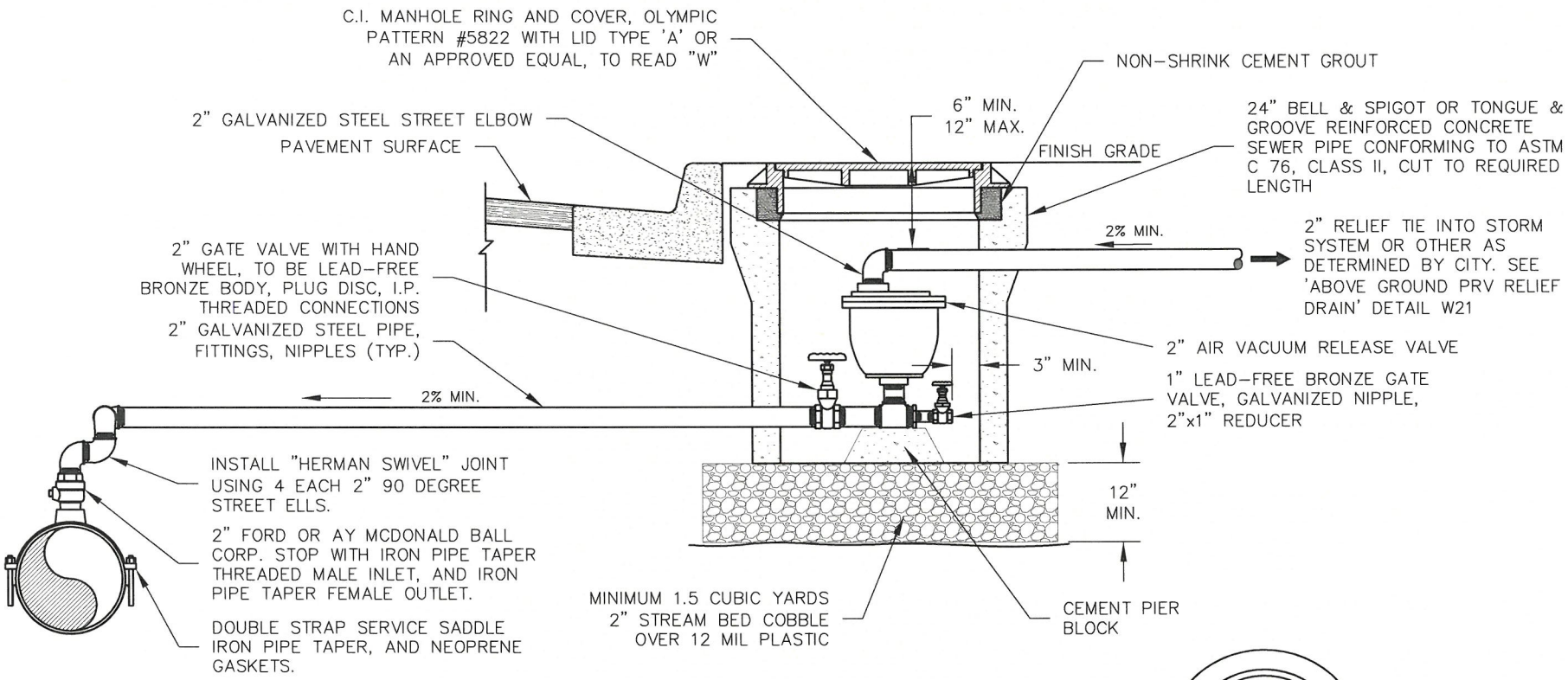
DETAIL APPROVED BY DATE

NOT TO SCALE

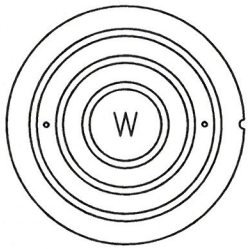
DETAIL NO. 1970

REVISION: 4 DATE: 01/02/2024

WTR-2VACVLV.DWG



SECTION VIEW A-A



WATER COVER

WATER NOTES:

1. AIR/VACUUM VAULT SHALL BE LOCATED WITHIN THE PLANTER STRIP OR BEHIND THE SIDEWALK. PART OF THE MANHOLE COVER MAY BE IN THE SIDEWALK IF NEEDED.
2. CORPORATION STOP, GATE VALVE, AND CONNECTING PIPE SHALL BE THE SAME DIAMETER AS THE AIR INLET.
3. USE APPROVED JOINTING COMPOUND ON ALL THREADED CONNECTIONS.
4. LOCATE AIR/VACUUM VALVE TO PROVIDE MAXIMUM CLEARANCE FOR ACCESS TO GATE VALVE.
5. AIR/VACUUM VALVE TO BE EQUAL TO APCO HEAVY DUTY COMBINATION AIR RELEASE VALVE, MODEL #145C.
6. ALL PIPE SHALL BE SCHEDULE 40 GALVANIZED STEEL PIPE CONFORMING TO ASTM A 120.
7. DETAILS SHOWN ON THE PLANS TAKE PRECEDENCE OVER THIS STANDARD DETAIL.
8. AIR/VAC ASSEMBLY MAY BE LOCATED ADJACENT TO MAIN LOCATION AT THE DISCRETION OF ENGINEER.

City of Camas WASHINGTON

WATER DETAIL

2" AIR/VACUUM RELEASE VALVE OUTSIDE OF CURB

1/3/24

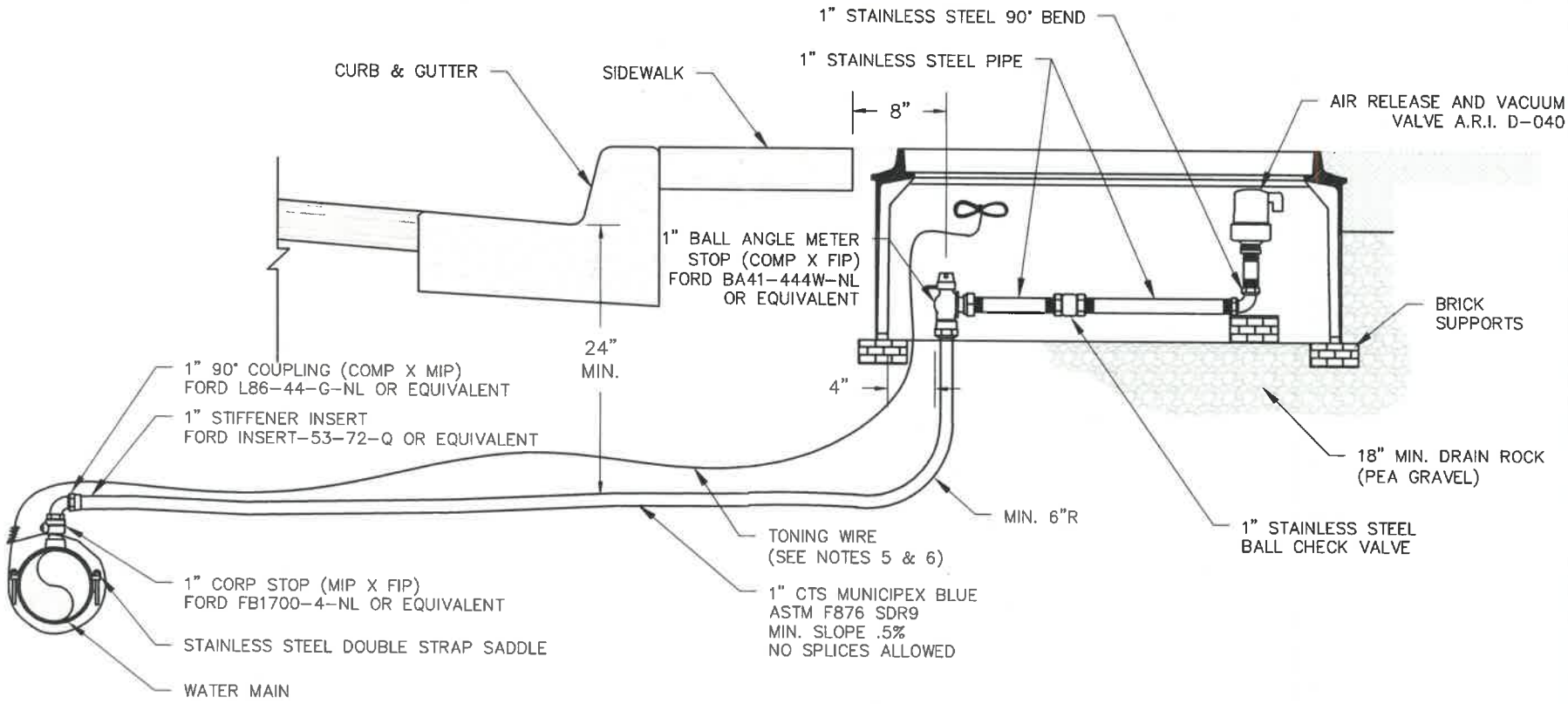
DETAIL APPROVED BY DATE

NOT TO SCALE

DETAIL NO. 1971

REVISION: 4 DATE: 01/02/2024

WTR-2VACVLV.DWG



NOTES:
1. METER BOX SHALL BE OLDCASTLE FIBRELYTE FL36BOX WITH NO MOUSE HOLES.
2. COVER SHALL BE OLDCASTLE FIBRELYTE FL36 FLUSH SOLID "WATER"
3. INSTALL METER BOX OUTSIDE OF SIDEWALK OR IN PLANTER STRIP, EXCEPT WHERE NOTED IN PLANS.
4. SEE TRENCH SECTION DETAILS G2 OR G3 FOR BACKFILL REQUIREMENTS.
5. TONING WIRE SHALL BE COPPERHEAD SUPERFLEX 12 AWG 45MIL BLUE HDPE INSULATION, NO SPLICES ALLOWED.
6. SEAL TONING WIRE SPLICE CONNECTIONS WITH COPPERHEAD 12 AWG SNAKEBITE LOCKING CONNECTORS (TYPICAL).
7. NEW WATER MAINS REQUIRE TONING WIRE TO A LOCATE STATION
8. TONING WIRE FROM MAIN TO SERVICE REQUIRES A SNAKEBITE LOCKING CONNECTOR
9. PREFERRED BRASS FITTINGS TO BE USED, IN ORDER:
    1. FORD
    2. AY MCDONALD

City of Camas WASHINGTON

WATER DETAIL

1" AIR RELEASE AND VACUUM VALVE ASSEMBLY (FOR 6" AND 8" WATER MAINS)

NOT TO SCALE

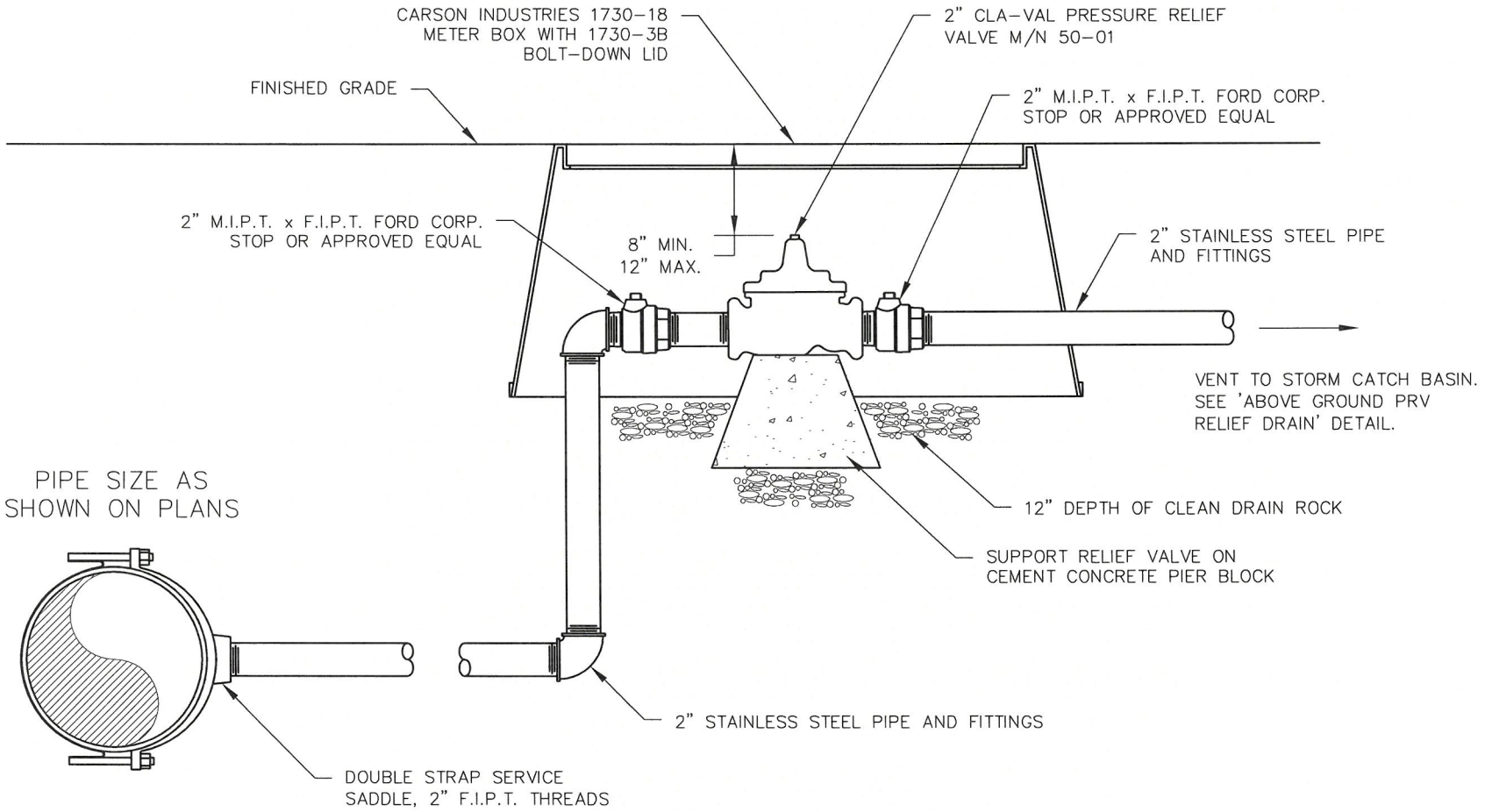
DETAIL NO. W17B

DETAIL APPROVED BY

7/6/2026
DATE

REVISION: 1 DATE: 7/02/2026

S1.DWG



City of Camas WASHINGTON

WATER DETAIL

2" PRESSURE RELIEF VALVE ASSEMBLY

DETAIL APPROVED BY

1/3/24

DATE

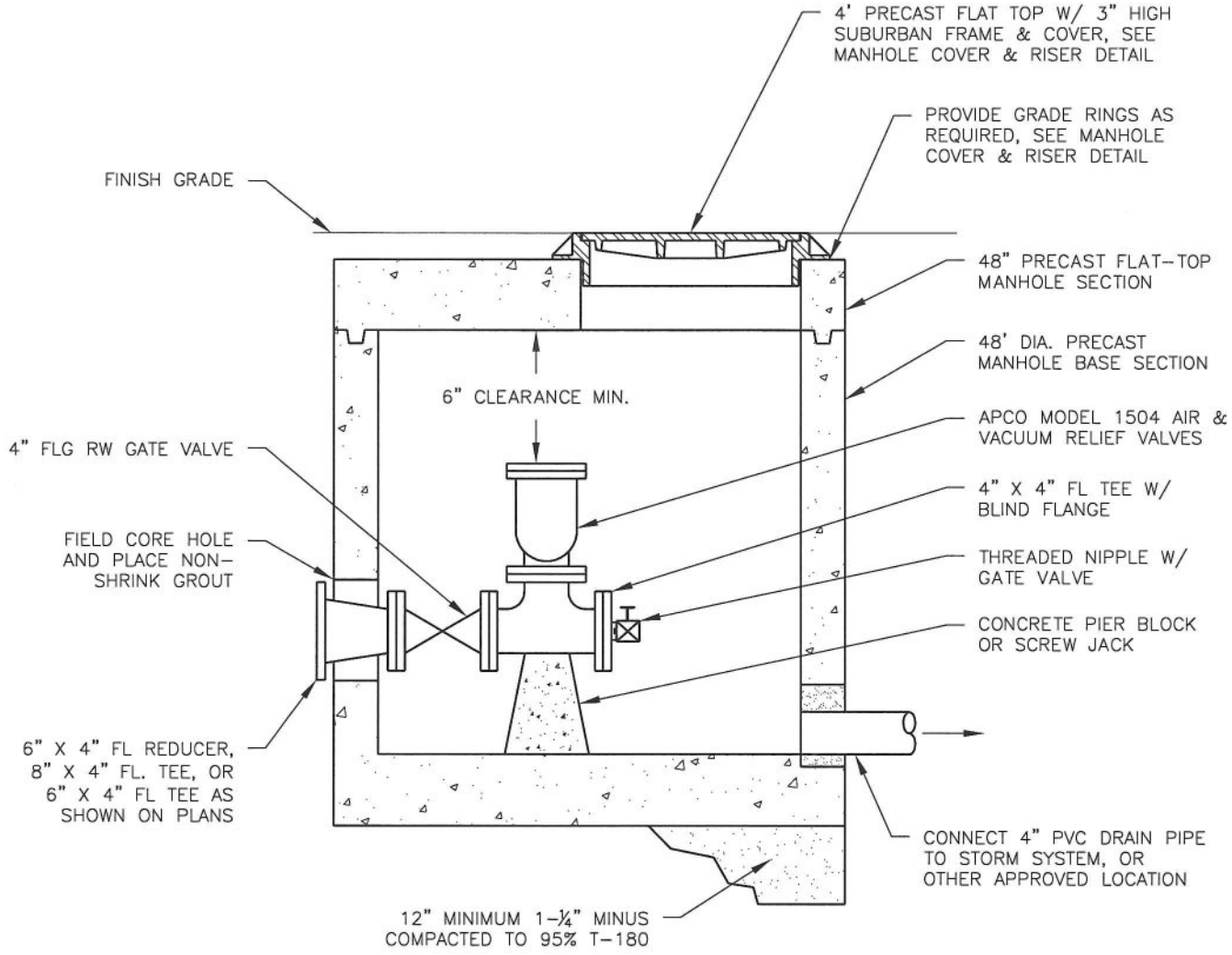
NOT TO SCALE

DETAIL NO.

1973

REVISION: 4 DATE: 01/02/2024

2PRV.DWG



NOTES:
1. MANHOLE SHALL CONFORM TO ASTM C-478.
2. MASTIC SEAL REQUIRED ON ALL KEYLOCK JOINTS.
3. VAULT SHALL BE SET FOR 1% SLOPE TO DRAIN.
4. ALL BACKFILL SHALL BE APPROVED GRANULAR MATERIAL.
5. SUMP PUMP MAY BE REQUIRED ON INSTALLATIONS WHERE DRAIN PIPE CANNOT BE CONNECTED TO ADEQUATE STORM DRAIN SYSTEM. THE APPROVED SUMP PUMP SHALL BE A COMMERCIAL GRADE WATER POWERED VENTURI DESIGN WITH BACKFLOW PREVENTION, SIZED TO PROVIDE 10GPM AT 10 FEET OF HEAD AT THE AVAILABLE SYSTEM WATER PRESSURE. BACKFLOW DEVICE SHALL BE CERTIFIED BY WASHINGTON STATE CERTIFIED BACKFLOW TESTER AFTER INSTALLATION AND PRIOR TO ACCEPTANCE. TEST RESULTS SHALL BE SENT TO CITY OF CAMAS WATER DEPARTMENT.

REV. NO.	DATE	BY	APPR.
1	5/1/07	SCD	JC
2	1/1/11	SCD	JC

CITY OF CAMAS ~ WATER DETAIL

4" VACUUM RELIEF VALVE

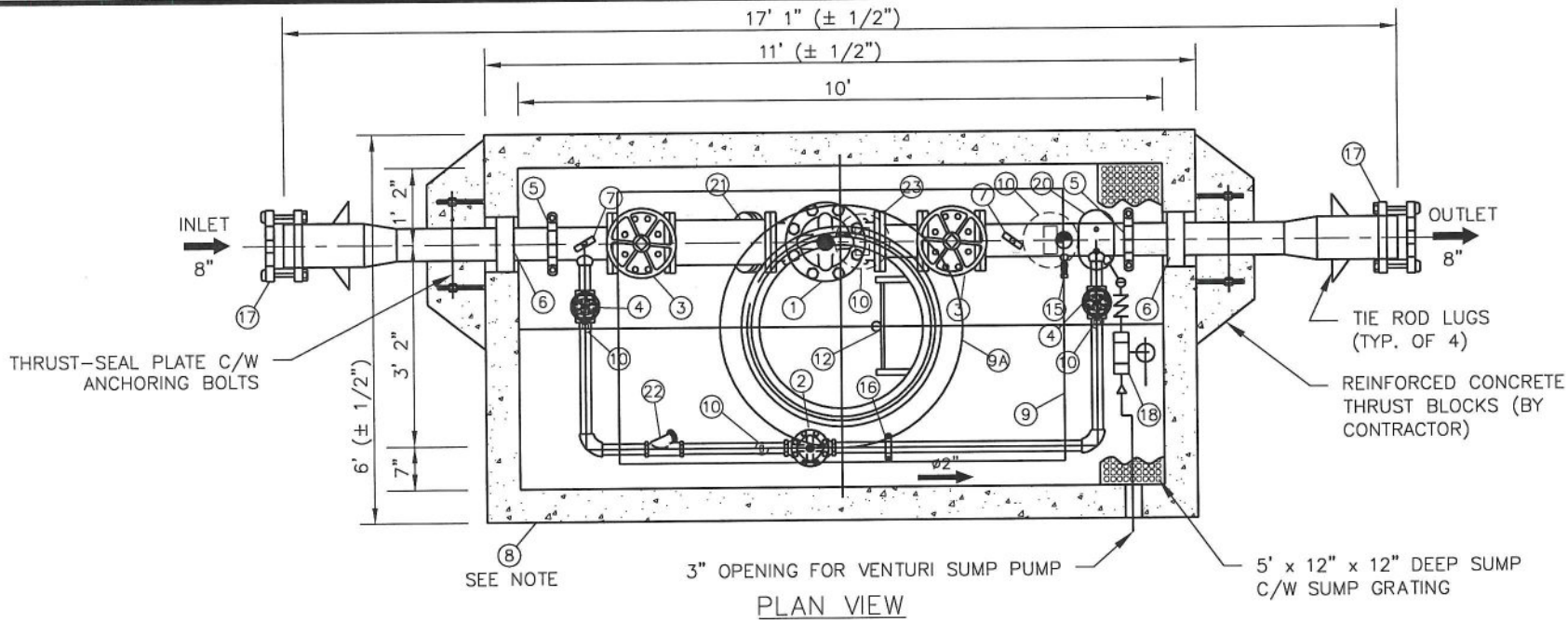
Jim C. Carothers 1-4-11

DETAIL APPROVED BY DATE

NOT TO SCALE

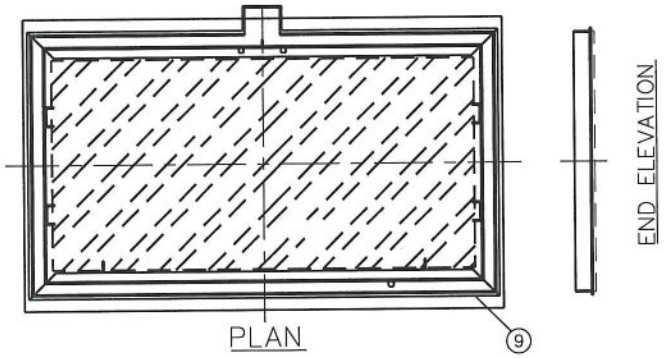
DETAIL NO. W19

4ARV.DWG



PLAN VIEW

50" x 82" OPENING FOR
36" x 72" ALUMINUM HATCH



36" x 72" ALUMINUM HATCH
(30"ø MANHOLE SHALL BE USED
AS APPROVED BY CITY OF CAMAS)

NOTES:
1. PRV STATION SHALL BE A PRE-ASSEMBLED, PRE-TESTED, PACKAGED UNIT BY GC SYSTEMS, INC., OR APPROVED EQUAL.
2. VAULT #10565 (H20 LOADING) INSIDE DIMENSIONS 10'LX5'WX6'6"H.

STANDARD FABRICATION & FINISHING SPECIFICATION:
ALL 2" AND SMALLER PIPE TO BE THREADED BRASS. ALL 3" AND LARGER PIPE, INSIDE WETTED SURFACES TO BE SANDBLASTED, EPOXY LINED AND COATED TO AWWA C-210 AND NSF-61 SPECIFICATION. FINISH COATING WILL BE BLUE ENAMEL.

FABRICATED STEEL PIPE & FITTINGS TO BE SCHEDULE NO. 40 STEEL PIPE FOR SIZES TO 10" AND ⅜" WALL FOR 12" AND LARGER.

REV. NO.	DATE	BY	APPR.
1	5/1/07	SCD	JC
2	1/1/11	SCD	JC

CITY OF CAMAS ~ WATER DETAIL

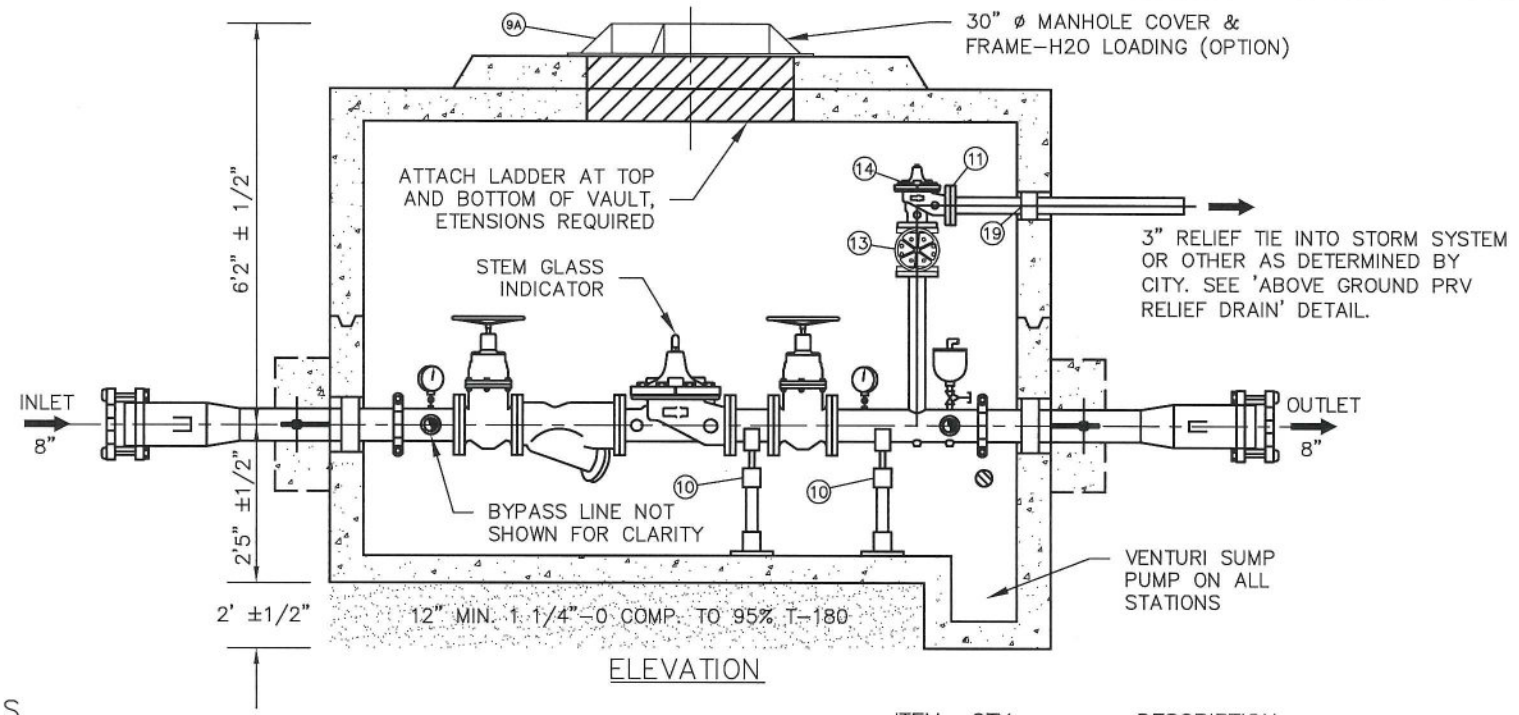
6"X2" PRV STATION W/ 3" RELIEF

Jan E. Cauthorn 1-4-11
DETAIL APPROVED BY DATE

NOT TO SCALE

DETAIL NO.
W20A

R-PRV3RELIEF.DWG



ELEVATION

MATERIALS

ITEM	QTY.	DESCRIPTION
1	1	6" CLA–VAL 90–01YBCS PRESSURE REDUCING VALVE
		C/W X 101 POSITION INDICATOR, DIBT–#150 FLG (15–75PSI)
2	1	2" CLA–VAL 90–01YBCS PRESSURE REDUCING VALVE
		C/W X 101 POSITION INDICATOR, DIBT–THREADED (15–75 PSI)
3	2	6" MUELLER A2360–6W41 NRS GATE VALVE C/W HANDWHEEL –#125 FLGD
4	2	2" MUELLER A2360–8 RW NRS GATE VALVE C/W HANDWHEEL–THREADED
5	2	6" VICTAULIC #07 COUPLING
6	2	6" PIPE SEAL ASSEMBLY
7	2	4" WIKA (0–200PSI) PRESSURE GAUGE C/W GAUGE COCK
8	1	#10565 PRECAST CONCRETE VAULT C/W WHITE INTERIOR, BLACK EXTERIOR
9	1	36"x72" ALUMINUM HATCH W/ SPRING ASSIST
10	5	ADJUSTABLE PIPE SUPPORTS
11	1	3" VICTAULIC #741 FLANGE ADAPTER ADAPTOR

ITEM	QTY.	DESCRIPTION
12	1	ALUMINUM LADDER WITH LADDER–UP ASSEMBLY
13	1	3" MUELLER A2360–6W41 NRS GATE VALVE C/W
		HANDWHEEL–#125 FLGD.
14	1	3" CLA–VAL 50A–01B PRESSURE RELIEF VALVE
		C/W DIBT–150# FLG (20–200 PSI)
15	1	3/4" HOSE BIB ASSEMBLY
16	1	2" VICTAULIC #07 COUPLING
17	1	8" SMITH BLAIR ST X DI TRANSITION COUPLING
18	1	VENTURI SUMP PUMP
19	1	3" PIPE SEAL ASSEMBLY
20	1	1" APCO 143C.1 COMB. A.R.V. C/W ISOLATION VALVE
21	1	6" MUELLER 758 Y–STRAINER – #125 FLGD
22	1	2" MUELLER 351M Y–STRAINER – THD
23	1	6" VICTAULIC #741 FLANGE ADAPTOR

REV. NO.	DATE	BY	APPR.
1	5/1/07	SCD	JC
2	1/1/11	SCD	JC
3	10/21/14	SCD	JC

CITY OF CAMAS ~ WATER DETAIL

6"X2" PRV STATION W/ 3" RELIEF

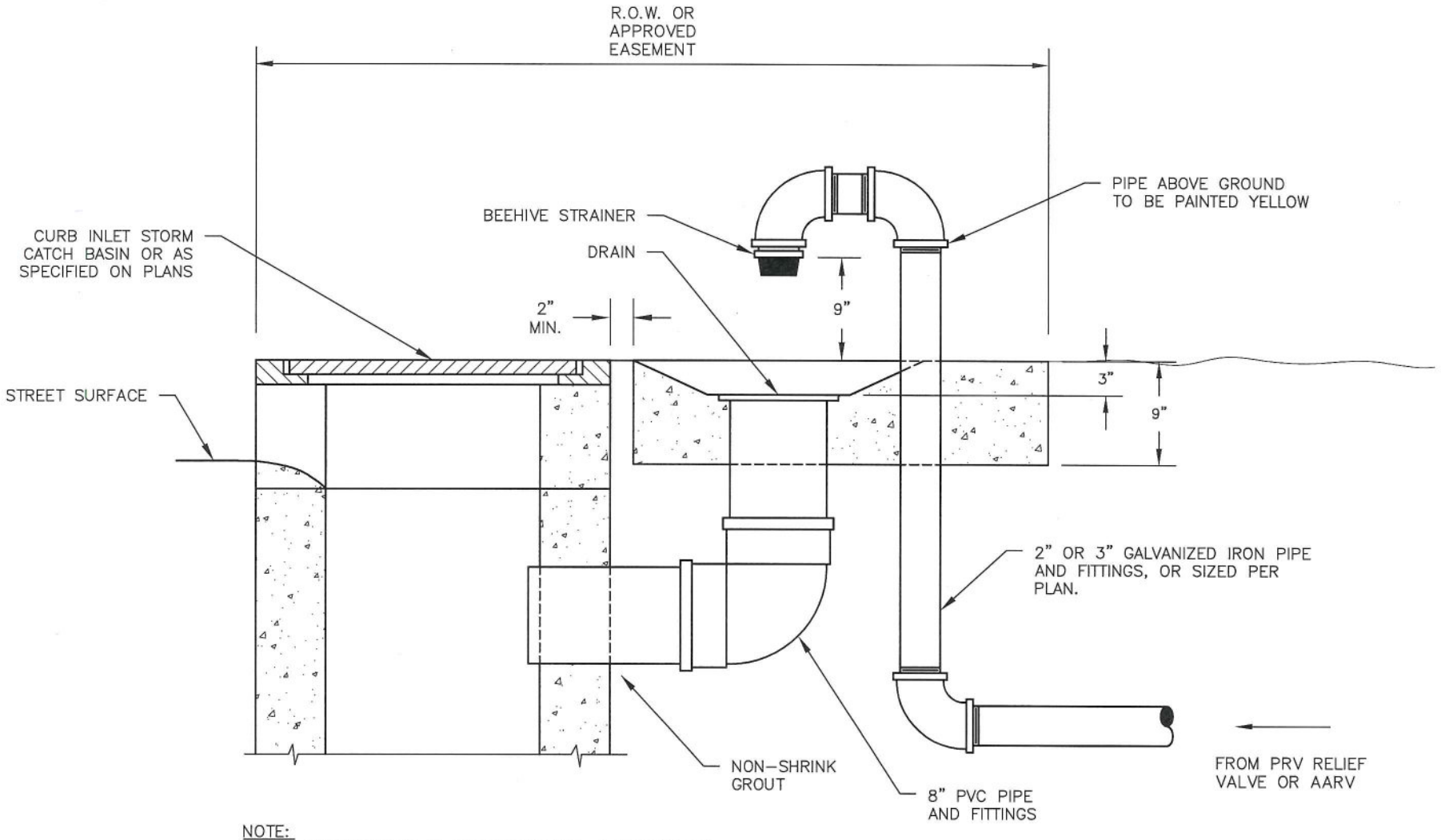
10-21-14

DETAIL APPROVED BY DATE

NOT TO SCALE

DETAIL NO. W20B

–PRV3RELIEF.DWG



NOTE:
1. IF CATCH BASIN IS NOT AVAILABLE, A DEDICATED STORM LATERAL MAY BE REQUIRED.

City of Camas WASHINGTON

WATER DETAIL

ABOVE GROUND PRV RELIEF DRAIN

5-16-19

DETAIL APPROVED BY DATE

NOT TO SCALE

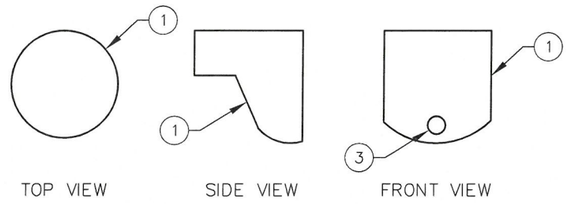
DETAIL NO. W21

REVISION: 4 DATE: 5/16/2019

WTR-RELIEFDRN.DWG

KORALEEN WATER QUALITY SAMPLING STATION:

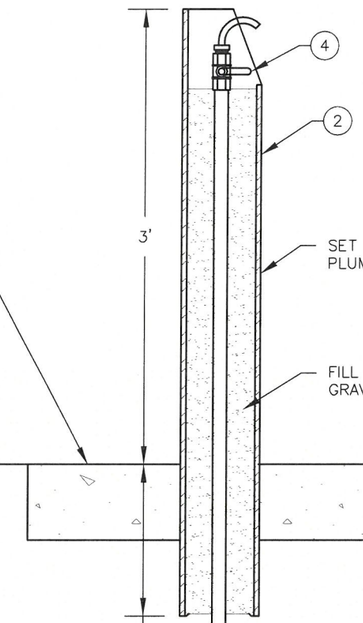
1.	ALUMINUM LID – 6" DIA. I.D.
2.	ALUMINUM HOUSING – 6" DIA. O.D.
3.	FLUSH MOUNTED LOCK
4.	½" X 1" BALL VALVE

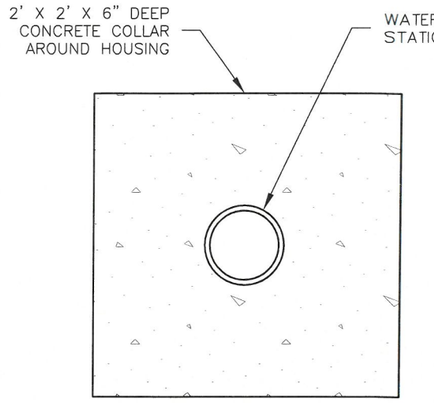


TOP VIEW SIDE VIEW FRONT VIEW

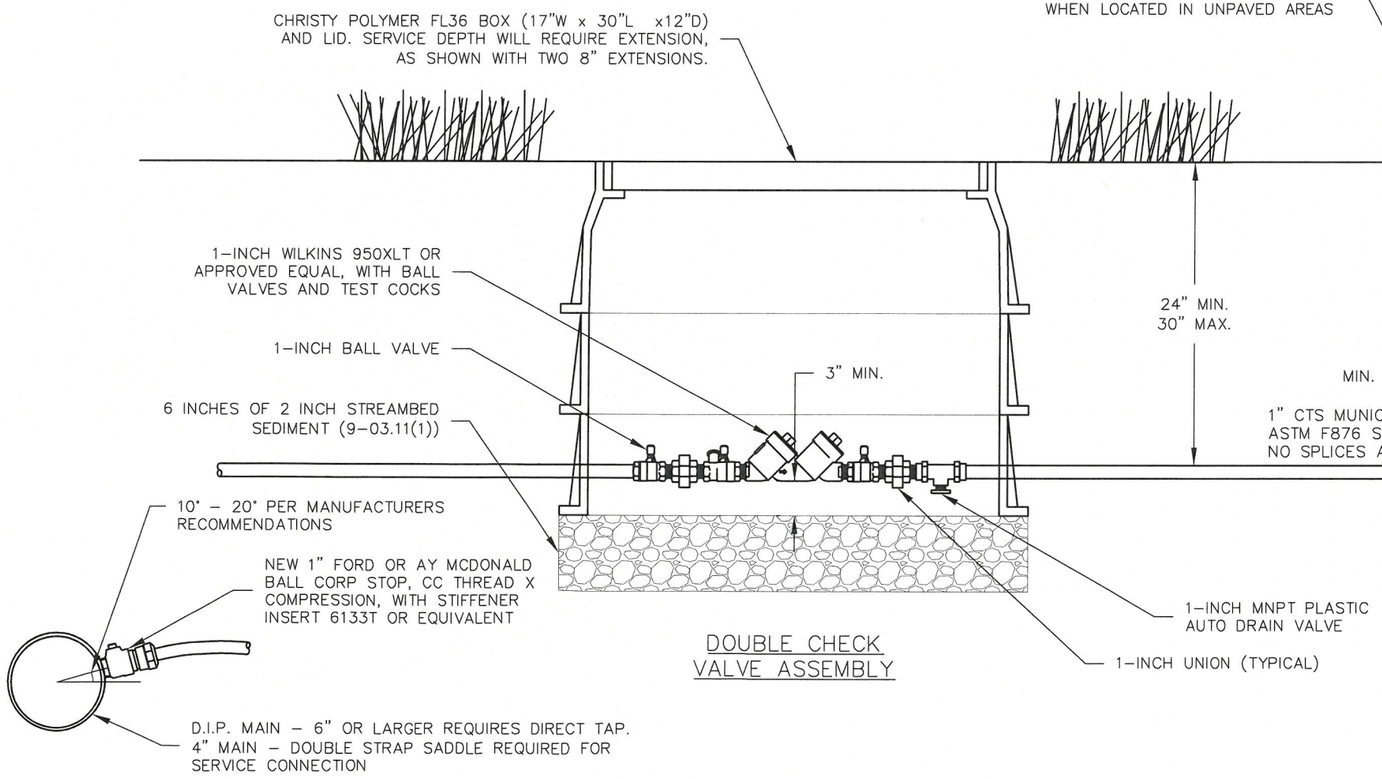
ALUMINUM LID

SAMPLING STATION





CONCRETE COLLAR DETAIL
PLAN VIEW
N.T.S.



DOUBLE CHECK VALVE ASSEMBLY

TYPICAL MAIN CONNECTION

NOTES:

1. THE DOUBLE CHECK VALVE ASSEMBLY (DCVA) SHALL LAY HORIZONTAL ONLY. DO NOT INSTALL IN AN AREA SUBJECT TO FLOODING.
2. THE DCVA MUST BE ACCESSIBLE TO ALLOW FOR ANNUAL TESTING.
3. THE WATER LINE SHALL BE DISINFECTED, FLUSHED AND PRESSURE TESTED PRIOR TO INSTALLING THE DCVA.
4. THE DCVA SHALL BE INSTALLED WITHIN THE RIGHT–OF–WAY, WITHIN AN EASEMENT, OR AT A LOCATION APPROVED BY CITY OF CAMAS WATER DEPARTMENT.
5. THE DCVA SHALL BE TESTED AFTER INSTALLATION AND PRIOR TO ACCEPTANCE,
6. ALL NEWLY INSTALLED FITTINGS IN CONTACT WITH WATER SHALL BE IN COMPLIANCE WITH THE REVISED SECTION 1417 OF THE EPA SAFE WATER DRINKING ACT AND CERTIFIED LEAD FREE USING NSF 372 STANDARDS.

City of Camas WASHINGTON

WATER DETAIL

WATER SAMPLING STATION

DETAIL APPROVED BY — DATE 1/3/24

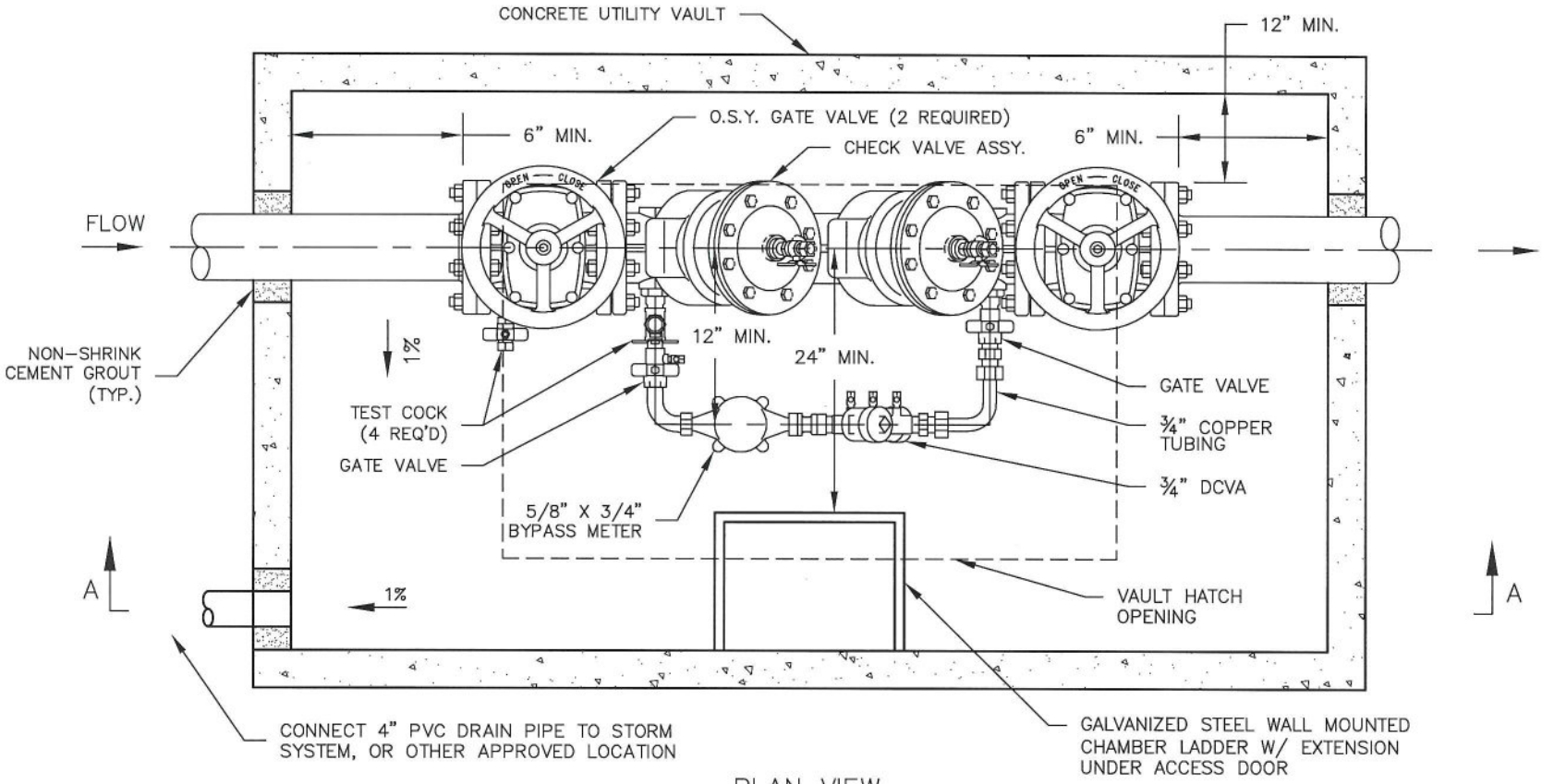
NOT TO SCALE

DETAIL NO. W2

REVISION: 5 DATE: 01/02/2024

1978

W1 SMPL.DWG



PLAN VIEW

DOUBLE CHECK DETECTOR VALVE ASSY. NOTES:

1. APPROVED DOUBLE CHECK DETECTOR VALVE ASSEMBLY TO LAY HORIZONTAL WITH THE GROUND, SHALL BE INSTALLED ON FIRE PROTECTION SYSTEMS WHEN CONNECTED TO POTABLE WATER SUPPLY. THE ASSEMBLY SHALL BE A COMPLETE ASSEMBLY INCUDING UL LISTED RESILIENT SEATED OSY SHUTOFF VALVES AND TEST COCKS. THE UNIT SHALL BE UL/FM APPROVED WITH UL/FM APPROVED OSY SHUTOFF VALVES. THE AUXILIARY LINE SHALL CONSIST OF AN APPROVED BACKFLOW PREVENTER AND WATER METER. THE ASSEMBLY SHALL MEET THE BASIC REQUIREMENTS OF ASSE 1048; AWWA STD. C510 FOR DOUBLE CHECK VALVES, AND BE APPROVED BY THE FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH AT THE UNIVERSITY OF SOUTHERN CALIFORNIA. THE DOUBLE CHECK DETECTOR VALVE ASSEMBLY SHALL BE A ZURN WILKINS MODEL 950DA OR APPROVED EQUAL.
2. SYSTEM SHALL BE DESIGNED FOR BACK SIPHONAGE AND BACK PRESSURE.
5. THE WATER LINE SHALL BE DISINFECTED, FLUSHED, AND PRESSURE TESTED PRIOR TO INSTALLING THE BACKFLOW ASSEMBLY. THE BACKFLOW ASSEMBLY SHALL BE PROTECTED FROM FREEZING AND FLOODING.
4. ALL PIPE, VALVE, AND FITTING JOINTS FROM THE SUPPLY MAIN SHALL BE FLANGED AND RESTRAINED. MINIMUM COVER 30". GROUT PIPE ENTRANCE AND EXIT IN VAULT WITH WATER TIGHT GROUT.
5. THE BACKFLOW ASSEMBLY SHALL BE TESTED AFTER INSTALLATION AND PRIOR TO ACCEPTANCE AND ALSO YEARLY THEREAFTER BY A WASHINGTON STATE CERTIFIED BACKFLOW TESTER. TEST RESULTS SHALL BE SENT TO THE CITY OF CAMAS WATER DEPARTMENT.
6. ALL BACKFILL SHALL BE APPROVED GRANULAR MATERIAL.

REV. NO.	DATE	BY	APPR.
1	5/1/07	SCD	JC
2	1/1/11	SCD	JC
3	10/21/14	SCD	JC

CITY OF CAMAS ~ WATER DETAIL

STANDARD DOUBLE CHECK DETECTOR VALVE ASSY.

Jan E. Cauthra 10-21-14

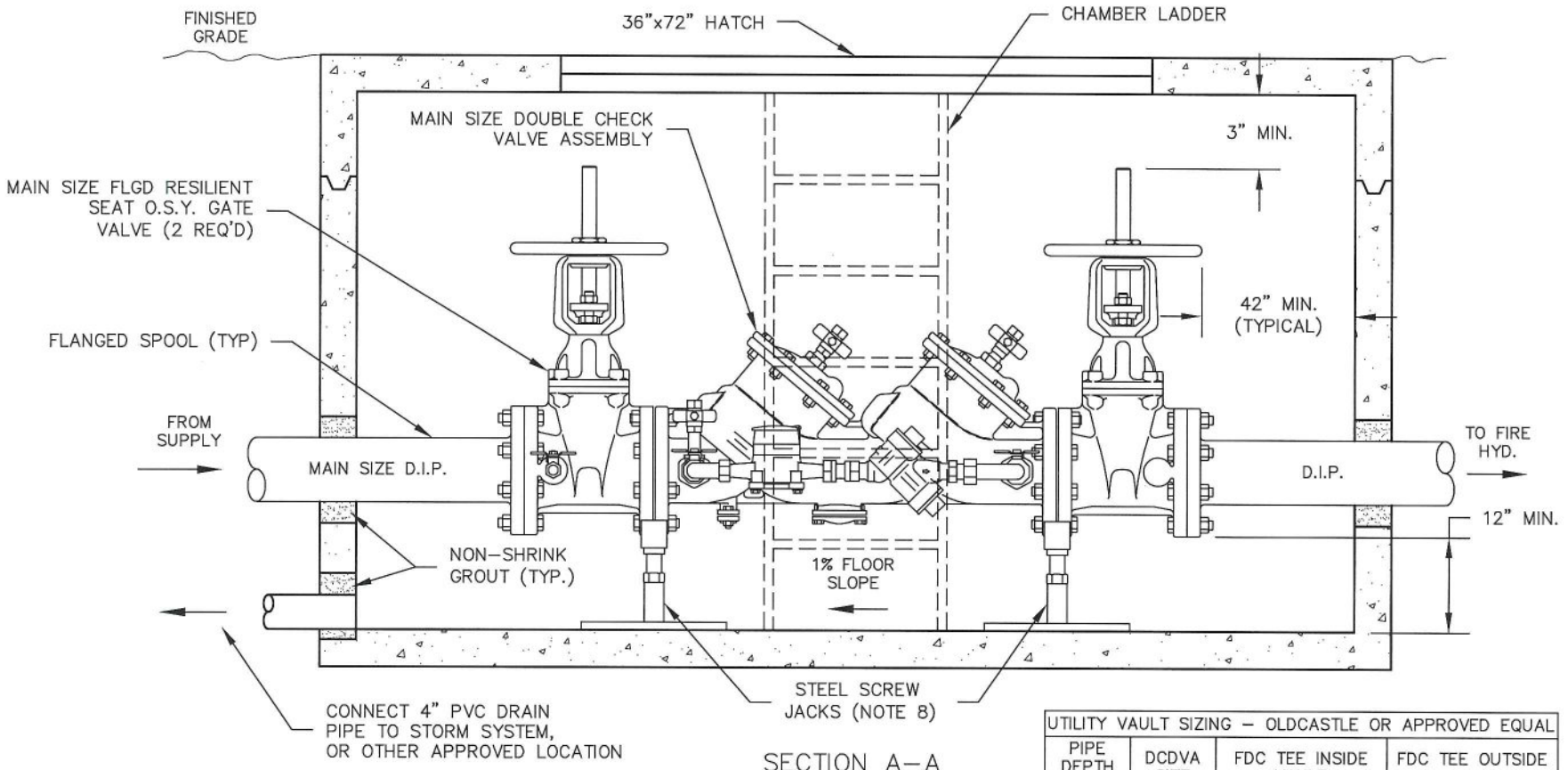
DETAIL APPROVED BY DATE

NOT TO SCALE

DETAIL NO.

W23A

—DCDVA.DWG



SECTION A-A

UTILITY VAULT SIZING – OLDCASTLE OR APPROVED EQUAL			
PIPE DEPTH UP TO	DCDVA SIZE	FDC TEE INSIDE VAULT	FDC TEE OUTSIDE VAULT
6'	4"	676-WA	577-WA
4'	6"	687-WA	675-WA
6'	6"	–	676-WA
6'	8"	5106-WA	687-WA
6'	10"	5106-WA	5106-WA

VAULT CONSTRUCTION NOTES:

1. VAULT SHALL BE PRE-APPROVED PRIOR TO INSTALLATION.
2. VAULT SHALL BE INSTALLED AT PROPERTY LINE OR EASEMENT LINE AND ON OWNERS PROPERTY.
3. VAULTS SHALL HAVE A MINIMUM OF 3' CLEARANCE FROM ALL STRUCTURES.
4. APPROVED VAULT SHALL BE RATED FOR H20 LOADING AND INCLUDE AN EXTENSION LADDER
5. VAULT SHALL BE SET FOR 1% SLOPE TO DRAIN.
6. ALL BACKFILL SHALL BE APPROVED GRANULAR MATERIAL.
7. HATCH SHALL BE AN H20 RATED, 36"x72" SPRING ASSISTED, HOT DIPPED GALVANIZED DIAMOND PLATE DOUBLE DOOR. FOR TRAFFIC INSTALLATIONS A 30" MANHOLE LID SHALL BE USED INSTEAD OF A HATCH.
8. SUMP PUMP MAY BE REQUIRED ON INSTALLATIONS WHERE DRAIN PIPE CANNOT BE CONNECTED TO ADEQUATE STORM DRAIN SYSTEM. THE APPROVED SUMP PUMP SHALL BE A COMMERCIAL GRADE WATER POWERED VENTURI DESIGN WITH BACKFLOW PREVENTION, SIZED TO PROVIDE 10GPM AT 10 FEET OF HEAD AT THE AVAILABLE SYSTEM WATER PRESSURE. BACKFLOW DEVICE SHALL BE CERTIFIED BY WASHINGTON STATE CERTIFIED BACKFLOW TESTER AFTER INSTALLATION AND PRIOR TO ACCEPTANCE. TEST RESULTS SHALL BE SENT TO CITY OF CAMAS WATER DEPARTMENT.
9. FOUR (4) STEEL SCREW JACKS REQUIRED FOR SUPPORT OF DOUBLE CHECK VALVE ASSEMBLY AND BYPASS ASSEMBLY.
10. FIRE DEPARTMENT CONNECTION (FDC) MAY BE LOCATED THROUGH THE VAULT LID (NOT SHOWN), OR MAY BE LOCATED OUTSIDE OF THE VAULT DEPENDING UPON SITE.

REV. NO.	DATE	BY	APPR.
1	5/1/07	SCD	JC
2	1/1/11	SCD	JC
3	10/21/14	SCD	JC

CITY OF CAMAS ~ WATER DETAIL

STANDARD DOUBLE CHECK DETECTOR VALVE ASSY.

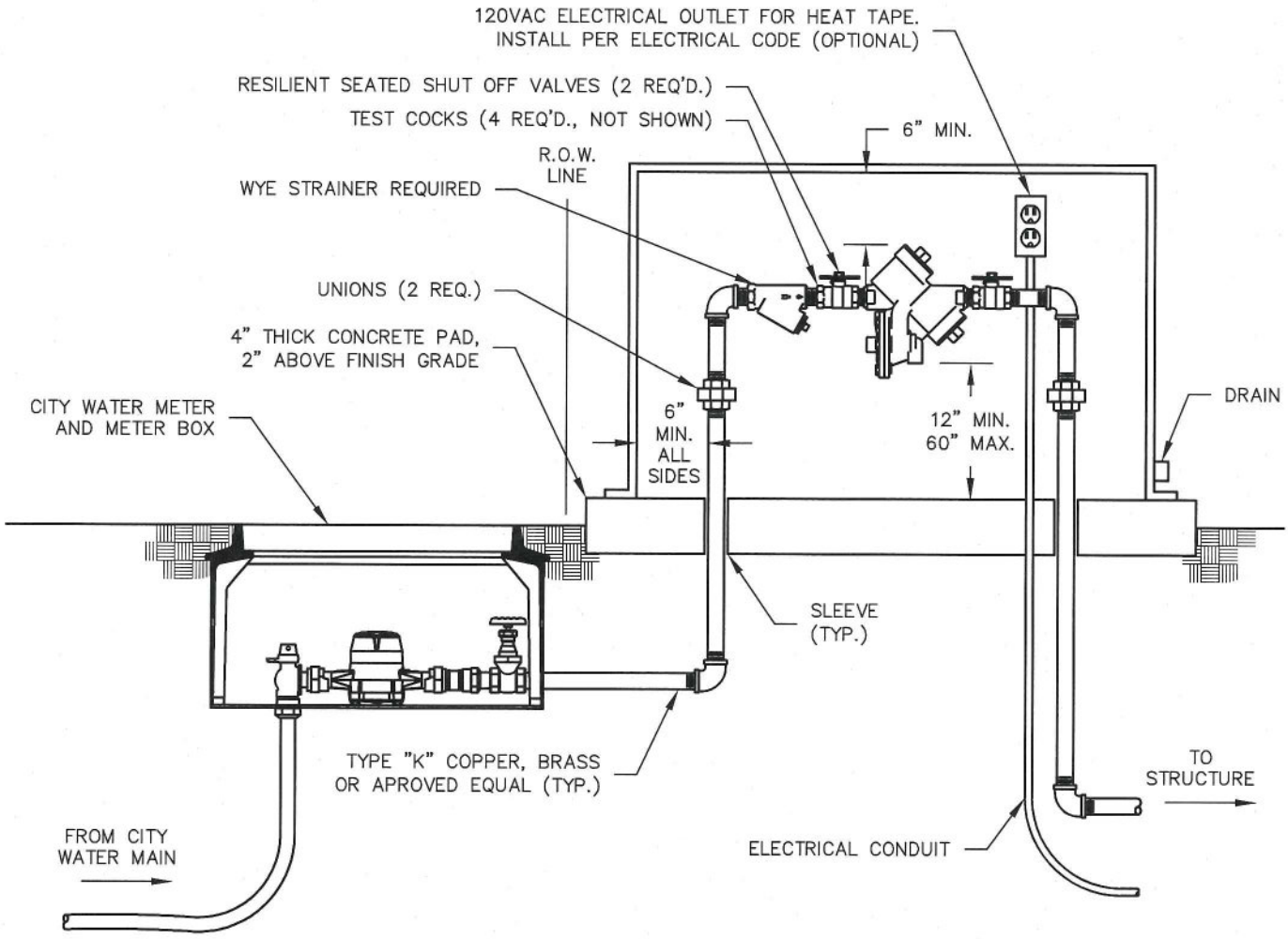
Jon E. Castelen 10-21-14

DETAIL APPROVED BY DATE

NOT TO SCALE

DETAIL NO. W23B

-DCDVA.DWG



NOTES:

1. REDUCED PRESSURE BACKFLOW ASSEMBLY (RPBA) SHALL BE DESIGNED FOR BACK SIPHONAGE AND BACK PRESSURE, AND APPROVED BY THE STATE OF WASHINGTON DEPARTMENT OF HEALTH.
2. THE RPBA SHALL LAY HORIZONTAL ONLY (VERTICAL IF APPROVED BY DEPT. OF HEALTH). DO NOT INSTALL IN A PIT, TRENCH OR AN AREA SUBJECT TO FLOODING.
3. THE RPBA MUST BE ACCESSIBLE TO ALLOW FOR ANNUAL TESTING.
4. THE DRAIN SHALL BE SIZED PER THE AWWA CROSS CONTAMINATION CONTROL MANUAL.
5. PLUMBING PERMIT IS REQUIRED – CONTACT THE APPROPRIATE JURISDICTION FOR PERMIT.
6. THE WATER LINE SHALL BE DISINFECTED, FLUSHED AND PRESSURE TESTED PRIOR TO INSTALLING THE RPBA. THE RPBA SHALL BE PROTECTED FROM FREEZING AND FLOODING.
7. THE RPBA SHALL BE INSTALLED ON OWNER'S PROPERTY AT PROPERTY LINE OR EASEMENT LINE, OR AT A LOCATION APPROVED BY CITY OF CAMAS WATER DEPARTMENT.
8. ALL ENCLOSURES SHALL BE PRE–APPROVED BY THE CITY OF CAMAS WATER DEPARTMENT PRIOR TO INSTALLATION
9. THE RPBA SHALL BE TESTED AFTER INSTALLATION AND PRIOR TO ACCEPTANCE, ALSO YEARLY THEREAFTER BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER. TEST RESULTS SHALL BE SENT TO THE CITY OF CAMAS WATER DEPARTMENT.
10. HEAT AND/OR INSULATION SHALL BE PROVIDED TO PREVENT FREEZING.
11. RPBA SHALL BE RETESTED IF MOVED OR REPAIRED.
12. ALL NEWLY INSTALLED FITTINGS IN CONTACT WITH WATER SHALL BE IN COMPLIANCE WITH THE REVISED SECTION 1417 OF THE EPA SAFE WATER DRINKING ACT AND CERTIFIED LEAD FREE USING NSF 372 STANDARDS.

City of Camas WASHINGTON

WATER DETAIL

REDUCED PRESSURE BACKFLOW ASSEMBLY, 1" AND 2"

NOT TO SCALE

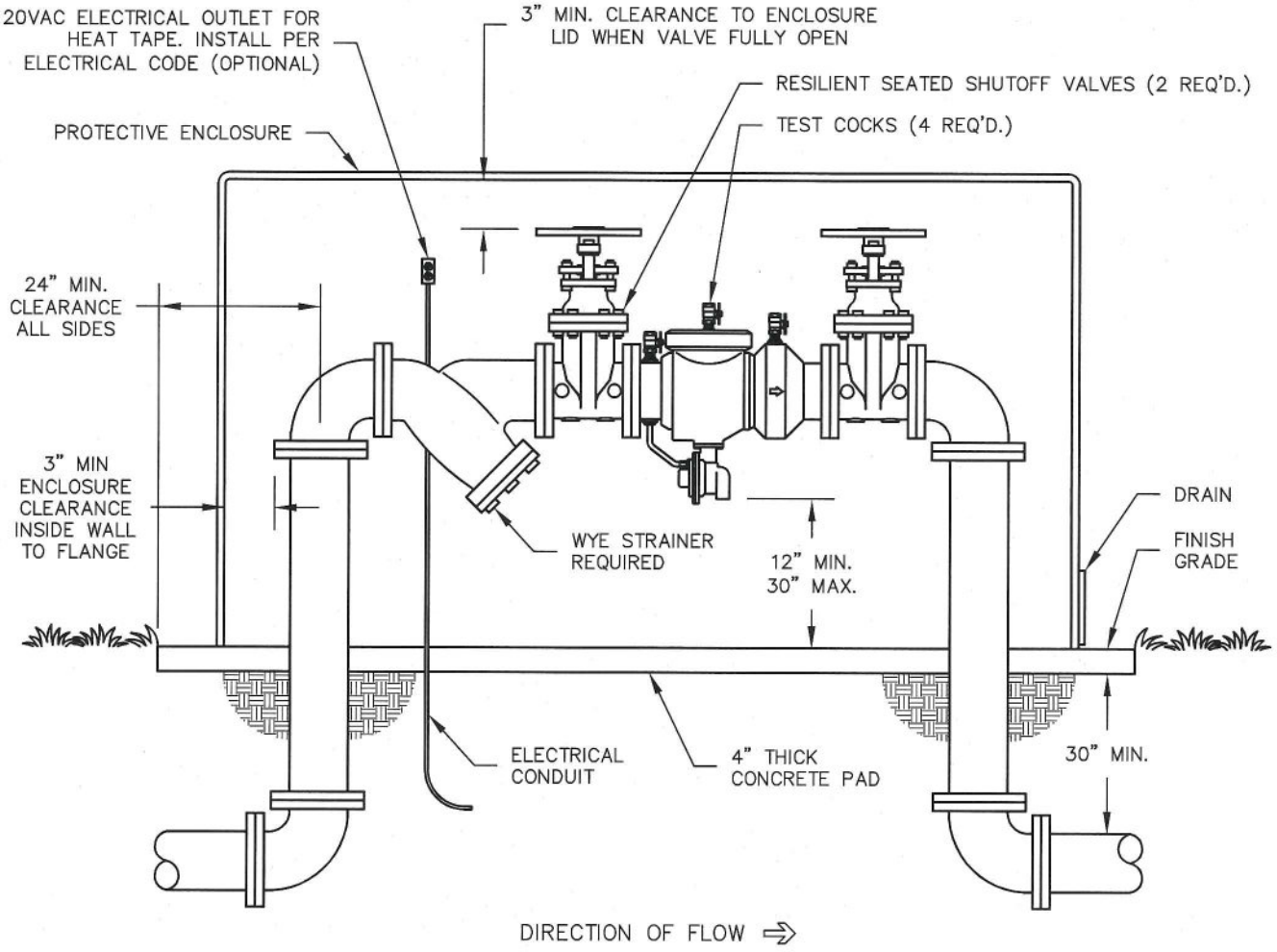
DETAIL NO. W24

Sam Adams 9-28-17

DETAIL APPROVED BY DATE

REVISION: 1 DATE: 09/2017

RPBA.DWG



NOTES:

1. REDUCED PRESSURE BACKFLOW ASSEMBLY (RPBA) SHALL BE DESIGNED FOR BACK SIPHONAGE AND BACK PRESSURE, AND APPROVED BY THE STATE OF WASHINGTON DEPARTMENT OF HEALTH.
2. THE RPBA SHALL LAY HORIZONTAL ONLY (VERTICAL IF APPROVED BY DEPT. OF HEALTH). DO NOT INSTALL IN A PIT, TRENCH OR AN AREA SUBJECT TO FLOODING.
3. THE RPBA MUST BE ACCESSIBLE TO ALLOW FOR ANNUAL TESTING.
4. THE DRAIN SHALL BE SIZED PER THE AWWA CROSS CONTAMINATION CONTROL MANUAL.
5. PLUMBING PERMIT IS REQUIRED – CONTACT THE APPROPRIATE JURISDICTION FOR PERMIT.
6. THE WATER LINE SHALL BE DISINFECTED, FLUSHED AND PRESSURE TESTED PRIOR TO INSTALLING THE RPBA. THE RPBA SHALL BE PROTECTED FROM FREEZING AND FLOODING.
7. ALL UNDERGROUND PIPE, VALVES AND FITTING JOINTS SHALL BE RESTRAINED FROM THE SUPPLY MAIN. ALL ABOVE GROUND JOINTS SHALL BE FLANGED.
8. ALL ENCLOSURES SHALL BE PRE–APPROVED BY THE CITY OF CAMAS WATER DEPARTMENT PRIOR TO INSTALLATION.
9. THE RPBA SHALL BE INSTALLED ON OWNER'S PROPERTY AT PROPERTY LINE OR EASEMENT LINE, OR AT A LOCATION APPROVED BY CITY OF CAMAS WATER DEPARTMENT.
10. ADEQUATE GRAVITY DRAINAGE SYSTEM REQUIRED WITH APPROVED AIR GAP.
11. MINIMUM 24" CLEARANCE ON ALL SIDES AROUND RPBA.
12. THE RPBA SHALL BE TESTED AFTER INSTALLATION AND PRIOR TO ACCEPTANCE, ALSO YEARLY THEREAFTER BY A WASHINGTON STATE DEPARTMENT OF HEALTH CERTIFIED BACKFLOW ASSEMBLY TESTER. TEST RESULTS SHALL BE SENT TO THE CITY OF CAMAS WATER DEPARTMENT.
13. HEAT AND/OR INSULATION SHALL BE PROVIDED TO PREVENT FREEZING.
14. RPBA SHALL BE RETESTED IF MOVED OR REPAIRED.
15. ALL NEWLY INSTALLED FITTINGS IN CONTACT WITH WATER SHALL BE IN COMPLIANCE WITH THE REVISED SECTION 1417 OF THE EPA SAFE WATER DRINKING ACT AND CERTIFIED LEAD FREE USING NSF 372 STANDARDS.

City of Camas WASHINGTON

WATER DETAIL

REDUCED PRESSURE BACKFLOW ASSEMBLY, 2.5" & LARGER

NOT TO SCALE

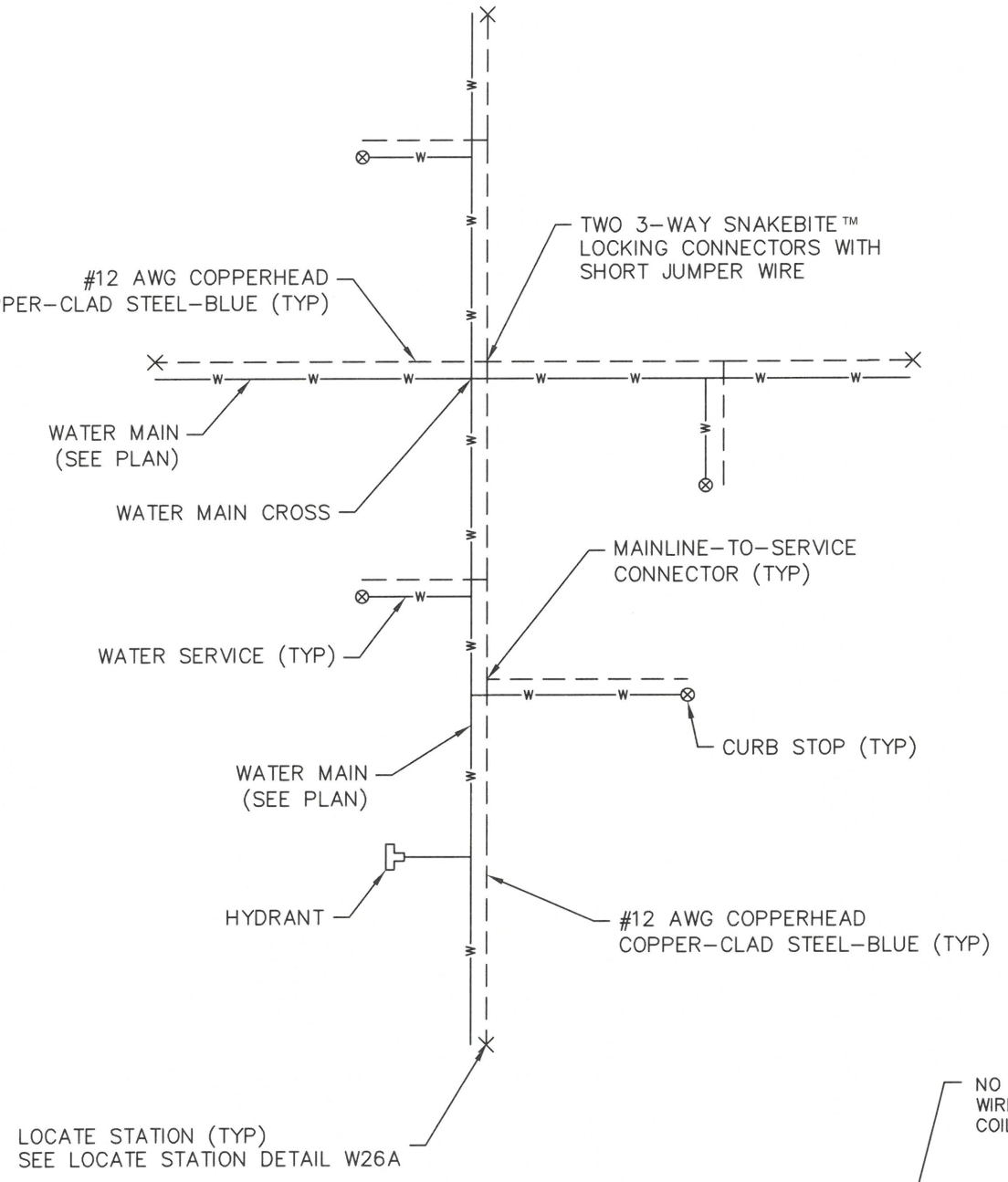
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Steve Adams 9-28-17

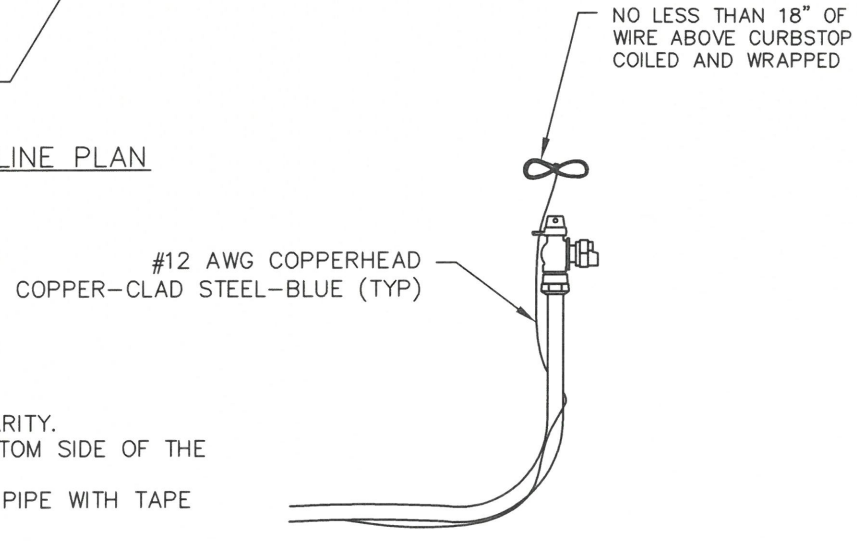
DETAIL APPROVED BY DATE

REVISION: 1 DATE: 09/2017

RPBA.DWG



WATERLINE PLAN



WATER SERVICE

NOTES:
1. WIRE SHOWN AWAY FROM PIPE FOR CLARITY.
2. WIRE SHALL BE INSTALLED ON THE BOTTOM SIDE OF THE PIPE, BELOW THE SPRING LINE.
3. THE WIRE SHALL BE FASTENED TO THE PIPE WITH TAPE OR PLASTIC TIES AT 10' INTERVALS.
4. LOCATE STATIONS TO BE LOCATED AT 1000' INTERVALS OR AS DIRECTED BY THE CITY OF CAMAS

City of Camas WASHINGTON

SANITARY SEWER DETAIL

WATER LOCATE STATION PLAN

3-28-22

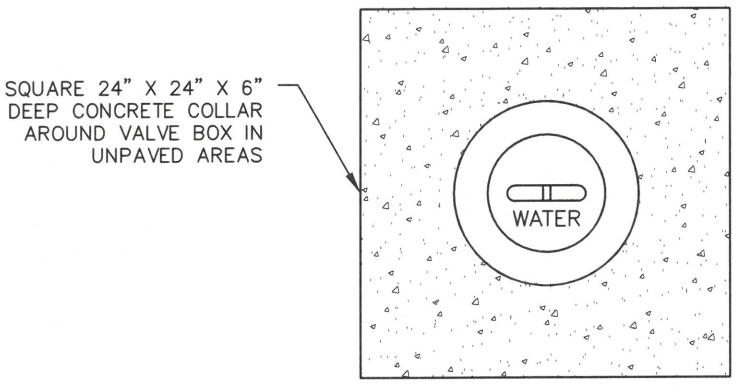
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NOT TO SCALE

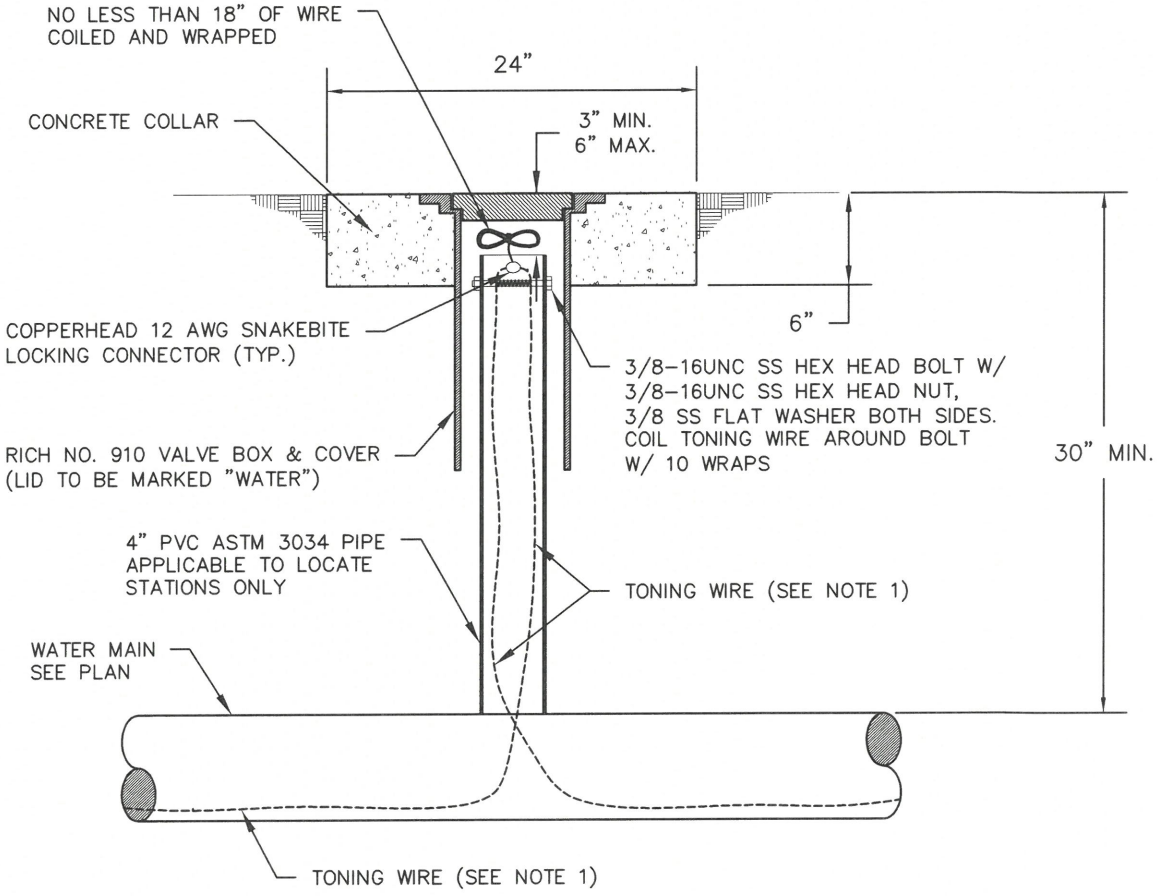
DETAIL NO. W26

REVISION: 1 DATE: 03/28/2022

WTR-RISER.DWG



CONCRETE COLLAR PLAN VIEW



NOTES:
1. TONING WIRE SHALL BE COPPERHEAD SUPERFLEX 12 AWG 45MIL BLUE HDPE INSULATION, NO SPLICES ALLOWED.
2. SEAL TONING WIRE SPLICE CONNECTIONS WITH COPPERHEAD 12 AWG SNAKEBITE LOCKING CONNECTORS (TYPICAL)
3. WIRE SHALL BE INSTALLED ON THE BOTTOM SIDE OF THE PIPE, BELOW THE SPRING LINE.
4. THE WIRE SHALL BE FASTENED TO THE PIPE WITH TAPE OR PLASTIC TIES AT 10' INTERVALS.
5. LOCATE STATIONS TO BE LOCATED AT 1000' INTERVALS OR AS DIRECTED BY THE CITY OF CAMAS

City of Camas WASHINGTON

SANITARY SEWER DETAIL

LOCATE STATION FOR WATER

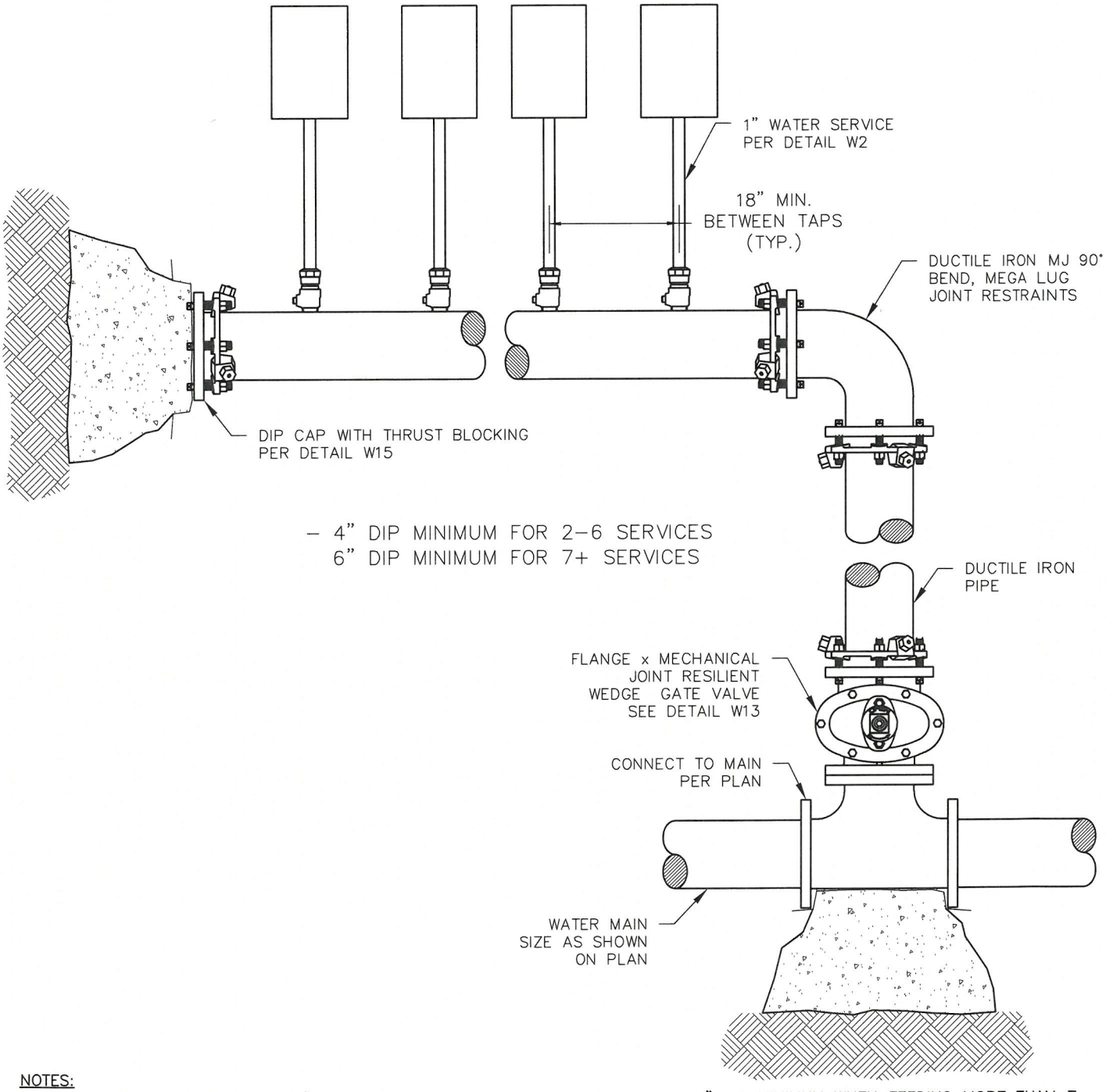
DETAIL APPROVED BY 3-28-22 DATE

NOT TO SCALE

REVISION: 1 DATE: 03/28/2022

DETAIL NO. W26A

WTR-RISER.DWG



NOTES:

1. WATERLINE MANIFOLD TO BE 4" DIP MINIMUM WHEN FEEDING 2–6 SERVICES, 6" DIP MINIMUM WHEN FEEDING MORE THAN 7 SERVICES
2. MANIFOLD LEG TO BE LOCATED UNDER PLANTER STRIP OR BEHIND SIDEWALK, AVOID PLACING UNDER IMPERVIOUS SURFACE.
3. MANIFOLD LEG TO BE AT A DEPTH OF 24" MIN/48" MAX.
4. NEW WATERLINE MANIFOLDS REQUIRE TONING WIRE, PLACED ON THE BOTTOM SIDE OF THE PIPE, BELOW THE SPRING LINE.
5. TONING WIRE SHALL BE FASTENED TO THE PIPE WITH TAPE OR PLASTIC TIES AT 10' INTERVALS.
6. TONING WIRE SHALL BE COPPERHEAD SUPERFLEX 12 AWG 45MIL BLUE HDPE INSLATION, NO SPLICES ALLOWED.
7. SEAL TONING WIRE SPLICE CONNECTIONS WITH COPPERHEAD 12 AWG SNAKEBITE LOCKING CONNECTORS (TYPICAL)
8. WATER SERVICES TO BE SPACED 18" MINIMUM AND INSTALLED PER DETAIL W2
9. METER BOXES TO BE LOCATED OUTSIDE OF SIDEWALK OR IN PLANTER STRIP, EXCEPT WHERE NOTED IN PLANS
10. TONING WIRE FROM THE MANIFOLD TO SERVICE REQUIRES A SNAKEBITE LOCKING CONNECTOR
11. PREFERRED BRASS FITTINGS TO BE USED, IN ORDER: 1) FORD 2) AY MCDONALD

City of Camas WASHINGTON

WATER DETAIL

WATER METER MANIFOLD ASSEMBLY

1/3/24

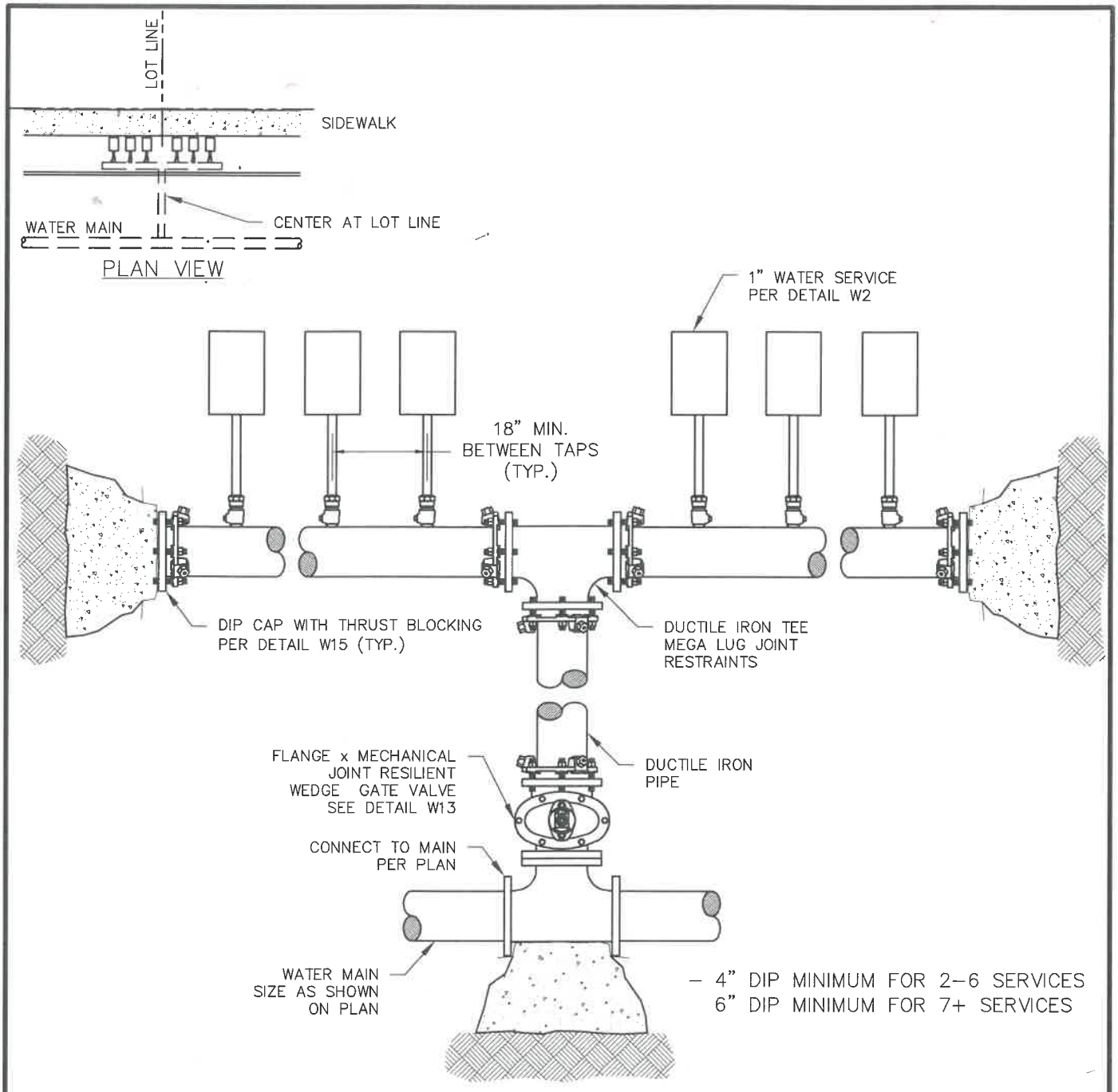
DETAIL APPROVED BY DATE

NOT TO SCALE

DETAIL NO. W27

REVISION: 2 DATE: 01/02/2024

WTR-MNFLD.DWG



NOTES:

1. WATERLINE MANIFOLD TO BE 4" DIP MINIMUM WHEN FEEDING 2–6 SERVICES, 6" DIP MINIMUM WHEN FEEDING MORE THAN 7 SERVICES
2. MANIFOLD LEG TO BE LOCATED UNDER PLANTER STRIP OR BEHIND SIDEWALK, AVOID PLACING UNDER IMPERVIOUS SURFACE.
3. MANIFOLD LEG TO BE AT A DEPTH OF 24" MIN/48" MAX.
4. NEW WATERLINE MANIFOLDS REQUIRE TONING WIRE, PLACED ON THE BOTTOM SIDE OF THE PIPE, BELOW THE SPRING LINE.
5. TONING WIRE SHALL BE FASTENED TO THE PIPE WITH TAPE OR PLASTIC TIES AT 10' INTERVALS.
6. TONING WIRE SHALL BE COPPERHEAD SUPERFLEX 12 AWG 45MIL BLUE HDPE INSLATION, NO SPLICES ALLOWED.
7. SEAL TONING WIRE SPLICE CONNECTIONS WITH COPPERHEAD 12 AWG SNAKEBITE LOCKING CONNECTORS (TYPICAL)
8. WATER SERVICES TO BE SPACED 18" MINIMUM AND INSTALLED PER DETAIL W2
9. METER BOXES TO BE LOCATED OUTSIDE OF SIDEWALK OR IN PLANTER STRIP, EXCEPT WHERE NOTED IN PLANS
10. TONING WIRE FROM THE MANIFOLD TO SERVICE REQUIRES A SNAKEBITE LOCKING CONNECTOR
11. PREFERRED BRASS FITTINGS TO BE USED, IN ORDER: 1) FORD 2) AY MCDONALD

City of Camas WASHINGTON

WATER DETAIL

WATER METER MANIFOLD ASSEMBLY

DETAIL APPROVED BY 2/12/2026 DATE

NOT TO SCALE

DETAIL NO. W27a

REVISION: 1 DATE: 02/10/2026

VTR-MNFLD.DWG

City of Camas

TRANSPORTATION SYSTEM PLAN

VOLUME 1

DRAFT OCTOBER 2026

ACKNOWLEDGMENTS

PROJECT ADVISORY COMMITTEE (PAC)

Steve Hogan, Mayor

Jon Daane, Citizen Representative

Joe Keller, Planning Commission

Jamie Howsley, Land Use Attorney

David Ripp, Port of Camas-Washougal

Jason Gibbens, WSDOT

Scott Collins, City of Washougal

Rebecca Kennedy, City of Vancouver

Ryan Lopossa, City of Vancouver

David Jardin, Clark County

Alan Peters, City of Camas

Robert Maul, City of Camas

Steve Wall, City of Camas

James Carothers, City of Camas

Allen Westersund, City of Camas

Reah Flisakowski, DKS Associates

Kevin Chewuk, DKS Associates

Laura Nowland, Camas School District

Jennifer Campos, RTC

Tayor Eidt, C-Tran

MAYOR AND CITY COUNCIL

Mayor Steve Hogan

Councilor Marilyn Boerke

Councilor Martin Elzingre

Councilor Mahsa Eshghi

Councilor Tim Hein

Councilor John Nohr

Councilor Jennifer Senescu

Councilor John Svilarich

PLANNING COMMISSION

Commissioner Troy Hull, Chair

Commissioner Geoerl Niles, Vice-Chair

Commissioner Joe Walsh

Commissioner Shawn High

Commissioner Paul Anderson

Commissioner Joe Keller

Commissioner Hannah Burak

PROJECT MANAGEMENT TEAM (PMT)

CITY OF CAMAS

James E Carothers, Engineering Manager/City Engineer, City of Camas

Scott Collins, Public Works Director, City of Camas

Alan Peters, Community Development Director, City of Camas

Robert Maul, Planning Manager, City of Camas

Allen Westersund, Engineer III, City of Camas

DKS ASSOCIATES

Reah Flisakowski, Senior Project Manager

Kevin Chewuk, Project Manager

Eileen Chai, Transportation Engineering Associate

FCS GROUP

Todd Chase, Project Manager

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VOLUME 2

Volume 2 of the Camas Transportation System Plan includes all background memoranda, and technical data that were the basis for its development. The contents of Volume 2 represent an iterative process in the development of the TSP. Refinements to various plan elements occurred throughout the process as new information was obtained. In all cases, the contents of Volume 1 supersede those in Volume 2.

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CHAPTER 1.

Context for the Plan

This chapter introduces the City of Camas and describes the purpose of a Transportation System Plan (TSP) and how it was developed. The process involved a formal decision-making structure, community engagement, and a structured technical analysis.

INTRODUCTION

The City of Camas, incorporated in 1906, is located along the Columbia River in the hills of eastern Clark County. Camas is home to approximately 28,000 people and is a part of the Portland-Vancouver Metropolitan Area with a total population of approximately 2.4 million people.

Located just east of Vancouver and on the doorstep of the Columbia River Gorge, Camas is a short 30 to 40-minute drive from downtown Portland. This unique location offers diverse housing, employment and recreation opportunities. The city is home to several large, hi-tech manufacturing industries, a vibrant downtown, and many new and established neighborhoods.

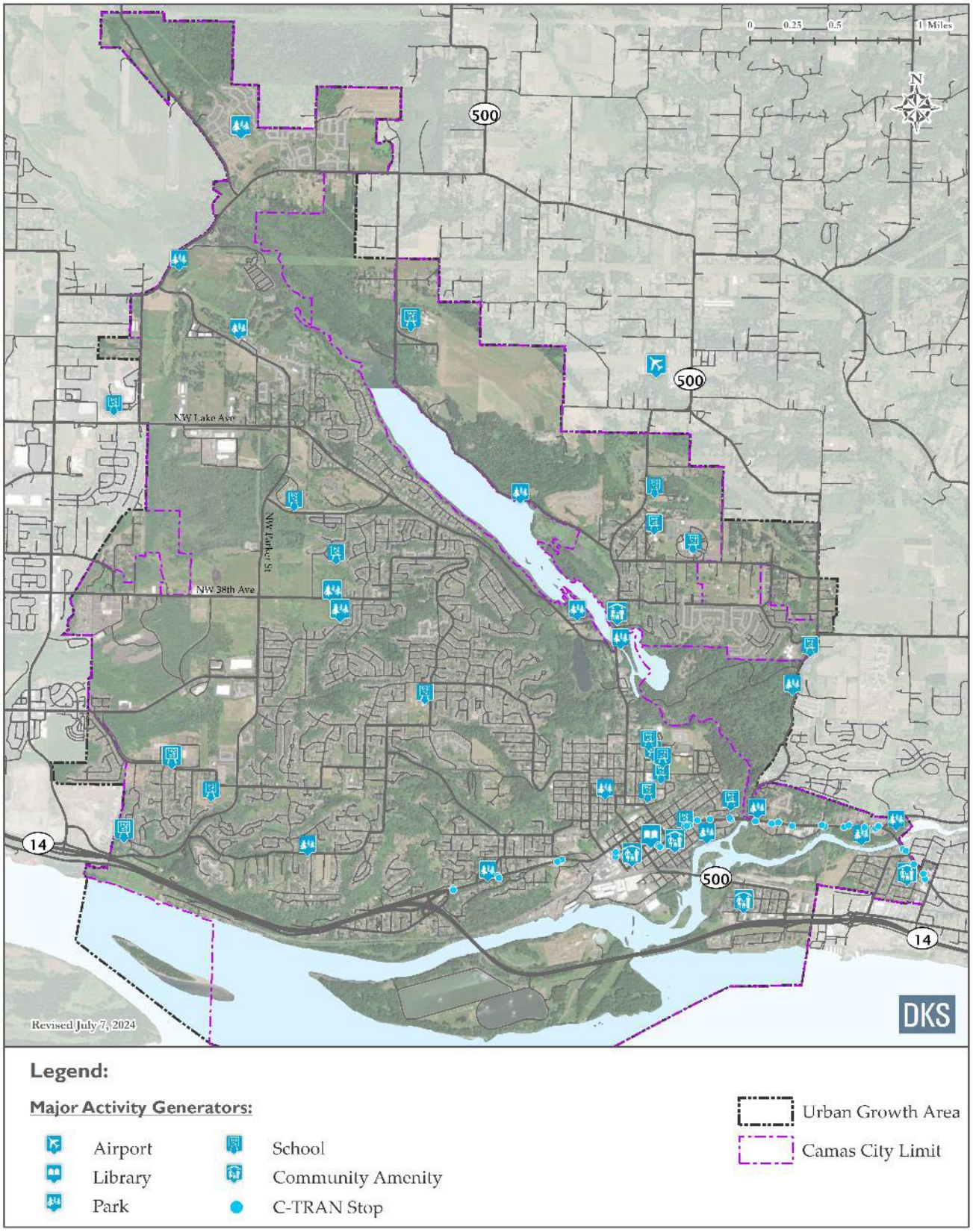
PLANNING AREA

The current City limits, shown in Figure 1, generally extends from north of NE Ingle Road and portions of NE 28th Street, to north of Lacamas Lake and NE 43rd Avenue-SE 15th Street to the Columbia River and from portions of NE Friberg-Strunk Street and east of SE 192nd Avenue to portions of SE Crown Road and Lechner Street. Beyond the current City limits, is the Urban Growth Area (UGA), also shown in Figure 1. The UGA is a land use planning tool designed to control urban expansion and promote the efficient use of land, public facilities, and services. Land inside the UGA is intended for urban development that is supported by urban services such as roads, water and sewer systems, parks, schools and fire and police protection. This boundary also supports 20-years' worth of population and employment growth, of which cities must plan for urban services within their designated UGA.

Camas is responsible for planning transportation infrastructure for all modes within its designated UGA, hereby referred to as "planning area", with the TSP being the City's tool for this effort. The City's planning area generally follows the current City limits, extending beyond that in a few locations, such as south of NE 28th Street and along portions of NW 38th Avenue, SE Payne Road, SE 15th Street and SE Crown Road (see Figure 1).

The City's planning area includes four distinct areas: 1) developed incorporated areas (i.e., in the existing City limits); 2) developed unincorporated areas; 3) undeveloped incorporated areas, such as the Northshore Subarea, which is planned for future urban development; and 4) undeveloped unincorporated areas. The TSP focuses on how to improve the existing transportation system for areas 1 and 2 noted above, and how to create a new system to serve future development in areas 3 and 4.

FIGURE 1: STUDY AREA AND KEY DESTINATIONS



OUR CAMAS 2045 COMPREHENSIVE PLAN

Our Camas 2045 is an update to the prior City of Camas comprehensive plan from 2016. It provides a roadmap for the future of the city and guides land use development and public facility investment decisions through 2045. Our Camas 2045 includes the latest land use for the City's planning area and incorporates the established visions and action plans for the recently completed North Shore subarea plan and Downtown subarea plan (i.e., Our Downtown Camas 2045) and provides the basis for the land use and growth assumptions that are planned for in the Camas TSP and its future 2045 travel forecasts.

PURPOSE OF THE TSP

The Camas TSP is a long-range plan to guide transportation investments within the City's planning area through the future horizon year of 2045. As the transportation element of the City's Comprehensive Plan, these transportation system improvements address current deficiencies and serve future local and regional needs, and align with the community's goals, objectives, and vision for the future. This TSP was developed through community and stakeholder input and is based on the City's transportation system needs, opportunities, and anticipated available funding. The State of Washington Growth Management Act (GMA) in RCW 36.70A.070 (6) requires the TSP to include:

- An inventory of transportation facilities and services.
- Adoption of multimodal levels of service standards for all locally owned arterials and active transportation facilities.
- A forecast of multimodal transportation for a minimum of 10 years including land use assumptions used in estimating travel (in this case, 25 years based on the adopted regional land-use plan).
- Identification of specific actions to bring transportation facilities and services to established multimodal levels of service.
- A list of transportation system needs to meet current and forecasted demand and implement the multimodal network.
- A finance plan that serves as the basis for the six-year transportation improvement program (TIP).

In compliance with requirements summarized above, the City of Camas created the TSP. This TSP will be used by the City to make strategic decisions about transportation system investments and will be instrumental in supporting grant applications to fund future projects, and ensuring projects are built in coordination with land use actions and future development.

SETTING DIRECTION FOR THE PLAN

A transportation vision, and set of goals, objectives, and performance measures (see Figure 2) were used to guide the project team in the development, evaluation, and prioritization of solutions that best fit the community and provided the basis for policies to support Plan implementation. They were established with guidance from the Project Advisory Committee (PAC).

Collectively, the transportation-related goals, policies, and evaluation criteria describe what the community wants the transportation system to do in the future, as summarized by a **vision statement**. A vision statement generally consists of an imaginative description of the desired condition in the future. It is important that the vision statement for transportation align with the community's core values.

Goals and objectives create manageable steppingstones through which the broad vision statement can be achieved. **Goals** are the first step down from the broader vision. They are broad statements that should focus on outcomes, describing a desired end state. Goals should be challenging, but not unreasonable.

Each goal is supported by more finite **policies**. In contrast to goals, policies should be specific and measurable. Where feasible, providing a targeted time period helps with objective prioritization and achievement. When developing policies, it is helpful to identify key issues or concerns that are related to the attainment of the goal.

The solutions recommended through the TSP must be consistent with the goals and policies. To accomplish this, **evaluation criteria** were developed based on the goals and policies. For the Camas TSP, they were used to inform the selection and prioritization of projects and policies for the plan by describing how well they support goal areas. The methodology for calculating the scores for each criterion can be found in Technical Memorandum #1b: Goals, Policies and Evaluation Criteria, included in the Appendix.

FIGURE 2: DIRECTION FOR THE PLAN



VISION FOR THE PLAN

The overall vision statement for the TSP is described below.

> IN 2040, RESIDENTS OF CAMAS CONTINUE TO APPRECIATE THEIR SAFE, DIVERSE, AND WELCOMING COMMUNITY AS A LIVABLE PLACE FOR PEOPLE OF ALL AGES. QUALITY PUBLIC FACILITIES, SERVICES, AND UTILITIES CONTRIBUTE TO THEIR HIGH QUALITY OF LIFE.

GOALS AND POLICIES FOR THE PLAN

The Camas TSP goals and policies are documented below, and are consistent with those in the 2045 City of Camas Comprehensive Plan (not in order of priority).

GOAL

TRANSPORTATION REVENUE

MAXIMIZE THE USE OF STATE AND FEDERAL FUNDS FOR TRANSPORTATION CAPITAL, OPERATING, SERVICE, AND DEMAND IMPROVEMENTS.

Policy a.	Maintain a capital improvement plan (CIP) that identifies construction and improvement priorities and funding.
Policy b.	Ensure that the transportation impact fee program responds to land use changes, supports connectivity, and requires new development to pay its proportionate share of needed capacity.
Policy c.	Support the Pavement Asset Management System and other maintenance programs to ensure cost -effective maintenance of transportation facilities and efficient use of public funds.
Policy d.	Develop equitable transportation impact fees to assess developers a fair-share contributions for any transportation improvements.
Policy e.	Prioritize transportation funding for multi -modal improvements that will enhance safety and access between infill areas, schools, and employment centers.
Policy f.	Focus transportation projects in economic development areas to act as catalysts for job growth.

GOAL

COMPLETE STREETS

STREETS WILL FUNCTION FOR ALL USERS OF ALL ABILITIES INCLUDING BICYCLISTS, PEDESTRIANS, TRANSIT USERS, AND MOTORISTS.

Policy a.	Implement the Transportation System Plan (TSP) to maintain the livability of Camas and guide decision-making for transportation-related projects, policies, and design. Ensure consistency between the TSP, the Parks, Recreation and Open Space Plan and the 6-year street plan.
Policy b.	Maintain the transportation system to enhance safety and efficiency for all users, facility aesthetics, access management measures and the overall integrity of the system.
Policy c.	Construct streets that are interconnected and avoid long cul-de-sacs or dead ends. Block lengths should be less than 1,000 feet. Include pedestrian and bicycle linkages in the construction of cul-de-sacs and other forms of dead-end streets. Existing dead-end streets should be retrofitted to provide bicycle and pedestrian linkages as practicable.
Policy d.	Develop and implement design standards that provide attractive streetscapes, encourage appropriate traffic volumes and speeds, and support multi-modal safety. Include enhanced roadway features such as roundabouts, decorative lighting, and landscaping in gateways and design overlay areas.
Policy e.	Minimize access to new development and redevelopment along City arterials and consolidate access points when spacing is insufficient.
Policy f.	Provide routes designed for active transportation to encourage mode shift for short trips. Route planning should seek shortcuts and other opportunities that provide advantages to active transportation users. Public investments should support active transportation routes such as street lighting, safe crosswalks, and protected bike lanes.
Policy g.	Coordinate with Camas School Dist rict to implement a safe routes to school program to encourage the use of alternative and active transportation.
Policy h.	Develop and implement Complete Streets design in al l new and retrofit street projects to support the use of alternative t ravel modes. Adopt engineering design standards nsistent with Complete Streets goals.
Policy i.	Increase wayfinding signage for outdoor destinations throughout the City.
Policy j.	Inventory current bicycle and pedestrian networks to identify gaps in route coverage. Support filling in network gaps as new development and redevelopment occurs to create a bicycle and pedestrian network that is safe, comfortable, and accessible to people of all ages and abilities.
Policy k.	Minimize cut and fill roadway design and, where feasible, minimize restructuring the natural contours of the land.
Policy l.	Encourage the inclusion of low impact development (LID) design features (e.g. rain gardens, grass pavers, pervious pavement) in the design of road surfaces.
Policy m.	Require LED l ights in new development and replace existing inventory that lack LED features.

GOAL

LOCAL AND REGIONAL TRANSIT

REGIONAL TRANSIT WILL PROVIDE SAFE, EFFICIENT, AND DEPENDABLE SERVICE TO THE CAMAS COMMUNITY.

Policy a. Coordinate with local municipal ities, Washington Department of Transportation, adjacent counties, and C-TRAN to ensure that minimum roadway and multi -modal design standards are consistent.

Policy b. Partner with C-Tran to advocate for and develop transit options that are safe, convenient, frequent, and accessible for Camas residents.

GOAL

TRAFFIC SAFETY

DESIGN AND CONSTRUCT SAFE TRANSPORTATION FACILITIES THAT MEET APPLICABLE REQUIREMENTS.

Policy a. Encourage traffic safety through education, enforcement, and engineering. Use traffic calming, traffic diversion, and other available tools such as landscaping, trees, and art to ensure a comfortable and safe environment for all users.

Policy b. Provide adequate access for emergency vehicles throughout the city.

Policy c. Develop safe pedestrian and bicycle routes between residential areas, schools, and public facilities.

Policy d. Require new development to implement designs standards using the Neighborhood Traffic Management Plan.

Policy e. Identify high accident areas and implement specific measures to reduce accident occurrences.

GOAL

TRANSPORTATION DEMAND MANAGEMENT

TRANSPORTATION PLANNING WILL ACHIEVE THE EFFICIENT USE OF TRANSPORTATION INFRASTRUCTURE, INCREASE I TS PERSON CARRYING CAPACITY, AND ACCOMMODATE AND FACILITATE FUTURE GROWTH CONSISTENT WITH LAND USE OBJECTIVES.

Policy a. Require large employers to implement a commute trip reduction program for employees, as mandated by state law.

Policy b. Support intergovernmental development review.

Policy c. Support the Regional Transportation Council (RTC) with funding and staff participation to the extent possible.

GOAL

CONCURRENCY AND LEVEL OF SERVICE

THE CITY WILL MAINTAIN THE ADOPTED LOS STANDARDS FOR ALL ARTERIAL STREETS AND TRANSIT ROUTES.

Policy a. Encourage growth in areas with existing or planned infrastructure capacity.

Policy b. Require new development to demonstrate that adequate person trips are available, or that multi-modal improvements to the transportation system will be made to accommodate the impacts concurrent with the development.

Policy c. Utilize traffic impact fee studies, development traffic impact analyses, and corridor studies to identify deficiencies and plan improvements to maintain or improve LOS standards.

Policy d. Take the following actions (in no priority order) if the probable funding falls short of meeting identified needs: 1) delay development until programs, facilities, or services can be funded; 2) obtain the revenue needed or revise the transportation plan to reflect known financial resources; or 3) change the transportation LOS standard, which is a last resort measure.

PERFORMANCE BASED PLANNING PROCESS

The TSP utilizes a performance-based planning process. The community vision is distilled into measurable goals and supporting policies. These goals and policies were used to identify evaluation criteria to help evaluate potential projects to enhance transportation system performance, and to measure long-term alignment between Camas's transportation system and the community's vision, goals, and policies. The plan process is illustrated below in Figure 3, along with the key questions that were considered during three development stages of the TSP.

FIGURE 3: PERFORMANCE BASED PLANNING PROCESS



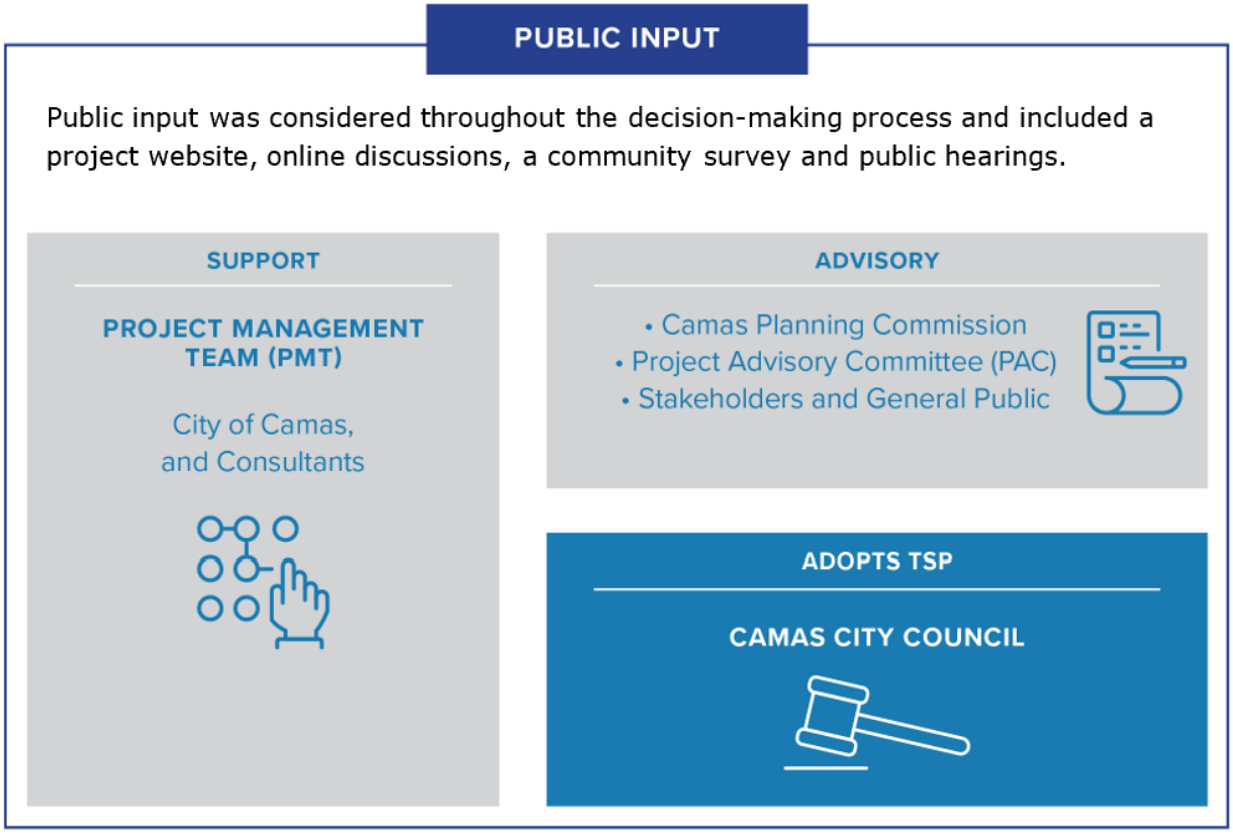
DECISION MAKING STRUCTURE

The decision-making structure for this TSP was developed to establish clear roles and responsibilities throughout the project. The decision-making structure (Figure 4) established a framework for broad-based community engagement for the project.

As the TSP was developed, the Project Management Team (PMT) worked with a Project Advisory Committee (PAC) that included local business representatives, emergency service and transit providers, and agency staff members from the City of Camas, City of Vancouver, City of Washougal, Clark County, C-Tran, Southwest Washington Regional Transportation Council (RTC) and the Washington State Department of Transportation (WSDOT). The PAC was formed to provide community-based recommendations, and informed and guided the plan by reviewing draft deliverables, providing insight into community perspectives, commenting on technical and regulatory issues, and providing recommendations for the TSP.

The City Council and Planning Commission for Camas were briefed during the development of this plan throughout the process. The PMT made recommendations to the City Council based on technical analysis and community input. The City Council made all final decisions pertaining to this TSP, including its adoption.

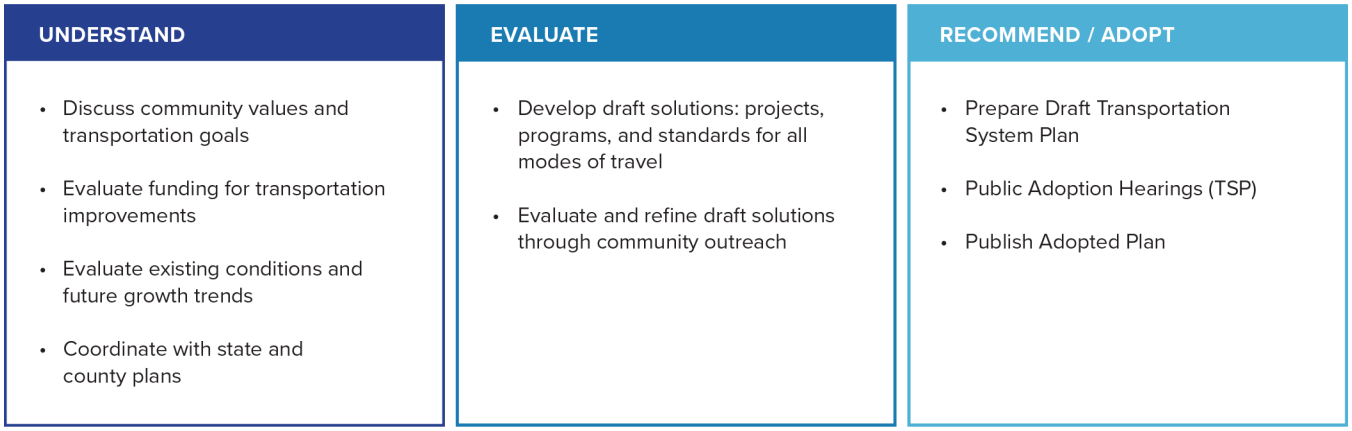
FIGURE 4: CAMAS TSP ROLES AND RESPONSIBILITIES



TECHNICAL DEVELOPMENT

Figure 5 illustrates the technical tasks involved in creating the TSP. These are categorized in three major stages: the first to understand system needs and constraints, the second to develop solutions, and the third to prepare and adopt the plan. Community input guided the TSP development through all stages.

FIGURE 5: CAMAS TSP DEVELOPMENT TECHNICAL TASKS



CHAPTER 2.

Camas Transportation System Today & Tomorrow

This chapter describes the transportation system as it exists and operates today and in the future. The assessment is used to identify community transportation needs and determine where the transportation system can be improved to better accommodate them. Needs were determined based on a comprehensive multimodal existing conditions analysis and projecting future conditions through the planning horizon (2045) based on assumed growth in households and employment, and the transportation standards from Chapter 3.

FACTORS IMPACTING TRAVEL DECISIONS

Travelers often weigh a variety of factors when deciding how to commute to or from their destination. Whether the trip will be via motor vehicle, walking, bicycle, public transportation, scooter, or other mode, the choice is often a balance between ease and convenience of travel, travel cost, and travel time.

LAND USE AND KEY DESTINATIONS

Land use is a key component of transportation system planning. Where people live and where they go to work, shop, or access services and the distance between these key destinations has a big impact on how they get around and the demands they place on the transportation system.

Many trips also occur between community amenities within the City's planning area, including parks, civic (e.g., schools, libraries, community centers), essential retail and services (e.g., grocery stores, pharmacies), and medical uses. These amenities are shown earlier in Figure 1. Most homes are located to the south of Lacamas Lake, with larger employment areas Downtown (central), and at the west end of the city. Schools are located throughout the city and most civic buildings are near Downtown. The city owns and maintains 16 parks; the majority — in number and in acreage— are located in the southern half of the city. Shopping and entertainment opportunities are generally found in the Downtown, and the southeastern part of the city. Future community amenities will also likely be built as development occurs in the Grass Valley and North Shore areas.

Those destined for a park or school generally have a higher likelihood to walk or bicycle than those going to work or shopping. The distance of that destination also plays a role in mode choice. Trips that are shorter generally present a better opportunity to walk or bicycle, and longer distance trips more often are conducive to transit or motor vehicle modes. Residents in the City's planning area who work outside of it (as well as people who work in the City's planning area but live elsewhere) are likely to commute by motor vehicle due to travel distance, commute time, and/or lack of adequate facilities. However, some commuters may choose bicycling or transit if the regional transportation system offers convenient and comfortable biking facilities or transit services between destinations.

QUALITY AND AVAILABILITY OF FACILITIES

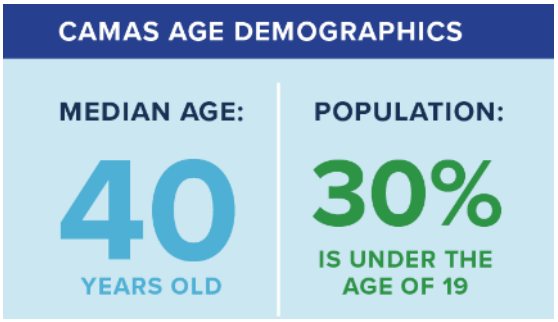
The availability of sidewalks, shared-use paths, curb ramps to provide wheelchair access, crosswalks, and bicycle facilities increases the comfort and access of those walking and biking. The lack of or poor quality of these facilities, particularly along or across higher volume or higher speed roadways, discourages people from utilizing non-motorized vehicle modes of transportation.

For transit, the distance to bus stops, frequency of service, route coverage, connections to other transportation modes, and amenities at stops are some of the factors that play a role in a user's decision to utilize it.

DEMOGRAPHICS

As shown in Table 1 and Figure 6, residents of Camas have a median age of 40, with about 30 percent of all residents within the school age range (i.e., under the age of 19) and about 13 percent of the population over the age of 65. Both age demographics are slightly different than those of the region and state, with the city accounting for 4 to 5 percent more school aged residents and 3 percent fewer residents aged over 65.

FIGURE 6: KEY DEMOGRAPHICS



As growth continues in the city, particularly in the North Shore subarea, it will likely continue to attract a high share of younger families. Overall, the city will continue to see people of all ages and abilities walking, biking, and using transit. It will also continue to see a higher share of school related trips when compared to other cities in the region given the significant share of younger families.

TABLE 1: CAMAS AGE DEMOGRAPHICS

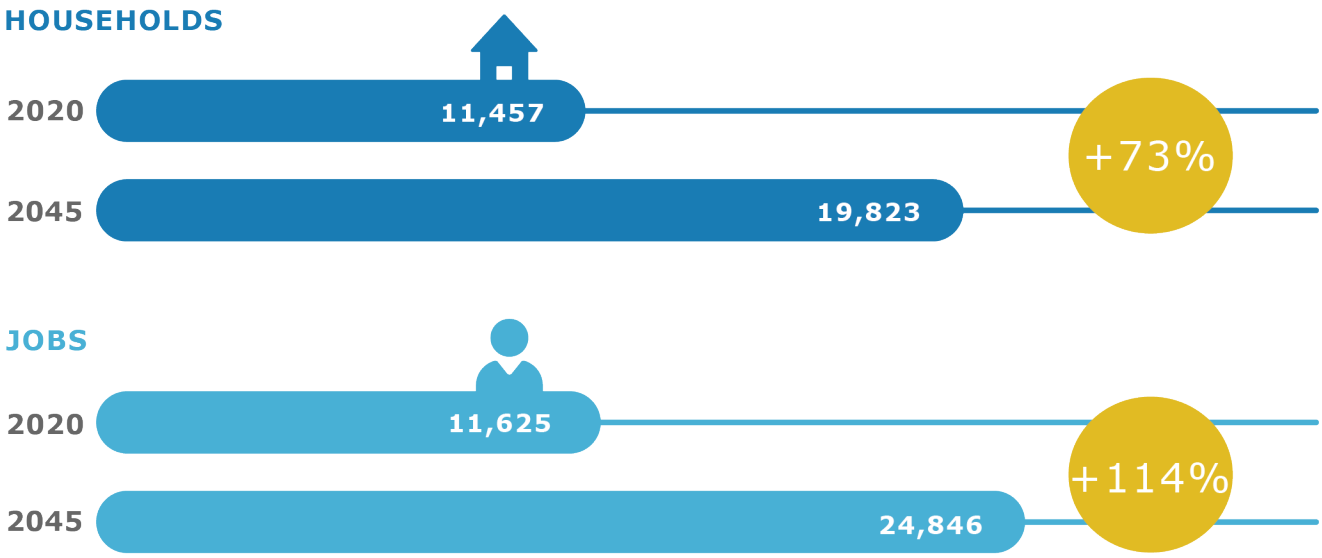
AGE	CAMAS	CLARK COUNTY	WASHINGTON
UNDER 19 YEARS	30%	25%	24%
20-34 YEARS	14%	20%	22%
35-49 YEARS	22%	20%	20%
50-64 YEARS	21%	19%	18%
65 YEARS AND OLDER	13%	16%	16%
MEDIAN AGE	**40.3**	**38.8**	**38.0**

POPULATION AND EMPLOYMENT GROWTH

As growth occurs to the year 2045, the demands on the City's transportation system will be influenced by changes in population, housing, and employment. These changes in travel demands will require better ways to manage the system, more choices for getting around, and targeted improvements to make the system safer and more efficient.

The Camas planning area is growing, and it is estimated that about 8,367 more households will live here by 2045, for a total of 19,823 (see Figure 7)[1]. There are currently about 11,625 jobs in Camas's planning area, and that total is estimated to increase to 24,846, with 13,221 more people working in the City's planning area by 2045 (see Figure 7)[2].

FIGURE 7. CAMAS PLANNING AREA HOUSEHOLD AND JOB GROWTH TRENDS



Source: RTC 2020 and 2045 Travel Demand Models; based on the Camas planning area.

TRAVEL DEMANDS AND CHARACTERISTICS

The number of people who choose to walk, bike, ride transit, or drive along with the distances they travel is important for assessing how well existing transportation facilities serve the needs of users. Available data on travel demand, travel mode choice, and trip length are used to better understand travel behavior in the community and inform the needs analysis for the transportation system. This data is largely derived from the Southwest Washington Regional Transportation Council (RTC) Travel Demand Model and the US Census Bureau. The following sections provide a summary of travel demands and characteristics in the City's planning area.

[1] These locations are based on boundaries approximated by the model TAZ boundaries and may not match current and future city limits; This analysis is consistent with City of Camas comprehensive plan (i.e., Our Camas 2045), which includes the latest land use for the City's planning area and incorporates the established visions and action plans for the recently completed North Shore subarea plan and Downtown subarea plan (i.e., Our Downtown Camas 2045).

[2] Ibid

DAILY PERSON TRIPS

The increase in the number of residents and jobs in the Camas planning area increases the overall number of person trips generated. Table 2 summarizes the total person trips (i.e., drive, walk, bike and transit trips) during an average weekday in the Camas planning area for year 2020 and 2045. The transportation network in the planning area accommodates over 123,000 person trips during an average weekday as of 2020, and that number is estimated to increase by over 127,000 through 2045, to an estimated 250,964 daily person trips if the land develops according to the land use assumptions during an average weekday. Of these daily person trips in 2020, over 11,000 were walk, bike, or transit trips, and that amount is expected to increase by nearly 102 percent through 2045, to an estimated 23,981 daily trips. This is representative of the increase in jobs available in the planning area, and corresponding increase in retail or other destinations in closer proximity to households. Drive trips (i.e., single occupant vehicle or shared rides) are expected to increase by over 115,000 through 2045 during an average weekday, which represents a slightly higher growth rate than walk, bike or transit trips, at 104 percent.

TABLE 2: PERSON TRIPS IN CAMAS PLANNING AREA

AVERAGE WEEKDAY PERSON TRIPS BY MODE	2020 DAILY PERSON TRIPS	2045 DAILY PERSON TRIPS	DAILY GROWTH (2020-2045)	DAILY GROWTH RATE (2020-2045)
DRIVE TRIPS	111,388	226,982	115,595	104%
WALK/BIKE TRIPS	10,175	19,006	8,831	87%
TRANSIT TRIPS	1,701	4,975	3,274	193%
TOTAL PERSON TRIPS	**123,264**	**250,964**	**127,700**	**104%**
TOTAL WALK, BIKE, TRANSIT TRIPS	**11,876**	**23,981**	**12,105**	**102%**

Source: 2020 and 2045 RTC travel demand models.

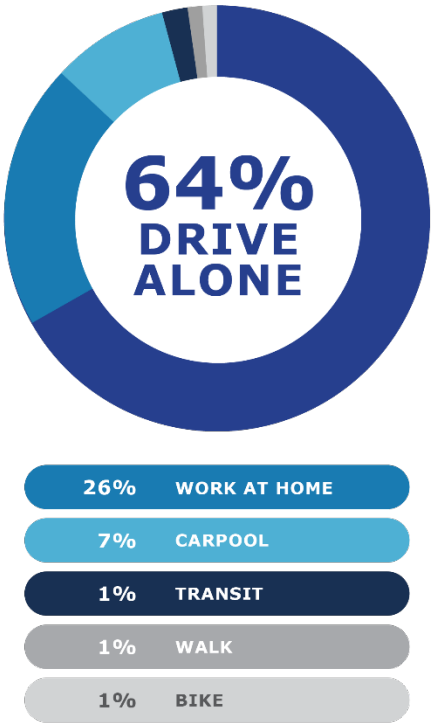
COMMUTER TRIPS

Much of the traffic in the Camas planning area, especially during the more congested weekday peak periods, is related to employment. Residents in the Camas planning area who are employed overwhelmingly commute to work outside of the planning area (87 percent), while jobs in the planning area are overwhelmingly filled by people who live outside of the planning area (84 percent)[3].

On average, almost 64 percent of employed residents in the Camas planning area commute to work using single-occupant motor vehicles. About 7 percent of residents carpool to work and the remaining 29 percent work from home, walk, bike, take transit, or use some other means of travel (see Figure 8).

About 26 percent of employed residents in the Camas planning area worked from home, which represents a 15 percent increase in the past 10 years. It seems likely that a higher percentage of workers will continue teleworking, at least part time. Any increase in the remote work share will change the demand on streets, including when and how they travel.

FIGURE 8: CAMAS PLANNING AREA COMMUTER MODE SHARE



Source: US Census Bureau, 2024 American Community Survey

QUALITY AND AVAILABILITY OF FACILITIES

To address changing transportation needs within the City's planning area though 2045, the existing and future travel conditions must be considered. The transportation system review documented the existing motor vehicle, pedestrian, bicycle and transit infrastructure. It also identified shortfalls and limitations regarding how people can travel within the City (such as lack of bike lanes or sidewalks). Solutions are identified in Chapter 4 for transportation infrastructure that is determined to not maintain acceptable service levels for residents.

STREET NETWORK

Camas streets are well connected and generally follow a grid pattern in the downtown area and nearby neighborhoods. However, the streets in the newer neighborhoods outside of these areas are more disconnected, limited at times by the topography. The major transportation routes through Camas include SR 14, SR 500, as well as a few key City roadways. SR 14 runs east-west through Camas parallel to the Columbia River. SR 14 connects Camas to Vancouver, Interstate 5 and Interstate 205 to the west, and Camas to Washougal to the east. SR 500 runs north-south through

[3] US Census Bureau, OnTheMap. Home/Work Distance/Direction Analysis, 2023.

the city connecting SR 14 south of downtown with NE Fourth Plain Boulevard north of the City. In the downtown area, it runs along portions of SE 6th Avenue, NE Dallas Street, NE 3rd Avenue and NE Garfield Street.

A few key city roadways that provide north-south access are NW Brady Road, NW Parker Street, Division Street, NW Fargo Street, NW Astor Street, NW Sierra Drive, and SE Crown Road. NW Brady Road and NW Parker Street provide a connection on the west side of Camas, Division Street, NW Fargo Street, NW Astor Street and NW Sierra Drive provide connections through the central neighborhoods of Camas, and SE Crown Road provides a connection on the east side of Camas. Key east-west city roadways include NW 6th Avenue, NE 3rd Avenue, NW Pacific Rim Boulevard, NW 38th Avenue, NW Lake Road, and NE Goodwin Road, with NW 6th Avenue and NE 3rd Avenue towards the south end of the city, NW Pacific Rim Boulevard and NW 38th Avenue centered in the middle, and NW Lake Road and NE Goodwin Road in the north end of the city.

STREET NETWORK PERFORMANCE ASSESSMENT

Congestion and safety for all modes was reviewed at intersections and streets in the City's planning area. This assessment shows how safe and efficient the street system is and provides information to identify needed improvements for the TSP.

Street Network Congestion

This assessment identified locations on the roadway network that operate above thresholds for congestion under current and future conditions. These are locations where motorists experience significant delay. These thresholds, identified in Chapter 3, provide a metric for assessing the impacts of new development on the transportation system and for identifying where capacity improvements may be needed. They are the basis for requiring improvements needed to sustain the transportation system as growth and development occur.

Figure 9 displays the results of the congestion analysis. The displayed conditions assume only transportation improvements to the current street network with secured funding through 2045. As shown, several intersections are expected to be congested by 2045 during the weekday p.m. peak hour. This includes several intersections along NW-NE 6th Avenue, which is expected to see a high amount of growth through 2045 as a primary connection between Downtown Camas and SR 14, and several intersections along NE Goodwin Road, NE 28th Street and NW Lake Road at the north end of the planning area where high growth is also expected through 2045.

The TSP includes conceptual intersection enhancements, and locations of future streets that will help to provide additional travel routes through the planning area and alleviate some of the local traffic from these major streets.

Most new Local streets will be built by new private development. When a private development project is approved, the builder or developer is required to provide a street network that complies with the standards included in Chapter 3. The connectivity standards require streets to be provided at a minimum spacing of 600 feet in most cases. These Local streets occur at more frequent intervals and are spaced closer than the larger streets (i.e., Arterial or Collector streets).

Street Network Safety

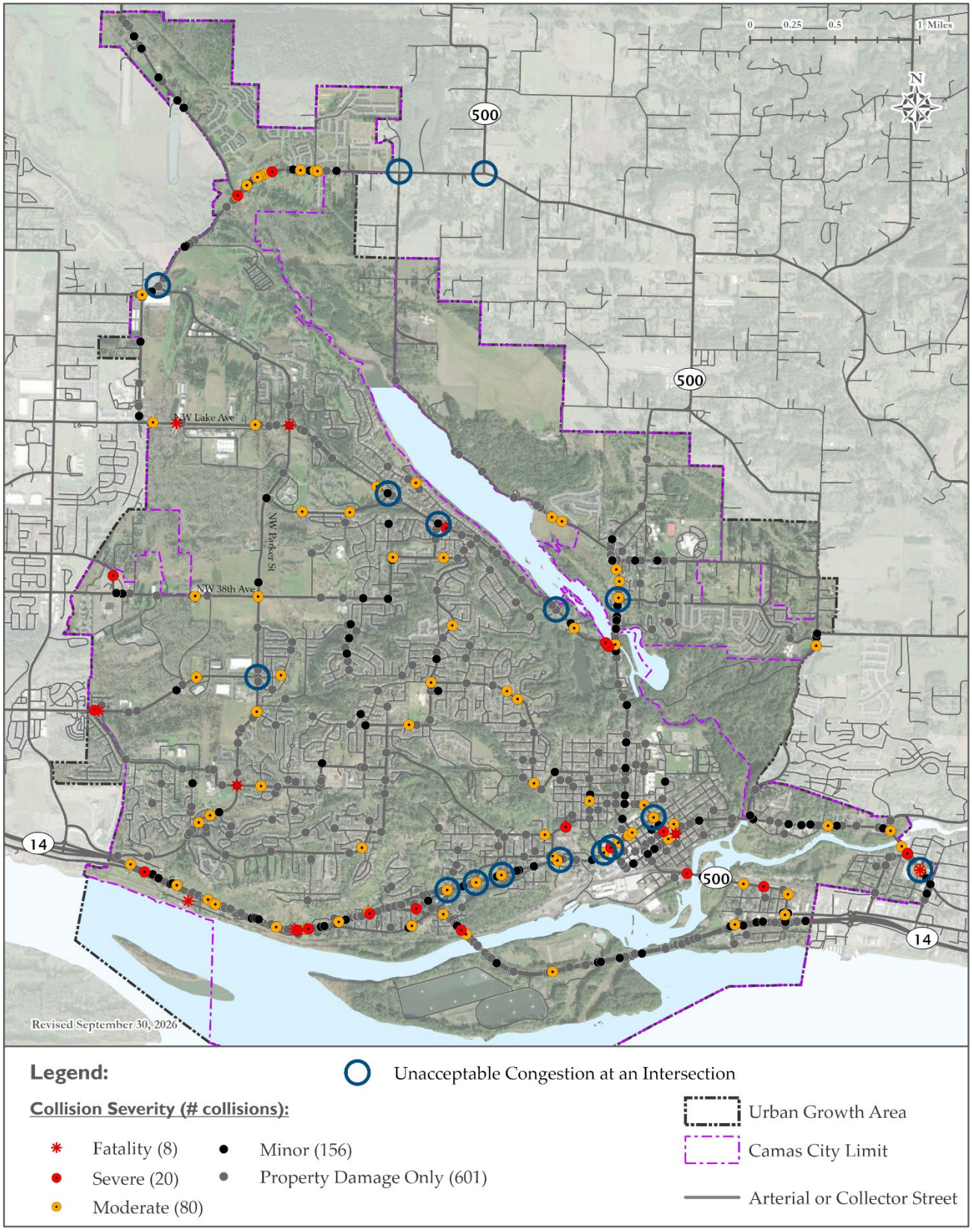
This assessment monitors the safety of travel in the planning area. It was used to track collision data over a 5-year period to provide trends related to total vehicle, pedestrian, and bicyclist collisions, fatal and severe injury collisions and total fatalities and severe injuries. Figure 9 shows data for the 5-year period, with 880 collisions occurring in the City's planning area. Of these collisions, 14 involved a pedestrian and 12 involved a bicyclist.

The pedestrian collisions occurred most frequently downtown (five crashes involving a pedestrian), and along NE 3rd Avenue between NE 4th Street and NE Weir Street (two crashes involving a pedestrian). Pedestrians sustained severe injuries in three crashes, one of which resulted in a death: at the NE 3rd Avenue / NE 4th Street, NE 3rd Avenue / NE Weir Street, and the SR 500 / NE 4th Avenue intersections. Moderate injuries to pedestrians were sustained in six of the crashes.

The majority of bicycle collisions occurred at intersections, with one at a traffic signal and six at stop-controlled locations. A cyclist sustained moderate injuries in six of the crashes. The bicycle-involved collisions occurred most often along NE 3rd Avenue between NE Sumner Court and NE Weir Street (three collisions involving a bicycle) and along SR 500 (NE Everett Street) between NE 38th Avenue and NW Lake Road (two collisions involving a bicycle).

In addition, a safety analysis was evaluated for streets in the planning area. This included an analysis of collision rates at intersections. This analysis identified the NE Ingle Road intersection with NE 28th Street as having a high collision rate, although this intersection has since been improved to include a traffic signal.

FIGURE 9: STREET NETWORK CONGESTION AND SAFETY



WALKING NETWORK

Walking supports healthy lifestyles, is an easy and economical way to travel, and is well suited for people of all ages and abilities. In this plan, "walking" and "pedestrian" are terms that include people who walk independently or use canes, wheelchairs, other walking aids, or strollers. Approximately one percent of commuters in the city walk to work, with one percent utilizing public transportation, which often includes walking at the beginning or end of the trip[4]. In addition to the work commute trips, walking trips are made to and from recreational areas, shopping areas, schools, and other key destinations in the City's planning area. Continuous and direct sidewalk connections to all key destinations and along all streets, in addition to safe crossing opportunities along major roadways, are essential to encourage walking and transit use.

PEDESTRIAN FACILITY GAPS

An inventory of the walking network in the City's planning area is provided in Technical Memorandum #2: Existing Conditions Analysis in TSP Volume 2. The pedestrian network is relatively complete within the current City limits, with most residential development having a full sidewalk system with relatively few gaps. A large part of downtown Camas was developed prior to 1950, a time in which sidewalks were incorporated into the design of neighborhoods and streets. Although most areas incorporated into Camas over the following decades have sidewalk coverage, a few areas do not have complete sidewalks on one side of the street, or even on both sides. These gaps are most significant in southwest, southeast, and northeast Camas, and on roadway segments outside the city limits.

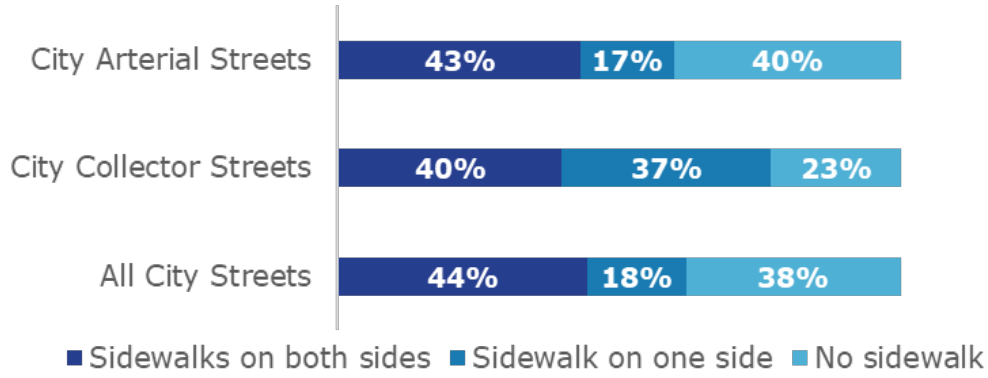
Many intersections in older parts of the city also lack ADA-compliant ramps, which provide important connections between sidewalks, making it easier to cross streets and handle the vertical drop at curbs. However, the city has been recently installing new curb ramps in many of these locations. The presence of curb ramps is fairly consistent along streets in downtown Camas, and in the newer neighborhoods in the city.

About 38 percent of street miles (including City arterial, collector and local streets) lack sidewalk coverage along one or both sides (see Figure 10). These gaps are more common along arterial streets than collector streets, at 40 and 23 percent of the street miles with no sidewalk on either side, respectively. These numbers do not incorporate off-street shared-use paths that may run alongside some roadways.

The TSP includes projects to complete the sidewalk gaps or improve existing sidewalk corridors along streets within the planning area, and many of which will be completed with new development (see Chapter 4).

[4] US Census Bureau, 2024 American Community Survey.

FIGURE 10: STREET MILES WITH SIDEWALKS WITHIN CAMAS



PEDESTRIAN LEVEL OF TRAFFIC STRESS EVALUATION

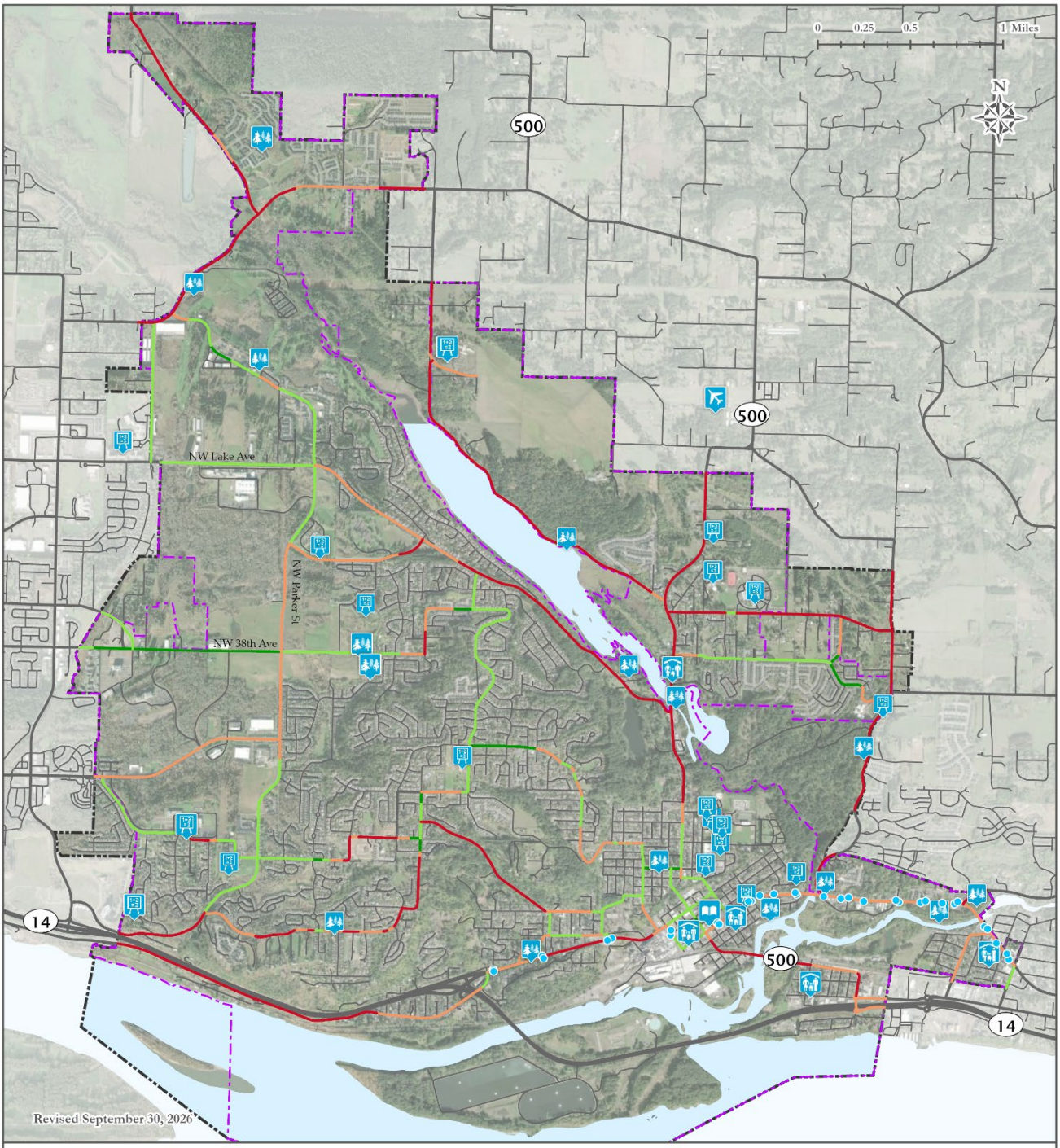
The pedestrian level of traffic stress (LTS) evaluation provides a metric to understand a multimodal user's perception of the safety and comfort of the transportation network. This method was used to understand key gaps and barriers to walking to be addressed through targeted improvements.

The LTS evaluation generates a ranking (i.e., low, moderate, high, or extreme stress) of the relative safety and comfort of a segment or intersection for pedestrians based on roadway and intersection characteristics (e.g., land use context, number of lanes, travel speed and volume, intersection control, type and width of buffer, and the presence and condition of any bicycle or pedestrian facilities). The LTS rating scale recognizes that as vehicle speeds and volumes increase, enhanced pedestrian facilities are needed to maintain a system that is accessible and comfortable for all users.

Results of the pedestrian LTS evaluation without the planned TSP projects on collector and arterial streets are summarized in Figure 11. A pedestrian walking along roughly 46 percent of these streets within the City's planning area will experience a low or moderate level of stress (i.e., LTS 1 or 2). Extreme or high level of stress (i.e., LTS 3 or 4) is experienced along 54 percent of these streets, mainly those with the highest speeds and traffic volumes or those located in high growth areas (i.e., household or employment growth) towards the edges of the city. The pedestrian network in these areas is largely unimproved due to the rural nature of the surrounding land use, but these streets are important for pedestrian travel, so this TSP places a high priority for improvement projects along them.

As redevelopment and frontage improvements occur through 2045, streets will be built to align with the standards outlined in Chapter 3 of this TSP. These standards require high-quality facilities, and an emphasis on safe, convenient, and comfortable travel in alignment with the multimodal level of traffic stress targets outlined in Chapter 3 to contribute towards a network wide lower stress pedestrian experience.

FIGURE 11: PEDESTRIAN LEVEL OF TRAFFIC STRESS



BIKING NETWORK

Bicycling is important for both transportation and recreation in the Camas planning area. This includes people who bike to work and school, recreation, or running errands. Riding bicycles also plays a key role in the transportation system's ability to support healthy and active lifestyles and provide a viable alternative to the automobile. While walking tends to be a competitive choice for trips under half a mile, bicycling tends to be suited for longer trips of three miles or longer.

This TSP includes projects to provide continuous bicycle connections between all key destinations that are essential for safe and attractive non-motorized travel options. It includes bicycle infrastructure that appeals to a wider range of people, both in age and ability. Many people want to bike, but they find riding near traffic in standard bike lanes stressful and unpleasant. This TSP includes a bicycle network of streets with facility standards designed to minimize interactions between people on bikes and car traffic (see Chapter 3 for more information). The network is designed so that everyone is within a quarter mile of one.

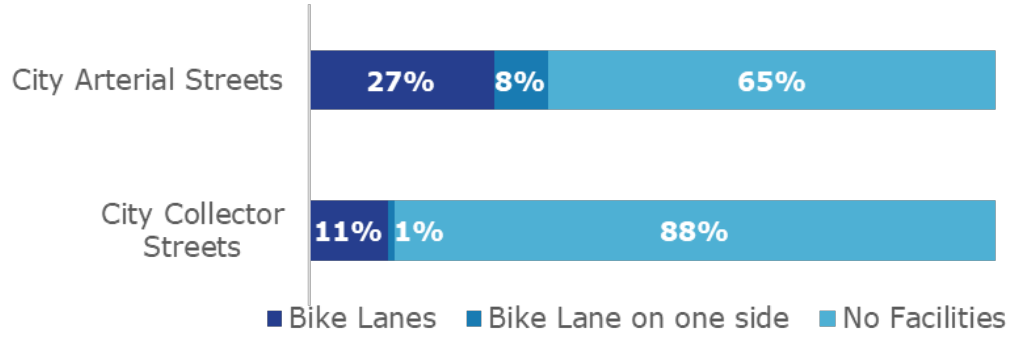
BICYCLE FACILITY GAPS

An inventory of the bicycle network in the City's planning area is provided in Technical Memorandum #2: Existing Conditions Analysis in TSP Volume 2. Significant segments of continuous bicycle lanes exist along portions of NW Lake Road, NW 38th Avenue, NW Parker Street, NW Friberg-Strunk Street, and SR 500, and paved shared-use paths exist along portions of NW Parker Street, NW 18th Avenue, Lacamas Lake, Washougal River, and scattered throughout the residential neighborhoods.

Figure 12 shows that about 65 percent of City arterial street miles and 88 percent of City collector street miles lack bicycle facilities (bike lanes or shoulder bikeways). These gaps are more common along collector streets than arterial streets, at 89 and 73 percent of the street miles with no facilities on one or both sides, respectively. These numbers do not incorporate off-street shared-use paths that may run alongside some roadways.

The TSP includes projects to complete the bikeway gaps or improve existing bike facilities along streets within the planning area, and many of which will be completed with new development (see Chapter 4).

FIGURE 12: STREET MILES WITH BIKE FACILITIES WITHIN CAMAS



BICYCLE LEVEL OF TRAFFIC STRESS EVALUATION

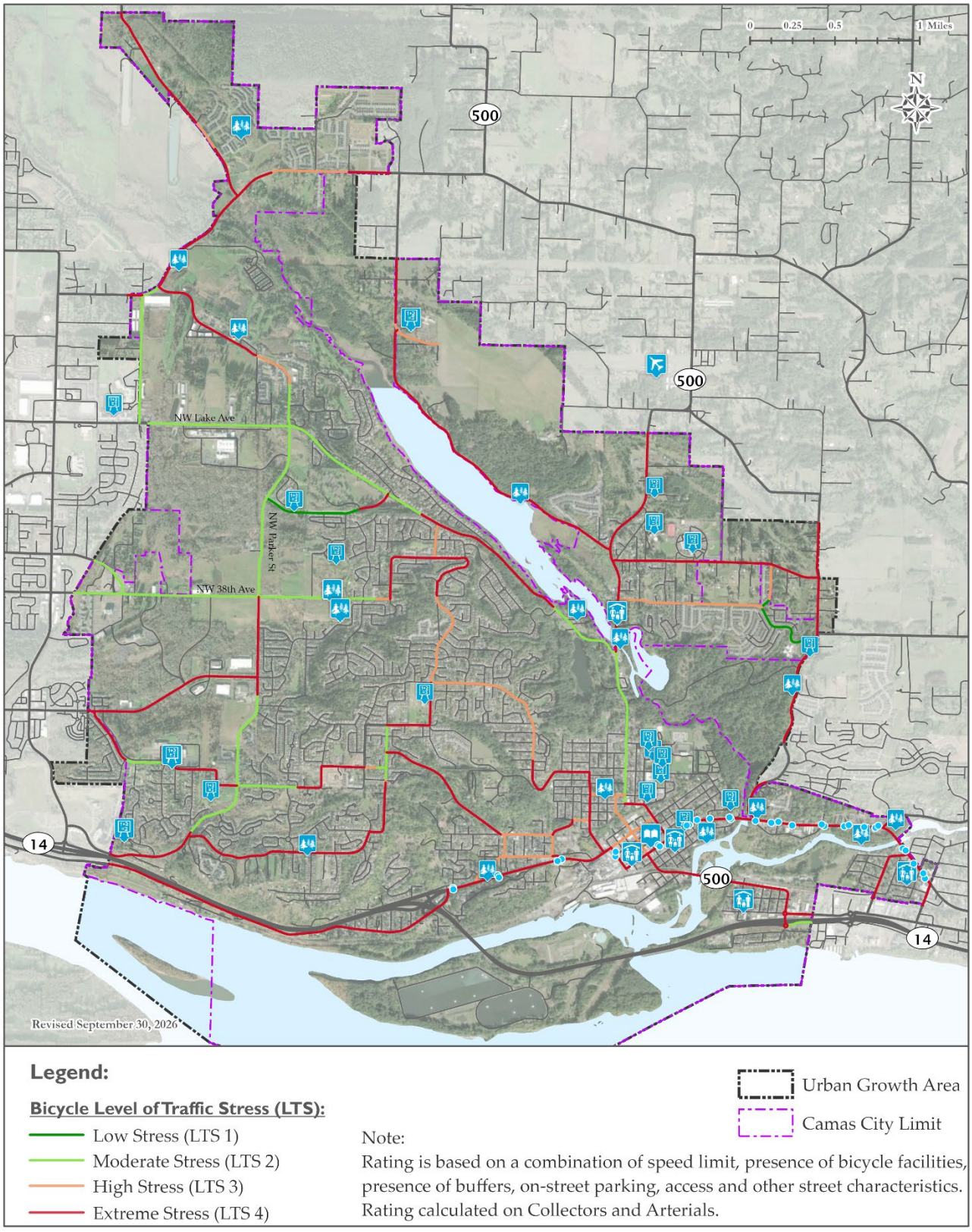
The bicycle level of traffic stress (LTS) evaluation provides a metric to understand a cyclist's perception of the safety and comfort of the transportation network. This method was used to understand key gaps and barriers to biking to be addressed through targeted improvements.

The LTS evaluation generates a ranking (i.e., low, moderate, high, or extreme stress) of the relative safety and comfort of a segment or intersection for bicyclists based on roadway and intersection characteristics (e.g., land use context, number of lanes, travel speed and volume, intersection control, type and width of buffer, and the presence and condition of any bicycle or pedestrian facilities). The LTS rating scale recognizes that as vehicle speeds and volumes increase, enhanced bicycle facilities are needed to maintain a system that is accessible and comfortable for all users.

Results of the bicycle LTS evaluation without the planned TSP projects on collector and arterial streets are summarized in Figure 13. A bicyclist riding along roughly 35 percent of these streets within the City's planning area will experience a low or moderate level of stress (i.e., LTS 1 or 2). This is generally representative of the many low volume and speed local streets, which are reasonably comfortable for bicycling today. In contrast, an extreme or high level of stress (i.e., LTS 3 or 4) is experienced along 65 percent of these streets, mainly those with the highest speeds and traffic volumes and lack of separated bicycle facilities. This includes portions of NW 6th Avenue, NE 3rd Avenue, and SR 500. These streets are important for bicycle travel, so this TSP places a high priority for improvement projects along them.

As redevelopment and frontage improvements occur through 2045, streets will be built to align with the standards outlined in Chapter 3. These standards require high-quality facilities, and an emphasis on safe, convenient, and comfortable travel, and align with the multimodal level of traffic stress targets outlined in Chapter 3 to contribute towards a network wide lower stress bicycle experience.

FIGURE 13: BICYCLE NETWORK ASSESSMENT



TRANSIT

C-TRAN provides transit service in Camas via one fixed bus route connecting the City with Vancouver and Washougal. Transit riders can transfer to other C-TRAN routes at the Fisher's Landing Transit Center in Vancouver. Figure 14 shows the route in Camas.

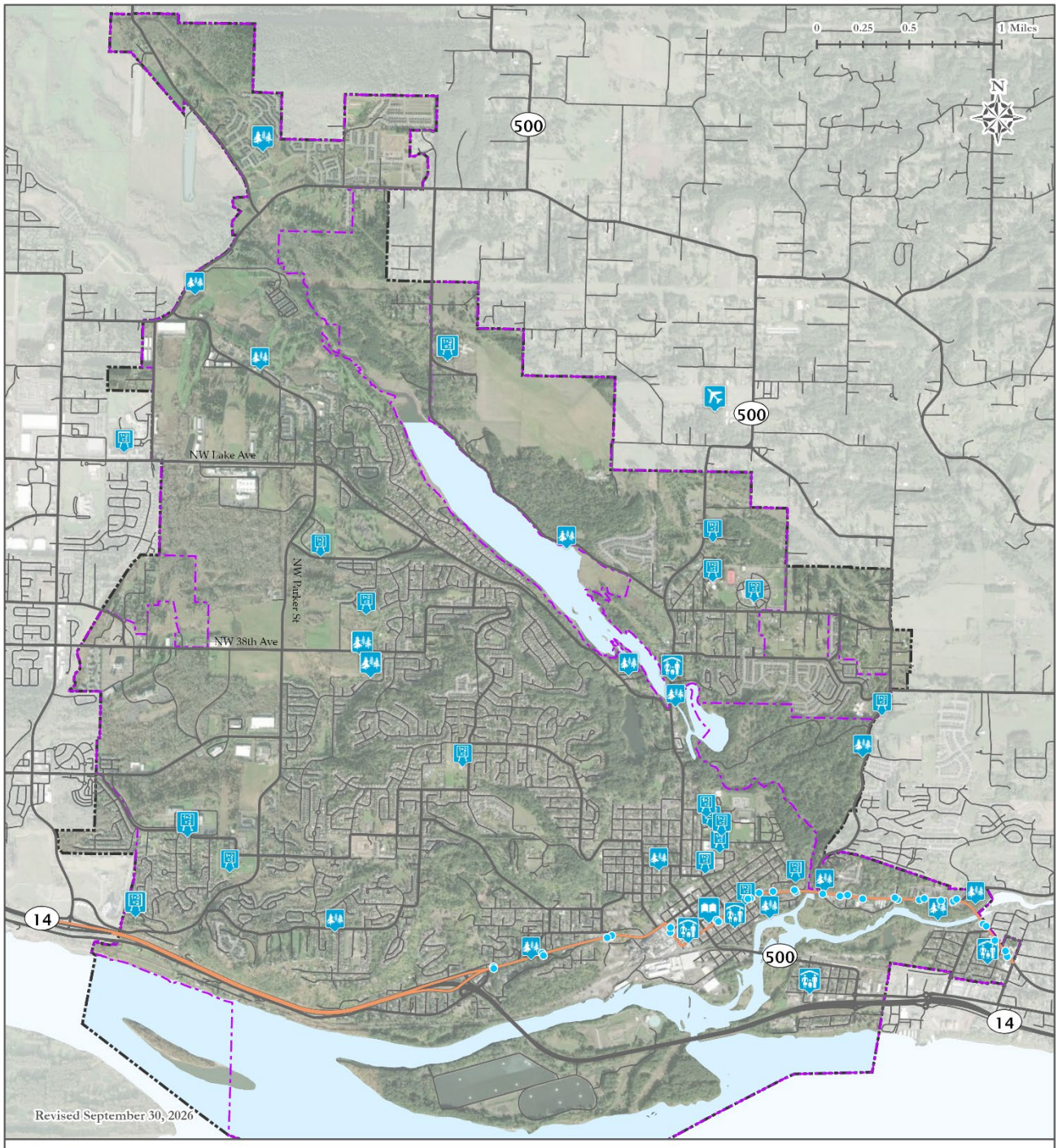
Bus stops in Camas are located along NW 6th Avenue near the SR 14 Ramps, NW Ivy Street, and NW Drake Street intersections, at the NE Adams Street / NE 5th Avenue, and along NE 3rd Avenue near the NE Franklin Street, NE Joy Street, NE 3rd Place, E. 1st Avenue, SE Crown Road, NE Summer Street, NE 3rd Loop, NE Shepherd Road, NE 2nd Avenue, NE Weir Street and NE Lechner Street intersections.

Each of the bus-stops are signed and the eastbound stop along NW 6th Avenue near the SR 14 Ramps provides a bus pull-out. The bus stop along NE 3rd Avenue at NE Franklin Street (near Camas City Hall) provides a bench and shelter. All remaining bus stops have no amenities. Most transit users in the city are more than a half-mile from a bus stop. A park-and-ride facility is located along SE Tampa Street, near the SE 8th Avenue / SE Union Street intersection. However, the park-and-ride is currently served by only the Connector service and not a fixed route.

The Camas/Washougal C-TRAN route travels through Camas eastbound and westbound approximately every half-hour to hour between 6:00 AM and 9:30 PM on weekdays. Service on weekends is provided approximatively every hour between 8:00 AM and 9:30 PM.

Key destinations along this route include Forest Home Park, Georgia Pacific, downtown Camas, Camas Municipal Center, Safeway, Louis Bloch Park, Washougal River Greenway, Camas Police Department, and the Lacamas Center. C-TRAN buses are equipped with a lift to allow for wheelchair access and include bicycle racks.

FIGURE 14: TRANSIT SYSTEM



CHAPTER 3.

Facility and Performance Standards

Camas applies transportation standards and regulations to the construction of new transportation facilities and to the operation of all facilities to ensure they are designed appropriately, and the system functions as intended. These standards enable consistent future actions that reflect the goals and policies of the City.

STREET JURISDICTION

Roadway ownership and maintenance responsibilities depend on the roadway authority. In addition, required design and operation standards for each street and intersection vary by agency.

WSDOT, the Federal Government, and RTC also classify roadways in Camas. Within Camas, SR 14 is classified by WSDOT as a Highway of Statewide Significance (HSS)[5], and SR 500 is classified as a non-HSS facility.

The federal government also has a functional classification system that is used to determine federal aid funding eligibility. Roadways federally designated as a major collector, minor arterial, principal arterial, or interstate are eligible for federal aid. Camas' functional classification system uses the similar designations as the federal government (e.g., a city designated arterial is intended to be the same as a federally designated minor arterial and a city designated collector is intended to be the same as a federally designated major collector). Future updates to the federal functional classification system should incorporate the designations reflected in the Transportation Plan along City roadways.

RTC has identified several streets in Camas as part of the regional transportation system in the Regional Transportation Plan for Clark County, including SR 14, SR 500, Lake Road - SE 1st Street, Parker Street, Pacific Rim Boulevard - 34th Street, NW 38th Avenue – SE 20th Street, NW 6th Avenue, and NE 3rd Avenue.

NETWORK CLASSIFICATIONS AND AREA DESIGNATIONS

All streets in the TSP planning area include classifications and area designations to help support the movement of all people and help to ensure the transportation system is comfortable, convenient, safe and well connected for all users (see Figure 15). These include functional classifications for vehicle travel and designations for mixed-use, residential, commercial, and industrial areas. The classifications and area designations combine to determine the minimum acceptable facility type and design requirements of different elements for each mode.

[5] Highways of Statewide Significance, WSDOT, http://www.wsdot.wa.gov/planning/HSS/

FIGURE 15: NETWORK CLASSIFICATIONS AND ROUTE DESIGNATIONS



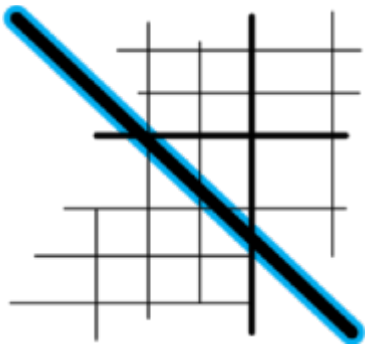
STREET FUNCTIONAL CLASSIFICATIONS

Functional classification for streets helps support the movement of vehicles and bicycles and is an important tool for managing the roadway network. The street functional classification system recognizes that individual streets do not act independently of one another but instead form a network that serves travel needs on a regional, citywide, neighborhood, and local level. By designating the management and design requirements for each roadway classification, this hierarchal system supports a network of streets that perform as desired.

The street functional classification system for roadways in the City's planning area is described below. From highest to lowest intended use, the classifications are Freeway, Arterial, Collector, Neighborhood Route, and Local Streets. The functional classification map (Figure 15) shows the designated classification for all roadways in the City's planning area, including new street extensions proposed as part of this plan (see Chapter 4). For a street cross-section, the functional classification determines the minimum number of vehicle travel way lanes, bike facility, and on-street parking requirements.

Freeway

Freeways serve as the main travel routes through the City and serve the highest volume of motor vehicle traffic. Freeways are generally for longer motor vehicle trips with limited local access. SR 14 is the only freeway in Camas.

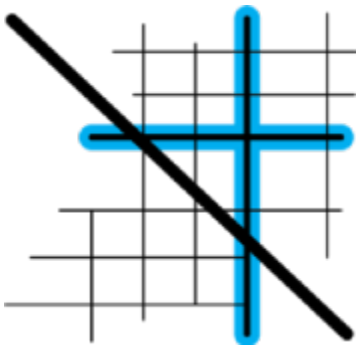


Arterial Street

Arterial Streets are primarily intended to serve regional and citywide traffic movement. Arterials provide the primary connection to other Arterial Streets or Collector Streets. They are typically spaced about one mile apart to assure accessibility and reduce the occurrence of

through traffic using collectors or local streets in lieu of a well-placed arterial street. Where an Arterial Street intersects with a Local Street, access management and/or turn restrictions may be employed to reduce traffic delay, while not adversely impacting safety and convenience for other modes. They often serve high volumes of traffic (>10,000 daily vehicles) over long distances and minimize direct access to adjacent land to support the safe and efficient movement of people and goods.

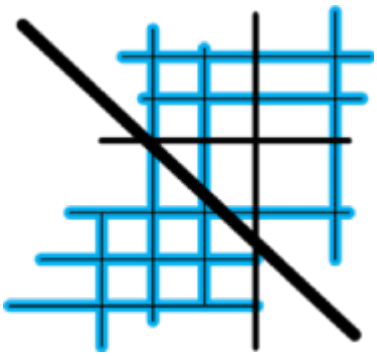
Collector Street



Collector Streets are intended to distribute traffic from Arterials Streets to streets of the same or lower classification. They provide both access and circulation within and between residential and non-residential areas. Collectors differ from arterials in that they provide more of a citywide circulation function, do not require as much access control compared to arterials, and they serve residential neighborhoods, distributing trips from the neighborhood and local street system.

Collectors generally support traffic volumes typically ranging up to 10,000 daily vehicles and speeds often managed between 25 mph and 35 mph.

Local Street



All streets not classified as Arterial or Collector are classified as Local streets. Local streets prioritize providing immediate access to adjacent land and often function as through routes for pedestrians and bicyclists. These streets should be designed to enhance the livability of neighborhoods and can generally accommodate up to 1,500 vehicles per day. A well-connected grid system of relatively short blocks can minimize excessive volumes of motor vehicles, limit out-of-direction travel, and encourage walking and biking. They should be provided at a maximum spacing of 600 feet in most cases. Speeds are not normally posted, with a statutory 25 mph speed limit in effect. Local streets are not intended to support long distance vehicular travel and are often designed to discourage through traffic without an origin or destination in the immediate area.

AREA DESIGNATIONS

To complement the street functional classifications, area designations for mixed-use, residential, commercial, and industrial areas are identified. The area designation map (Figure 15) shows the designated area type for all roadways in the City's planning area, including new street extensions proposed as part of this plan (see Chapter 4). The designations are used to determine how users of a roadway interact with the surrounding land use. Since the type and intensity of adjacent land uses and zoning directly influence the level of use by pedestrians, bicyclists and transit riders, the design of a street (including its intersections, sidewalks, and transit stops) should reflect its

surroundings. The area designations balance street functional classification, adjacent land use, zoning designation and the competing travel needs by prioritizing various design elements.

Mixed-Use Area

Mixed-use areas typically have a higher amount of pedestrian activity and are often on a transit route. These streets emphasize a variety of travel choices such as pedestrian, bicycle and transit use to complement the development along the street. Since mixed-use streets typically serve pedestrian oriented land uses, walking should receive the highest priority of all the travel modes. They should be designed with features such as wider sidewalks, pedestrian amenities, transit amenities, attractive landscaping, on-street parking, pedestrian crossing enhancements and bicycle lanes.

Residential Area

Residential areas consist mostly of households, although various small shops may be embedded within the neighborhood. These are areas that often connect to local parks, schools, and mixed-use areas. They should be designed to emphasize walking, while still accommodating the needs of bicyclists and motor vehicles. A high priority should be given to design elements such as traffic calming, landscape buffers, walkways/pathways/trails, on-street parking, and pedestrian safety enhancements.

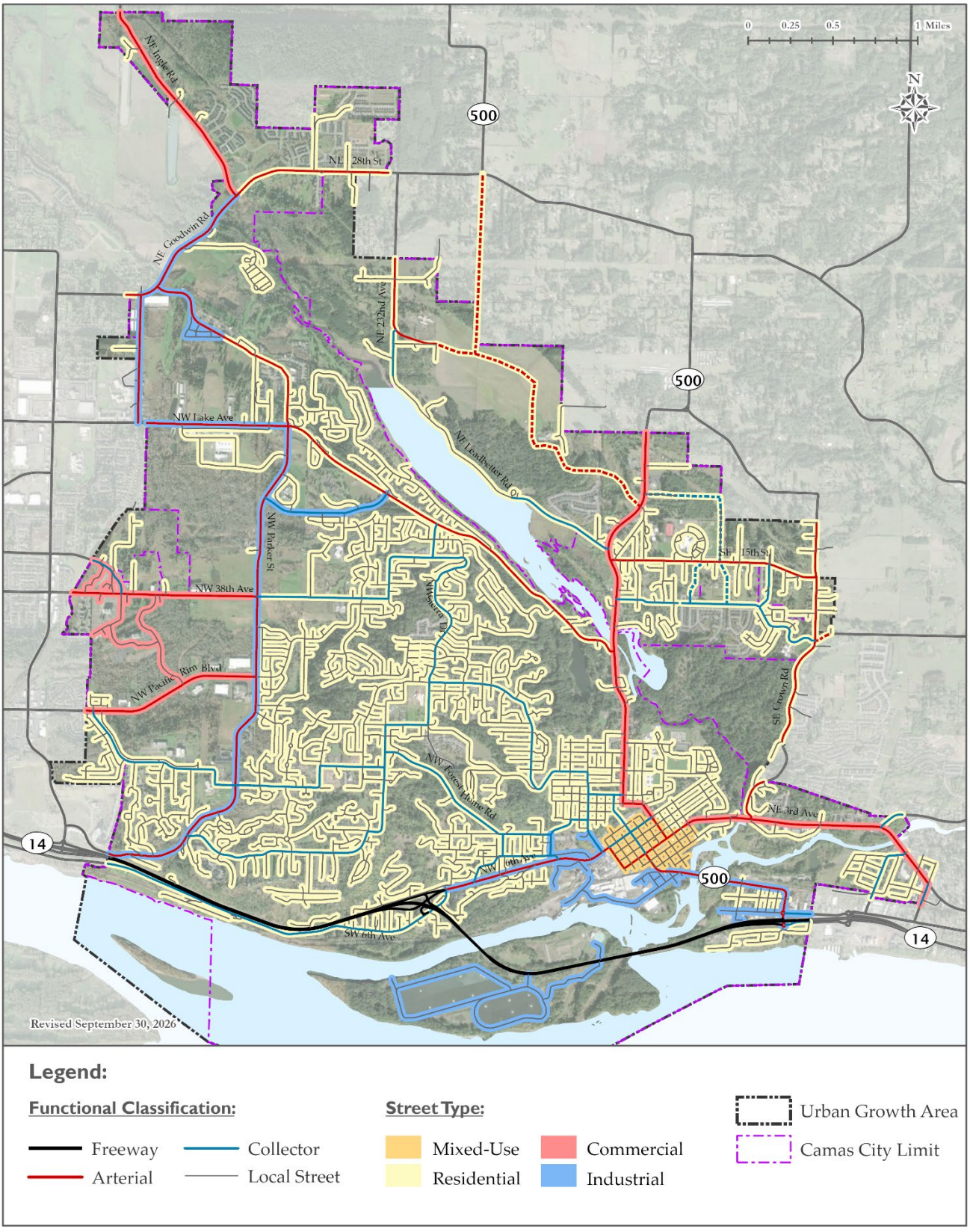
Commercial Area

Commercial areas are primarily lined with retail and large employment complexes. These uses serve customers throughout the City and region and may not have a direct relationship with nearby residential neighborhoods. These areas are somewhat more auto oriented but should still accommodate pedestrians and bicyclists safely and comfortably. Design features should include landscaped medians or a two-way left turn lane, sidewalks and bike lanes, pedestrian crossing enhancements and a buffer between the roadway and the sidewalk. On-street parking should be discouraged.

Industrial Area

Industrial areas accommodate a high volume of large vehicles such as trucks, trailers and other delivery vehicles. Pedestrians and bicyclists may be less frequent in these areas but should still be accommodated safely and comfortably. Roadway widths are typically wider to accommodate larger vehicles. On-street parking should be discouraged.

FIGURE 16: STREET FUNCTIONAL CLASSIFICATIONS AND AREA DESIGNATIONS



TYPICAL STREET CROSS-SECTIONS

The design of the streets in the City's planning area is based on the network classifications and area designation. All streets in the planning area are multimodal and include travel lanes and on-street parking for vehicles, sidewalks for pedestrians, and on-street or separated facilities for bicyclists. Accommodating these modes varies by the functional classification and area designations. These cross-section standards identify the design characteristics needed to meet the function and demand for each facility type for streets in the City's planning area. Since the actual design of a roadway can vary from segment to segment due to adjacent land uses and demands, this system allows standardization of key characteristics to provide consistency. Typical cross-section requirements are provided in Table 3, and several typical cross-sections examples have been highlighted below in Figure 17 through Figure 19.

The following method shall be used to determine the design of new streets and the reconstruction or improvement of existing streets.

Use the following steps to determine the typical standards that apply to a roadway:

1. Confirm the functional classification and area designation that apply using **Figure 16**.
2. Use **Table 3** to determine the typical cross-section requirements, based on the functional classification and area designation.
3. Combine the elements to determine the typical cross-section. Examples are provided in **Figure 17** through **Figure 19**.

TABLE 3: TYPICAL STREET CROSS-SECTION REQUIREMENTS

		AREA DESIGNATION			
		MIXED-USE	RESIDENTIAL	COMMERCIAL	INDUSTRIAL
SIDEWALK WIDTH (ALL STREETS) *		14 ft.	12 ft.	11 ft.	11 ft.
PEDESTRIAN THROUGHWAY ZONE		*8 ft.*	*6 ft.*	*6 ft.*	*6 ft.*
FURNISHINGS/ LANDSCAPE ZONE		*4.5 ft.*	*4.5 ft.*	*4.5 ft.*	*4.5 ft.*
EDGE (CURB AND CLEARANCE)		*1.5 ft.*	*1.5 ft.*	*0.5 ft.*	*0.5 ft.*
BIKE FACILITY	Arterial Street	7 ft. Buffered Bike Lanes (includes 2 ft. buffer) **			
	Collector Street	6 ft. Bike Lanes **			
	Local Street	Shared with Travel Lane			
ON-STREET PARKING WIDTH (ALL STREETS)		8 ft	8 ft	None	None
TYPICAL THROUGH LANES (ALL STREETS)		2	2	2 to 4 ***	2 to 4 ***
TRAVEL LANE WIDTH	Arterial Street	11 ft.	11 ft.	12 ft.	12 ft.
	Collector Street	11 ft.	11 ft.	12 ft.	12 ft.
	Local Street	10 ft.	10 ft.	12 ft.	12 ft.
MEDIAN/ TURN LANE WIDTH	Arterial Street	11 ft. left turn lane at intersections	11 ft. left turn lane at intersections	14 ft. median/ center turn lane	14 ft. center turn lane
	Collector Street	None	None	12 ft. left turn lane at intersections	12 ft. center turn lane
	Local Street	None	None	None	None
TYPICAL STREET WIDTH ****	Arterial Street	52 ft	52 ft	52 to 76 ft	52 to 76 ft
	Collector Street	50 ft	50 ft	48 ft	48 ft
	Local Street	36 ft	36 ft	24 ft	24 ft
TYPICAL RIGHT OF WAY	Arterial Street	80 ft.	76 ft.	74 to 98 ft.	74 to 98 ft.
	Collector Street	78 ft.	74 ft.	70 ft.	70 ft.
	Local Street	64 ft.	60 ft.	46 ft.	46 ft.

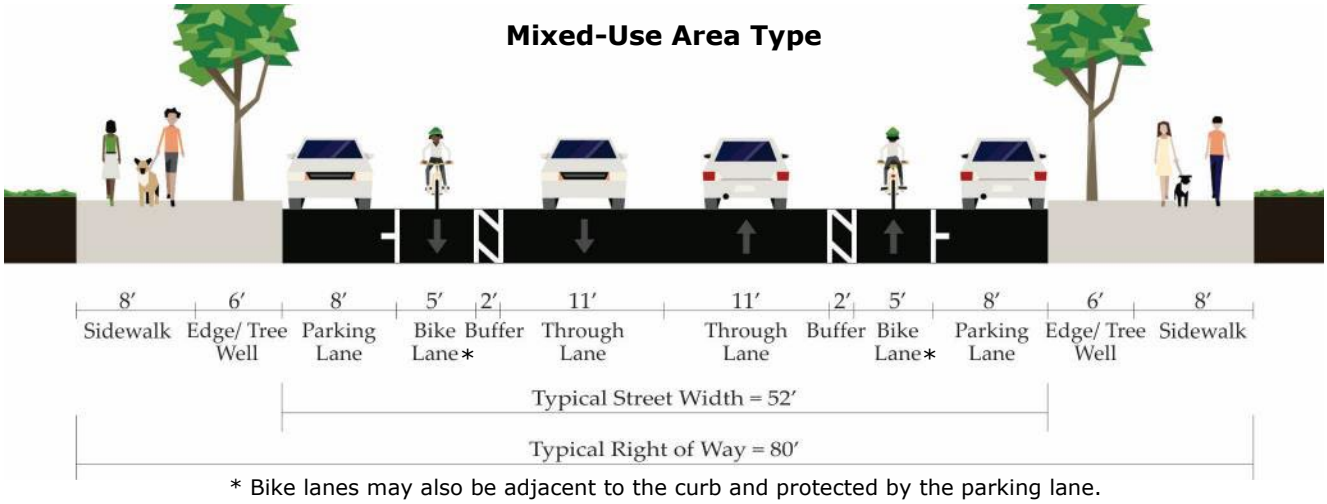
Notes: Flexibility in street sections may be allowed for development when deemed to provide overall additional public enhancements, as determined by the City Engineer or City Engineer's designee.

* Sidewalk may meander and include varying materials and/or color, and the landscape zone may need to be increased based on the types of trees that are to be installed (i.e., 4 ft. for a small tree, 6 ft. for a medium tree and 8 ft. for a large tree, as determined by the City Engineer or City Engineer's designee.

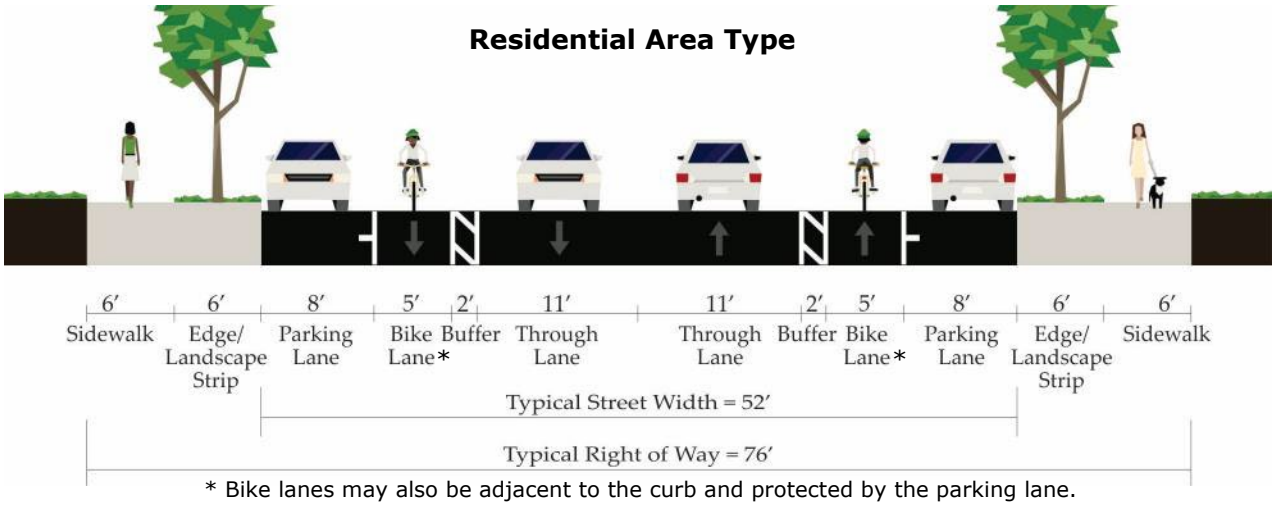
** Bike lane may also be adjacent to the curb and protected by the parking lane

*** Up to four lanes on arterial streets only in commercial and industrial areas. Any roadway exceeding three lanes must include protected bike facilities.

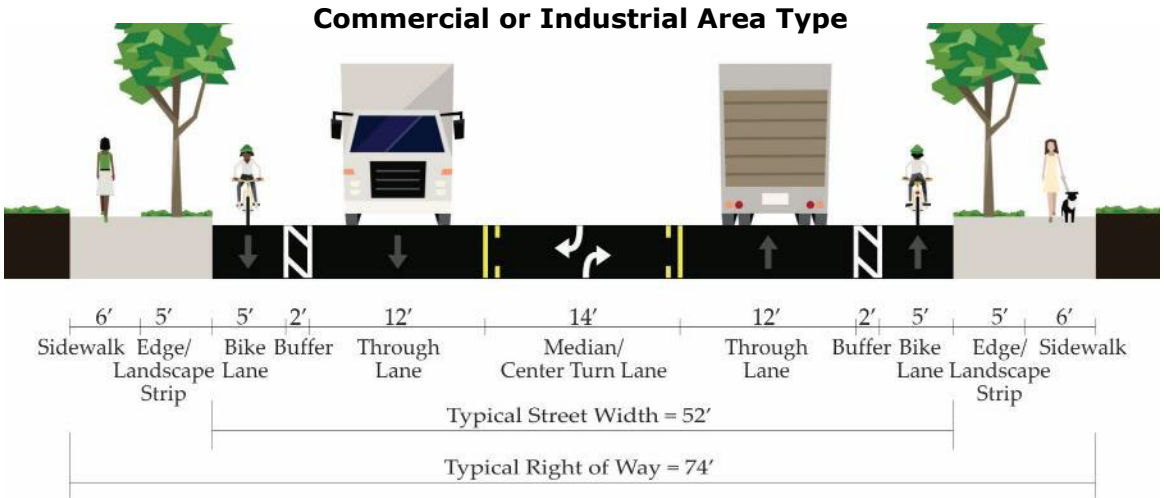
FIGURE 17: TYPICAL CROSS-SECTION FOR ARTERIAL STREET BY AREA TYPE



* Bike lanes may also be adjacent to the curb and protected by the parking lane.
Note: Any roadway exceeding three lanes must include protected bike facilities.

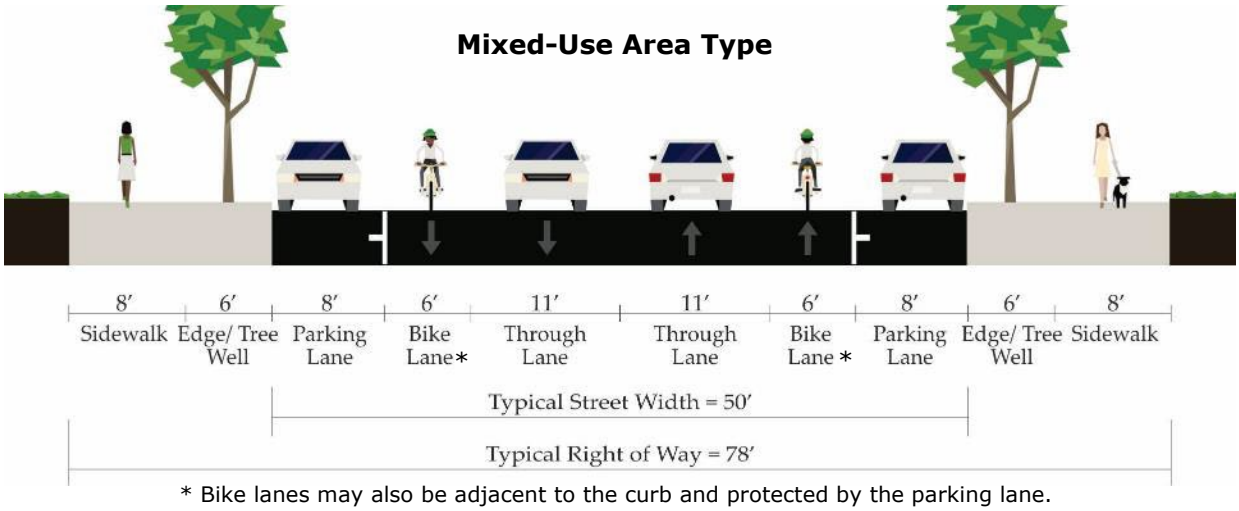


* Bike lanes may also be adjacent to the curb and protected by the parking lane.
Note: Any roadway exceeding three lanes must include protected bike facilities.

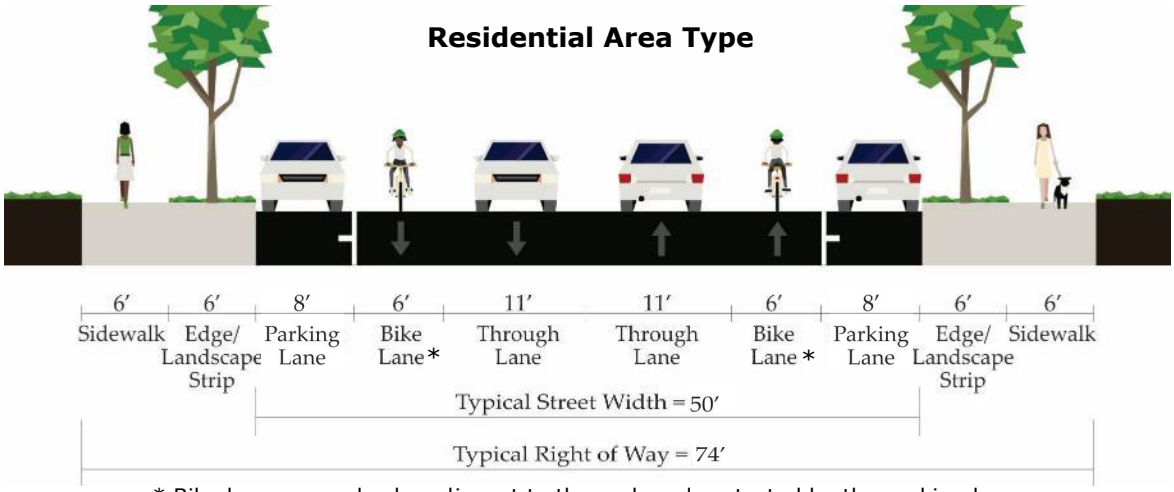


Note: Any roadway exceeding three lanes must include protected bike facilities.

FIGURE 18: TYPICAL CROSS-SECTION FOR COLLECTOR STREET BY AREA TYPE



* Bike lanes may also be adjacent to the curb and protected by the parking lane.



* Bike lanes may also be adjacent to the curb and protected by the parking lane.

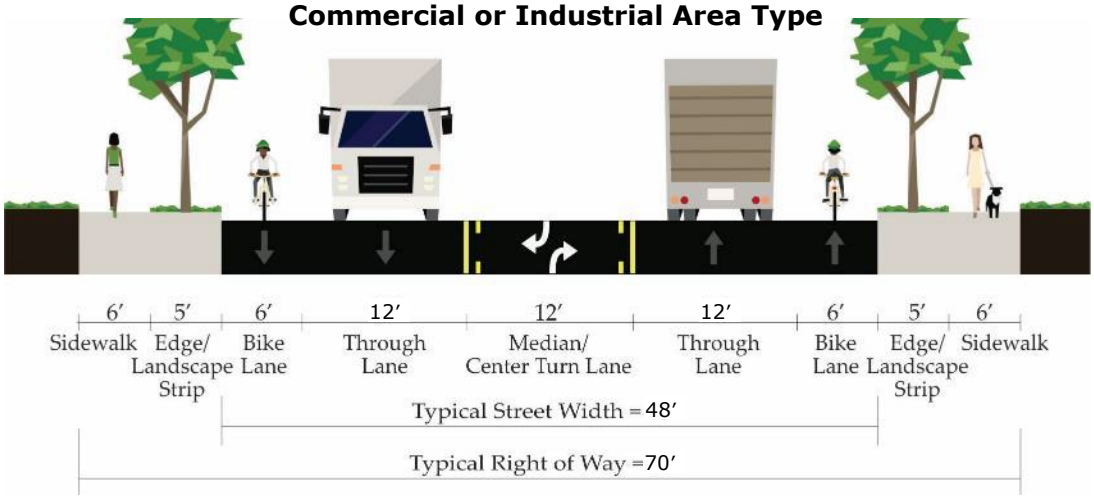
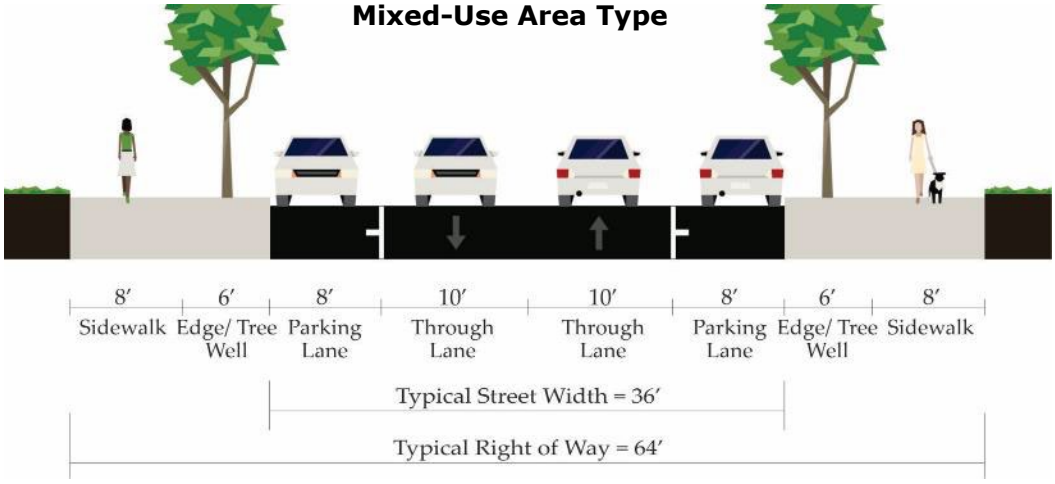
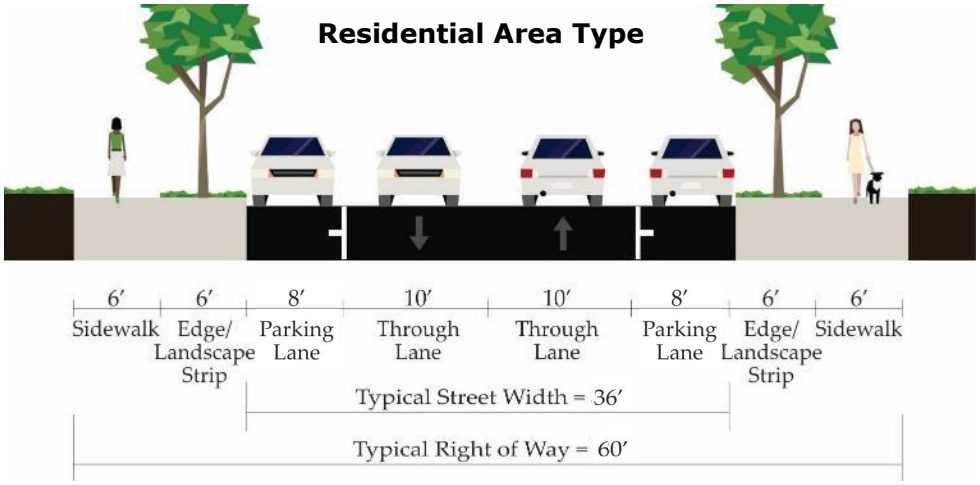
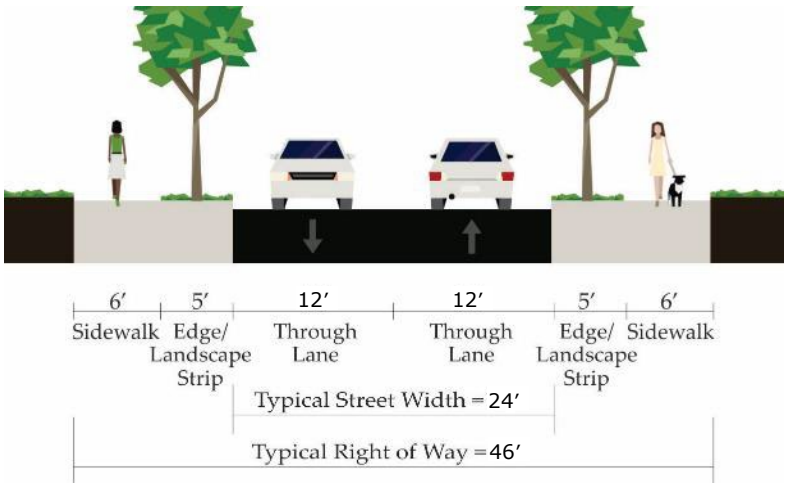


FIGURE 19: TYPICAL CROSS-SECTION FOR LOCAL STREET BY AREA TYPE







CONSTRAINED STREET CROSS-SECTIONS

The typical designs are intended to be implemented in newly developing or redeveloping areas of the City's planning area, where constrained conditions do not limit the ability to construct the typical cross-section. A variety of physical and natural constraints may prevent adherence to the multimodal network design requirements in this chapter. Typical design constraints include:

- Infill sites
- Innovative designs (e.g., roundabouts)
- Reallocation of right-of-way between modes (e.g., narrow travel lanes to accommodate wider bike lanes)
- Severe constraints presented by topography, environmental, or other resources present
- Existing developments and/or buildings that make it extremely difficult or impossible to meet the standards

A deviation to the street standards may be requested from the City Engineer or City Engineer's designee with justification of constraints to consider a constrained cross-section or other adjustments. The minimum acceptable cross-section configuration is shown in Table 4.

TABLE 4: CONSTRAINED ACCEPTABLE STREET CROSS-SECTION

	ARTERIAL STREET	COLLECTOR STREET	LOCAL STREET
SIDEWALK WIDTH (ALL AREA DESIGNATIONS)	10.5 ft.	9.5 ft.	9.5 ft.
PEDESTRIAN THROUGHWAY ZONE	*6 ft.*	*5 ft.*	*5 ft.*
FURNISHINGS/ LANDSCAPE ZONE	*4 ft.*	*4 ft.*	*4 ft.*
EDGE (CURB AND CLEARANCE)	*0.5 ft.*	*0.5 ft.*	*0.5 ft.*
BIKE FACILITY (ALL AREA DESIGNATIONS)	6 ft. Bike Lanes	5 ft. Bike Lanes; or Bikeway on Adjacent Corridor	Shared with Travel Lane
ON-STREET PARKING WIDTH (ALL AREA DESIGNATIONS)	None	None	None
TYPICAL THROUGH LANES (ALL AREA DESIGNATIONS)	2	2	2
TRAVEL LANE WIDTH (ALL AREA DESIGNATIONS)	11 ft.	10 ft.	10 ft.
MEDIAN/ TURN LANE WIDTH (ALL AREA DESIGNATIONS)	As Needed	As Needed	None

SIDEWALKS

Sidewalks provide for pedestrian movement and access, enhance connectivity, and promote walking. The requirements for pedestrian facilities in the City's planning area promote superior sidewalk design and encourage walking by making it more attractive. The area designations determine pedestrian facility design treatments along streets, including the width of the throughway for pedestrians, and the buffer between the vehicle travel way.

The sidewalk encompasses three zones (as shown in Figure 20), including the frontage, pedestrian throughway, and furnishings/ landscape. The minimum configuration for each of these zones is provided in Table 2. Wider widths may be considered as conditions warrant. For example, if a tree requires a wider area, the width of the landscape zone may be increased.

FIGURE 20: SIDEWALK ZONES



- The **frontage zone** describes the section where a pedestrian interacts with the adjacent buildings or private property and includes entryways and outdoor seating. This zone is typically between 1 and 3 feet wide in mixed-use areas (i.e., to accommodate outdoor seating in commercial areas or building access in residential areas) and ½ foot in other areas, and it may include a concrete or natural surface depending on the adjacent land use. The adjoining development may elect to expand this zone with additional space provided outside of and adjacent to the street right-of-way.

- The **pedestrian throughway zone** is the accessible zone in which pedestrians travel. It includes a minimum eight-foot-wide clear throughway in mixed-use areas, and six-feet wide clear throughway along streets with a Residential, Commercial, or Industrial area designation.

- The **furnishings/ landscape zone** is the sidewalk section located between the pedestrian throughway and the curb, and includes street furnishings or landscaping (e.g., benches, lighting, bicycle parking, tree wells, and/or plantings). If adjacent to on-street parking, it should also include a clearance distance between any curbside parking and the street furnishing area or landscape strip (i.e., so vehicles parking, or opening doors do not interfere with street furnishings and/or landscaping). Streets located along a transit route should incorporate furnishings to support transit ridership, such as transit shelters and benches,

into the furnishings/landscape strip. It should include a minimum width between 5 to 6 feet, depending on the area designation.

BICYCLE FACILITIES

Streets should be safe and comfortable for bicyclists of all ages and abilities to encourage ridership. Building high quality bicycle infrastructure can help the City work towards achieving improved safety and public health, reduced congestion, and more equitable access.

The typical bicycle facilities shown in Table 3 and Figure 17 through Figure 19**.** for each area designation are determined based on a street's design and motor vehicle traffic conditions (i.e., expected vehicle speeds and volumes). When bike facilities are routed along the lowest speed and volume streets (i.e., streets with a Local functional classification), shared streets are typical. When the bike facilities are routed on busier or faster streets (i.e., streets with an Arterial or Collector functional classification), on-street bike lanes, which may be buffered or protected from the vehicle travel way, are typical. These may be separated from the vehicle travel way by a painted buffer and include vertical or horizonal protection, like bollards, planter boxes, curbs, or parked cars. These facilities include buffered bike lanes, cycle tracks, or shared-use paths.

Table 3 and Figure 17 through Figure 19 show the minimum bicycle facilities for streets in the City's planning area. Regardless of the area designation, Arterial Streets require 7-foot buffered bike lanes (i.e., 5-foot bike lane with 2-foot buffer), Collector Streets require 6-foot bike lanes, while Local Street typically have no on-street bike facility (i.e., bikes share the travel way with vehicular traffic). The bike lane on Arterial and Collector streets may also be adjacent to the curb and protected by the parking lane.

In general, streets with motor vehicle volumes over 3,000 per day should include conventional bike lanes at a minimum. When daily motor vehicle volumes exceed 6,000, buffered or protected bike lanes are desired. In any case, if motor vehicle travel speeds exceed 35 miles per hour, buffered or protected bicycle facilities are desired. In general, facilities that are protected or separated from the vehicle travel way include a 12-foot two-way or 6-foot one-way cycle track, 12-foot shared use path, or 7-foot buffered bike lanes. Non-separated bike lanes should be a minimum of 6-feet wide, while shared streets should include shared lane markings, with vehicle speed and volume management.

SEPARATED PEDESTRIAN AND BICYCLE FACILITIES

Some pedestrian and bicycle facilities may be separated from the right-of-way of a street, and include pedestrian trails, pedestrian, and bicycle accessway paths, and shared use paths. These facilities serve a variety of recreational, and transportation needs for pedestrians and bicyclists.

PEDESTRIAN TRAIL

Pedestrian trails offer recreational opportunities for pedestrians and are typically located in parks or natural areas. They should include a minimum width of 6 feet and may include a hard or soft surface.

ACCESSWAY PATH

Accessways provide short path segments between disconnected streets or localized recreational walking and biking opportunities. To allow for both pedestrian and bicycle travel, the accessway path must be on public easements or rights-of-way and have minimum paved surface of 10 feet, with a 2-foot shoulder on each side, and 14 feet of right-of-way. For low use segments, an accessway can be as narrow as 8 feet wide, with a 2-foot shoulder on each side and a total right-of-way of 12 feet.

Narrower widths with a minimum paved surface of 5 feet, with a 2-foot shoulder on each side, and 9 feet of right-of-way are acceptable for an accessway serving pedestrian access only (i.e., no bicycles).

SHARED USE PATH

Shared-use paths provide longer distance off-roadway facilities for walking and biking. Depending on their location, they can serve both recreational and citywide circulation needs. Shared-use path designs vary in surface types and widths. Hard surfaces are generally better for bicycle travel. Widths need to provide ample space for both walking and biking and should be able to accommodate maintenance vehicles.

To allow for both pedestrian and bicycle travel a shared-use path should typically be at least 12 feet wide, with a 2-foot shoulder on each side, and 16 feet of right-of-way (see Figure 21). In areas with a low amount of walking or biking demand, the path can be 6 feet wide, with a 2-foot shoulder on each side and a total right-of-way of 10 feet (see Figure 22).

FIGURE 21: TYPICAL DESIGN FOR REGIONAL SHARED-USE PATHS

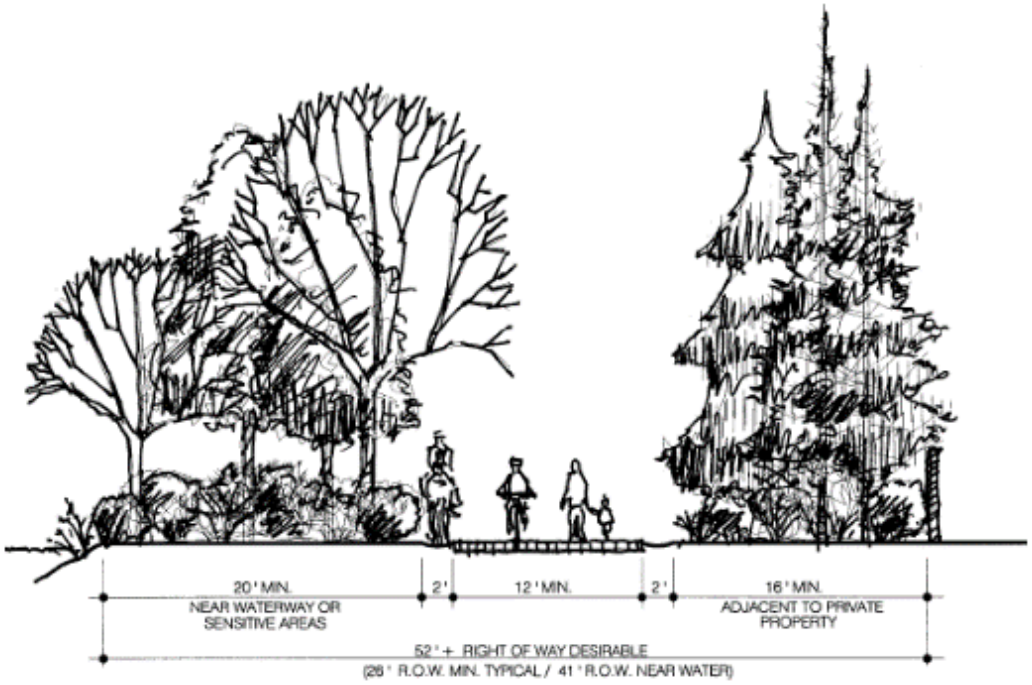
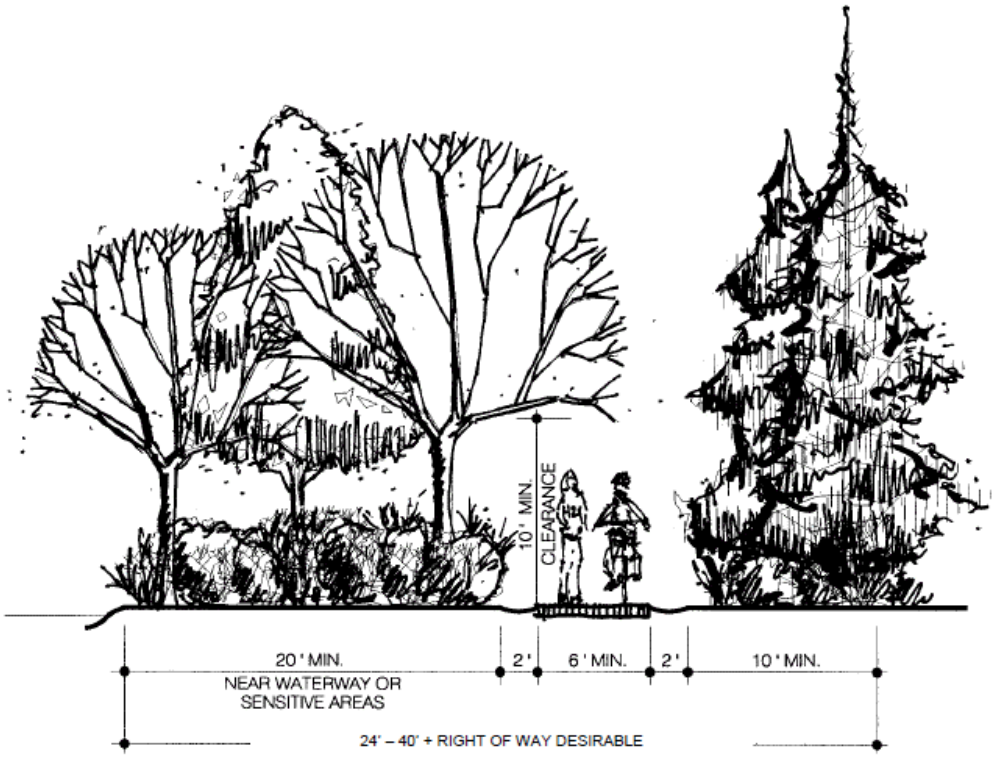


FIGURE 22: TYPICAL DESIGN FOR LOCAL SHARED-USE PATHS



PERFORMANCE STANDARDS

Performance standards are applied to the operation and design of transportation facilities to ensure that the network functions as intended. In Camas, this includes performance standards for vehicles, pedestrians, bicyclists and overall system connectivity.

VEHICLE CONGESTION THRESHOLDS

Mobility targets for streets and intersections in Camas provide a metric for assessing the impacts of new development on the existing transportation system and for identifying where capacity improvements may be needed. They are the basis for requiring improvements needed to sustain the transportation system as growth and development occur. Two methods used to gauge operational conditions for motor vehicles include volume-to-capacity (v/c) ratios and level of service (LOS).

- Volume-to-capacity (v/c) ratio: A v/c ratio is a decimal representation (between 0.00 and 1.00) of the proportion of capacity that is being used at a turn movement, approach leg, or intersection. It is determined by dividing the peak hour traffic volume by the hourly capacity of a given intersection or movement. A lower ratio indicates smooth operations and minimal delays. As the ratio approaches 1.00 (generally above 0.70), congestion noticeably increases, and performance is reduced. If the ratio is greater than 1.00, the turn movement, approach leg, or intersection is oversaturated and usually results in excessive queues and long delays.

- Level of service (LOS): LOS is a "report card" rating (A through F) based on the average delay experienced by vehicles at the intersection. LOS A, B, and C indicate conditions where traffic moves without significant delays over periods of peak hour travel demand. LOS D and E are progressively worse operating conditions. LOS F represents conditions where average vehicle delay is excessive and demand exceeds capacity, typically resulting in long queues and delays.

This TSP includes performance standards for motor vehicles. A LOS "D" and a v/c ratio not higher than 0.85 is the minimum performance standard during the highest one-hour period of the day for signalized, all-way stop and roundabout controlled intersections under City jurisdiction. These standards shall be applied to the intersection as a whole.

A LOS "E" and a v/c ratio not higher than 0.90 is the minimum performance standard during the highest one-hour period of the day for two-way stop and yield controlled intersections under City jurisdiction. These standards shall be applied to all intersection approaches serving more than 20 vehicles. Mobility standards do not apply to approaches at intersections serving 20 vehicles or fewer during the highest one-hour period of the day[6]. This mobility standard allows more flexibility

[6] When a low number of vehicles approach a stop-controlled intersection (i.e., 20 or fewer), particularly at those with high volumes on the uncontrolled major street, long delays for vehicles often result during peak periods. This can cause the intersection to operate with a peak hour v/c ratio that exceeds the adopted intersection mobility standard and can

in the tension between larger intersection and street designs that are sometimes needed to accommodate peak vehicle demands, and the desire to maintain smaller designs that encourage slower vehicle speeds and tend to be more accommodating to pedestrian and bicycle users.

Level of Service for Highways of Statewide Significance is set by the State. In Clark County, the standard is set as LOS "D" for urban areas, including SR 14. Level of Service for regional state highway facilities (not part of the HSS), including SR 500 in Camas, is set through the Southwest Washington Regional Transportation Council (RTC). The Southwest Washington RTC Board adopted LOS 'E' or better for non-HSS urban state highway facilities.

Facilities that are forecasted to exceed these vehicle congestion thresholds were identified in Chapter 2 with improvements provided in Chapter 4.

MULTIMODAL LEVEL OF TRAFFIC STRESS THRESHOLDS

Pedestrian and bicycle level of traffic stress (LTS) evaluations provide a metric to understand a multimodal user's perception of the safety and comfort of the transportation network. This method can be used to understand key gaps and barriers to walking and bicycling which can then be addressed through targeted improvements.

The LTS evaluation generates a ranking between 1 and 4 of the relative safety and comfort of a segment or intersection for bicyclists or pedestrians based on roadway and intersection characteristics (e.g., land use context, number of lanes, travel speed and volume, intersection control, type and width of buffer, and the presence and condition of any bicycle or pedestrian facilities). The LTS rating scale recognizes that as vehicle speeds and volumes increase, enhanced pedestrian and bicycle facilities are needed to maintain a system that is accessible and comfortable for all users. The following summarizes the LTS rankings:

- Low Stress (LTS 1) – represents little traffic stress and requires less attention, so is suitable for all cyclists or pedestrians of all ages and abilities. Traffic speeds are typically low (i.e., 25 mph) and there is no more than one lane in each direction. Intersections are easily crossed by children and adults. Typical locations include residential local streets, separated bike paths/cycle tracks, and sidewalks/shared use paths with a buffer between vehicles and cyclists or pedestrians.
- Moderate Stress (LTS 2) – represents little traffic stress but requires more attention than can be expected of young children and is more suitable for teen and adult pedestrians or cyclists with adequate bike handling skills. Traffic speeds are slightly higher (i.e., up to 35 mph), but speed differentials are still low, and roadways can be up to three lanes wide. Intersections are not difficult to cross for most teenagers and adults. Typical locations include collector-level streets with bike lanes or a central business district. Sidewalks are generally in good condition with limited impediments for mobility device users (i.e., adequate sidewalk widths and ramps in most locations).
- High Stress (LTS 3) – represents moderate stress and is suitable only for the most observant adult cyclists or pedestrians. Traffic speeds are typically moderate (i.e., 35 to 40

necessitate the need to expand the intersection. Therefore, stop controlled approaches with a low volume of traffic are commonly excluded from agency mobility standards.

mph) but can be on roadways up to five lanes wide, and there can be limited buffers between travel lanes and the sidewalk. Intersections are still perceived to be safe by most adults. Typical locations include lower-speed (i.e., 35 mph) arterials with bike lanes or moderate speed (i.e., 40 mph) collectors up to three lanes wide. Select segments of these roadways may be impassable to pedestrians who require a mobility device.

- Extreme Stress (LTS 4) – represents high stress and only marginally suitable for experienced and skilled cyclists or able-bodied adult pedestrians. Traffic speeds are typically moderate to high (i.e., 40 mph or more) and can be on roadways from two to over five lanes wide with limited or no pedestrian or bicycle facilities. Intersections can be complex, wide, and or high volume/speed that can be perceived as unsafe by adults and are difficult and/or dangerous to cross. Typical locations include high-speed or multilane roadways with narrow or no bike lanes and sidewalks. Roadways without sidewalks are also included in this category.

All collector and arterial streets in Camas must provide an LTS of 2 or better for pedestrian and bicycle facilities. Facilities that are forecasted to exceed this standard were identified in Chapter 2 with improvements provided in Chapter 4. The cross-section requirements for streets in the City's planning area allow for a LTS of 2 or better to be achieved for newly built or reconstructed pedestrian and bicycle facilities.

MULTIMODAL CONNECTIVITY

Transportation facility and access spacing standards include a broad set of techniques that balance the need to provide for efficient, safe, and timely multimodal travel with the ability to allow access to individual destinations. These standards help create a system of direct, continuous, and connected transportation facilities to minimize out-of-direction travel and decrease travel times for all users, while enhancing safety for people walking, biking, and driving by reducing conflict points.

Table 5 identifies maximum and minimum public roadway intersection, minimum private access, and maximum pedestrian and bicycle accessway spacing standards for streets in Camas. New streets or redeveloping properties must comply with these standards to the extent practical, as determined by the City Engineer or City Engineer designee. As the opportunity arises through redevelopment, strategies could be implemented along streets or at driveways not complying with these standards, such as shared access points, access restrictions (using a median or channelization islands), or closure of unnecessary access points, as feasible.

Street connectivity must be reviewed with all traffic studies associated with new development in the City's planning area to ensure that the multimodal objectives of the TSP are followed. Applicants will be required to provide a proposed street map as part of the development approval process.

TABLE 5: TRANSPORTATION FACILITY AND ACCESS SPACING STANDARDS

	FUNCTIONAL CLASSIFICATION		
	ARTERIAL STREET	COLLECTOR STREET	LOCAL STREET
BLOCK SIZE (SPACING BETWEEN TWO PUBLIC STREETS) *			
MAXIMUM BLOCK SIZE *	1,000 ft.	600 ft.	600 ft.
MINIMUM BLOCK SIZE	600 ft.	300 ft.	150 ft.
MAXIMUM DISTANCE OF PEDESTRIAN/ BICYCLE FROM A CONNECTING STREET OR ACCESSWAY ALONG EACH BLOCK	300 ft.	300 ft.	300 ft.
MINIMUM DRIVEWAY SPACING **			
MINIMUM SPACING BETWEEN TWO DRIVEWAYS	600 ft.***	300 ft.***	5-10 ft. ****
MINIMUM DRIVEWAY SETBACK FROM INTERSECTION, FULL ACCESS	600 ft.	300 ft.	10 ft.
MINIMUM DRIVEWAY SETBACK FROM INTERSECTION, RIGHT-IN, RIGHT-OUT ACCESS	300 ft.	150 ft.	n/a

Note: All distances measured from the edge of adjacent approaches.

* If the maximum block size standards are exceeded for full public street connections on collector or local streets, mid-block pedestrian and bicycle accessways on public easements or rights-of-way must be provided to ensure pedestrians are no more than half the street spacing distance from a connecting street along the full length of all blocks (i.e., 300 feet on collector or local streets).

Arterial streets require mid-block pedestrian and bicycle accessways on public easements or rights-of-way to ensure pedestrians are no more than 300 feet from a connecting street or accessway along the full block length (i.e., a typical 1,000-foot block on an arterial street requires two accessways).

If the full street connection is impractical due to topography, natural areas, inadequate sight distance, lack of supporting land use or other factors that may prevent a safe connection, the City Engineer or City Engineer Designee may approve a deviation.

** All properties are allowed one driveway, which must take access from the lowest classified street.

*** New residential access is not permitted along arterials or collectors.

**** Minimum driveway spacing along a local street is 5 feet for residential uses and 10 feet for non-residential uses.

STREET CROSSINGS

Streets with high traffic volumes and/or speeds and in areas with trail crossings, or nearby transit stops, residential uses, schools, parks, shopping, and employment destinations generally require enhanced street crossings with treatments, such as marked crosswalks, high visibility crossings, and curb extensions to improve safety and convenience. Crossing locations with higher volumes of pedestrians (either observed or projected) are also candidate locations for rectangular rapid flashing beacons or pedestrian hybrid beacons, which increase the visibility of the crossing for drivers.

Crossing opportunities along City streets should also align, where practical, with the transportation facility spacing standards shown earlier in this chapter to ensure pedestrian and bicycle accessways are connected and continuous across streets. Exceptions include where the connection is impractical due to topography, inadequate sight distance, high vehicle travel speeds, lack of supporting land use, or other factors that may prevent safe crossing, as determined by the City Engineer or City Engineer Designee.

Locations of enhanced pedestrian and bicycle crossing treatments along City streets should be determined using the National Cooperative Highway Research Program (NCHRP) Report 562, Improving Pedestrian Safety at Unsignalized Intersections[7]. These guidelines for pedestrian and bicycle crossing treatments are based on vehicle speed on the major street, pedestrian crossing distance, peak hour pedestrian volume, peak hour vehicle volume, and local parameters such as motorist compliance, pedestrian walking speed, and pedestrian start-up and clearance time. NCHRP Report 562 includes worksheets for inputting the variables above and identifying the appropriate treatment type. These guidelines should be reviewed with all traffic studies for any potential street crossing associated with new development in the City's planning area. Table 6 summarizes potential crossing treatments at intersections and mid-block locations for pedestrians and bicyclists.

[7] http://www.trb.org/Publications/Blurbs/157723.aspx

TABLE 6: CROSSING TREATMENTS FOR PEDESTRIANS AND BICYCLISTS

CROSSING TREATMENTS		CROSSING LOCATION	
		INTERSECTION	MIDBLOCK
RECTANGULAR FLASHING BEACON (RRFB)			✓
CONVENTIONAL CROSSWALK		✓	✓
BULB OUT		✓	
MEDIAN REFUGE		✓	✓
INTERSECTION CROSSING MARKINGS		✓	
BIKE BOXES		✓	
TWO STAGE QUEUE BOXES		✓	

VOLUME AND SPEED MANAGEMENT TOOLS

Volume and speed management refers to street design techniques that slow traffic and make streets safer and more pleasant for pedestrian and bicycle users and adjoining land uses without significantly changing their vehicle capacity. These design techniques encourage a more inviting environment for pedestrians and bicyclists, particularly along streets designed for shared bicycle travel.

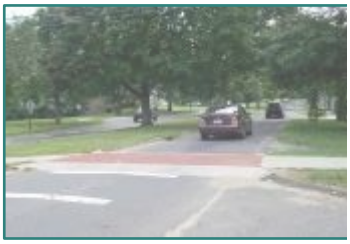
Table 7 shows common traffic calming applications and suggests which devices may be appropriate for streets in the Camas planning area. Volume and speed management measures must balance vehicle speeds and volumes with the mobility and circulation needs of service providers, such as emergency responders. Any traffic calming project should include coordination with emergency service providers to ensure the project does not impede response times.

Volume and speed management influences driver behavior through physical and psychological means, by using one or more of the following:

- **Horizontal impediments** designed to make a driver turn the wheel and reduce the sight lines of unending pavement, which usually results in slower speeds. Examples include chicanes, roundabouts, and mini roundabouts.
- **Road narrowing** via striping, parking, or curb to reduce the drive lane widths, which slightly lower speeds. These treatments have the additional benefit of shortening pedestrian crossings, which lead to a safer multi-modal environment. Examples include curb extensions or bulbouts, or mid-block pedestrian refuge islands.
- **Closing the through road partially or fully** to disrupt travel patterns. These treatments alone may not change vehicle speeds but are effective at lowering volumes along certain streets.

TABLE 7: VOLUME AND SPEED MANAGEMENT TOOLS

TOOLS *		USE BY FUNCTIONAL CLASSIFICATION			IMPACT	
		Arterial Street	Collector Street	Local Street	Speed Reduction	Traffic Diversion
NARROWING TRAVEL LANES		✓	✓	✓	✓	
PLACING BUILDINGS, ON-STREET PARKING, AND LANDSCAPING CLOSER TO THE STREET		✓	✓	✓	✓	
CURB EXTENSIONS OR BULBOUTS		✓	✓	✓	✓	
ROUNDABOUTS		✓	✓	✓	✓	
MINI-ROUNDABOUTS			✓	✓	✓	
MEDIANS AND PEDESTRIAN ISLANDS		✓	✓	✓	✓	

TOOLS *		USE BY FUNCTIONAL CLASSIFICATION			IMPACT	
		Arterial Street	Collector Street	Local Street	Speed Reduction	Traffic Diversion
PAVEMENT TEXTURE		✓	✓	✓	✓	
RAISED INTERSECTION OR CROSSWALK				✓	✓	✓
CHOKER				✓	✓	✓
CHICANES				✓	✓	✓
DIVERTERS (WITH EMERGENCY VEHICLE PASS-THROUGH)			✓	✓	✓	✓

Note: * Any traffic calming project should include coordination with emergency service providers to ensure the project does not impede response times.

CHAPTER 4.

Projects and Priorities

This chapter describes the transportation system improvement projects identified to address the system needs discussed in Chapter 2.

PROCESS FOR DEVELOPING PROJECTS

The project team developed the recommended transportation solutions using guidance provided by the project goals and with input from three main sources:

- Stakeholders (via committee meetings, online surveys, and project website comments)
- Previous Plans (such as the Camas North Shore Subarea Plan)
- Independent Project Team Evaluation (Existing and Future Transportation Conditions and Needs Evaluation)

The full list of projects in this TSP are identified to improve the transportation network along major streets in the City's planning area, regardless of their priority or their likelihood of being funded. This TSP focuses on streets in the planning area with a functional classification of Collector or higher. Additional improvements will occur with private development in the City's planning area, including the build out of the local street network consistent with the standards in Chapter 3.

The TSP planning process screens candidate projects to set aside those that may not be feasible due to environmental or existing development limitations. The remaining projects are a combination of new and previous ideas for the transportation system that seek to address the gaps and deficiencies in the city.

PROJECT FUNDING

Each project was reviewed to consider how it might be funded through 2045. All projects were assigned a primary funding agency which includes Camas, Clark County and WSDOT. In general, the primary funding agency was assumed to be the current or future facility owner, as they are responsible for overseeing construction and long-term maintenance. In some cases, funding partnerships were identified for projects that were expected to provide mutual benefits between agencies or where there were opportunities to accelerate projects to completion. Each project was also assigned an assumed funding source, which included the Camas Street Fund (i.e., State Gas Tax, Transportation Benefit District revenues, etc.), the City Transportation Impact Fee (TIF) revenues, or partner agency funds (i.e., WSDOT, Clark County). It is important to note that these funding assumptions do not oblige any agency to commit to these projects or fund them in this manner.

Approximately $263 million is estimated to be available for locally funded improvements through 2045 (see Table 8). About $178.6 million of the total project costs are assumed to be TIF eligible improvements, with the remaining $137.9 million and $63.5 million of the total project costs assumed to be City and partner agency responsibility, respectively.

This TSP assumes an estimated $178.6 million in TIF funding through 2045 and about $20.9 million from the Camas Street Fund and $63.5 million from partner agencies to fund the portion of

projects that are not eligible to use TIF funds through 2045 (see Table 8). While there may be opportunities with other agencies to jointly fund projects, the assumed funding is not guaranteed as these decisions are ultimately up to those agencies.

TABLE 8: ESTIMATED TRANSPORTATION PROJECT FUNDING (2026 DOLLARS)

FUNDING SOURCE	TOTAL FUNDING NEED	ESTIMATED FUNDING AVAILABLE THROUGH 2045
TRANSPORTATION IMPACT FEE (TIF) *	$178,650,000	$178,650,000
CAMAS STREET FUND	$137,983,000 **	$20,900,000 ***
PARTNER AGENCY	$63,542,000 **	$63,542,000 ****
TOTAL	**$380,175,000**	**$263,092,000**

Notes: * Based on the estimated share of project costs that are eligible to use TIF funds.

** The total funding need is based on the assigned primary lead agency for each project and the share of project costs after excluding the portion that is eligible to use TIF funds. Projects assigned with a partner agency as the primary lead were assumed to have an 80 percent share of the project costs after excluding the portion that is eligible to use TIF funds, with the remaining 20 percent share assigned to the City.

*** The estimated funding available from the Camas Street Fund is based on the remaining revenue after excluding expenditures through 2045 (based on average revenues and expenditures for the fund between 2023 and 2025) and generally accounts for the portion of the fund utilized for capital projects.

**** This assumes funding from partner agencies, which may include Grants to fund future projects. While there may be opportunities with other agencies to jointly fund projects, these funding decisions are ultimately up to those agencies and outcomes of the competitive grant process.

PRIORITIZING TRANSPORTATION PROJECTS

Unless the City expands its funding options, many of the transportation projects identified are not reasonably likely to be funded by 2045 (as shown in Table 8). For this reason, projects from the transportation list were divided into three improvement packages with implementation priority horizons, referred to as Tier 1, Tier 2 and Tier 3 and shown in Table 9.

- **Tier 1:** Projects recommended for implementation within 1 to 6 years.
- **Tier 2:** Projects recommended for implementation within 6 to 12 years.
- **Tier 3:** Projects likely to be implemented beyond 12 years.

Projects in the Tier 1 and Tier 2 groups have a total construction budget that is similar to the reasonably available funding over the planning horizon without including the partner agency funding, meaning the estimated $199 million likely to be available through existing City funding sources (i.e., City TIF and Camas Street Fund).

The project priority horizons do not create an obligation to construct projects in any order, and it is recognized that these priorities may change over time. The City of Camas will use the priorities

listed in this TSP to guide investment decisions but will also regularly reassess local priorities to leverage new opportunities and reflect evolving community interests. During the short-term, most of the City's investments will occur within the current City limits. As annexation occurs over time, other projects will have the potential to be funded by the City or through private development as a condition of approval.

PLANNED TRANSPORTATION PROJECTS

The full project list includes 91 projects totaling over $380 million in total investments and is shown in Table 9 and Figure 23 to Figure 25. For the purposes of cost estimates, project design elements are identified, however, the actual design elements for any project are subject to change and will ultimately be determined through a preliminary and final design process and are subject to City, WSDOT, Clark County, and/or other partner agency approval. The projects were assigned to one of several categories:

- **Multi-Modal Street Improvement** – these projects will improve or construct new multi-modal streets throughout the planning area, each with facilities for motorists, pedestrians, and bicyclists. A total of 27 projects are identified that, as of 2026, will cost an estimated $246.5 million to complete.
- **Intersection Improvement** – these projects will improve safety and mobility at intersections throughout the planning area. A total of 17 projects were identified to construct new or improve existing intersections that, as of 2026, will cost an estimated $55.1 million to complete.
- **Pedestrian/ Bike Improvement** – these projects include stand-alone sidewalk, path and roadway crossing improvements, and an integrated network of bicycle lanes, marked on-street routes and shared-use paths to facilitate safe and convenient travel citywide. A total of 44 pedestrian and bicycle projects were identified that, as of 2026, will cost an estimated $77.0 million to complete.
- **Demand/ System Management** – this will enhance the quality and convenience for transit passengers and encourage more efficient usage of the transportation system. Three projects were identified that, as of 2026, will cost an estimated $1.4 million.

TABLE 9: PLANNED TRANSPORTATION PROJECTS

ID ***	PROJECT DESCRIPTION**	PROJECT PURPOSE	ESTIMATED COST (2026 DOLLARS)	TIF ELIGIBLE SHARE	PRIMARY LEAD AGENCY	PRIORITY HORIZON
A	Bike Parking Program	Increase bike parking	$150,000	42%	Camas	Tier 3
	Install new bike parking throughout the City.					
B	Wayfinding Signage Program	Improve wayfinding signage	$300,000	42%	Camas	Tier 3
	Install wayfinding signage to assist pedestrians and bicyclists in choosing comfortable routes and to help visitors navigate through the City.					
T1	Facility Improvements	Enhance transit service and amenities	$1,000,000	42%	Camas	Tier 3
	Improve transit stop amenities as needed, to include sheltered stops with seating, landing pads, route information, sidewalk connections, bicycle parking and lighting.					
M1	NW Pacific Rim Boulevard reconfiguration between SE Payne Road and NW Parker Street	Safety; Bicycle facility gap	$2,600,000	42%	Camas	Tier 3
	Reconfigure the existing paved width of NW Pacific Rim Boulevard between SE Payne Road and NW Parker Street to address safety and bicycle facility gaps. Requires coordination with the City of Vancouver.					
M2	NW 6th Avenue improvements between Norwood Street and Adams Street	Motor vehicle congestion and safety; Bicycle facility gap	$7,000,000	42%	Camas	Tier 3
	Reconfigure the existing paved width of NW 6th Avenue between Norwood Street and Adams Street to address congestion at intersections, safety and bicycle facility gaps. Included in 2024 six-year Transportation Improvement Program as Priority #11.					
M3	NE 3rd Avenue reconfiguration between NE Garfield Street and 4th Street	Safety; Bicycle facility gap	$4,050,000	42%	Camas	Tier 3
	Reconfigure the existing paved width of NE 3rd Avenue between NE Garfield Street and 4th Street to address congestion at intersections, safety and bicycle facility gaps.					
M4	NE 3rd Avenue reconfiguration between 4th Street and SE Lechner Street	Pedestrian and bicycle facility gap	$1,250,000	42%	Camas	Tier 3
	Reconfigure the existing paved width of NE 3rd Avenue between 4th Street and SE Lechner Street to address congestion at intersections, safety, pedestrian and bicycle facility gaps.					
M5	NE Laurel Street extension to SE 15th Street	Street connectivity; Pedestrian and bicycle facility gap	$2,200,000	100%	Camas	Tier 2
	Extend NE Laurel Street to SE 15th Street. This street should be constructed as a Collector, with sidewalks and bike lanes.					
M6	NE Pioneer Street extension to SE 15th Street	Street connectivity; Pedestrian and bicycle facility gap	$2,650,000	100%	Camas	Tier 3
	Extend NE Pioneer Street to SE 15th Street. This street should be constructed as a Collector, with sidewalks and bike lanes.					
M7	SE 271st Avenue extension to SE 8th Street extension	Street connectivity; Pedestrian and bicycle facility gap	$7,200,000	100%	Camas	Tier 3
	Extend/Improve SE 271st Avenue from SE 15th Street to the SE 8th Street extension. This street should be constructed as a Collector, with sidewalks and bike lanes.					
M8	SE 8th Street extension between SR 500-NE Everett Street and the SE 271st Avenue extension	Street connectivity; Pedestrian and bicycle facility gap	$4,600,000	100%	Camas	Tier 1
	Extend SE 8th Street from SR 500-NE Everett Street to the SE 271st Avenue extension. This street should be constructed as a Collector, with sidewalks and bike lanes.					
M9	SR 500-NE Everett Street widening between NW Lake Road and the UGA	Safety; Pedestrian and Bicycle facility gap	$45,700,000	100%	WSDOT	Tier 1
	Widen SR 500-NE Everett Street between NW Lake Road and the UGA boundary to include pedestrian and bike facilities (i.e., assumes a shared-use path on both sides per Everett Street Corridor Analysis). Includes bridge replacement. Included in 2024 six-year Transportation Improvement Program as Priority #1.					
M10	Northshore Boulevard extension to SR 500-NE Everett Street	Street connectivity; Pedestrian and bicycle facility gap	$18,200,000	42%	Camas	Tier 1
	Extend Northshore Boulevard to SR 500-NE Everett Street/NE Everett Drive. This street should be constructed as an Arterial, with sidewalks and bike lanes. Included in 2024 six-year Transportation Improvement Program as Priority #9.					

ID ***	PROJECT DESCRIPTION**	PROJECT PURPOSE	ESTIMATED COST (2026 DOLLARS)	TIF ELIGIBLE SHARE	PRIMARY LEAD AGENCY	PRIORITY HORIZON
M11	NE 232nd Avenue widening between Northshore Boulevard and the UGA	Safety; Pedestrian and Bicycle facility gap	$5,100,000	100%	Camas	Tier 3
	Widen NE 232nd Avenue between Northshore Boulevard and the UGA boundary to include one travel lane in each direction, a center turn-lane/median, a bike lane and sidewalk on the west side and a shared-use path on the east side. PE included in 2024 six-year Transportation Improvement Program as Priority #27.					
M12	NE 242nd Avenue extension from NE 28th Street to Northshore Boulevard	Street connectivity; Pedestrian and bicycle facility gap	$9,350,000	100%	Clark County	Tier 3
	Extend NE 242nd Avenue from NE 28th Street to Northshore Boulevard. This street should be constructed as an Arterial, with sidewalks and bike lanes. PE included in 2024 six-year Transportation Improvement Program as Priority #34.					
M13	NW Lake Road / NW Leadbetter Drive intersection improvements	Motor vehicle congestion and safety	$3,950,000	42%	Camas	Tier 3
	Intersection improvements (i.e., potential installation of roundabout or traffic signal).					
M14	NW Lake Road / NW Lacamas Lane intersection improvements	Motor vehicle congestion and safety	$3,750,000	42%	Camas	Tier 3
	Intersection improvements (i.e., potential installation of roundabout or traffic signal).					
M17	Northshore Boulevard / Northshore Roadway C (east) intersection improvements	Motor vehicle congestion and safety	$3,950,000	100%	Camas	Tier 2
	Intersection improvements (i.e., potential installation of roundabout per the Northshore Subarea Plan).					
M18	Northshore Boulevard / Northshore Roadway E intersection improvements	Motor vehicle congestion and safety	$3,950,000	42%	Camas	Tier 2
	Intersection improvements (i.e., potential installation of roundabout per the Northshore Subarea Plan).					
M19	NE 28th Street widening between N Juniper Street and NE 232nd Avenue	Safety; Pedestrian and Bicycle facility gap	$5,350,000	42%	Camas	Tier 2
	Widen NE 28th Street between N Juniper Street and NE 232nd Avenue to include one travel lane in each direction, a center turn-lane/median, bike lanes and sidewalks. Included in 2024 six-year Transportation Improvement Program as Priority #8.					
M20	NE 28th Street widening between NE Ingle Road and N Juniper Street	Safety; Pedestrian and Bicycle facility gap	$9,500,000	42%	Camas	Tier 2
	Widen NE 28th Street between NE Ingle Road and N Juniper Street to include one travel lane in each direction, a center turn-lane/median, bike lanes and sidewalks. Included in 2024 six-year Transportation Improvement Program as Priority #8.					
M21	NE Goodwin Road widening between NE Ingle Road and NE 13th Street	Safety; Pedestrian and Bicycle facility gap	$12,400,000	42%	Camas	Tier 2
	Widen NE Goodwin Road between NE Ingle Road and NE 13th Street to include bike lanes and sidewalks. Included in 2024 six-year Transportation Improvement Program as Priority #8.					
M22	NE Ingle Road widening between NE 28th Street and the UGA	Safety; Pedestrian and Bicycle facility gap	$1,650,000	42%	Camas	Tier 2
	Widen NE Ingle Road between NE 28th Street and the UGA to include one travel lane in each direction, a center turn-lane/median, bike lanes and sidewalks. PE included in 2024 six-year Transportation Improvement Program as Priority #39.					
M24	SR 500-NE Everett Street / NE 35th Avenue intersection improvements	Motor vehicle congestion and safety	$3,950,000	42%	WSDOT	Tier 3
	Intersection improvements (i.e., potential installation of roundabout).					
M25	NW 38th Avenue-NW Astor Street-NW 43rd Avenue widening between NW Dahlia Drive and NW Sierra Street	Safety; Pedestrian and Bicycle facility gap	$7,750,000	42%	Camas	Tier 2
	Widen NW 38th Avenue-NW Astor Street-NW 43rd Avenue between NW Dahlia Drive and NW Sierra Street to include one travel lane in each direction, a center turn-lane/median, bike lanes and sidewalks. PE included in 2024 six-year Transportation Improvement Program as Priority #26.					
M26	NW 16th Avenue-NW Hood Street-NW 18th Street widening between NW Klickitat Street and NW Astor Court	Safety; Pedestrian and Bicycle facility gap	$4,450,000	42%	Camas	Tier 2
	Widen NW 16th Avenue-NW Hood Street-NW 18th Street between NW Klickitat Street and NW Astor Court to include one travel lane in each direction, a center turn-lane/median, bike lanes and sidewalks. Included in 2024 six-year Transportation Improvement Program as Priority #6 and #23.					
M27	NW 11th Avenue-NW Astor Street widening between NW McIntosh Road and NW 16th Avenue	Safety; Pedestrian and Bicycle facility gap	$5,800,000	42%	Camas	Tier 2

ID ***	PROJECT DESCRIPTION**	PROJECT PURPOSE	ESTIMATED COST (2026 DOLLARS)	TIF ELIGIBLE SHARE	PRIMARY LEAD AGENCY	PRIORITY HORIZON
	Widen NW 11th Avenue-NW Astor Street between NW McIntosh Road and NW 16th Avenue to include one travel lane in each direction, a center turn-lane/median, bike lanes and sidewalks. PE included in 2024 six-year Transportation Improvement Program as Priority #22.					
M28	NW McIntosh Road widening between NW Brady Road and NW 11th Avenue	Safety; Pedestrian and Bicycle facility gap	$9,800,000	42%	Camas	Tier 2
	Widen NW McIntosh Road between NW Brady Road and NW 11th Avenue to include one travel lane in each direction, a center turn-lane/median, bike lanes and sidewalks. PE included in 2024 six-year Transportation Improvement Program as Priority #28.					
M29	SE Crown Road widening between NE 3rd Avenue and NE Woodburn Drive	Safety; Pedestrian and Bicycle facility gap	$11,700,000	42%	Camas	Tier 3
	Widen SE Crown Road between NE 3rd Avenue and NE Woodburn Drive to include one travel lane in each direction, left-turn lanes at intersections and a shared-use path (per the Crown Road Corridor Study). Widen the SE Crown Road approach to NE 3rd Avenue to accommodate westbound truck turning maneuvers. Requires coordination with Washougal and Clark County. Included in 2024 six-year Transportation Improvement Program as Priority #5.					
M30	SE 283rd Avenue widening between NE Woodburn Drive and the SE 8th Street extension	Safety; Pedestrian and Bicycle facility gap	$10,800,000	42%	Camas	Tier 2
	Widen SE 283rd Avenue between NE Woodburn Drive and the SE 8th Street extension to include one travel lane in each direction, left-turn lanes at intersections and a shared-use path. Requires coordination with Clark County.					
M31	SE Lechner Street reconfiguration between NE 3rd Avenue and the UGA boundary	Safety; Pedestrian and Bicycle facility gap	$400,000	42%	Camas	Tier 3
	Reconfigure SE Lechner Street between NE 3rd Avenue and the UGA boundary to include one travel lane in each direction, a center turn-lane/median and bike lanes.					
M32	NE 6th Avenue / NE Adams Street intersection improvements	Motor vehicle congestion and safety	$4,000,000	42%	Camas	Tier 2
	Intersection improvements (e.g., Per the Camas Safety Plan this should include the installation of a roundabout and intersection lighting; retain eastbound right-turn slip lane).					
M33	NE 6th Avenue / SR 500-NE Garfield Street intersection improvements	Motor vehicle congestion	$250,000	42%	WSDOT	Tier 2
	Intersection improvements (i.e., restripe the eastbound NE 6th Avenue approach to include a separate left-turn and through/right turn lane; requires removal of on-street parking along the south side of NE 6th Avenue within 75 feet of the intersection).					
M34	SE Crown Road / SE 23rd Street-NE Woodburn Drive intersection improvements	Motor vehicle safety	$4,100,000	0%	Camas	Tier 3
	Intersection improvements (e.g., installation of a roundabout per the Crown Road Corridor Study). Realign SE 23rd Street to intersect with NE Woodburn Drive. This street should be constructed as an Arterial, with sidewalks and bike lane. Realignment included in 2024 six-year Transportation Improvement Program as Priority #29.					
M35	SR 500-NE Everett Street / NE 38th Avenue intersection improvements	Motor vehicle congestion and safety	$3,950,000	42%	WSDOT	Tier 3
	Intersection improvements (i.e., installation of roundabout or a southbound left-turn lane on SR 500-NE Everett Street).					
M36	SR 500-NE Everett Street / NE 43rd Avenue intersection improvements	Motor vehicle congestion and safety	$3,950,000	42%	WSDOT	Tier 3
	Intersection improvements (i.e., potential installation of roundabout per the Northshore Subarea Plan).					
M37	SR 500-NE Everett Street / SE Leadbetter Road intersection improvements	Motor vehicle safety	$25,000	0%	WSDOT	Tier 3
	Intersection improvements (i.e., installation of a median to limit SE Leadbetter Road access to left-in, right-in, right-out only).					
M38	SR 500-NE Everett Street / Northshore Boulevard extension intersection improvements	Motor vehicle safety	$3,950,000	0%	WSDOT	Tier 1
	Intersection improvements (e.g., potential installation of a roundabout per Northshore Subarea Plan).					
M40 *	NE 28th Street / SR 500-NE 242nd Avenue intersection improvements	Motor vehicle congestion	$3,950,000	0%	WSDOT	Tier 3
	Intersection improvements (e.g., installation of a southbound left-turn lane on SR 500-NE Everett Street, eastbound left-turn lane on NE 28th Street and traffic signal, or installation of a roundabout). Requires coordination with WSDOT and Clark County.					
M41 *	NE 232nd Avenue / NE 28th Street intersection improvements	Motor vehicle congestion	$1,850,000	0%	Clark County	Tier 3
	Intersection improvements (e.g., installation of a roundabout or traffic signal). Requires coordination with Clark County. Included in 2024 six-year Transportation Improvement Program as Priority #20.					
M42 *	NE 199th Avenue / SR 500-NE 58th Street intersection improvements	Motor vehicle congestion	$3,950,000	0%	WSDOT	Tier 3

ID ***	PROJECT DESCRIPTION**	PROJECT PURPOSE	ESTIMATED COST (2026 DOLLARS)	TIF ELIGIBLE SHARE	PRIMARY LEAD AGENCY	PRIORITY HORIZON
	Intersection improvements (e.g., installation of a westbound left-turn lane and eastbound right-turn lane on SR 500-NE 58th Street and traffic signal, or installation of a roundabout). Requires coordination with WSDOT and Clark County.					
M43	NW Camas Meadows Drive / NE Goodwin Road intersection improvements	Motor vehicle congestion	$3,950,000	42%	Camas	Tier 2
	Intersection improvements (i.e., installation of a roundabout or traffic signal). Included in 2024 six-year Transportation Improvement Program as Priority #37.					
M44	NW Lake Road / NW Sierra Street intersection improvements	Motor vehicle congestion	$3,750,000	42%	Camas	Tier 1
	Intersection improvements (i.e., installation of a roundabout or traffic signal). Included in 2024 six-year Transportation Improvement Program as Priority #2.					
M45	Pacific Rim Boulevard / NW Parker Street intersection improvements	Motor vehicle congestion	$1,700,000	42%	Camas	Tier 2
	Intersection improvements (i.e., installation of a traffic signal). Included in 2024 six-year Transportation Improvement Program as Priority #38.					
M46	NW Lake Road safety improvements from NE Everett Street to NW Leadbetter Drive	Multimodal Safety	$4,300,000	0%	Camas	Tier 1
	Implement safety improvements along NW Lake Road safety improvements from NE Everett Street to NW Leadbetter Drive. These include horizontal curve signing, profiled pavement marking and shoulder widening per the Camas Safety Plan.					
M47	SR-14 West Camas Slough Bridge widening	Motor vehicle congestion	$45,000,000	0%	WSDOT	Tier 3
	Widen the SR-14 West Camas Slough Bridge to four lanes. Included in 2024 six-year Transportation Improvement Program as Priority #7. WSDOT project.					
M48	Northshore Boulevard / Northshore Roadway A intersection improvements	Motor vehicle congestion and safety	$3,950,000	42%	Camas	Tier 2
	Intersection improvements (i.e., potential installation of roundabout per the Northshore Subarea Plan).					
P1	Pedestrian improvements on NW 7th Avenue between NW Fargo Street and NW Drake Street	Pedestrian facility gap	$1,150,000	42%	Camas	Tier 3
	Add pedestrian improvements to NW 7th Avenue between NW Fargo Street and NW Drake Street (i.e., complete sidewalk gaps on the south side).					
P2	Pedestrian improvements on NW 10th Avenue between NW Forest Home Road and NW Elm Street	Pedestrian facility gap	$1,750,000	42%	Camas	Tier 3
	Add pedestrian improvements to NW 10th Avenue between NW Forest Home Road and NW Elm Street (i.e., complete sidewalk gaps on the north side).					
P3	Pedestrian improvements on Division Street between NW 6th Avenue and NW 11th Avenue	Pedestrian facility gap	$1,150,000	42%	Camas	Tier 3
	Add pedestrian improvements to Division Street between NW 6th Avenue and NW 11th Avenue (i.e., complete sidewalk gaps on the west side).					
P4	Pedestrian improvements on SR 500-SE Union Street between SE 8th Avenue and SE 6th Avenue	Pedestrian facility gap	$650,000	42%	Camas	Tier 3
	Add pedestrian improvements to SR 500-SE Union Street between SE 8th Avenue and SE 6th Avenue (i.e., complete sidewalk gaps on the east side).					
P5	Pedestrian improvements on NE 2nd Avenue-NE Whitney Street between NE 3rd Avenue and SE James Street	Pedestrian facility gap	$1,400,000	42%	Camas	Tier 3
	Add pedestrian improvements to NE 2nd Avenue-NE Whitney Street between NE 3rd Avenue and SE James Street (i.e., complete sidewalk gaps on the east side).					
P6	Pedestrian improvements on SR 500-NE Everett Street between NE 23rd Avenue and Fallen Leaf Lake Park	Pedestrian facility gap	$2,000,000	42%	Camas	Tier 3
	Add pedestrian improvements to SR 500-NE Everett Street between NE 23rd Avenue and Fallen Leaf Lake Park (i.e., complete sidewalk gaps on both sides).					
P7	Pedestrian improvements on NW Lake Road between NW Lacamas Lane and the Lacamas Lake Lodge	Pedestrian facility gap	$3,600,000	42%	Camas	Tier 3
	Add pedestrian improvements to NW Lake Road between NW Lacamas Lane and the Lacamas Lake Lodge (i.e., complete sidewalk gaps on both sides). Included in 2024 six-year Transportation Improvement Program as Priority #3.					
P8	Pedestrian improvements on NE Umatilla Street between NE Woodburn Drive and SE 15th Street	Pedestrian facility gap	$1,100,000	42%	Camas	Tier 3

ID ***	PROJECT DESCRIPTION**	PROJECT PURPOSE	ESTIMATED COST (2026 DOLLARS)	TIF ELIGIBLE SHARE	PRIMARY LEAD AGENCY	PRIORITY HORIZON
	Add pedestrian improvements to NE Umatilla Street between NE Woodburn Drive and SE 15th Street (i.e., complete sidewalk gaps on the east side). Requires right-of-way acquisition, outside current city limits, in part.					
P9	Pedestrian improvements on NE 43rd Avenue-SE 15th Street between SR 500-NE Everett Street and SE Crown Road	Pedestrian facility gap	$10,900,000	42%	Camas	Tier 2
	Add pedestrian improvements to NE 43rd Avenue-SE 15th Street between SR 500-NE Everett Street and SE Crown Road (i.e., complete sidewalk gaps on both sides). Included in 2024 six-year Transportation Improvement Program as Priority #13 and #30.					
P10	Pedestrian improvements on NW Camas Meadows Drive between NE Goodwin Road and NW Payne Street	Pedestrian facility gap	$1,150,000	42%	Camas	Tier 3
	Add pedestrian improvements to NW Camas Meadows Drive between NE Goodwin Road and NW Payne Street (i.e., complete sidewalk gaps on the south side).					
P11	Pedestrian improvements on NW Leadbetter Drive between NW Parker Street and NW Lake Road	Pedestrian facility gap	$3,800,000	42%	Camas	Tier 3
	Add pedestrian improvements to NW Leadbetter Drive between NW Parker Street and NW Lake Road (i.e., complete sidewalk gaps on both sides). Included in 2024 six-year Transportation Improvement Program as Priority #19.					
P12	Pedestrian improvements on NW Parker Street between NW Leadbetter Drive and NW 38th Avenue	Pedestrian facility gap	$2,300,000	42%	Camas	Tier 3
	Add pedestrian improvements to NW Parker Street between NW Leadbetter Drive and NW 38th Avenue (i.e., complete sidewalk gaps on the west side).					
P14	Pedestrian improvements on NW Fargo Street between NW Kent Street and NW Fargo Loop	Pedestrian facility gap	$2,250,000	42%	Camas	Tier 3
	Add pedestrian improvements to NW Fargo Street between NW Kent Street and NW Fargo Loop (i.e., complete sidewalk gaps on the north/east side).					
P15	Pedestrian improvements on NW 23rd Avenue between NW Astor Street and NW Tanner Street	Pedestrian facility gap	$600,000	42%	Camas	Tier 3
	Add pedestrian improvements to NW 23rd Avenue between NW Astor Street and NW Tanner Street (i.e., complete sidewalk gaps on both sides). Included in 2024 six-year Transportation Improvement Program as Priority #17.					
P17	Pedestrian improvements on NW 10th Avenue west of NW Norwood Street	Pedestrian facility gap	$600,000	42%	Camas	Tier 3
	Add pedestrian improvements to NW 10th Avenue west of NW Norwood Street (i.e., complete sidewalk gaps on the south side).					
B1	Bicycle improvements on NW Ivy Street-NW 7th Avenue from NW 6th Avenue to NW Drake Street	Bicycle facility gap	$550,000	42%	Camas	Tier 3
	Add bicycle improvements to NW Ivy Street-NW 7th Avenue from NW 6th Avenue to NW Drake Street (i.e., pavement markings/ signage designating it as a shared street for bikes).					
B2	Bicycle improvements on NW Drake Street between NW 7th Avenue and NW 12th Avenue	Bicycle facility gap	$400,000	42%	Camas	Tier 3
	Add bicycle improvements to NW Drake Street between NW 7th Avenue and NW 12th Avenue (i.e., restripe with bike lanes).					
B3	Bicycle improvements on NW 12th Avenue-Division Street-NE 15th Avenue-NE 18th Avenue-NE 21st Avenue between NW Drake Street and SR 500-NE Everett Street	Bicycle facility gap	$1,350,000	42%	Camas	Tier 3
	Add bicycle improvements to NW 12th Avenue-Division Street-NE 15th Avenue-NE 18th Avenue-NE 21st Avenue between NW Drake Street and SR 500-NE Everett Street (i.e., pavement markings/ signage designating it as a shared street for bikes).					
B4	Bicycle improvements on NE 22nd Avenue-NE Ione Street-NE 19th Avenue-NE Oak Street-NE 6th Avenue between SR 500-NE Everett Street and NE Joy Street	Bicycle facility gap	$1,100,000	42%	Camas	Tier 3
	Add bicycle improvements to NE 22nd Avenue-NE Ione Street-NE 19th Avenue-NE Oak Street-NE 6th Avenue between SR 500-NE Everett Street and SR 500-NE Joy Street (i.e., pavement markings/ signage designating it as a shared street for bikes).					
B5	Bicycle improvements on NE 6th Avenue-NE Dallas Street-NE Joy Street between NE Adams Street and NE 3rd Avenue	Bicycle facility gap	$1,000,000	42%	Camas	Tier 3
	Add bicycle improvements to NE 6th Avenue-NE Dallas Street-NE Joy Street between NE Adams Street and NE 3rd Avenue (i.e., pavement markings/ signage designating it as a shared street for bikes).					
B6	Bicycle improvements on NE Woodburn Drive between Laurel Street and the NE Umatilla Street	Bicycle facility gap	$3,000,000	42%	Camas	Tier 3

ID ***	PROJECT DESCRIPTION**	PROJECT PURPOSE	ESTIMATED COST (2026 DOLLARS)	TIF ELIGIBLE SHARE	PRIMARY LEAD AGENCY	PRIORITY HORIZON
	Add bicycle improvements to NE Woodburn Drive between Laurel Street and the NE Umatilla Street (i.e., widen for bike lanes).					
B7	Bicycle improvements on NE Umatilla Street between NE Woodburn Drive and SE 15th Street	Bicycle facility gap	$1,850,000	42%	Camas	Tier 3
	Add bicycle improvements to NE Umatilla Street between NE Woodburn Drive and SE 15th Street (i.e., widen for bike lanes).					
B8	Bicycle improvements on NE 43rd Avenue-SE 15th Street between SR 500-NE Everett Street and SE Crown Road	Bicycle facility gap	$7,750,000	42%	Camas	Tier 2
	Add bicycle improvements to NE 43rd Avenue-SE 15th Street between SR 500-NE Everett Street and SE Crown Road (i.e., widen for bike lanes). Included in 2024 six-year Transportation Improvement Program as Priority #13 and #30.					
B10	Bicycle improvements on NW Leadbetter Drive between NW Fremont Street and NW Lake Road	Bicycle facility gap	$250,000	42%	Camas	Tier 3
	Add bicycle improvements to NW Leadbetter Drive between NW Fremont Street and NW Lake Road (i.e., restripe with bike lanes).					
B11	Bicycle improvements on NW Sierra Street between NW Lake Road and NW 43rd Avenue	Bicycle facility gap	$300,000	42%	Camas	Tier 3
	Add bicycle improvements to NW Sierra Street between NW Lake Road and NW 43rd Avenue (i.e., restripe with bike lanes; requires removal of left-turn lane to NW 44th Avenue; at the NW Lake Road intersection stripe with a southbound bike lane and shared northbound left and right turn-lanes).					
B12	Bicycle improvements on NE Fremont Street-NW Leadbetter Parkway-NW Dahlia Drive-NW 29th Avenue-NW Valley Street-NW Utah Street between NW Leadbetter Drive and NW 28th Avenue	Bicycle facility gap	$2,050,000	42%	Camas	Tier 3
	Add bicycle improvements to NE Fremont Street-NW Leadbetter Parkway-NW Dahlia Drive-NW 29th Avenue-NW Valley Street-NW Utah Street between NW Leadbetter Drive and NW 28th Avenue (i.e., pavement markings/ signage designating it as a shared street for bikes).					
B13	Bicycle improvements on NW 44th Avenue-NW Bass Street-NW 45th Avenue-NW 44th Avenue-NW Lacamas Lane-NW 35th Avenue-NW 34th Avenue-NW Norwood Street between NW Dahlia Drive and NW 28th Avenue	Bicycle facility gap	$2,900,000	42%	Camas	Tier 3
	Add bicycle improvements to NW 44th Avenue-NW Bass Street-NW 45th Avenue-NW 44th Avenue-NW Lacamas Lane-NW 35th Avenue-NW 34th Avenue-NW Norwood Street between NW Dahlia Drive and NW 28th Avenue (i.e., pavement markings/ signage designating it as a shared street for bikes).					
B14	Bicycle improvements on NW 28th Avenue-NW Fargo Street between NW Sierra Street and NW 18th Avenue	Bicycle facility gap	$1,250,000	42%	Camas	Tier 3
	Add bicycle improvements to NW 28th Avenue-NW Fargo Street between NW Sierra Street and NW 18th Avenue (i.e., pavement markings/ signage designating it as a shared street for bikes).					
B15	Bicycle improvements on NW 18th Loop between NW 18th Avenue and NW Couch Street	Bicycle facility gap	$400,000	42%	Camas	Tier 3
	Add bicycle improvements to NW 18th Loop between NW 18th Avenue and NW Couch Street (i.e., restripe with a bike lane on the uphill side).					
B16	Bicycle improvements on NW Sierra Street between NW 28th Avenue and NW 23rd Avenue	Bicycle facility gap	$350,000	42%	Camas	Tier 3
	Add bicycle improvements to NW Sierra Street between NW 28th Avenue and NW 23rd Avenue (i.e., restripe with bike lanes).					
B17	Bicycle improvements on NW 23rd Avenue between NW Astor Street and NW Sierra Street	Bicycle facility gap	$1,000,000	42%	Camas	Tier 3
	Add bicycle improvements to NW 23rd Avenue between NW Astor Street and NW Sierra Street (i.e., widen for bike lanes). Included in 2024 six-year Transportation Improvement Program as Priority #17.					
B18	Bicycle improvements on NW Pacific Rim Drive-NW Endicott Street-NW 37th Avenue between NW Parker Street and NW Dahlia Drive	Bicycle facility gap	$1,150,000	42%	Camas	Tier 3
	Add bicycle improvements to NW Pacific Rim Drive-NW Endicott Street-NW 37th Avenue between NW Parker Street and NW Dahlia Drive (i.e., pavement markings/ signage designating it as a shared street for bikes).					
B19	Bicycle improvements on NW Julia Street-NW 26th Avenue-NW Maryland Street-NW Larkspur Street-NW Klickitat Street between NW Pacific Rim Drive and NW 16th Avenue	Bicycle facility gap	$1,400,000	42%	Camas	Tier 3

ID ***	PROJECT DESCRIPTION**	PROJECT PURPOSE	ESTIMATED COST (2026 DOLLARS)	TIF ELIGIBLE SHARE	PRIMARY LEAD AGENCY	PRIORITY HORIZON
	Add bicycle improvements to NW Julia Street-NW 26th Avenue-NW Maryland Street-NW Larkspur Street-NW Klickitat Street between NW Pacific Rim Drive and NW 16th Avenue (i.e., pavement markings/ signage designating it as a shared street for bikes).					
B20	Bicycle improvements on NW Klickitat Street between NW 16th Avenue and NW McIntosh Road	Bicycle facility gap	$500,000	42%	Camas	Tier 3
	Add bicycle improvements to NW Klickitat Street between NW 16th Avenue and NW McIntosh Road (i.e., pavement markings/ signage designating it as a shared street for bikes).					
B21	Bicycle improvements on SE Payne Road-NW 18th Avenue-NW Tidland Street-NW 16th Avenue between NW Pacific Rim Boulevard and NW Brady Road	Bicycle facility gap	$6,600,000	42%	Camas	Tier 3
	Add bicycle improvements to SE Payne Road-NW 18th Avenue-NW Tidland Street-NW 16th Avenue between NW Pacific Rim Boulevard and NW Brady Road (i.e., widen for bike lanes). Included in 2024 six-year Transportation Improvement Program as Priority #24 and #25.					
B22	Bicycle improvements on NW 10th Avenue between NW 10th Place and NW Drake Street	Bicycle facility gap	$850,000	42%	Camas	Tier 3
	Add bicycle improvements to NW 10th Avenue between NW 10th Place and NW Drake Street (i.e., pavement markings/ signage designating it as a shared street for bikes).					
S1	Shared-use path on NW Brady Road between the City limits and NW McIntosh Road	Pedestrian and bicycle facility gap	$1,350,000	42%	Camas	Tier 3
	Create a shared-use path connection along the north side of NW Brady Road between the City limits and NW McIntosh Road. Included in 2024 six-year Transportation Improvement Program as Priority #21.					
S2	Shared-use path between NW 11th Avenue and NW 10th Avenue	Pedestrian and bicycle facility gap	$450,000	42%	Camas	Tier 3
	Create a shared-use path connection between NW 11th Avenue and NW 10th Avenue. Will require grading, switchbacks and/or stairs to navigate the steep slopes.					
S4	Fallen Leaf Lake Park Crossing	Pedestrian and bicycle facility gap	$50,000	42%	Camas	Tier 3
	Install a pedestrian and bicycle crossing on SR 500-NE Everett Street at Fallen Leaf Lake Park. This improvement includes a continental crossing, a median refuge island and pedestrian crosswalk signs.					
S5	Shared-use path on NE Leadbetter Road between SR 500-NE Everett Street and the Lacamas Lake boat ramp	Pedestrian and bicycle facility gap	$800,000	42%	Camas	Tier 3
	Create a shared-use path connection along the north side of NE Leadbetter Road between SR 500-NE Everett Street and the Lacamas Lake boat ramp.					
S6	Shared-use path on NE Leadbetter Road between the Lacamas Lake boat ramp and NE 232nd Avenue-Northshore Boulevard	Pedestrian and bicycle facility gap	$2,100,000	42%	Camas	Tier 3
	Close NE Leadbetter Road to motor vehicle traffic (except emergency services) between the Lacamas Lake boat ramp and NE 232nd Avenue-Northshore Boulevard and convert the roadway surface to a shared-use path.					
S7	Lacamas Trail SE Crown Road Crossing	Pedestrian and bicycle facility gap	$1,800,000	42%	Camas	Tier 3
	Install a pedestrian and bicycle crossing on Crown Road at the Lacamas Trail. As part of this project, extend the sidewalk along the west side of SE Crown Road from Woodburn Elementary to the Lacamas Trail. This improvement includes a continental crossing, a median refuge island and pedestrian crosswalk signs.					
S8	E 1st Avenue Crossing	Pedestrian and bicycle facility gap	$50,000	42%	Camas	Tier 3
	Install a pedestrian and bicycle crossing on NE 3rd Avenue at E 1st Avenue. This improvement includes a continental crossing, a median refuge island and pedestrian crosswalk signs.					
S9	NE Weir Street Crossing	Pedestrian and bicycle facility gap	$50,000	42%	Camas	Tier 3
	Install a pedestrian and bicycle crossing on NE 3rd Avenue at NE Weir Street. This improvement includes a continental crossing, a median refuge island and pedestrian crosswalk signs.					

Note: * Project (or a portion of the alignment) is located outside the UGA and is shown for future planning purposes only.

** The project design elements depicted are identified for planning purposes. The actual design elements for any project are subject to change and will ultimately be determined through a preliminary and final design process and are subject to agency approval.

*** Some projects were omitted or relabeled from the draft project list, with ID's M15, M16, M23, M39, P13, P16, B9 and S3 missing from the final project list.

FIGURE 23: PLANNED ROADWAY AND INTERSECTION PROJECTS

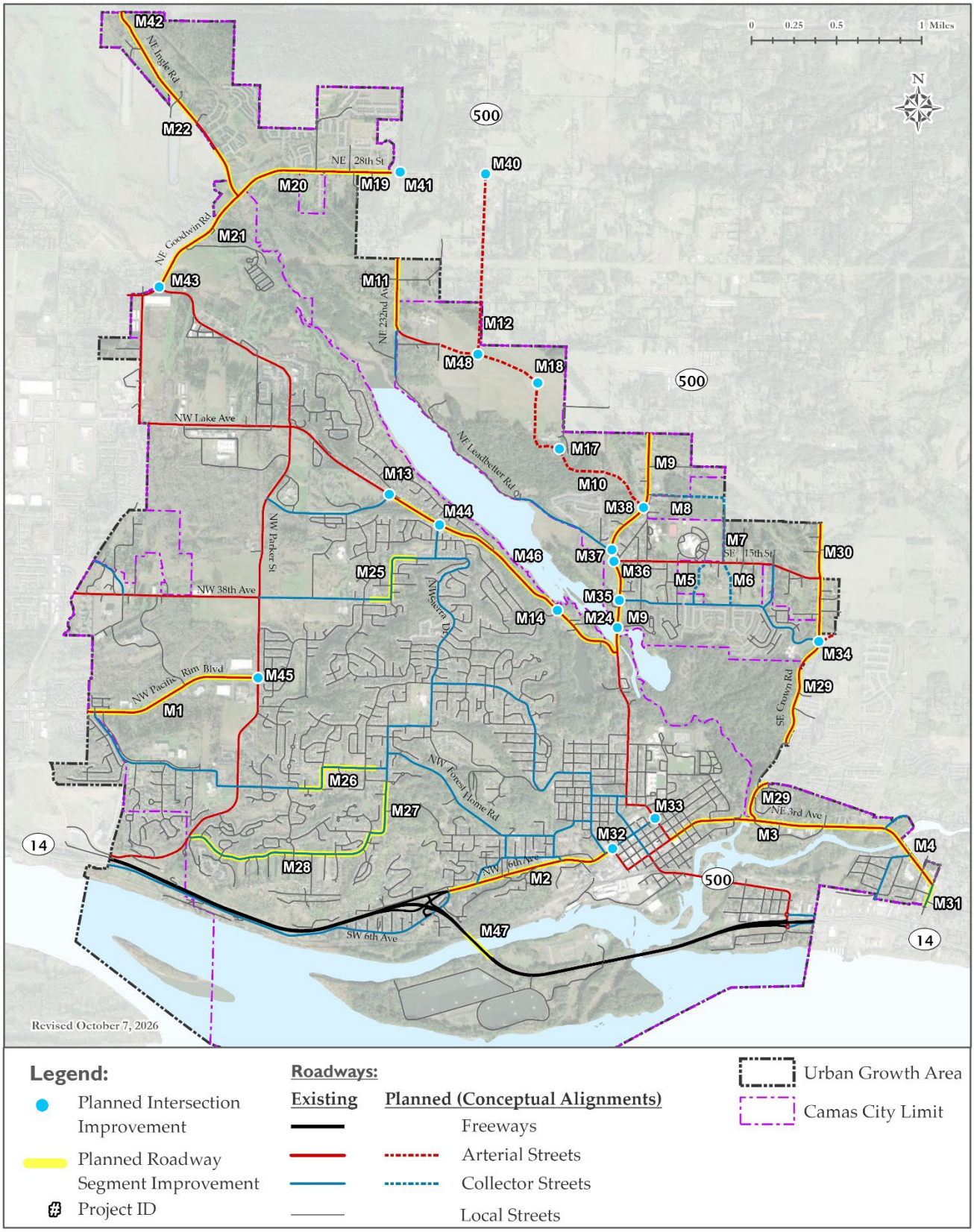


FIGURE 24: PLANNED PEDESTRIAN PROJECTS

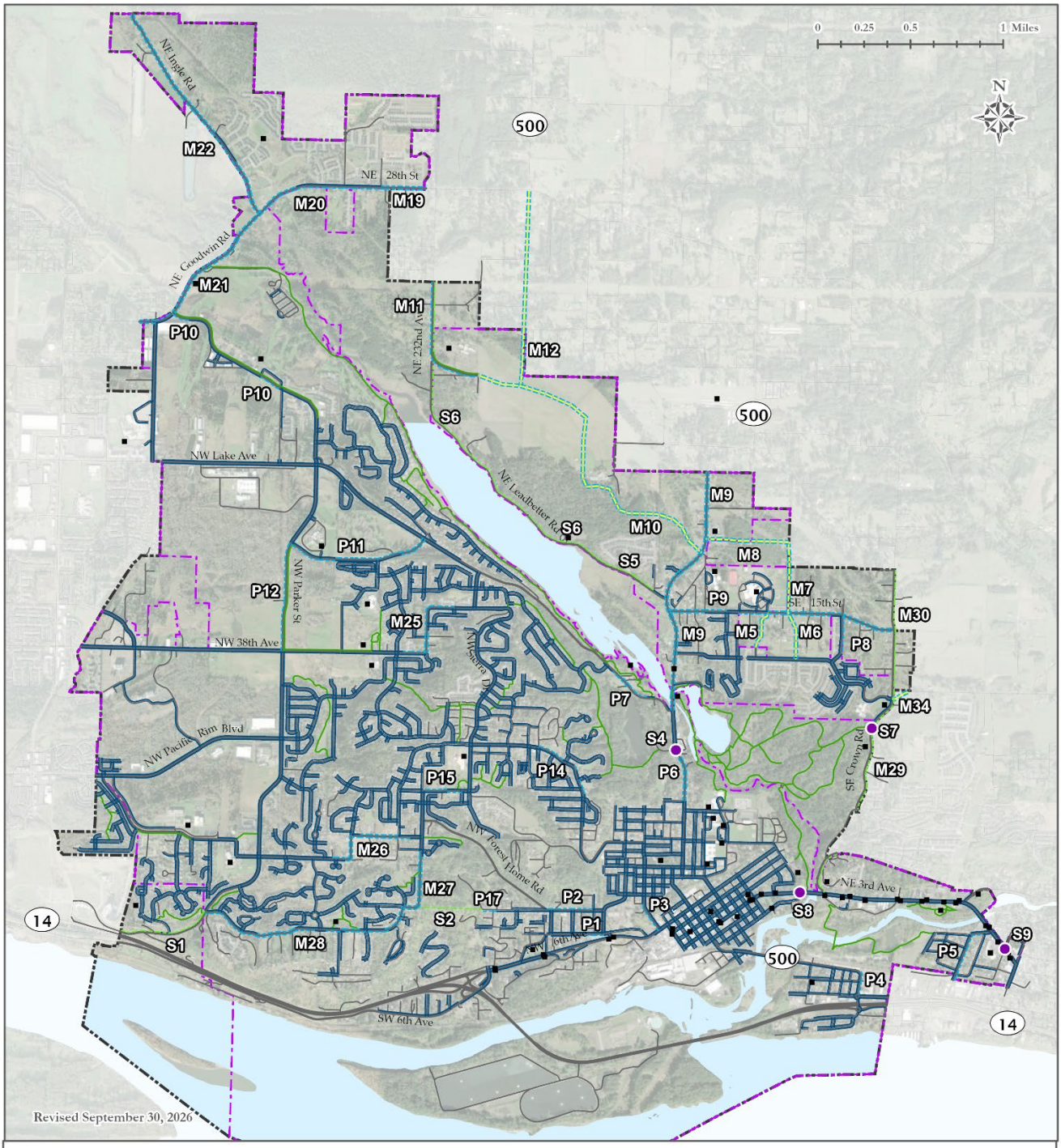
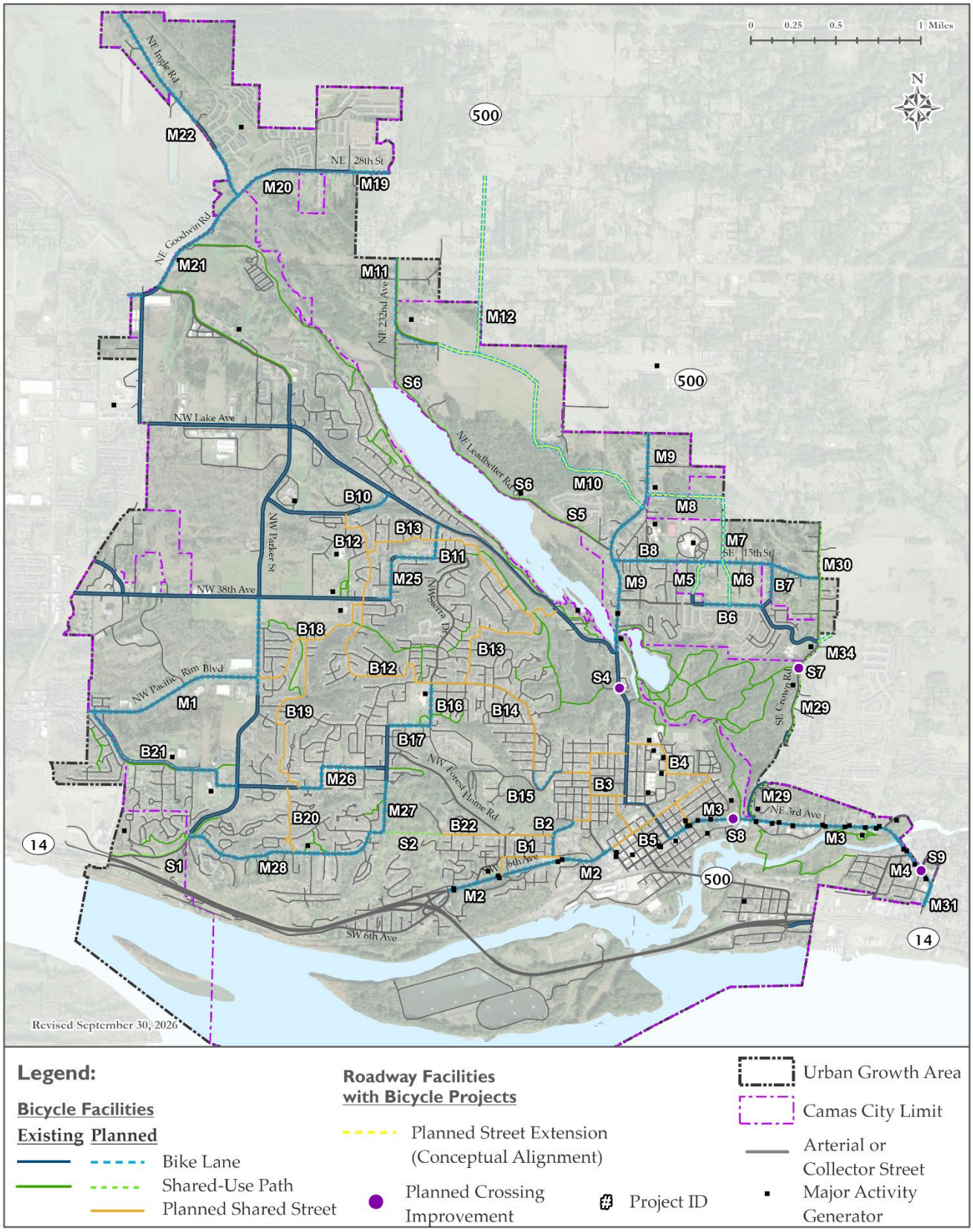


FIGURE 25: PLANNED BICYCLE PROJECTS



CHAPTER 5.

Implementation and On-Going Strategies

The following chapter summarizes system performance outcomes and provides transportation strategies and policy considerations for plan implementation and monitoring. Some are emerging issues to be monitored, and others are ongoing but need greater emphasis or attention. Addressing these will take the City time to evaluate, and they may require future decisions from the City Council.

SYSTEM PERFORMANCE OUTCOMES

This TSP uses system performance measures to support the City's transportation planning and decision-making process. The performance measures serve as the link between TSP goals and plan implementation by enabling the City to measure the degree to which the TSP investments support City-wide priorities through 2045. While the performance assessment does not represent the complete picture, it does offer a baseline against which to assess how the policies, investments, and planning decisions made in this plan may affect the future.

The three TSP performance measures include: 1) Pedestrian Level of Traffic Stress; 2) Bicycle Level of Traffic Stress; and 3) Vehicle Congestion. The current TSP system performance assessment is based on the existing motor vehicle, pedestrian and bicycle facilities and highlights changes in 2045 both without and with the planned TSP projects identified in Chapter 4 along all collector and arterial street segments in the Camas planning area.

PEDESTRIAN AND BICYCLE LEVEL OF TRAFFIC STRESS OUTCOMES

The pedestrian and bicycle LTS evaluation provides a quantitative metric to understand a multimodal user's perception of the safety and comfort of the transportation network and was used by the TSP to understand key gaps and barriers to walking and biking in the City's planning area.

Results of the pedestrian and bicycle LTS evaluations are summarized in Table 10. All collector and arterial streets in Camas must provide an LTS of 2 or better for pedestrian and bicycle facilities, of which an estimated 60 percent of these streets (or about 57 total miles) are forecasted to exceed that threshold by 2045 without any improvements (see Table 10). This TSP includes an estimated $77 million in targeted improvements to address gaps in the walking and biking networks in the City's planning area through 2045. Table 10 shows that these projects will improve about 20 miles of pedestrian facilities (or about 79 percent of the LTS 3 or 4 miles) and 23 miles of bicycle facilities (or around 73 percent of the LTS 3 or 4 miles) that were forecasted to exceed the LTS threshold by 2045.

This TSP addresses all feasible gaps in the walking and biking networks on collector and arterial streets in the City's planning area through 2045. An estimated 5 miles of pedestrian facilities and 8 miles of bicycle facilities along these streets (see Table 10) were deemed infeasible due to physical and natural constraints that prevent adherence to the multimodal network design requirements. However, there was typically a sidewalk available on one side of the street along these segments or a parallel bike route identified in the TSP to serve users of these facilities.

TABLE 10: MULTIMODAL LEVEL OF TRAFFIC STRESS IN CAMAS PLANNING AREA

MULTIMODAL LEVEL OF TRAFFIC STRESS	PEDESTRIAN NETWORK				BICYCLE NETWORK			
	2045 WITHOUT TSP PROJECTS		2045 WITH TSP PROJECTS		2045 WITHOUT TSP PROJECTS		2045 WITH TSP PROJECTS	
	TOTAL MILES	SHARE OF TOTAL MILES	TOTAL MILES	SHARE OF TOTAL MILES	TOTAL MILES	SHARE OF TOTAL MILES	TOTAL MILES	SHARE OF TOTAL MILES
EXTREME STRESS MILES (LTS 4)	5.15	11%	11.09	23%	4.77	10%	9.13	19%
HIGH STRESS MILES (LTS 3)	16.58	35%	31.08	65%	11.94	25%	30.26	64%
MODERATE STRESS MILES (LTS 2)	10.56	22%	2.41	5%	7.03	15%	1.71	4%
LOW STRESS MILES (LTS 1)	15.31	32%	3.02	6%	23.85	50%	6.50	14%
TOTAL MILES*	47.60	100%	47.60	100%	47.60	100%	47.60	100%
TOTAL MILES OVER LTS 2	25.87	54%	5.43 **	11%	30.89	65%	8.21 **	17%
CHANGE (WITH PROJECTS - WITHOUT PROJECTS)			-20.44	-79%		**CHANGE**	-22.67	-73%

Source: Based on existing pedestrian and bicycle facilities in 2024 and planned TSP projects along all collector and arterial street segments in the Camas planning area.

*Total miles include the length of all collector and arterial street segments in the Camas planning area.

**An estimated 5 miles of pedestrian facilities and 8 miles of bicycle facilities along collector and arterial streets were deemed infeasible due to physical and natural constraints that prevent adherence to the multimodal network design requirements. However, there was typically a sidewalk available on one side of the street along these segments or a parallel bike route identified in the TSP to serve users of these facilities.

VEHICLE CONGESTION OUTCOMES

Mobility targets for intersections in the City's planning area provide a metric for assessing the impacts of new development on the existing transportation system and for identifying where capacity improvements may be needed.

Results of the vehicle congestion evaluation are summarized in Table 11. This TSP includes performance standards for motor vehicles, of which 16 of the 50 key intersections in Camas (i.e., intersections of two collector and/or arterial streets) are forecasted to exceed that threshold by 2045 without any improvements (see Table 11). The TSP includes conceptual intersection enhancements, and locations of future collector and arterial streets that will help to provide additional travel routes and alleviate some of the local traffic from streets in the Camas planning area through 2045. Table 11 shows that these projects will improve the 16 substandard intersections that were forecasted to exceed the vehicle congestion threshold by 2045.

TABLE 11: VEHICLE CONGESTION IN CAMAS PLANNING AREA

ID	STUDY INTERSECTION	EXISTING TRAFFIC CONTROL	2045 WITHOUT TSP PROJECT			RECOMMENDED TSP IMPROVEMENT	2045 WITH TSP PROJECT		
			DELAY	LOS	V/C		DELAY	LOS	V/C
1	NW Grand Ridge Drive at NW Brady Road	Two-Way Stop Control	9/20	A/C	0.42/0.24	n/a	-	-	-
2	NW Brady Road at NW McIntosh Road	Two-Way Stop Control	9/36	A/E	0.26/0.45	n/a	-	-	-
3	NW Brady Road at NW 16th Avenue	Traffic Signal	20	B	0.79	n/a	-	-	-
4	Pacific Rim Boulevard at Payne Road	Traffic Signal	13	B	0.47	n/a	-	-	-
5	Pacific Rim Boulevard at Fisher Creek Drive	Two-Way Stop Control	8/22	A/C	0.10/0.76	n/a	-	-	-
6	Pacific Rim Boulevard at NW Parker Street	All-Way Stop Control	36	**F**	**1.02**	Intersection improvements*	15	B	0.48
7	NW 38th Avenue at NW Parker Street	Traffic Signal	25	C	0.78	n/a	-	-	-
8	SE Bybee Road at SE 20th Street	Traffic Signal	24	C	0.73	n/a	-	-	-
9	NW Leadbetter Drive at NW Parker Street	Two-Way Stop Control	9/43	A/E	0.26/0.57	n/a	-	-	-
10	Lake Road at NW Parker Street	Traffic Signal	22	C	0.67	n/a	-	-	-
11	NW Payne Street at NW Lake Road	Two-Way Stop Control	10/38	A/E	0.27/0.59	n/a	-	-	-
12	NW Friberg-Strunk Street at Lake Road	Traffic Signal	23	C	0.80	n/a	-	-	-
13	NW Friberg-Strunk Street at Union High	Two-Way Stop Control	8/14	A/B	0.16/0.12	n/a	-	-	-
14	NE 13th Street at NW Friberg-Strunk Street	Traffic Signal	19	B	0.80	n/a	-	-	-
15	NW Camas Meadows Drive at NE Goodwin Road	Two-Way Stop Control	11/294	**B/F**	**0.41/1.25**	Intersection improvements*	15	B	0.76
16	NE Ingle Road at NE 28th Street	Traffic Signal	17	B	0.74	n/a	-	-	-
17	NE 232nd Avenue at NE 28th Street	Two-Way Stop Control	9/237	**A/F**	**0.16/1.40**	Intersection improvements*	16	B	0.78

ID	STUDY INTERSECTION	EXISTING TRAFFIC CONTROL	2045 WITHOUT TSP PROJECT			RECOMMENDED TSP IMPROVEMENT	2045 WITH TSP PROJECT		
			DELAY	LOS	V/C		DELAY	LOS	V/C
18	NE 28th Street at SR 500-NE 242nd Avenue	Two-Way Stop Control	9/124	**A/F**	**0.27/1.13**	Intersection improvements*	9	A	0.61
19	NE 199th Avenue at SR 500-NE 58th Street	Two-Way Stop Control	9/356	**A/F**	**0.19/1.70**	Intersection improvements*	11	B	0.62
20	SR 500 at NE 3rd Street	Roundabout	6	A	0.37	n/a	-	-	-
21	SR 500-NE Everett Street at SE Leadbetter Road	Two-Way Stop Control	9/20	A/C	0.28/0.29	n/a	-	-	-
22	SR 500-NE Everett Street at NE 43rd Avenue	Traffic Signal	11	B	0.55	n/a	-	-	-
23	SR 500-NE Everett Street at NE 38th Avenue	Two-Way Stop Control	10/69	**B/F**	0.45/0.56	Intersection improvements*	8	A	0.69
24	SR 500-NE Everett Street at NW Lake Road	Roundabout	11	B	0.66	n/a	-	-	-
25	NW Lake Road at NW Lacamas Lane	Two-Way Stop Control	11/62	**B/F**	0.42/0.22	Intersection improvements*	6	A	0.62
26	NW Lake Road at NW Sierra Street	Two-Way Stop Control	12/735	**B/F**	**0.31/2.29**	Intersection improvements*	11	B	0.66
27	NW Lake Road at NW Leadbetter Drive	Two-Way Stop Control	10/166	**A/F**	**0.32/1.14**	Intersection improvements*	14	B	0.64
28	NW Sierra Street at NW 45th Avenue	Two-Way Stop Control	8/18	A/C	0.22/0.13	n/a	-	-	-
29	NW Dahlia Drive at NW 38th Avenue	Two-Way Stop Control	9/47	A/E	0.15/0.67	n/a	-	-	-
30	NW Utah Street at NW 28th Avenue	Two-Way Stop Control	8/12	A/B	0.09/0.22	n/a	-	-	-
31	NW Sierra Drive at NW 28th Avenue	All-Way Stop Control	10	B	0.30	n/a	-	-	-
32	NW Astor Street at NW Forest Home Road	Two-Way Stop Control	8/11	A/B	0.08/0.24	n/a	-	-	-
33	NW Astor Street at NW 18th Avenue	Two-Way Stop Control	8/11	A/B	0.07/0.15	n/a	-	-	-
34	NW Forest Home Road at NW 10th Avenue	Two-Way Stop Control	8/11	A/B	0.07/0.22	n/a	-	-	-
35	Division Street at NW 18th Avenue	Two-Way Stop Control	8/12	A/B	0.22/0.32	n/a	-	-	-
36	NW 6th Avenue at SR 14 Ramps	Roundabout	74	**F**	**1.24**	Corridor Improvements**	14	B	0.61
37	NW 6th Avenue at NW Logan Street	Two-Way Stop Control	11/35	B/E	0.74/0.29	n/a	-	-	-
38	NW 6th Avenue at NW Ivy Street	Two-Way Stop Control	10/115	**B/F**	0.45/0.25	Corridor Improvements**	4	A	0.47
39	NW 6th Avenue at Drake Street	Two-Way Stop Control	11/221	**B/F**	**0.42/1.18**	Corridor Improvements**	5	A	0.49
40	NE 6th Avenue at NE Division Street	Two-Way Stop Control	12/154	**B/F**	0.56/0.56	Corridor Improvements**	4	A	0.59
41	NE 6th Avenue at NE Adams Street	Two-Way Stop Control	291	**F**	**2.09**	Corridor Improvements**	10	A	0.66
42	NE 6th Avenue at SR 500-NE Garfield Street	Two-Way Stop Control	9/93	**A/F**	0.29/0.88	Intersection improvements*	6	A	0.48
43	NE 3rd Avenue at SR 500-NE Garfield Street	Traffic Signal	18	B	0.68	n/a	-	-	-

ID	STUDY INTERSECTION	EXISTING TRAFFIC CONTROL	2045 WITHOUT TSP PROJECT			RECOMMENDED TSP IMPROVEMENT	2045 WITH TSP PROJECT		
			DELAY	LOS	V/C		DELAY	LOS	V/C
44	NE 3rd Avenue at SR 500-NE Dallas Street	Traffic Signal	16	B	0.77	n/a	-	-	-
45	Crown Street at 3rd Avenue	Traffic Signal	20	B	0.69	n/a	-	-	-
46	Shephard Road at NE 3rd Avenue	Traffic Signal	11	B	0.42	n/a	-	-	-
47	NE 3rd Avenue at NE 4th Street	Traffic Signal	6	A	0.40	n/a	-	-	-
48	Weir Road at NE 3rd Avenue	Two-Way Stop Control	10/106	**A/F**	**0.14/1.00**	Corridor Improvements***	7	A	0.38
49	SE 283rd Avenue at SE 23rd Street	Two-Way Stop Control	8/13	A/B	0.23/0.21	n/a	-	-	-
50	SE 283rd Avenue at SE 15th Street	Two-Way Stop Control	8/13	A/B	0.16/0.26	n/a	-	-	-

Notes: **Red shading** indicates an intersection with two-way stop control that exceeds the vehicle congestion threshold of LOS "E" or v/c 0.90, or an intersection with traffic signal, roundabout or all-way stop control that exceeds the vehicle congestion threshold of LOS "D" or v/c 0.85.

Intersection operations are reported for the entire intersection at traffic signals, roundabouts or all-way stop control intersections, and for the worst major street movement/worst minor street movement at two-way stop control intersections.

* Intersection improvements to be confirmed through future design and may include the potential installation of roundabout or traffic signal.

** Corridor wide improvements to NW/NE 6th Avenue between Norwood Street and Adams Street to be confirmed through future design to address congestion at intersections, safety and bicycle facility gaps and may include the potential installation of a traffic signal.

*** Corridor wide improvements to NE 3rd Avenue between NE Garfield Street and SE Lechner Street to be confirmed through future design to address congestion at intersections, safety and bicycle facility gaps and may include the potential installation of a traffic signal.

STEPS TO SUPPORT PLAN IMPLEMENTATION

Chapter 3 of the TSP includes several updated transportation standards and regulations. These apply to the construction of new transportation facilities and to the operation of all facilities to ensure they are designed appropriately, and that the system functions as intended. These standards and regulations will need to be added by reference or incorporated into the City's Municipal Code and/or Development Code:

ACTION: Amend the Camas Municipal Code to:

- Update references to adopted vehicle functional classifications, as well as area designations, consistent with the TSP.
- Update references to minimum street cross-section and facility widths, consistent with the TSP.
- Update references to vehicle mobility standards and new pedestrian and bicycle level of traffic stress targets for City streets, consistent with the TSP.
- Update references for transportation facility and access spacing standards identified the TSP for City streets.

City of Camas

TRANSPORTATION SYSTEM PLAN

VOLUME 2

DRAFT OCTOBER 2026

TSP VOLUME 2: APPENDIX

Volume 2 of the Camas Transportation System Plan includes all background memoranda, and technical data that were the basis for its development. The contents of Volume 2 represent an iterative process in the development of the TSP. Refinements to various plan elements occurred throughout the process as new information was obtained. In all cases, the contents of Volume 1 supersede those in Volume 2.

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APPENDIX A. BACKGROUND PLANS, POLICIES AND TRAFFIC IMPACT FEE SUMMARY

MEMORANDUM

720 SW Washington St.
Suite 500
Portland, OR 97205
503.243.3500
www.dksassociates.com

DATE: May 15 2024

TO: Curleigh Carothers, City of Camas
Steve Wall, City of Camas

FROM: Reah Flisakowski, DKS Associates
Kevin Chewuk, DKS Associates
Veronica Sullivan, DKS Associates

SUBJECT: Camas Transportation Plan
Technical Memo #1a – Background Plans, Policies and Traffic Impact Fee Summary

P18039-000

This memorandum summarizes recent planning documents, policies and regulations that are applicable to the City of Camas Transportation Plan and Traffic Impact Fee (TIF) program. The transportation element of the City's current Comprehensive Plan will serve as the foundation for this process, upon which new information obtained from system analysis and stakeholder input will be applied to address changing transportation needs through the year 2040. As new strategies for addressing transportation needs are proposed, compliance and coordination with the plans, policies, and regulations described in this document will be required.

Note that this document does not include the full list of projects recommended from these plans. The list of previously recommended projects will be provided in Technical Memorandum #5 - Solutions Identification and Evaluation.

Planning Context

Growth Management Act (1990)

The Growth Management Act (GMA) was adopted in 1990 and includes both a set of high-level goals and a set of statutes and administrative codes that implement those goals. The two goals most relevant to transportation planning are Goal 2 and Goal 12:

- **Goal 2** – Transportation. Encourage efficient multimodal transportation systems.
- **Goal 12** – Public facilities and services. Ensure that those public facilities and services necessary to support development shall be adequate to serve the development at the time the

development is available for occupancy and use without decreasing current service levels below locally established minimum standards.

The provisions of the GMA govern the transportation element of comprehensive plans through two sections of statute and one section of administrative code:

- RCW 36.70A.070 Comprehensive plans – Mandatory elements
- RCW 36.70A.108, Transportation element – Multimodal transportation improvements and strategies
- WAC 365-196-430, Transportation element

The Department of Commerce's Growth Management Services Division provides a useful and comprehensive checklist to help guide jurisdictions to update any element of the Comprehensive Plan to ensure compliance with the GMA. The checklist was last updated in 2014 and integrates all planning requirements defined in state statute or administrative code under the GMA.

The checklist summarizes the mandatory requirements under the GMA. Table 1 provides an overview of the topics addressed in the checklist and a summary of the mandatory elements related to each topic.

Table 1: Summary of Transportation Element Requirements of the GMA

Topic	Requirement(s)
Transportation inventory	Include an inventory of for all air, water, and ground transportation facilities.
Level of service standards	Plan must be regionally coordinated and must include standards for arterials, transit routes, and state highways.
Concurrency	Provide specific actions for bringing locally-owned facilities into compliance when below LOS standard.
Forecasting	Include a forecast of at least 10-years that provides information on the location and timing of capacity needs on the state and local system. The forecast must be based on growth assumptions in the Land Use Element.
Bicycle and pedestrian planning	Include a bicycle and pedestrian component.
Transportation Demand Management	Describe existing and planned TDM strategies. Camas is required to implement a Commute Trip Reduction (CTR) Program under the 2006 CTR Efficiency Act.
Funding	Include a multi-year financing plan that includes 6-year Transportation Improvement Program; Assess needs relative to funding sources; If funding is insufficient, identify how additional funds will be raised or modifications to land use assumptions to ensure LOS standards will be met.
Consistency and Coordination	Discuss intergovernmental coordination; Identify impact on adjacent jurisdiction; Demonstrate consistency with the regional transportation plan.

What this means for the Camas Transportation Plan: The GMA regulates both the process and content of the Transportation Element of comprehensive plans. The requirements of the GMA should be reviewed throughout development of the Transportation Plan.

WSDOT Highway System Plan (2007-2026)

The WSDOT (Washington State Department of Transportation) Highway System Plan is the element of the 2006 Washington's Transportation Plan (WTP) that identifies current and forecasted state highway needs based on the investment options identified in the WTP. The Plan identifies all the needs consistent with the WTP and provides strategies and performance measures to address those needs. This plan is based on the goals established in the WTP and supports the state's transportation policy goals contained in the RCW 47.04.280:

1. **Preservation:** to maintain, preserve and extend the life and utility of prior investments in transportation systems and services;
2. **Safety:** to provide for and improve the safety and security of transportation customers and the transportation system;
3. **Mobility:** to improve the predictable movement of goods and people throughout Washington state;
4. **Environment:** to enhance Washington's quality of life through transportation investments that promote energy conservation, enhance healthy communities and protect the environment; and
5. **Stewardship:** to continuously improve the quality, effectiveness and efficiency of the transportation system.

What this means for the Camas Transportation Plan: The Plan will ensure consistency with the Highway System Plan. It will identify needs for SR 14 and SR 500 in Camas to ensure that the state's transportation network functions safely, efficiently, reliably and cost effectively.

Regional Transportation Plan for Clark County (2014)

Washington State's Growth Management Act approved the Regional Transportation Planning Program which created a formal mechanism for local governments and the state to coordinate transportation planning for regional transportation facilities. The Growth Management Act authorized the creation of Regional Transportation Planning Organizations (RTPOs) by units of local government. Southwest Washington Regional Transportation Council (RTC) is the designated RTPO for the three-county area of Clark, Skamania and Klickitat.

The duties of the RTPO include:

- Designation of the regional transportation system.
- Development of a six-year Transportation Improvement Program (TIP) to include regionally-significant city road projects, county road projects, transit capital projects and WSDOT transportation projects. The TIP must include a financial plan.
- Development of a Regional Transportation Plan (RTP) to include a regional transportation strategy, identification of existing and planned facilities and programs, Level of Service standards, a financial plan, assessment of regional development patterns and capital investment using a regional transportation approach. The Plan should also establish the relationship of High Capacity Transit to other public transportation providers. The concept of least cost planning is to be used in development of the RTP.
- Review of the Regional Transportation Plan at least every two years to ensure that it is current.
- Establish guidelines and principles for development and evaluation of local comprehensive plan transportation elements and certify that the transportation elements meet the requirements of the GMA and are consistent with the RTP.
- Develop a regional Level of Service (LOS) standard for the regional system as required by the LOS Bill.

Clark County's Regional Transportation Plan (RTP) is the region's long-range transportation planning document with a 2035 horizon. It is consistent with Federal and State requirements and builds upon strategies identified by State and local agencies to address short-, mid-, and long-term needs.

Sections relevant to Camas include:

- **Regional Transportation System:** The RTP focuses on the regional transportation system and identifies several streets in Camas as part of the system, including SR 14, SR 500, Lake Road - SE 1st Street, Parker Street, Pacific Rim Boulevard - 34th Street, NW 38th Avenue – SE 20th Street, NW 6th Avenue, and NE 3rd Avenue.

- **Highways of Statewide Significance (HSS):** SR 14 in Camas is designated as a highway facility of Statewide Significance. The State must give higher priority to correcting identified deficiencies on transportation facilities of statewide significance.
- **Level of service standards:** Level of Service for Highways of Statewide Significance is set by the State. In Clark County, the standard is set as LOS "D" for urban areas, including SR 14. Level of Service for regional state highway facilities (not part of the HSS), including SR 500 in Camas, is set through a Regional Transportation Planning Organization (RTPO). The RTC Board adopted LOS 'E' or better for non-HSS urban state highway facilities and LOS 'C' or better on rural non-HSS facilities.
- **Regional Transportation System Improvements: The RTP identifies improvements necessary to meet the transportation needs within and through the region over the next 20-plus years on the** RTP's Designated Regional Transportation System.

What this means for the Camas Transportation Plan: The Plan will ensure consistency with the RTP, it will adopt the LOS standard for Highways of Statewide Significance and regionally significant roadways, and will identify capital projects for the Regional Transportation System in Camas.

2035 Camas Comprehensive Plan

The Camas Comprehensive Plan, adopted in 2016, includes the City's transportation goals and policies. Comprehensive Plan Chapter 4, Transportation, provides the policy framework for the development and maintenance of the City's streets, bicycle and pedestrian ways and transit facilities, low-impact development, safety, traffic calming, and transportation demand management.

Overall, there are 41 policies in the chapter on transportation, categorized by the transportation-related topics listed below

- **Street Goal:** Streets will function for all users including bicyclists, pedestrians, transit users and motorists. Policies T-1.1 to T-1.7.
- **Walking, Bicycling and ADA Mobility Goal:** The needs of bicyclists, pedestrians, transit users and accessibility (ADA-compliant) will be considered in all street improvements and will be integrated in all collector and arterial roadways projects, including regular safe street crossings. Policies T-2.1 to T-2.7.

- **Local and Regional Transit:** Regional Transit will provide safe, efficient, and dependable service to our community. Policies T-3.1 to T-3.2.
- **Design and Low-Impact Development:** The transportation system will be designed to support community character and environmental policies. Policies T-4.1 to T-4.4.
- **Safety and Traffic Calming:** Design and construct safe transportation facilities that meet applicable requirements. Policies T-5.1 to T-5.6.
- **Transportation Demand Management:** Transportation planning will achieve the efficient use of transportation infrastructure, increase its person-carrying capacity and accommodate and facilitate future growth consistent with land use objectives. Policies T-6.1 to T-6.4.
- **Concurrency and Level of Service:** The City will maintain the adopted LOS standards for all arterials, transit routes and highways. Policies T-7.1 to T-7.5.
- **Transportation Revenue:** Maximize the use of state and federal funds for transportation capital operating service and demand improvements. Policies T-8.1 to T-8.6.

The Transportation Comprehensive Plan Map provides a summary of existing and proposed transportation facilities in the City, including the number of travel lanes.

What this means for the Camas Transportation Plan: The TSP update process will provide an opportunity to review transportation policies, as well as supporting sections of the Comprehensive Plan transportation element, to better represent current state and local practices and objectives. Potential policy changes may reflect issues such as strategies to optimize transportation management and maximizing the efficiency of the existing transportation system, and the role the transportation system plays in human health. Particular attention will be given to ensuring that the TSP will be consistent with existing City policies.

Other Background Information for the Transportation Plan

The following sections summarize additional background information or guidance documents that will be used in for the Camas Transportation Plan.

SR-500/ 6th Avenue Corridor Analysis

The SR 500/ 6th Avenue Corridor Analysis identifies travel conditions for motor vehicles and future needs for pedestrians, bicycles and transit. The corridor was divided into six segments and improvement alternatives were identified and evaluated between the NW 6th Avenue/NW Norwood Street intersection to approximately 500 feet south of the SR 500/NE 3rd Street intersection.

> **What this means for the Camas Transportation Plan: The project list for the SR-500/ 6th Avenue Corridor Analysis potentially will need to be updated to reflect outcomes of the Transportation Plan process.**

North Urban Growth Area Traffic Analysis

The North Urban Growth Area Traffic Analysis evaluates the potential lane configuration and roadway cross-section configuration for an arterial connection through this area. The North Urban Growth Area study area lies to the north of Lacamas Lake between NE 232nd Avenue and NE Everett Street (SR 500).

> **What this means for the Camas Transportation Plan: The findings for the North Urban Growth Area Traffic Analysis will be reviewed and updated if needed during the development of the Plan.**

Crown Road Corridor Plan

PLACEHOLDER- The Crown Road Corridor Plan has not been completed.

Clark County Transportation Capital Facilities Plan (2016-2035)

The Clark County Transportation Capital Facilities Plan provides the County with a guide for transportation system improvements to meet existing and future travel needs while setting forth supporting goals and policies. The plan focuses on roadway facilities within the County that are outside of City limits, so there are no identified projects within Camas.

What this means for the Camas Transportation Plan: The Transportation Plan should be consistent with all relevant provisions of the County Transportation Capital Facilities Plan.

Clark County Bicycle and Pedestrian Plan (2010)

The Clark County Bicycle and Pedestrian Plan is a 20-year vision and implementation strategy that was developed to increase the number of people walking and bicycling while improving pedestrian and bicycling safety throughout the county. Clark County recognizes the importance of walkable, bikeable neighborhoods which can make a community more livable, attractive, healthier and increase spending on local goods and services. The Plan's recommendations focus on walkways, bikeways and trials that connect key destinations in Clark County.

The plan focuses on bicycle and pedestrian facilities within the County that are outside of City limits, so there are no newly identified projects within Camas. However, the plan's appendix provides a summary of existing, partially constructed and previously planned shared-use paths in Camas.

What this means for the Camas Transportation Plan: The Transportation Plan should be consistent with all relevant provisions of the County Bicycle and Pedestrian Plan.

Clark County Arterial Atlas with 2017 Amendments

The Clark County Arterial Atlas is a supporting document to Clark County's Comprehensive Growth Management Plan that outlines future growth and unites the long-range roadway system with land use plans. The Arterial Atlas provides guidance for developing a roadway system that will help fulfill the objectives of the comprehensive plan. The County's arterial functional classification system and the cross-sections for non-local roadways in the County's jurisdiction are provided in the adopted Arterial Atlas.

The relevant classifications in Camas are:

- **State Routes: SR-14 and** SR-500
- **Primary Arterials:** Lake Road, 6th Avenue, Adams Street, and 3rd Avenue
- Arterial Roadways: **Pacific Rim Blvd,** Brady Road, **NW Parker St, NW 38th Ave, Astor St, 43rd Ave, Sierra St, Cascade St, NW 23rd Ave, 18th St, NW Fargo St, Leadbetter Rd, Crown Rd, Division St, and** Whitney St

What this means for the Camas Transportation Plan: The functional classification system for the City will be revisited for the Transportation Plan. The Plan should be consistent with the Clark County classifications.

Vancouver Transportation Plan (2004)

The Vancouver Transportation Plan is the transportation element of the Vancouver Comprehensive Plan. The purpose of this transportation plan is to identify policies, objectives, programs and projects that will support future growth and development of Vancouver, as directed by the Vancouver Comprehensive Plan.

The plan identifies transportation improvements within the City of Vancouver. Some of these projects, specifically those that are in the portions of the City of Vancouver adjacent to Camas, may need to be integrated into the Camas Transportation Plan to ensure consistency among the transportation networks of the two cities.

What this means for the Camas Transportation Plan: The Transportation Plan will consider the projects in the Vancouver Transportation Plan that are adjacent to the City of Camas that will enhance regional connectivity.

Vancouver Transportation Improvement Program (2018-2023)

The Vancouver Six-Year Transportation Improvement Program identifies projects that are funded and expected to be constructed between the years 2018-2023.

The plan identifies transportation improvements within the City of Vancouver. Some of these projects, specifically those that are in the portions of the City of Vancouver adjacent to Camas, may need to be integrated into the Camas Transportation Plan to ensure consistency among the transportation networks of the two cities.

What this means for the Camas Transportation Plan: The Transportation Plan will consider the projects in the Vancouver Transportation Improvement Program that are adjacent to the City of Camas to ensure consistency.

Washougal Transportation Capital Facilities Plan (2016)

The Washougal Transportation Capital Facilities Plan provides the City of Washougal with a guide for transportation system improvements to meet existing and future travel needs while setting forth supporting goals and policies.

The plan identifies transportation improvements within the City of Washougal. Some of these projects, specifically those that are in the portions of the City of Washougal adjacent to Camas, may need to be integrated into the Camas Transportation Plan to ensure consistency among the transportation networks of the two cities.

> **What this means for the Camas Transportation Plan: The Transportation Plan will consider the projects in the Washougal Transportation Capital Facilities Plan that are adjacent to the City of Camas that will enhance regional connectivity.**

Federal Functional Classifications

The federal government also has a functional classification system that is used to determine federal aid funding eligibility. Roadways federally designated as a major collector, minor arterial, principal arterial, or freeway/ expressway/ interstate are eligible for federal aid.

The following federal classifications apply to roadways in Camas:

- **Freeway/ expressway:** SR 14
- **Principal arterials:** NW 6th Avenue, NE Adams Street and NE 3rd Avenue
- **Minor arterials:** SR 500, NW 7th Avenue, NW Ivy Street, NW Forest Home Road, NW Astor Street, NW 18th Avenue, NW 16th Avenue, Brady Road, NW 18th Avenue, SE Payne Road, NW Pacific Rim Boulevard, NW Parker Street, NW 38th Avenue, NW 43rd Avenue, SW Sierra Street, NW Lake Road, NW Camas Meadows Drive, NW Friberg Street, NE Goodwin Road, NE Leadbetter Road and SE Crown Road
- **Major collectors:** SW 6th Avenue, Division Street, NW 18th Avenue, NW Fargo Street, NW Sierra Street, NW 23rd Avenue, NW Astor Street, NW 11th Avenue, NW McIntosh Road, NW Cascade Street, and NE 43rd Avenue

What this means for the Camas Transportation Plan: The functional classification system for the City will be revisited for the Transportation Plan. The Plan should be consistent with the Federal classifications.

Camas Transportation Impact Fee Summary

The TIF for the City of Camas (City) was most recently updated in May 2012 by DKS Associates. The TIF uses 2005 through 2035 as the analysis period for the TIF calculation. Total project costs in the TIF calculation equal $135.9M and resulting TIF-eligible project costs were $79.6M. The TIF also includes a $3.0M bond reimbursement cost basis.

Project costs are allocated to one of two districts (save for one project, which is allocated by District proportionally): North District (roughly north of Lacamas Lake) and South District. The North District pays a larger TIF than the South District.

The memo uses a 60% reduction factor to the final calculated TIF to arrive at the net rate charged on development. Though it is unclear where this reduction factor is calculated, the 2012 update references previous work in determining the 60% reduction. The TIF update documents a 3.9% per year index factor. It appears that the City has indexed the TIF annually since the 2012 update.

The City charges the TIF per P.M. Peak Hour Trip basis. The charge for a given development is based on the latest edition of the Institute of Transportation Engineer's *Trip Generation Handbook*.

What this means for the Camas Transportation Plan: The Transportation Impact Fee will be updated as needed and incorporated into the Transportation Plan funding strategy.

APPENDIX B. GOALS, POLICIES AND EVALUATION CRITERIA

MEMORANDUM

720 SW Washington St.
Suite 500
Portland, OR 97205
503.243.3500
www.dksassociates.com

DATE: May 15, 2024

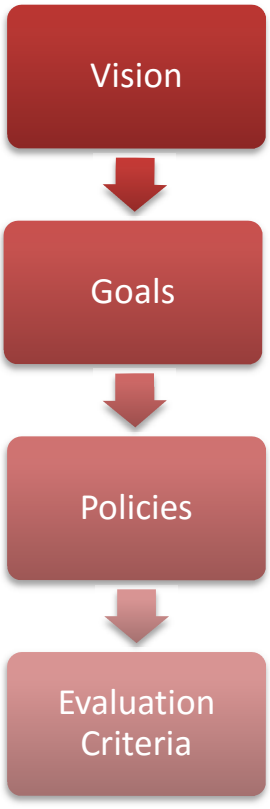
TO: Curleigh Carothers, City of Camas
Steve Wall, City of Camas

FROM: Reah Flisakowski, DKS Associates
Kevin Chewuk, DKS Associates

SUBJECT: Camas Transportation Plan
Technical Memo #1b – Goals, Policies and Evaluation Criteria P18039-000

The purpose of this memorandum is to initiate the process of developing the transportation-related vision, goals, policies, and evaluation criteria that will help guide the development of the Camas Transportation Plan (TP), and future investment decisions. This effort will continue through the planning process, shaped by input received from the Stakeholder Advisory Committee, Economic Development Committee and the general public.

Setting Direction for Transportation Planning



Collectively, the transportation-related goals, policies, and evaluation criteria describe what the community wants the transportation system to do in the future, as summarized by a **vision statement**. A vision statement generally consists of an imaginative description of the desired condition in the future. It is important that the vision statement for transportation align with the community's core values.

Goals and policies create manageable stepping stones through which the broad vision statement can be achieved. **Goals** are the first step down from the broader vision. They are broad statements that should focus on outcomes, describing a desired end state. Goals should be challenging, but not unreasonable.

Each goal must be supported by more finite **policies**. In contrast to goals, policies should be specific and measurable. Where feasible, providing a targeted time period helps with policy prioritization and achievement. When developing policies, it is helpful to identify key issues or concerns that are related to the attainment of the goal.

The solutions recommended through the TP must be consistent with the goals and objectives. To accomplish this, measurable **evaluation criteria** that are based on the goals and objectives will be developed. For the Camas TP, they will be used to inform the selection and prioritization of projects and policies for the plan by describing how well the alternatives considered support goal areas.

Developing Goals and Policies

The Camas 2035 Comprehensive Plan (adopted in June 2016) will provide the transportation vision, goals and policies for the Camas TP. The policies from the Camas 2035 Comprehensive Plan that set transportation standards were omitted from this memorandum. They will be reviewed with other transportation standards later in the planning process.

Transportation Vision Statement

In 2035, residents of Camas continue to appreciate their safe, diverse, and welcoming community as a livable place for people of all ages. Quality public facilities, services, and utilities contribute to their high quality of life.

Transportation Goals and Policies

Streets

Goal

Streets will function for all users including bicyclists, pedestrians, transit users, and motorists.

Policies

- Maintain the livability of Camas through proper location and design of transportation facilities, consistent with the Camas Transportation Plan map and 6-year street plan.
- Support the need for regular street maintenance, safety and efficiency improvements, and access management measures.
- Construct streets that are interconnected and avoid long cul-de-sacs or dead ends. Block lengths should be less than 1,000 feet.
- Maintain the transportation system at a level that preserves user safety, facility aesthetics, and the overall integrity of the system.
- Provide attractive streetscapes through design standards that encourage appropriate traffic volumes, speeds, and multi-modal safety.
- Minimize access to new development and redevelopment along the City's arterials, and consolidate access points when spacing is insufficient.
- Include enhanced roadway features such as roundabouts, decorative lighting, and landscaping for gateways.

Walking, Bicycling, and ADA Mobility

Goal

The needs of bicyclists, pedestrians, transit users, and accessibility (ADA-compliant) will be considered in all street improvements and will be integrated in all collector and arterial roadway projects, including regular safe street crossings.

Policies

- Enhance travel choices and provide pedestrian and bicycle routes designed especially for them, not simply along routes designed for cars. Route planning should seek shortcuts and other opportunities that give walking or biking advantages over the automobile.
- Support opportunities to increase participation of school-age children in walking or biking to school to improve their health and reduce traffic congestion.
- Include pedestrian and bicycle linkages in the construction of cul-de-sacs and other forms of dead-end streets. Existing dead-end streets should be retrofitted to provide bicycle and pedestrian linkages as practicable.
- Recognize and support Complete Street implementation in all new and retrofit development to better the health of the community.
- Coordinate with schools and the community to designate safe pedestrian and bicycle routes between residential areas, schools, and public facilities.
- Increase wayfinding signage for outdoor destinations throughout the City.
- Support enhanced pedestrian improvements in the downtown and other economic development areas.

Local and Regional Transit

Goal

Regional transit will provide safe, efficient, and dependable service to our community.

Policies

- Coordinate with local municipalities, the Washington State Department of Transportation, adjacent counties, and C-TRAN to ensure that minimum roadway and multi-modal design standards are consistent.
- Continue to advocate for quality regional transit services and an increase to service availability.

Design and Low-Impact Development

Goal

The transportation system will be designed to support community character and environmental policies.

Policies

- Provide attractive streetscapes through design standards that encourage appropriate traffic volumes, speeds, robust landscaping, and safety for pedestrians and bicyclists.
- Minimize cut and fill in roadway design and minimize restructuring the natural contours of the land.
- Encourage the inclusion of LID design features (e.g., rain gardens, grass pavers, pervious pavement) in the design of private driveways, parking lots, and other road surfaces.
- Continue implementing new strategies such as LED lights as a standard for new development and replacing existing inventory.

Safety and Traffic Calming

Goal

Design and construct safe transportation facilities that meet applicable requirements.

Policies

- Encourage traffic safety through education, enforcement, and engineering.
- Ensure that adequate access for emergency services vehicles is provided throughout the City.
- Provide design standards that encourage appropriate traffic volumes, speeds, and pedestrian safety.
- Incorporate safe pedestrian and bicycle routes between residential areas, schools, and public facilities in development.
- Require new developments to implement design standards using the Neighborhood Traffic Management Plan.
- Identify high accident areas, and implement specific measures to reduce their occurrence.

Transportation Demand Management

Goal

Transportation planning will achieve the efficient use of transportation infrastructure, increase its person carrying capacity, and accommodate and facilitate future growth consistent with land use objectives.

Policies

- Require large employers to implement a commute trip reduction program for employees, as mandated by the state's Commute Trip Reduction law.
- Develop Complete Street design that is supportive of the use of alternative modes of travel and adopt engineering design standards consistent with these goals.
- Support intergovernmental development review.
- Support RTC with funding and staff participation to the extent possible.

Concurrency and Level of Service

Goal

- The City will maintain the adopted LOS standards for all arterials, transit routes, and highways.

Policies

- Encourage growth in areas with existing or planned infrastructure capacity.
- Require new development to demonstrate that adequate person trips are available, or that multi-modal improvements to the transportation system are made to accommodate the impacts concurrent with the development.
- Utilize traffic impact fee studies, development traffic impact analyses, and corridor studies to identify deficiencies and plan improvements to maintain or improve level-of-service standards.
- Take the following actions (not in priority order) if probable funding falls short of meeting identified needs:
    - Delay development until programs, facilities, or services can be funded;
    - Obtain needed revenue or revise the transportation plan to reflect known financial resources.
    - As a last choice, change the transportation LOS standard.

Transportation Revenue

Goal

Maximize the use of state and federal funds for transportation capital, operating, service, and demand improvements.

Policies

- Maintain a capital improvement plan that identifies construction and improvement priorities and funding.
- Ensure that the transportation impact fee program responds to land use changes, so that connectivity occurs and new development pays its proportionate share of needed capacity.
- Support the Pavement Management System to ensure cost-effective maintenance of transportation facilities and efficient use of public funds.
- Develop equitable transportation impact fees by which land developers are assessed fair-share contributions for any transportation improvements.
- Direct transportation funding primarily toward multi-modal improvements that will enhance safety and circulation within and between infill areas, schools, and employment centers within City limits.
- Focus transportation projects in economic development areas to act as catalysts for job growth.

Developing Evaluation Criteria

As transportation improvement alternatives are developed, many of the policies will be used as evaluation criteria to assess the relative value of each project considered for inclusion in the TP. This will include criteria that are both qualitative and quantitative in nature. While some goals include more policies than others, all goals will be weighted equally unless the project team decides that some are more important than others. Using the evaluation criteria, considered projects will be rated and categorized as high, medium, or low priorities according to their ability to meet a broad range of community objectives.

APPENDIX C. EXISTING CONDITIONS ANALYSIS

720 SW Washington St.
Suite 500
Portland, OR 97205
503.243.3500
www.dksassociates.com

MEMORANDUM

DATE: May 15, 2024

TO: Curleigh Carothers, City of Camas
Steve Wall, City of Camas

FROM: Reah Flisakowski, DKS Associates
Kevin Chewuk, DKS Associates

SUBJECT: Camas Transportation Plan
Technical Memo 2 – Existing Conditions Analysis P18039-000

This memorandum summarizes the existing transportation conditions in Camas. Included is a summary of where people travel, why they travel there, how they get there, what transportation infrastructure is available along those routes, and how the existing transportation system is operating for pedestrian, bicyclists, transit riders, and motor vehicles.

Introduction

The City of Camas, incorporated in 1906, is located along the Columbia River in the hills of eastern Clark County. Camas is home to approximately 23,000 people and is a part of the Portland-Vancouver Metropolitan Area with a total population of approximately 2.4 million people.

Located just east of Vancouver and on the door-step of the Columbia River Gorge, Camas is a short 30 to 40-minute drive from downtown Portland. This unique location offers diverse housing, employment and recreation opportunities. The city is home to several large, hi-tech manufacturing industries, a vibrant downtown, and many new and established neighborhoods.

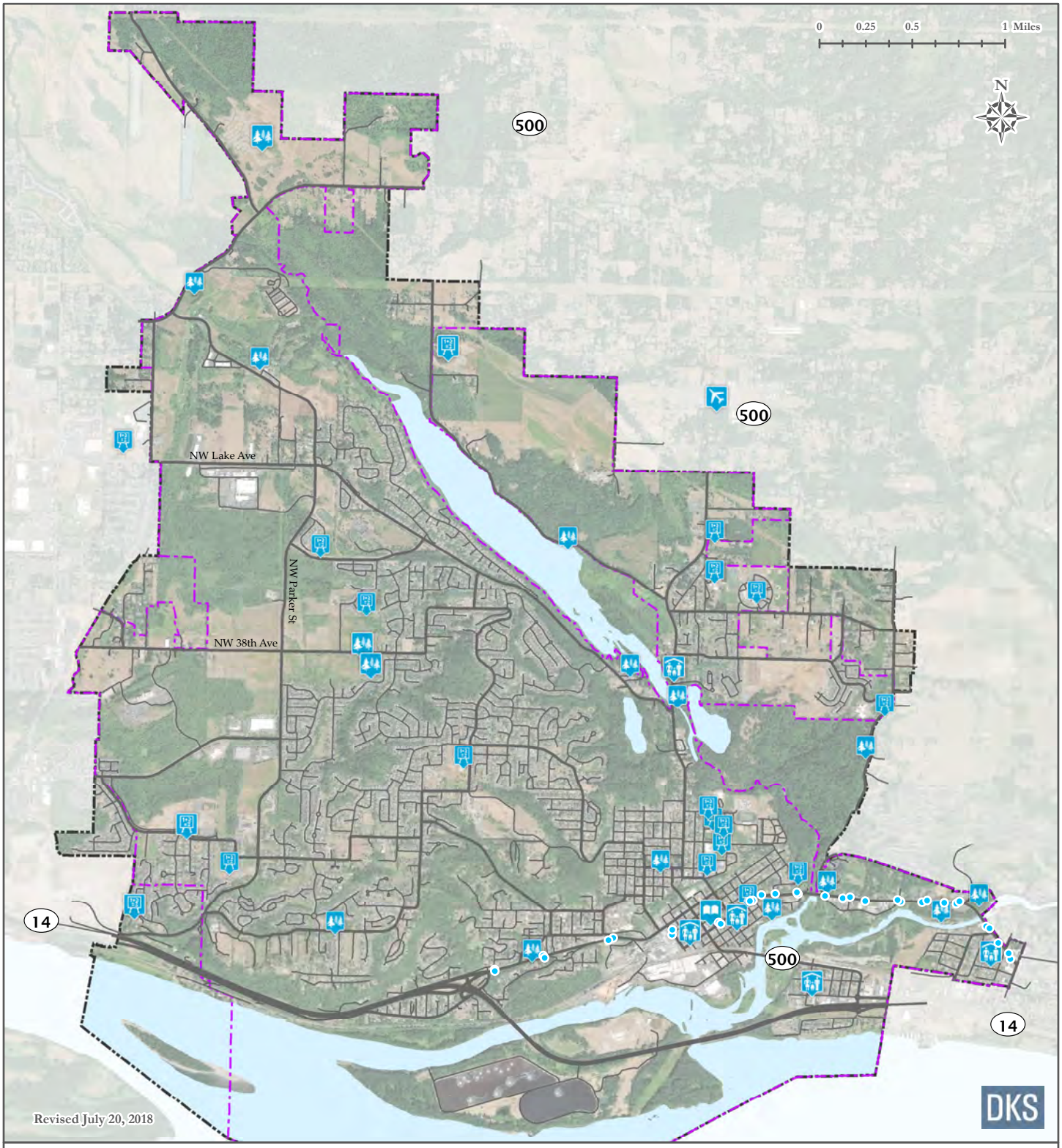
Key Destinations

The first step in planning an effective transportation system is understanding the key destinations throughout the city. These destinations, also called 'activity generators', typically fall into the categories of residential areas, employment, shopping, schools, civic buildings, recreation, and entertainment.

Within the City

Key activity generators in Camas are mapped in Figure 1. Most homes are located to the south of Lacamas Lake, with larger employment areas in the downtown (central), and the west. The elementary, middle, and high schools are located throughout the city and most civic buildings are near downtown. The city owns and maintains 16 parks; the majority — in number and in acreage— are located in the southern half of the city. Shopping and entertainment opportunities are generally found in the downtown, and the southeastern part of the city.

I Key Destinations



Legend:

Major Activity Generators:

- Airport
- Library
- Park
- School
- Community Amenity
- C-TRAN Stop

- Urban Growth Area
- Camas City Limit

Outside of the City

Having safe and efficient access to areas outside of the city is critical for many people who either live or work outside of Camas. Much of the traffic in Camas, especially during the more congested weekday peak periods, is related to employment. As shown in Table 1, more than 80 percent of the workers in Camas live in another city that is located more than three miles away. Residents of Camas also contribute to travel between cities, as shown in Table 2. Nearly 90 percent of workers living in Camas commute to employment locations at least three miles outside of the city.

Table 1: Where Camas Workers Live

Camas workers who:	Percent of Camas Residents	Distance from Camas
Live in Camas	17%	-
Live outside Camas	83%	-
Live in Vancouver	*24%*	*5+ miles*
Live in Washougal	*8%*	*3+ miles*
Live in Portland	*5%*	*15+ miles*
Live in Battle Ground	*2%*	*20+ miles*
Live in Other Places	*44%*	*10+ miles*

Source: Home Destination Report, On The Map, US Census Bureau, 2015

Table 2: Where Camas Residents Work

Camas residents who:	Percent of Camas Workers	Distance from Camas
Work in Camas	13%	-
Work outside Camas	87%	-
Work in Vancouver	*28%*	*5+ miles*
Work in Portland	*20%*	*15+ miles*
Work in Washougal	*3%*	*3+ miles*
Work in Beaverton or Hillsboro	*3%*	*28+ miles*
Work in Gresham	*2%*	*20+ miles*
Work in Other Places	*31%*	*10+ miles*

Source: Work Destination Report, On The Map, US Census Bureau, 2015

What Factors Affect How People Travel?

Travelers often weigh a variety of factors when deciding how to commute to their destination. Whether the trip will be via motor vehicle, walking, bicycle, or public transportation, the choice is often a balance between ease and convenience of travel, travel cost, and travel time.

Where are you going? Whether you are going to work, school, shopping, or to a park, your trip type (or your destination point) often determines your mode of transportation. Those destined for a park or school generally have a higher likelihood to walk or bicycle than those going to work or shopping. The distance of that destination plays a role in mode choice. Trips that are shorter generally present a better opportunity to walk or bicycle; longer distance trips more often require transit or motor vehicle modes.

Will you have to cross a busy road or walk or bike along a road without comfortable facilities? The availability of sidewalks, shared-use paths, curb ramps to provide wheelchair access, crosswalks, and bicycle lanes increases the comfort and access of walking and biking. The lack of or poor quality of these facilities, particularly on higher volume or higher speed roadways, discourages people from utilizing non-motorized vehicle modes of transportation.

Where you work and how long it takes you to get there. Camas residents who work outside of the city (as well as people who work in Camas but live elsewhere) are likely to commute by motor vehicle due to travel distance and commute time. However, some commuters may choose to bike or use transit if the regional transportation system offers convenient and comfortable biking facilities or transit services between cities.

What public transportation service is available? Distance to bus stops, frequency of service, route coverage, connections to other transportation options, and amenities at stops are some of the factors that play a role in a user's decision to utilize public transportation. For those who cannot afford or are unable to drive, transit is an attractive option for making longer trips.

Age and income. Demographic characteristics, such as age and income, play a key role in selecting a mode of transportation. Camas residents with lower incomes, as well as the youngest and oldest residents, often account for more trips via walking, biking, and public transportation.

As seen in Table 3, the central and southeast/Downtown part of the city has the lowest median household income, and accounts for some of the highest proportion of residents over 65. This may be an area of the city where transit enhancements could be focused.

About 37 percent of Camas residents living in the northwest part of the city are school-age children. The north-central part of Camas has the highest median household income (over $125,000), which is up to $55,000 more than the income of households located in other sections of Camas.

Table 3: Key Demographics in Camas

Demographic	Northwest Camas	Northeast Camas	Southwest Camas	North-Central Camas	Central Camas	Southeast Camas / Downtown
Age (by percent of residents)						
School-Aged (Under 18)	37%	31%	32%	33%	28%	23%
College-Aged (18-24)	2%	6%	4%	4%	6%	3%
Middle-Aged (25 to 64)	49%	49%	53%	52%	54%	59%
Retired-Aged (65+)	12%	14%	10%	11%	12%	15%
Median Household Income	$103,214	$76,222	$97,738	$125,430	$68,475	$70,729

Source: US Census Bureau, 2012-2016 American Community Survey

Is it cold or raining? Weather plays a role in determining how trips are made. Camas experiences cool, rainy winters, with mild and generally dry summers. According to the Oregon Climate Service, average temperatures in the winter months (December to February) are around 42 degrees Fahrenheit, with measurable rainfall occurring about 18 days each winter month. The spring and fall months (March to May, and September to November) are slightly warmer and dryer, with average temperatures around 52 degrees Fahrenheit, and about 14 days of measurable rainfall. The summer months (June to August) are typically very pleasant, with average temperatures around 67 degrees Fahrenheit, and less than 4 days of measurable rainfall each month[1]. Cold, rainy weather can make walking and biking trips less attractive, encouraging users to make a trip by motor vehicle.

How are People Choosing to Travel?

The number of people who choose to walk, bike, ride transit or drive is important for assessing how well existing transportation facilities serve the needs of users. Available data on commuter travel mode choices and peak hour travel demand is used to better understand travel behavior in the community and inform the needs analysis for the existing transportation system.

[1] Climate Summary for Vancouver (no data was available for Camas), Oregon Climate Service.

Commute Mode of Camas Residents

Most Camas residents commuted to work between the years 2012 and 2016 by single-occupant motor vehicles (about 75 percent). About three percent of residents walked and biked to work, and approximately three percent used public transportation.

The commute mode choices of Camas residents are compared with other cities in the region in Table 4. The single-occupant motor vehicle commute share in Camas was lower than that of Washougal, and comparable to that of Vancouver. The walking and biking commute share in Camas was similar to that of Vancouver and Washougal, and much lower than that of Portland. Commuting to work via public transportation was not common in most of these cities (three percent or less)[2].

Table 4: Transportation Modes Used by Employees to Commute to Work

	Percent of Commuters			
Transportation Mode	Camas	Vancouver	Washougal	Portland
Workers over 16 years	10,202	78,689	6,758	325,341
Motor Vehicle- Single Occupant	75%	76%	80%	58%
Motor Vehicle- Carpool	8%	11%	9%	9%
Walked	2%	3%	3%	6%
Biked	1%	0%	0%	7%
Public Transportation	3%	3%	2%	12%
Worked at Home	11%	5%	5%	8%
Other	1%	1%	2%	1%

Source: US Census Bureau, 2012-2016 American Community Survey

Commute Mode of Camas Employees

The travel choices of those who work in Camas, including people who live outside of the city, are important community considerations for economic reasons as well as quality of life. Over 80 percent of the commuters destined for jobs in northeast, and central Camas commute to work by single-occupant motor vehicle (see Table 5). This is slightly higher than the shares of single-occupant motor

[2] Although the US Census Bureau is a valuable source of information for work-related commute patterns, it does not truly represent the full range of travel within Camas. Non-motorized vehicle transportation modes are likely higher in Camas for other types of travel including trips to school, recreation, or access to transit.

vehicle commuters destined for jobs in southwest, north-central, and southeast/Downtown Camas, which are around 75 percent. Walking and biking to work is more common in southeast/Downtown Camas (6 percent). The highest usage of public transportation for commuting occurs in central Camas (5 percent).

Table 5: Transportation Modes Used by Employees to Commute to Work in Camas

	Percent of Commuters					
Transportation Mode	Northwest Camas	Northeast Camas	Southwest Camas	North-Central Camas	Central Camas	Southeast Camas / Downtown
Motor Vehicle- Single Occupant	66%	85%	75%	77%	81%	77%
Motor Vehicle- Carpool	11%	7%	8%	10%	5%	7%
Walked	1%	1%	2%	0%	1%	6%
Biked	0%	0%	1%	1%	1%	0%
Public Transportation	1%	1%	3%	1%	5%	1%
Worked at Home	19%	6%	10%	11%	6%	8%
Other	2%	1%	2%	0%	2%	1%

Source: US Census Bureau, 2012-2016 American Community Survey

Transportation Demand by Mode

Pedestrian, bicycle, and motor vehicle traffic counts were conducted at key intersections throughout Camas on typical weekdays[3]. This information indicates where and when travel demand is highest for each mode of travel. It also provides a basis for assessing how well existing transportation facilities are able to meet the needs of users during peak demand periods.

- **Pedestrian volumes** during the PM peak hour are generally highest near downtown Camas, including along NE 3rd Avenue and NE Adams Street (the traffic count summary is included in the appendix). The highest hourly pedestrian activity during the evening peak occurred at the NW Sierra Drive intersection with NW 28th Avenue, with 30 pedestrian crossings in the one-hour period. Other study intersections with more than 15 pedestrian crossings during the one-

[3] Based on counts conducted in April of 2018.

hour period included NE 6th Avenue at NE Adams Street, NE 3rd Avenue at NE Dallas Street, NE 3rd Avenue at NE 4th Street, and Weir Road at NE 3rd Avenue.

- **Bicycle volumes** indicate limited biking, with the highest volumes along NW Lake Road, and NW Sierra Street (the traffic count summary is included in the appendix). During the evening peak hour, 20 of the 50 study intersections had no observed bicyclists during the one-hour period. The NW Lake Road at SR 500, NW Lake Road at NW Sierra Street, NW Lake Road at NW Leadbetter Drive, NW Sierra Street at NW 45th Avenue, and NE 6th Avenue at NE Garfield Street intersections had the highest observed bicycle volumes, with 4 or more bicyclists counted during the single hour at each of the intersections.
- **Motor vehicle volumes** on the roadways in Camas (the traffic count summary is included in the appendix) most commonly peak during weekday evenings between 4:50 p.m. and 5:50 p.m. The highest hourly motor vehicle volumes during the evening peak occurred along the NW 6th Avenue corridor between the SR 14 ramps and NE Adams Street, with more than 1,300 trips during the one-hour period. The NW Lake Road at NE Everett Street, and NW 6th Avenue at SR 14 Ramps intersections had the highest observed volumes, with more than 1,800 entering vehicle trips during the single hour at each of the intersections.

What transportation infrastructure is available?

Existing transportation infrastructure includes a range of facilities for people who drive, walk, ride bikes, or use transit. The following sections summarize the existing infrastructure for the pedestrian, bicycle, transit, and roadway systems.

Pedestrian System

Walking plays a key role in Camas' transportation network. Planning for pedestrians not only helps the city provide a complete, multi-modal transportation system, it supports healthy lifestyles and addresses a social equity issue, ensuring that the young, the elderly, and those not financially able to afford motorized transport have access to goods, services, employment, and education. Approximately two percent of commuters in the city walk to work, with another three percent utilizing public transportation to get to work, which generally includes a walking trip at the beginning or end. In addition to the work commute trips, walking trips are made to and from recreational or shopping areas, schools, or other activity generators. Continuous sidewalk connections between all activity generators and arterial/collector roadways are desirable to allow for safe and attractive non-motorized travel options.

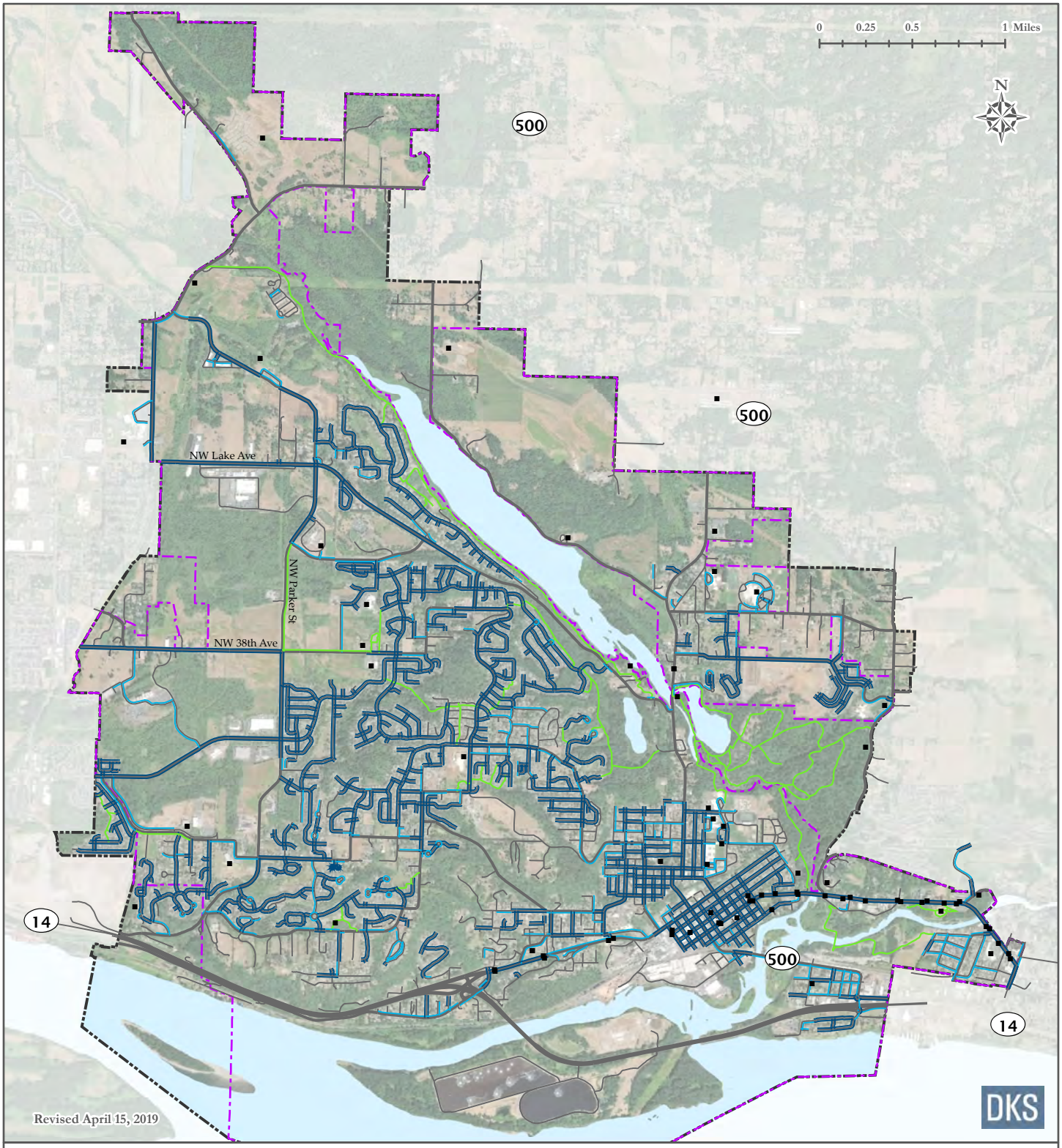
The walking network in Camas, shown in Figure 2, is composed of sidewalks, and shared-use paths, and is fairly well developed. A large part of downtown Camas was developed prior to 1950, a time in

which sidewalks were incorporated into the design of neighborhoods and streets. Although most areas incorporated into Camas over the following decades have sidewalk coverage, a few areas do not have complete sidewalks on one side of the street, or even on both sides. These gaps are most significant in southwest, southeast, and northeast Camas, and on roadway segments outside the city limits.

Paved shared-use paths exist along portions of NW Parker Street, NW 18th Avenue, Lacamas Lake, Washougal River, and scattered throughout the residential neighborhoods. Unpaved pedestrian only trails are located throughout the city.

Many intersections in older parts of the city lack ADA-compliant ramps, which provide important connections between sidewalks, making it easier to cross streets and handle the vertical drop at curbs. However, the city has been recently installing new curb ramps in many of these locations. The presence of curb ramps is fairly consistent along streets in downtown Camas, and in the newer neighborhoods in the city.

2 Pedestrian System



Legend:

Pedestrian Facilities

- Sidewalk on Both Sides
- Sidewalk on One Side
- Trails
- Arterial or Collector Street
- Major Activity Generator
- Urban Growth Area
- Camas City Limit

Bicycle System

The bicycle system provides a non-motorized travel option for trips that are longer than a comfortable walking distance. A well-developed bicycle system promotes a healthy and active lifestyle for the residents, and visitors of Camas. Approximately one percent of commuters in the city bicycle to work. In addition to the work commute trips, bicycle trips are made to and from recreational or shopping areas, schools, or other activity generators. Continuous bicycle connections between all activity generators and arterial/collector roadways are desirable to allow for safe and attractive non-motorized travel options.

The bicycle network in Camas, shown in Figure 3, is composed of bike lanes, roadway shoulders, shared roadways, and shared-use paths.

- **Bike lanes** are portions of the roadway designated specifically for bicycle travel via a striped lane and pavement stencils. Standard width for a bicycle lane is six feet. The minimum width of a bicycle lane against a curb or adjacent to a parking lane is five feet. A bicycle lane may be as narrow as four feet, but only in very constrained situations. Bike lanes are most appropriate on arterials and collectors, where high traffic volumes and speeds warrant greater separation of the travel modes. Significant segments of continuous bicycle lanes exist along portions of NW Lake Road, NW 38th Avenue, NW Parker Street, NW Friberg-Strunk Street, and SR 500.

- **Shoulder bikeways** are paved with striped shoulders wide enough for bicycle travel. A six-foot paved shoulder is desired to adequately provide for bicyclists, with a four-foot minimum width in constrained areas. Roadways with shoulders less than four feet are considered shared roadways. Some shoulder bikeways are signed to alert motorists to expect bicycle travel along the roadway.

- **Shared roadways** include those on which bicyclists and motorists share the same travel lane. The most suitable roadways for shared bicycle use are those with low speeds (25 mph or less) and low traffic volumes (3,000 vehicles of fewer per day). Shared roadways, often signed as bicycle routes, serve to provide continuity to other bicycle facilities (e.g., bicycle lanes) or can be designated as a preferred route through the community. Common practice is to sign a route with standard Manual on Uniform Traffic Control Devices (MUTCD) green bicycle route signs with directional arrows and/or pavement markings. Shared roadways can have signs that highlight a special route or provide directional information in bicycling minutes or distance. Most local roadways in the city are considered shared roadways, but do not have signs or pavement markings.

- **Shared-use paths** provide off-street travel for bicyclists and pedestrians, and are wider than an average sidewalk (e.g., 10 – 14 feet). Shared-use paths are typically paved (asphalt or concrete),

but may also consist of an unpaved smooth surface as long as it meets Americans with Disabilities Act (ADA) standards. Paved shared-use paths exist along portions of NW Parker Street, NW 18th Avenue, Lacamas Lake, Washougal River, and scattered throughout the residential neighborhoods.

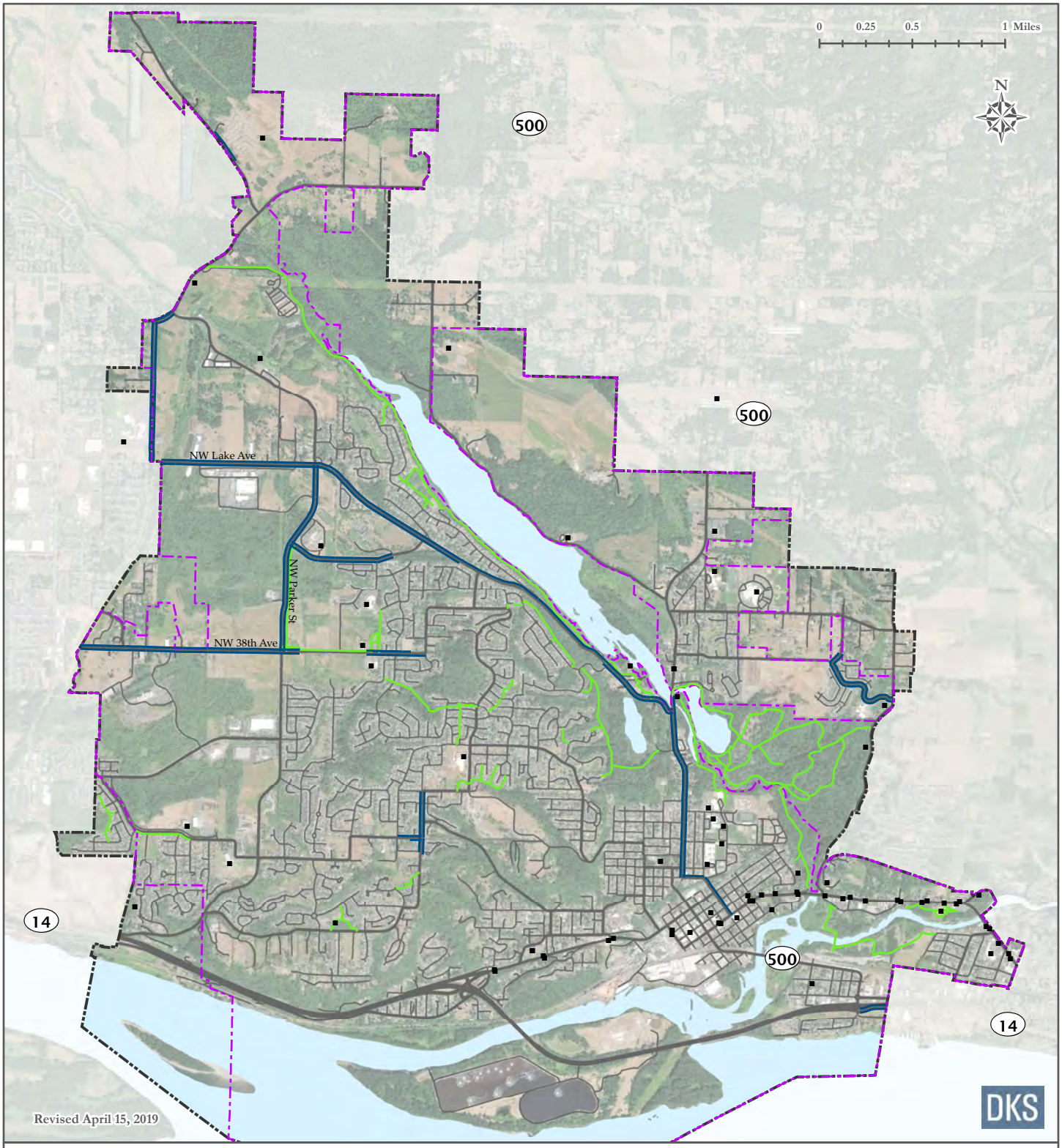
Bicycle Parking

End-of-trip bicycle facilities are a fundamental component of a bicycle network. Lack of safe and secure facilities for either short-term or long-term parking can be an obstacle to promoting bicycle riding.

Short-term parking accommodates visitors, customers, and others expecting to depart within two hours. It requires a standard rack, appropriate location and placement, and weather protection.

Long-term parking accommodates employees, students, residents, commuters, and others who park for more than two hours. This parking requires a secure, weather-protected manner and location.

3 Bicycle System



Legend:

Bicycle Facilities

- Bike Lane
- Trails
- Arterial or Collector Street
- Major Activity Generator
- Urban Growth Area
- Camas City Limit

Transit System

C-TRAN provides transit service in Camas via one fixed bus route connecting the city with Vancouver and Washougal. Transit riders can transfer to other C-TRAN routes at the Fisher's Landing Transit Center in Vancouver. Figure 4 shows the routes in Camas.

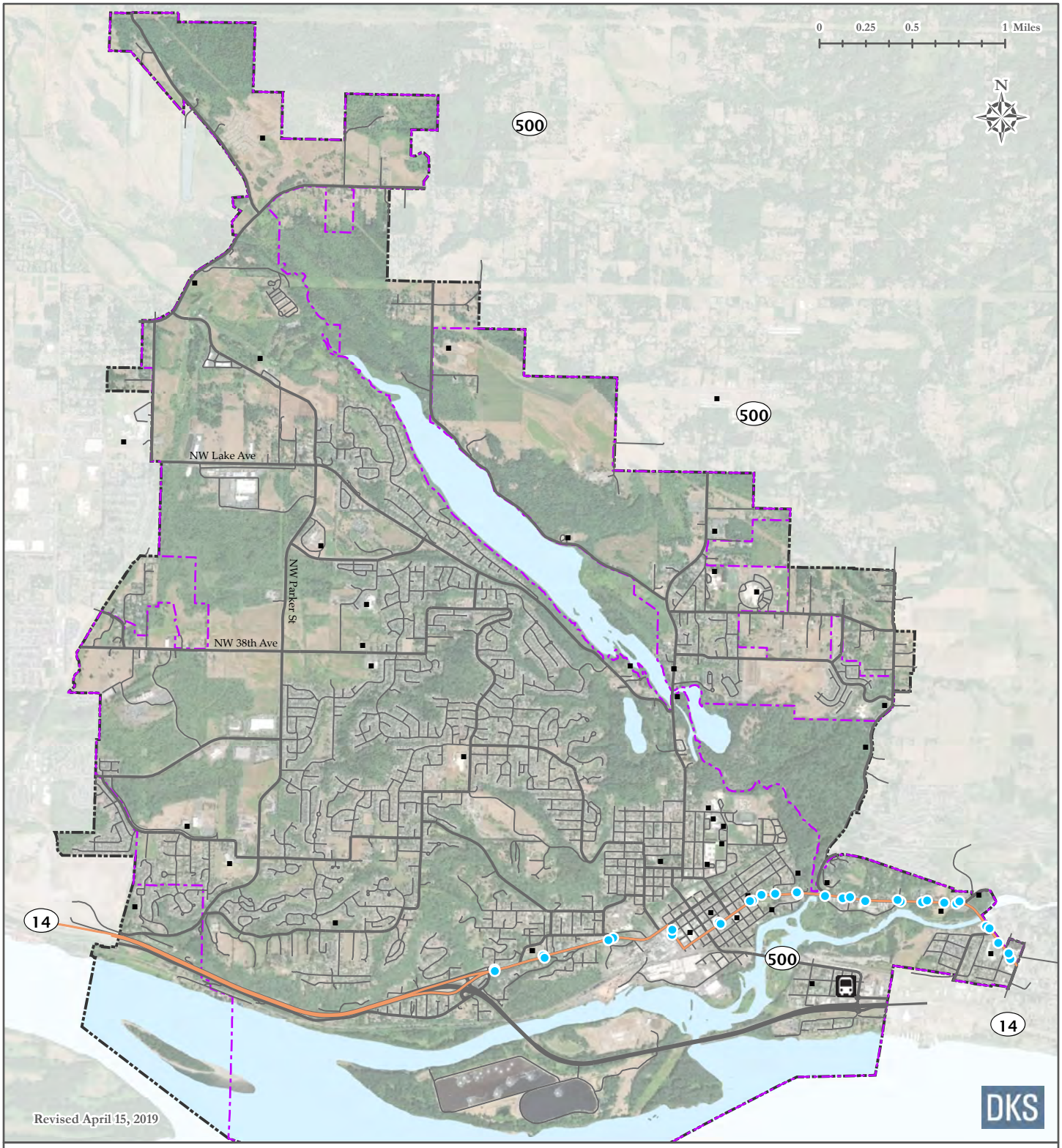
Bus stops in Camas are located along NW 6th Avenue near the SR 14 Ramps, NW Ivy Street, and NW Drake Street intersections, at the NE Adams Street / NE 5th Avenue, and along NE 3rd Avenue near the NE Franklin Street, NE Joy Street, NE 3rd Place, E. 1st Avenue, SE Crown Road, NE Summer Street, NE 3rd Loop, NE Shepherd Road, NE 2nd Avenue, NE Weir Street and NE Lechner Street intersections.

Each of the bus-stops are signed and the eastbound stop along NW 6th Avenue near the SR 14 Ramps provides a bus pull-out. The bus stop along NE 3rd Avenue at NE Franklin Street (near Camas City Hall) provides a bench and shelter. All remaining bus stops have no amenities. Most transit users in the city are more than a half-mile from a bus stop. A park-and-ride facility is located along SE Tampa Street, near the SE 8th Avenue / SE Union Street intersection. However, the park-and-ride is currently served by only the Connector service and not a fixed route.

The Camas/Washougal C-TRAN route travels through Camas eastbound and westbound approximately every half-hour between 6:00 AM and 7:30 PM on weekdays. Service on Saturday is provided approximatively every half-hour between 8:00 AM and 7:30 PM, and approximatively every hour between 8:00 AM and 6:00 PM on Sunday.

Key destinations along this route include Forest Home Park, Georgia Pacific, downtown Camas, Camas Municipal Center, Safeway, Louis Bloch Park, Washougal River Greenway, Camas Police Department, and the Lacamas Center. C-TRAN buses are equipped with a lift to allow for wheelchair access and include bicycle racks.

4 Transit System



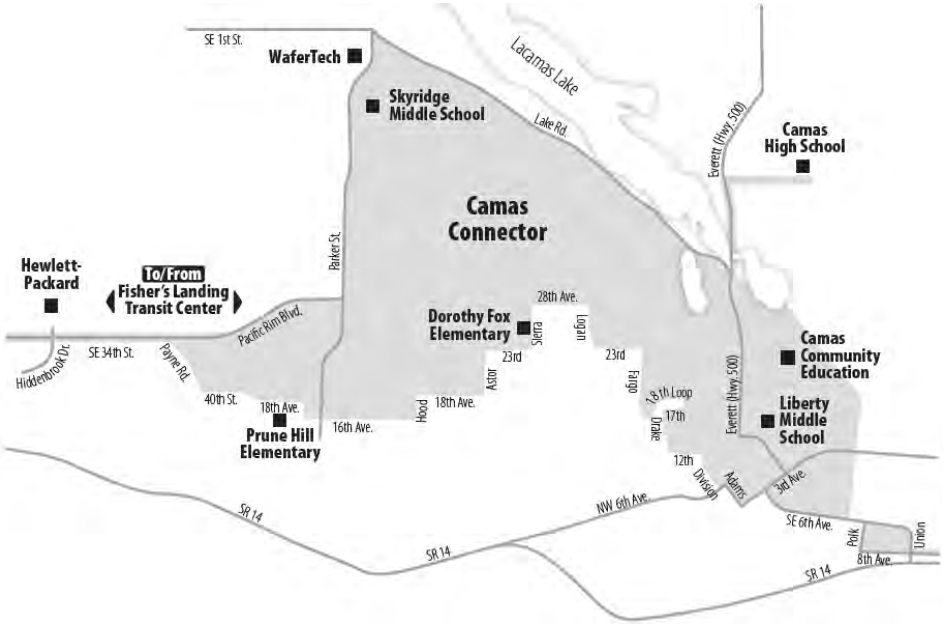
Legend:

Transit Facilities:

- C-TRAN Bus Stop
- Transit Route
- Park and Ride
- Arterial or Collector Street
- Major Activity Generator
- Urban Growth Area
- Camas City Limit

C-TRAN's "Connector" service provides Camas with fully accessible dial-a-ride (reservation based service) and scheduled stop service (no reservation required) at designated stops within the service area. Connector fixed route service is provided from the Fisher's Landing Transit Center in Vancouver to near the SE 34th Street / SE Hiddenbrook Drive intersection just to the west of Camas. The route provides scheduled service four times daily each weekday. Connector reservation based service is available within the service area from 5:30 AM to 9:15 AM and 2:00 PM to 7:00 PM each weekday. The Connector service area in Camas is shown in Figure 5. The Connector bus service is not available on weekends.

Figure 5: Connector Bus Service



Roadway System

Camas streets are well connected and generally follow a grid pattern in the downtown area and nearby neighborhoods. However, the streets in the newer neighborhoods outside of these areas are more disconnected, limited at times by the topography. The major transportation routes through Camas include SR 14, SR 500, as well as a few key city roadways. SR 14 runs east-west through Camas parallel to the Columbia River. SR 14 connects Camas to Vancouver, Interstate 5 and Interstate 205 to the west, and Camas to Washougal to the east. SR 500 runs north-south through the city connecting SR 14 south of downtown with NE Fourth Plain Boulevard north of the city. In the downtown area, it runs along portions of SE 6th Avenue, NE Dallas Street, NE 3rd Avenue and NE Garfield Street.

A few key city roadways that provide north-south access are NW Brady Road, NW Parker Street, Division Street, NW Fargo Street, NW Astor Street, NW Sierra Drive, and SE Crown Road. NW Brady Road and NW Parker Street provide a connection on the west side of Camas, Division Street, NW Fargo Street, NW Astor Street and NW Sierra Drive provide connections through the central neighborhoods of Camas, and SE Crown Road provides a connection on the east side of Camas. Key east-west city roadways include NW 6th Avenue, NE 3rd Avenue, NW Pacific Rim Boulevard, NW 38th Avenue, NW Lake Road, and NE Goodwin Road, with NW 6th Avenue and NE 3rd Avenue towards

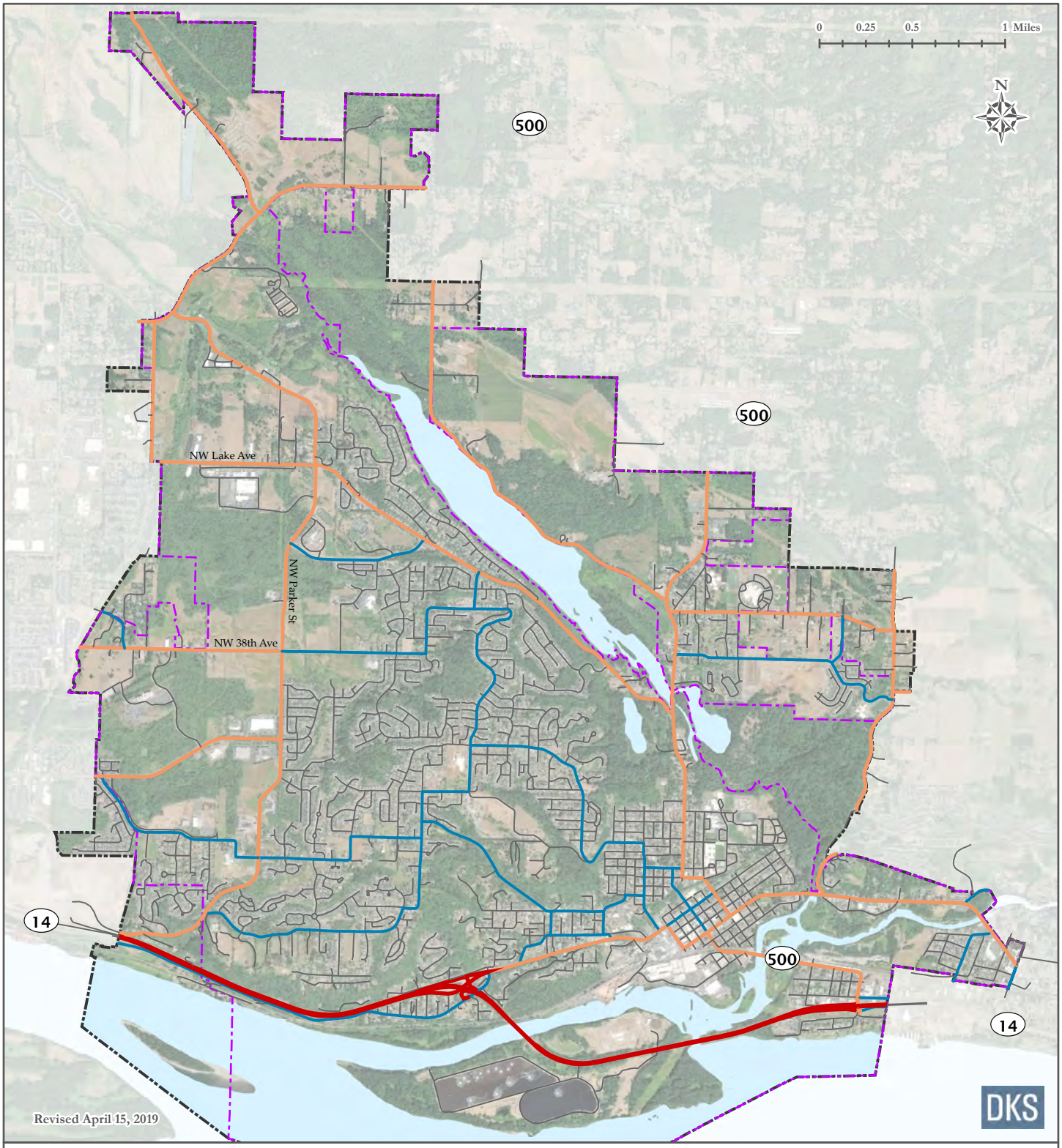
the south end of the city, NW Pacific Rim Boulevard and NW 38th Avenue centered in the middle, and NW Lake Road and NE Goodwin Road in the north end of the city.

Functional Classification

To manage the street network, the city classified the streets based on a hierarchy according to the intended purpose of each (as shown in Figure 6). From highest to lowest intended usage, the classifications are principal arterial, arterial, collector, and local streets. Streets with higher intended usage generally limit access to adjacent property in favor of more efficient motor vehicle traffic movement (i.e., mobility). Local roadways with lower intended usage have more driveway access and intersections, and generally accommodate shorter trips to nearby destinations.

- **Principal Arterials** serve as the main travel routes through the city and serve the highest volume of motor vehicle traffic. SR 14 is the only principal arterial in Camas. Principal arterials are generally for longer motor vehicle trips with limited local access. The posted speed limit on SR 14 is 60 miles per hour.
- **Arterials** connect many parts of the city and often serve traffic traveling to and from principal arterials. These roadways provide greater accessibility to neighborhoods, connect to major activity generators, and provide efficient through movement for local traffic. In Camas, portions of SR 500, NW Lake Road, NW Brady Road, NW Parker Street, NW 6th Avenue and NE 3rd Avenue are examples of arterials. Posted speeds on arterial streets in Camas typically range between 25 (in residential areas) and 50 miles per hour (in rural areas).
- **Collectors** connect neighborhoods to arterials. These streets serve as major neighborhood routes and generally provide more direct property access or driveways than arterial streets. In Camas, portions of Division Street, NW Forest Home Road, NW Fargo Street, NW Sierra Drive, and SE Payne Road are examples of collector streets. Posted speeds on collector streets in Camas typically range between 25 and 35 miles per hour.
- **Local Streets** provide more direct access to residences without serving through travel in Camas. These roadways generally are lined with residences and are designed to serve lower volumes of traffic with a speed limit of 25 miles per hour.

6 Roadway System



Legend:

Functional Classification:

- Principal Arterial
- Arterial
- Collector
- Local Streets
- Urban Growth Area
- Camas City Limit

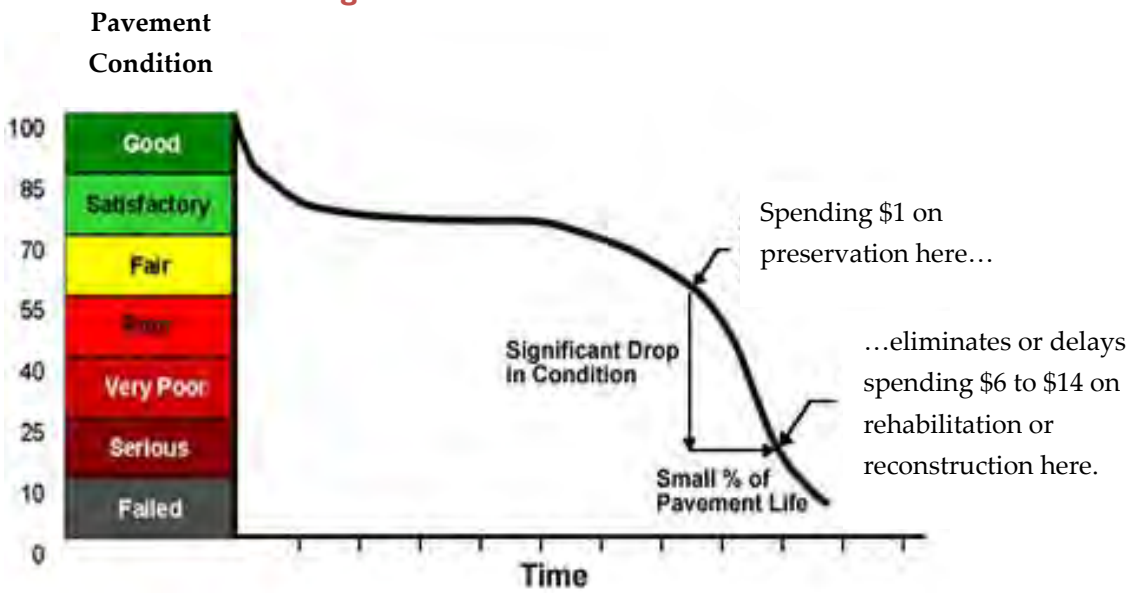
The Washington State Department of Transportation (WSDOT) and the Southwest Washington Regional Transportation Council (RTC) also classify roadways in Camas. Within Camas, SR 14 is classified by WSDOT as a Highway of Statewide Significance (HSS)[4], and SR 500 is classified as a non-HSS facility.

RTC has identified several streets in Camas as part of the regional transportation system in the Regional Transportation Plan for Clark County, including SR 14, SR 500, Lake Road - SE 1st Street, Parker Street, Pacific Rim Boulevard - 34th Street, NW 38th Avenue – SE 20th Street, NW 6th Avenue, and NE 3rd Avenue.

Pavement Quality

The Pavement Condition Index (PCI) is a numerical index between 0 and 100 which is used to indicate the general condition of pavement. Deferring necessary repair and preservation means spending much more to fix the same roadways later, and repair costs rise exponentially as roadways are left unmaintained (see Figure 7). Every $1 spent to keep a roadway in good condition avoids $6 to $14 needed later to rebuild the same roadway once it has deteriorated significantly[5]. Figure 8 displays the PCI ratings of roadways in Camas. About 75 percent of the roadway miles in Camas have pavement in good or satisfactory condition, 13 percent in fair condition, six percent in poor condition, and six percent in very poor or worse condition.

Figure 7: Pavement Condition Index



[4] Highways of Statewide Significance, WSDOT, http://www.wsdot.wa.gov/planning/HSS/

[5] Smart Growth America, Repair Priorities 2014, American Association of State Highway Officials (AASHTO)

Figure 8: Pavement Quality of Roadways in Camas (by percent of roadway miles)



Bridges

There are 15 bridges within the Camas Urban Growth Area, with eight along state facilities and seven along city or county facilities, as shown in Figure 9. Seven bridges are flagged as functionally obsolete[6], including:

- The bridge along SW 6th Avenue over SR 14.
- The bridge along SR 500 over the Washougal River.
- The bridge along SR 500 over Lacamas Lake.
- The bridge along NE 3rd Avenue over the Washougal River. This bridge is scheduled for seismic upgrades in 2020.
- The bridge along NE Goodwin Road over Lacamas Creek.
- The bridge along Division Street over Mill Ditch.
- The bridge along NE Dallas Street over Mill Ditch.

[6] Functionally obsolete bridges are those that do not have adequate lane widths, shoulder widths, or vertical clearances to serve current traffic demand, or those that may be occasionally flooded.

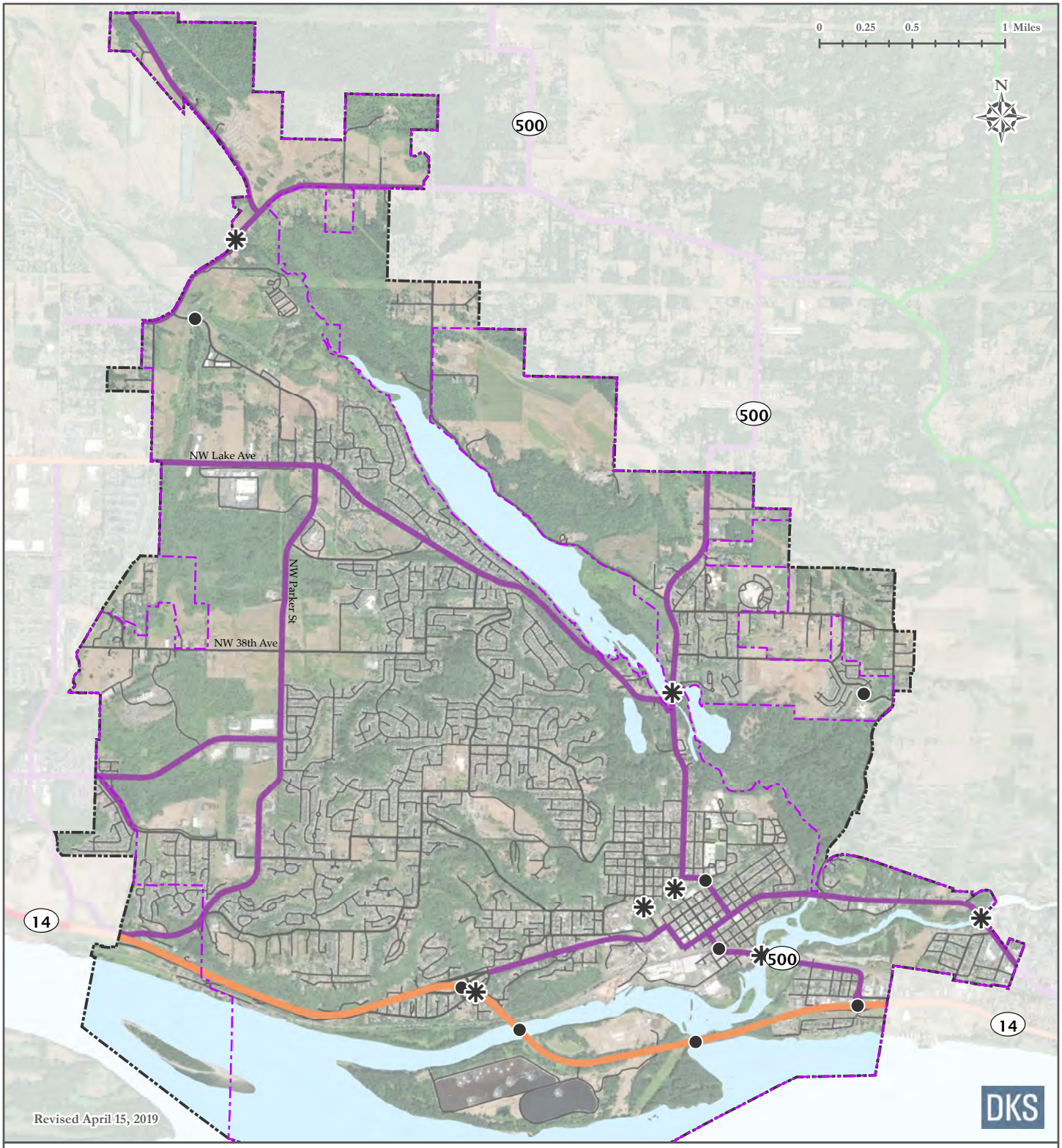
Freight

Efficient truck movement plays a vital role in the economical movement of raw materials and finished products. The designation of through truck routes provides for this efficient movement, while maintaining neighborhood livability, public safety, and minimizing maintenance costs of the roadway system. The Washington State Freight and Goods Transportation System (FGTS) tonnage classification system identifies different categories of freight corridors based on annual freight tonnage moved. It defines tonnage thresholds and identifies heavily used truck freight corridors within the state. Washington State FGTS truck freight corridors are classified into five categories, T-1 through T-5, based on annual gross truck tonnage. The following corridors are identified in Camas (see Figure 9).

- **T-1:** more than 10 million tons per year. There are no T-1 corridors in Camas.
- **T-2:** 4 million to 10 million tons per year. SR 14 is the only T-2 corridor in Camas.
- **T-3:** 300,000 to 4 million tons per year. In Camas, portions of NW 6th Avenue, NE Adams Street, NE 3rd Avenue, SR 500, NW Lake Road, NW Parker Street, NW Brady Road, NW Pacific Rim Boulevard, NE Goodwin Road, NE 28th Street, and NE Ingle Road are T-3 corridors.
- **T-4:** 100,000 to 300,000 tons per year. There are no T-4 corridors in Camas.
- **T-5:** at least 20,000 tons in 60 days and less than 100,000 tons per year. There are no T-5 corridors in Camas.

Heavy vehicles account for approximately four percent of the traffic on NE 3rd Street, three percent on SR 500, NW Pacific Rim Boulevard and Lake Road, two percent on NW 6th Avenue and NE Goodwin Road, and one percent on NW Brady Road and NW Parker Street through Camas during an average weekday. Traffic count data including heavy vehicle percentages is summarized in the appendix.

9 Freight Corridors and Bridge Conditions



Legend:

Bridge Condition:

- Not Deficient
- Functionally Obsolete

Freight Corridors

- T-2 Truck Freight Corridor
- T-3 Truck Freight Corridor

- Urban Growth Area
- Camas City Limit
- Arterial or Collector St

Rail

Freight rail service is provided to Camas by the BNSF Railway (see Figure 10). The main line enters the city from the west between the Columbia River and SR 14, before crossing under SR 14 north of the Camas Slough near SW 6th Avenue. The line parallels the Camas Slough before crossing under SR 500 and over the Washougal River, before running east into Washougal north of SR 14.

The BNSF Railway through Camas serves up to 40 trains each day. Within Camas there are a total of eight rail crossings, with three of the crossings public and five private. The public crossings are all grade separated and the private crossings are all stop controlled.

Amtrak passenger service is available in Vancouver, less than 15 miles away. Connections to the Amtrak depot in Vancouver can be made via C-TRAN.

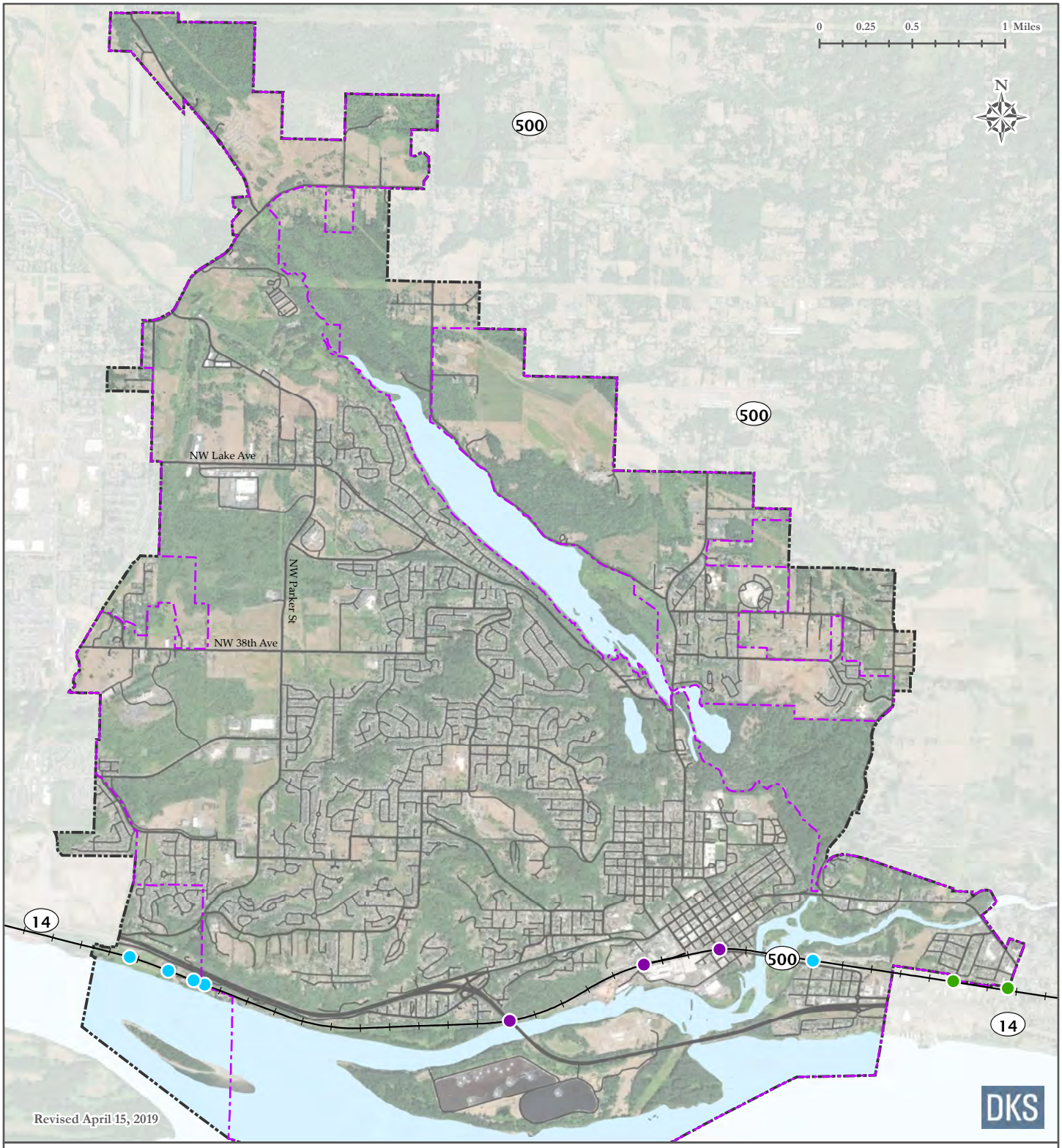
Air

Grove Field, owned and operated by the Port of Camas-Washougal, is a public use airport located along SR 500, about four miles from downtown. The airport is a local general aviation facility, which primarily supports single engine, general aviation aircraft, but is capable of accommodating smaller twin-engine general aviation aircraft. It also supports local air transportation needs and special use aviation activities. The airport provides support to 51 based aircraft. Services and facilities available include: hangar storage, tie-downs, fixed base operator services and training facilities, aircraft rental, aircraft maintenance, and fueling. The airport has one runway, and serves 9,800 annual operations (i.e., take-offs or landings).

Regional and international air service for passengers and freight is provided via Portland International Airport (PDX). The airport is located approximately 12 miles (or under 20 minutes) to the west of Camas and is connected via SR-14 and I-205.

The current Airport master plan calls for construction of additional hangar storage.

10 Rail Lines and Crossings



Legend:

Rail:

- At-Grade Crossing, gated
- At-Grade Crossing, ungated
- Grade Separated Crossing
- Railroad
- Urban Growth Area
- Camas City Limit
- Arterial or Collector St

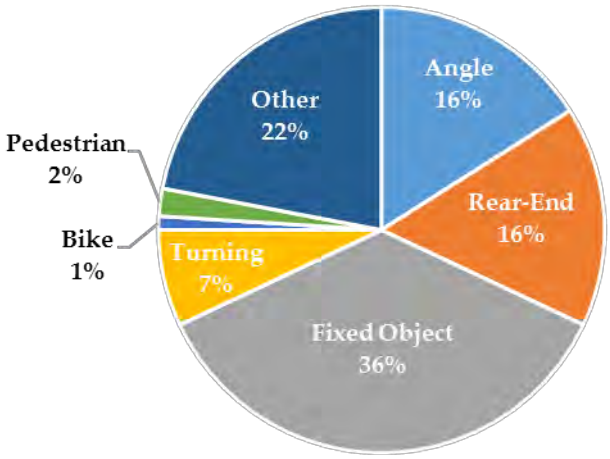
What is the Condition of the Existing Transportation System?

The transportation system in Camas is managed with a variety of measures designed to ensure that the transportation infrastructure in the city maintains acceptable quality and performance. Performance is evaluated based on the history of crashes and various measures of the pedestrian, bicycle, and motor vehicle transportation system.

Safety Evaluation

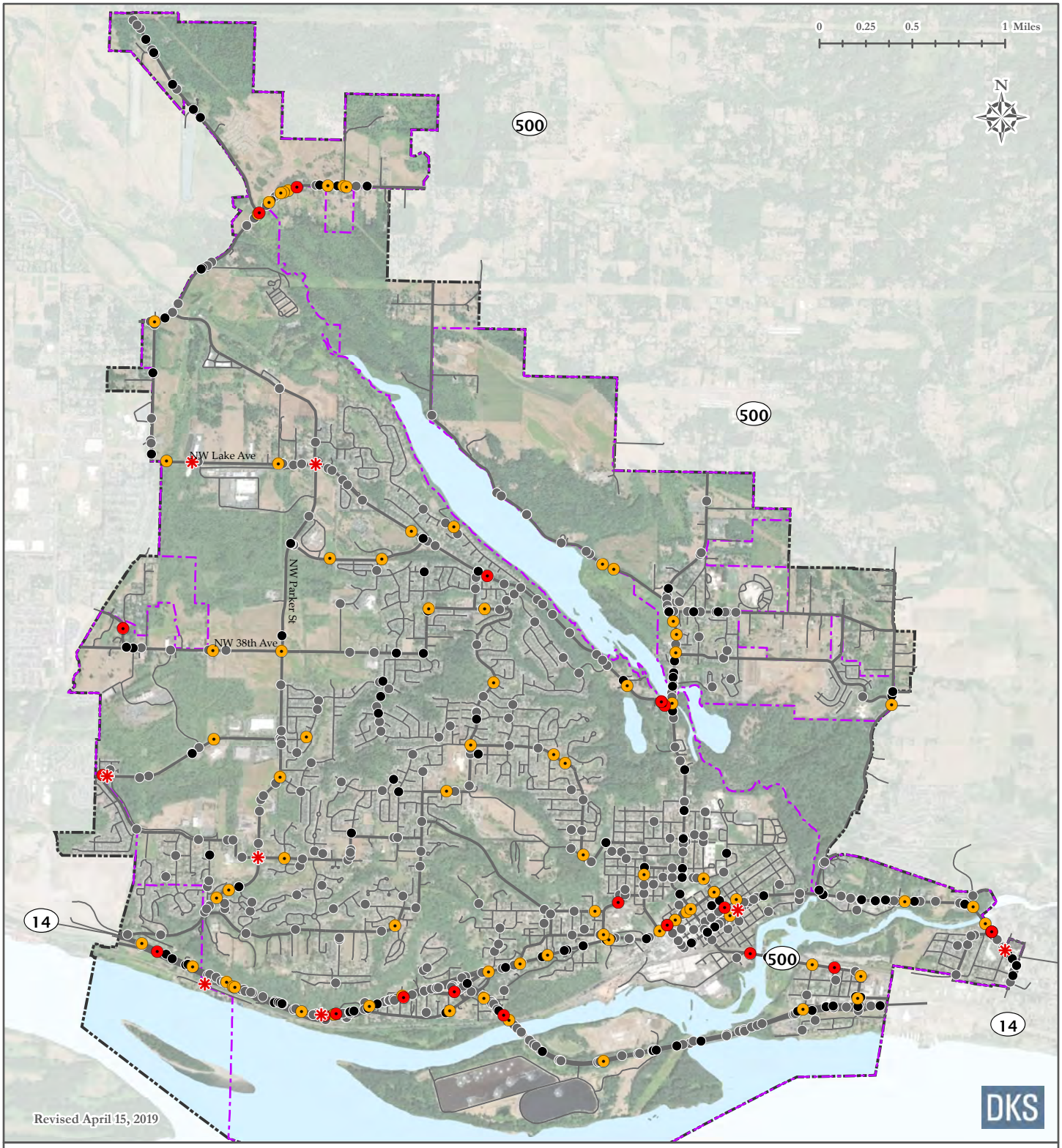
A review of available crash data identified patterns of motor vehicle, pedestrian, and bicyclist crashes. WSDOT's crash data from January 2013 through January 2018 (the most recent five years of available data) for all roadways within the Urban Growth Area of Camas showed a total of 880 crashes (an average of 176 crashes a year). A majority of these (about 75 percent) were either rear-end, turning, angle, or fixed-object type crashes (see Figure 11). Two percent of the crashes (about three per year) involved pedestrians and one percent (about two per year) involved bicycles. Figure 12 shows the high crash locations within the Urban Growth Area.

Figure 11: Crash Types (2013-2018)



Eight crashes resulted in deaths during this period, and an additional 20 crashes caused serious injuries. The high-severity crashes are a small portion of all crashes, making up only 11 percent of all reported crashes. However, the overall severity of crashes in Camas over the past five years is generally low, with 88 percent involving only property damage (no injuries) or minor injuries.

12 Crash Locations



Legend:

Collision Severity:

- Fatality
- Severe
- Moderate
- Minor
- Property Damage Only

- Urban Growth Area
- Camas City Limit
- Arterial or Collector St

Causes of Crashes

The City of Camas, Clark County and WSDOT strive to provide roads that are engineered to be as safe as possible. However, engineering is only one part of the road safety equation. Education and enforcement are critical elements in promoting safe driver behavior. The five most common driver errors are responsible for nearly 60 percent of all crashes in Camas.

- Inattention (29 percent)
- Did Not Yield Right-of-Way (13 percent)
- Followed Too Closely (10 percent)
- Disregarded Traffic Signal or Stop Sign (3 percent)
- Operating Defective Equipment (3 percent)

Risky behavior choices not only contribute to a substantial number of crashes in Camas, they generally lead to more severe outcomes for the people involved. Alcohol and/or drug use was involved in 79 crashes, including seven serious injuries. This represents around nine percent of all crashes and 25 percent of high-severity crashes. Speeding or driving too fast for conditions, was involved in 123 crashes (14 percent of all crashes), 10 of which were high-severity, including three deaths (36 percent of high-severity crashes).

Pedestrian Safety

There were 14 pedestrian-involved crashes over the past five years. They occurred most frequently downtown (five crashes involving a pedestrian), and along NE 3rd Avenue between NE 4th Street and NE Weir Street (two crashes involving a pedestrian).

Pedestrians sustained severe injuries in three crashes, one of which resulted in a death; at the NE 3rd Avenue / NE 4th Street, NE 3rd Avenue / NE Weir Street, and the SR 500 / NE 4th Avenue intersections. Moderate injuries to pedestrians were sustained in six of the crashes.

The majority of pedestrian-involved crashes (79 percent) were caused by drivers failing to yield the right of way to a pedestrian in a crosswalk or on a sidewalk. All of the pedestrian-involved crashes occurred during the day or at night in a location with street lighting.

The dominant trends observed in the crash data for pedestrian-involved crashes indicate that actions aimed at improving driver yield rates for pedestrians would be valuable in reducing the number of pedestrian-involved crashes. Engineering countermeasures to achieve this include: ensuring adequate signing indicating pedestrian crossing locations and state laws on yielding, providing and enhancing

lighting at crossings and locations with high pedestrian traffic, modifying traffic signal phasing to reduce pedestrian conflict opportunities, or improving roadside pedestrian visibility.

The data also indicates that actions focusing on motorist behaviors may be effective, including targeted enforcement and education efforts in the downtown area. These could include actions such as police enforcement of crosswalk laws through staged crossings, or efforts to increase general compliance with red lights and stop signs.

Bicycle Safety

There were 12 bicycle-involved crashes over the past five years. The majority of the bicycle-involved crashes occurred at intersections, with one at a traffic signal and six at stop controlled locations. A cyclist sustained moderate injuries in six of the crashes. The bicycle-involved collisions occurred most often along NE 3rd Avenue between NE Sumner Court and NE Weir Street (three collisions involving a bicycle) and along SR 500 (NE Everett Street) between NE 38th Avenue and NW Lake Road (two collisions involving a bicycle).

Most of the crashes involving a bicyclist were caused by drivers failing to yield the right of way when turning (58 percent). About 17 percent of the crashes were caused by either a bicycle or motorist failing to obey traffic control devices. The vast majority of bicycle crashes occurred during the day.

The dominant trends observed in the crash data for bicycle-involved crashes indicate that actions aimed at improving driver yield rates at intersections, specifically while turning, would be valuable in reducing the number of bicycle-involved crashes. Engineering countermeasures to achieve this include actions to increase the visibility of bicycling and encourage drivers to expect bikes at intersections, such as by providing highly visible space for bicycles and signing. Other engineering approaches include reducing conflict opportunities at intersections, such as through bike boxes or bike-specific signal phasing.

Ensuring a comprehensive bicycle network, including crossing opportunities, can also reduce conflicts between bicycles and motor vehicles. Effective bicycle detection at signals, and an evaluation of stop-controlled intersections along popular biking routes, may promote bicyclist adherence to traffic control devices.

The data also indicates that actions focusing on motorist and bicyclist behaviors may be effective, including targeted enforcement and education efforts along portions of SR 500 and NE 3rd Avenue.

Intersection Safety

Crash rates provide an additional perspective on intersection safety and identify locations where people have a higher risk of being involved in a crash. Crash frequencies (the number of crashes in a period of time) tend to increase with higher vehicle traffic. With more exposure to vehicles, there are

more opportunities for crashes to occur. Crash rates consider the amount of crashes relative to the traffic volume at the intersection, and are expressed in units of crashes per million entering vehicles (MEV). Where an intersection's crash rate is at or greater than 1.0 MEV, it is an indication that a problem might exist and that further study is warranted.

There was one intersection, NE Ingle Road at NE 28th Street, with a crash rate that exceeded 1.0 MEV as shown in Table 6. This table also includes the other nine intersections with the highest crash rates in the city. The crash rates for all study intersections are provided in the appendix.

Table 6: Study Intersections with Highest Crash Rates

	Intersection	Total Collisions (2013 to 2018)	Collision Type				Collision Severity		Collision Rate per MEV*
			Rear-end	Angle	Pedestrian / Bike	Other	Property Damage Only	Injury	
14	NE 13th Street at NW Friberg-Strunk Street	7	3	0	1	3	5	2	0.42
16	NE Ingle Road at NE 28th Street	15	5	2	0	8	10	5	1.03
17	NE 232nd Avenue at NE 28th Street	5	0	1	0	4	5	0	0.48
19	NE 199th Avenue at SR 500-NE 58th Street	7	0	5	0	2	5	2	0.46
20	SR 500 at NE 3rd Street	4	0	0	0	4	3	1	0.43
31	NW Sierra Drive at NW 28th Avenue	4	0	3	0	1	3	1	0.40
42	NE 6th Avenue at SR 500-NE Garfield Street	11	2	7	0	2	7	4	0.60
43	NE 3rd Avenue at SR 500-NE Garfield Street	13	3	2	2	6	8	5	0.49
44	NE 3rd Avenue at SR 500-NE Dallas Street	11	3	2	0	6	8	3	0.52
49	SE 283rd Avenue at SE 23rd Street	4	0	1	0	3	2	2	0.68

Note: * Per MEV = Crashes per million entering vehicles

The study intersections with the highest crash rates are discussed below.

- **NE 13th Street / NW Friberg-Strunk Street (signalized):** Rear-end crashes were most prominent here, caused primarily by inattention and following too close between vehicles traveling on NE 13th Street-Goodwin Road going eastbound or westbound. Less than a third of the crashes resulted in injuries (2 of 7).
- **NE Ingle Road / NE 28th Street-Goodwin Road (stop controlled):** This three-leg intersection with stop control on NE Ingle Road, had 15 collisions. Rear-end and fixed object crashes were the most prominent here. The majority of the rear-end crashes were on NE 28th Street-Goodwin Road traveling north-eastbound, while a majority of the fixed object crashes were on NE Ingle Road traveling south-eastbound. Following too close and driver inattention were the leading causes of crashes at this location. A third of the crashes resulted in injuries (5 of 15).
- **NE 232nd Avenue / NE 28th Street (stop controlled):** This is a three-leg intersection with stop control on NE 232nd Avenue (the north leg of the intersection is a private driveway). Turning movement crashes were most common here, caused by drivers failing to yield or making improper turns. None of the crashes resulted in injuries.
- **NE 199th Avenue at NE 58th Street-SR 500 (stop controlled):** This is a three-leg intersection with stop control on NE 199th Avenue. Angle crashes were most prominent here, caused by drivers failing to yield. Less than a third of the crashes resulted in injuries (2 of 7).
- **SR 500 at NE 3rd Street (stop controlled):** Fixed object crashes were the most prominent here. The intersection is within a curve along SR 500. Speeding was the most common cause of crashes. A quarter of the crashes resulted in injuries (1 of 4).
- **NW Sierra Drive at NW 28th Avenue (all-way stop):** Angle crashes were most prominent here, caused by drivers passing the stop sign or failing to yield. A quarter of the crashes resulted in injuries (1 of 4).
- **NE 6th Avenue at SR 500-NE Garfield Street (stop controlled):** This is a four-leg intersection with stop control on NE 6th Avenue. Angle crashes were most prominent here, caused by drivers passing the stop sign or failing to yield. Less than a third of the crashes resulted in injuries (4 of 11).
- **NE 3rd Avenue at SR 500-NE Garfield Street (signalized):** Turning and angle crashes were the most prominent here. The intersection has a permitted left turn on the eastbound NE 3rd Avenue approach. Disregarding traffic controls and failure to yield were the most common causes of crashes, possibly related to the permissive turn phasing**.** There were two pedestrian

crashes caused by a driver failing to yield when making a left turn from NE Garfield Street to eastbound NE 3rd Avenue. Less than a third of the crashes resulted in injuries (5 of 13).

- **NE 3rd Avenue at SR 500-NE Dallas Street (signalized):** Turning and angle crashes were the most prominent here. The intersection has permitted left turn lanes on all approaches. Disregarding traffic controls and failure to yield were the most common causes of crashes, possibly related to the permissive turn phasing. More than a quarter of the crashes resulted in injuries (3 of 11).
- **SE 283rd Avenue at SE 23rd Street (stop controlled):** This is a three-leg intersection with stop control on SE 23rd Street. Fixed object crashes were the most prominent here. The majority of the fixed object crashes were on SE 283rd Avenue traveling northbound or southbound. Speeding and driver inattention were the leading causes of crashes at this location. Half of the crashes resulted in injuries (2 of 4).

Walking and Bicycle Network Conditions

To assess the pedestrian and bicycle network conditions within the study area, a high-level qualitative evaluation was conducted. The quality and availability of various characteristics are rated system-wide as "Excellent", "Good", "Fair", or "Poor". The intent of the analysis is to show the extent to which the pedestrian and bicycle network provides a level of comfort and safety for users. The analysis will be used to inform, create, and confirm recommendations for pedestrian and bicycle projects.

Qualitative Pedestrian Network Assessment

For the pedestrian network evaluation, consideration is given to the presence of a sidewalk or path, a buffer zone (i.e., bike lane, shoulder, landscape strip, or on-street parking) and street lighting, and traffic volumes, number of travel lanes and travel speeds along the adjacent roadway.

In Camas, an "Excellent" rating requires sidewalks on both sides of the roadway, along with a desirable buffer zone given the roadway characteristics. A "Good" rating requires sidewalks on both sides of the roadway and a buffer zone, but without the desirable features or widths given the roadway characteristics. A "Fair" rating is given to a roadway with sidewalks on both sides, but without an adequate buffer zone. A "Poor" rating denotes gaps within the pedestrian facilities along that corridor.

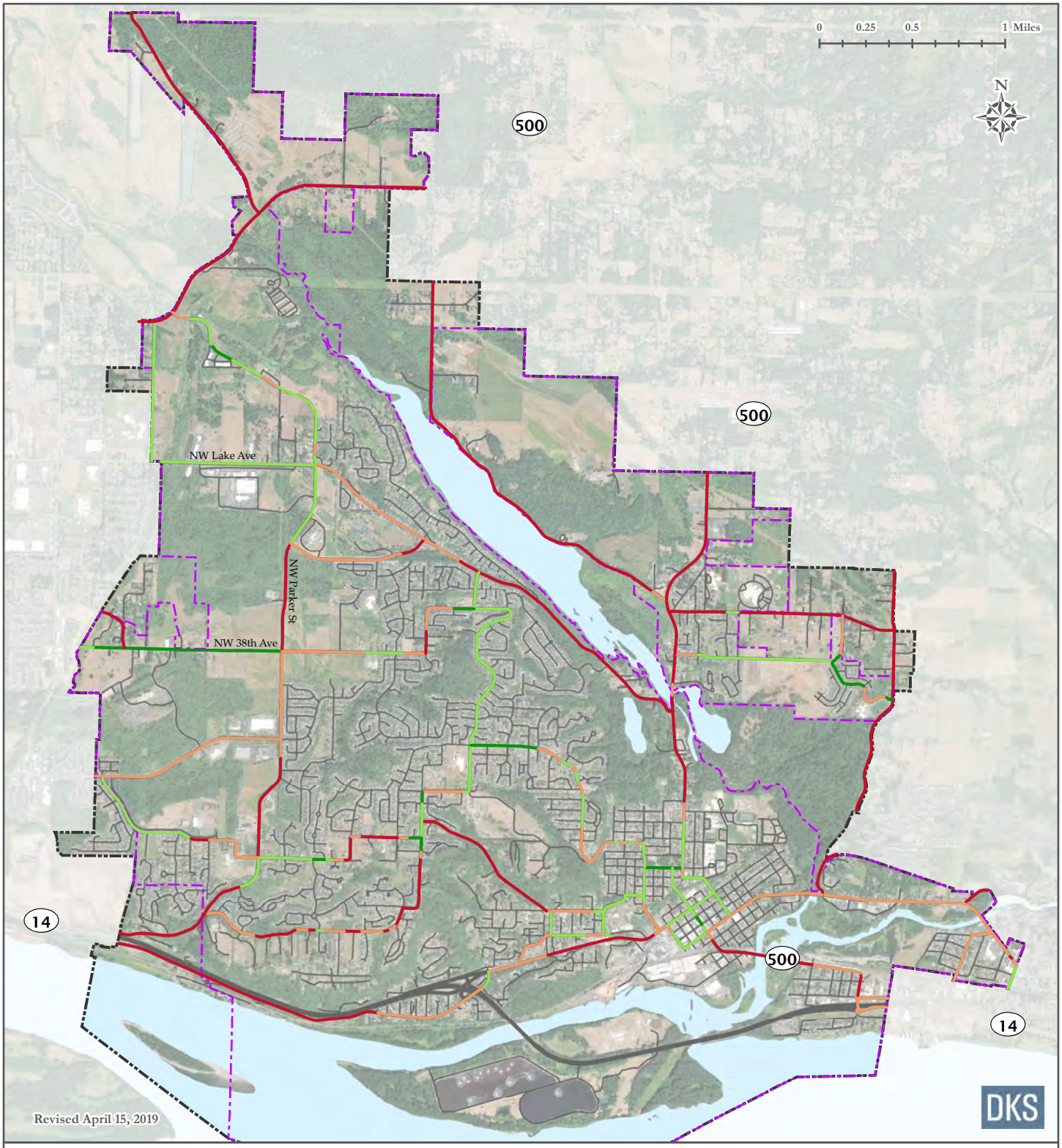
Figure 13 summarizes the pedestrian network conditions in Camas. Overall, the network rates relatively high near downtown, and poor towards the edges of the city.

Qualitative Bicycle Network Assessment

For the bicycle network evaluation, consideration is given to the presence and width of bike facilities (i.e., bike lane, shoulder, path, shared roadway), grade and pavement conditions of the roadway, and the number of travel lanes, motor vehicle volumes, and travel speeds along the adjacent roadway. In Camas, an "Excellent" rating requires separated bicycle facilities. A "Good" rating requires adequate bicycle facilities and width given the segment characteristics. A "Fair" rating is given to a roadway with bicycle facilities, but without the preferred facility type or width given the segment characteristics. A "Poor" rating denotes gaps within the bike network along that corridor.

Figure 14 summarizes the bicycle network conditions in Camas. This analysis shows that the arterial and collector streets in Camas rate relatively high on the northwest side of the city, and poor on the south and east side. The streets with the lowest ratings are the streets important for local and regional through travel (i.e., portions of NW 6th Avenue, NE 3rd Avenue, and SR 500), where most businesses and services are located. These streets rate low due to the relatively high motor vehicle traffic volumes and speeds and lack of separated bicycle facilities.

13 Pedestrian Network Assessment



Legend:

Qualitative Pedestrian Network Assessment:

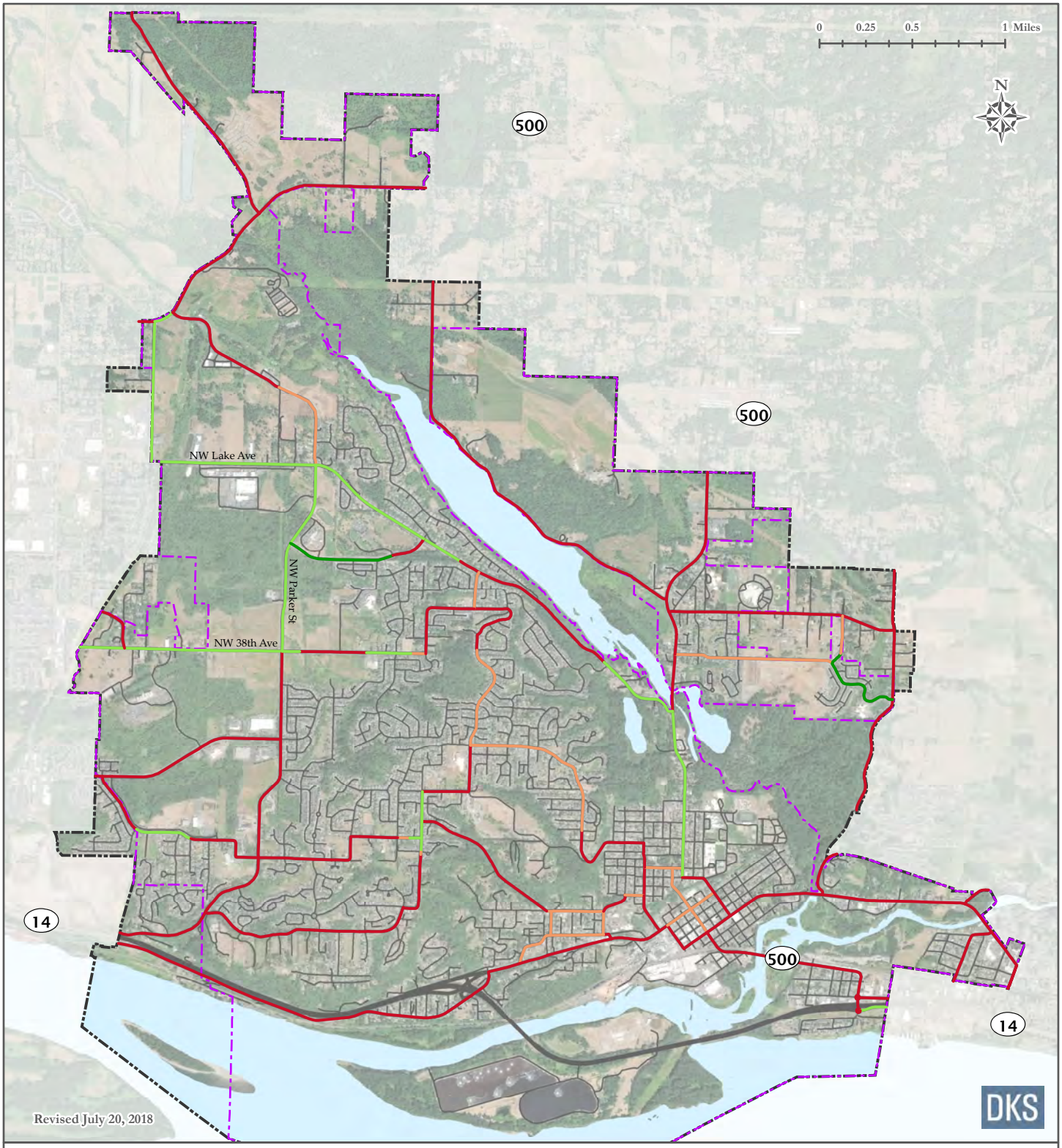
- Excellent
- Good
- Fair
- Poor

Urban Growth Area

Camas City Limit

Note:
Rating is based on a combination of sidewalk presence, speed limit, presence of buffers, roadway volume, number of lanes, shoulder widths and presence of lighting. Rating calculated on Collectors and Arterials.

14 Bicycle Network Assessment



Legend:

Qualitative Bicycle Network Assessment:

- Excellent
- Good
- Fair
- Poor

Urban Growth Area

Camas City Limit

Note:
Rating is based on a combination of speed limit, presence of bicycle facilities, presence of buffers, on-street parking, access and other street characteristics. Rating calculated on Collectors and Arterials.

Roadway Network Conditions

The Transportation Plan compares intersections in Camas to mobility standards intended to maintain a minimum level of efficiency for motor vehicle travel. Two methods to gauge intersection operations include volume-to-capacity (v/c) ratios and level of service (LOS).

- **Volume-to-capacity (v/c) ratio:** A decimal representation (between 0.00 and 1.00) of the proportion of occupied capacity (capacity defined as the theoretical maximum vehicle throughput in a given time frame) at a turn movement, approach leg, or intersection. It is the peak hour traffic volume divided by the hourly capacity of a given intersection or movement. A lower ratio indicates smooth operations and minimal delays. A ratio approaching 1.00 indicates increased congestion and reduced performance. A ratio greater than 1.00 indicates the turn movement, approach leg, or intersection is oversaturated, which usually results in excessive queues and long delays.
- **Level of service (LOS):** A "report card" rating (A through F) based on the average delay experienced by vehicles at the intersection. LOS A, B, and C indicate conditions where traffic moves without significant delays over periods of peak hour travel demand. LOS D and E are progressively worse operating conditions. LOS F represents conditions where average vehicle delay has become excessive and traffic is highly congested.

Intersection mobility targets vary by jurisdiction of the roadways. Level of Service for Highways of Statewide Significance is set by the State. In Clark County, the standard is set as LOS "D" for urban areas, including SR 14. Level of Service for regional state highway facilities (not part of the HSS), including SR 500 in Camas, is set through the Southwest Washington Regional Transportation Council (RTC). The Southwest Washington RTC Board adopted LOS 'E' or better for non-HSS urban state highway facilities.

A LOS "D" is the minimum performance standard during the peak-hour for intersections along arterial and collector roadways under city jurisdiction. At roundabout intersections, v/c ratio of 0.90 also applies along arterial roadways and a v/c ratio of 0.85 along collector roadways.

The applicable mobility standards at each study intersection in the city are identified in the appendix. Study intersections that do not meet the mobility standards shown may require mitigation strategies to be identified in the Transportation Plan.

Intersection Operations

Table 7 shows the study intersections that do not meet mobility standards under the existing (2018) p.m. peak hour. A complete listing of operating conditions at study intersections is provided in the appendix. Of the 50 study intersections, four city locations do not meet their respective mobility standard under existing p.m. peak hour conditions.

Table 7: Study Intersections That Do Not Meet Mobility Standards (2018 PM Peak)

	Intersection	Mobility Target	Delay	Level of Service	Volume / Capacity
4	Pacific Rim Boulevard at Payne Road	LOS D	103.5	F	0.98
38	NW 6th Avenue at NW Ivy Street	LOS D	39.0	E	0.13
39	NW 6th Avenue at Drake Street	LOS D	41.7	E	0.50
40	NE 6th Avenue at NE Division Street	LOS D	61.1	F	0.31

Signalized intersections:
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection

Stop Controlled intersections:
LOS = Level of Service of Worst Movement
V/C = Volume-to-Capacity Ratio of Worst Movement

Summary of Key Findings

Below is a summary of key findings from the analysis of existing transportation conditions that helps establish a baseline for system performance.

Pedestrian Network

- Traveling by foot is far more common near downtown.
- Gaps in the sidewalk system are more common in southwest, southeast, and northeast Camas, and on roadway segments outside the city limits.
- Most crashes involving pedestrians occur downtown, and along NE 3rd Avenue between NE 4th Street and NE Weir Street.
- The vast majority of pedestrian-involved crashes (79 percent) were caused by drivers failing to yield the right of way to a pedestrian in a crosswalk or along a sidewalk.
- Overall, the walking network rates relatively high near downtown, and poor towards the edges of the city.

Bicycle Network

- Traveling by bicycle is more common along NW Lake Road, and NW Sierra Street.
- Significant segments of continuous bicycle lanes exist along portions of NW Lake Road, NW 38th Avenue, NW Parker Street, NW Friberg-Strunk Street, and SR 500.
- Most crashes involving bicycles occur at intersections.
- Most of the crashes involving a bicyclist were caused by drivers failing to yield the right of way when turning.
- The arterial and collector streets in Camas rate relatively high on the northwest side of the city, and poor on the south and east side. The streets with the lowest ratings are the streets important for local and regional through travel, where most businesses and services are located.

Transit System

- C-TRAN provides transit service in Camas via one fixed bus route connecting the city with Vancouver and Washougal. Transit riders can transfer to other C-TRAN routes at the Fisher's Landing Transit Center in Vancouver.
- Bus stops in Camas are located along NW 6th Avenue near the SR 14 Ramps, NW Ivy Street, and NW Drake Street intersections, at the NE Adams Street / NE 5th Avenue, and along NE 3rd

Avenue near the NE Franklin Street, NE Joy Street, NE 3rd Place, E. 1st Avenue, SE Crown Road, NE Summer Street, NE 3rd Loop, NE Shepherd Road, NE 2nd Avenue, NE Weir Street and NE Lechner Street intersections.

- Each of the bus-stops are signed and the eastbound stop along NW 6th Avenue near the SR 14 Ramps provides a bus pull-out. The bus stop along NE 3rd Avenue at NE Franklin Street (near Camas City Hall) provides a bench and shelter.
- All remaining bus stops have no amenities.
- C-TRAN's "Connector" service provides Camas with fully accessible dial-a-ride and scheduled stop service at designated stops within the service area.
- Most transit users in the city are more than a half-mile from a bus stop.

Roadway Network

- More than half of the workers in Camas live in another city that is located more than ten miles away, creating many long commute trips and encouraging travel by motor vehicle.
- Motor vehicle volumes on the roadways in Camas most commonly peak during weekday evenings between 4:50 p.m. and 5:50 p.m.
- Camas experiences an average of around 176 crashes a year, though the severity of most crashes is generally low, with 88 percent involving only property damage or minor injuries.
- The NE Ingle Road at NE 28th Street intersection in Camas was noted as having a high rate of crashes.
- The five most common driver errors are responsible for nearly 60 percent of all crashes in Camas.

    1. Inattention (29 percent)
    2. Did Not Yield Right-of-Way (13 percent)
    3. Followed Too Closely (10 percent)
    4. Disregarded Traffic Signal or Stop Sign (3 percent)
    5. Operating Defective Equipment (3 percent)

- Of the 50 study intersections, four city locations do not meet their respective mobility standard under existing p.m. peak hour conditions, including Pacific Rim Boulevard at Payne Road, NW

6th Avenue at NW Ivy Street, NW 6th Avenue at Drake Street, and NE 6th Avenue at NE Division Street.

- About 75 percent of the roadway miles in Camas have pavement in good or satisfactory condition, 13 percent in fair condition, six percent in poor condition, and six percent in very poor or worse condition.

Other Modes of Travel

- Seven bridges are flagged as functionally obsolete, including along SW 6th Avenue over SR 14, along SR 500 over the Washougal River, along SR 500 over Lacamas Lake, along NE 3rd Avenue over the Washougal River (this bridge is scheduled for seismic upgrades in 2020), along NE Goodwin Road over Lacamas Creek, along Division Street over Mill Ditch, and along NE Dallas Street over Mill Ditch.
- Within Camas, SR 14 is classified as a T-2 truck freight corridor, while portions of NW 6th Avenue, NE Adams Street, NE 3rd Avenue, SR 500, NW Lake Road, NW Parker Street, NW Brady Road, NW Pacific Rim Boulevard, NE Goodwin Road, NE 28th Street, and NE Ingle Road are T-3 corridors.
- Freight rail service is provided to Camas by the BNSF Railway.
- Grove Field serves 9,800 annual operations (i.e., take-offs or landings).
- Regional and international air service for passengers and freight is provided via Portland International Airport (PDX).

APPENDIX D. FUTURE BASELINE CONDITIONS ANALYSIS

MEMORANDUM

720 SW Washington St.
Suite 500
Portland, OR 97205
503.243.3500
www.dksassociates.com

DATE: May 15, 2024

TO: Curleigh Carothers, City of Camas
Steve Wall, City of Camas

FROM: Reah Flisakowski, DKS Associates
Kevin Chewuk, DKS Associates

SUBJECT: Camas Transportation Plan
Technical Memo 3 – Future Baseline Conditions Analysis P18039-000

The condition of Camas' future transportation system depends on the growth in population and employment, future travel patterns (e.g., choice of modes, routes, and frequency of trips), and community investment decisions. Growth in population and the number of jobs is forecast based on trends and knowledge of the city and region. Future travel patterns are more difficult to predict as the community's investment decisions and the economy can have significant effect on choice of modes and routes. The objective of the transportation planning process is to generate information necessary for making decisions that will result in safe and efficient travel options through 2040.

Methodology for Estimating Future Travel

The 2040 transportation conditions in Camas were forecasted based on trips that new growth will generate, assuming no new investments in infrastructure beyond what is funded for construction already. It describes where the transportation system will perform satisfactorily and areas of the network likely to be congested or in need of investments to function adequately in the future. Subsequent memos will explore potential solutions for addressing future transportation system needs.

Future Estimates of Walking, Biking, and Transit

Methodology for determining future needs for walking, biking, and transit in Camas begins with an assessment of who is walking, biking, and taking transit now and where they are traveling. Technical Memorandum #2 (Existing Conditions Analysis) answers these questions for pedestrians, bicyclists and transit riders and details existing conditions of the infrastructure.

The existing facilities were then compared to major growth areas of the city, and in proximity to key destinations, such as schools, parks, transit stops, shopping and employment. A review of the city shows that the walking and biking infrastructure is inadequate in anticipated major growth areas and

near key destinations, which have the potential to attract significant walking and biking trips. The inadequate walking and biking infrastructure further hinders transit riders, as these users typically utilize these facilities at the beginning and end of their trip.

Baseline Street Network Performance

The baseline condition reflects the street network performance for motor vehicles, assuming only transportation projects with secured funding will be built. Other identified TIF projects that are not fully funded will be evaluated as potential solutions in Technical Memorandum #5 to validate their need in the future.

The following motor vehicle capacity projects have been completed or have funding identified in the Camas Transportation Plan study area through 2040:

- Eastbound left-turn pocket added to NW Brady Road at the NW Grand Ridge Drive intersection (study intersection #1)
- Traffic signal installed at the **NW Brady Road intersection with NW 16th Avenue** and left-turn pockets for all approaches (study intersection #3)
- Traffic signal installed at the **Pacific Rim Boulevard intersection with Payne Road** and left-turn pockets for the northbound and southbound approaches (study intersection #4)
- Traffic signal installed at **SE 20th Street/38th Avenue intersection with SE Bybee Road/NW Fisher Creek Drive** and realign SE Bybee Road so that is intersects with NW Fisher Creek Drive (study intersection #8)
- Traffic signal installed at the **NE Ingle Road intersection with NE 28th Street-NE Goodwin Road** (study intersection #16)
- Install a roundabout at the **SR 500 (NE Everett Street) intersection with NE 3rd Street** (study intersection #20)
- Roundabout installed at the **SR 500 (NE Everett Street) intersection with NE Lake Road** (study intersection #24)
- **Larkspur Street** improved between NW Lake Road and NW Camas Meadows Drive, including sidewalks and bike lanes
- **NW Brady Road** improved between NW 16th Avenue and NW Pacific Rim Boulevard, including sidewalks and bike lanes
- Improve NW 38th Avenue between NW Parker Street and Grass Valley Park

Camas 2040

Future land use changes and growth in population, housing, and employment within Camas' urban growth area (UGA) will have a significant impact on the existing transportation system and will create new travel demands. These growth projections and how they translate to new trips on the transportation network are key elements of the future conditions and performance analysis.

The Southwest Washington Regional Transportation Council (RTC) travel demand model is the primary tool used to determine future traffic volumes in Camas and the surrounding region. The RTC model forecasts travel changes in response to future land use and transportation scenarios. This model translates estimated land uses into person trips, selects travel modes and assigns motor vehicle trips to the roadway network. It is an informational tool to assist with decision making, providing objective and quantitative information exploring the potential impacts of alternative transportation system investments.

Forecasted Population and Employment Growth

Understanding the influence of area land uses on the transportation system is a key factor in transportation system planning. The amount of land that is to be developed, the types of land uses, and their proximity to each other have a direct relationship to expected demands on the transportation system.

The RTC model includes forecasted land uses for the Camas Transportation Plan study area. The land uses reflect Camas' Comprehensive Plan and growth assumptions identified for the year 2040. Complete land use data sets are developed for both the 2015 base year and 2040 future year. The land use information has been coordinated with all the other jurisdictions in the RTC travel area. A sub-area level model was also created for the Camas planning area that included a 2040 planning horizon. Local land uses were developed for 2040 with input from City staff. Future year land use and trips were adjusted based on the adopted changes from the Camas Northshore Subarea Plan.

Table 1 summarizes baseline and projected future totals for households and employment within the Camas Transportation Plan study area, from which traffic growth estimates were made. These values indicate that growth in employment is expected to outpace residential development, both overall and as a percentage increase. Most household growth is assumed to occur in the north area of the city, while employment growth is generally assumed to occur in the southwest and northeast.

Table 1: Land Use Assumptions for Camas

Camas Transportation Plan Study Area*	2015	2040	Change (2040-2015)	Percent Increase (2040-2015)
RTC Model Households	9,580	15,220	5,640	59%
RTC Model Employment	8,947	21,243	12,296	137%
Northshore Plan Household Updates**	-	+1,918	-	-
Northshore Plan Employment Updates**	-	-2,508	-	-
Total Households (with Northshore Plan Updates)	9,580	17,138	7,558	79%
Total Employment (with Northshore Plan Updates)	8,947	18,735	9,788	109%

* These locations are based on boundaries approximated by the model TAZ boundaries and may not match current and future city limits.
** This reflects the difference between the 2040 land use included in the RTC model for the Northshore Subarea Plan area (i.e., 2,232 households and 4,476 jobs) and the 2040 land use from adopted changes from the Northshore Subarea Plan (i.e., 4,150 households and 1,968 jobs).

Future Travel Growth

With more jobs, residents, and through travel, the street network in Camas must accommodate about 9,000 additional motor vehicle trip ends during the weekday evening peak hour. Today, the Camas street network is generally able to handle the evening peak hour trips; however, the evening peak hour motor vehicle trips are likely to increase significantly by the end of 2040.

Forecasted 2040 motor vehicle volumes for peak hour conditions were utilized to determine areas on the baseline roadway network that will be congested and may require future investments to accommodate forecasted growth. The 2040 baseline motor vehicle volumes for study intersections in the appendix show volumes are anticipated to be highest along major roadways that connect the surrounding region to the employment areas in Camas, including NW Pacific Rim Boulevard, NW 38th Avenue, NW Parker Street, NW Lake Road, SR 500-NE Everett Street, NW 6th Avenue and NE 3rd Avenue. Other roadways expected to experience significant traffic increases include NE Goodwin Road, NE Ingle Road and NE 28th Street. Each of these roadways connects a major residential and/or employment growth area in the City.

Where Transportation Improvements May be Needed

Review of the expected growth throughout the city and existing gaps and deficiencies of the transportation system identified the following locations as possible candidates for improvements.

Walking Network Needs

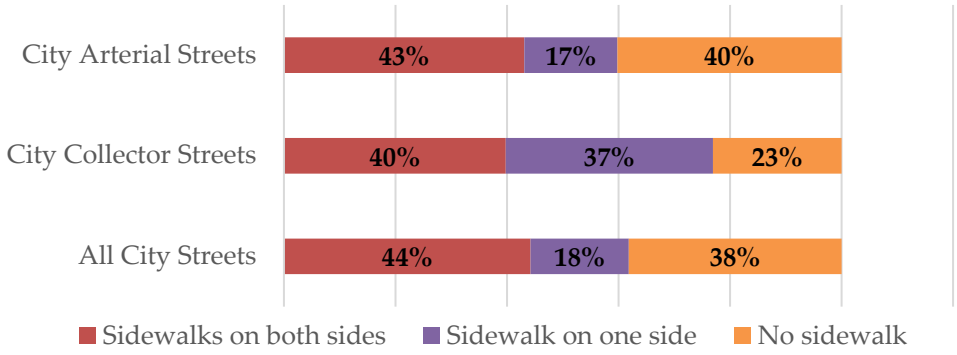
The following section describes the walking network needs identified for the 2040 Baseline street network.

Future Walking Network

The percent of roadways with sidewalks (see Figure 1) will improve slightly from existing conditions. About 56 percent of City street miles (including City arterial, collector and local streets) lack sidewalk coverage along one or both sides. With a few projects currently committed for funding, the 2040 Baseline pedestrian network is similar to today's conditions. These numbers do not incorporate off-street shared-use paths that may run alongside some roadways.

Any future streets constructed in association with development projects will be required to construct sidewalks as well, increasing the overall sidewalk supply.

Figure 1: Street Miles with Sidewalks within Camas



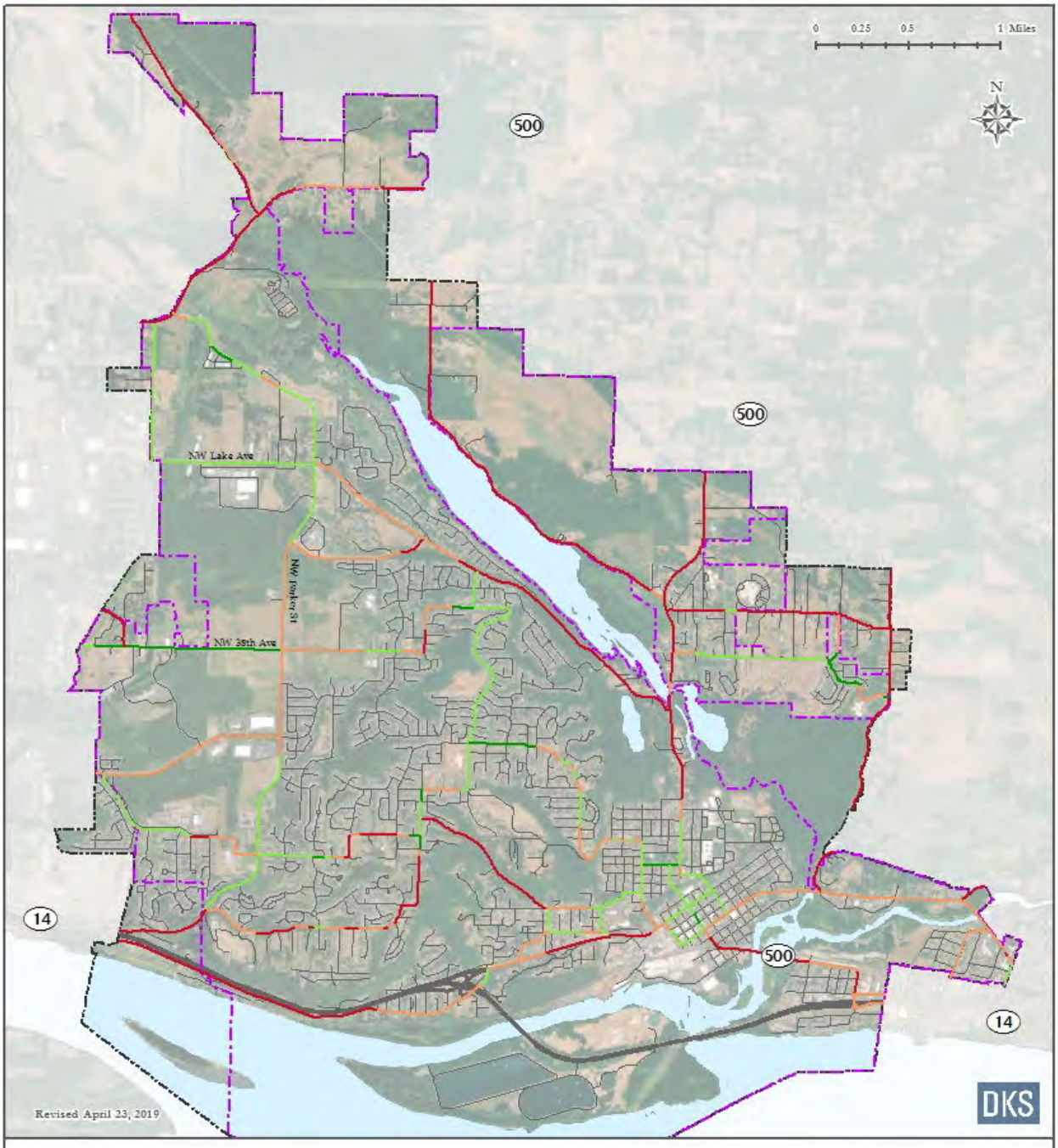
Future Qualitative Pedestrian Assessment

The Qualitative Pedestrian Network Assessment shows the extent to which the walking network on collector and arterial streets provides a level of comfort and safety for users. The assessment method and conditions of the pedestrian network are summarized in a previous memo[1]. Since traffic volume is the only input factor anticipated to change significantly under future conditions, there were no significant changes made to the street segment quality ratings identified in existing conditions (see Figure 2).

About 30 percent of the collector and arterial street miles' in Camas rate "good" or "excellent" for pedestrians. However, over 35 percent of the collector and arterial street miles' rate poorly. Most of the street miles' rated "poor" are located in high growth areas (i.e., household or employment growth). The pedestrian network in these areas is largely unimproved due to the rural nature of the surrounding land use but will likely be improved as future development occurs. Overall, the pedestrian network continues to rate relatively high near downtown, and poor towards the edges of the City.

[1] See Technical Memorandum #2: Existing Conditions Analysis, July 20, 2018

2 Future Pedestrian Network Assessment



Walking Facility Gaps

Despite the high level of sidewalk coverage towards downtown, parts of the City experience sidewalk gaps. These gaps are predominately concentrated on the edge of the City. However, there are segments along streets near downtown, and other segments that provide important connections that lack sidewalks on one or both sides of the street.

Missing segments in developed areas include:

- NW Brady Road, south of NW McIntosh Road
- NW McIntosh Road, east of NW Brady Road
- NW Lake Road, west of SR 500-NE Everett Street
- SR 500-NE Everett Street, south of NW Lake Road

Segments in undeveloped areas where future development will require sidewalks include:

- NW Parker Street, north of NW Pacific Rim Boulevard
- NE Goodwin Road-NE 28th Street, east of NW Friberg-Strunk Street
- NE Ingle Road, north of NE Goodwin Road
- NE 232nd Avenue-NE Leadbetter Road, west of SR 500-NE Everett Street (note that this segment to eventually be partially closed to motorist traffic and made into a trail)
- NE 43rd Avenue-SE 15th Street, east of SR 500-NE Everett Street
- SR 500-NE Everett Street, north of NW Lake Road

In addition to the areas where these gaps already exist, future pedestrian infrastructure needs can be identified based on anticipated growth. Higher densities and more people require more pedestrian infrastructure to accommodate demand. Where growth is anticipated, street segments with "poor" or "fair" pedestrian network qualitative assessment scores will need enhancements in order to improve their conditions. These segments include:

- NW 38th Avenue, east of NW Parker Street (note that multimodal improvements are being constructed on NW 38th Avenue between NW Parker Street and Grass Valley Park in 2024).
- NW Pacific Rim Boulevard, west of NW Parker Street
- NW 6th Avenue, west of NE Adams Street

Methodology to Address Deficiencies

A list of potential pedestrian network improvement projects will be developed in Technical Memorandum #5 based on streets with pedestrian deficiencies. A street is considered deficient for walking if it meets one or more of the following conditions:

- Arterial or collector street without pedestrian facilities
- "Poor" qualitative pedestrian assessment rating
- Qualitative pedestrian assessment rating less than "good" in close proximity to parks, schools, transit stops, or other important destinations

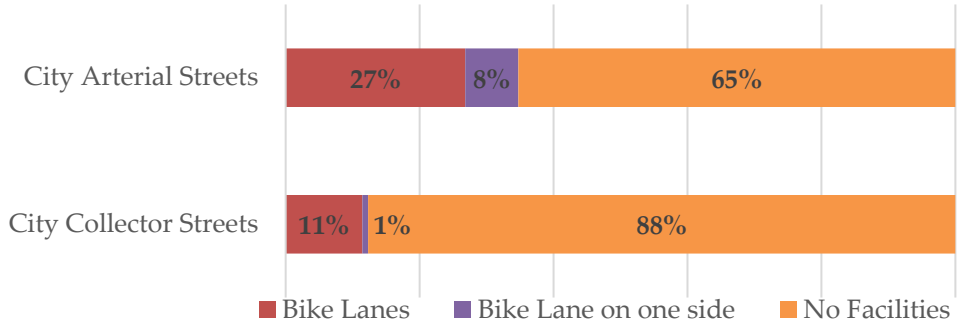
Bicycle Network Needs

The following section describes the bicycle network needs identified for the 2040 Baseline street network.

Future Bicycle Network

Little is expected to change from the existing bicycle network (see Figure 3). About 65 percent of City arterial street miles and 88 percent of City collector street miles lack bicycle facilities (bike lanes or shoulder bikeways). With a few projects currently committed for funding, the 2040 Baseline bicycle network is similar to today's conditions. These numbers do not incorporate off-street shared-use paths that may run alongside some roadways.

Figure 3: Street Miles with Bike Facilities within Camas



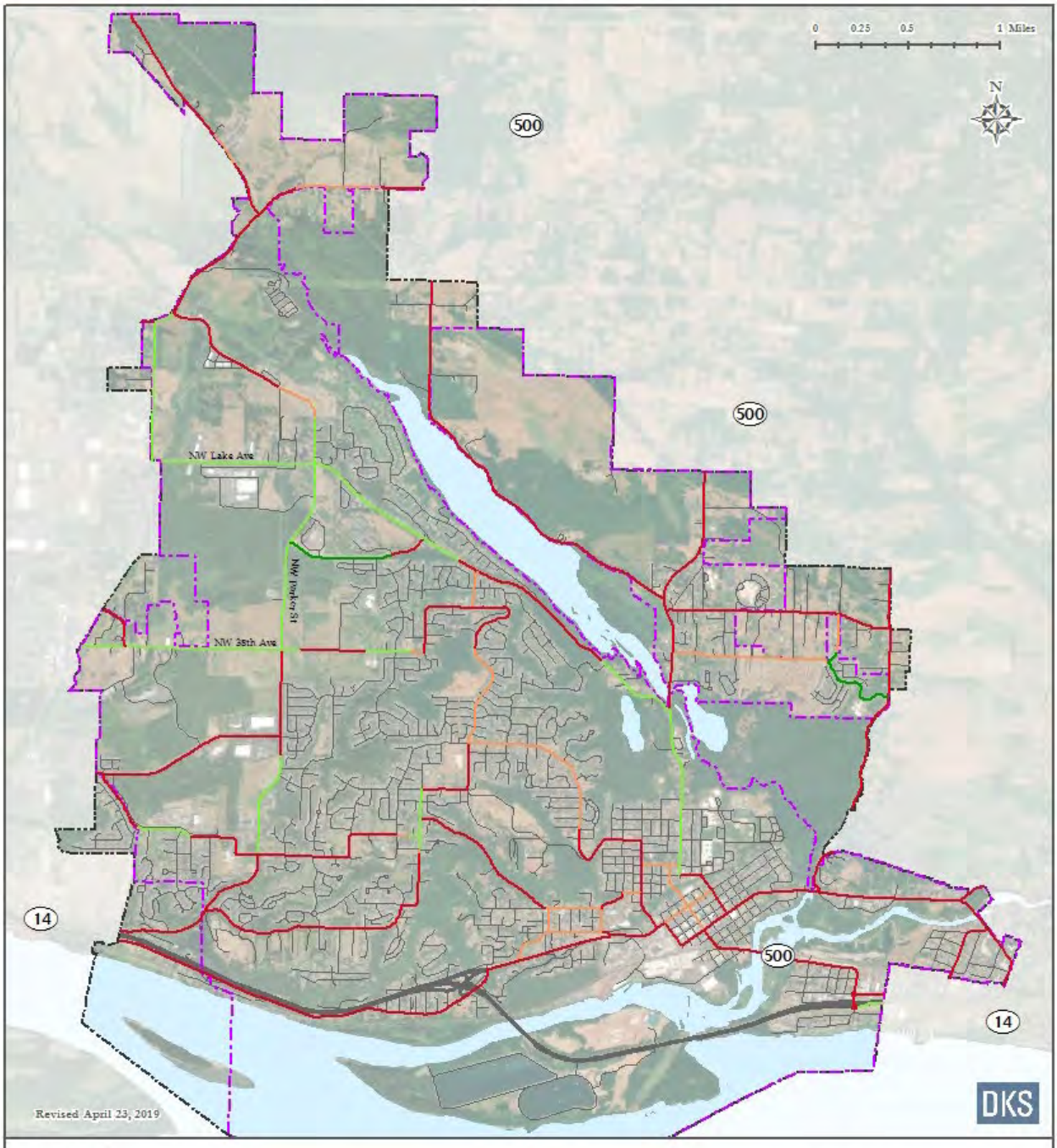
Future Qualitative Bicycle Assessment

The Qualitative Bicycle Network Assessment shows the extent to which the bicycle network on collector and arterial streets provides a level of comfort and safety for users. The assessment method and conditions of the bicycle network are summarized in a previous memo[2]. Since traffic volume is the only input factor anticipated to change significantly under future conditions, there were no significant changes made to the street segment quality ratings identified in existing conditions (see Figure 4).

About 20 percent of the collector and arterial street miles' in Camas rate "good" or "excellent" for bicyclists. However, about 65 percent of the collector and arterial street miles' rate poorly for bicyclists. Overall, the bicycle network continues to rate relatively high on the northwest side of the city and poor on the south and east side. The streets with the lowest ratings are the streets important for local and regional through travel (i.e., portions of NW 6th Avenue, NE 3rd Avenue, and SR 500), where most businesses and services are located. These streets rate low due to the relatively high motor vehicle traffic volumes and speeds and lack of separated bicycle facilities.

[2] See Technical Memorandum #2: Existing Conditions Analysis, July 20, 2018

4 Future Bicycle Network Assessment



Bicycle Facility Gaps

Bicycle network gaps are spread throughout the City. These gaps are predominately located on segments of streets in undeveloped areas, or on segments of streets that have no on-street bike facilities that would better connect the bicycle network. Some of these segments include:

- NW Brady Road-NW Parker Street, south of NW 38th Avenue
- NW Pacific Rim Boulevard, west of NW Parker Street
- NW 38th Avenue, east of NW Parker Street (note that multimodal improvements are being constructed on NW 38th Avenue between NW Parker Street and Grass Valley Park in 2024).
- NW Lake Road, west of Sierra Street to Lacamas Lane (eastbound only)
- NE Goodwin Road-NE 28th Street, east of NW Friberg-Strunk Street
- SR 500-NE Everett Street, north of NW Lake Road
- SE 6th Avenue, south of NE 3rd Avenue
- NE 3rd Avenue, east of NE Adams Street
- NE Adams Street, between NE 3rd Avenue and NW 6th Avenue
- NW 6th Avenue, west of NE Adams Street

In addition to these missing segments, future bicycle needs can be identified based on where growth is expected to occur. The areas with the greatest increase in employment and population densities are listed below. As most of these areas are undeveloped, future bicycle infrastructure is likely to be provided or enhanced through development of the local street system.

- In north Camas, north of NW Lake Road
- In southwest Camas, west of NW Brady Road-NW Parker Street
- In northeast Camas, east of NW 232nd Avenue

Major street segments with "poor" bicycle network qualitative assessment scores include:

- NW Brady Road-NW Parker Street, south of NW 38th Avenue
- NE Ingle Road, north of NE Goodwin Road
- NW Lake Road, between NW Sierra Street and NW Lacamas Lane (eastbound only)
- SR 500-NE Everett Street, north of NW Lake Road
- SE 6th Avenue, south of NE 3rd Avenue
- NE 3rd Avenue, east of NE Adams Street

- NW 6th Avenue, west of NE Adams Street

Generally, improvements are needed if the City prioritizes more bicycle friendly streets for novice riders. Such improvements would focus on improving the density and connectivity of low-stress bike routes, and in some cases identified bicycle deficiencies and gaps can be addressed by providing accommodations on nearby streets.

Other Bicycle Needs

Other bicycle needs identified through field observations and transportation analysis include enhancing bicycle connections to key destinations and expanding low stress bicycle routes. Not all of the roadways lacking bicycle facilities will be able to accommodate bike lanes due to right-of-way constraints, limited funding, and/or fewer constraints on parallel corridors. A network of low stress bikeways will be considered to relieve some of the right-of-way constraints posed on streets where bikeways are rated poor, but space does not permit consideration of bike lanes or buffered bike lanes.

As mitigations for motor vehicle travel are considered for intersections and along roadway segments, innovative designs may be considered to avoid undesirable impacts on bicycle safety and connectivity.

Methodology to Address Deficiencies

A list of potential bicycle network improvement projects will be developed in Technical Memorandum #5 based on streets with bicycle deficiencies. A street is considered deficient if it meets one or more of the following conditions:

- Arterial or collector street without bicycle facilities or adjacent corridor with bicycle facilities
- "Poor" qualitative bicycle assessment rating
- Qualitative bicycle assessment rating less than "good" in close proximity to parks, schools, transit stops, or other important destinations

Motor Vehicle Network Needs

An increase in motor vehicle travel leads to an increase in congestion. Travel activity, as reflected by evening peak hour motor vehicle trips beginning or ending in Camas, is expected to increase significantly through 2040. Through trips (i.e., trips that neither begin nor end in Camas) are also expected to increase through 2040 and are generally representative of increased growth in statewide travel and in neighboring cities such as Vancouver and Washougal.

Study intersection operations were analyzed in the same manner as was done for existing conditions[3]. Forecasted intersection capacity and level of service were compared to applicable agency mobility standards to identify where significant congestion is likely to occur. Table 2 shows the study intersections that do not meet mobility standards under the 2040 peak hour conditions. A complete listing of operating conditions at study intersections is provided in the appendix.

Of the 50 study intersections, 16 would not meet their respective mobility standard during the 2040 peak hour conditions. Three of these intersections also did not meet the mobility targets under existing p.m. peak hour conditions (NW 6th Avenue at NW Ivy Street, NW 6th Avenue at Drake Street and NE 6th Avenue at NE Division Street). Four of the substandard intersections are along SR 500.

Table 2: Study Intersections That Do Not Meet Mobility Standards (2040 PM Peak)

	Intersection	Mobility Target*	Delay	Level of Service	Volume / Capacity
6	Pacific Rim Boulevard at NW Parker Street	LOS D; v/c 0.85	42	E	0.84
17	NE 232nd Avenue at NE 28th Street	LOS E; v/c 0.90	>300	F	>2.0
18	NE 28th Street at SR 500-NE 242nd Avenue	LOS E	>300	F	>2.0
19	NE 199th Avenue at SR 500-NE 58th Street	LOS E	>300	F	1.96
23	SR 500-NE Everett Street at NE 38th Ave	LOS E	98	F	0.67
25	NW Lake Road at NW Lacamas Lane	LOS E; v/c 0.90	63	F	0.38
26	NW Lake Road at NW Sierra Street	LOS E; v/c 0.90	>300	F	1.77
27	NW Lake Road at NW Leadbetter Drive	LOS E; v/c 0.90	106	F	0.92
29	NW Dahlia Drive at NW 38th Avenue	LOS E; v/c 0.90	56	F	0.72
36	NW 6th Avenue at NW Norwood Street	LOS D	44	E	1.08

[3] Technical Memorandum #2: Existing Conditions Analysis, July 20, 2018

Table 2: Study Intersections That Do Not Meet Mobility Standards (2040 PM Peak)

	Intersection	Mobility Target*	Delay	Level of Service	Volume / Capacity
38	NW 6th Avenue at NW Ivy Street	LOS E; v/c 0.90	100	F	0.26
39	NW 6th Avenue at Drake Street	LOS E; v/c 0.90	99	F	0.73
40	NE 6th Avenue at NE Division Street	LOS E; v/c 0.90	207	F	0.68
41	NE 6th Avenue at NW Adams Street	LOS E; v/c 0.90	55	F	0.98
42	NE 6th Avenue at SR 500-NE Garfield St	LOS E	66	F	0.78
48	NE Weir Street at NE 3rd Avenue	LOS E; v/c 0.90	110	F	1.02

*Recommended mobility targets for City intersections

Signalized intersections:
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection

Stop Controlled intersections:
LOS = Level of Service of Worst Movement
V/C = Volume-to-Capacity Ratio of Worst Movement

Corridor Needs

With projected population and employment growth in Camas, a few roadway segments are expected to be deficient by 2040 during the evening peak period. In addition, a few major corridors lack adequate walking or biking facilities. With growing traffic volumes through 2040, these problematic areas will likely persist and may even become progressively worse. These corridors include:

- SR 500-NE Everett Street between NE 23rd Avenue and SE Leadbetter Road
- NW 6th Avenue between Norwood Street and Adams Street
- NE 3rd Avenue between NE Dallas Street and SE Lechner Street

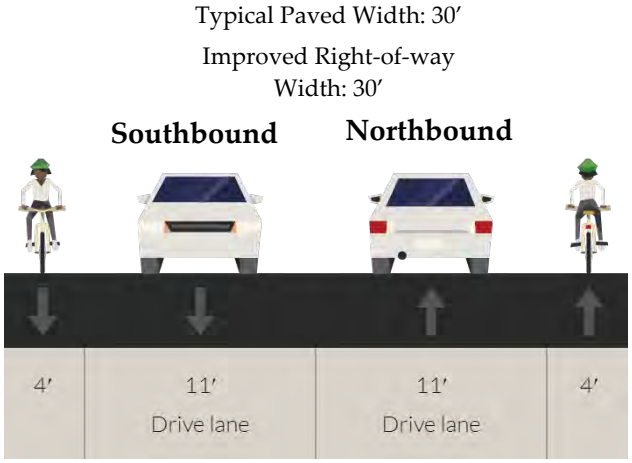
The following sections summarize the evaluation of improvement options to provide early direction in developing recommended solutions for these street segments. The options consider the available right-of way and environmental constraints to ease implementation. These design options are preliminary and are subject to change. Community input and further technical analysis will ultimately lead to a recommended solution to be included in the Transportation Plan.

Segment 1: SR 500-NE Everett Street between NE 23rd Avenue and NW Lake Road

The segment of SR 500-NE Everett Street between NE 23rd Avenue and NW Lake Road includes two travel lanes and four-foot bike lanes. It lacks adequate pedestrian facilities. This segment also lacks an adequate pedestrian and bicycle crossing between the trails in Fallen Leaf Lake Park on the west side and Lacamas Park on the east side of SR 500. There is approximately 60 feet of right-of-way at the north end of the corridor and 80 to 100 feet of right-of-way at the south end. Long segments of the corridor are constrained with adjacent steep slopes or drainage areas that limit the ability to widen the corridor. Five design options were evaluated along this segment. These options are:

Option 1a: Do Nothing

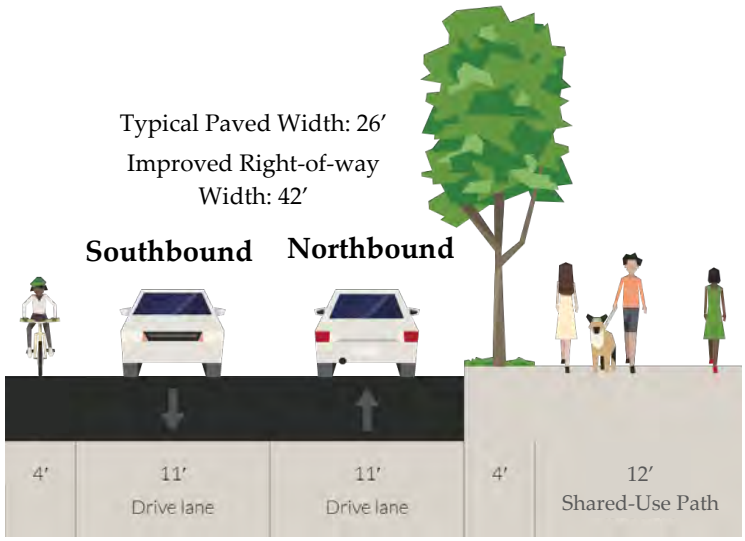
SR 500-NE Everett Street would retain two travel lanes with no pedestrian facilities and substandard bike lanes.



Option 1a: Do Nothing

Option 1b: Widen to include an adjacent shared-use path

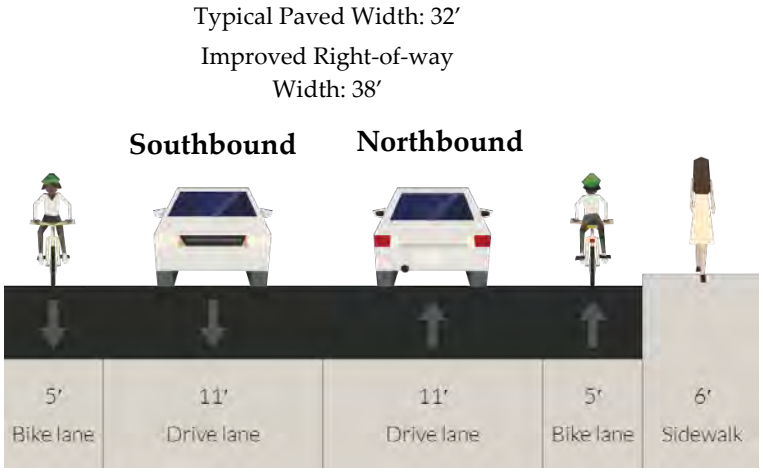
SR 500-NE Everett Street would retain one travel lane in each direction. The segment would include a shared-use path on the east side. A buffer would be between the roadway and shared-use path. This option fits within the existing right-of-way and would require no roadway widening but would require construction of a buffer and shared-use path on the east side. This option does not provide pedestrian access on both sides.



Option 1b: Add a shared-use path

Option 1c: Widen to include bike lanes and a sidewalk

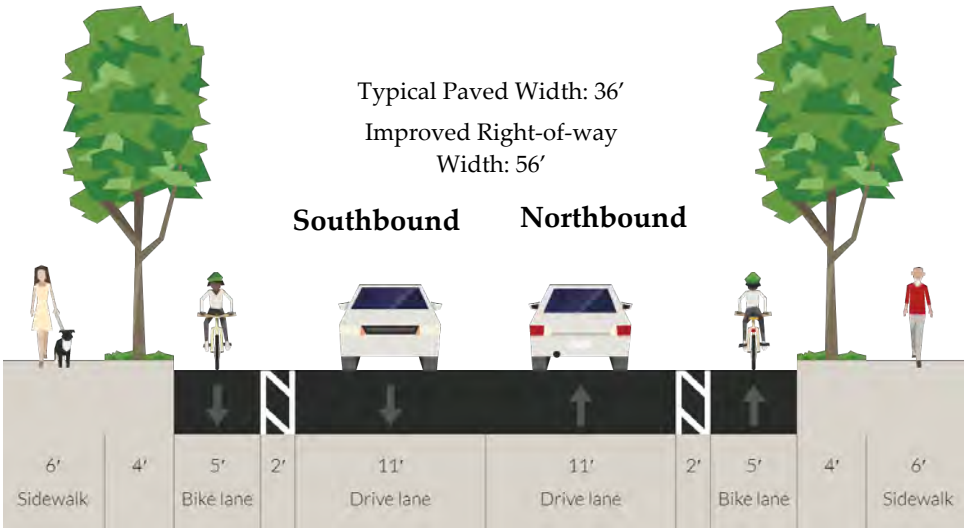
SR 500-NE Everett Street would be widened to provide standard width bike lanes in both directions and a sidewalk on one side of the street. This option fits within the existing right-of-way but would require some roadway widening and construction of a sidewalk and drainage system on the east side. This option does not provide pedestrian access on both sides.



Option 1c: Widen to include bike lanes and a sidewalk

Option 1d: Widen to include buffered bike lanes and a sidewalk on both sides

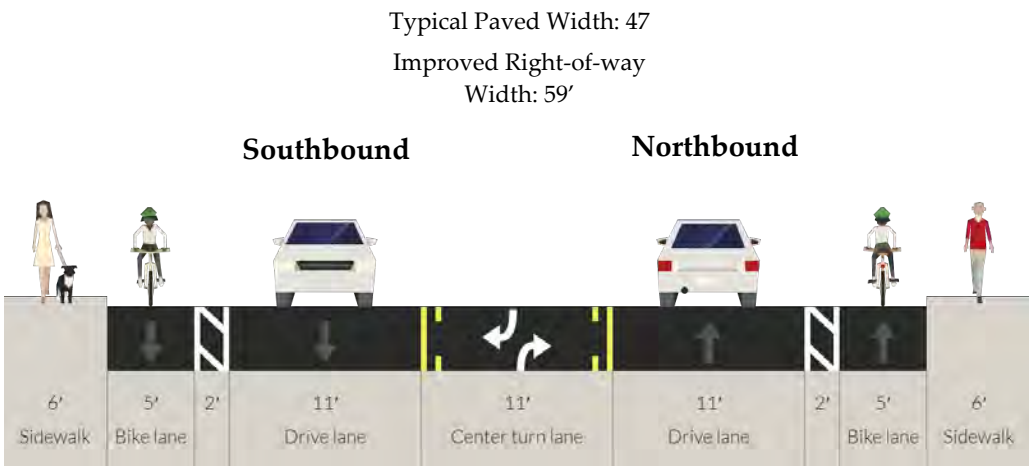
SR 500-NE Everett Street would be widened to provide bike lanes and striped buffers between the bike lane and travel lane. A buffer and sidewalk would also be added to both sides of the street. This option would require roadway widening and construction of a sidewalk and drainage system on both sides. In addition, it may not fit within the existing right-of-way given the steep driveways on the west side requiring severe elevation change.



Option 1d: Widen to include buffered bike lanes and a sidewalk on both sides

Option 1e: Widen to include a center turn lane, buffered bike lanes and a sidewalk on both sides

SR 500-NE Everett Street would be widened to provide a center turn lane, bike lanes and striped buffers between the bike lane and travel lane, and sidewalks on both sides of the street. This option would require roadway widening and construction of a sidewalk and drainage system on both sides. In addition, it may not fit within the existing right-of-way given the steep driveways on the west side requiring severe elevation change.



Option 1e: Widen to include a center turn lane, buffered bike lanes and a sidewalk on both sides

Evaluation of Design Options:

The evaluation summary of key criteria is shown in Table 3. Option 1b to 1e have the greatest likelihood to address the identified gaps and deficiencies since Option 1a (Do Nothing) does not provide adequate pedestrian or bicycle facilities. Most options will fit within the existing right-of-way along the segment, but Options 1d and 1e will require the most significant widening.

Table 3: SR 500-NE Everett Street (NE 23rd Avenue and NW Lake Road) Design Options Evaluation

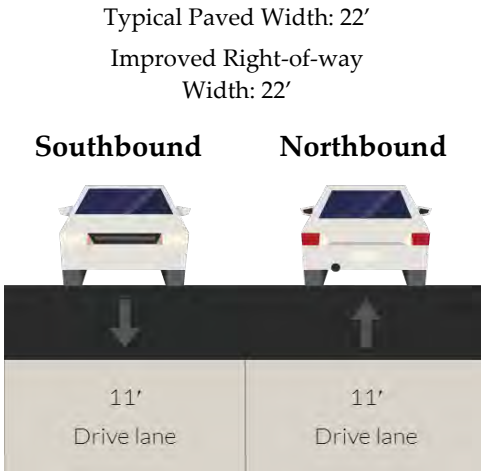
Design Options	Fits in Existing Right-of-way	Improves Pedestrian and Bicycle Facilities	Improves Safety	Impact to Motor Vehicle Operations	Expected Cost
Option 1a	🙂	☹	☹	😐	N/A
Option 1b	🙂	😐	🙂	😐	$$$
Option 1c	🙂	😐	🙂	😐	$$$$
Option 1d	☹	🙂	🙂	😐	$$$$$
Option 1e	☹	🙂	🙂	🙂	$$$$$

Segment 2: SR 500-NE Everett Street between NE 35th Avenue and SE Leadbetter Road

The segment of SR 500-NE Everett Street between NE 35th Avenue and SE Leadbetter Road includes two travel lanes. It lacks adequate pedestrian or bicycle facilities. There is at least 60 feet of right-of-way along this segment. Three design options were evaluated along this segment. These options are:

Option 2a: Do Nothing

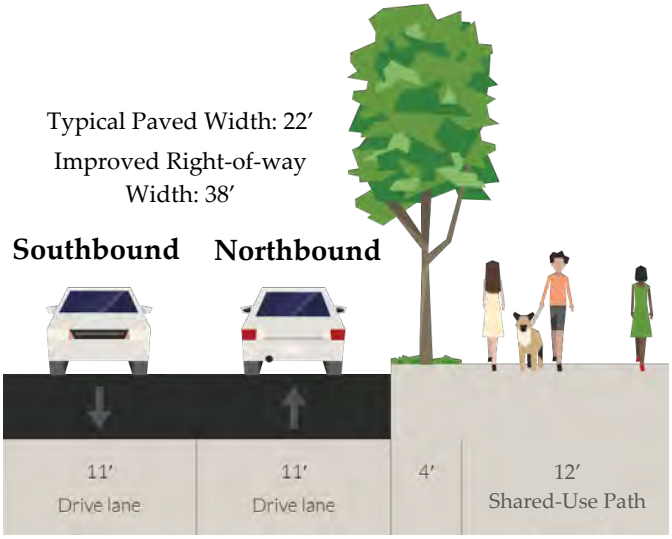
SR 500-NE Everett Street would retain two travel lanes with no pedestrian or bicycle facilities.



Option 2a: Do Nothing

Option 2b: Widen to include an adjacent shared-use path

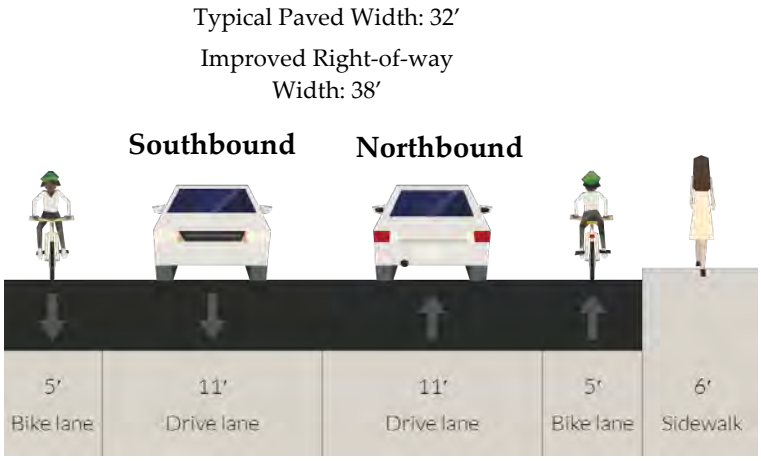
SR 500-NE Everett Street would retain one travel lane in each direction. The segment would include a shared-use path on the east side. A buffer would be between the roadway and shared-use path. This option fits within the existing right-of-way and would require no roadway widening but would require construction of a buffer and shared-use path on the east side.



Option 2b: Add a shared-use path

Option 2c: Widen to include bike lanes and a sidewalk

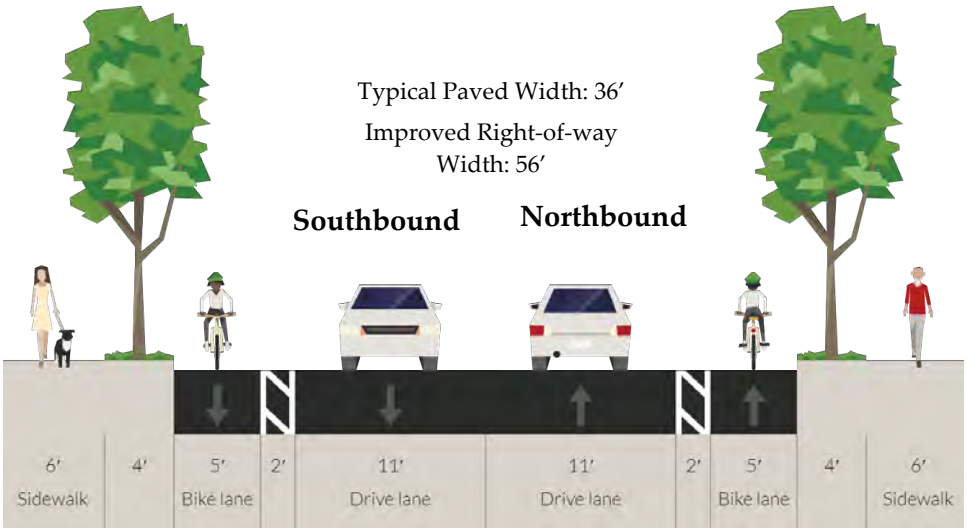
SR 500-NE Everett Street would be widened to provide bike lanes and a sidewalk on one side of the street. This option fits within the existing right-of-way but would require some roadway widening and construction of a sidewalk on the east side.



Option 2c: Widen to include bike lanes and a sidewalk

Option 2d: Widen to include buffered bike lanes and a sidewalk on both sides

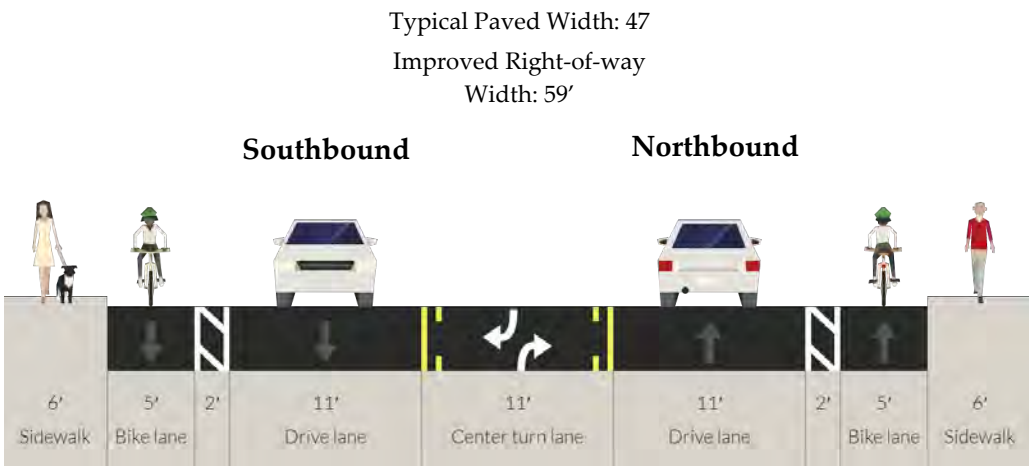
SR 500-NE Everett Street would be widened to provide bike lanes and striped buffers between the bike lane and travel lane. A buffer and sidewalk would also be added to both sides of the street. This option fits within the existing right-of-way but would require roadway widening and construction of a sidewalk and drainage system on both sides.



Option 2d: Widen to include buffered bike lanes and a sidewalk on both sides

Option 2e: Widen to include a center turn lane, buffered bike lanes and a sidewalk on both sides

SR 500-NE Everett Street would be widened to provide a center turn lane, bike lanes and striped buffers between the bike lane and travel lane, and sidewalks on both sides of the street. This option fits within the existing right-of-way but would require roadway widening and construction of a sidewalk and drainage system on both sides.



Option 2e: Widen to include a center turn lane, buffered bike lanes and a sidewalk on both sides

Evaluation of Design Options: The evaluation summary of key criteria is shown in Table 4. Options 2b to 2e have the greatest likelihood to address the identified gaps and deficiencies since Option 2a (Do Nothing) does not provide adequate pedestrian or bicycle facilities. All options will fit within the existing right-of-way along the segment, but Options 2d and 2e will require the most significant widening.

Table 4: SR 500-NE Everett Street (NE 35th Avenue and SE Leadbetter Road) Design Options Evaluation

Design Options	Fits in Existing Right-of-way	Improves Pedestrian and Bicycle Facilities	Improves Safety	Impact to Motor Vehicle Operations	Expected Cost
Option 2a	🙂	☹	☹	😐	N/A
Option 2b	🙂	🙂	🙂	😐	$$$
Option 2c	🙂	🙂	🙂	😐	$$$
Option 2d	🙂	🙂	🙂	😐	$$$$$
Option 2e	🙂	🙂	🙂	🙂	$$$$$

Segment 3: NW 6th Avenue between Norwood Street and Adams Street

The segment of NW 6th Avenue between Norwood Street and Adams Street includes four travel lanes and a sidewalk on the north side, and a sidewalk on the south side west of NW Ivy Street. It lacks adequate bicycle facilities. This segment has several driveway and street connections to NW 6th Avenue and lacks a center turn lane for decelerating left turning vehicles to move out of the path of through traffic. Keeping those vehicles out of the mainline could prevent rear-end collisions. This segment has bus stops on both sides and there is at least 80 feet of right-of-way. Four design options were evaluated along this segment.

Option 3a: Do Nothing

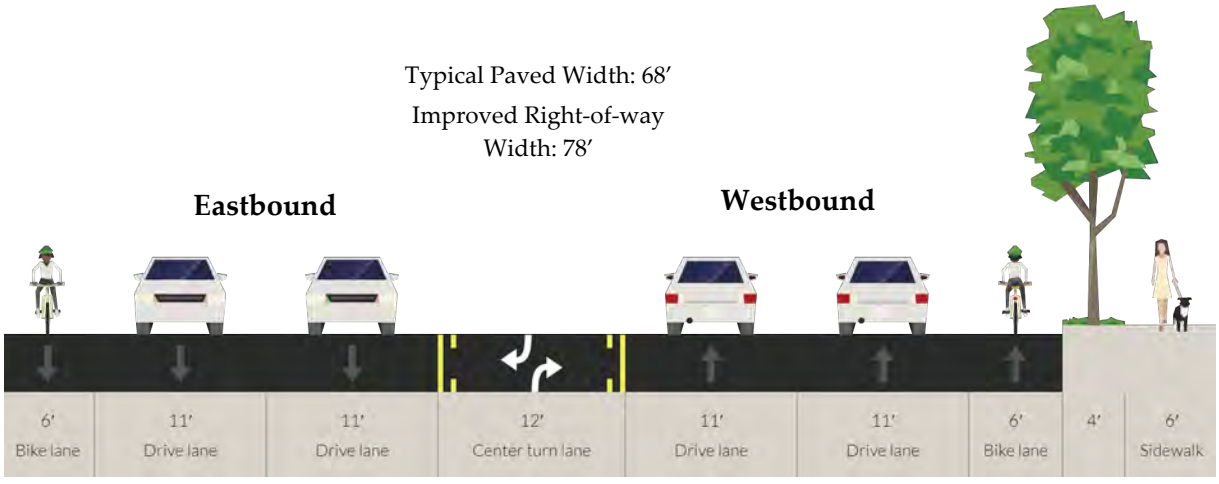
NW 6th Avenue would retain four travel lanes with a roadway adjacent sidewalk and no bike facilities.



Option 3a: Do Nothing

Option 3b: Widen to five lanes, with a sidewalk and bike lanes

NW 6th Avenue would be widened to provide five lanes (two travel lanes in each direction and a center turn lane), in addition to bike lanes and a sidewalk. The segment would include a buffer and sidewalk on only the north side. This option would not fit within existing buildable right-of-way due to slopes on the south side and could impact adjacent development to the north side. The addition of a center-turn lane would provide a safety benefit.



Option 3b: Widen to five lanes, with a sidewalk and bike lanes

Option 3c: Reconfigure to three lanes and bike lanes

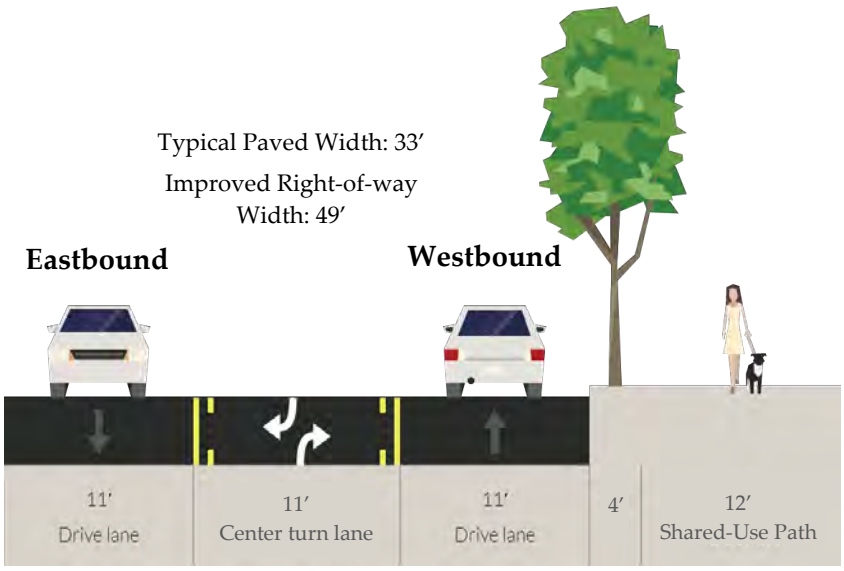
NW 6th Avenue would drop one travel lane in each direction and add bike lanes. The segment would include the existing sidewalks. The elimination of travel lanes for motor vehicles would increase congestion somewhat; however, future traffic demand on this segment is below the capacity of a three-lane roadway, and the resulting operation would be similar to the three-lane section of NW 6th Avenue near Norwood Street. This option would eliminate the existing motor vehicle passing opportunities along NW 6th Avenue. The addition of a center-turn lane would provide a safety benefit. This option fits within the existing right-of-way and would require no widening.



Option 3c: Reconfigure to three lanes and bike lanes

Option 3d: Reconfigure to three lanes and an adjacent shared-use path

NW 6th Avenue would drop one travel lane in each direction. The segment would include a shared-use path on the north side. A buffer would be between the roadway and shared-use path. The elimination of travel lanes for motor vehicles could increase congestion somewhat; however, future traffic demand on this segment is below the capacity of a three-lane roadway, and the resulting operation would be similar to the three-lane section of NW 6th Avenue near Norwood Street. This option would



Option 3d: Reconfigure to three lanes and a shared-use path

eliminate the existing motor vehicle passing opportunities along NW 6th Avenue. The addition of a center-turn lane would provide a safety benefit. This option fits within the existing right-of-way and would require no roadway widening but would require reconstruction on the north side to include a buffer and shared-use path.

Option 3e: Reconfigure to three lanes with buffered bike lanes and a sidewalk on both sides

NW 6th Avenue would drop one travel lane in each direction. The segment would include bike lanes and striped buffers between the bike lane and travel lane, and sidewalks on both sides of the street. The elimination of travel lanes for motor vehicles could increase congestion somewhat; however, future traffic demand on this segment is below the capacity of a three-lane roadway, and the resulting operation would be similar to the three-lane section of NW 6th Avenue near Norwood Street. This option would eliminate the existing motor vehicle passing opportunities along NW 6th Avenue. The addition of a center-turn lane would provide a safety benefit. This option fits within the existing right-of-way and would but require roadway widening and a retaining wall on the south side.



Option 3e: Reconfigure to three lanes with buffered bike lanes and a sidewalk on both sides

Evaluation of Design Options: The evaluation summary of key criteria is shown in Table 5. Options 3c, 3d and 3e have the greatest likelihood to address the identified gaps and deficiencies along the segment. Option 3a (Do Nothing) does not provide adequate bicycle facilities or improve safety along the segment. Options 3b and 3e will require the most significant widening and will not fit within existing buildable right-of-way. Options 3c and 3d can fit within existing paved roadway width but will eliminate travel lanes to accommodate the center turn lane and pedestrian and bicycle facilities.

Table 5: NW 6th Avenue Design Options Evaluation

Design Options	Fits in Existing Right-of-way	Improves Pedestrian and Bicycle Facilities	Improves Safety	Impact to Motor Vehicle Operations	Expected Cost
Option 3a					N/A
Option 3b					$$$$$
Option 3c					$
Option 3d					$$$
Option 3e					$$$$

Segment 4: NE 3rd Avenue between NE Garfield Street and SE Crown Road

The segment of NE 3rd Avenue between NE Garfield Street and SE Crown Road generally includes four travel lanes and roadway adjacent sidewalks (the street section along this segment varies some). It lacks adequate bicycle facilities. This segment has several driveway and street connections to NE 3rd Avenue and lacks a center turn lane for decelerating left turning vehicles to move out of the path of through traffic. Keeping those vehicles out of the through travel lane could prevent rear-end collisions. There is about 70 feet of right-of-way along this segment. Three design options were evaluated.

Option 4a: Do Nothing

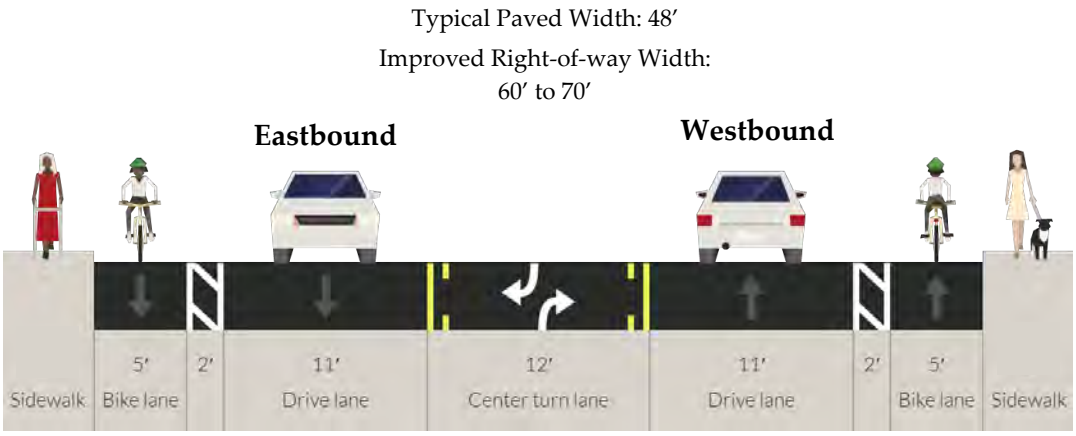
NE 3rd Avenue would retain four travel lanes with roadway adjacent sidewalks and no bike facilities.



Option 4a: Do Nothing

Option 4b: Reconfigure to three lanes, buffered bike lanes and wider sidewalks

NE 3rd Avenue would drop one travel lane in each direction and add bike lanes and striped buffers between the bike lane and travel lane. The existing sidewalks would be widened. The elimination of travel lanes for motor vehicles could increase congestion somewhat; however, future traffic demand for this segment is below the capacity of a three-lane roadway, and the resulting congestion would be similar to the three-lane section east of SE Lechner Street. The addition of a center-turn lane would provide a safety benefit.



Option 4b: Reconfigure to three lanes, buffered bike lanes and wider sidewalks

Option 4c: Reconfigure to two lanes with bike lanes, parking and wider sidewalks

NE 3rd Avenue would drop one travel lane in each direction and add bike lanes and on-street parking. The existing sidewalks would be widened. The elimination of travel lanes for motor vehicles could increase congestion somewhat; however, future traffic demand on this segment is below the capacity of a two-lane roadway, and the resulting congestion would be similar to the two-lane section west of NE Dallas Street.



Option 4c: Reconfigure to two lanes, with bike lanes, parking and wider sidewalks

Evaluation of Design Options: The evaluation summary of key criteria is shown in Table 6. Options 4b and 4c have the greatest likelihood to address the identified gaps and deficiencies along the segment. Option 4a (Do Nothing) does not provide adequate bicycle facilities or improve safety along the segment. Options 4b and 4c can fit within the existing paved roadway width but will eliminate travel lanes to accommodate the center turn lane and bicycle facilities.

Table 6: NE 3rd Avenue (NE Dallas Street to SE Crown Road) Design Options Evaluation

Design Options	Fits in Existing Right-of-way	Improves Pedestrian and Bicycle Facilities	Improves Safety	Impact to Motor Vehicle Operations	Expected Cost
Option 4a					N/A
Option 4b					$
Option 4c					$

Segment 5: NE 3rd Avenue between SE Crown Road and SE Lechner Street

The segment of NE 3rd Avenue between SE Crown Road and SE Lechner Street includes four to five travel lanes and roadway adjacent sidewalks. It lacks adequate bicycle facilities. There were several pedestrian and bicycle involved collisions along this segment over the previous five years. There is at least 90 feet of right-of-way along this segment. Three design options were evaluated.

Option 5a: Do Nothing

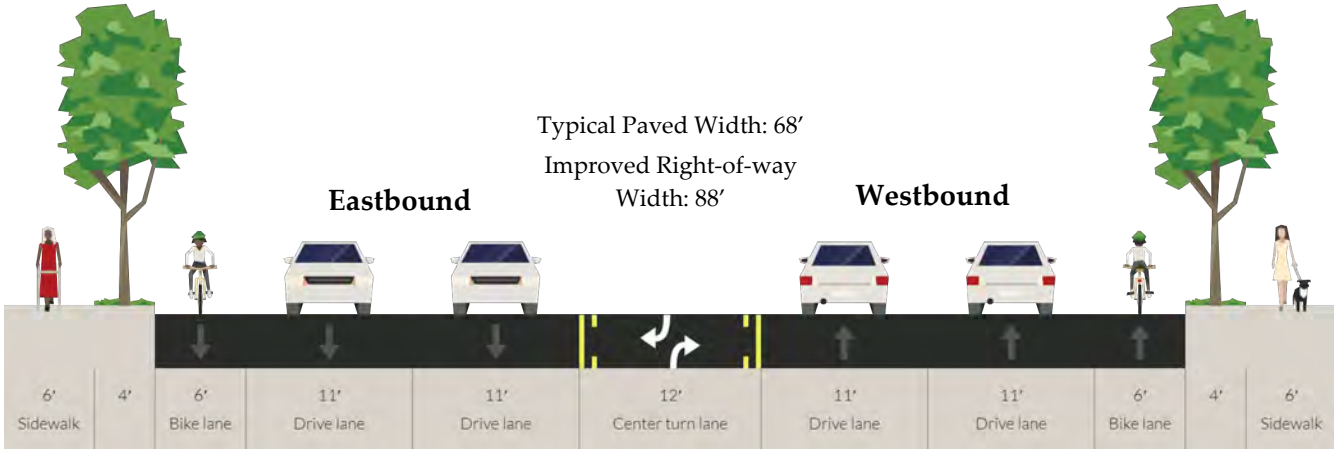
NE 3rd Avenue would retain four to five travel lanes with roadway adjacent sidewalks and no bike facilities. The existing five-lane section is shown below.



Option 5a: Do Nothing

Option 5b: Widen to five lanes, with sidewalks and bike lanes

NE 3rd Avenue would be widened to provide five lanes (two travel lanes in each direction and a center turn lane), in addition to the bike lanes. The segment would include a buffer and sidewalk on

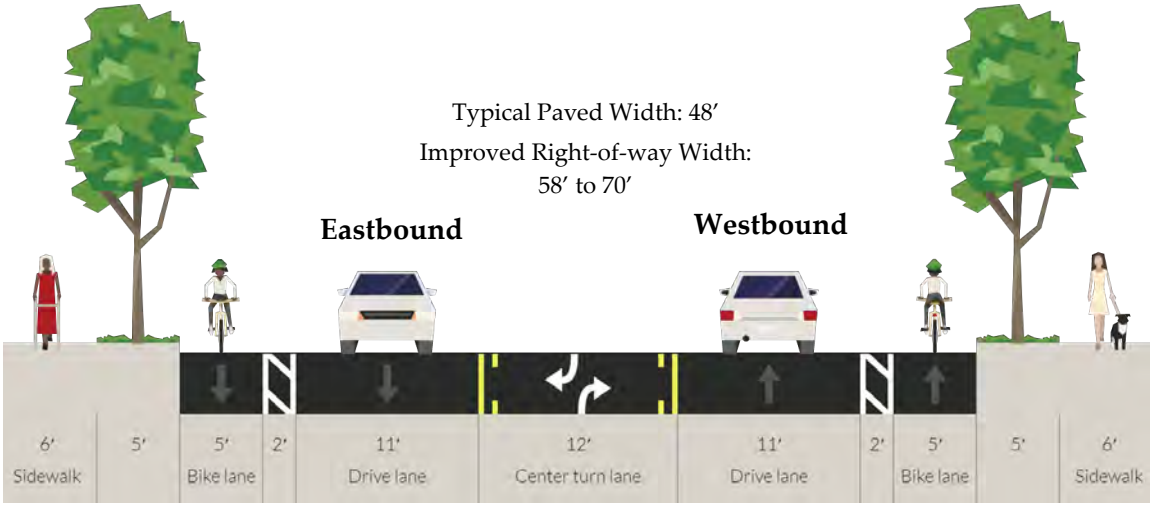


Option 5b: Widen to five lanes, with sidewalks and bike lanes

both sides. This option would fit within existing buildable right-of-way, but would require significant widening and could impact adjacent development.

Option 5c: Reconfigure to three lanes and buffered bike lanes

NE 3rd Avenue would drop one travel lane in each direction and add bike lanes and striped buffers between the bike lane and travel lane. No changes would be made to the existing sidewalks along the four lane segments. However, they would be reconstruced along the five-lane segment to include wider sidewalks and a buffer. The elimination of travel lanes for motor vehicles could increase congestion somewhat; however, future traffic demand on this segment is below the capacity of a three-lane roadway, and the resulting congestion would be similar to the three-lane section east of SE Lechner Street.



Option 5c: Reconfigure to three lanes and buffered bike lanes

Evaluation of Design Options: The evaluation summary of key criteria is shown in Table 7. Options 5b and 5c have the greatest likelihood to address the identified gaps and deficiencies along the segment. Option 5a (Do Nothing) does not provide adequate bicycle facilities or improve safety along the segment. Option 5c can fit within the existing paved roadway width but will eliminate travel lanes to accommodate the center turn lane and bicycle facilities. Option 5b does not improve safety as much as Option 5c due to the width of the roadway creating longer crossings for pedestrians and bicyclists.

Table 7: NE 3rd Avenue (SE Crown Road and SE Lechner Street) Design Options Evaluation

Design Options	Fits in Existing Right-of-way	Improves Pedestrian and Bicycle Facilities	Improves Safety	Impact to Motor Vehicle Operations	Expected Cost
Option 5a					N/A
Option 5b					$$$$$
Option 5c					$

Safety Needs

A few locations were identified in Technical Memorandum #2 as high collision locations. With growing traffic volumes, these problematic areas likely will persist, and may even become progressively worse. There are no additional safety needs identified for future conditions other than those previously identified in Technical Memorandum #2.

Freight Needs

With growing traffic volumes from existing conditions, 17 intersections along Washington State Freight corridors would not meet their respective mobility targets during the 2040 design hour conditions.

Other Needs

Technical Memorandum #2 identified existing transit, bridge, rail and air needs. There are no additional needs identified for future conditions other than those previously identified in Technical Memorandum #2.

Next Steps

The system needs identified in this memorandum will be revised based on input received from City staff and the Transportation Plan Project Advisory Committee to develop a preliminary project list in Technical Memo 5 – Solutions Identification and Evaluation.

APPENDIX E. RECOMMENDED TRANSPORTATION STANDARDS

MEMORANDUM

720 SW Washington St.
Suite 500
Portland, OR 97205
503.243.3500
www.dksassociates.com

DATE: May 15, 2024

TO: Curleigh Carothers, City of Camas
Steve Wall, City of Camas

FROM: Reah Flisakowski, DKS Associates
Kevin Chewuk, DKS Associates

SUBJECT: Camas Transportation Plan
Technical Memo 4 – Recommended Transportation Standards P18039-000

This document provides an overview of the transportation system standards recommended for adoption as part of the Transportation Plan for Camas. Included is a detail of the roadway functional classification system, typical designs for roadways and shared use paths, special route designations, access spacing and mobility standards, and guidance for Traffic Impact Analysis requirements. Together, these standards will help ensure future facilities are designed appropriately and that all facilities are managed to serve their intended purpose.

Multi-Modal Street System

Traditional roadway designs focus on the safety and flow of motor vehicle traffic. The one size fits all design approach is less effective at integrating the roadway with the character of the surrounding area and addressing the needs of other users of a roadway. For instance, the design of an arterial roadway through a commercial area has often traditionally been the same as one through a residential neighborhood, both primarily focused on the movement of motor vehicles.

In Camas, all roadways are proposed to be multi-modal or "complete streets", with each street serving the needs of the various travel modes. Streets in the city will not all be designed the same. It is recommended that Camas classify the street system into a hierarchy organized by functional classification and street type (representative of their places). These classifications ensure that the streets reflect the neighborhood through which they pass, consisting of a scale and design appropriate to the character of the abutting properties and land uses. The classifications also provide for and balance the needs of all travel modes including pedestrians, bicyclists, transit riders, motor vehicles and freight. Within these street classifications, context sensitive design may result in alternative cross-sections.

Functional Classification

Traditionally, roadways are classified based on the type of vehicular travel they are intended to serve (local versus through traffic). In Camas, the functional classification of a roadway (shown in Figure 1) is recommended to determine the level of mobility for all travel modes, level of access, and use. The roadway functional classification system recognizes that individual roadways do not act independently, but instead form a network that serves travel needs on a local and regional level. From highest to lowest intended use, the recommended classifications are freeway, arterial, collector and local streets. Streets with higher intended usage generally limit access to adjacent property in favor of more efficient motor vehicle traffic movement (i.e., mobility). Local roadways with lower intended usage have more driveway access and intersections, and generally accommodate shorter trips to nearby destinations.

Functional Classification Designations

Table 1 shows the recommended changes to the existing functional classifications of roadways in Camas to better reflect their intended use. Since SR 14 serves regional travel through the city, it is recommended to be a freeway. Roadways providing primary access to SR 14 are recommended to be arterials. Roadways providing primary access to neighborhoods and activity generators in Camas are recommended to be collectors. All other roadways are recommended to be classified as local streets. The Camas Multi-Modal Street System map (Figure 1) shows the recommended designations of roadways within the Urban Growth Area (UGA) only; refer to the county plan for designations of other roadways outside of the UGA.

- **Freeways** serve as the main travel routes through the city and serve the highest volume of motor vehicle traffic. SR 14 is the only freeway in Camas. Freeways are generally for longer motor vehicle trips with limited local access. The posted speed limit on SR 14 is 60 miles per hour.

- **Arterials** connect many parts of the city and often serve traffic traveling to and from freeways. These roadways provide greater accessibility to neighborhoods, connect to major activity generators, and provide efficient through movement for local traffic. In Camas, portions of SR 500, NW Lake Road, NW Brady Road, NW Parker Street, NW 6th Avenue and NE 3rd Avenue are examples of arterials. Posted speeds on arterial streets in Camas typically range between 25 (in residential areas) and 50 miles per hour (in rural areas).

- **Collectors** connect neighborhoods to arterials. These streets serve as major neighborhood routes and generally provide more direct property access or driveways than arterial streets. In Camas, portions of Division Street, NW Forest Home Road, NW Fargo Street, and NW Sierra

Drive are examples of collector streets. Posted speeds on collector streets in Camas typically range between 25 and 35 miles per hour.

- **Local Streets** provide more direct access to residences without serving through travel in Camas. These roadways generally are lined with residences and are designed to serve lower volumes of traffic with a speed limit of 25 miles per hour.

Table 1: Recommended Functional Classification Changes

Roadway	From	To	Change from Prior Functional Classification*
N Shepherd Road	NE 3rd Avenue	UGB	Upgrade from Local Street to Collector
NE 2nd Avenue	NE 3rd Avenue	NE Whitney Street	Upgrade from Local Street to Collector
NE 15th Avenue	Division Street	NE Everett Street	Upgrade from Local Street to Collector
NE Dallas Street	NE 15th Avenue	NE 6th Avenue	Upgrade from Local Street to Collector
NE Goodwin Road	NW Friberg-Strunk Street	NW Alexandra Lane	Upgrade from Local Street to Arterial
NE Ingle Road	NE Goodwin Road	UGB	Upgrade from Collector to Arterial
NE Leadbetter Road	NE 9th Street	NE Everett Street	Upgrade from Local Street to Arterial
NE Whitney Street	NE 2nd Avenue	UGB	Upgrade from Local Street to Collector
NW 7th Avenue	NW Ivy Street	NW Drake Street	Upgrade from Local Street to Collector
NW 12th Avenue	NW Benton Street	Division Street	Upgrade from Local Street to Collector
NW 23rd Avenue	NW Cascade Street	NW Astor Street	Downgrade from Collector to Local Street
NW 26th Avenue	NW Julia Street	NW Maryland Street	Downgrade from Collector to Local Street
NW 28th Avenue	NW Cascade Street	NW Sierra Street	Downgrade from Collector to Local Street
NW 29th Avenue	NW Dahlia Drive	NW Valley Street	Downgrade from Collector to Local Street
NW 37th Avenue	NW Endicott Street	NW Dahlia Drive	Downgrade from Collector to Local Street
NW Benton Street	NW Drake Street	NW 12th Avenue	Upgrade from Local Street to Collector
NW Cascade Street	NW 18th Avenue	NW 28th Avenue	Downgrade from Collector to Local Street
NW Dahlia Drive	NW 38th Avenue	NW 29th Avenue	Downgrade from Collector to Local Street
NW Endicott Street	NW Pacific Rim Drive	NW 37th Avenue	Downgrade from Collector to Local Street
NW Fremont Street	NW Grass Valley Drive	NW Leadbetter Drive	Downgrade from Collector to Local Street
NW Grass Valley Drive	NW Inglewood Street	NW Fremont Street	Downgrade from Collector to Local Street
NW Inglewood Street	NW 38th Avenue	NW Grass Valley Drive	Downgrade from Collector to Local Street
NW Ivy Street	NW 6th Avenue	NW 7th Avenue	Downgrade from Collector to Local Street

Table 1: Recommended Functional Classification Changes

Roadway	From	To	Change from Prior Functional Classification*
NW Julia Street	NW Pacific Rim Drive	NW 26th Avenue	Downgrade from Collector to Local Street
NW Logan Street	NW 6th Avenue	NW 7th Avenue	Upgrade from Local Street to Collector
NW Maryland Street	NW 26th Avenue	Southern terminus	Downgrade from Collector to Local Street
NW Ogden Street	NW 16th Avenue	Northern terminus	Downgrade from Collector to Local Street
NW Pacific Rim Drive	NW Parker Street	NW Endicott Street	Downgrade from Collector to Local Street
NW Utah Street	NW Valley Street	NW 28th Avenue	Downgrade from Collector to Local Street
NW Valley Street	NW 29th Avenue	NW Utah Street	Downgrade from Collector to Local Street
SE 23rd Street	SE 283rd Avenue	UGB	Upgrade from Collector to Arterial
SE Lechner Street	NE 3rd Avenue	UGB	Upgrade from Local Street to Collector

* Existing functional classifications as shown in the Camas Transportation Comprehensive Plan Map

The Washington State Department of Transportation (WSDOT), Federal Government, and the Southwest Washington Regional Transportation Council (RTC) also classify roadways in Camas. Within Camas, SR 14 is classified by WSDOT as a Highway of Statewide Significance (HSS)[1], and SR 500 is classified as a non-HSS facility.

The federal government also has a functional classification system that is used to determine federal aid funding eligibility. Roadways federally designated as a major collector, minor arterial, principal arterial, or interstate are eligible for federal aid. Camas' functional classification system uses the similar designations as the federal government (e.g., a city designated arterial is intended to be the same as a federally designated minor arterial and a city designated collector is intended to be the same as a federally designated major collector). Future updates to the federal functional classification system should incorporate the designations reflected in the Transportation Plan along city roadways.

RTC has identified several streets in Camas as part of the regional transportation system in the Regional Transportation Plan for Clark County, including SR 14, SR 500, Lake Road - SE 1st Street, Parker Street, Pacific Rim Boulevard - 34th Street, NW 38th Avenue – SE 20th Street, NW 6th Avenue, and NE 3rd Avenue.

[1] Highways of Statewide Significance, WSDOT, http://www.wsdot.wa.gov/planning/HSS/

Multi-Modal Street Type

It is recommended that Camas further classify the roadways within the city based on the neighborhood it serves and the intended function for pedestrians, bicyclists and transit riders in that specific area. Within the context of Camas' recommended "complete street" system that serves all modes, the street type of a roadway defines its cross-section characteristics and determines how users of a roadway interact with the surrounding land use. Since the type and intensity of adjacent land uses and zoning directly influence the level of use by pedestrians, bicyclists and transit riders, the design of a street (including its intersections, sidewalks, and transit stops) should reflect its surroundings.

The street types attempt to strike a balance between street functional classification, adjacent land use, zoning designation and the competing travel needs by prioritizing various design elements. Four street types are recommended and described below for Camas:

- **Mixed-Use Streets** typically have a higher amount of pedestrian activity and are often on a transit route. These streets should emphasize a variety of travel choices such as pedestrian, bicycle and transit use to complement the development along the street. Since mixed-use streets typically serve pedestrian oriented land uses, walking should receive the highest priority of all the travel modes. They should be designed with features such as wider sidewalks, pedestrian amenities, transit amenities, attractive landscaping, on-street parking, pedestrian crossing enhancements and bicycle lanes.

- **Residential Streets** are generally surrounded by residential uses, although various small shops may be embedded within the neighborhood. These streets often connect neighborhoods to local parks, schools and mixed-use areas. They should be designed to emphasize walking, while still accommodating the needs of bicyclists and motor vehicles. A high priority should be given to design elements such as traffic calming, landscaped buffers, walkways/pathways/trails, on-street parking and pedestrian safety enhancements.

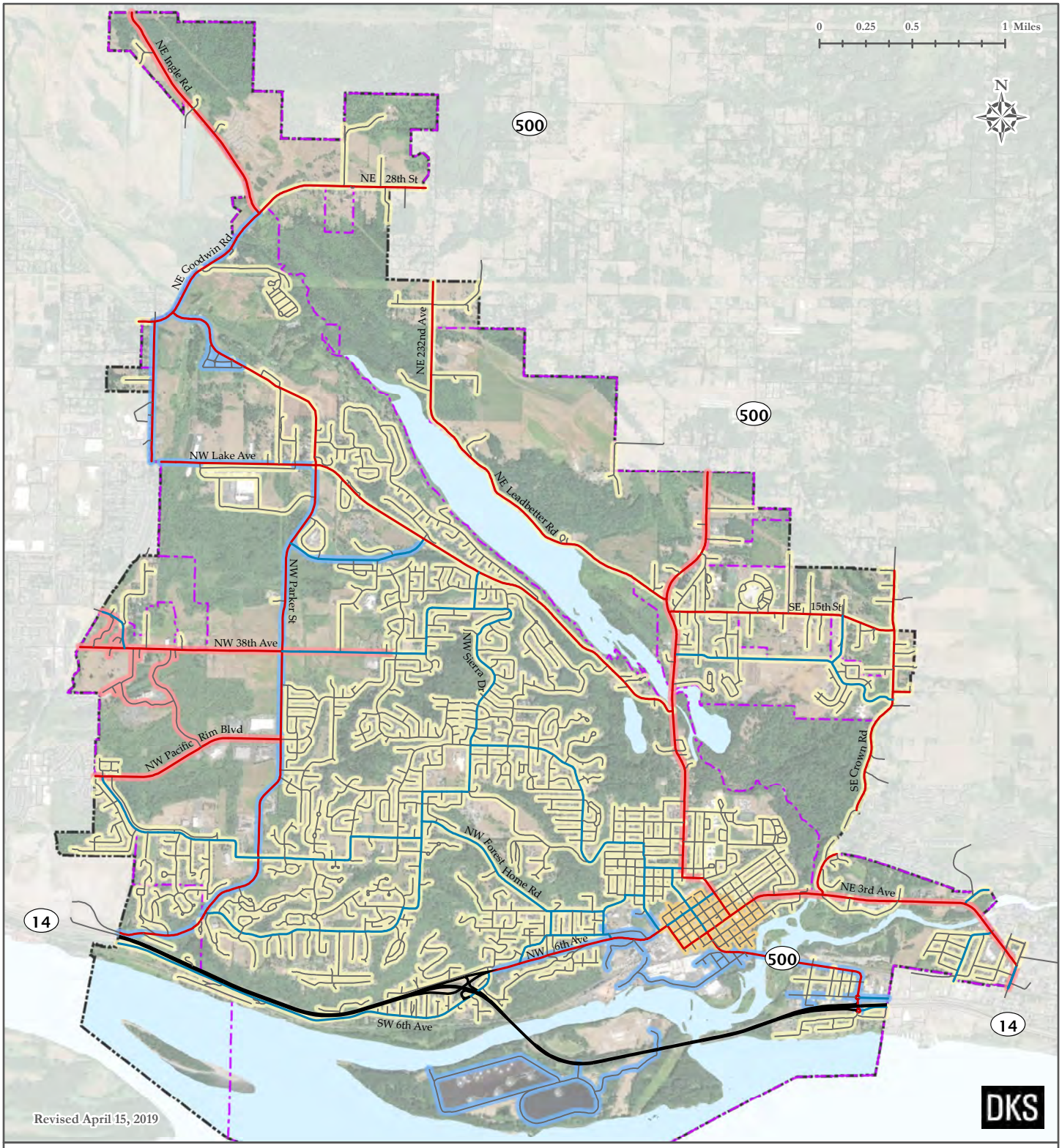
- **Commercial Streets** are primarily lined with retail and large employment complexes. These uses serve customers throughout the city and region and may not have a direct relationship with nearby residential neighborhoods. These streets are somewhat more auto-oriented but should still accommodate pedestrians and bicyclists safely and comfortably. Design features should include landscaped medians or a two-way left turn lane, sidewalks and bike lanes, pedestrian crossing enhancements and a buffer between the roadway and the sidewalk. On-street parking should be discouraged.

- **Industrial Streets** serve industrial areas. These streets are designed to accommodate a high volume of large vehicles such as trucks, trailers and other delivery vehicles. Pedestrians and

bicyclists may be less frequent in these areas but should still be accommodated safely and comfortably. Roadway widths are typically wider to accommodate larger vehicles. On-street parking should be discouraged.

The Camas Multi-Modal Street System map (Figure 1) shows the recommended street types of roadways within the UGA.

I Multi-Modal Street System



Legend:

Functional Classification:

- Freeway
- Arterial
- Collector
- Local Street

Street Type:

- Mixed-Use
- Residential
- Commercial
- Industrial

- Urban Growth Area
- Camas City Limit

Design Types of Streets

The recommended design of the streets in Camas requires attention to many elements of the public right-of-way and considers how the street interacts with the adjoining properties. The four zones that are recommended to comprise the cross-section of streets in Camas, include the context zone, walking zone, biking/on-street parking zone and driving zone, are shown in Figure 2.

- **Context Zone:** The context zone is the point at which the sidewalk interacts with the adjacent buildings or private property. The purpose of this zone is to provide a buffer between land use adjacent to the street and to ensure that all street users have safe interactions. This zone is typically outside of the public right-of-way.

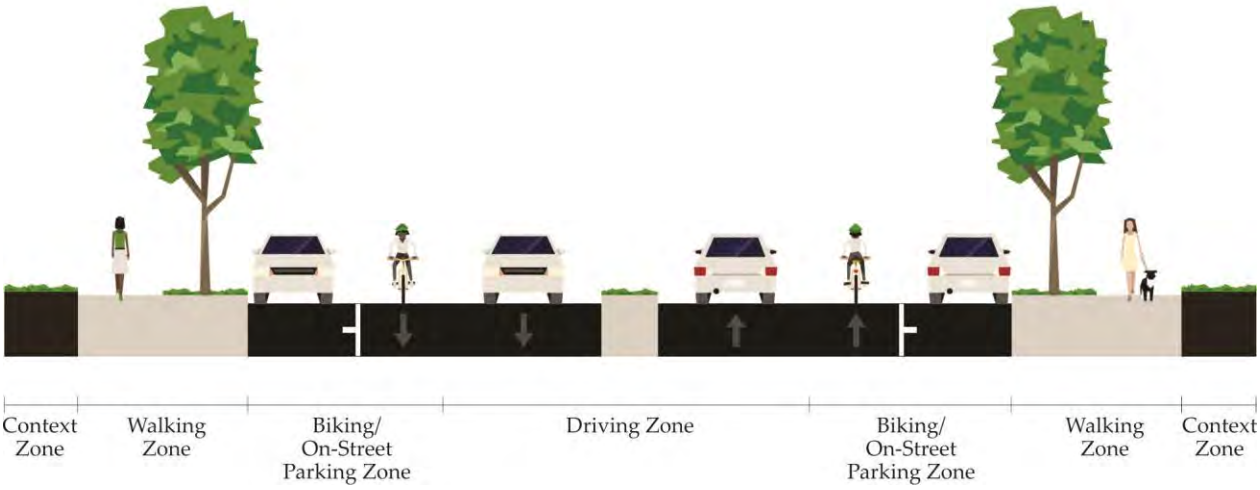
- **Walking Zone:** This is the zone in which pedestrians travel. The walking zone is determined by the street type and should be a high priority in mixed-use and residential areas. It includes a minimum six-foot clear throughway for walking, an area for street furnishings or landscaping (e.g. benches, transit stops and/or plantings) and a clearance distance between curbside on-street parking and the street furnishing area or landscape strip (so parking vehicles or opening doors do not interfere with street furnishings and/or landscaping). Streets located along a transit route should incorporate furnishings to support transit ridership, such as transit shelters and benches, into the furnishings/landscape strip adjacent to the biking/on-street parking zone.

- **Biking/On-Street Parking Zone:** This is the zone for biking and on-street parking and is the location where users will access transit. It should include minimum 6-foot bike lanes. The biking/on-street parking zone is determined by the street type and in some cases the functional classification and should be a high priority in mixed-use and residential areas. Mixed use and residential areas should include a minimum 6-foot striped bike lane with on-street parking. Streets in commercial or industrial areas should include minimum 6-foot bike lanes, with no on-street parking.

- **Driving Zone:** This is the throughway zone for drivers, including cars, buses and trucks and should be a high priority in commercial/employment and industrial areas. The functional classification of the street generally determines the number of through lanes, lane widths, and median and left-turn lane requirements. However, the route designations (such as transit street or freight route) take presentence when determining the appropriate lane width in spite of the functional classification. Wider lanes (between 13 to 14 feet) should only be used for short distances as needed to help buses and trucks negotiate right-turns without encroaching into adjacent or opposing travel lanes. Streets that require a raised median should include a minimum 6-foot-wide pedestrian refuge at marked crossings. Otherwise, the median can be

reduced to a minimum of 4 feet at midblock locations, before widening at intersections for left-turn lanes (where required or needed).

Figure 2: Components of Camas Streets



The design of these zones varies based on the functional classification and street type. Overall, there are 12 different design types recommended for streets, ranging from mixed-use arterial to industrial local street. Note that a design type is not available for limited access roadways classified as freeways (e.g., SR 14).

The typical roadway cross-section standards recommended for streets can be seen in Figures 3 through 5 and Tables 2 through 4. Arterial roadways are recommended to include buffered bike lanes (5-foot bike lane with a 2-foot buffer) since they have higher traffic volumes and speeds. Arterial roadways in mixed-used areas are recommended to include wider sidewalks (8 feet versus 6 feet in the current standard) to complement the street side environment. Those in mixed-use and residential areas are recommended to have narrower travel lanes (11 feet versus 12 feet in the current standard) to encourage slower travel speeds. Collector roadways are recommended to include narrower through travel lanes (11 feet versus 12 feet in the current standard) in favor of wider bike lanes (6 feet versus 5 feet in the current standard). Local streets are recommended to include narrower travel lanes in favor of wider sidewalks (6 feet versus 5 feet in the current standard).

A center turn lane/median is recommended on arterial and collector streets in commercial and industrial areas since they have more trucks and turning maneuvers into driveways when compared to mixed-use and residential areas. Two lanes are recommended in mixed-use and residential areas to encourage narrow streets and a more pedestrian friendly environment. Parking is recommended to be allowed on mixed-use and residential streets, but not along commercial or industrial streets.

Narrower parking lanes are recommended on collector and local streets in residential areas (7 feet versus 8 feet in the current standard).

The Transportation Plan does not modify the design standards for SR 14, the city's only freeway.

Figure 3a: Mixed-Use Arterial

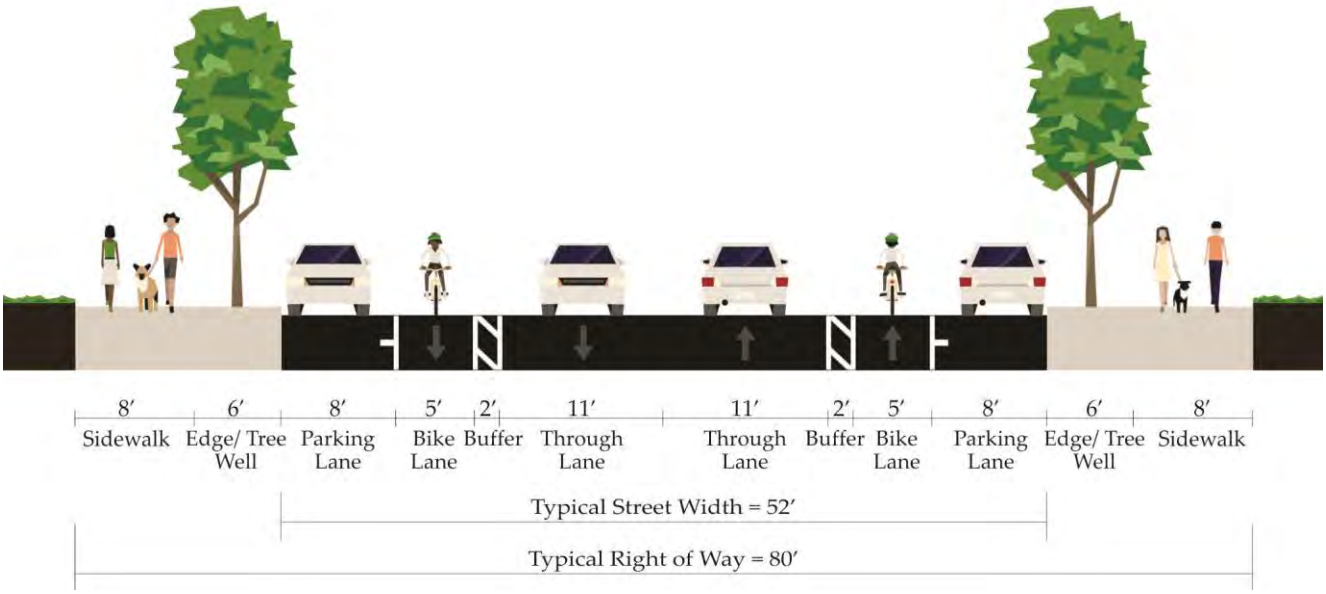


Figure 3b: Residential Arterial

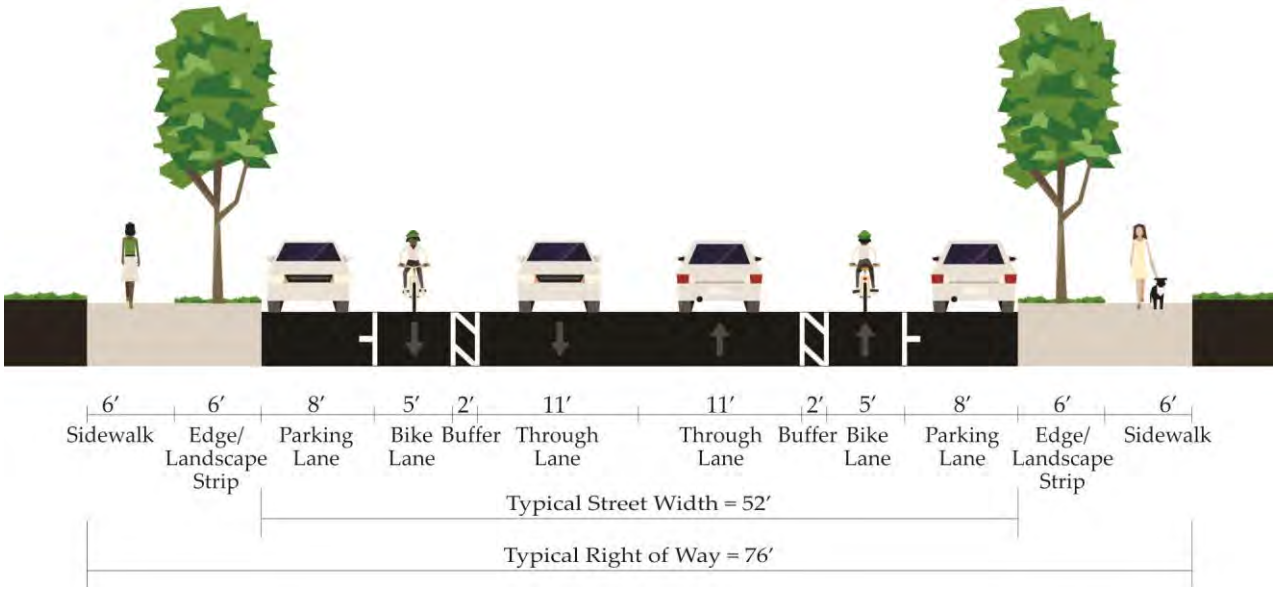


Figure 3c: Commercial Arterial

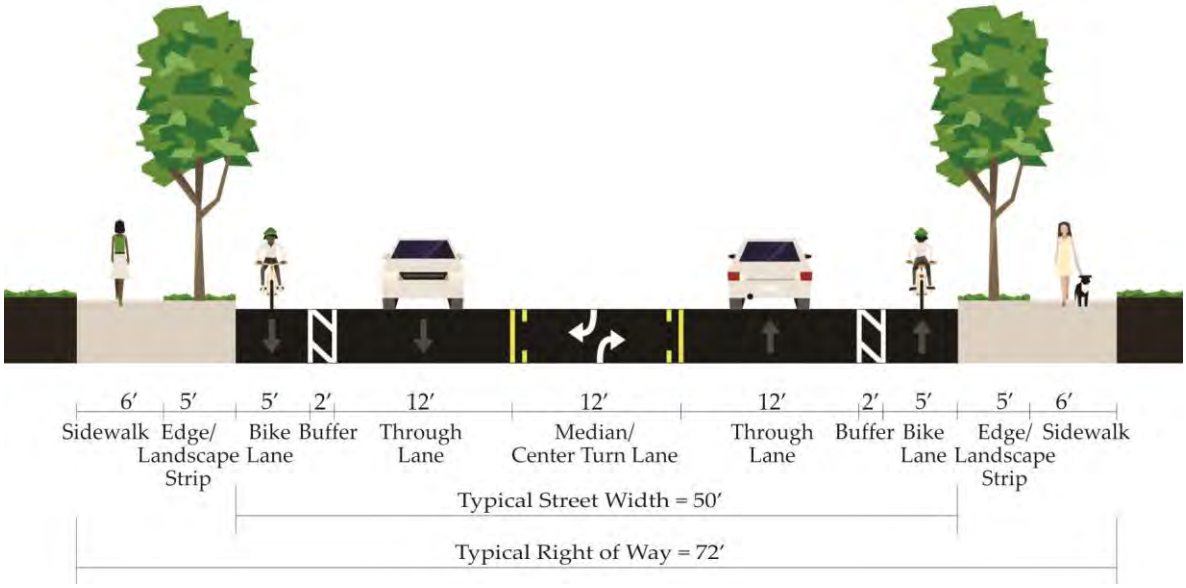


Figure 3d: Industrial Arterial

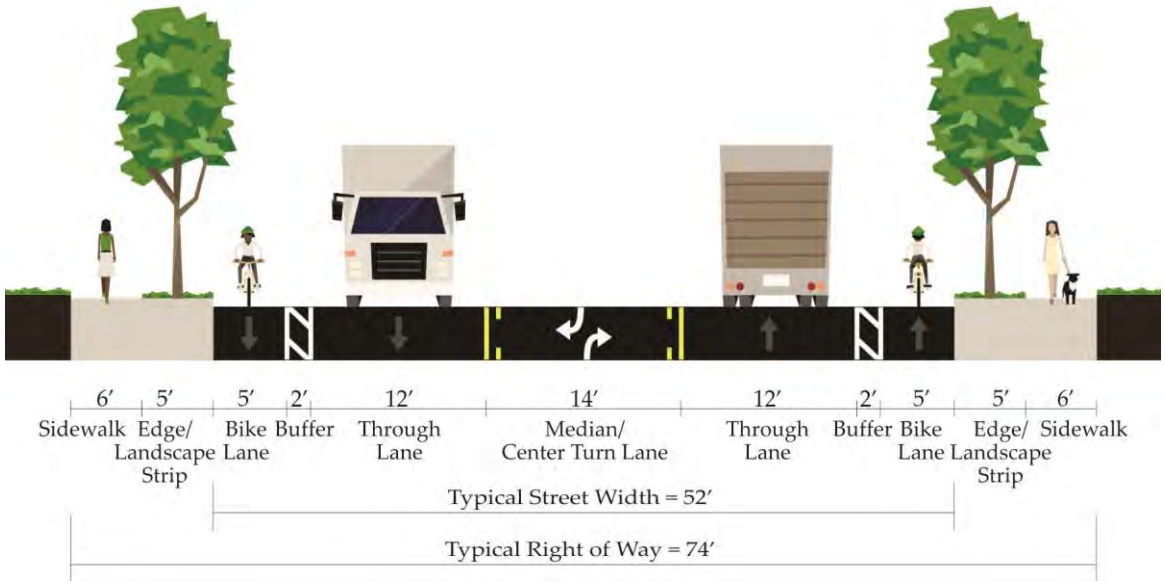


Table 2: Recommended Typical Roadway Cross-section Standards for Arterials

	Mixed-Use	Residential	Commercial	Industrial
Walking Zone				
Minimum Walkway Width	14 ft.	12 ft.	11 ft.	11 ft.
Walkway Type (throughway)	8 ft. sidewalk	6 ft. sidewalk	6 ft. sidewalk	6 ft. sidewalk
Minimum Furnishings/ Landscape Strip Width	4.5 ft. tree well	4.5 ft. landscape strip	4.5 ft. landscape strip	4.5 ft. landscape strip
Edge (Curb and Clearance between Furnishings/ Landscape Strip)	1.5 ft.	1.5 ft.	0.5 ft.	0.5 ft.
Biking / On-Street Parking Zone				
Biking Facility	7 ft. Buffered Bike Lanes (includes 2 ft. buffer)	7 ft. Buffered Bike Lanes (includes 2 ft. buffer)	7 ft. Buffered Bike Lanes (includes 2 ft. buffer)	7 ft. Buffered Bike Lanes (includes 2 ft. buffer)
Minimum On-Street Parking Width	8 ft.	8 ft.	None	None
Driving Zone				
Through Lanes	2	2	2 to 4	2 to 4
Minimum Lane Width	11 ft.	11 ft.	12 ft.	12 to 14 ft.
Median/ Turn Lane	Required 11 ft. left turn lane at intersections	Required 11 ft. left turn lane at intersections	Required 12 ft. median/ center turn lane	Required 14 ft. center turn lane
Street Width and Right of Way				
Typical Street Width	52 ft	52 ft	50 to 74 ft	52 to 76 ft
Typical Right of Way	80 ft.	76 ft.	72 to 96 ft.	74 to 98 ft.

Figure 4a: Mixed-Use Collector

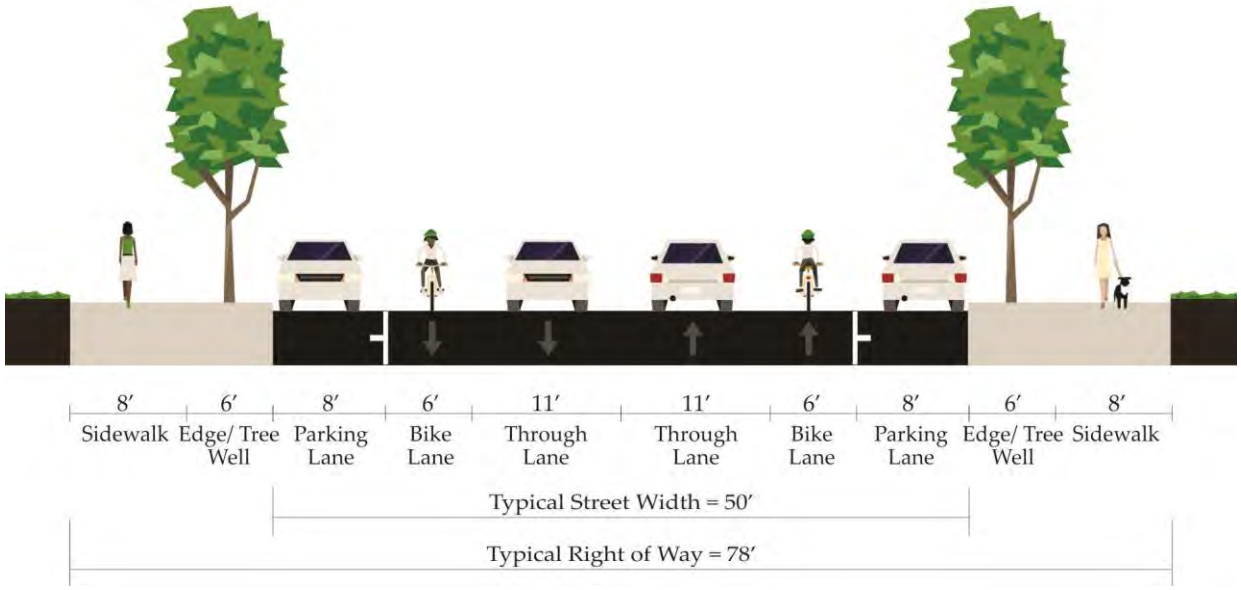


Figure 4b: Residential Collector

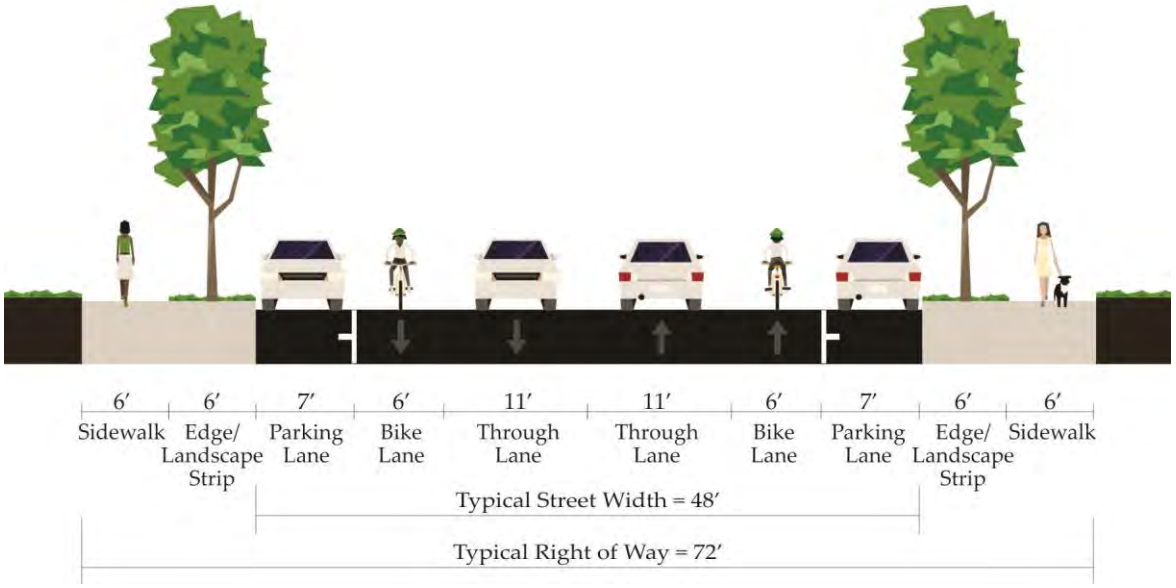


Figure 4c: Commercial Collector

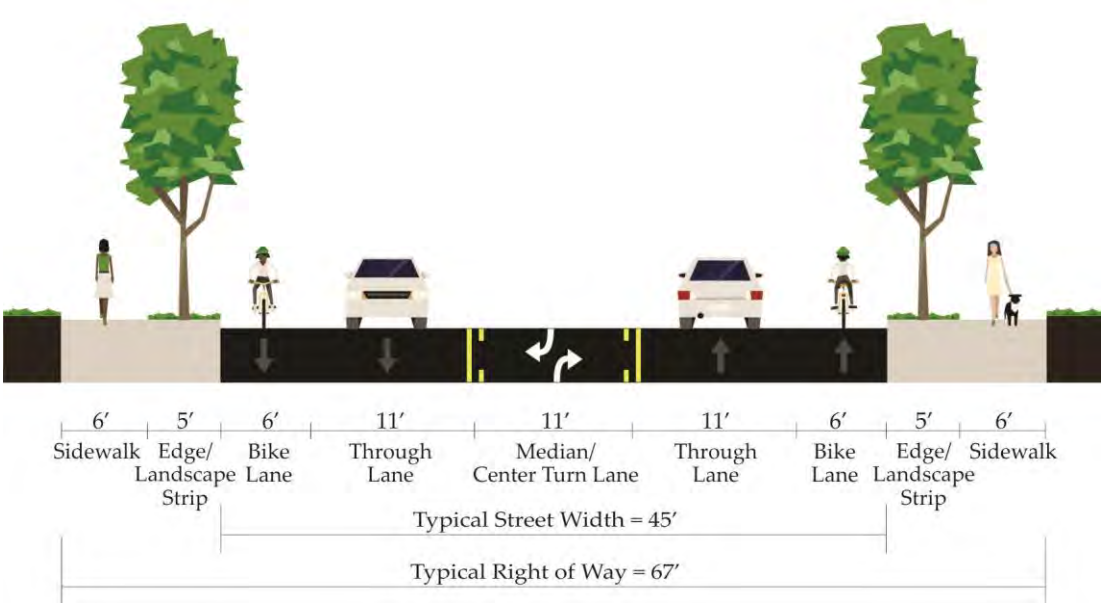


Figure 4d: Industrial Collector

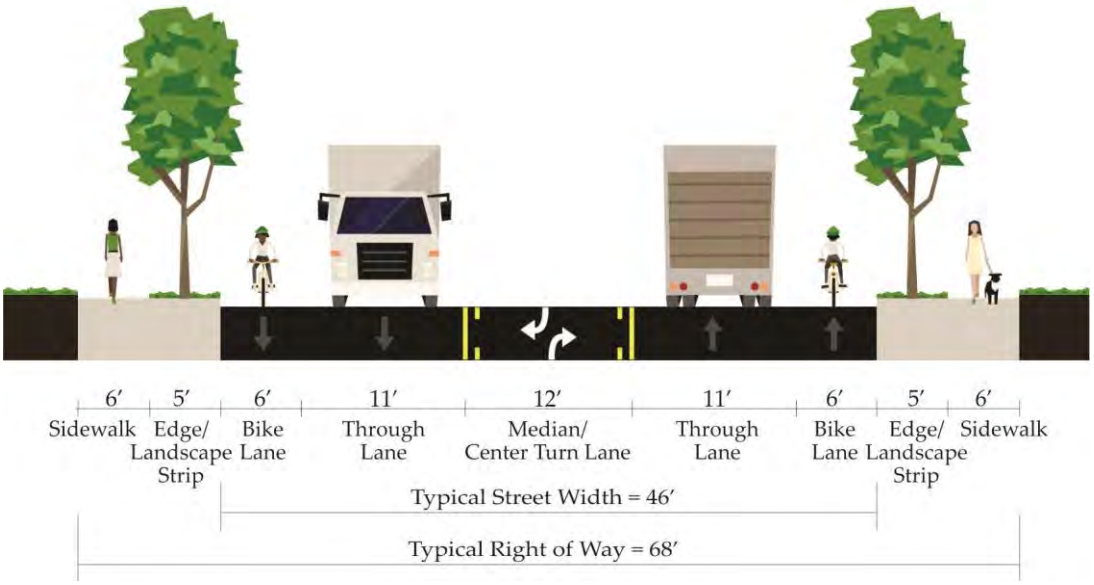


Table 3: Recommended Typical Roadway Cross-section Standards for Collectors

	Mixed-Use	Residential	Commercial	Industrial
Walking Zone				
Minimum Walkway Width	14 ft.	12 ft.	11 ft.	11 ft.
Walkway Type (throughway)	8 ft. sidewalk	6 ft. sidewalk	6 ft. sidewalk	6 ft. sidewalk
Minimum Furnishings/ Landscape Strip Width	4.5 ft. tree well	4.5 ft. landscape strip	4.5 ft. landscape strip	4.5 ft. landscape strip
Edge (Curb and Clearance between Furnishings/ Landscape Strip)	1.5 ft.	1.5 ft.	0.5 ft.	0.5 ft.
Biking / On-Street Parking Zone				
Biking Facility	6 ft. Bike Lanes	6 ft. Bike Lanes	6 ft. Bike Lanes	6 ft. Bike Lanes
Minimum On-Street Parking Width	8 ft.	7 ft.	None	None
Driving Zone				
Through Lanes	2	2	2	2
Minimum Lane Width	11 ft.	11 ft.	11 ft.	11 to 12 ft.
Median/ Turn Lane	None	None	Required 11 ft. left turn lane at intersections	Required 12 ft. center turn lane
Street Width and Right of Way				
Typical Street Width	50 ft	48 ft	45 ft	46 ft
Typical Right of Way	78 ft.	72 ft.	67 ft.	68 ft.

Figure 5a: Mixed-Use Local

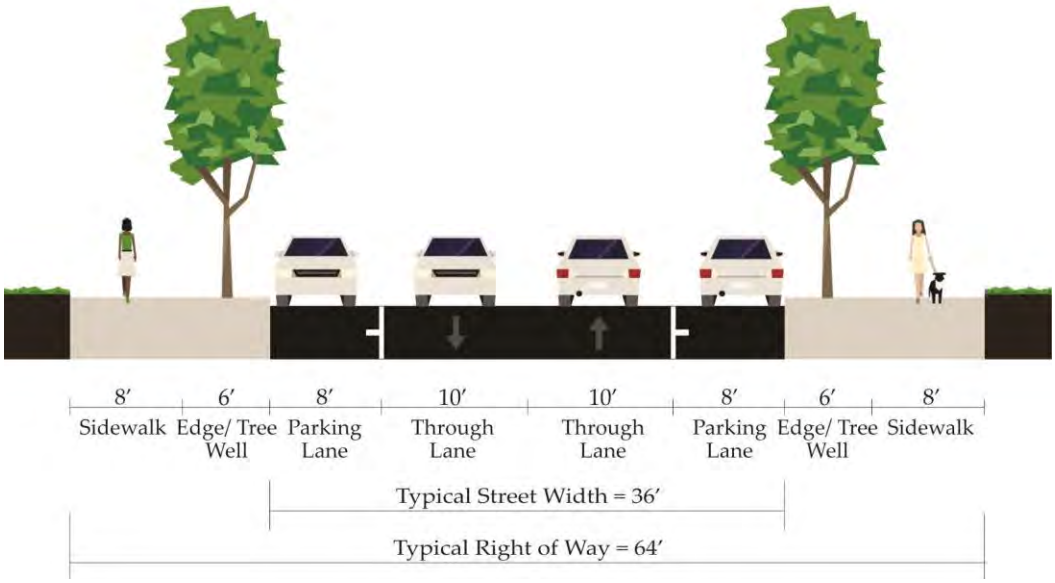


Figure 5b: Residential Local

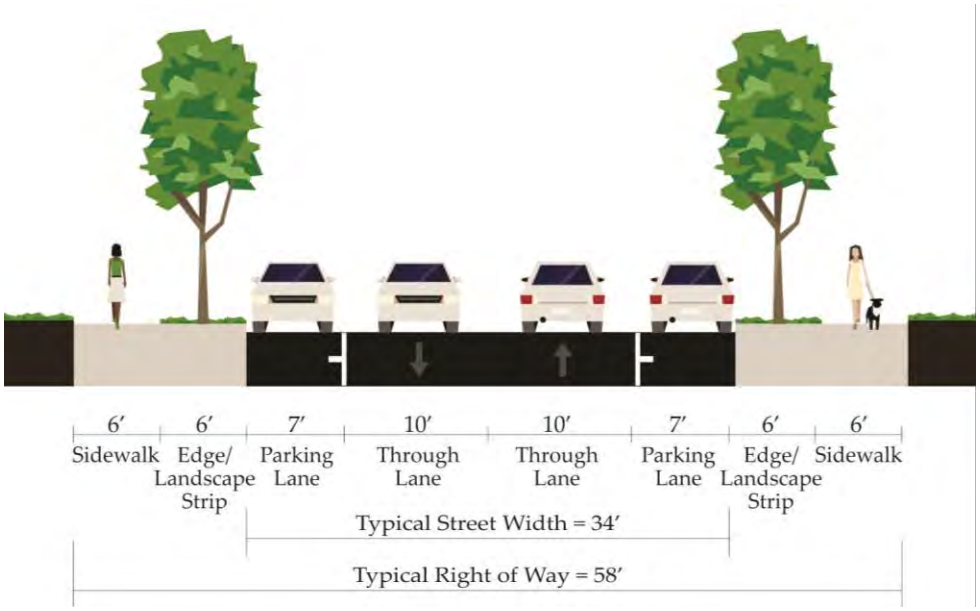


Figure 5c: Commercial Local

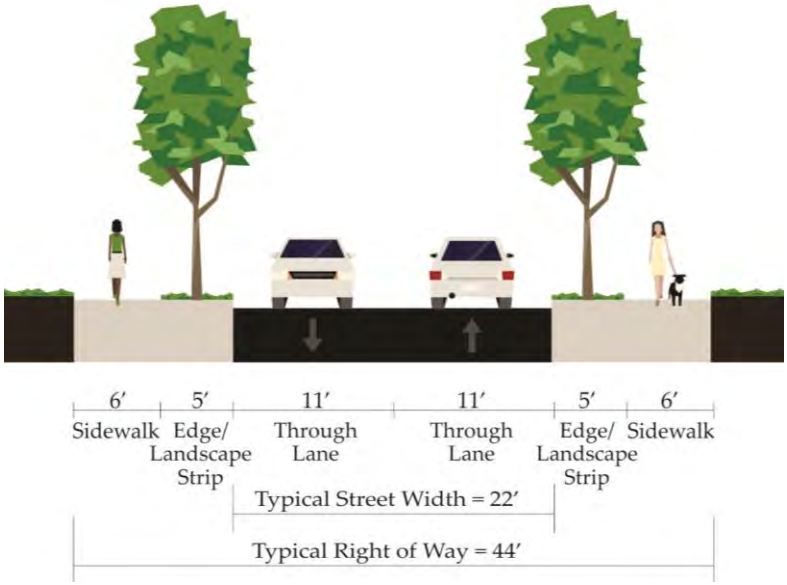


Figure 5d: Industrial Local

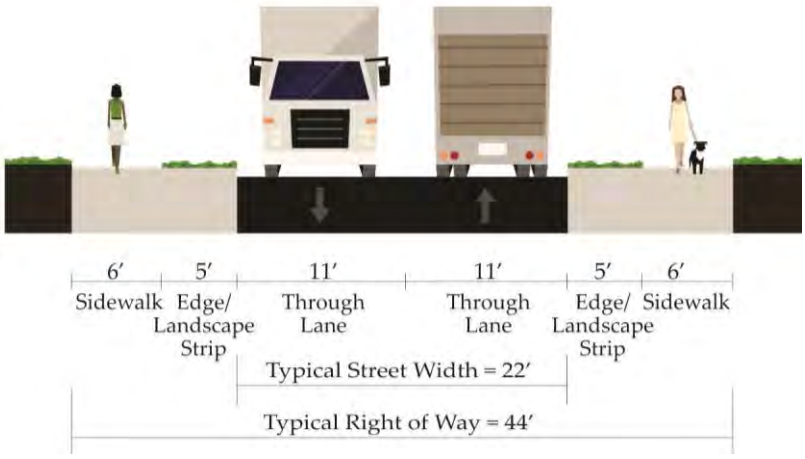


Table 4: Recommended Typical Roadway Cross-section Standards for Local Streets

	Mixed-Use	Residential	Commercial	Industrial
Walking Zone				
Minimum Walkway Width	14 ft.	12 ft.	11 ft.	11 ft.
Walkway Type (throughway)	8 ft. sidewalk	6 ft. sidewalk	6 ft. sidewalk	6 ft. sidewalk
Minimum Furnishings/ Landscape Strip Width	4.5 ft. tree well	4.5 ft. landscape strip	4.5 ft. landscape strip	4.5 ft. landscape strip
Edge (Curb and Clearance between Furnishings/ Landscape Strip)	1.5 ft.	1.5 ft.	0.5 ft.	0.5 ft.
Biking / On-Street Parking Zone				
Biking Facility	Shared Lanes	Shared Lanes	Shared Lanes	Shared Lanes
Minimum On-Street Parking Width	8 ft.	7 ft.	None	None
Driving Zone				
Through Lanes	2	2	2	2
Minimum Lane Width	10 ft.	10 ft.	11 ft.	11 to 12 ft.
Median/ Turn Lane	None	None	None	None
Street Width and Right of Way				
Typical Street Width	36 ft	34 ft	22 ft	22 ft
Typical Right of Way	64 ft.	58 ft.	44 ft.	44 ft.

Constrained Roadway Option

Constrained Streets are generally those where the construction may be challenging due to topography or environmentally sensitive, historic, or developed areas. These streets may require modified designs that may not be to scale with the adjacent land use to allow for reasonable construction costs. Constrained elements may include narrower or limited travel lanes, and pedestrian and bicycle facilities, or accommodations that generally match those provided by the surrounding developed land uses. Recommended guidance for modifications to the standard designs is provided in Table 5. Any modification of a standard design requires approval of a deviation prior to construction.

Table 5: Recommended Constrained Roadway Options

	Arterials	Collectors	Local Streets
Walking Zone			
Minimum Walkway Width	9.5 ft.	8.5 ft.	8.5 ft.
Walkway Type (throughway)	6 ft. sidewalk	5 ft. sidewalk	5 ft. sidewalk
Minimum Furnishings/ Landscape Strip Width	3 ft.	3 ft.	3 ft.
Edge (Curb and Clearance between Furnishings/ Landscape Strip)	0.5 ft.	0.5 ft.	0.5 ft.
Biking / On-Street Parking Zone			
Biking Facility	6 ft. Bike Lanes	5 ft. Bike Lanes; or Bikeway on Adjacent Corridor	None
Minimum On-Street Parking Width	None	None	None
Driving Zone			
Through Lanes	2	2	2
Minimum Lane Width	11 ft.	10 ft.	10 ft.
Median/ Turn Lane	As Needed	As Needed	None

Freight and Truck Routes

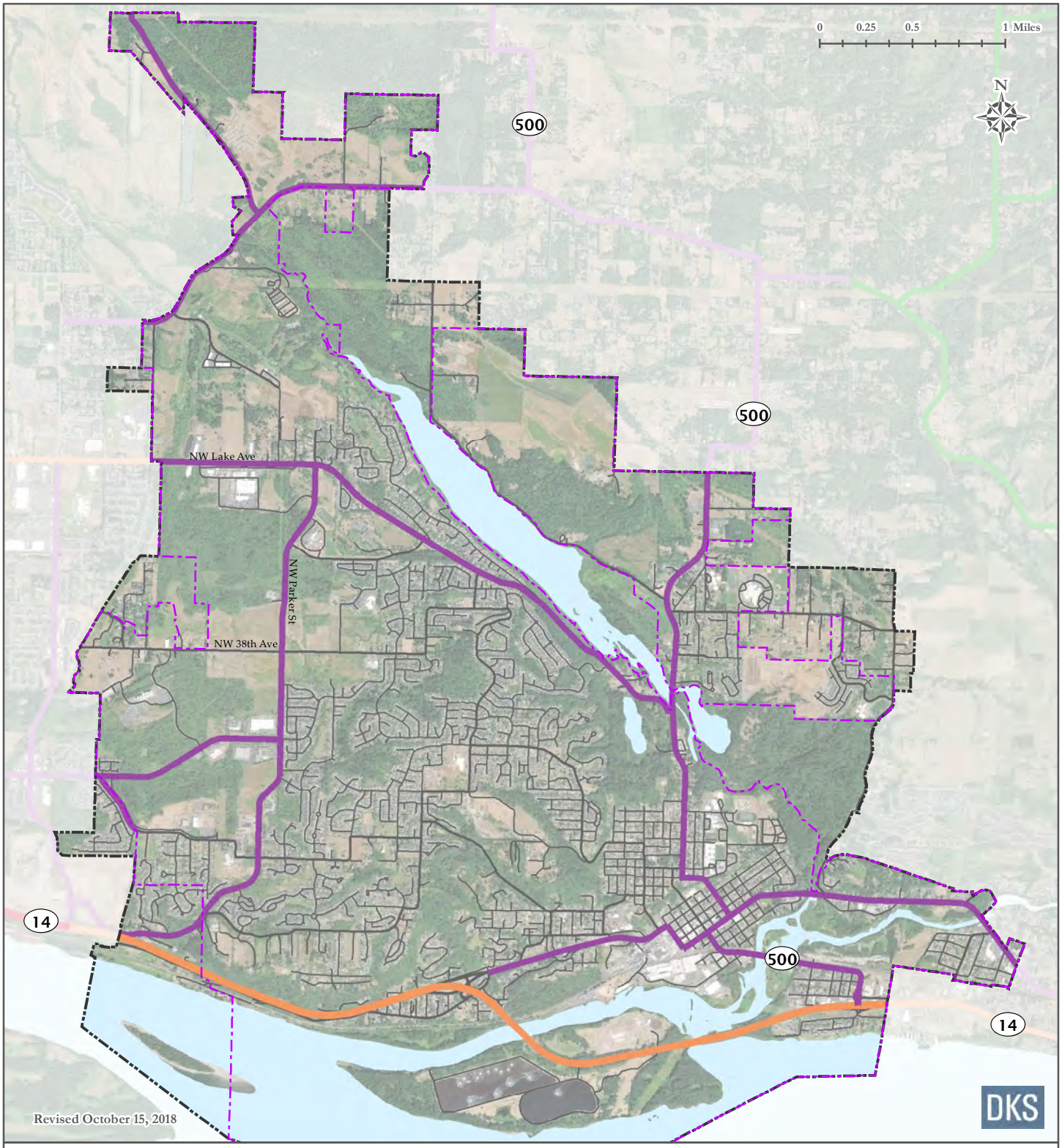
Figure 6 shows roadways designated to help ensure trucks can efficiently travel through and access major destinations in Camas. These routes play a vital role in the economical movement of raw materials and finished products, while maintaining neighborhood livability, public safety, and minimizing maintenance costs of the roadway system.

The Washington State Freight and Goods Transportation System (FGTS) tonnage classification system identifies different categories of freight corridors based on annual freight tonnage moved. It defines tonnage thresholds and identifies heavily used truck freight corridors within the state. Washington State FGTS truck freight corridors are classified into five categories, T-1 through T-5, based on annual gross truck tonnage. The following corridors are identified in Camas (see Figure 2).

- **T-1:** more than 10 million tons per year. There are no T-1 corridors in Camas.
- **T-2:** 4 million to 10 million tons per year. SR 14 is the only T-2 corridor in Camas.
- **T-3:** 300,000 to 4 million tons per year. In Camas, portions of NW 6th Avenue, NE Adams Street, NE 3rd Avenue, SR 500, NW Lake Road, NW Parker Street, NW Brady Road, NW Pacific Rim Boulevard, NE Goodwin Road, NE 28th Street, and NE Ingle Road are T-3 corridors.
- **T-4:** 100,000 to 300,000 tons per year. There are no T-4 corridors in Camas.
- **T-5:** at least 20,000 tons in 60 days and less than 100,000 tons per year. There are no T-5 corridors in Camas.

The Transportation Plan has not changed the Washington FGTS designations.

6 Freight and Truck Routes



Legend:

Freight Corridors

- T-2 Truck Freight Corridor
- T-3 Truck Freight Corridor

- Urban Growth Area
- Camas City Limit
- Arterial or Collector St

Walking and Biking Design Standards

The following sections detail various walking and biking standards and treatment guidelines.

Walking and Biking Facilities

As shown in Figures 3 to 5, the existing city roadway design standards are recommended to be modified to require buffered bike lanes along arterial roadways and wider bike lanes along collector roadways. Local streets are also recommended to require wider sidewalks in mixed-use, residential and commercial areas. Newly constructed roadways are recommended to provide accommodations to walking users via a 8-foot sidewalk in mixed-use areas and a six-foot sidewalk in residential, commercial and industrial areas. Biking users are recommended to be accommodated with a five-foot bike lane with 2-foot buffer along arterial roadways and a six-foot bike lane along collector roadways. Shared streets for bikes are also recommended to be designated throughout the city and should include pavement markings/ signage.

Shared-Use Paths

Shared-use paths provide off-roadway facilities for walking and biking travel. Depending on their location, they can serve both recreational and transportation needs. Shared-use path designs vary in surface types and widths. Hard surfaces are generally better for bicycle travel. Widths need to provide ample space for both walking and biking and should be able to accommodate maintenance vehicles.

The design standards from the Camas Parks, Recreation and Open Space Comprehensive Plan (PROS) are recommended in the Transportation Plan. A paved regional shared-use path should be at least 12 feet wide (see Figure 7). A paved local shared-use path should be at least 10 feet wide in areas with significant walking or biking demand; otherwise, it should be a minimum 6 feet wide (see Figure 8).

Figure 7: Typical Design for Regional Shared-Use Paths

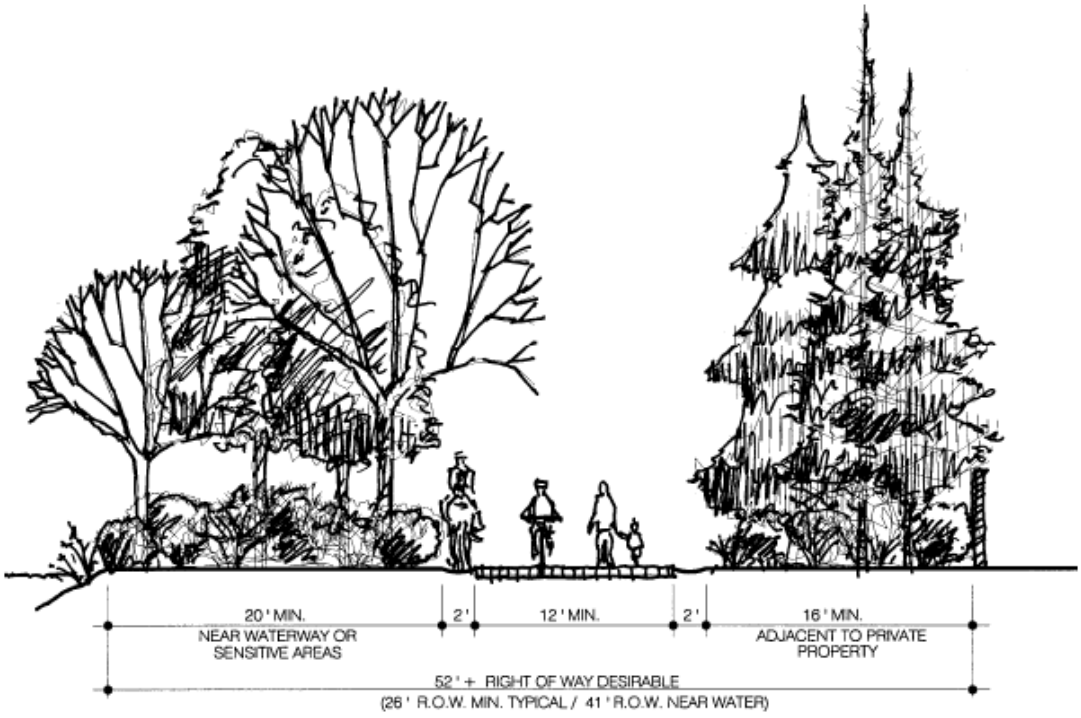
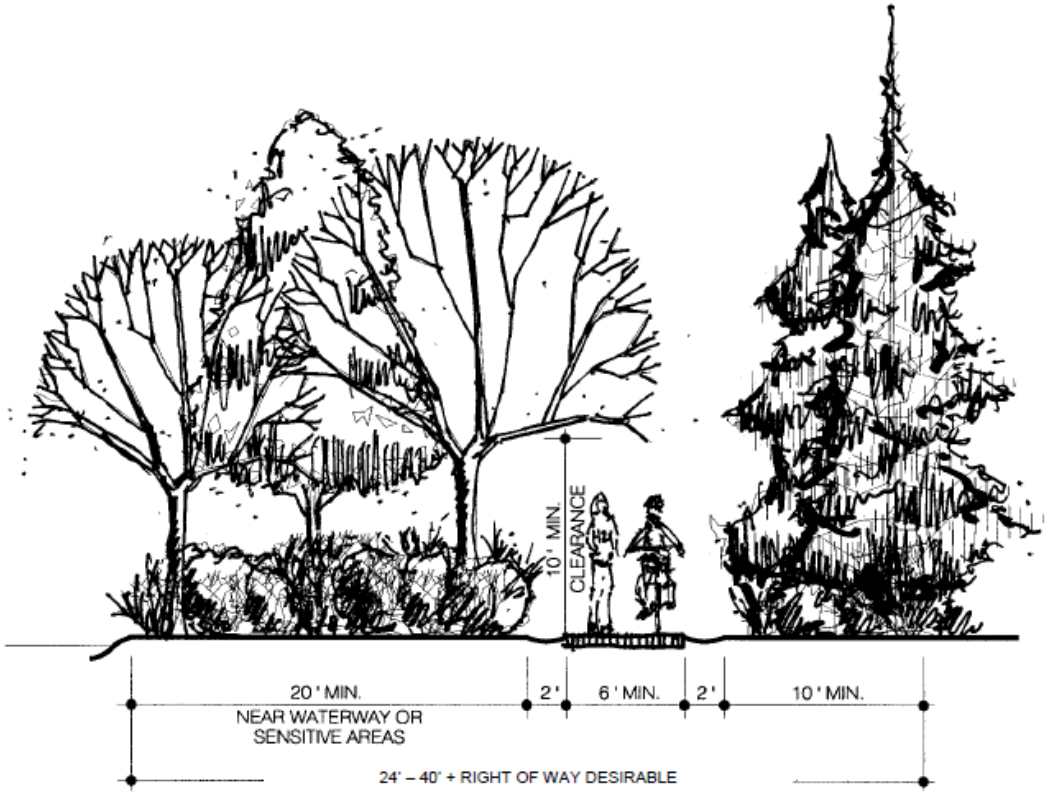


Figure 8: Typical Design for Local Shared-Use Paths



Street Crossings

Roadways with high traffic volumes and/or speeds in areas with nearby transit stops, residential uses, schools, parks, shopping and employment destinations generally require enhanced street crossings with treatments, such as marked crosswalks, high visibility crossings, and curb extensions to improve the safety and convenience. Crossings should be consistent with the recommended block spacing standards shown in Table 6 and mid-block pedestrian and bicycle accessways are recommended to be provided at spacing no more than 330 feet. Exceptions include where the connection is impractical due to topography, inadequate sight distance, high vehicle travel speeds, lack of supporting land use or other factors that may prevent safe crossing (as determined by the city).

Roadway and Access Spacing Standards

Access management is a broad set of techniques that balance the need to provide for efficient, safe, and timely travel with the ability to allow access to individual destinations. Appropriate access management standards and techniques can reduce congestion and accident rates and may lessen the need for construction of additional roadway capacity.

Table 6 identifies recommended maximum and minimum public roadway intersection, minimum private access, and maximum pedestrian and bicycle accessway spacing standards for roadways in Camas. The only recommended change is a new minimum spacing standard for right-in, right-out driveways from adjacent intersections. New roadways or redeveloping properties must comply with these standards to the extent practical, as determined by the city. As the opportunity arises through redevelopment, roadways not complying with these standards could improve with strategies such as shared access points, access restrictions (through the use of a median or channelization islands), or closure of unnecessary access points, as feasible.

Table 6: Roadway and Access Spacing Standards

	Arterials	Collectors	Local Streets
Maximum Block Size (Public Street to Public Street)	1,000 ft.	600 ft.	600 ft.
Minimum Block Size (Public Street to Public Street)	660 ft.	330 ft.	110 ft.
Minimum Driveway Spacing (Public Street to Driveway and Driveway to Driveway)	660 ft.**	330 ft.**	110 ft.
Minimum Full-access Driveway Setback from Intersection	300 ft.	110 ft.	n/a
Minimum Right-in, Right-out Driveway Setback from Intersection	150 ft.	55 ft.	n/a
Maximum Distance between Pedestrian/ Bicycle Accessways (Public Street to Public Street, Public Street to Accessway or Accessway to Accessway) *	330 ft.	330 ft.	330 ft.

Note: all distances measured from the edge of adjacent approaches.

* Mid-block pedestrian and bicycle accessways on public easements or rights-of-way must be provided at spacing no more than 330 feet, unless the connection is impractical due to existing development, topography, environmental constraints, lack of supporting land use or other factors (as determined by the city).

** New residential accesses are not permitted along arterials or collectors

Mobility Standards

Mobility standards for streets and intersections in Camas provide a metric for assessing the impacts of new development on the existing transportation system and for identifying where capacity improvements may be needed. They are the basis for requiring improvements needed to sustain the transportation system as growth and development occur. Two methods used to gauge operational conditions for motor vehicles include volume-to-capacity (v/c) ratios and level of service (LOS).

- **Volume-to-capacity (v/c) ratio:** A v/c ratio is a decimal representation (between 0.00 and 1.00) of the proportion of capacity that is being used at a turn movement, approach leg, or intersection. The ratio is the peak hour traffic volume divided by the hourly capacity of a given intersection or movement. A lower ratio indicates smooth operations and minimal delays. A ratio approaching 1.00 indicates increased congestion and reduced performance.
- **Level of service (LOS):** LOS is a "report card" rating (A through F) based on the average delay experienced by vehicles at the intersection. LOS A, B, and C indicate conditions where traffic

moves without significant delays over periods of peak hour travel demand. LOS D and E are progressively worse operating conditions. LOS F represents conditions where average vehicle delay is excessive, and demand exceeds capacity, typically resulting in long queues and delays.

The Transportation Plan recommends separate mobility standards, one that applies to signalized, all-way stop and roundabout controlled intersections and another that applies to two-way stop and yield controlled intersections under city jurisdiction. A new v/c standard is also recommended to be applied to intersections.

A LOS "D" and a v/c ratio not higher than 0.85 is the minimum recommended performance standard during the peak-hour for signalized, all-way stop and roundabout controlled intersections under city jurisdiction. These standards are recommended to be applied to the intersection as a whole.

A LOS "E" and a v/c ratio not higher than 0.90 is the minimum recommended performance standard during the peak-hour for two-way stop and yield controlled intersections under city jurisdiction. These standards are recommended to be applied to all intersection approaches serving more than 20 vehicles. Mobility standards are recommended to not apply to approaches at intersections serving 20 vehicles or fewer during the peak hour.

Level of Service for Highways of Statewide Significance is set by the State. In Clark County, the standard is set as LOS "D" for urban areas, including SR 14. Level of Service for regional state highway facilities (not part of the HSS), including SR 500 in Camas, is set through the Southwest Washington Regional Transportation Council (RTC). The Southwest Washington RTC Board adopted LOS 'E' or better for non-HSS urban state highway facilities.

Traffic Calming

Traffic calming (primarily in residential and mixed-use areas) refers to street design techniques that slow traffic and make streets safer and more pleasant for users and adjoining land uses without significantly changing their vehicle capacity.

Table 7 lists common traffic calming applications and suggests which devices may be appropriate for streets in Camas. Traffic calming measures must balance vehicle speeds and volumes with mobility, circulation, and function. Any traffic calming project should include coordination with emergency service providers to ensure the project does not impede response.

Traffic calming influences driver behavior through physical and psychological means, by using one or more of the following:

- Narrowing of the street by providing curb extensions or bulbouts, or mid-block pedestrian refuge islands

- Deflecting the vehicle path vertically by installing speed humps, speed tables, or raised intersections
- Deflecting the vehicle path horizontally with chicanes, roundabouts, and mini-roundabouts
- Providing visual cues such as placing buildings, street trees, on-street parking, and landscaping next to the street to create a sense of enclosure that prompts drivers to reduce vehicle speeds

Table 7: Traffic Calming Measures by Street Functional Classification

	Arterials	Collectors	Local Streets
Narrowing travel lanes	Yes	Yes	Most calming measures are generally appropriate on local streets that connect to two or more streets and are infrequent emergency response routes.
Placing buildings, street trees, on-street parking, and landscaping next to the street	Yes	Yes	
Curb Extensions or Bulbouts	Yes	Yes	
Roundabouts	Yes	Yes	
Mini-Roundabouts	No	Yes	
Medians and Pedestrian Islands	Yes	Yes	
Pavement Texture	Yes	Yes	
Speed Hump or Speed Table	No	No	
Raised Intersection or Crosswalk	No	No	
Speed Cushion (provides fire apparatus pass-through with no vertical deflection)	No	Yes	
Choker	No	No	
Traffic Circle	No	No	
Diverter (with emergency vehicle pass through)	No	Yes	
Chicanes	No	No	

APPENDIX F. SOLUTIONS IDENTIFICATION AND EVALUATION

720 SW Washington St.
Suite 500
Portland, OR 97205
503.243.3500
www.dksassociates.com

MEMORANDUM

DATE: May 16, 2024

TO: Curleigh Carothers, City of Camas
Steve Wall, City of Camas

FROM: Reah Flisakowski, DKS Associates
Kevin Chewuk, DKS Associates

SUBJECT: Camas Transportation Plan
Technical Memo 5 – Solutions Identification and Evaluation P18039-000

This document details the transportation system investments recommended to serve travel in Camas. Included is a summary of the process utilized to develop and analyze the solutions and a description of the projects identified to improve the transportation system in the City.

Transportation Vision Statement

Before developing projects, we must first talk about the ideal transportation system for the City. The following vision statement was developed to provide direction for the future of the transportation system.

> *In 2040, residents of Camas continue to appreciate their safe, diverse, and welcoming community as a livable place for people of all ages. Quality public facilities, services, and utilities contribute to their high quality of life.*

The vision statement and eight associated goals (see Technical Memorandum #1b: Goals, Policies and Evaluation Criteria) describe the desires of the City for their transportation system. The eight transportation goals also help set priorities for transportation solutions. It is not the expectation that the City must fully achieve this vision, but instead that it act as a guide for developing and prioritizing projects within the transportation plan.

Approach to Developing Project

Camas' approach to developing transportation projects included consideration of a wide range of options that:

- Preserve the function of the system through cost-effective management practices such as improved traffic signal operations, encouraging alternative modes of travel, and implementation of new policies and standards.
- Improve existing facility efficiency through minor enhancement projects that upgrade roads to desired standards, fill important system connectivity gaps, or include safety improvements to intersections and corridors.
- Add capacity to the system by widening, constructing major improvements to existing roadways, or extending existing roadways to create parallel routes to congested corridors.
- Add capacity to the system by constructing new facilities.

The project team recommended solution types to address identified needs based on a projects cost-effectiveness, ability to support the transportation goals of the City, and community input. This process allows the City to maximize use of available funds, minimize impacts to the natural and built environments, and balance investments across all modes of travel.

Each goal included policies that act as measurable evaluation criteria (see Technical Memorandum #1b: Goals, Policies and Evaluation Criteria). These will be used to screen and prioritize the preliminary transportation solutions. Projects deemed to contribute more towards achieving the transportation goals of Camas will be ranked higher, and the plan will assign higher priority to their implementation (see Figure 1). Recommended projects will be consistent with the community goals and policies.

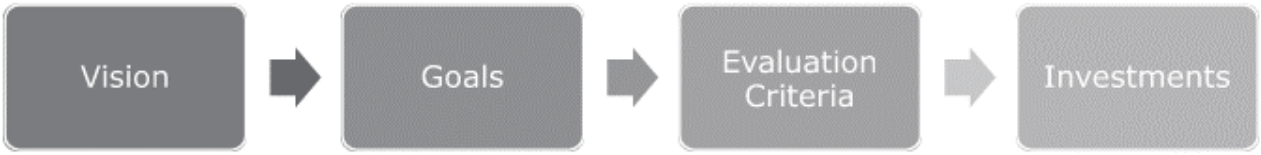


Figure 1: Project Prioritization Process

This memorandum presents the preliminary project list to address all of the identified City transportation needs, regardless of the ability to fund them. The complete list of projects, shown in Table 1, is referred to as Aspirational Projects. The list will be refined based on input received from the Project Advisory Committee and the public to indicate the highest priority projects and anticipated funding potential. Figures 2 through 4 illustrate the preliminary motor vehicle, pedestrian and bicycle projects in Camas.

Table 1: Aspirational Project List

ID	Project Description	Project Elements**	Project Purpose
Demand and System Management Projects			
A	Bike Parking Program	Install new bike parking throughout the City.	Increase bike parking
B	Wayfinding Signage Program	Install wayfinding signage to assist pedestrians and bicyclists in choosing comfortable routes and to help visitors navigate through the City.	Improve wayfinding signage
Transit Projects			
T1	Facility Improvements	Improve transit stop amenities as needed, to include sheltered stops with seating, landing pads, route information, sidewalk connections, bicycle parking and lighting.	Enhance transit service and amenities
Motor Vehicle Projects			
M1	NW Pacific Rim Boulevard reconfiguration between SE Payne Road and NW Parker Street	Reconfigure the existing paved width of NW Pacific Rim Boulevard between SE Payne Road and NW Parker Street to address safety and bicycle facility gaps. Requires coordination with the City of Vancouver.	Safety; Bicycle facility gap
M2	NE 6th Avenue reconfiguration between Norwood Street and Adams Street	Reconfigure the existing paved width of NE 6th Avenue between Norwood Street and Adams Street to address safety and bicycle facility gaps. Included in 2023 six-year Transportation Improvement Program as Priority #12.	Safety; Bicycle facility gap
M3	NE 3rd Avenue reconfiguration between NE Garfield Street and 4th Street	Reconfigure the existing paved width of NE 3rd Avenue between NE Garfield Street and 4th Street to address safety and bicycle facility gaps.	Safety; Bicycle facility gap
M4	NE 3rd Avenue reconfiguration between 4th Street and SE Lechner Street	Reconfigure the existing paved width of NE 3rd Avenue between 4th Street and SE Lechner Street to address safety, pedestrian and bicycle facility gaps.	Pedestrian and bicycle facility gap
M5	NE Laurel Street extension to SE 15th Street	Extend NE Laurel Street to SE 15th Street. This street should be constructed as a Collector, with sidewalks and bike lanes.	Street connectivity; Pedestrian and bicycle facility gap
M6	NE Pioneer Street extension to SE 15th Street	Extend NE Pioneer Street to SE 15th Street. This street should be constructed as a Collector, with sidewalks and bike lanes.	Street connectivity; Pedestrian and bicycle facility gap
M7	NE Pioneer Street extension to SE 8th Street extension	Extend NE Pioneer Street from SE 15th Street to the SE 8th Street extension. This street should be constructed as a Collector, with sidewalks and bike lanes.	Street connectivity; Pedestrian and bicycle facility gap

Table 1: Aspirational Project List

ID	Project Description	Project Elements**	Project Purpose
M8	NE Umatilla Street extension to SE 8th Street extension	Extend NE Umatilla Street from SE 15th Street to the SE 8th Street extension. This street should be constructed as a Collector, with sidewalks and bike lanes.	Street connectivity; Pedestrian and bicycle facility gap
M9	SE 8th Street extension between SR 500-NE Everett Street and SE 283rd Avenue	Extend SE 8th Street from SR 500-NE Everett Street to SE 283rd Avenue. This street should be constructed as a Collector, with sidewalks and bike lanes.	Street connectivity; Pedestrian and bicycle facility gap
M10	SR 500-NE Everett Street widening between NW Lake Road and the UGA	Widen SR 500-NE Everett Street between NW Lake Road and the UGA boundary to include bike lanes and sidewalks. Includes bridge replacement. Included in 2023 six-year Transportation Improvement Program as Priority #2.	Safety; Pedestrian and Bicycle facility gap
M11	SE 8th Avenue extension (Roadway C) to Northshore Subarea Roadway D	Extend SE 8th Avenue (Northshore Subarea Roadway C) from SR 500-NE Everett Street to Northshore Subarea Roadway D. This street should be constructed as a Collector, with sidewalks and bike lanes. Alignment based on Northshore subarea plan Option B, Roadway C.	Street connectivity; Pedestrian and bicycle facility gap
M12	SE 8th Avenue extension (Roadway C) to Northshore Boulevard	Extend SE 8th Avenue (Northshore Subarea Roadway C) from Northshore Subarea Roadway D to Northshore Boulevard. This street should be constructed as a Collector, with sidewalks and bike lanes. Alignment based on Northshore subarea plan Option B, Roadway C.	Street connectivity; Pedestrian and bicycle facility gap
M13	Northshore Boulevard extension to NE 3rd Street-Northshore Subarea Roadway D	Extend Northshore Boulevard to NE 3rd Street-Northshore Subarea Roadway D. This street should be constructed as an Arterial, with sidewalks and bike lanes. Included in 2023 six-year Transportation Improvement Program as Priority #10.	Street connectivity; Pedestrian and bicycle facility gap
M14	NE 232nd Avenue widening between Northshore Boulevard and the UGA	Widen NE 232nd Avenue between Northshore Boulevard and the UGA boundary to include one travel lane in each direction, a center turn-lane/median, a bike lane and sidewalk on the west side and a shared-use path on the east side. Included in 2023 six-year Transportation Improvement Program as Priority #28.	Safety; Pedestrian and Bicycle facility gap
M15	Northshore Subarea Roadway D from SE 8th Avenue (Northshore Subarea Roadway C) to Northshore Subarea Roadway A	Construct a new street between SE 8th Avenue (Northshore Subarea Roadway C) and Northshore Subarea Roadway A. This street should be constructed as a Collector, with sidewalks and bike lanes. Alignment based on Northshore subarea plan Option B, Roadway D.	Street connectivity; walking and biking facility gap
M16	Northshore Subarea Roadway E from Northshore Subarea Roadway D to the SE 8th Avenue extension (Northshore Subarea Roadway C)	Construct a new street between Northshore Subarea Roadway D and the SE 8th Avenue extension (Northshore Subarea Roadway C). This street should be constructed as a Collector, with sidewalks and bike lanes. Alignment based on Northshore subarea plan Option B, Roadway E.	Street connectivity; walking and biking facility gap

Table 1: Aspirational Project List

ID	Project Description	Project Elements**	Project Purpose
M17	Northshore Subarea Roadway A from NE 242nd Avenue-NE 14th Street to the Leadbetter House	Construct a new street between NE 242nd Avenue-NE 14th Street and the Leadbetter House. This street should be constructed as a Collector, with sidewalks and bike lanes. Alignment based on Northshore subarea plan Option B, Roadway A.	Street connectivity; Pedestrian and bicycle facility gap
M18	Northshore Boulevard intersection improvements	Intersection improvements at Northshore Subarea Roadway E and Northshore Subarea Roadway A (e.g., installation of a roundabout). Based on Northshore subarea plan Option B.	Motor vehicle congestion and safety
M19	NE 28th Street widening between N Juniper Street and NE 232nd Avenue	Widen NE 28th Street between N Juniper Street and NE 232nd Avenue to include one travel lane in each direction, a center turn-lane/median, bike lanes and sidewalks.	Safety; Pedestrian and Bicycle facility gap
M20	NE 28th Street widening between NE Ingle Road and N Juniper Street	Widen NE 28th Street between NE Ingle Road and N Juniper Street to include one travel lane in each direction, a center turn-lane/median, bike lanes and sidewalks.	Safety; Pedestrian and Bicycle facility gap
M21	NE Goodwin Road widening between NE Ingle Road and NE 13th Street	Widen NE Goodwin Road between NE Ingle Road and NE 13th Street to include bike lanes and sidewalks. Included in 2023 six-year Transportation Improvement Program as Priority #9.	Safety; Pedestrian and Bicycle facility gap
M22	NE Ingle Road widening between NE 28th Street and the UGA	Widen NE Ingle Road between NE 28th Street and the UGA to include one travel lane in each direction, a center turn-lane/median, bike lanes and sidewalks. Included in 2023 six-year Transportation Improvement Program as Priority #40.	Safety; Pedestrian and Bicycle facility gap
M23	SE Bybee Road realignment to NW Fisher Creek Drive	Realign SE Bybee Road to intersect with NW 38th Avenue at NW Fisher Creek Drive. This street should be constructed as a Collector, with sidewalks and bike lanes. Included in 2023 six-year Transportation Improvement Program as Priority #13.	Street connectivity; Pedestrian and bicycle facility gap
M24	NW 38th Avenue widening between NW Parker Street and Grass Valley Park	Widen NW 38th Avenue between NW Parker Street and Grass Valley Park to include one travel lane in each direction, a center turn-lane/median, bike lanes and sidewalks. Included in 2023 six-year Transportation Improvement Program as Priority #1.	Safety; Pedestrian and Bicycle facility gap
M25	NW 38th Avenue-NW Astor Street-NW 43rd Avenue widening between NW Dahlia Drive and NW Sierra Street	Widen NW 38th Avenue-NW Astor Street-NW 43rd Avenue between NW Dahlia Drive and NW Sierra Street to include one travel lane in each direction, a center turn-lane/median, bike lanes and sidewalks. Included in 2023 six-year Transportation Improvement Program as Priority #27.	Safety; Pedestrian and Bicycle facility gap
M26	NW 16th Avenue-NW Hood Street-NW 18th Street widening between NW Klickitat Street and NW Astor Court	Widen NW 16th Avenue-NW Hood Street-NW 18th Street between NW Klickitat Street and NW Astor Court to include one travel lane in each direction, a center turn-lane/median, bike lanes and sidewalks. Included in 2023 six-year Transportation Improvement Program as Priority #7 and #24.	Safety; Pedestrian and Bicycle facility gap

Table 1: Aspirational Project List

ID	Project Description	Project Elements**	Project Purpose
M27	NW 11th Avenue-NW Astor Street widening between NW McIntosh Road and NW 16th Avenue	Widen NW 11th Avenue-NW Astor Street between NW McIntosh Road and NW 16th Avenue to include one travel lane in each direction, a center turn-lane/median, bike lanes and sidewalks. Included in 2023 six-year Transportation Improvement Program as Priority #23.	Safety; Pedestrian and Bicycle facility gap
M28	NW McIntosh Road widening between NW Brady Road and NW 11th Avenue	Widen NW McIntosh Road between NW Brady Road and NW 11th Avenue to include one travel lane in each direction, a center turn-lane/median, bike lanes and sidewalks. Included in 2023 six-year Transportation Improvement Program as Priority #29.	Safety; Pedestrian and Bicycle facility gap
M29	SE Crown Road widening between NE 3rd Avenue and NE Woodburn Drive	Widen SE Crown Road between NE 3rd Avenue and NE Woodburn Drive to include one travel lane in each direction, left-turn lanes at intersections and a shared-use path (per the Crown Road Corridor Study). Widen the SE Crown Road approach to NE 3rd Avenue to accommodate westbound truck turning maneuvers. Requires coordination with Washougal and Clark County. Included in 2023 six-year Transportation Improvement Program as Priority #6.	Safety; Pedestrian and Bicycle facility gap
M30	SE 283rd Avenue widening between NE Woodburn Drive and the SE 8th Street extension	Widen SE 283rd Avenue between NE Woodburn Drive and the SE 8th Street extension to include one travel lane in each direction, left-turn lanes at intersections and a shared-use path. Requires coordination with Clark County.	Safety; Pedestrian and Bicycle facility gap
M31	SE Lechner Street reconfiguration between NE 3rd Avenue and the UGA boundary	Reconfigure SE Lechner Street between NE 3rd Avenue and the UGA boundary to include one travel lane in each direction, a center turn-lane/median and bike lanes.	Safety; Pedestrian and Bicycle facility gap
M32	NE 6th Avenue / NE Adams Street intersection improvements	Intersection improvements (e.g., Per the Camas Safety Plan this should include the installation of a roundabout and intersection lighting; retain eastbound right-turn slip lane).	Motor vehicle congestion and safety
M33	NE 6th Avenue / SR 500-NE Garfield Street intersection improvements	Intersection improvements (i.e., restripe the eastbound NE 6th Avenue approach to include a separate left-turn and through/right turn lane; requires removal of on-street parking along the south side of NE 6th Avenue within 75 feet of the intersection).	Motor vehicle congestion
M34	SE Crown Road / SE 23rd Street-NE Woodburn Drive intersection improvements	Intersection improvements (e.g., installation of a roundabout per the Crown Road Corridor Study). Realign SE 23rd Street to intersect with NE Woodburn Drive. This street should be constructed as an Arterial, with sidewalks and bike lane. Realignment included in 2023 six-year Transportation Improvement Program as Priority #30.	Motor vehicle safety
M35	SR 500-NE Everett Street / NE 38th Avenue intersection improvements	Intersection improvements (i.e., installation of roundabout or a southbound left-turn lane on SR 500-NE Everett Street).	Motor vehicle congestion and safety

Table 1: Aspirational Project List

ID	Project Description	Project Elements**	Project Purpose
M36	SR 500-NE Everett Street / NE 43rd Avenue intersection improvements	Intersection improvements (i.e., potential installation of roundabout per the Northshore Subarea Plan).	Motor vehicle congestion and safety
M37	SR 500-NE Everett Street / SE Leadbetter Road intersection improvements	Intersection improvements (i.e., installation of a median to limit SE Leadbetter Road access to left-in, right-in, right-out only).	Motor vehicle safety
M38	SR 500-NE Everett Street / SE 8th Street intersection improvements	Intersection improvements (e.g., potential installation of a roundabout per Northshore Subarea Plan).	Motor vehicle safety
M39 *	SR 500-NE Everett Street / SE NE 3rd Street / NE Robinson Road intersection improvements	Intersection improvements (e.g., installation of a roundabout). Requires coordination with WSDOT and Clark County.	Motor vehicle safety
M40 *	NE 28th Street / SR 500-NE 242nd Avenue intersection improvements	Intersection improvements (e.g., installation of a southbound left-turn lane on SR 500-NE Everett Street, eastbound left-turn lane on NE 28th Street and traffic signal, or installation of a roundabout). Requires coordination with WSDOT and Clark County.	Motor vehicle congestion
M41 *	NE 232nd Avenue / NE 28th Street intersection improvements	Intersection improvements (e.g., installation of a roundabout or traffic signal). Requires coordination with Clark County. Included in 2023 six-year Transportation Improvement Program as Priority #21.	Motor vehicle congestion
M42 *	NE 199th Avenue / SR 500-NE 58th Street intersection improvements	Intersection improvements (e.g., installation of a westbound left-turn lane and eastbound right-turn lane on SR 500-NE 58th Street and traffic signal, or installation of a roundabout). Requires coordination with WSDOT and Clark County.	Motor vehicle congestion
M43	NW Camas Meadows Drive / NE Goodwin Road intersection improvements	Intersection improvements (i.e., installation of a roundabout or traffic signal). Included in 2023 six-year Transportation Improvement Program as Priority #38.	Motor vehicle congestion
M44	NW Lake Road / NW Sierra Street intersection improvements	Intersection improvements (i.e., installation of a roundabout). Included in 2023 six-year Transportation Improvement Program as Priority #3.	Motor vehicle congestion
M45	Pacific Rim Boulevard / NW Parker Street intersection improvements	Intersection improvements (i.e., installation of a traffic signal). Included in 2023 six-year Transportation Improvement Program as Priority #39.	Motor vehicle congestion
M46	NW Lake Road safety improvements from NE Everett Street to NW Leadbetter Drive	Implement safety improvements along NW Lake Road safety improvements from NE Everett Street to NW Leadbetter Drive. These include horizontal curve signing, profiled pavement marking and shoulder widening per the Camas Safety Plan.	Multimodal Safety
~~M47~~	~~NE Goodwin Road / NE Ingle Road intersection improvements~~	~~Intersection improvements (i.e., installation of a traffic signal). Project has been completed.~~	~~Motor vehicle congestion~~

Table 1: Aspirational Project List

ID	Project Description	Project Elements**	Project Purpose
M48	SR-14 West Camas Slough Bridge widening	Widen the SR-14 West Camas Slough Bridge to four lanes. Included in 2023 six-year Transportation Improvement Program as Priority #8. WSDOT project.	Motor vehicle congestion
Pedestrian Projects			
P1	Pedestrian improvements on NW 7th Avenue between NW Fargo Street and NW Drake Street	Add pedestrian improvements to NW 7th Avenue between NW Fargo Street and NW Drake Street (i.e., complete sidewalk gaps on the south side).	Pedestrian facility gap
P2	Pedestrian improvements on NW 10th Avenue between NW Forest Home Road and NW Elm Street	Add pedestrian improvements to NW 10th Avenue between NW Forest Home Road and NW Elm Street (i.e., complete sidewalk gaps on the north side).	Pedestrian facility gap
P3	Pedestrian improvements on Division Street between NW 6th Avenue and NW 11th Avenue	Add pedestrian improvements to Division Street between NW 6th Avenue and NW 11th Avenue (i.e., complete sidewalk gaps on the west side).	Pedestrian facility gap
P4	Pedestrian improvements on SR 500-SE Union Street between SE 8th Avenue and SE 6th Avenue	Add pedestrian improvements to SR 500-SE Union Street between SE 8th Avenue and SE 6th Avenue (i.e., complete sidewalk gaps on the east side).	Pedestrian facility gap
P5	Pedestrian improvements on NE 2nd Avenue-NE Whitney Street between NE 3rd Avenue and SE James Street	Add pedestrian improvements to NE 2nd Avenue-NE Whitney Street between NE 3rd Avenue and SE James Street (i.e., complete sidewalk gaps on the east side).	Pedestrian facility gap
P6	Pedestrian improvements on SR 500-NE Everett Street between NE 23rd Avenue and Fallen Leaf Lake Park	Add pedestrian improvements to SR 500-NE Everett Street between NE 23rd Avenue and Fallen Leaf Lake Park (i.e., complete sidewalk gaps on both sides).	Pedestrian facility gap
P7	Pedestrian improvements on NW Lake Road between NW Lacamas Lane and the Lacamas Lake Lodge	Add pedestrian improvements to NW Lake Road between NW Lacamas Lane and the Lacamas Lake Lodge (i.e., complete sidewalk gaps on both sides). Included in 2023 six-year Transportation Improvement Program as Priority #4.	Pedestrian facility gap
P8	Pedestrian improvements on NE Umatilla Street between NE Woodburn Drive and SE 15th Street	Add pedestrian improvements to NE Umatilla Street between NE Woodburn Drive and SE 15th Street (i.e., complete sidewalk gaps on the east side). Requires right-of-way acquisition, outside current city limits, in part.	Pedestrian facility gap
P9	Pedestrian improvements on NE 43rd Avenue-SE 15th Street between SR 500-NE Everett Street and SE Crown Road	Add pedestrian improvements to NE 43rd Avenue-SE 15th Street between SR 500-NE Everett Street and SE Crown Road (i.e., complete sidewalk gaps on both sides). Included in 2023 six-year Transportation Improvement Program as Priority #14 and #31.	Pedestrian facility gap

Table 1: Aspirational Project List

ID	Project Description	Project Elements**	Project Purpose
P10	Pedestrian improvements on NW Camas Meadows Drive between NE Goodwin Road and NW Payne Street	Add pedestrian improvements to NW Camas Meadows Drive between NE Goodwin Road and NW Payne Street (i.e., complete sidewalk gaps on the south side).	Pedestrian facility gap
P11	Pedestrian improvements on NW Leadbetter Drive between NW Parker Street and NW Lake Road	Add pedestrian improvements to NW Leadbetter Drive between NW Parker Street and NW Lake Road (i.e., complete sidewalk gaps on both sides). Included in 2023 six-year Transportation Improvement Program as Priority #20.	Pedestrian facility gap
P12	Pedestrian improvements on NW Parker Street between NW Leadbetter Drive and NW 38th Avenue	Add pedestrian improvements to NW Parker Street between NW Leadbetter Drive and NW 38th Avenue (i.e., complete sidewalk gaps on the west side).	Pedestrian facility gap
P13	Pedestrian improvements on SE Bybee Road between SE 196th Avenue and the SE Bybee Road realignment	Add pedestrian improvements to SE Bybee Road between SE 196th Avenue and the SE Bybee Road realignment (i.e., complete sidewalk gaps on both sides).	Pedestrian facility gap
P14	Pedestrian improvements on NW Fargo Street between NW Kent Street and NW Fargo Loop	Add pedestrian improvements to NW Fargo Street between NW Kent Street and NW Fargo Loop (i.e., complete sidewalk gaps on the north/east side).	Pedestrian facility gap
P15	Pedestrian improvements on NW 23rd Avenue between NW Astor Street and NW Tanner Street	Add pedestrian improvements to NW 23rd Avenue between NW Astor Street and NW Tanner Street (i.e., complete sidewalk gaps on both sides). Included in 2023 six-year Transportation Improvement Program as Priority #18.	Pedestrian facility gap
P16	Pedestrian improvements on NW 18th Avenue-NW Tidland Street-NW 16th Avenue between NW Whitman Street and NW Brady Road	Add pedestrian improvements to NW 18th Avenue-NW Tidland Street-NW 16th Avenue between NW Whitman Street and NW Brady Road (i.e., complete sidewalk gaps on north/east side). Included in 2023 six-year Transportation Improvement Program as Priority #25 and #26.	Pedestrian facility gap
P17	Pedestrian improvements on NW 10th Avenue west of NW NW Norwood Street	Add pedestrian improvements to NW 10th Avenue west of NW Norwood Street (i.e., complete sidewalk gaps on the south side).	Pedestrian facility gap
Bicycle Projects			
B1	Bicycle improvements on NW Ivy Street-NW 7th Avenue from NW 6th Avenue to NW Drake Street	Add bicycle improvements to NW Ivy Street-NW 7th Avenue from NW 6th Avenue to NW Drake Street (i.e., pavement markings/ signage designating it as a shared street for bikes).	Bicycle facility gap
B2	Bicycle improvements on NW Drake Street between NW 7th Avenue and NW 12th Avenue	Add bicycle improvements to NW Drake Street between NW 7th Avenue and NW 12th Avenue (i.e., restripe with bike lanes).	Bicycle facility gap

Table 1: Aspirational Project List

ID	Project Description	Project Elements**	Project Purpose
B3	Bicycle improvements on NW 12th Avenue-Division Street-NE 15th Avenue-NE 18th Avenue-NE 21st Avenue between NW Drake Street and SR 500-NE Everett Street	Add bicycle improvements to NW 12th Avenue-Division Street-NE 15th Avenue-NE 18th Avenue-NE 21st Avenue between NW Drake Street and SR 500-NE Everett Street (i.e., pavement markings/ signage designating it as a shared street for bikes).	Bicycle facility gap
B4	Bicycle improvements on NE 22nd Avenue-NE Ione Street-NE 19th Avenue-NE Oak Street-NE 6th Avenue between SR 500-NE Everett Street and NE Joy Street	Add bicycle improvements to NE 22nd Avenue-NE Ione Street-NE 19th Avenue-NE Oak Street-NE 6th Avenue between SR 500-NE Everett Street and SR 500-NE Joy Street (i.e., pavement markings/ signage designating it as a shared street for bikes).	Bicycle facility gap
B5	Bicycle improvements on NE 6th Avenue-NE Dallas Street-NE Joy Street between NE Adams Street and NE 3rd Avenue	Add bicycle improvements to NE 6th Avenue-NE Dallas Street-NE Joy Street between NE Adams Street and NE 3rd Avenue (i.e., pavement markings/ signage designating it as a shared street for bikes).	Bicycle facility gap
B6	Bicycle improvements on NE Woodburn Drive between Laurel Street and the NE Umatilla Street	Add bicycle improvements to NE Woodburn Drive between Laurel Street and the NE Umatilla Street (i.e., widen for bike lanes).	Bicycle facility gap
B7	Bicycle improvements on NE Umatilla Street between NE Woodburn Drive and SE 15th Street	Add bicycle improvements to NE Umatilla Street between NE Woodburn Drive and SE 15th Street (i.e., widen for bike lanes).	Bicycle facility gap
B8	Bicycle improvements on NE 43rd Avenue-SE 15th Street between SR 500-NE Everett Street and SE Crown Road	Add bicycle improvements to NE 43rd Avenue-SE 15th Street between SR 500-NE Everett Street and SE Crown Road (i.e., widen for bike lanes). Included in 2023 six-year Transportation Improvement Program as Priority #14 and #31.	Bicycle facility gap
B9	Bicycle improvements on SE Bybee Road between SE 196th Avenue and the SE Bybee Road realignment	Add bicycle improvements to SE Bybee Road between SE 196th Avenue and the SE Bybee Road realignment (i.e., widen for bike lanes).	Bicycle facility gap
B10	Bicycle improvements on NW Leadbetter Drive between NW Fremont Street and NW Lake Road	Add bicycle improvements to NW Leadbetter Drive between NW Fremont Street and NW Lake Road (i.e., restripe with bike lanes).	Bicycle facility gap
B11	Bicycle improvements on NW Sierra Street between NW Lake Road and NW 43rd Avenue	Add bicycle improvements to NW Sierra Street between NW Lake Road and NW 43rd Avenue (i.e., restripe with bike lanes; requires removal of left-turn lane to NW 44th Avenue; at the NW Lake Road intersection stripe with a southbound bike lane and shared northbound left and right turn-lanes).	Bicycle facility gap

Table 1: Aspirational Project List

ID	Project Description	Project Elements**	Project Purpose
B12	Bicycle improvements on NE Fremont Street-NW Leadbetter Parkway-NW Dahlia Drive-NW 29th Avenue-NW Valley Street-NW Utah Street between NW Leadbetter Drive and NW 28th Avenue	Add bicycle improvements to NE Fremont Street-NW Leadbetter Parkway-NW Dahlia Drive-NW 29th Avenue-NW Valley Street-NW Utah Street between NW Leadbetter Drive and NW 28th Avenue (i.e., pavement markings/ signage designating it as a shared street for bikes).	Bicycle facility gap
B13	Bicycle improvements on NW 44th Avenue-NW Bass Street-NW 45th Avenue-NW 44th Avenue-NW Lacamas Lane-NW 35th Avenue-NW 34th Avenue-NW Norwood Street between NW Dahlia Drive and NW 28th Avenue	Add bicycle improvements to NW 44th Avenue-NW Bass Street-NW 45th Avenue-NW 44th Avenue-NW Lacamas Lane-NW 35th Avenue-NW 34th Avenue-NW Norwood Street between NW Dahlia Drive and NW 28th Avenue (i.e., pavement markings/ signage designating it as a shared street for bikes).	Bicycle facility gap
B14	Bicycle improvements on NW 28th Avenue-NW Fargo Street between NW Sierra Street and NW 18th Avenue	Add bicycle improvements to NW 28th Avenue-NW Fargo Street between NW Sierra Street and NW 18th Avenue (i.e., pavement markings/ signage designating it as a shared street for bikes).	Bicycle facility gap
B15	Bicycle improvements on NW 18th Loop between NW 18th Avenue and NW Couch Street	Add bicycle improvements to NW 18th Loop between NW 18th Avenue and NW Couch Street (i.e., restripe with a bike lane on the uphill side).	Bicycle facility gap
B16	Bicycle improvements on NW Sierra Street between NW 28th Avenue and NW 23rd Avenue	Add bicycle improvements to NW Sierra Street between NW 28th Avenue and NW 23rd Avenue (i.e., restripe with bike lanes).	Bicycle facility gap
B17	Bicycle improvements on NW 23rd Avenue between NW Astor Street and NW Sierra Street	Add bicycle improvements to NW 23rd Avenue between NW Astor Street and NW Sierra Street (i.e., widen for bike lanes). Included in 2023 six-year Transportation Improvement Program as Priority #18.	Bicycle facility gap
B18	Bicycle improvements on NW Pacific Rim Drive-NW Endicott Street-NW 37th Avenue between NW Parker Street and NW Dahlia Drive	Add bicycle improvements to NW Pacific Rim Drive-NW Endicott Street-NW 37th Avenue between NW Parker Street and NW Dahlia Drive (i.e., pavement markings/ signage designating it as a shared street for bikes).	Bicycle facility gap
B19	Bicycle improvements on NW Julia Street-NW 26th Avenue-NW Maryland Street-NW Larkspur Street-NW Klickitat Street between NW Pacific Rim Drive and NW 16th Avenue	Add bicycle improvements to NW Julia Street-NW 26th Avenue-NW Maryland Street-NW Larkspur Street-NW Klickitat Street between NW Pacific Rim Drive and NW 16th Avenue (i.e., pavement markings/ signage designating it as a shared street for bikes).	Bicycle facility gap

Table 1: Aspirational Project List

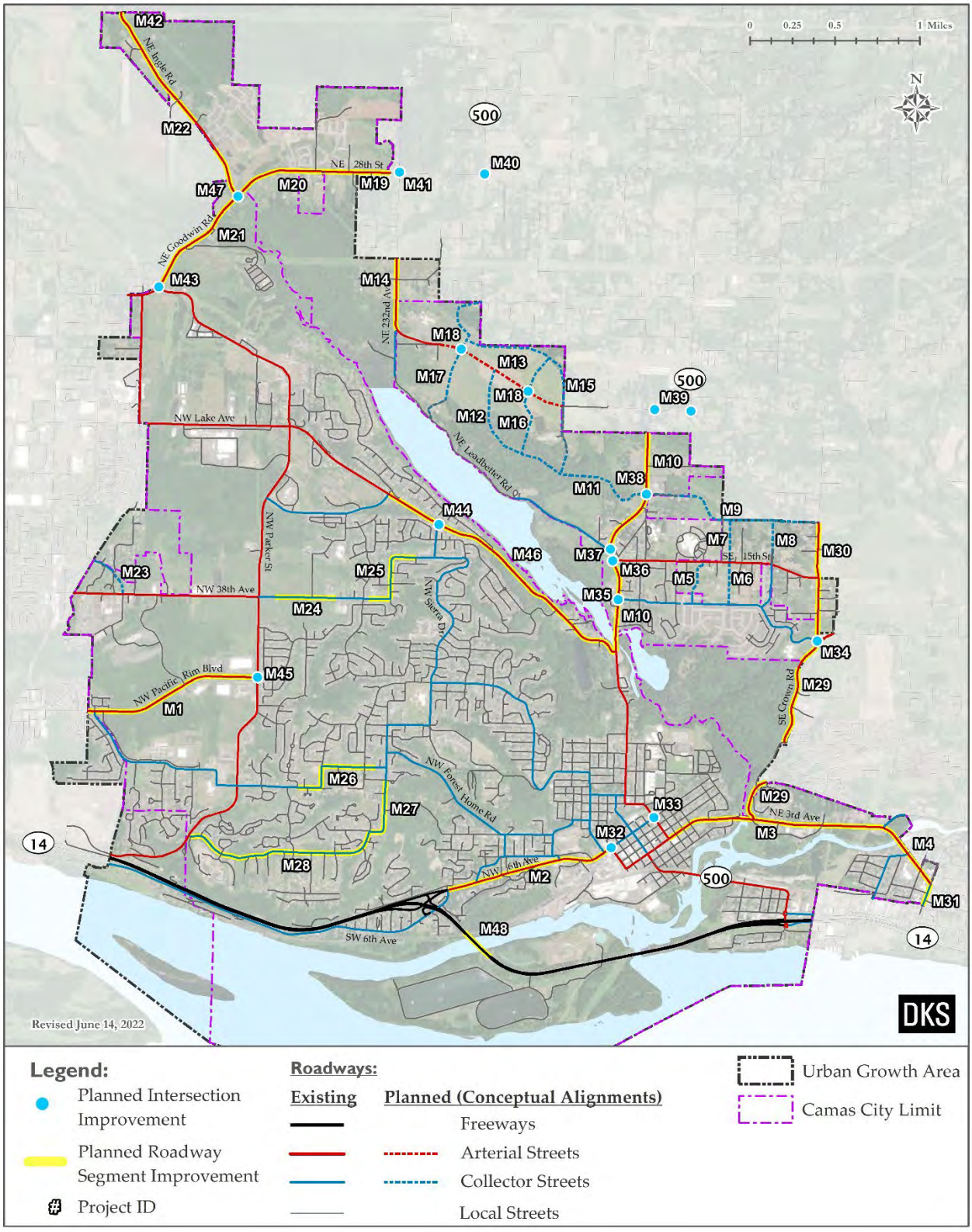
ID	Project Description	Project Elements**	Project Purpose
B20	Bicycle improvements on NW Klickitat Street between NW 16th Avenue and NW McIntosh Road	Add bicycle improvements to NW Klickitat Street between NW 16th Avenue and NW McIntosh Road (i.e., pavement markings/ signage designating it as a shared street for bikes).	Bicycle facility gap
B21	Bicycle improvements on SE Payne Road-NW 18th Avenue-NW Tidland Street-NW 16th Avenue between NW Pacific Rim Boulevard and NW Brady Road	Add bicycle improvements to SE Payne Road-NW 18th Avenue-NW Tidland Street-NW 16th Avenue between NW Pacific Rim Boulevard and NW Brady Road (i.e., widen for bike lanes). Included in 2023 six-year Transportation Improvement Program as Priority #25 and #26.	Bicycle facility gap
B22	Bicycle improvements on NW 10th Avenue between NW 10th Place and NW Drake Street	Add bicycle improvements to NW 10th Avenue between NW 10th Place and NW Drake Street (i.e., pavement markings/ signage designating it as a shared street for bikes).	Bicycle facility gap
Shared Pedestrian and Bicycle Projects			
S1	Shared-use path on NW Brady Road between the City limits and NW McIntosh Road	Create a shared-use path connection along the north side of NW Brady Road between the City limits and NW McIntosh Road. Included in 2023 six-year Transportation Improvement Program as Priority #22.	Pedestrian and bicycle facility gap
S2	Shared-use path between NW 11th Avenue and NW 10th Avenue	Create a shared-use path connection between NW 11th Avenue and NW 10th Avenue. Will require grading, switchbacks and/or stairs to navigate the steep slopes.	Pedestrian and bicycle facility gap
S3	Shared-use path between NW 18th Avenue and NW Brady Road	Create a shared-use path connection between NW 18th Avenue and NW Brady Road.	Pedestrian and bicycle facility gap
S4	Fallen Leaf Lake Park Crossing	Install a pedestrian and bicycle crossing on SR 500-NE Everett Street at Fallen Leaf Lake Park. This improvement includes a continental crossing, a median refuge island and pedestrian crosswalk signs.	Pedestrian and bicycle facility gap
S5	Shared-use path on NE Leadbetter Road between SR 500-NE Everett Street and the Lacamas Lake boat ramp	Create a shared-use path connection along the north side of NE Leadbetter Road between SR 500-NE Everett Street and the Lacamas Lake boat ramp.	Pedestrian and bicycle facility gap
S6	Shared-use path on NE Leadbetter Road between the Lacamas Lake boat ramp and NE 232nd Avenue-Northshore Boulevard	Close NE Leadbetter Road to motor vehicle traffic (except emergency services) between the Lacamas Lake boat ramp and NE 232nd Avenue-Northshore Boulevard and convert the roadway surface to a shared-use path.	Pedestrian and bicycle facility gap
S7	Lacamas Trail SE Crown Road Crossing	Install a pedestrian and bicycle crossing on Crown Road at the Lacamas Trail. As part of this project, extend the sidewalk along the west side of SE Crown Road from Woodburn Elementary to the Lacamas Trail. This improvement includes a continental crossing, a median refuge island and pedestrian crosswalk signs.	Pedestrian and bicycle facility gap

Table 1: Aspirational Project List

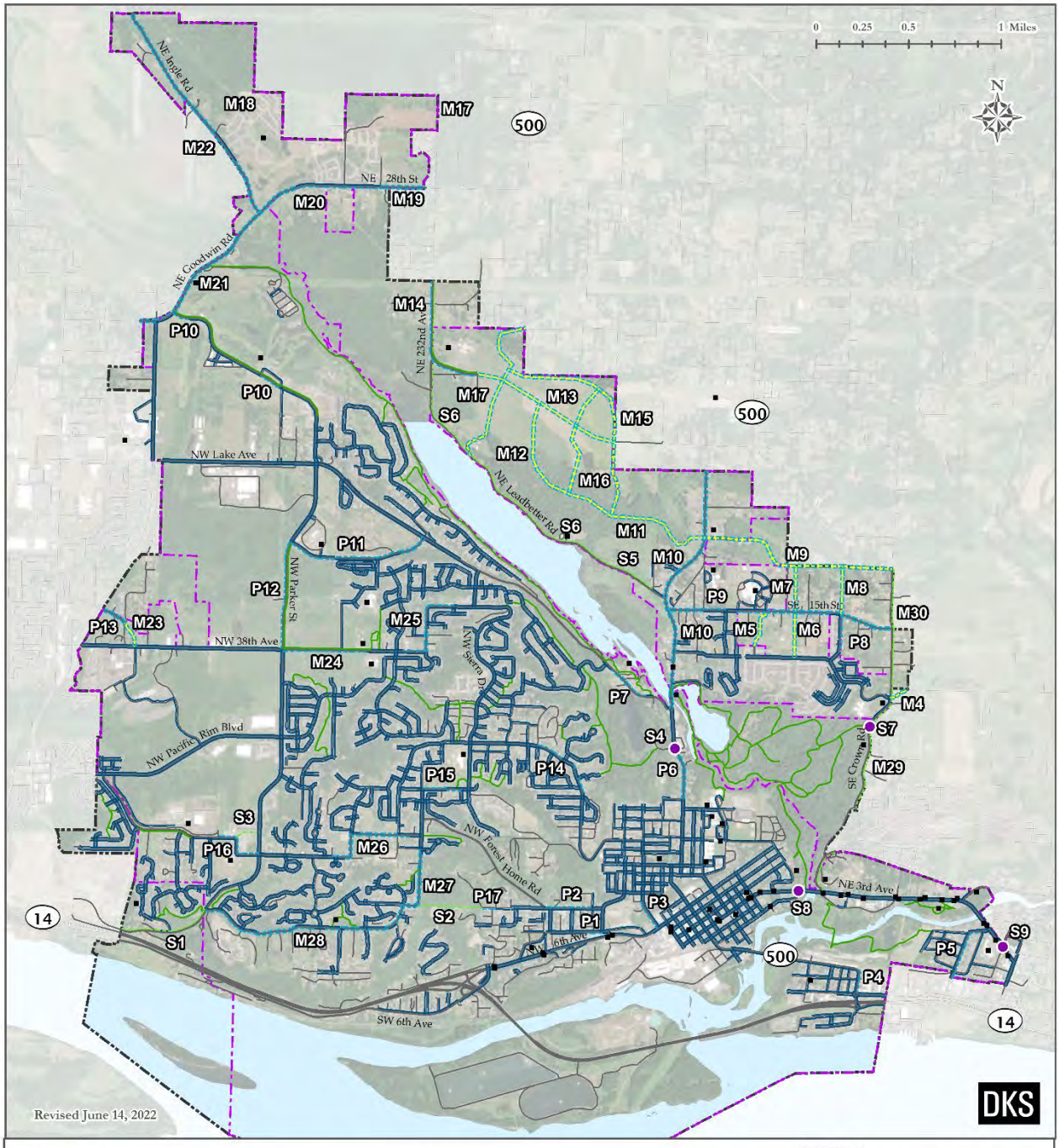
ID	Project Description	Project Elements**	Project Purpose
S8	E 1st Avenue Crossing	Install a pedestrian and bicycle crossing on NE 3rd Avenue at E 1st Avenue. This improvement includes a continental crossing, a median refuge island and pedestrian crosswalk signs.	Pedestrian and bicycle facility gap
S9	NE Weir Street Crossing	Install a pedestrian and bicycle crossing on NE 3rd Avenue at NE Weir Street. This improvement includes a continental crossing, a median refuge island and pedestrian crosswalk signs.	Pedestrian and bicycle facility gap

Note: * Project (or a portion of the alignment) is located outside the UGA and is shown for future planning purposes only.
** The project design elements depicted are identified for planning purposes. The actual design elements for any project are subject to change and will ultimately be determined through a preliminary and final design process and are subject to City and/or WSDOT approval.

2 Motor Vehicle Projects



3 Pedestrian Projects



Legend:

Pedestrian Facilities

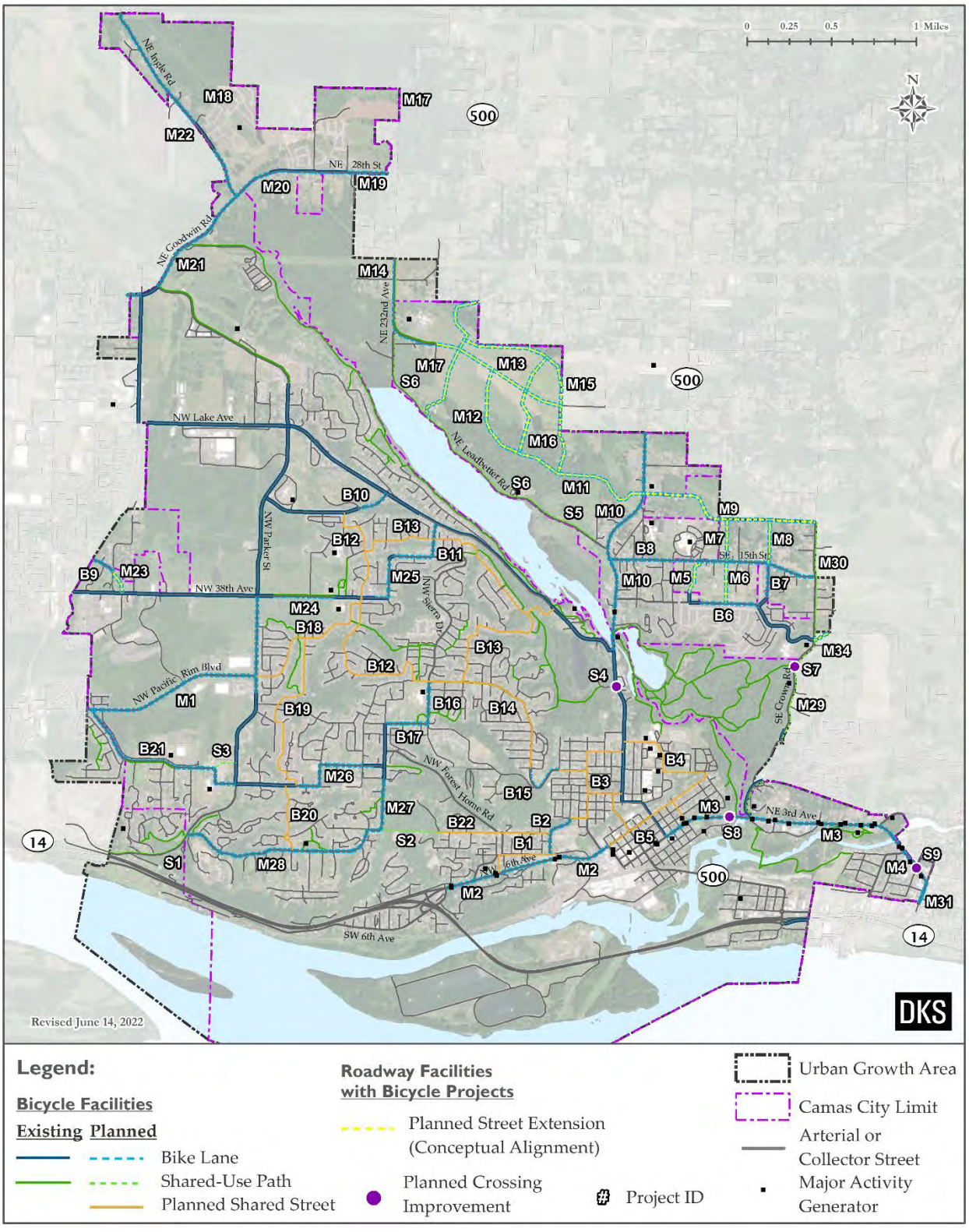
Existing **Planned**

- Sidewalk
- Shared-Use Path

Roadway Facilities with Pedestrian Projects

- Planned Street Extension (Conceptual Alignment)
- Planned Crossing Improvement
- # Project ID
- Urban Growth Area
- Camas City Limit
- Arterial or Collector Street
- Major Activity Generator

4 Bicycle Projects



APPENDIX G. TRAFFIC IMPACT FEE STUDY

City of Camas

Traffic Impact Fee Study

Draft Methodology Report

March 2025

Washington
7525 166th Avenue NE, Ste. D215
Redmond, WA 98052
425.867.1802

Oregon
5335 Meadows Road, Ste 330
Lake Oswego, OR 97035
503.841.6543

Colorado
PO Box 19114
Boulder, CO 80301-9998
719.284.9168

www.fcsgroup.com

FCS
a Bowman company

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PURPOSE

The purpose of this memorandum is to describe the Camas Traffic Impact Fee (TIF) methodology that has been developed during the 2024 Transportation System Plan (TSP) update by DKS Associates. This methodology provides a fee update calculated using the prior/current TIF methodology (assuming that there are two districts that will serve the City of Camas) and a new alternative (which considers a citywide fee) with expected levels of trip growth rates and project costs, as described below.

BACKGROUND

An impact fee is a one-time fee paid at the time of development, intended to represent the share of system capacity that will serve growth. Traffic impact fees are authorized under Washington law (RCW 82.02) to promote orderly growth and development. The Washington Growth Management Act allows cities, counties and towns to establish standards, by ordinance, which requires new growth and development to pay a share of the cost of the new facilities needed to serve growth and development. This share of the cost, herein called the "private share," is collected at the time of new development and is one source of funding for the transportation capital improvement program.

The TIF project list provided in **Appendix A** was developed to meet the long-range land use growth goals articulated in the *Camas TSP (Amended 2025).*

Additionally, per RCW 82.02.050, "impact fees (a) can be imposed for system improvements that are reasonably related to the new development; (b) cannot exceed a proportionate share of the costs of system improvements that are reasonably related to the new development, and (c) should be used for system improvements that will reasonably benefit the new development."

The law also provides for "the imposition of an impact fee for system improvement costs previously incurred by a county, city, or town to the extent that new growth and development will be served by the previously constructed improvements provided such fee shall not be imposed to make up for any system improvement deficiencies." If applicable, an existing capacity component of the fee would be made up of the cost of available, unused capacity in the existing system, with possible adjustments for grant-funded and contributed infrastructure. This TIF update is consistent with the prior adopted methodology in that it does not include any additional fees for the existing remaining capacity in the transportation system.

RCW 82.02.070 further requires that impact fee receipts should be earmarked specifically and retained in special interest-bearing accounts, and, absent a compelling reason, must be expended or encumbered for permissible use within ten years of receipt.

The existing Camas transportation impact fee administrative procedures are described in Chapter 3.88 of the Camas Municipal Code. In general, Traffic Impact Fees are calculated using the following formula:

$$\mathbf{TIF = T \times (1\text{-}B\text{-}D) \times C \times A}$$

Whereas:

"TIF" means the traffic impact component of the total development impact fee.

"T" means the average PM peak hour vehicle trip ends for each use, estimated by the current edition of the ITE Trip Generation Manual, computed by taking the size of the development times the PM peak hour trip generation rate.

"B" is the reduction for bypass trips for ITE land use codes in the 800s and 900s estimated by the current edition of the ITE Trip Generation Handbook.

"D" is the reduction for diverted linked trips for ITE land use codes in the 800s and 900s estimated by the current edition of the ITE Trip Generation Handbook.

"C" is the cost per PM peak hour trip end.

"A" is an adjustment to the cost of public facilities within the curb-to-curb section of project capacity improvements for past or future payments made or reasonably anticipated to be made in the form of user fees, debt service payments, taxes, or other payments earmarked for or pro-ratable to traffic system improvements contained in the capital facilities plan. This adjustment is determined to be 10 percent so that "A" equals 90 percent.

RCW 82.02.060 requires that "an adjustment to the cost of the public facilities for past and future payments made or reasonably anticipated to be made by new development to pay for particular system improvements in the form of user fees, debt service payments, taxes, or other payments earmarked for or pro-ratable to the particular system improvement" must be made to the total cost basis. Therefore, additional funding sources such as sales tax revenues, transfers from the general fund etc. must be prorated between the existing population and projected growth. This requirement is met through the TIF adjustment described above in the formula variable "A."

This report provides a traffic impact fee methodology that is consistent with the current Camas TIF program formula which splits the city into north and south service areas as well as an alternative methodology that calculates the fee on a citywide basis.

The recommended maximum Traffic Impact Fee is calculated per PM Peak Hour Vehicle Trip (PHVT) generated, which is calculated by estimating the net cost of applicable improvements and dividing by the estimated number of new trips expected between 2025 and 2045.

The city council may decide to implement the new TIF rate upon adoption of this Technical Document or could instruct city staff to phase-in the new TIF rate over time. A phase-in approach would result in foregone local transportation revenue that would need to be funded by alternative funding sources, such as General Funds or Local Improvement Districts.

GROWTH IN TRIPS

Before determining the total cost of TIF eligible capital projects, the level of future trip growth must be determined. **Exhibit 1** shows the projected growth in PM Peak Hour Vehicle Trips (PHVT), the basis for determining the portion of total costs to be included in the TIF. The amount of PHVT is estimated for 2015, 2025 and forecasted for 2045. The 2025-2045 growth forecast serves as the denominator in the TIF calculation.

Citywide trip growth is assumed to equal 7,129 net new trips by 2045. It is projected that 3,472 of those new trips will be generated in the North District, a 76% growth share. In the more built out South District 3,657 trips are expected to be added which represents a 29% growth share. The overall citywide growth share is estimated at 41%.

Exhibit 1: Projected Trip Growth, City of Camas

Area	Trip-Ends in 2015	Trip Ends in 2040	2015-2040 AGR	Trip Ends 2025 est.	Trip Ends 2045 proj.	New Trip Ends from 2025 to 2045	Average Growth Share
North District	530	3,185	7.43%	1,086	4,558	3,472	76%
South District	7,745	11,786	1.69%	9,162	12,819	3,657	29%
Total	8,276	14,971	2.40%	10,248	17,377	7,129	41%

Source: DKS Associates, 2015-2040 forecast, extrapolated to 2045.

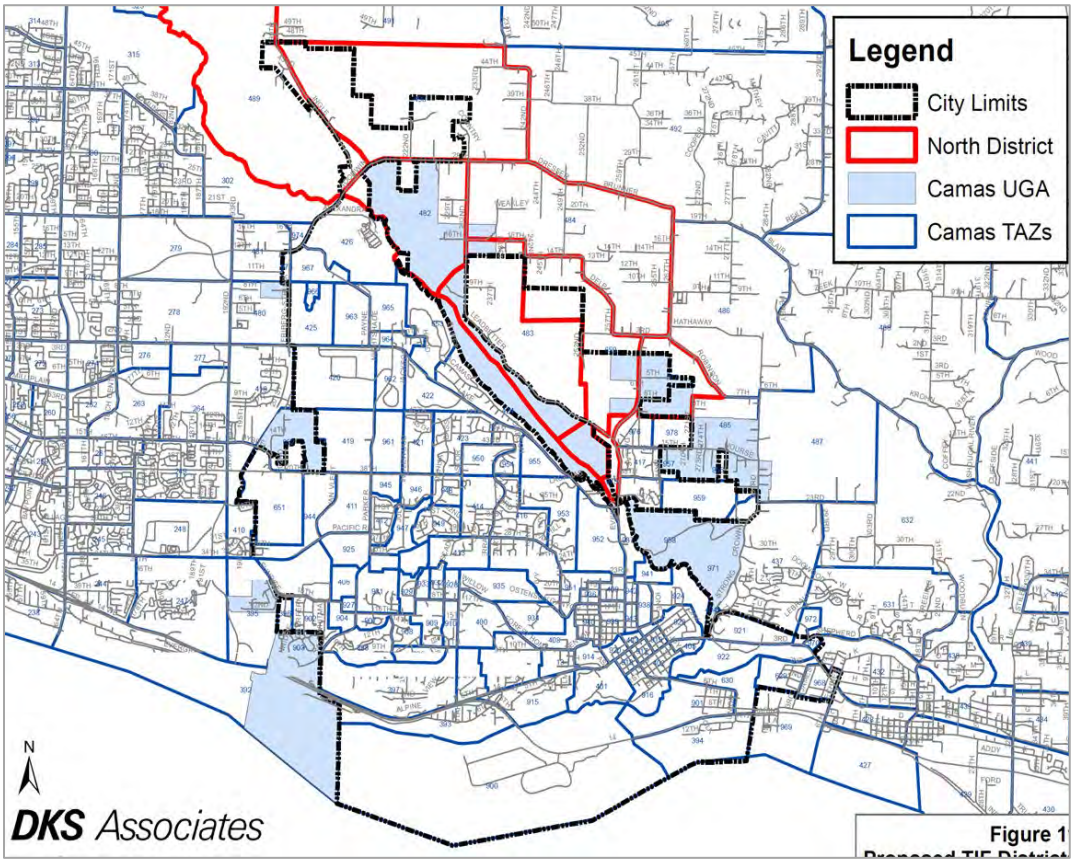


Figure 1

TIF COST BASIS

RCW 82.02.050 specifies that transportation impact fees are to be spent on "system improvements." System improvements can include physical changes to existing roadways, as well as new roadway connections that are built to benefit projected needs of the transportation system. Each project listed in **Appendix A** meets these requirements and are required to meet future growth needs.

The portion of each project facility that is TIF-eligible is calculated by dividing the total capital costs of the identified improvement projects by the projected increase in demand (measured in terms of vehicle trips).

TIFs are collected to pay for a portion of the transportation improvements needed to accommodate traffic resulting from new development. TIFs are paid only for new development or redevelopment which would add trips compared to its current use. The fee is assessed by examining the number of trips expected to be generated from that development. The fees collected can be used to expand existing transportation facilities and to build new facilities.

During the TIF update process, updated cost estimates (in Year 2024 dollars) were developed for facilities needed to address future transportation needs. Some improvements are eligible for TIF funds, while others are not.

TIF eligible projects were determined using the following criteria:

- ✓ Roads classified as principal or minor arterials, and State Highways.
- ✓ Roads that serve primarily citywide trips, regional trips or trips over multiple land uses that serve the majority of trips to and from Camas.
- ✓ Roads that serve to reduce impacts on adjacent facilities.

Frontage improvements and right-of-way outside the curb-to-curb section, including landscaping and sidewalks are not included in TIF calculation. In most instances, the costs of frontage improvements will be borne by the adjacent development.

The TIF eligible cost basis for each cost category listed in **Appendix A** accounts for the total capital cost of the project less safety related project elements, and non-TIF eligible (private share) elements.

In theory, a new collector or arterial roadway that is explicitly needed to serve future growth within the City could be 100% TIF cost eligible (before fee adjustments or credits).

The maximum TIF related 'growth share' for an upgrade to an existing transportation facility, based on **Exhibit 1**, is the percentage of total trips in 2045 that can be attributed to future growth. As discussed above, this is calculated as the net change in trips from 2025 to 2045 divided by future trips in year 2045. This equates to 41% citywide; or 76% in the North District, and 29% in the South District. These figures represent the maximum TIF share that would be used for an add capacity to an existing transportation facility.

Most upgrades to existing transportation facilities will result in significantly less TIF eligible funding. However, the determination of the TIF eligible cost shares and creditable private improvements usually vary from project to project.

City staff compiled the CIP with estimates of total transportation project costs after accounting for improvements that are planned to be constructed between 2025 and 2045 at a total cost of $187.3 million (**Exhibit 2**).

Exhibit 2: Summary of Camas Transportation Projects: 2025-2045

Project Type	Count	Total Cost
Bike	22	$ 21,425,000
DSM	2	$ 450,000
Intermodal	19	$ 64,200,000
Motor Vehicle	29	$ 71,700,000
Pedestrian	17	$ 16,125,000
Shared	9	$ 5,400,000
Transit	1	$ 1,000,000
Total (2024$)	99	$ 180,300,000
Total (2025$)		$ 187,330,000

Source: DKS Associates, Sept. 28, 2024.

TSDC OVERLAY METHODOLOGY

The updated TIF methodology is calculated by determining the City's cost share of the capacity-increasing improvements, which are estimated at $41.7 M in the North District and $48.2 M in the South District) and removing for existing TIF fund balances: estimated at $1.1 M in the North District, and$2.9 M in the South District.

As shown in **Exhibit 3**, the adjusted TIF cost basis for each district is divided by the projected trip growth between 2025 and 2045 (3,472 in the North District, 3,657 in the South District). After accounting for the TIF reduction factor of 10%, the resulting net TIF equates to $10,518 per PHVT in the North District and $11,142 per PHVT in the South District.

Exhibit 3: Camas TIF Calculation: Alt. 1 Two Districts

	North District	*South District*	*Citywide*
Total Capital Facility Costs	$ 76,916,865	$ 110,414,835	$ 187,331,700
Less Non-Capacity Related Facility Costs	$ (35,209,563)	$ (62,248,392)	$ (97,457,955)
Unadjusted Future TIF Project Cost Basis	$ 41,707,302	$ 48,166,443	$ 89,873,745
Less Estimated TIF Fund Balance	$ (1,136,561)	$ (2,895,232)	$ (4,031,793)
Total Current TIF Cost Basis	$ 40,570,741	$ 45,271,211	$ 85,841,952
Growth in Trips	3,472	3,657	7,129
Unadjusted TIF per PM peak hour vehicle trip end	$11,686	$12,379	$12,042
Reduction Factor*	10.0%	10.0%	10.0%
Calculated TIF per PM peak hour vehicle trip end	$10,518	$11,142	$10,838

**Reduction factor reflects estimated additional share of capacity projects (curb-to-curb sections only) funded by non-TIF and/or private sources.*

This calculation represents the maximum defensible impact fees that the City of Camas may adopt in part or in full.

A summary of the maximum defensible TIF for selected land use development types is shown in **Exhibit 4**.

Exhibit 4: Camas TIF for Selected Land Use Type: Alt. 1

Camas TIF Update, Updated Fee Calculations for Selected Development Types (before credits)

Type	Unit	Existing North Fee	Existing South Fee	Updated North Fee	Updated South Fee
Single-family Detached	Dwelling Unit	$10,633	$4,102	$9,293	$9,845
Apartments	Dwelling Unit	$5,972	$2,273	$3,856	$4,084
Duplexes/Townhomes	Dwelling Unit	$6,391	$2,433	$5,042	$5,341
ADU (Internal)*	Dwelling Unit	$2,593	$987	$3,233	$3,425
ADU (External)**	Dwelling Unit	$3,630	$1,382	$4,554	$4,824
Commercial	PM Peak Hour Trip	$10,633	$4,102	$10,518	$11,142

**Calculated based on a 0.71 factor applied to ITE Code 223 per 11th Edition of Trip Generation*
***Calculated based on current city policy ratio of 0.41 x SFD trip rate; also applies to affordable housing units*
Note: TIF charges may be exempted by council policy for ADUs and affordable housing units.

TSDC CITYWIDE METHODOLOGY

The citywide alternative TIF methodology is calculated by determining the City's cost share of the capacity improvements ($89.9 M) and removing for existing TIF fund balance ($4 M). As shown in **Exhibit 5**, the adjusted TIF cost basis is divided by the projected trip growth between 2025 and 2045 (7,129). The resulting net TIF equates to $10,838 per PHVT citywide.

Exhibit 5: Citywide Camas Transportation Impact Fee Calculation: Alt. 2

		Single District
Total Capital Facility Costs	$	187,331,700
Less Non-Capacity Related Facility Costs	$	(97,457,955)
Unadjusted Future Project Cost Basis	$	89,873,745
Less Estimated TIF Fund Balance	$	(4,031,793)
Updated Future TIF Cost Basis	$	85,841,952
(a) Unadusted Future TIF cost basis share of total cost		*48.0%*
(b) Recent Avg. City Share of Future Curb-to-Curb Cost		*46.3%*
Total Current TIF Cost Basis	**$**	**85,841,953**
Growth in Trips (PMPHVT)		**7,129**
Unadjusted TIF per PM peak hour vehicle trip end	$	12,041.83
Reduction Factor*		10.0%
Reduction Amount	$	(1,204.18)
Calculated TIF per PM peak hour vehicle trip end	**$**	**10,837.65**

**Reduction factor reflects estimated additional share of capacity projects (curb-to-curb sections only) funded by non-TIF and/or private sources.*

This calculation represents the maximum defensible impact fees that the City of Camas may adopt in part or in full.

A summary of the maximum defensible TIF for selected land use development types is shown in **Exhibit 6,** with amounts rounded to the nearest dollar.

Exhibit 6: Camas TIF for Selected Land Uses: Alt. 2 One Service District

Camas TIF Update, Updated Fee Calculations for Selected Development Types (before credits)

Type	Unit	Existing North Fee	Existing South Fee	Updated Citywide Fee
Single-family Detached	Dwelling Unit	$10,633	$4,102	$10,187
Apartments (low rise)	Dwelling Unit	$6,122	$2,362	$5,196
Duplexes/Townhomes	Dwelling Unit	$6,551	$2,527	$5,196
ADU (Internal)*	Dwelling Unit	$2,658	$1,025	$3,544
ADU (External)**	Dwelling Unit	$3,721	$1,436	$4,992
Commercial	PM Peak Hour Trip	$10,740	$4,143	$10,838

**Calculated based on a 0.71 factor applied to ITE Code 223 per 11th Edition of Trip Generation*
***Calculated based on current city policy ratio of 0.41 x SFD trip rate; also applies to affordable housing units*
Note: TIF charges may be exempted by council policy for ADUs and affordable housing units.

FEES BY HOME SIZE

New Washington State law requires a scaling impact fee schedule for impact fees charged to residential dwelling units. This is discussed in RCW 82.02.060(1), which states that the schedule for TIFs "shall reflect the proportionate impact of new housing units… based on the square footage, number of bedrooms, or trips generated." Per the same code section, this scaling requirement is intended "to produce a proportionally lower impact fee for smaller housing units." This requirement is not just for single-family dwelling units, but also for multi-family dwelling units.

One approach for scaling the TIF is to estimate the smallest dwelling unit size (inclusive of single-family and multi-family dwelling units) necessary to accommodate one resident in Camas, and thereby calculate the TIF per dwelling unit as a per square foot charge. The Census Bureau's statistics from the American Community Survey state that the average occupancy per dwelling unit in Camas in 2020 was 2.78. Per Clark County Assessor's data, the City's estimated average dwelling unit size (inclusive of both single-family and multi-family dwelling units) is 2,277 square feet. That means that, on average, 738 square feet accommodates one resident, and 1 square foot will accommodate 0.0014 residents.

American Housing Survey data for the Portland Metro Area shows that, to a point, house size is positively correlated with the number of occupants. After about 2,605 square feet, that correlation dissipates. Therefore, we recommend that the City scale its transportation impact fee for residential developments up to a maximum of 2,605 square feet. Using the citywide approach detailed below as an example, scaling would set a minimum TIF of $2,625 for dwelling units at 738 square feet or less, and a maximum TIF of $9,265 at 2,605 square feet or more. Each intermediate square foot would increase the TIF by $3.56. The approach for each scenario is summarized in **Exhibit 7** below.

Exhibit 7: Scaled Residential TIF Calculations

Needs to be updated

North Area Aproach

TIF Schedule for a Single-Family Home	Square Feet	Residents	TIF
TIF per resident	738	1.0000	$4,534
TIF per square foot of single-family residence	1	0.0014	$6.14
Maximum SDC per single-family residence	2,605	3.5294	$16,001

South Area Aproach

TIF Schedule for a Single-Family Home	Square Feet	Residents	TIF
TIF per resident	738	1.0000	$1,132
TIF per square foot of single-family residence	1	0.0014	$1.53
Maximum SDC per single-family residence	2,605	3.5294	$3,994

Citywide Aproach

TIF Schedule for a Single-Family Home	Square Feet	Residents	TIF
TIF per resident	738	1.0000	$2,625
TIF per square foot of single-family residence	1	0.0014	$3.56
Maximum SDC per single-family residence	2,605	3.5294	$9,265

Source: ITE Manual, 11th Edition, and U.S. Census, American Community Survey, Portland-Vancouver MSA

The City can use the summary provided in **Exhibit 8** to generate a TIF schedule to be applied to both single-family and multi-family residential units based on their total square footage (SF). **Exhibit 8** provides an example of such a schedule where housing units are sorted into different SF ranges, with each range being assigned a SF for the purpose of calculating the TIF.

Exhibit 8: Scaled Single Family Residential TIF Schedule

Needs to be updated

Dwelling Floor Area (Sq. Ft.)	Uniform Citywide Alt.	Two District Alt.	
		North District	South District
< 1,000	$3,002	$5,184	$1,294
1,000-2,000	$4,890	$8,445	$2,108
2,001 to 2,605	$8,317	$14,364	$3,585
>2,606	$9,265	$16,001	$3,994

Source: Previous Tables

In addition to requirements for scaling laid out in RCW 82.02.060(1), state law also puts restrictions on the impact fees that can be charged to accessory dwelling units (ADUs). Per RCW 36.70A.681(a), the city may not assess impact fees on ADUs that are greater than 50 percent of the charge assessed to the principal or standard size dwelling unit. Therefore, if the City implements a scaling schedule as laid out in **Exhibit 8**, the City should also ensure that its code limits the charge for an ADU to 50 percent of the charge assessed to the principal dwelling unit.

APPENDIX A – PROJECT CAPACITY SHARE PERCENTAGES CALCULATED BY TRIP DISTRIBUTION

Needs to be updated

APPENDIX B – PROPOSED TIF RATE SCHEDULE: FY 2026

APPENDIX C - WASHINGTON REQUIREMENTS FOR FEES BY HOME SIZE

RCW 82.02.060

Impact fees—Local ordinances—Required provisions—Exemptions.

The local ordinance by which impact fees are imposed:

(1) Shall include a schedule of impact fees which shall be adopted for each type of development activity that is subject to impact fees, specifying the amount of the impact fee to be imposed for each type of system improvement. The schedule shall be based upon a formula or other method of calculating such impact fees. The schedule shall reflect the proportionate impact of new housing units, including multifamily and condominium units, based on the square footage, number of bedrooms, or trips generated, in the housing unit in order to produce a proportionally lower impact fee for smaller housing units. In determining proportionate share, the formula or other method of calculating impact fees shall incorporate, among other things, the following:

(a) The cost of public facilities necessitated by new development;

(b) An adjustment to the cost of the public facilities for past or future payments made or reasonably anticipated to be made by new development to pay for particular system improvements in the form of user fees, debt service payments, taxes, or other payments earmarked for or proratable to the particular system improvement;

(c) The availability of other means of funding public facility improvements;

(d) The cost of existing public facilities improvements; and

(e) The methods by which public facilities improvements were financed;

(2) May provide an exemption for low-income housing, and other development activities with broad public purposes, including development of an early learning facility, from these impact fees, provided that the impact fees for such development activity shall be paid from public funds other than impact fee accounts;

(3)(a) May not impose an impact fee on development activities of an early learning facility greater than that imposed on commercial retail or commercial office development activities that generate a similar number, volume, type, and duration of vehicle trips;

(b) When a facility or development has more than one use, the limitations in this subsection (3) or the exemption applicable to an early learning facility in subsections (2) and (4) of this section only apply to that portion that is developed as an early learning facility. The impact fee assessed on an early learning facility in such a development or facility may not exceed the least of the impact fees assessed on comparable businesses in the facility or development;

(4) May provide an exemption from impact fees for low-income housing or for early learning facilities. Local governments that grant exemptions for low-income housing or for early learning facilities under this subsection (4) may either: Grant a partial exemption of not more than eighty percent of impact fees, in which case there is no explicit requirement to pay the exempted portion of the fee from public funds other than impact fee accounts; or provide a full waiver, in which case the

remaining percentage of the exempted fee must be paid from public funds other than impact fee accounts, except as provided in (b) of this subsection. These exemptions are subject to the following requirements:

(a) An exemption for low-income housing granted under subsection (2) of this section or this subsection (4) must be conditioned upon requiring the developer to record a covenant that, except as provided otherwise by this subsection, prohibits using the property for any purpose other than for low-income housing. At a minimum, the covenant must address price restrictions and household income limits for the low-income housing, and that if the property is converted to a use other than for low-income housing, the property owner must pay the applicable impact fees in effect at the time of conversion;

(b) An exemption for early learning facilities granted under subsection (2) of this section or this subsection (4) may be a full waiver without an explicit requirement to pay the exempted portion of the fee from public funds other than impact fee accounts if the local government requires the developer to record a covenant that requires that at least 25 percent of the children and families using the early learning facility qualify for state subsidized child care, including early childhood education and assistance under chapter 43.216 RCW, and that provides that if the property is converted to a use other than for an early learning facility, the property owner must pay the applicable impact fees in effect at the time of conversion, and that also provides that if at no point during a calendar year does the early learning facility achieve the required percentage of children and families qualified for state subsidized child care using the early learning facility, the property owner must pay 20 percent of the impact fee that would have been imposed on the development had there not been an exemption within 90 days of the local government notifying the property owner of the breach, and any balance remaining thereafter shall be a lien on the property; and

(c) Covenants required by (a) and (b) of this subsection must be recorded with the applicable county auditor or recording officer. A local government granting an exemption under subsection (2) of this section or this subsection (4) for low-income housing or an early learning facility may not collect revenue lost through granting an exemption by increasing impact fees unrelated to the exemption. A school district who receives school impact fees must approve any exemption under subsection (2) of this section or this subsection (4);

(5) Shall provide a credit for the value of any dedication of land for, improvement to, or new construction of any system improvements provided by the developer, to facilities that are identified in the capital facilities plan and that are required by the county, city, or town as a condition of approving the development activity;

(6) Shall allow the county, city, or town imposing the impact fees to adjust the standard impact fee at the time the fee is imposed to consider unusual circumstances in specific cases to ensure that impact fees are imposed fairly;

(7) Shall include a provision for calculating the amount of the fee to be imposed on a particular development that permits consideration of studies and data submitted by the developer to adjust the amount of the fee;

(8) Shall establish one or more reasonable service areas within which it shall calculate and impose impact fees for various land use categories per unit of development;

(9) May provide for the imposition of an impact fee for system improvement costs previously incurred by a county, city, or town to the extent that new growth and development will be served by the previously constructed improvements provided such fee shall not be imposed to make up for any system improvement deficiencies; and

(10) Must adopt or amend by ordinance, and incorporate into their development regulations, zoning regulations, and other official controls the requirements of this section to take effect six months after the jurisdiction's next periodic comprehensive plan update required under RCW 36.70A.130.

For purposes of this section, "low-income housing" means housing with a monthly housing expense, that is no greater than thirty percent of eighty percent of the median family income adjusted for family size, for the county where the project is located, as reported by the United States department of housing and urban development.

For the purposes of this section, "early learning facility" has the same meaning as in RCW 43.31.565.