City Council Workshop Agenda
Tuesday, February 20, 2024, 4:30 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 observe the meeting (no public comment ability)
- go to www.cityofcamas.us/meetings and click "Watch Livestream" (left on page)

To participate in the meeting (able to public comment)
- go to https://us06web.zoom.us/j/87310065017
(public comments may be submitted to publiccomments@cityofcamas.us)

CALL TO ORDER

ROLL CALL

PUBLIC COMMENTS

WORKSHOP TOPICS

1. Community Chest Update
   Presenter: Joelle Scheldorf and Dave Pinkernell, Camas-Washougal Community Chest Board Members
   Time Estimate: 15 minutes

2. Clark County Property Tax Exemption Presentation
   Presenter: Holly Hill, Clark County Program Outreach Coordinator
   Time Estimate: 15 minutes

3. New Position Descriptions for the Public Works Department
   Presenter: Jennifer Gorsuch, Administrative Services Director and Steve Wall, Public Works Director
   Time Estimate: 10 minutes

4. Consider Accepting All of Updated Volume 1 and the Introduction, Appendices, and the Updated City's Portion of Volume 2 of the Clark Regional Natural Hazard Mitigation Plan.
   Presenter: Lauren Hollenbeck, Senior Planner
   Time Estimate: 10 minutes

5. City and Clark County Lacamas Watershed Management Draft Interlocal Agreement

Presenter: Steve Wall, Public Works Director
Time Estimate: 30 minutes

6. Draft Resolution 24-001 Creating a Regional Fire Protection Planning Committee
Presenter: Doug Quinn, City Administrator
Time Estimate: 5 minutes

7. Legacy Lands Master Plan – Greenworks Professional Services Agreement
Presenter: Trang Lam, Parks & Recreation Director
Time Estimate: 15 minutes

8. Staff Miscellaneous Updates
Presenter: Doug Quinn, City Administrator
Time Estimate: 10 minutes

COUNCIL COMMENTS AND REPORTS

PUBLIC COMMENTS

CLOSE OF MEETING

HELPING LOCAL CHARITIES THRIVE

CAMAS–WASHOUGAL
COMMUNITY CHEST

SINCE 1946

Who we are:

A philanthropic organization providing grants to local charitable organizations to improve the welfare of our community.

WHAT WE DO

We collect donations from individuals and businesses and distribute them to nonprofits providing services in our community. Enabling nonprofits to focus on their core competency of helping people in our community.

WHERE & WHY?

We advance the welfare of Camas & Washougal by funding grants across a range of needs:

- *poverty, hunger, homelessness*
- *schools and education*
- *health, welfare, special needs*
- *natural resource conservation*
- *crisis and emergency services*
- *civic, culture, arts, history*
- *diversity, equity, and inclusivity*

HELPING LOCAL CHARITIES THRIVE

Item 1.

WE HELPED THESE LOCAL NONPROFITS THRIVE:

- UNITE! Washougal Community Coalition
- ReFuel Washougal
- Inter-Faith Treasure House "Dedicated to helping those less fortunate"
- KOMAK Security and hope for people with cancer.
- REACH Community Development
- Silver Star Search and Rescue
- Journey theater arts group
- Clark County Historical Museum
- Washougal School District
- Camas School District
- the YMCA
- Friends of the Columbia Gorge
- Janus youth programs
- Meals on Wheels People
- Loaves & Fishes Centers
- Pathways Clinic
- TreeSong Nature Awareness and Retreat Center
- Lower Columbia Estuary Partnership
- WCGHS West Columbia Gorge Humane Society
- Family Promise of Clark County
- Boy Scouts of America Cascade Pacific Council
- Opera Quest Northwest
- FVRLibraries Fort Vancouver Regional Libraries
- Kiwanis Camp Wa-Ri-Ki
- Innovative Services NW
- Camas Farmer's Market
- East County Citizens' Alliance
- Parks Foundation of Clark County
- Since 1896
- Launch Money Indoor Skate Park
- General Federation of Women's Clubs Living the Volunteer Spirit
- Cascadia Tech Academy Inspiring Greatness
- Impact Camas-Washougal
- Children's Home Society of Washington
- pink lemonade project
- Lacamas Watershed Council
- Two Rivers Heritage Museum ...where history lives
- Kiwanis Camp Wa-Ri-Ki
- PAL Police Activities League
- Camas Parks & Recreation
- Adventure Camps Teen Reach TRAClife Mentoring Programs
- Dance Evolution Promoting Health & Wellness

Item 1.

Camas Principal's Checkbook & Washougal Principal's Checkbook

Funds to help students with financial need have access to activities, services, or materials necessary for a well-rounded, quality education.

Principals and teachers can pay for clothes, shoes, activity fees, head lice treatment, or emergency medical treatment deemed necessary by the school's principal to help ensure equitable education for students in need.

Item 1.

Inter-Faith Treasure House

Providing food for anyone who is hungry.

School weekend backpack programs.

Our grant pays IFTH's utility bills. We are keeping the lights on at the Treasure House!

CAMAS
FARMER'S MARKET

Produce Pals

Educating and inspiring children to grow, prepare, and eat healthy foods.

Our grant to ReFuel Washougal

ReFuel Washougal

Provided supplies for Friday to-go meals,

Heavy duty rain protection for those living outdoors

Rotary Foundation of Camas Washougal

Lower Columbia Estuary Partnership

Lower Columbia Estuary Partnership

Hands-on class-room science education plus outdoor field experience.

Kids learning to be Stewards of our community.

Our grant to IMPACT Camas-Washougal provided:

IMPACT Camas-Washougal

Grocery store gift cards & food boxes distributed to 161 Camas and Washougal families in need.

CWCC Board Members 2023-24

Mindy Schmidt – President	Richard Reiter – Campaign Chair
Dave Pinkernell – Governance Comm Chair	Marianne Reiter – Co-Treasurer
David Scott – Grant Committee chair	Cari Corbett – Secretary
Deanna Rusch – Past President	Stuart Bennett
Joelle Scheldorf	Susan Bennett – Co-Treasurer
John Spencer / Dave Ripp	Mary Templeton
Ann Stevens	Doug Quinn
Doug Hood	A.J. Bogue
Andrew Gustely	

Partnerships expanding our impact

Our continued partnership with the
Camas-Washougal Rotary Foundation
Made 6 additional grants totaling $15,000 in 2023

Our new partnership with the
Camas Lions Foundation
Made 1 additional grant for $5,000 in 2023.

Please support the Community Chest

In 2023, we received over $200K in grant applications and funded $140K.

C-W Community Chest has no paid employees and very low expenses. We have pledged to give back every dollar donated.

Over **97% of all donations** have gone directly back into the community. (The remaining 2-3% largely covers insurance and printing fees.)

Now is the time to donate:

via your **payroll deduction** plan

or at www.CamasWashougalCommunityChest.org/donate

Please help us get the word out to other organizations in our community.

Thank you for your ongoing support!

Item 1.

WE HELPED THESE LOCAL NONPROFITS THRIVE:

- UNITE! Washougal Community Coalition
- ReFuel Washougal
- Inter-Faith Treasure House "Dedicated to helping those less fortunate"
- KOMAK Security and hope for people with cancer.
- REACH Community Development
- Silver Star Search and Rescue
- Journey theater arts group
- Clark County Historical Museum
- Washougal School District
- Camas School District
- the YMCA
- Friends of the Columbia Gorge
- Janus youth programs
- Meals on Wheels People
- Loaves & Fishes Centers
- Lower Columbia Estuary Partnership
- WCGHS West Columbia Gorge Humane Society
- Family Promise of Clark County
- Pathways Clinic
- TreeSong Nature Awareness and Retreat Center
- Boy Scouts of America Cascade Pacific Council
- Opera Quest Northwest
- FVRLibraries Fort Vancouver Regional Libraries
- Camas Farmer's Market
- East County Citizens' Alliance
- Parks Foundation of Clark County
- Since 1896
- Kiwanis Camp Wa-Ri-Ki
- Innovative Services NW
- Lunch Money Indoor Skate Park
- General Federation of Women's Clubs Living the Volunteer Spirit
- Cascadia Tech Academy Inspiring Greatness
- Impact Camas-Washougal
- Children's Home Society of Washington
- pink lemonade project
- Lacamas Watershed Council
- Two Rivers Heritage Museum ...where history lives.
- Kiwanis Camp Wa-Ri-Ki
- PAL Police Activities League
- Camas Parks & Recreation
- Adventure Camps Teen Reach TRACfile Mentoring Programs
- Dance Evolution Promoting Health & Wellness

CAMAS–WASHOUGAL COMMUNITY CHEST

44 local nonprofits supported in 2022-2023

SINCE 19[obscured]

Back up slides

Our grant to
Fort Vancouver Library Foundation - Washougal

FVRLibraries
FORT VANCOUVER REGIONAL LIBRARIES

Funded summer reading program at Washougal Library. Toddler thru teens strengthened literacy skills.

Item 1.

Kiwanis Camp Wa-Ri-Ki

Outdoor Environmental Education.

Leadership skills.

Nature based kills.

Increased self esteem.

CAMAS–WASHOUGAL COMMUNITY CHEST

SINCE 19

GFWC - Camas-Washougal

General Federation of WOMEN'S CLUBS
Living the Volunteer Spirit

Reading books for kids.

Fine motor skills / sensory packets for pre-K children

Both Washougal and Camas School Districts.

East County Family Resource Center

Emergency basic assistance,
Parent education,
Youth support groups,
Behavioral health services,
Healthcare services,
Weekend backpack program

Property Tax Exemption

FOR SENIORS AND PERSONS WITH DISABILITIES

Clark County Assessor's Office
Assessment Services Team
12 February 2024

CLARK COUNTY WASHINGTON
ASSESSOR'S OFFICE

AGENDA

- Program Overview
- Qualifications and Eligibility
- Income Thresholds
- Income, explained
- Deductions, explained
- Required Documents
- How to Apply
- Conclusion/Contact
- Questions

CLARK COUNTY WASHINGTON
ASSESSOR'S OFFICE

OVERVIEW

Under the exemption program, the assessed value of your property is frozen (for tax purposes) and you may be eligible for a reduction in your property taxes. This could be worth thousands of dollars in savings and a lien will not be placed on the property. The program is retroactive, as applicants can apply for previous years to get a refund as well.

CLARK COUNTY WASHINGTON
ASSESSOR'S OFFICE

OVERVIEW

Washington State Program

- Administered by each county Assessor's office within WA state, with guidance from the Department of Revenue
- Rules of the program are set by State Legislature

Purpose

- Reduce property taxes for senior citizens and people with disabilities, allowing them to remain in their home despite increasing property taxes.

How it works

- Freezes the assessed value of the home and land
- Exempts taxpayers from paying excess levies and part 2 of the state school tax
- Reduces the taxable value of the property based on income
- No obligation for repayment, no lien on the property

Department of Revenue Washington State

CLARK COUNTY WASHINGTON
ASSESSOR'S OFFICE

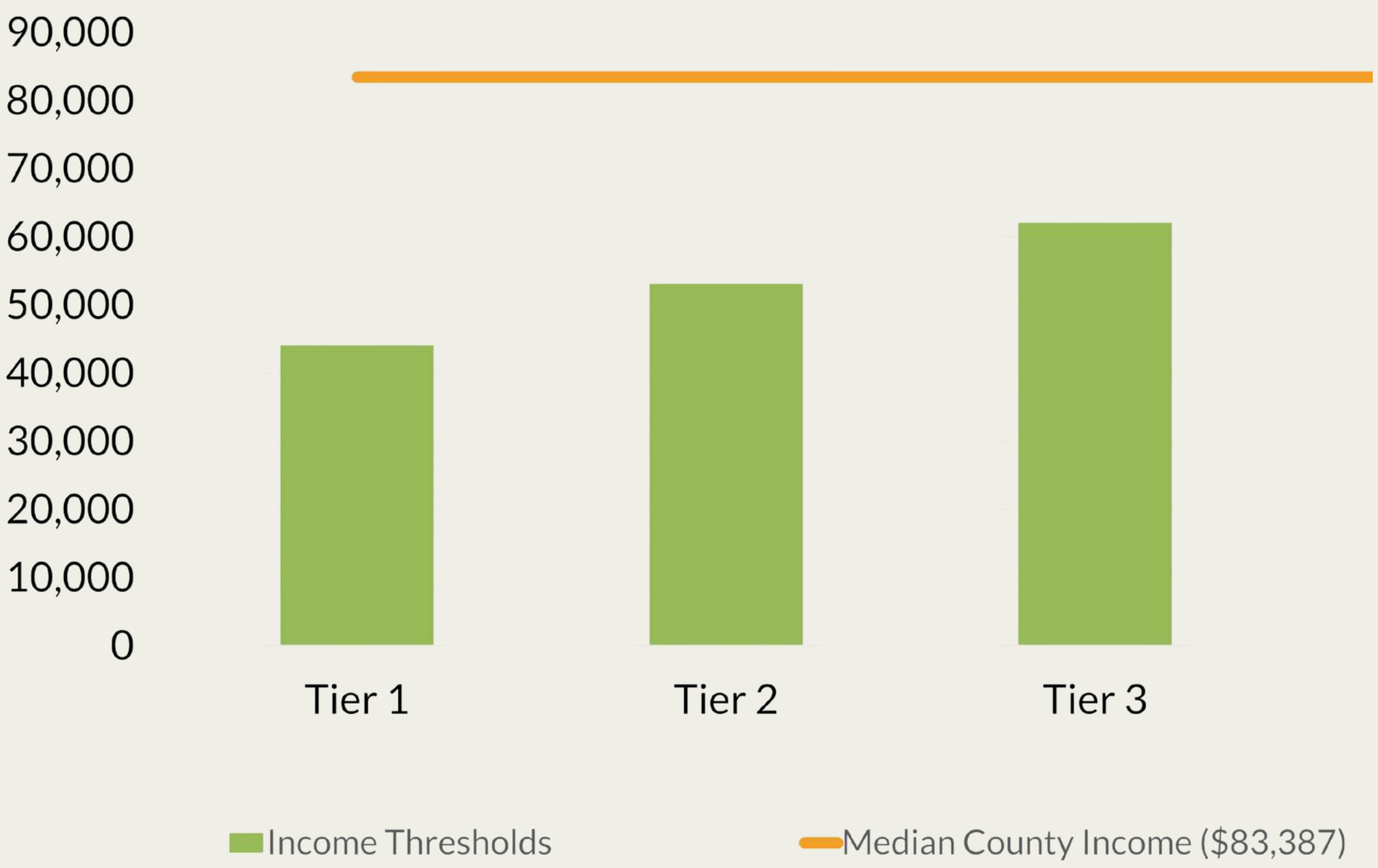
QUALIFICATIONS

To be eligible you must meet the following requirements on December 31st of the year before the tax is due.

- **Own the home by December 31 of the assessment year.**
- **Reside in the home as the primary residence for a minimum of 6 months each year.**
- **Must qualify based on either age (61+) or disability status.**
- **Household income must be below $62,000 (taxable and non-taxable income).**
- **Some medical expenses may be deducted from the calculation of household income.**

CLARK COUNTY WASHINGTON
ASSESSOR'S OFFICE

INCOME THRESHOLDS



TIER 1: 0 - 44,000

Exempt from paying regular property tax on whichever is greater: $60,000 or 60% of the assessed taxable value. Home and land value are frozen.

TIER 2: 44,001 - 53,000

Exempt from paying regular property tax on whichever is greater: $50,000 or 35% of the assessed taxable value. This may not exceed $70,000. Home and land value are frozen.

TIER 3: 53,001 - 62,000

Exempt from paying excess levies. Home and land value are frozen.

CLARK COUNTY WASHINGTON
ASSESSOR'S OFFICE

WHAT COUNTS AS INCOME?

Income includes:

- Taxable AND non-taxable household Income
- Unlike the IRS, items such as capital losses or depreciation are not deducted from income for purposes of this program.
- We use IRS documents, but WA DOR sets the regulations regarding which income we include and exclude

Income not included:

- Veteran Disability payments
- DSHS Payments
- Federal Stimulus Payments
- IRA Rollovers
- Reverse mortgages
- Must see documentation to support the income exclusion

CLARK COUNTY WASHINGTON
ASSESSOR'S OFFICE

WHAT COUNTS AS A DEDUCTION?

Deductions allowed prior to 2022

- Out-of-pocket prescription drug expenses
- Medicare premiums parts A,B,C and D
- Medicare Senior Advantage Insurance Premiums
- In Home Care expenses
- Nursing or Adult family home expenses

Deductions added 2022 forward

- Medical/ Mobility equipment expenses
- Long Term Care Insurance Premiums paid
- Health Insurance cost sharing out of pocket expenses
- Naturopathic treatments from Washington licensed naturopath
- Disposable medical supplies
- Prosthetic device expenses

CLARK COUNTY WASHINGTON
ASSESSOR'S OFFICE

REQUIRED DOCUMENTS

With application, please provide:

- Drivers License or State ID Card
- Disability Award Letter
- Complete Tax Return including all schedules (if filed)
- If you don't file taxes – provide all W2's and 1099's showing income
- Pension/Annuity 1099s
- Social Security 1099s
- Any expenses for allowed deductions

If applicable:

- Death Certificate for any owners
- Divorce Decree
- Copy of entire trust (with declaration of trust)

CLARK COUNTY WASHINGTON
ASSESSOR'S OFFICE

HOW TO APPLY

- **Online**: Clark.wa.gov/Assessor
- **Email**: taxreduction@clark.wa.gov
- **Mail**: Send to -

Senior Exemption
Clark County Assessor's Office
PO Box 5000
Vancouver WA 98666

Assessor's Office:

- 2nd floor of the Public Service Center
- Monday – Thursday 9:00am to 4:00pm
- Appointments available select days - call for more information
- 564-397-2391

Drop Box:

- Located at the Clark County Public Service Center
- 1300 Franklin St, First Floor
- Monday – Friday between the hours of 9:00am to 5:00pm

CLARK COUNTY WASHINGTON
ASSESSOR'S OFFICE

Thank you!

QUESTIONS?

Clark County Assessor's Office
Assessment Services Team
12 February 2024

CLARK COUNTY WASHINGTON
ASSESSOR'S OFFICE

OVERVIEW

Under the exemption program, the assessed value of your property is frozen (for tax purposes) and you may be eligible for a reduction in your property taxes. This could be worth thousands of dollars in savings for you and a lien will not be placed on your property. The program is retroactive, as applicants can apply for previous years to get a refund as well. Contact us and we will walk you through the process to determine your eligibility and the level of your exemption.

VISIT

1300 FRANKLIN ST,
PUBLIC SERVICE CENTER
2ND FLOOR

EMAIL

TAXREDUCTION@CLARK.WA.GOV

CALL

564.397.2391

WEBSITE

CLARK.WA.GOV/ASSESSOR

MAIL

CLARK COUNTY ASSESSOR'S OFFICE
P.O. BOX: 5000
VANCOUVER WA
98666-5000

CLARK COUNTY WASHINGTON
ASSESSOR'S OFFICE

2024 - 2026

PROPERTY TAX EXEMPTION FOR SENIOR CITIZENS AND PEOPLE WITH DISABILITIES

PROGRAM OVERVIEW

Public Service Center, 2nd Floor.
1300 Franklin St. Vancouver, WA 98660

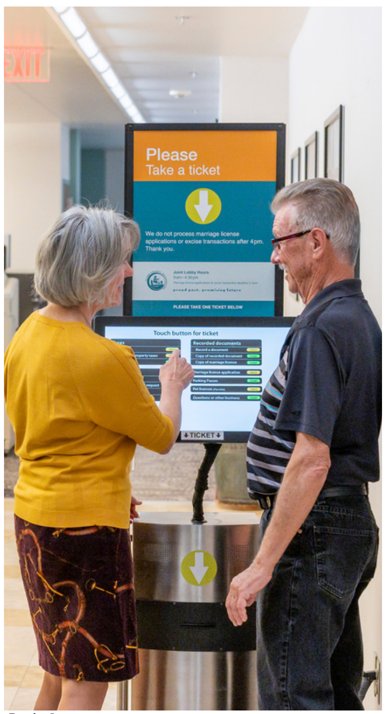
ELIGIBILITY

To be eligible, you must meet the following requirements on December 31 of the year before the taxes are due.

The requirements are determined by income, age or disability, residency, and ownership:

Income Requirement:
$62,000 or less

Age Requirement:
61+



Beth Conyers

Disability Requirement:
Unable to work due to disability OR a veteran entitled to and receiving compensation from the V.A. at an 80% disability rating for a service-connected disability

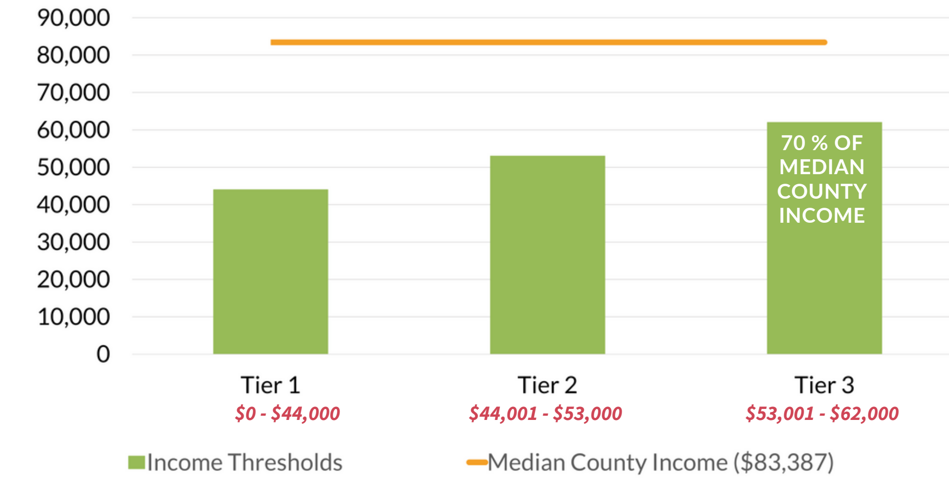
Residency:
You must reside in the home as your primary residence for a minimum of 6 months out of the year.

Ownership:
You must own your home by Dec. 31 of the assessment year.

For more information, visit clark.wa.gov/assessor

INCOME THRESHOLDS

Note: All income levels listed are for years 2024-2026.



Median county income is based off the most recent data from 2022. Our maximum income threshold is 70% of this number.

Tier 1: Exempt from paying regular property tax on whichever is greater: $60,000 or 60% of the assessed taxable value. Home and land value are frozen.

Tier 2: Exempt from paying regular property tax on whichever is greater: $50,000 or 35% of the assessed taxable value. This may not exceed $70,000. Home and land value are frozen.

Tier 3: Exempt from paying excess levies. Home and land value are frozen.

Household income is calculated using the combined disposable income earned during the application year for you, your spouse, your domestic partner, or/and any co-tenants.

Staff Report

February 20, 2024 Council Workshop

New Position Descriptions for the Public Works Department
Presenter: Jennifer Gorsuch, Administrative Services Director and Steve Wall, Public Works Director
Time Estimate: 10 minutes

Phone	Email
360.817.7013	jgorsuch@cityofcamas.us

BACKGROUND: On the March 4, 2024 Regular Meeting, there will be a resolution for creation of two new positions for the Public Works Department. The proposed positions of Cross-Connection Control Specialist and Laboratory Analyst would be in the AFSCME bargaining unit and staff have worked with the union on the position duties and proposed salaries and have reached agreement on both.

SUMMARY:
Both of these positions are included in the 2023-2024 budget.

Cross-Connection Control Specialist (CCCS)
The Center for Disease Control data indicates “cross-connection” deficiencies (areas where the public water supply is connected to a non-potable supply) account for approximately 50% of all water distribution-related waterborne disease outbreaks. In accordance with the Washington Administrative Code (WAC) 246-290-490, each water purveyor is required to have someone designated as a CCCS. The duties of a CCCS as defined by the WAC’s is to: develop, implement, and maintain a CCC program; assess the degree of hazard posed by the consumer’s water system; determine the appropriate backflow protection for each customer; inspect backflow assembly and air gap installations; develop and maintain CCC records; and to take corrective actions in the event of a backflow incident.

The City does not currently have a designated staff member responsible for cross-connection control and instead has relied on a variety of staff to fill the role as part of their regularly assigned duties. Given the number of Backflow Devices and potential cross connections in the system, the City has made it a priority to add a Cross-Connection Control Specialist.

Laboratory Analyst
This position will be a full-time position solely dedicated to managing the Wastewater Treatment Plant (WWTP) Lab and performing all testing, monitoring, and other lab duties to meet the requirements included in the City’s NPDES Permit.

The City does not currently have a designated staff member responsible for the lab and has instead relied upon the Operators to “take turns” completing lab duties at the WWTP.

The new Lab Analyst position will free up the operators to focus on their regular activities and put a much-needed single focus on completing lab activities, ordering supplies, and working with the WWTP Supervisor to use lab data to inform potential issues or concerns with WWTP operations.

BUDGET IMPACT: These positions were included in the 2023-2024 adopted budget and no additional funding is requested. Approximate total cost for salary and benefits for: CCCS = $100-110k and for Lab Analyst = $110-120k annually.

RECOMMENDATION: This is informational only. The resolution for position creation will be on the March 4, 2024, Council agenda for approval.

RESOLUTION NO. 24-002

A RESOLUTION adopting creation of new position descriptions within the Public Works Department.

BE IT RESOLVED BY THE COUNCIL OF THE CITY OF CAMAS AS FOLLOWS:

I

There is hereby created in the Public Works Department a new position entitled Cross-Connection Control Specialist. Such position shall be a union represented in the AFSCME bargaining unit and shall perform such duties as shall be outlined in any job description proscribed by the City, as may be revised from time to time. The position description and salary schedule are attached hereto as Exhibit “A” and shall be effective as of March 1, 2024.

II

There is hereby created in the Public Works Department a new position entitled Laboratory Analyst. Such position shall be a union represented in the AFSCME bargaining unit and shall perform such duties as shall be outlined in any job description proscribed by the City, as may be revised from time to time. The position description and salary schedule are attached hereto as Exhibit “B” and shall be effective as of March 1, 2024.

PASSED BY the Council and approved by the Mayor this 4th day of March, 2024.

SIGNED: ____
Mayor

ATTEST:____
Clerk

APPROVED as to form:

____
City Attorney

EXHIBIT A

CITY OF CAMAS
Union Status: Represented
January 2024

CROSS-CONNECTION CONTROL SPECIALIST

*Class specifications are intended to present a descriptive list of the range of duties performed by employees in the class. Specifications are **not** intended to reflect all duties performed within the job.*

JOB OBJECTIVES

Under general supervision this position performs a variety of work in support of the City's Cross-Connection inspection and backflow prevention control program as it relates to the Washington Administrative Code 246-292-033 (Duties of a Cross-Connection Control Specialist); conducts cross-connection control surveys and inspections; inspects, maintains, and repairs backflow devices owned by the City, in order to control, prevent, and eliminate contamination to the City water supply. Additionally, this position provides information and assistance to other departments, contractors, engineers, and the general public, and maintains a variety of records, files, and related documents. This position will fill in and back-up the Water Division employees when needed. This position works under the supervision of the Lead Utility Maintenance Worker (Water) and the Utilities Manager.

Employees within this class perform the full range of duties as assigned. Employees at this level receive only occasional instruction or assistance as new or unusual situations arise and are fully aware of the operating procedures and policies of the work unit. Work is normally reviewed only on completion and for overall results. Positions in this class require prior experience in water systems, customer service and backflow prevention practices.

ESSENTIAL FUNCTION STATEMENTS

The following tasks are typical for positions in this classification. Any single position may not perform all of these tasks and/or may perform similar related tasks not listed here:

Receive, investigate, review, trouble-shoot and respond to complaints on backflow prevention devices and other relevant issues related to the operation and maintenance of the City's water distribution system; resolve complaints in a timely and efficient manner.

Inspect, maintain, repair, and schedule testing for backflow prevention devices owned by and located within the City's distribution system.

Inspect and ensure new and previously installed backflow devices, both publicly and privately owned, are properly installed to protect against backflow, back-siphonage, and back pressure; ensure compliance with all regulations.

Notify customers of scheduled and required backflow testing.

Conduct cross-connection surveys and inspections of water user premises to identify where cross-connections are likely to occur and determine the degree of hazard; ensure conformance with federal, state, and local Cross-Connection regulations.

Maintain schedules for testing and/or replacement of obsolete or inefficient backflow prevention devices.

Conduct traffic control when working in high traffic areas of the City; install street barricades and cones prior to the performance of maintenance or repair activities; direct and control traffic around work sites.

Respond to inquiries from contractors, architects, engineers, customers and the public concerning the City and State rules and regulations regarding the cross-connection and backflow prevention control program; provide information within the area of assignment.

Prepare and maintain a variety of reports, correspondence, records, and files related to area of assignment including annual State required forms; enter data into computerized maintenance management system or other computer system.

Read maps and interpret plans, specifications, and maintenance manuals.

Turn off/on customer's water when customer is not in compliance.

Create and maintain a Cross-Connection Control Manual.

Observe safe work methods and safety precautions related to all work sites.

Perform special projects related to the area of assignment as assigned.

Fill-in and back-up water department in down time or in times of need.

AUXILIARY FUNCTION STATEMENTS

Follow all safety rules and procedures established for the work area.

Perform related duties and responsibilities as required.

QUALIFICATIONS

Knowledge of:

Washington Administrative Code 246-292-033 regarding the requirements for and duties of a Cross-Connection Control Specialist.

Operations, maintenance and general operation of a municipal water supply system and appurtenances.

Operations, services, and activities of a cross-connection control program.

Practices, principles, and techniques of cross-connections.

Procedures for inspection, installation, cleaning, repairing, and removing backflow prevention devices.

Methods and techniques of performing preventive maintenance including preventive maintenance inspection methods.

Methods and techniques of performing diagnostic troubleshooting services.

Basic legal requirements of cross-connections.

Backflow prevention testing regulations.

Water system piping and plumbing systems.

Principles and practices used in the identification of water user connections and locations where cross-connections are likely to occur, and the type of backflow prevention assembly required.

Tools and equipment used in area of assignment.

Pertinent safety principles and practices including working in confined spaces.

Practices and procedures of traffic control including proper placement of cones, barricades and warning devices.

Basic office procedures, methods, and equipment including computers.

Principles and practices of customer service.

Principles and procedures of record keeping and record retention.

Occupational hazards and standard safety procedures.

Pertinent federal, state, and local laws, codes, and regulations including City ordinances that pertain to water quality and county, state and federal water quality standards and regulations.

Ability to:

Perform a variety of skilled and complex work to inspect, install, repair, maintain, and schedule testing of City owned backflow prevention devices.

Evaluate the degree of potential health hazard to the public water supply that may be created as a result of conditions existing on a user's premises.

Interpret, apply, and enforce pertinent rules and regulations.

Interpret and explain cross-connection and water quality regulations.

Read, research, and reference various technical and regulatory methods and procedures.

Plan, organize and lay out work.

Read and interpret plans, maps, specifications, manuals, and drawings.

Use and operate vehicles and equipment, hand tools, and power tools and equipment required for the work in a safe and efficient manner.

Operate office equipment including computers and supporting software applications.

Ensure adherence to safe work practices and procedures including safety around work areas in high traffic.

Set up a safe work site including cones, signs and directing traffic.

Minimize public and employee safety hazards by conforming to required codes.

Successfully operate various software programs as required using computers or other types of handheld devices.

Maintain records including time, material, and equipment use records.

Exercise independent judgment and initiative without close supervision.

Take coaching, instruction, and feedback with a cooperative and positive attitude.

Understand and follow oral and written instructions.

Communicate clearly and concisely, both orally and in writing.

Establish and maintain cooperative working relationships with those contacted in the course of work, including the ability to interact effectively and courteously with the public, coworkers and vendors.

Education and Experience Guidelines
Any combination of education and experience that would likely provide the required knowledge and abilities is qualifying. A typical way to obtain the knowledge and abilities would be:

Education:

Equivalent to the completion of the twelfth grade supplemented by specialized training in water systems and in cross-connection inspection and backflow prevention.

Experience:

Three years of responsible experience in the operation and maintenance of water systems supplemented by demonstrable experience in the operation, maintenance, and inspection of backflow prevention devices and cross-connection control surveys.

License or Certificate:

Possession of an appropriate, valid driver's license.

Possession of a Backflow Assembly Tester Certificate issued by the Washington State Department of Health, or ability to obtain within 6 months.

Possession of a Water Distribution Manager 1 Certificate issued by the Washington State Department of Health.

Possession of a Cross-Connection Control Specialist Certificate issued by the Washington State Department of Health.

Possession of a Traffic Control Flagger Certificate.

PHYSICAL DEMANDS AND WORKING CONDITIONS

The physical demands herein are representative of those that must be met by an employee to successfully perform the essential functions of this job. Reasonable accommodations may be made to enable individuals with disabilities to perform these essential job functions.

Environment: Field environment; travel from site to site; exposure to noise, dust, grease, smoke, fumes, gases, inclement weather conditions, potentially hazardous chemicals.

Mobility: Heavy, moderate or light lifting; walking, standing or sitting for prolonged periods of time; operating motorized equipment and vehicles; performing heavy manual labor.

Vision: Visual acuity to operate assigned machinery and equipment.

Hearing: Auditory acuity to hear warning alarms or audible signs of equipment malfunction.

Other Factors: Incumbents may be required to work extended hours including evenings and weekends. Incumbents may be required to travel outside City boundaries to attend meetings.

2024 Salary Scale

Position	1	2	3	4	5	6	7
Cross-Connection Control Specialist	6202	6390	6581	6777	6984	7191	7407

EXHIBIT B

CITY OF CAMAS
Union Status: Represented
January 2024

LABORATORY ANALYST

*Class specifications are intended to present a descriptive list of the range of duties performed by employees in the class. Specifications are **not** intended to reflect all duties performed within the job.*

JOB OBJECTIVES

Under general direction, to operate and maintain the City's wastewater treatment plant laboratory and related equipment; to ensure compliance with National Pollution Discharges Elimination System (NPDES) permit sampling and analysis requirements; to perform sampling and highly complex and specialized chemical, physical, and biological testing on industrial, ambient, municipal wastewater, sludge and soil samples; to coordinate technical and procedural decisions within the lab; to provide specialized laboratory support including equipment oversite; and to repair, maintain and order laboratory supplies and equipment. This position works under the supervision of the Wastewater Treatment Plant (WWTP) Supervisor.

The Laboratory Analyst is a professional journey-level classification which performs varied and complex analyses. The position reports results of testing to plant operations staff for plant management and process control to ensure compliance with federal and state regulations regarding effluent, biosolids handling, and surface water management. The Laboratory Analyst may train other plant personnel in specific laboratory operations and has lead responsibility for the Lab. The Laboratory Analyst may also be asked to assist with maintenance responsibilities when necessary or deemed appropriate by the WWTP Supervisor.

ESSENTIAL FUNCTION STATEMENTS

The following tasks are typical for positions in this classification. Any single position may not perform all of these tasks and/or may perform similar related tasks not listed here:

Works directly with the WWTP Supervisor to coordinate goals, objectives, facility performance and appearance; enhances efficiencies with the collection, preservation, and analyzation of samples from industrial, wastewater treatment plant, ambient, storm water, sludge, and soil locations; and makes recommendations and assists the Supervisor in implementing process changes.

Analyzes water, wastewater, industrial waste, and biosolids samples for BOD, COD, oxygen demand, suspended solids, alkalinity, coliform bacteria, pH, nutrient levels, metals content, and other counts in accordance with standards of Federal, State and local agencies and QA/QC standards; prepares chemical and bacteriological media, stains, reagents and test solutions routinely used in the laboratory.

Prepares samples for testing using digestion and/or chemical reagents; conducts complex laboratory tests using a wide variety of equipment to determine concentrations of metals or other hazardous materials.

Conducts field inspections and assessments; reviews and evaluates delineations, mitigation and enhancement plans as they related to water quality needs and standards; validates and interprets laboratory test results; provides technical advice and recommendations on an as needed basis.

Performs special chemical and technical studies as required for quality control standards; oversees quality control programs including statistical reports, analytical methods, data recordkeeping, instrument calibration and certification, reagents preparation and standardization; maintains all complex quality assurance/control work.

Establishes schedules to meet daily analytical and sampling needs, adjusts schedules in response to events, adjusts schedules as needed to accomplish assigned tasks.

Communicates regularly with department staff and provides input on unit process optimization, housekeeping, laboratory facility area operations, and safety; provides feedback to Supervisor from staff with concerns and suggestions.

Plans, organizes, develops, and provides mentoring and training on laboratory processes, sampling, and data review; provides technical guidance; coordinates laboratory training.

Records results of analyses for compilation into test reports which are subsequently filed with state and federal water quality agencies; uses test results to calculate complex statistical reports and trending for process control.

Trains and/or leads preparatory and analytical laboratory work; serves as a reference and provides technical assistance to project managers and other personnel.

Ensures compliance with safety procedures and regulations; inspects laboratory and related facilities for hazardous conditions and initiates corrective measures as necessary.

Maintains, cleans, and makes minor repairs on laboratory apparatus and equipment and ensures a high standard of housekeeping, quality control and safety; calibrates instrumentation as assigned.

Performs trace contaminant analysis using laboratory instrumentation. Assists in investigative analysis to support process control measures.

Assists with developing Standard Operating Procedures (SOP's) for new methods.

May assist with maintenance responsibilities throughout the WWTP.

Immediately informs WWTP Supervisor of any personnel, equipment, instrument and material problems and SOP or methodology deviations; responds to and documents any necessary corrective action.

AUXILIARY FUNCTION STATEMENTS

Follow all safety rules and procedures established for the work area.

Perform related duties and responsibilities as required.

QUALIFICATIONS

Knowledge of:

Operating parameters of complex laboratory equipment.

Laboratory procedures, methods and techniques used in standardized sampling, preservation, examination, testing, and analysis of water and wastewater samples.

Laboratory safety procedures including management of chemical and biological hazards.

Principles of standard chemical, biological, microscopic, and microbiological examination techniques.

General knowledge and principles of operations and maintenance of a wastewater treatment plant.

Operation and maintenance of analytic instrumentation and other laboratory equipment; statistical methodologies to collect, analyze and evaluate data and perform short term studies on industrial waste, surface water, wastewater, and biosolids.

Laboratory procedures, methods and techniques used in standardized sampling, examination, testing, and analysis of water and wastewater samples.

Laboratory safety procedures including management of chemical and biological hazards.

Principles of quality control.

Principles and concepts of working in teams.

Sampling and sample preparation techniques.

Mathematics with strong emphasis in algebra

English grammar, spelling, and punctuation.

Computer applications in wastewater treatment.

Procedures for examination of water and wastewater.

Water biology, bacteriology and bioassay as applied to the examination and analysis of water and wastewater.

Qualitative and quantitative analytical chemistry including instrumental methods.

Principles and practices of record keeping.

Occupational hazards and standard safety precautions.

Pertinent Federal, State, and local laws, codes, and regulations.

Ability to:

Operate complex analytical laboratory instrumentation.

Perform complex and precise physical, chemical, and biological analytical tests and procedures; recognize deviations from normal sampling and analysis conditions.

Interpret and explain laboratory methods, processes, and procedures.

Use computers and software for word processing, spreadsheets, data collection and database management.

Establish and maintain cooperative and effective working relationships with those contacted in the course of work including a variety of City and other government officials and the public; operate effectively in a team environment.

Communicate clearly and concisely, both orally and in writing.

Use measurement systems, mathematics, and formulas of analytical chemistry.

Operate standard and complex analytical laboratory /instrumentation equipment,

Prepare reagents and solutions.

Use proper methods for cleaning and sterilizing laboratory equipment.

Read and interpret federal and state water quality regulations.

Comply with established laboratory testing programs.

Read, analyze, and utilize complex formulas, charts, and directions.

Prepare comprehensive technical written reports.

Plan improvements in standard laboratory methods.

Prepare and maintain accurate records.

Use appropriate procedures for testing, interpreting, and reporting laboratory findings with a high degree of accuracy and precision ensuring quality control.

Carry out established laboratory testing programs.

Clean lab glassware, dishes, and equipment.

Understand and follow oral and written directions.

Education and Experience Guidelines

Any combination of education and experience that would likely provide the required knowledge and abilities is qualifying. A typical way to obtain the knowledge and abilities would be:

Education:

Equivalent to a Bachelor's degree in Chemistry or related field of natural science with heavy emphasis in chemistry is preferred.

Experience:

Five (5) years total with a minimum of three (3) years experieince in a wastewater treatment plant laboratory supplemented by two (2) additional years of environmental or field experience in areas such as microbiology, biology and chemistry.

License or Certificate

Possession of a valid driver's license.

Possession of a Washington State Group 1 Operator in Training or other Operator Certificate, preferred.

PHYSICAL DEMANDS AND WORKING CONDITIONS

The physical demands herein are representative of those that must be met by an employee to successfully perform the essential functions of this job. Reasonable accommodations may be made to enable individuals with disabilities to perform these essential job functions.

Environment: Work is primarily performed indoors within an office or laboratory setting. Will spend some time outdoors and exposed to inclement weather. Exposure to bacteria, viruses and toxic material in wastewater, and handling chemicals and bacteriological waste matter.

Mobility: Heavy, moderate, or light lifting; walking, standing, or sitting for prolonged periods of time; operating motorized equipment and vehicles. Frequent standing, squatting, and bending. Ability to lift up to 45 pounds. Will routinely carry, push, and pull objects.

Vision: Visual acuity to operate assigned laboratory equipment.

Hearing: Auditory acuity to hear warning alarms, timers, and/or audible signs of equipment malfunction.

Other Factors: May be exposed to possible operations hazards including fumes, airborne particles, and noise, rotating machinery, high pressure, hot and cold temperatures, slippery surfaces, water, and electrical hazards. Frequently exposed to toxic and caustic chemicals. Incumbents may be required to work extended hours including evenings and weekends and may be required to travel outside City boundaries to attend meetings.

2024 Salary Scale

Position	1	2	3	4	5	6	7
Laboratory Analyst	6581	6777	6984	7191	7407	7629	7859

Staff Report

February 20, 2024, Council Workshop Meeting

Consider Accepting All of Updated Volume 1 and the Introduction, Appendices, and the Updated City's Portion of Volume 2 of the Clark Regional Natural Hazard Mitigation Plan.
Presenter: Lauren Hollenbeck, Senior Planner
Time Estimate: 10 minutes

Phone	Email
360.817.1568	lhollenbeck@cityofcamas.us

BACKGROUND: In 2004, Clark County and a partnership of local governments within the County, led by Clark Regional Emergency Management Services (CRESA), developed a countywide hazard mitigation plan to reduce risks from natural disasters. The result of this effort was a Federal Emergency Management Agency (FEMA) approved multi-jurisdictional, multi-hazard mitigation plan (a.k.a Clark Regional Natural Hazard Mitigation Plan – CRNHMP) that met federal mandates in the Disaster Mitigation Act of 2000 (Public Law 106-390) and established eligibility for hazard mitigation project funding under the unified hazard mitigation assistance grant program, which provides pre- and post-disaster grant funding opportunities.

Federal regulations require periodic updates to hazard mitigation plans. Accordingly, in 2017, a comprehensive update to the initial CRNHMP was adopted by each jurisdictional planning partner, including the City of Camas, and subsequently approved by FEMA.

The current update was enacted in 2022 to build upon the previous comprehensive update. However, the plan update was delayed due to the COVD-19 pandemic, which limited the planning partner's available time and staffing to work on the update. Therefore, the current update was minimal and focused on updating the hazard analysis with updated/new information and data including the jurisdictional annexes.

SUMMARY: Additional information will be presented during the meeting.

BENEFITS TO THE COMMUNITY: Upon City adoption of the updated CRNHMP, federal grant mitigation assistance funding will be made available that can be used to implement the long-term hazard mitigation measures specified within the City's annex of the CRNHMP before and after a major disaster declaration. The CRNHMP is considered a living document such that, as awareness of additional hazards develops and new strategies and projects are conceived to offset or prevent losses due to natural disasters, the CRNHMP will be evaluated and revised on a continual 5-year time frame for grant funding assistance eligibility.

POTENTIAL CHALLENGES: Natural hazards will continue to impact residents, property, the environment, and the economy. As a result, ongoing analysis of recommended mitigation strategies is necessary in response to mitigating the impacts of those natural hazards.

BUDGET IMPACT: An adopted hazard mitigation plan secures the eligibility for hazard mitigation project funding under the unified hazard mitigation assistance federal grant programs. There is no budget impact with the adoption of this plan.

RECOMMENDATION: Staff recommends that Council consider adoption of a resolution of all of Volume 1 and the Introduction, Appendices and the City's portion of Volume 2 of the Clark Regional Hazard Mitigation Plan at the March 4, 2024, Regular Council Meeting.

2.1.2 Federal Eligibility

Federal planning requirements stipulate that hazard mitigation plans must present a schedule for monitoring, evaluating, and updating the plan. A jurisdiction covered by a plan that has expired is not able to pursue elements of federal funding for which a current hazard mitigation plan is a prerequisite. The schedule for updating the plan in the 2004 effort was not followed, and that plan expired in 2009. 11 years passed since the initial planning effort, and coverage has lapsed from 2009 until the updated plan was approved in 2017. During the 2017 plan update, CRESA committed to maintaining this plan in accordance with federal requirements on behalf of the Clark regional hazard mitigation planning partnership that has committed to this process. The current update is being completed in compliance of federal expectations.

2.2 THE UPDATED PLAN—WHAT IS DIFFERENT?

The 2023 plan update was a challenge due to the kickoff being pushed back due to the COVID-19 Pandemic. The pandemic also limited the planning partner's available time and staffing to work on the mitigation plan update. To respect our partner's ability to complete the plan, we kept the plan update fairly simple and did not make changes to the structure of the plan. The mitigation plan update focused on updating the hazard analysis with updated/new information and data, as well as updating the jurisdictional annexes. We also added 2 new partners into the planning process, but lost one along the way.

Table 2-1 indicates the major changes between the two plans as they relate to 44 CFR planning requirements.

Table 2-1. Plan Changes Crosswalk

44 CFR Requirement	Previous Plan	Updated Plan
§201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval; (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.	The plan update was facilitated through a Steering Committee made up of stakeholders within the planning area. The Steering Committee was responsible for review of relevant plans and programs, review and identification of goals and objectives, confirmation of a public involvement strategy, development of a plan implementation and maintenance strategy, and review and approval of the draft plan. All Steering Committee meetings were open to the public. Additional public input was received through several public events early and late in the planning process and through a public survey. A 30-day public comment period was held before the draft plan was submitted for review. Agency coordination occurred through several avenues including the development of the risk assessment, monthly updates on plan progress distributed to a mailing list, attendance at steering committee meetings, the composition of the Steering Committee and the dissemination of the draft plan for public comment.	The plan update was facilitated through a Planning Team made up of representatives within the planning area. The Planning Team was responsible for review of relevant plans and programs, review and identification of goals and objectives, confirmation of a public involvement strategy, development of a plan implementation and maintenance strategy, and review and approval of the draft plan. Public input was received through release of a public feedback draft and social media updates. Due to limited outreach events stemming from the COVID-19 Pandemic, most outreach was conducted virtually. A 30-day public comment period was held before the draft plan was submitted for review. Agency coordination occurred through several avenues including the development of the risk assessment through a collaborative virtual platform, attendance at planning team meetings, and the dissemination of the draft plan for public comment.
§201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.	A comprehensive risk assessment for the planning area that looks at 8 natural hazards of concern: dam failure, drought, earthquake, flood, landslide, severe weather, volcanic hazards, and wildfire. This assessment used the best available data and science with the Hazus-MH (version 2.2) risk assessment software and GIS analysis.	Time and funding limitations prevented a full Hazus-MH risk assessment from being completed, but information was updated where relevant new data was available. All relevant data tables and figures were updated to include the most up-to-date information. Additionally, information from the Portland-Vancouver Metro Area's Enhanced Earthquake Analysis was included in the analysis.
§201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.	Comprehensive risk assessments of each hazard of concern are presented in Chapters 7 through 14. Each chapter includes the following: • Hazard profile, including maps of extent and location, historical occurrences, frequency, severity and warning time • Secondary hazards • Exposure of people, property, critical facilities and environment • Vulnerability of people, property, critical facilities and natural environment • Future trends • Scenarios • Issues. Each hazard is compared to each other via a risk ranking methodology described in Chapter 15.	Comprehensive risk assessments of each hazard of concern are presented in Chapters 7 through 14. Each chapter includes the following: • Hazard profile, including maps of extent and location, historical occurrences, frequency, severity and warning time • Secondary hazards • Exposure of people, property, critical facilities and environment • Vulnerability of people, property, critical facilities and natural environment • Future trends • Scenarios • Issues. Each hazard is compared to each other via a risk ranking methodology described in Chapter 15.

44 CFR Requirement	Previous Plan	Updated Plan
§201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i). This description shall include an overall summary of each hazard and its impact on the community	Vulnerability was assessed for all hazards of concern. The Hazus-MH computer model was used for the dam failure, earthquake, and flood hazards. These were Level-2 (user-defined) analyses using coordinating agency and County data. Critical facilities and assets were defined and inventoried using the Hazus Comprehensive Data Management System and other available datasets. Outputs were generated for other hazards by applying an estimated damage function to affected assets when available. The asset inventory was extracted from the Hazus-MH model. Best available data were used for all analyses.	The current plan utilizes the information from the 2016 hazard analysis and provide updated data/information as supplement to the previous needs.
§201.6(c)(2)(ii): [The risk assessment] must also address National Flood Insurance Program insured structures that have been repetitively damaged floods	The description of the National Flood Insurance Program and repetitive loss discussion was enhanced to meet new DMA and CRS planning requirements. The update includes an analysis of repetitive loss properties. For these properties the type of structure was determined and likely causes of flooding were cited, and the information was reflected on maps. National Flood Insurance Program capability is also assessed for each jurisdiction in Volume II.	The repetitive loss properties were updated to include losses between the previous plan and the current.
§201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.	A complete inventory of the numbers and types of buildings exposed was generated for each hazard of concern. The Steering Committee defined "critical facilities" as they pertained to the planning area, and these facilities were inventoried. Each hazard chapter provides a discussion of future development trends as they pertain to the hazard.	Future development numbers were updated to the best of the ability. Limited changes have been made to the comprehensive growth plan since the last update. The current growth plan is current through 2035. Estimates were updated where data allowed.
§201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) and a description of the methodology used to prepare the estimate.	Dollar loss estimations were generated for all hazards of concern likely to impact property. These were generated by Hazus for the dam failure, earthquake, and flood. For the other hazards, loss estimates were generated by applying a regionally relevant damage function to the exposed inventory. In all cases, a damage function was applied to an asset inventory. The asset inventory was the same for all hazards and was generated in the Hazus-MH model.	Funding and time constraints prevented running a full comprehensive vulnerability assessment. While there has been development and inflation since the 2016 plan was completed, the estimates from the 2016 Hazus-MH analysis were used for this update, with the understanding that a full analysis will need to be run for the next mitigation plan update.

44 CFR Requirement	Previous Plan	Updated Plan
§201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.	There is a discussion on future development trends as they pertain to each hazard of concern. This discussion looks predominantly at the existing land use and the current regulatory environment that dictates this land use and also includes information on vacant buildable lands where feasible.	There is a discussion on future development trends as they pertain to each hazard of concern. This discussion looks predominantly at the existing land use and the current regulatory environment that dictates this land use and also includes information on vacant buildable lands where feasible.
§201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.	Risk assessment results were generated for each planning partner to support the concept of risk ranking, which was performed by each planning partner. Risk ranking was used by each planning partner to provide vision and focus to action plan development.	Risk assessment results were generated for each planning partner to support the concept of risk ranking, which was performed by each planning partner. Risk ranking was used by each planning partner to provide vision and focus to action plan development
§201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.	Action plans were developed for each planning partner via a facilitated process that includes: • Risk ranking • Capability assessment • Action alternative review • Action selection • Action prioritization • Action category analysis	Action plans were developed for each planning partner via a facilitated process that includes: • Risk ranking • Capability assessment • Action alternative review • Action selection • Action prioritization • Action category analysis
§201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.	The plan update identifies a purpose, 6 goals and 12 objectives. Goals were selected that support the purpose, objectives were selected that meet multiple goals, and actions were selected and prioritized based on meeting multiple objectives.	The plan update identifies a purpose, 6 goals and 12 objectives. Goals were selected that support the purpose, objectives were selected that meet multiple goals, and actions were selected and prioritized based on meeting multiple objectives.
§201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.	A hazard mitigation best practices catalog was developed through a facilitated process that looks at strengths, weaknesses, obstacles and opportunities in the planning area. This catalog identifies actions that manipulate the hazard, reduce exposure to the hazard, reduce vulnerability, and increase mitigation capability. The catalog further segregates actions by scale of implementation. A table in the action plan section analyzes each action by mitigation type to illustrate the range of actions selected.	A hazard mitigation best practices catalog was developed through a facilitated process that looks at strengths, weaknesses, obstacles and opportunities in the planning area. This catalog identifies actions that manipulate the hazard, reduce exposure to the hazard, reduce vulnerability, and increase mitigation capability. The catalog further segregates actions by scale of implementation. A table in the action plan section analyzes each action by mitigation type to illustrate the range of actions selected.
§201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program, and continued compliance with the program's requirements, as appropriate.	All municipal planning partners were asked to assess National Flood Insurance Program capability in their jurisdictional annexes. All participating communities have identified actions supporting continued compliance and good standing under the program.	All municipal planning partners were asked to assess National Flood Insurance Program capability in their jurisdictional annexes. All participating communities have identified actions supporting continued compliance and good standing under the program.

44 CFR Requirement	Previous Plan	Updated Plan
§201.6(c)(3)(iii): [The mitigation strategy shall describe] how the actions identified in Section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.	Each of the recommended actions is prioritized using a qualitative methodology that looked at the objectives the project will meet, the timeline for completion, how the project will be funded, the impact of the project, the benefits of the project and the costs of the project. This prioritization scheme is detailed in Chapter 18.	Each of the recommended actions is prioritized using a qualitative methodology that looked at the objectives the project will meet, the timeline for completion, how the project will be funded, the impact of the project, the benefits of the project and the costs of the project. This prioritization scheme is detailed in Chapter 18.
§201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.	A detailed plan maintenance strategy is provided that includes the following: • Annual review and progress reporting • Defined role for Steering Committee • Plan update triggers • Plan incorporation guidelines • Strategy for continuing public involvement • Grant coordination protocol	A detailed plan maintenance strategy is provided that includes the following: • Annual review and progress reporting • Defined role for Steering Committee • Plan update triggers • Plan incorporation guidelines • Strategy for continuing public involvement • Grant coordination protocol
§201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.	This is included in the detailed plan maintenance strategy and also discussed in each jurisdictional annex.	This is included in the detailed plan maintenance strategy and also discussed in each jurisdictional annex.
§201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.	This is included in the detailed plan maintenance strategy.	This is included in the detailed plan maintenance strategy.
§201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commission, Tribal Council).	17 planning partners will seek DMA compliance for this plan. Appendix G contains the resolutions of all planning partners that adopted this plan	

Clark Regional Emergency Services Agency

Clark Regional Natural Hazard Mitigation Plan
Volume 1—Planning Area-Wide Elements

Approved: March 31, 2023

March 31, 2023

Clark Regional Natural Hazard Mitigation Plan: Volume 1—Planning Area-Wide Elements

March 31, 2023

PREPARED BY

Clark Regional Emergency Services Agency
710 W. 13th Street
Vancouver, WA 98660

CONTENTS

Appendices

Tables

Figures

ACKNOWLEDGMENTS

Project Manager

Dakota Karlsen
Emergency Management Coordinator
Clark Regional Emergency Services Agency
710 W 13th Street
Vancouver, WA 98660
360-992-6271
dakota.karlsen@clark.wa.gov

Planning Committee

The dedication of the Planning Committee members who graciously allocated their time to this process is greatly appreciated.

- Chad Eiken
- Cheri Dailey
- Chris Griffith
- Chrystal Jones
- Dameon Pesanti
- Donna Willis
- Gene Juve
- Heath Henderson
- Jason Mansfield
- Lauren Hollenbeck
- Lee Knottnerus
- Maria Swinger-Inskeep
- Mark Herceg
- Melissa Tracy
- Mike Lewis
- Mitch Kneipp
- Nathan McCann
- Nicole Daltoso
- Robert Maul
- Ryan Jeynes
- Scott Duetsch
- Scott Ouchi
- Shane Gardner
- Shawn Moore
- Stephanie Fields
- Todd Krout
- Tracy Coleman

Special Acknowledgements

The development of this plan would not have been possible without the dedication and commitment to this process by the planning committee members, the planning partnership, local residents and coordinating stakeholders. All who participated in the public process are commended for their participation and contributions to this planning process.

EXECUTIVE SUMMARY

Hazard mitigation is the use of long-term and short-term policies, programs, projects, and other activities to alleviate the death, injury, and property damage that can result from a disaster. Clark County and a partnership of local governments within the County, led by Clark Regional Emergency Management Services (CRESA), have developed a countywide hazard mitigation plan to reduce risks from natural disasters. The plan complies with hazard mitigation planning requirements to establish eligibility for funding under Federal Emergency Management Agency grant programs.

PREVIOUS HAZARD MITIGATION PLANNING IN CLARK COUNTY

Federal regulations require periodic updates of hazard mitigation plans to reevaluate recommendations, monitor the impacts of actions that have been accomplished, and determine if there is a need to change the focus of mitigation strategies. A jurisdiction covered by a plan that has expired is no longer in compliance with the federal requirements for hazard mitigation planning.

Clark County and its seven cities prepared an initial hazard mitigation plan that was approved by the Federal Emergency Management Agency in 2004. In 2016, a comprehensive update to the initial plan was enacted to reestablish grant eligibility for the original planning partnership and to expand eligibility to participating special purpose districts and the City of Woodland. Planning partners who participated in the initial planning effort made efforts to reconcile the status of actions identified in the 2004 plan to the best of their abilities. Due to the significant amount of time that has passed since initial development and other factors such as staff turnover, not all action items were able to be reconciled. Through this planning effort, the planning partnership, led by CRESA, had recommitted to establishing implementation and maintenance processes that will be followed over the performance period of the 2016 plan. A hazard mitigation working group has been established that would meet to coordinate efforts and conduct updates.

In 2022, the current update was enacted to build upon the previous comprehensive update and update the plan with new data, new partners, and updated annexes. The COVID-19 pandemic required the process to go virtual, and coordination was conducted utilizing online platforms. Participating planning partners are listed in Tables ES-1 and ES-2. Eighteen local governments are seeking Disaster Mitigation Act compliance through this planning effort.

Table ES-1-1. Municipal Planning Partners

Jurisdiction	Point of Contact	Title	Jurisdiction	Point of Contact	Title
Clark County	Mike Lewis	Emergency Manager	City of Vancouver	Gene Juve	Emergency Manager
City of Battle Ground	Mark Herceg	Public Works Director	City of Washougal	Mitch Kneipp	Community Development Director
City of Camas	Lauren Hollenbeck	Senior Planner	City of Ridgefield	Lee Knottnerus	Deputy City Manager

Jurisdiction	Point of Contact	Title	Jurisdiction	Point of Contact	Title
City of La Center	Maria Swinger-Inskeep	Director of Administrative Services	Town of Yacolt	Stephanie Fields	Town Clerk

Table ES-1-2. Special Purpose District Planning Partners

Jurisdiction	Point of Contact	Title	Jurisdiction	Point of Contact	Title
Fire District 3	Jason Mansfield	Division Chief	Ridgefield School District	Chris Griffith	Assistant Superintendent
Port of Vancouver	Scott Ouchi	Emergency Manager	Clark Public Utilities	Chrystal Jones	Emergency & Environmental Coordinator
Battle Ground Public Schools	Cheri Dailey	Director of Business & Risk Management	Clark Regional Wastewater District	Shawn Moore	District Engineer
Evergreen Public Schools	Shane Gardner	Director of Safety & Security	C-TRAN	Scott Deutsch	Director of Safety & Risk
Vancouver Public Schools	Nicole Daltoso	Senior Director of Capital Facilities			

PLAN UPDATE PROCESS

Updating the plan consisted of the following phases:

- **Phase 1, Organize Resources**—A planning team was assembled for the plan update, consisting of staff from CRESA and representatives from each of the 18 planning partners. The team conducted outreach to establish the planning partnership. A 18-member planning team was assembled to oversee the plan update. Coordination with other local, state and federal agencies involved in hazard mitigation occurred throughout the plan update process. This phase included a review of the existing plan, the Washington State Hazard Mitigation Plan, and existing programs that may support hazard mitigation actions.
- **Phase 2, Update Goals, Objectives and Actions**—The Planning Team reviewed and updated the goals and objectives from the 2016 plan. The planning partnership selected a range of appropriate mitigation actions to work toward achieving the goals set forth in this plan update. Additionally, the Steering Committee selected a set of county-wide mitigation actions.
- **Phase 3, Develop Plan Implementation and Maintenance Strategy**—The Planning Team developed a plan implementation and maintenance strategy that includes the establishment of a hazard mitigation working group, annual progress reporting, a strategy for continued public involvement, a commitment to plan integration with other relevant plans and programs, and a recommitment from the planning partnership to actively maintain the plan over the five-year performance period.
- **Phase 4, Assemble the Updated Plan**—The Planning Team assembled a document to meet federal hazard mitigation planning requirements for all partners. The updated plan contains two volumes. Volume 1 contains components that apply to all partners and the broader planning area. Volume 2 contains all components that are jurisdiction-specific. Each planning partner has a dedicated annex in Volume 2.

- **Phase 5, Plan Adoption/Implementation**—Once pre-adoption approval has been granted by Washington State's Emergency Management Division and FEMA Region X, the final adoption phase will begin. Each planning partner will individually adopt the updated plan.

Phase 6, Plan Implementation, will occur over the next five years as the planning partnership begins to implement the county-wide and jurisdiction specific actions identified in this plan.

RISK ASSESSMENT RESULTS

Based on the risk assessment, hazards were ranked as follows for the risk they pose to the overall planning area as shown in Table ES-3.

Table ES-1-3. Hazard Risk Ranking

Hazard Ranking	Hazard Event	Category
1	Earthquake	High
1	Severe weather	High
2	Flood	Medium
2	Landslide	Medium
2	Wildfire	Medium
3	Volcano	Low
4	Drought	Low
5	Dam failure	Low

Each planning partner also ranked hazards for its own area. Table ES-4 summarizes the categories of high, medium and low (relative to other rankings) based on the numerical ratings that each jurisdiction assigned each hazard. The results indicate the following general patterns:

- The earthquake and severe weather hazards were most commonly ranked as high.
- The flood and landslide hazards were most commonly ranked as medium.
- The dam failure, drought, volcano and wildfire hazard were most commonly ranked as low.

Table ES-1-4. Summary of Hazard Ranking Results

	Number of Jurisdictions Assigning Ranking to Hazard			
	High	Medium	Low	Not Ranked
Dam Failure	0	1	11	5
Drought	0	0	15	2
Earthquake	15	2	0	0
Flood	2	11	4	0
Landslide	0	10	7	0
Severe weather	15	1	1	0
Volcano	0	3	14	0
Wildfire	2	4	8	3

MITIGATION PURPOSE STATEMENT, GOALS AND OBJECTIVES

The following purpose statement guided the Steering Committee and the planning partnership in selecting the actions contained in this plan update:

> Define natural hazard risk and, through collaboration and partnerships, establish strategies and actions for reducing the impacts of disasters in Clark County.

The Steering Committee and the planning partnership established the following goals for the plan update:

- Reduce and prevent the loss of life and property.
- Protect public services and critical facilities from the impacts of natural disasters.
- Increase public awareness of vulnerability to natural hazards and educate on risk reduction strategies.
- Promote community resilience.
- Protect environmental resources and utilize natural systems to reduce natural hazard impacts.
- Develop and implement cost-effective mitigation strategies.

The following objectives were identified that meet multiple goals, helping to establish priorities for recommended mitigation actions:

1. Inform the public on the risk exposure to natural hazards and ways to increase the public's capability to prepare, respond, recover and mitigate the impacts of these events.
2. Reduce the impacts of hazards on vulnerable populations.
3. Improve and maintain systems that provide warning and emergency communications.
4. Work cooperatively with stakeholders in planning for and reducing the impacts of natural hazards.
5. Incorporate risk reduction strategies in new and updated infrastructure and development plans to reduce the impacts of natural hazards.
6. Integrate natural hazard mitigation goals and objectives into other existing plans and programs within the planning area.
7. Provide incentives for development and land use techniques that reduce risks.
8. Strengthen and build redundancy into infrastructure, prioritizing areas that may be potentially isolated areas.
9. Retrofit, purchase, or relocate structures in high hazard areas, especially those known to be repetitively damaged.
10. Avoid, minimize or mitigate risks to critical facilities and infrastructure.
11. Support and enhance environmental protection and sustainability activities that may also accomplish mitigation objectives.
12. Use the best available data, science and technologies to implement mitigation strategies.

MITIGATION ACTIONS

Status of Previous Plan Initiatives

Table ES-5 summarizes the initiatives that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table ES-5. County-Wide Mitigation Actions

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
Establish a county-wide repository of perishable data from hazard events and develop a standard form for capturing information		X	
Comments: Specific jurisdictions have begun looking at how to best collect data, but a regional effort is still outstanding.			

Develop a county-wide recovery/resiliency plan		X	
Comments: A regional recovery framework was completed for the 5-County Portland-Vancouver Metro Region, which includes Clark County in 2018. Each of the 5 counties had planned to create a local framework which connects to the regional framework, but the plan was delayed due to the COVID-19 pandemic.			
Participate in the plan implementation hazard mitigation working group by sharing lessons learned and mitigation success stories and actively participating in progress reporting		X	
Comments: Continued Action Item			
Support and guide the technology for regional hazard warning systems	X		
Comments: Continued Action Item			
Ensure that a link to the hazard mitigation plan website hosted by CRESA is posted conspicuously on each planning partner website		X	
Comments: Continued Action Item			
Support regional collaboration and consistency in hazard mitigation implementation and programs		X	
Comments: Continued Action Item			
Where appropriate, support retro-fitting, relocating or acquisition from willing property owners of structures located in hazard-prone areas to protect structures from future damage, with repetitive and severe repetitive loss as a priority. Seek opportunities to leverage partnerships within the planning area in these pursuits		X	
Comments: Continued Action Item			
Utilize information contained within the Clark Regional Natural Hazard Mitigation Plan to support updates to other emergency management plans in effect within the planning area		X	
Comments: Continued Action Item			
Utilize information contained within the Clark Regional Natural Hazard Mitigation Plan to support updates to other plans in effect within the planning area		X	
Comments: Continued Action Item			
Develop the capacity for a regional post-disaster volunteer coordination program		X	
Comments: Work in this area had begun through the Clark County Community Organizations Active in Disasters (CC-COAD) group, though much work remains to be completed.			
Explore opportunities with all community stakeholders to implement, identify and fund mitigation actions		X	
Comments: Continued Action Item			
Continue regional partnerships to improve and enhance mitigation efforts in the larger region		X	
Comments: Continued Action Item			
Establish guidelines to increase communication and coordination of mitigation actions across agencies whenever feasible		X	
Comments: Continued Action Item			

Continue to work with planning partners and other stakeholders to clearly articulate and define emergency management roles and responsibilities within the County, including the implementation of identified mitigation actions.		X	
Comments: Continued Action Item			

a. HMGP = Hazard Mitigation Grant Program; FMA = Flood Mitigation Assistance = PDM = Pre-Disaster Mitigation Assistance; CDBG-DR = Community Development Block Grants Disaster Recovery; UASI = Urban Area Security Initiative

HAZARD MITIGATION ACTION PLAN

Mitigation actions presented in this update are activities designed to reduce or eliminate losses resulting from natural hazards. The update process resulted in the identification of more than 272 mitigation actions for implementation by individual planning partners, as presented in Volume 2 of this plan. In addition, the steering committee and planning partnership identified 13 countywide actions benefiting the whole partnership, as listed in Table ES-5.

Table ES-5

Applies to New or Existing Assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding[a]	Timeline
CW-1—Establish a county-wide repository of perishable data from hazard events and develop a standard form for capturing information						
New and existing	All hazards	4, 12	CRESA	Low	Staff time	Short-term
CW-2—Develop a county-wide recovery/resiliency plan						
New and existing	All hazards	2, 4, 6	CRESA	High	Local, possible grant funding (UASI)	Short-term
CW-3—Participate in the plan implementation hazard mitigation working group by sharing lessons learned and mitigation success stories and actively participating in progress reporting						
New and existing	All hazards	1, 4, 6, 12	Planning Partners/ facilitated by CRESA	Low	Staff time	Ongoing
CW-4—Ensure that a link to the hazard mitigation plan website hosted by CRESA is posted conspicuously on each planning partner website						
N/A	All hazards	1, 4	Planning Partners	Low	Staff time	Short-term
CW-5—Support regional collaboration and consistency in hazard mitigation implementation and programs						
New and existing	All hazards	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	Clark County/CRESA	Low	Staff time	Ongoing
CW-6—Where appropriate, support retro-fitting, relocating or acquisition from willing property owners of structures located in hazard-prone areas to protect structures from future damage, with repetitive and severe repetitive loss as a priority. Seek opportunities to leverage partnerships within the planning area in these pursuits						
Existing	All hazards	4, 5, 7, 9, 10	Planning Partners	High	HMGP, PDM, FMA, CDBG-DR	Ongoing
CW-7—Utilize information contained within the Clark Regional Natural Hazard Mitigation Plan to support updates to other emergency management plans in effect within the planning area						
New and existing	All hazards	2, 4	CRESA	Low	Staff time	Ongoing
CW-8—Utilize information contained within the Clark Regional Natural Hazard Mitigation Plan to support updates to other plans in effect within the planning area						
New and existing	All hazards	2, 4, 5	Planning Partners	Low	Staff time	Ongoing
CW-9—Develop the capacity for a regional post-disaster volunteer coordination program						
N/A	All hazards	1, 2, 3, 4	CRESA	Medium	Staff time, Local funds	Long-term
CW-10—Explore opportunities with all community stakeholders to implement, identify and fund mitigation actions						
New and existing	All hazards	1, 2, 4,12	CRESA	Medium	Staff time, Local funds	Ongoing

Applies to New or Existing Assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding[a]	Timeline
CW-11—Continue regional partnerships to improve and enhance mitigation efforts in the larger region						
New and existing	All hazards	1, 4	CRESA	Low	Staff-time	Ongoing
CW-12—Establish guidelines to increase communication and coordination of mitigation actions across agencies whenever feasible						
New and existing	All hazards	4	CRESA	Low	Staff time	Short-term
CW-13—Continue to work with planning partners and other stakeholders to clearly articulate and define emergency management roles and responsibilities within the County, including the implementation of identified mitigation actions.						
New and existing	All hazards	1, 4, 6	CRESA	Low	Staff time	Ongoing

IMPLEMENTATION

Full implementation of the recommendations of this plan will require time and resources. The measure of the plan's success will be its ability to adapt to changing conditions. Clark County and its planning partners will assume responsibility for adopting the recommendations of this plan and committing resources toward implementation. The framework established by this plan commits all planning partners to pursue actions when the benefits of a project exceed its costs. The planning partnership developed this plan with extensive public input, and public support of the actions identified in this plan will help ensure the plan's success.

Part 1. BACKGROUND AND METHODS

1. INTRODUCTION TO HAZARD MITIGATION PLANNING

1.1 ABOUT HAZARD MITIGATION

1.1.1 What Is It?

As the cost of disasters continues to rise, communities must find ways to reduce hazard risks. The term "hazard mitigation" refers to actions that reduce or eliminate long-term risks caused by hazards such as earthquakes, floods, storms, and wildfires. It involves strategies such as planning, policy changes, programs, projects, and other activities that can mitigate the impacts of hazards. Without an investment in hazard mitigation, repeated disasters result in repeated damage and rebuilding. This recurrent reconstruction becomes more expensive as the years go by. Hazard mitigation breaks this costly cycle of damage and reconstruction by taking a long-term view of rebuilding and recovering from disasters.

1.1.2 When Does it Apply?

The federal Disaster Mitigation Act (DMA) of 2000 requires state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. The DMA emphasizes planning for disasters before they occur. However, hazard mitigation is also essential to post-disaster recovery. After disasters, repairs and reconstruction often just restore damaged property to pre-disaster conditions. The implementation of additional hazard mitigation actions leads to building smarter, safer, and more resilient communities that are better able to reduce future injuries and damage.

1.1.3 Who Is Responsible?

The responsibility for hazard mitigation lies with private property owners; business and industry; and local, state and federal governments. The Federal Emergency Management Agency (FEMA) encourages multi-jurisdictional planning under its guidance for the DMA, urging state and local authorities to work together on pre-disaster planning. The enhanced planning network called for by the DMA helps local governments articulate accurate needs for mitigation, resulting in faster allocation of funding and more cost-effective risk reduction projects. One of the benefits of multi-jurisdictional planning is the ability to pool resources and eliminate redundant activities within a planning area that has uniform risk exposure and vulnerabilities.

1.1.4 How Is It Developed and Implemented?

The DMA promotes sustainability for disaster resistance. "Sustainable hazard mitigation" includes the sound management of natural resources and the recognition that hazards and mitigation must be understood in the largest possible social and economic context. Efforts to reduce risks should be compatible with other community goals, which may be related to economic development, sustainability, public and environmental health, or other issues. As communities plan for new development and improvements to existing infrastructure, mitigation should be an important consideration.

1.2 HAZARD MITIGATION FOR CLARK COUNTY

In 2016, the *Clark Regional Natural Hazard Mitigation Plan* was Clark County's first comprehensive hazard mitigation plan update since the *Clark County Multi-Jurisdictional All-Hazard Mitigation Plan* was initially adopted in 2004. The 2022 update brings us an opportunity to look at the work that was done to ensure that current iteration continues to identify resources and strategies for reducing risk from natural hazards. Strategies were selected because they meet a program requirement and the needs of the planning partners and their residents. The plan will help guide and coordinate mitigation activities throughout the planning area. The main purpose of the plan is to identify risks posed by hazards and to present strategies to reduce the impact of hazard events. The plan also meets the following objectives:

- Meet or exceed requirements of the DMA.
- Enable all planning partners to use federal grant funding to reduce risk through mitigation.
- Meet the needs of each planning partner.
- Create a risk assessment that focuses on Clark County hazards of concern.
- Create a single planning document that integrates all planning partners into a framework that supports partnerships within the county, and puts all partners on the same planning cycle for future updates.
- Meet the planning requirements of FEMA's Community Rating System (CRS), allowing planning partners that participate in the CRS program to maintain or enhance their CRS classifications.
- Coordinate existing plans and programs so that high-priority actions and projects to mitigate possible disaster impacts are funded and implemented.

The process of developing and implementing this plan encompasses eight phases:

- Phase 1—Organize resources
- Phase 2—Perform a risk assessment
- Phase 3—Develop and implement a public involvement strategy
- Phase 4—Identify goals, objectives and actions
- Phase 5—Develop a plan maintenance strategy
- Phase 6—Assemble the updated plan
- Phase 7—Initiate and complete plan review and adoption
- Phase 8—Implement the approved, adopted plan.

The methodology and results of Phases 1 through 5 are presented within this document. Phases 6 through 8 represent activities to move from planning through adoption to implementation of targeted mitigation actions.

1.3 WHO WILL BENEFIT FROM THIS PLAN?

Effective hazard mitigation can provide the following benefits:

- Reduce the loss of life, property, essential services, critical facilities, and economic hardship
- Reduce short-term and long-term recovery and reconstruction costs
- Increase cooperation and communication within the community through the planning process
- Increase potential for state and federal funding for pre- and post-disaster projects.

All residents and businesses of Clark County are the ultimate beneficiaries of this hazard mitigation plan update. The plan identifies strategies and actions that will reduce risk for those who live in, work in, and visit the county. It provides a viable planning framework for all foreseeable natural hazards that may impact the county. Participation in the development of the plan by key stakeholders in the county helped ensure that outcomes will be mutually beneficial. The resources and background information in the plan are applicable countywide, and the plan's goals and recommendations can lay groundwork for the development and implementation of local mitigation activities and partnerships.

1.4 HOW TO USE THIS PLAN

In order to fulfill the requirements of the DMA and be eligible for federal disaster funding grant programs, a local hazard mitigation plan must contain a set of information as outlined in the Code of Federal Regulations (see box at right). The *Clark Regional Natural Hazard Mitigation Plan* has been organized to provide all the required information. Notations are provided throughout the plan indicating specific requirements being addressed.

This plan has been set up in two volumes so that elements that are jurisdiction-specific can easily be distinguished from those that apply to the whole planning area:

- **Volume 1**—Volume 1 includes all federally required elements of a disaster mitigation plan that apply to the entire planning area. This includes the description of the planning process, public involvement strategy, goals and objectives, countywide hazard risk assessment, countywide mitigation actions, and a plan maintenance strategy. The following appendices at the end of Volume 1 include supporting information:
  - Appendix A—A glossary of acronyms and definitions
  - Appendix B—The Steering Committee ground rules
  - Appendix C—Hazard mitigation questionnaire and summary of results.
  - Appendix D—Planning partner updates distributed through the course of the planning process
  - Appendix E—Concepts and methods used for hazard mapping
  - Appendix F—Plan adoption resolutions from Planning Partners
  - Appendix G—A template for progress reports to be completed as this plan is implemented.
  - Appendix H—The FEMA plan review crosswalk for this plan
- **Volume 2**—Volume 2 includes all federally required jurisdiction-specific elements, in annexes for each participating jurisdiction. It includes a description of the participation requirements that each jurisdiction agreed to, as well as instructions and templates that the partners used to

REQUIRED CONTENT FOR LOCAL HAZARD MITIGATION PLANS (44 CFR 201.6(c))

1. Documentation of the process used to develop the plan, including who was involved and how the public was involved.

2. A risk assessment that provides the following information:

- A description of the type, location, and extent of all natural hazards that can affect the jurisdiction, previous occurrences of hazard events, and the probability of future hazard events.
- A description of the jurisdiction's vulnerability to the hazards in terms of:
  - Buildings, infrastructure and critical facilities located in hazard areas
  - Potential dollar losses
  - Development trends and the ability to consider mitigation in land use decisions.
- Assessment of each participating jurisdiction's risks where they vary from those of the entire planning area.

3. A mitigation strategy for reducing potential losses identified in the risk assessment:

- A description of mitigation goals.
- A range of mitigation actions and projects to consider.
- An action plan for each participating jurisdiction recommending and prioritizing specific mitigation actions.

4. A plan maintenance process that includes:

- A schedule for monitoring, evaluating, and updating the mitigation plan.
- A process for incorporating the requirements of the mitigation plan into other local planning mechanisms.
- A plan for ongoing public participation.

5. Documentation that the plan has been formally adopted by the governing body of each jurisdiction requesting approval of the plan.

complete their annexes. Volume 2 also includes “linkage” procedures for eligible jurisdictions that did not participate in development of this plan but wish to adopt it in the future.

All planning partners will adopt Volume 1 in its entirety and at least the following parts of Volume 2: Part 1; each partner’s jurisdiction-specific annex; and the appendices.

2. PLAN UPDATE—WHAT HAS CHANGED

1.1 THE PREVIOUS PLAN

The inevitability of natural hazards and the growing population and activity in Clark County create a need to develop strategies, coordinate resources, and increase public awareness to mitigate future hazard events. To accomplish these objectives, Clark County and its cities prepared a hazard mitigation plan in 2004, which was formally approved by FEMA Region X on December 16, 2004. This effort was led by the Clark Regional Emergency Services Agency (CRESA), which provides emergency management for Clark County and the Cities of Battle Ground, Camas, La Center, Ridgefield, Vancouver, Washougal, and Yacolt. The plan development was funded in part by a planning grant from the federal Hazard Mitigation Grant Program, which was applied for and received after the 2001 Nisqually Earthquake and resulting presidential disaster declaration. Several factors initiated this planning effort:

- The Clark County area has significant exposure to numerous natural hazards that have caused millions of dollars in past damage.
- The participating partners (Clark County and cities and districts within the county) want to be proactive in preparedness for the probable impacts of natural hazards.
- Local resources to undertake risk reduction actions are limited. Being able to leverage federal financial assistance is paramount to successful hazard mitigation.

The 2004 plan was presented in a single volume that addressed eight hazards: earthquakes, floods, severe weather, volcanic eruption, landslide, wildfire, hazardous materials release, and terrorism. Five goals and 11 objectives were identified to guide the identification and selection of mitigation actions to reduce risk from these hazards. The mitigation action plan included 47 targeted mitigation initiatives that were defined and prioritized through a workshop process with Stakeholder Committee members. Jurisdiction-specific risk assessment information and mitigation actions were presented in two chapters covering all participating jurisdictions.

The performance period of the initial plan ran from 2004 to its expiration in 2009. Due to the length of time that the 2004 remain expired, the 2016 *Clark Regional Natural Hazard Mitigation Plan* was considered as a new plan with a new process and a new direction. The process brought in additional planning partners to cover many of the special districts within the community. The 2016 planning process allowed partners to look at mitigation planning in a new light and determine the best way to move forward for each jurisdiction involved. The plan was approved on August 16, 2017.

2.1 WHY UPDATE?

Natural hazards continue to impact residents, property, the environment and the economy of Clark County. Since the initial planning effort, the communities of Clark County have undergone changes in their composition, development patterns, and priorities. This update provides an opportunity to reevaluate recommendations, monitor the impacts of actions that have been accomplished, and determine if there is a need to change the focus of mitigation strategies.

2.1.1 Changes in Development

Hazard mitigation plans must be revised to reflect changes in development within the planning area during the previous performance period of the plan (44 CFR Section 201.6(d)(3)). The plan must describe development changes in hazard-prone areas that increased or decreased vulnerability for each jurisdiction since the last plan was approved. If no changes in development impacted the jurisdiction's overall vulnerability, then plan updates may validate the information in the previously approved plan. The intent of this requirement is to ensure that the mitigation strategy continues to address the risk and vulnerability of existing and potential development and takes into consideration possible future conditions that could impact vulnerability.

Clark County and its incorporated cities have experienced relatively moderate changes in population, housing and land use in recent years. The total County population increased 11.4 percent from 2015 to 2020, to 503,311. Unincorporated areas saw a population growth of 5.5 percent over that time and incorporated areas grew 6.8 percent. Land uses have remained mostly constant, with minor changes in some places, mostly in Camas, La Center, and Yacolt (Clark County, 2016).

From 2000 to 2019, Clark County's estimated total housing units increased from 134,030 to 189,853—a 42-percent increase. Vacant and renter-occupied units were also on the rise, but so were household income and the ability for individuals to secure adequate housing (Clark County, 2016).

The county lost 6 percent of its employment base in the economic downturn starting in 2008, worse than the nation and state. In 2013 the downward employment trend in Clark County reversed and job growth began accelerating (Clark County, 2016).

There was a major update of Clark County's Shoreline Master Program in 2012 with reviews conducted and amendments approved most recently in 2020 to comply with amendments to the State Shoreline Management Act. The changes were relatively minor—simplifying shoreline designations, making them more consistent with the cities, protecting shoreline environmental functions, and encouraging public access and water-dependent use (Clark County, 2016).

A Rural Lands Task Force has been established to examine and make recommendations on how the County could facilitate more efficient use of its rural and resource lands (Clark County, 2016).

Changes in development are difficult to assess between the 2004 and 2016 hazard mitigation plans due to a variety of factors. One particularly important factor is that the 2004 plan loss estimates focused on residential losses, while the 2016 update assesses all general building stock in the planning area. Exposure and vulnerability are discussed as appropriate in the risk assessment portion of this plan; however, it should be noted that the changes in methodology used to assess risk between the planning processes are significant. Clark County and its cities have adopted comprehensive plans that govern land-use decisions and policy-making, as well as a building code and specialty ordinances based on state and federal mandates. This plan update assumes that some new development triggered by the increase in population occurred in hazard areas. Because all such new development would have been regulated pursuant to local programs and codes, it is generally assumed that vulnerability did not increase even if exposure did. Now that the planning area is equipped with tools such as a level 2 user-defined Hazus–MH model for the planning area, this type of comparative analysis will be possible for future updates to this plan.

The 2022 hazard mitigation plan update was unable to provide additional focus on development assessments and hazard risk assessments due to the COVID-19 Pandemic. The planning team was unable to dedicate time to the plan due to staffing shortages, budgetary restrictions, and planning team members working in the emergency operations center for numerous activations.

2.1.2 Federal Eligibility

Federal planning requirements stipulate that hazard mitigation plans must present a schedule for monitoring, evaluating, and updating the plan. A jurisdiction covered by a plan that has expired is not able to pursue elements of federal funding for which a current hazard mitigation plan is a prerequisite. The schedule for updating the plan in the 2004 effort was not followed, and that plan expired in 2009. 11 years passed since the initial planning effort, and coverage has lapsed from 2009 until the updated plan was approved in 2017. During the 2017 plan update, CRESA committed to maintaining this plan in accordance with federal requirements on behalf of the Clark regional hazard mitigation planning partnership that has committed to this process. The current update is being completed in compliance of federal expectations.

2.2 THE UPDATED PLAN—WHAT IS DIFFERENT?

The 2023 plan update was a challenge due to the kickoff being pushed back due to the COVID-19 Pandemic. The pandemic also limited the planning partner's available time and staffing to work on the mitigation plan update. To respect our partner's ability to complete the plan, we kept the plan update fairly simple and did not make changes to the structure of the plan. The mitigation plan update focused on updating the hazard analysis with updated/new information and data, as well as updating the jurisdictional annexes. We also added 2 new partners into the planning process, but lost one along the way.

Table 2-1 indicates the major changes between the two plans as they relate to 44 CFR planning requirements.

Table 2-1. Plan Changes Crosswalk

44 CFR Requirement	Previous Plan	Updated Plan
§201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval; (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.	The plan update was facilitated through a Steering Committee made up of stakeholders within the planning area. The Steering Committee was responsible for review of relevant plans and programs, review and identification of goals and objectives, confirmation of a public involvement strategy, development of a plan implementation and maintenance strategy, and review and approval of the draft plan. All Steering Committee meetings were open to the public. Additional public input was received through several public events early and late in the planning process and through a public survey. A 30-day public comment period was held before the draft plan was submitted for review. Agency coordination occurred through several avenues including the development of the risk assessment, monthly updates on plan progress distributed to a mailing list, attendance at steering committee meetings, the composition of the Steering Committee and the dissemination of the draft plan for public comment.	The plan update was facilitated through a Planning Team made up of representatives within the planning area. The Planning Team was responsible for review of relevant plans and programs, review and identification of goals and objectives, confirmation of a public involvement strategy, development of a plan implementation and maintenance strategy, and review and approval of the draft plan. Public input was received through release of a public feedback draft and social media updates. Due to limited outreach events stemming from the COVID-19 Pandemic, most outreach was conducted virtually. A 30-day public comment period was held before the draft plan was submitted for review. Agency coordination occurred through several avenues including the development of the risk assessment through a collaborative virtual platform, attendance at planning team meetings, and the dissemination of the draft plan for public comment.
§201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.	A comprehensive risk assessment for the planning area that looks at 8 natural hazards of concern: dam failure, drought, earthquake, flood, landslide, severe weather, volcanic hazards, and wildfire. This assessment used the best available data and science with the Hazus-MH (version 2.2) risk assessment software and GIS analysis.	Time and funding limitations prevented a full Hazus-MH risk assessment from being completed, but information was updated where relevant new data was available. All relevant data tables and figures were updated to include the most up-to-date information. Additionally, information from the Portland-Vancouver Metro Area's Enhanced Earthquake Analysis was included in the analysis.
§201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.	Comprehensive risk assessments of each hazard of concern are presented in Chapters 7 through 14. Each chapter includes the following: • Hazard profile, including maps of extent and location, historical occurrences, frequency, severity and warning time • Secondary hazards • Exposure of people, property, critical facilities and environment • Vulnerability of people, property, critical facilities and natural environment • Future trends • Scenarios • Issues. Each hazard is compared to each other via a risk ranking methodology described in Chapter 15.	Comprehensive risk assessments of each hazard of concern are presented in Chapters 7 through 14. Each chapter includes the following: • Hazard profile, including maps of extent and location, historical occurrences, frequency, severity and warning time • Secondary hazards • Exposure of people, property, critical facilities and environment • Vulnerability of people, property, critical facilities and natural environment • Future trends • Scenarios • Issues. Each hazard is compared to each other via a risk ranking methodology described in Chapter 15.

44 CFR Requirement	Previous Plan	Updated Plan
§201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i). This description shall include an overall summary of each hazard and its impact on the community	Vulnerability was assessed for all hazards of concern. The Hazus-MH computer model was used for the dam failure, earthquake, and flood hazards. These were Level-2 (user-defined) analyses using coordinating agency and County data. Critical facilities and assets were defined and inventoried using the Hazus Comprehensive Data Management System and other available datasets. Outputs were generated for other hazards by applying an estimated damage function to affected assets when available. The asset inventory was extracted from the Hazus-MH model. Best available data were used for all analyses.	The current plan utilizes the information from the 2016 hazard analysis and provide updated data/information as supplement to the previous needs.
§201.6(c)(2)(ii): [The risk assessment] must also address National Flood Insurance Program insured structures that have been repetitively damaged floods	The description of the National Flood Insurance Program and repetitive loss discussion was enhanced to meet new DMA and CRS planning requirements. The update includes an analysis of repetitive loss properties. For these properties the type of structure was determined and likely causes of flooding were cited, and the information was reflected on maps. National Flood Insurance Program capability is also assessed for each jurisdiction in Volume II.	The repetitive loss properties were updated to include losses between the previous plan and the current.
§201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.	A complete inventory of the numbers and types of buildings exposed was generated for each hazard of concern. The Steering Committee defined "critical facilities" as they pertained to the planning area, and these facilities were inventoried. Each hazard chapter provides a discussion of future development trends as they pertain to the hazard.	Future development numbers were updated to the best of the ability. Limited changes have been made to the comprehensive growth plan since the last update. The current growth plan is current through 2035. Estimates were updated where data allowed.
§201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) and a description of the methodology used to prepare the estimate.	Dollar loss estimations were generated for all hazards of concern likely to impact property. These were generated by Hazus for the dam failure, earthquake, and flood. For the other hazards, loss estimates were generated by applying a regionally relevant damage function to the exposed inventory. In all cases, a damage function was applied to an asset inventory. The asset inventory was the same for all hazards and was generated in the Hazus-MH model.	Funding and time constraints prevented running a full comprehensive vulnerability assessment. While there has been development and inflation since the 2016 plan was completed, the estimates from the 2016 Hazus-MH analysis were used for this update, with the understanding that a full analysis will need to be run for the next mitigation plan update.

44 CFR Requirement	Previous Plan	Updated Plan
§201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.	There is a discussion on future development trends as they pertain to each hazard of concern. This discussion looks predominantly at the existing land use and the current regulatory environment that dictates this land use and also includes information on vacant buildable lands where feasible.	There is a discussion on future development trends as they pertain to each hazard of concern. This discussion looks predominantly at the existing land use and the current regulatory environment that dictates this land use and also includes information on vacant buildable lands where feasible.
§201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.	Risk assessment results were generated for each planning partner to support the concept of risk ranking, which was performed by each planning partner. Risk ranking was used by each planning partner to provide vision and focus to action plan development.	Risk assessment results were generated for each planning partner to support the concept of risk ranking, which was performed by each planning partner. Risk ranking was used by each planning partner to provide vision and focus to action plan development
§201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.	Action plans were developed for each planning partner via a facilitated process that includes: • Risk ranking • Capability assessment • Action alternative review • Action selection • Action prioritization • Action category analysis	Action plans were developed for each planning partner via a facilitated process that includes: • Risk ranking • Capability assessment • Action alternative review • Action selection • Action prioritization • Action category analysis
§201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.	The plan update identifies a purpose, 6 goals and 12 objectives. Goals were selected that support the purpose, objectives were selected that meet multiple goals, and actions were selected and prioritized based on meeting multiple objectives.	The plan update identifies a purpose, 6 goals and 12 objectives. Goals were selected that support the purpose, objectives were selected that meet multiple goals, and actions were selected and prioritized based on meeting multiple objectives.
§201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.	A hazard mitigation best practices catalog was developed through a facilitated process that looks at strengths, weaknesses, obstacles and opportunities in the planning area. This catalog identifies actions that manipulate the hazard, reduce exposure to the hazard, reduce vulnerability, and increase mitigation capability. The catalog further segregates actions by scale of implementation. A table in the action plan section analyzes each action by mitigation type to illustrate the range of actions selected.	A hazard mitigation best practices catalog was developed through a facilitated process that looks at strengths, weaknesses, obstacles and opportunities in the planning area. This catalog identifies actions that manipulate the hazard, reduce exposure to the hazard, reduce vulnerability, and increase mitigation capability. The catalog further segregates actions by scale of implementation. A table in the action plan section analyzes each action by mitigation type to illustrate the range of actions selected.
§201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program, and continued compliance with the program's requirements, as appropriate.	All municipal planning partners were asked to assess National Flood Insurance Program capability in their jurisdictional annexes. All participating communities have identified actions supporting continued compliance and good standing under the program.	All municipal planning partners were asked to assess National Flood Insurance Program capability in their jurisdictional annexes. All participating communities have identified actions supporting continued compliance and good standing under the program.

44 CFR Requirement	Previous Plan	Updated Plan
§201.6(c)(3)(iii): [The mitigation strategy shall describe] how the actions identified in Section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.	Each of the recommended actions is prioritized using a qualitative methodology that looked at the objectives the project will meet, the timeline for completion, how the project will be funded, the impact of the project, the benefits of the project and the costs of the project. This prioritization scheme is detailed in Chapter 18.	Each of the recommended actions is prioritized using a qualitative methodology that looked at the objectives the project will meet, the timeline for completion, how the project will be funded, the impact of the project, the benefits of the project and the costs of the project. This prioritization scheme is detailed in Chapter 18.
§201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.	A detailed plan maintenance strategy is provided that includes the following: • Annual review and progress reporting • Defined role for Steering Committee • Plan update triggers • Plan incorporation guidelines • Strategy for continuing public involvement • Grant coordination protocol	A detailed plan maintenance strategy is provided that includes the following: • Annual review and progress reporting • Defined role for Steering Committee • Plan update triggers • Plan incorporation guidelines • Strategy for continuing public involvement • Grant coordination protocol
§201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.	This is included in the detailed plan maintenance strategy and also discussed in each jurisdictional annex.	This is included in the detailed plan maintenance strategy and also discussed in each jurisdictional annex.
§201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.	This is included in the detailed plan maintenance strategy.	This is included in the detailed plan maintenance strategy.
§201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commission, Tribal Council).	17 planning partners will seek DMA compliance for this plan. Appendix G contains the resolutions of all planning partners that adopted this plan	

3. Planning Approach

The planning effort to prepare the 2022 update to the *Clark Regional Natural Hazard Mitigation Plan* required a unique approach due to disruptions in planning team availability and the inability to meet in person due the 2019 COVID Pandemic. The process necessitated online meetings and utilization of an online collaboration platform. The approach to developing this hazard mitigation plan encouraged participation from many stakeholders. The activities carried out under this approach are described in the following sections (44 CFR, Section 201.6(c)(1)).

3.1 FORMATION OF THE PLANNING TEAM

A planning team was convened with representation of members of each of the jurisdictions involved in the planning update effort. The planning team was led by the Mitigation Coordinator at Clark Regional Emergency Services Agency acting as the Project Manager. The Project Manager presented the timeline, priorities, goals, and tools to be utilized by the planning team. They also managed the online collaborative planning workspace and facilitated virtual meetings.

3.2 ESTABLISHMENT OF THE PLANNING PARTNERSHIP

In order to promote the wise use of resources and to encourage coordination within the County, CRESA encouraged all eligible local governments to participate in this hazard mitigation planning process. The planning team invited all local governments to a planning partner kickoff meeting on Sept 28, 2021. This meeting was held to introduce the planning team, provide an overview of the mitigation planning process and solicit planning partners. Key objectives were as follows:

- Provide an overview of the Disaster Mitigation Act.
- Describe the reasons for a plan.
- Introduce the planning team.
- Outline the work plan.
- Outline planning partner expectations.
- Seek commitment to the planning partnership.
- Explain the role of CRESA in maintaining the plan and the partnership.

Each jurisdiction wishing to join the planning partnership was asked to provide a “letter of intent to participate” that designated a primary and secondary point of contact for the jurisdiction and confirmed the jurisdiction’s commitment to the process and understanding of expectations. Linkage procedures have been established (see Volume 2 of this plan) for any jurisdiction wishing to link to the Clark County plan in the future. The municipal planning partners covered under this plan are shown in Table 3-1. The special purpose district planning partners are shown in Table 3-2.

Table 3-1. Municipal Planning Partners

Jurisdiction	Point of Contact	Title	Jurisdiction	Point of Contact	Title
Clark County	Mike Lewis	Emergency Manager	City of Vancouver	Gene Juve	Emergency Manager
City of Battle Ground	Mark Herceg	Public Works Director	City of Washougal	Mitch Kneipp	Community Development Director

Jurisdiction	Point of Contact	Title	Jurisdiction	Point of Contact	Title
City of Camas	Lauren Hollenbeck	Senior Planner	City of Ridgefield	Lee Knottnerus	Deputy City Manager
City of La Center	Maria Swinger-Inskeep	Director of Administrative Services	Town of Yacolt	Stephanie Fields	Town Clerk

Table 3-2. Special Purpose District Planning Partners

Jurisdiction	Point of Contact	Title	Jurisdiction	Point of Contact	Title
Fire District 3	Jason Mansfield	Division Chief	Ridgefield School District	Chris Griffith	Assistant Superintendent
Port of Vancouver	Scott Ouchi	Emergency Manager	Clark Public Utilities	Chrystal Jones	Emergency & Environmental Coordinator
Battle Ground Public Schools	Cheri Dailey	Director of Business & Risk Management	Clark Regional Wastewater District	Shawn Moore	District Engineer
Evergreen Public Schools	Shane Gardner	Director of Safety & Security	C-TRAN	Scott Deutsch	Director of Safety & Risk
Vancouver Public Schools	Nicole Daltoso	Senior Director of Capital Facilities			

3.3 THE STEERING COMMITTEE

A change from the 2016 plan was to eliminate the Steering Committee and focus on interfacing directly with the planning partners. This change was partly in response to many jurisdictions having changes in workflows and representative availability due to the 2019 COVID Pandemic. Asking members of the planning team to take on additional duties at this time was untenable. This approach will be reviewed for the next update to determine the best way forward then.

3.4 COORDINATION WITH OTHER AGENCIES

Opportunities for involvement in the hazard mitigation planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)). This task was accomplished by the planning team as follows:

- **Planning Partnership Formation**—Eligible local jurisdictions in the planning area were invited to participate in the planning partnership. This included 35 municipalities and special purpose districts, of which 18 submitted letters of intent to participate in the planning partnership.
- **Steering Committee Involvement**—Agency representatives were invited to participate on the Steering Committee. In addition to the agencies that ultimately agreed to serve on the committee, the following agencies and organizations were contacted regarding their participation, but were unable to participate:
  - Cascade Volcano Observatory
  - Clark County Local Emergency Planning Committee
  - Fire Chiefs Association
  - Washington Department of Natural Resources.
- **Data Provision**—The following agencies were contacted during the course of the planning process to provide data or technical input:

  - Cascade Volcano Observatory
  - Cowlitz County
  - PacifiCorp
  - Washington Department of Natural Resources.
- **Agency Notification**—The following agencies were kept apprised of planning milestones and invited to participate in the plan development through steering committee meeting reminders and monthly updates:
  - Cascade Volcano Observatory
  - Clark County Sheriff's Office
  - Columbia County Emergency Management
  - Cowlitz County Department of Emergency Management
  - Evergreen Public Schools
  - FEMA Region X
  - Multnomah County Emergency Management
  - Northwest Natural
  - PeaceHealth Southwest Medical Center
  - Portland Bureau of Emergency Management
  - Skamania County Department of Emergency Management
  - U.S. Forest Service
  - Washington County Emergency Management
  - Washington Department of Ecology
  - Washington Department of Natural Resources
  - Washington Emergency Management Division
  - Washington State Department of Commerce
  - Washington State Department of Transportation.

  These agencies received notices that included meeting announcements and meeting agenda. Many of these agencies supported the effort by attending meetings.
- **Pre-Adoption Review**—All the agencies listed above were provided an opportunity to review and comment on this plan, primarily through the hazard mitigation plan website (see Section 3.5). Each agency was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to FEMA's Community Rating System contractor, the Insurance Services Office, Inc., for a pre-adoption review to ensure CRS program compliance.

Distribution lists for agency coordination are available upon request.

3.5 PUBLIC INVOLVEMENT

Broad public participation in the planning process helps ensure that diverse points of view about the planning area's needs are considered and addressed. The public must have opportunities to comment on disaster mitigation plans during the drafting stages and prior to plan approval (44 CFR, Section 201.6(b)(1)). The Community Rating System (CRS) expands on these requirements by making CRS credits available for optional public involvement activities.

3.5.1 Strategy

The COVID-19 Pandemic required the mitigation planning team to rethink public outreach. Limited pre-planned outreach activities and in-person presentations required the team to focus on virtual meeting platforms and outreach opportunities. The outreach strategy leaned heavily on partners sharing on their websites, social media, and press releases to get public draft feedback.

Press Releases and Media Coverage

This Press release was distributed as the public review draft was posted in order for regional partners and the public to provide feedback and comments to the plan.

CRESA SEEKS COMMENT ON UPDATED HAZARD MITIGATION PLANS
News Release from Clark Regional Emergency Services (CRESA)
Posted on FlashAlert: November 8th, 2022 12:21 PM
For the past year CRESA has been working with 17 local agencies and jurisdictions to update our 2017 Natural Hazard Mitigation Plan.
These plans are usually updated annually as needed with a full review every five years. Due to COVID-19, this cycle was extended for 1 year.
Now it's your opportunity to share your thoughts on the plan. Please visit: cresa911.org/emergency-management/mitigation/ to read the updated plans.
Comments and feedback can be sent to: scott.johnson@clark.wa.gov

The press release generated an article in the local newspaper that can be found at https://www.columbian.com/news/2022/nov/09/clark-regional-emergency-services-agency-seeks-feedback-on-hazard-mitigation-plan/

Social Media

Examples of outreach using social media are shown in Figure 3-1.

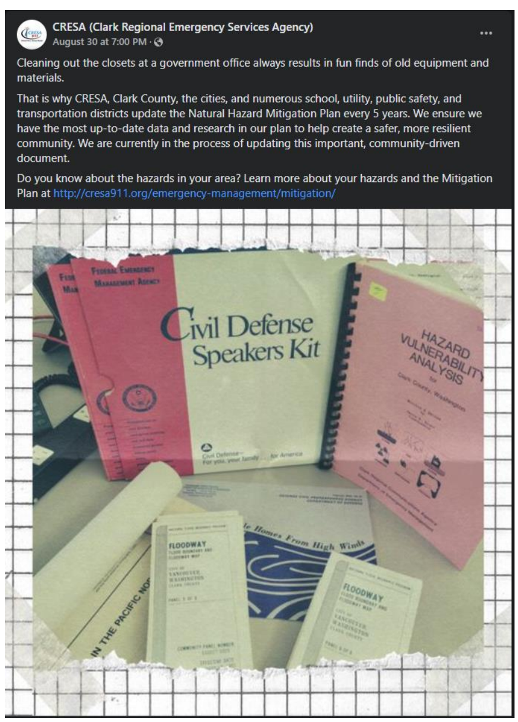


Figure 3-1. Hazard Mitigation Planning Information on Social Media

Project and Partner Websites

Since the creation of the 2017 plan, CRESA has maintained a mitigation page http://cresa911.org/emergency-management/mitigation/ on the CRESA website to keep the public posted on plan development milestones (see Figure 3-2):

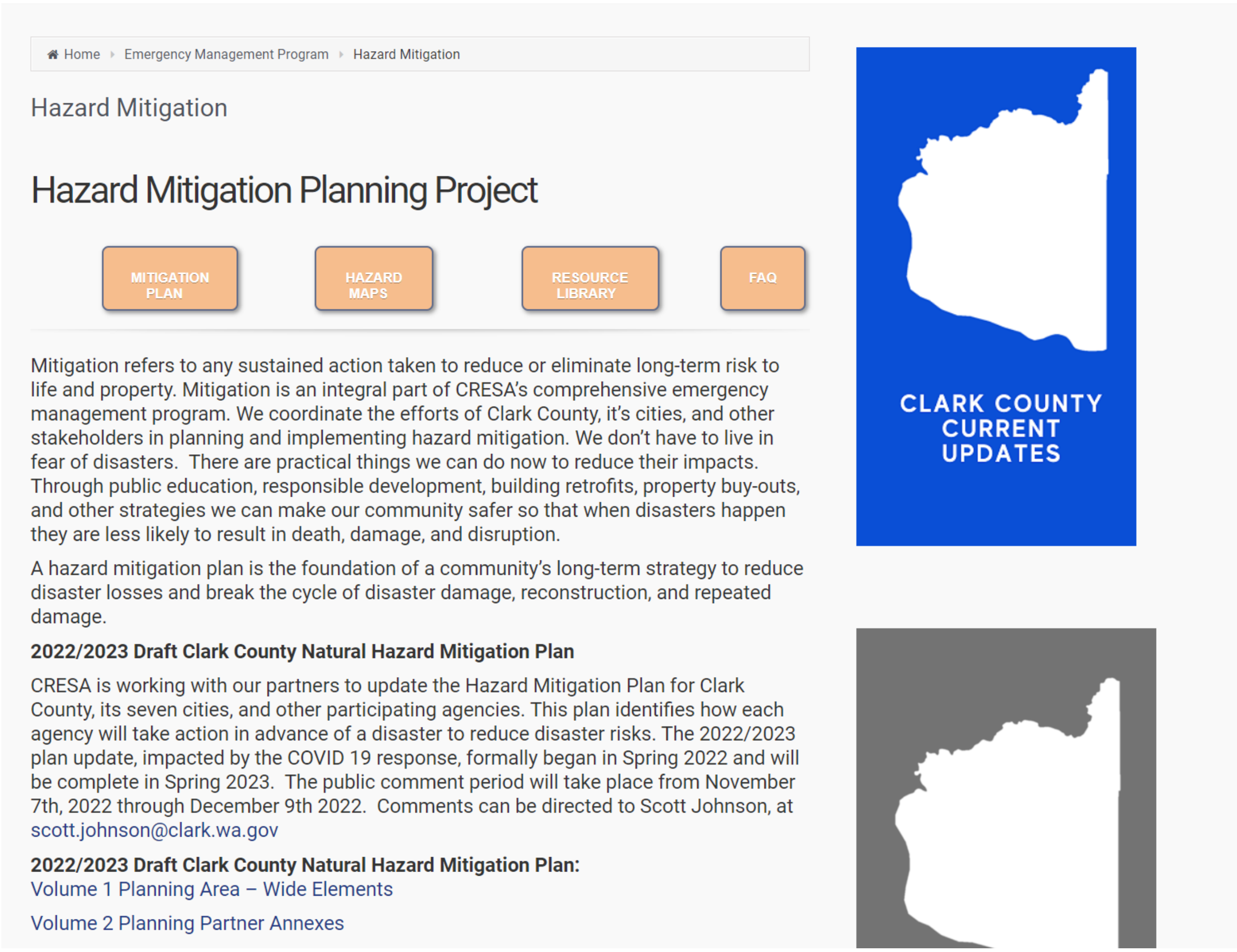


Figure 3-2. Sample Page from Hazard Mitigation Plan Web Site

In addition to the CRESA website, some partner agencies have also posted notices on their community facing websites to showcase both their participation in the planning process and to facilitate community members commenting. (See Table 3-1)

Clark Regional Waste Water District
Vancouver Public Schools
Battle Ground Public Schools
City of Ridgefield
Town of Yacolt

Table 3-1. Sample of partner agency websites notifying public of comment opportunities

Public Involvement Results

Public Comment Period

A 30 day public comment period was held from November 7 2022 to December 9 2022. No public comments were received. Partner comments we of an administrative nature and included website updates and agency name changes.

3.6 PLAN DEVELOPMENT CHRONOLOGY/MILESTONES

Table 3-3 summarizes important milestones in the development of the plan. Most of the planning process was conducted over email and utilizing a collaborative virtual work environment called Mural. For this reason, meetings were kept to a minimum in order to assist planning partners who were working on pandemic response and with smaller workforces.

Table 3-3. Plan Development Milestones

Date	Event	Description
2021		
9/28	Planning partner kickoff meeting	Attendees were advised of planning partner expectations and asked to formally commit to the process.
2022		
1/13	Planning Team Meeting	Introduced the collaborative planning platform and discussed the Annex development process
11/7	Public outreach	Public comment period opens
12/9	Public outreach	Public comment period closes
12/12	Regulatory review submittal	Final draft plan submitted to Washington State for review and approval
2023		
X/X	Adoption	Adoption window of final plan opens
X/X	Plan approval	Final plan approved by FEMA

4. CLARK COUNTY PROFILE

4.1 PLANNING AREA OVERVIEW

Clark County is located in southwest Washington, in the northern portion of the Portland metropolitan area. The county borders the relatively rural Washington counties of Cowlitz to the north and Skamania to the east. The Columbia River makes up the county's western and southern borders, with the State of Oregon across the river. Clark County is the fifth smallest of Washington's 39 counties by area (656 square miles) but the fifth largest by population (503,311 in 2020).

Seven incorporated cities lie entirely within the county, and the City of Woodland lies partly in Clark County and partly in Cowlitz County. The City of Vancouver is the county seat. The other incorporated cities in the county are Battle Ground, Camas, La Center, Ridgefield, Washougal, and Yacolt. The planning area for this hazard mitigation plan consists of all incorporated and unincorporated areas of Clark County, as well as the portion of the City of Woodland that lies in Cowlitz County. All partners to this plan have jurisdictional authority within this planning area.

The Cowlitz Indian Tribe is the only tribe with land in the county; the Tribe also has land in Cowlitz County (Washington State, 2015). The Tribe's reservation was established in March 2015 along Interstate 5, west of La Center, when a U.S. District Court judge approved 152 acres in Clark County to be set aside for it (Cowlitz Tribe, 2015).

4.2 PHYSICAL SETTING

4.2.1 Topography and Geology

Elevations in Clark County range from 50 feet in downtown Vancouver to over 3,500 feet in the foothills in the northeast. The Cascade Mountain Range, crossing the eastern half of the county, was formed 4 to 7 million years ago as a result of the steep descent of the Juan De Fuca plate below the continental margin. The friction of this descent created two folds that formed the Cascade and Olympic Mountain Ranges. (Townsend and Figge, 2002).

In addition to tectonic movements, repeated glacier movement across the region over the past 2 million years affected the geological features of the western portion of Clark County. The most recent period of glaciation was the Vashon period, which occurred during the late Pleistocene. Glaciers in this period advanced into Washington from Canada about 18,000 years ago and retreated 10,000 to 12,000 years ago (Townsend and Figge, 2002).

4.2.2 Seismic and Volcanic Features

The Washington portion of the Portland metropolitan area is the second most seismically active area in Washington, after the Puget Sound area. Clark County lies between the Lacamas Lake Fault in the eastern part of the county and the Portland Hills Fault in Oregon. 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 Magnitude 5.5 earthquake on November 5, 1962 was located underneath the City of Vancouver (CRESA, 2011).

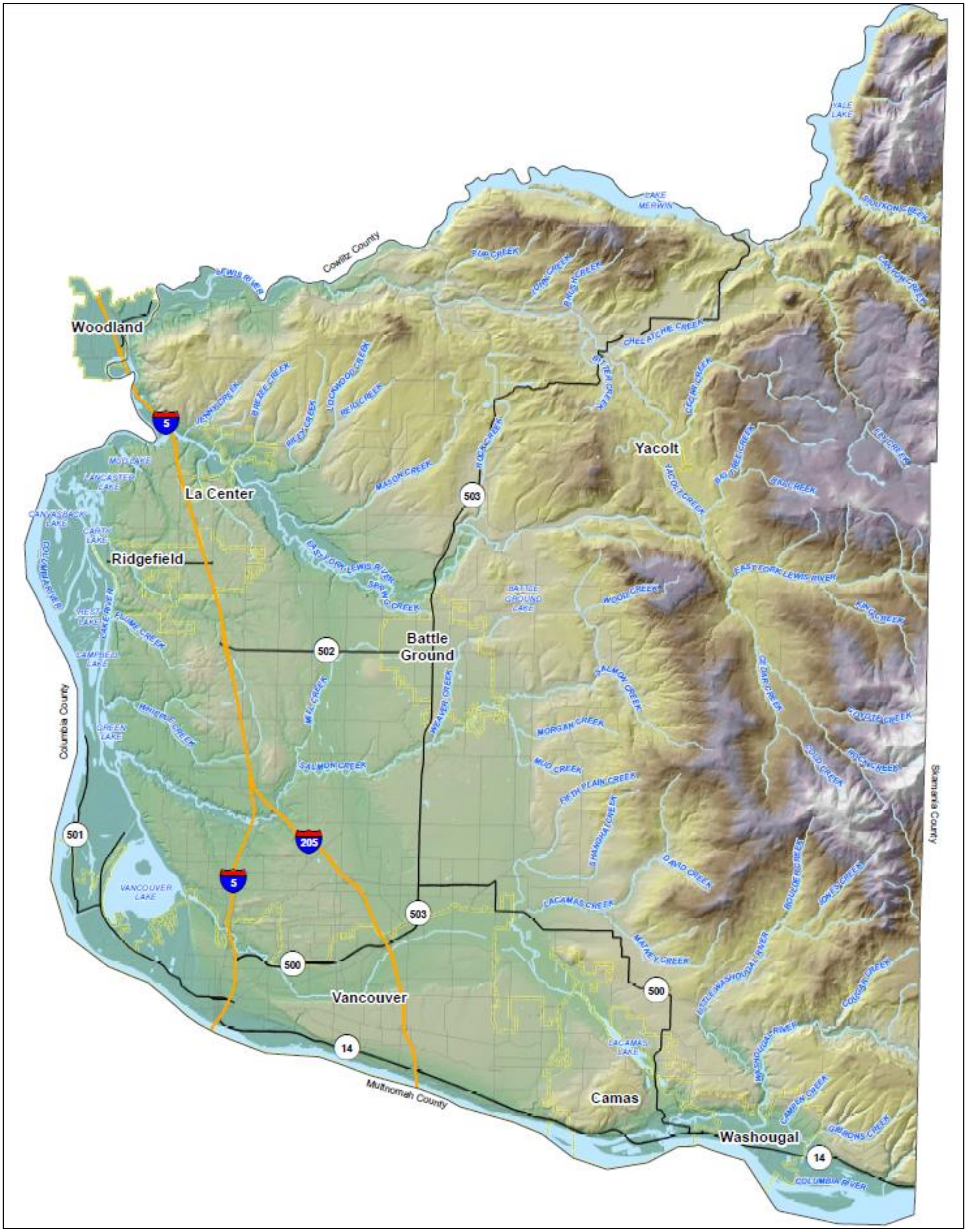


Figure 4-1. Main Features of the Planning Area

All of western Washington also is located on the Pacific "Ring of Fire"—a geological area known for volcanic activity and frequent seismic activity. Washington is near the convergence of several tectonic plates, including the Pacific, North American, and Juan de Fuca. In general earthquakes in the area arise from three sources:

- The oblique subduction of the Juan de Fuca plate can produce events as large as magnitude 7.
- Faults on the North American plate can produce moderate to large events on either side of the Cascades.
- Great earthquakes, which can have magnitudes of 9.0 or greater, can occur at the boundaries of these plates generally referred to as the Cascadia Subduction Zone (USGS, 2012a).

Mount St. Helens, Mount Hood and Mount Adams are nearby volcanoes associated with the Cascade range. Active volcanoes have been present in the Cascades for millions of years, and the remnants of former volcanoes make up the bedrock of the current Cascade range. Volcanoes in the range are still active, although their presence as a result of the fold is merely incidental to the older chain (Townsend and Figge, 2002).

4.2.3 Soils

Clark County is located within the Willamette-Puget trough, a structural low between the Coast Range to the west and the Cascade Range to the east. The regional geology of Clark County is generally divided into four major physiographic categories (CRESA, 2004):

- The Lowland Valley area, adjacent to the Columbia River, consists primarily of recent floodplain and stream deposits of semi-consolidated silt, clay, sand, and gravel.
- Alluvial deposits of thickness ranging from a few feet to about 200 feet overlying the Troutdale Formation define the Fourth Plains area.
- The Troutdale bench is the highest in a series of flat plains rising step-like from the Columbia River and is predominately composed of cemented sandy gravel and fine sand, silt and clay.
- The Foothills area rising to the east is a mixture of older, mostly volcanic, consolidated rocks underlying local sedimentary deposits.

4.2.4 Surface Waters

Major waterways in or surrounding Clark County are the Columbia River, the Lewis River, and the East Fork of the Lewis River. Smaller waterways include Cedar Creek, Canyon Creek, Chelatchie Creek, Dugan Creek, Gee Creek, Salmon Creek, Mill Creek, the Washougal River, the North Fork of the Washougal River, Weaver Creek, Burnt Creek, and Lacamas Creek (CRESA, 2004).

4.2.5 Climate

The climate of the county is greatly influenced by its geography. Moist air flows up the Columbia River bringing rain and moderate temperatures. It is seasonally mild, with relatively cool, dry summers and warm, wet winters. Average temperatures range from 40ºF in January to 65 or 70ºF in August. Annual rainfall is variable, ranging from about 37 to more than 110 inches in various parts of the county. Precipitation tends to be greatest in the more mountainous (northeast) portions of the county. Concentrated rainfall events are relatively common, especially during winter (CRESA, 2004). Average climate conditions at two National Oceanic and Atmospheric Administration (NOAA) weather stations in Clark County are shown in Table 4-1.

Table 4-1. Normal Precipitation and Temperatures

	Precipitation (inches)		Temperature (ºF)					
			Minimum		Average		Maximum	
	1981 – 2010	1991 – 2020	1981 – 2010	1991 – 2020	1981 – 2010	1991 – 2020	1981 – 2010	1991 – 2020
NOAA Weather Station: Battle Ground, WA US								
January	7.19	7.20	32.6	31.9	39.7	39.0	46.8	46.1
February	5.42	5.32	32.6	31.7	41.9	41.1	51.2	50.4
March	5.54	5.59	36.0	34.6	45.9	44.7	55.8	54.7
April	4.35	4.54	39.0	37.9	49.6	48.8	60.2	59.7
May	3.43	3.36	44.1	43.3	55.2	54.9	66.4	66.5
June	2.51	2.31	48.2	49.3	59.8	59.2	71.4	71.1
July	0.87	0.63	51.2	50.6	64.7	64.6	78.2	78.6
August	0.95	0.80	50.6	50.2	65.0	64.9	79.4	79.6
September	2.24	2.20	45.9	45.6	60.3	60.0	74.6	74.5
October	4.40	4.82	40.0	39.9	51.6	51.2	63.1	62.5
November	8.14	7.91	36.5	35.4	44.2	43.5	51.9	51.5
December	7.56	7.99	32.0	31.9	38.5	38.5	45.0	45.1
Annual	52.60	52.37	40.7	40.0	51.4	50.9	62.0	61.7
NOAA Weather Station: Vancouver Pearson Airport, WA US								
January	5.50	5.34	35.4	34.4	41.6	40.7	47.7	47.0
February	4.03	3.77	35.3	35.1	43.5	43.1	51.7	51.0
March	3.57	3.95	39.1	38.4	48.0	47.2	56.9	56.1
April	3.01	2.93	42.6	42.2	52.1	51.7	61.5	61.2
May	2.47	2.51	48.2	48.2	58.1	58.3	68.1	68.3
June	1.79	1.61	53.3	53.0	63.3	63.3	73.4	73.5
July	0.69	0.42	56.9	57.1	68.4	69.0	80.0	80.9
August	0.77	0.52	56.9	57.2	69.2	69.4	81.5	81.6
September	1.56	1.43	51.6	52.0	63.6	63.9	75.7	75.8
October	3.07	3.41	44.1	44.8	53.8	54.2	63.4	63.7
November	5.91	5.51	39.8	39.4	46.4	46.2	53.1	53.0
December	6.77	6.07	34.5	35.0	40.6	40.8	46.7	46.5
Annual	39.14	37.47	44.8	44.7	54.1	54.0	63.3	63.2

Source: NOAA, 2015. NOAA, 2022.

4.3 MAJOR PAST HAZARD EVENTS

Presidential disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A presidential disaster declaration puts federal recovery programs into motion to help disaster victims, businesses and public entities. Some of the programs are matched by state programs. The planning area has experienced 11 events since 1956 for which presidential disaster declarations were issued. These events are listed in Table 4-2.

Review of these events helps identify ways to increase a community's capability to avoid large-scale events in the future. Still, many natural hazard events do not trigger federal disaster declaration protocol but have significant impacts on their communities. These events are also important to consider in establishing recurrence intervals for hazards of concern and are addressed in more detail in Part 2 of this document.

Table 4-2. Federal Disaster Declarations for Events Affecting Clark County

Disaster Number[a]	Incident Description	Event Begin Date
DR-185	Heavy Rains and Flooding	December 29, 1964
DR-545	Severe Storms, Mudslides, Flooding	December 10, 1977
DR-623	Volcanic Eruption, Mount St. Helens	May 21, 1980
DR-1079	Storms, High Winds, Floods	November 7, 1995
DR-1100	Severe Storms, Flooding	January 26, 1996
DR-1159	Severe Winter Storms, Flooding	December 26, 1996
DR-1361	Earthquake	February 28, 2001
EM-3227	Hurricane Katrina Evacuation	August 29, 2005
DR-1671	Severe Storms, Flooding, Landslides, and Mudslides	November 2, 2006
DR-1682	Severe Winter Storm, Landslides, and Mudslides	December 14, 2006
DR-1825	Severe Winter Storm and Record and Near Record Snow	December 12, 2008
DR-4253	Severe Winter Storm, Straight Line Winds, Flooding, Landslides, Mudslides, Tornado	December 1, 2015

a. DR = major disaster; EM = emergency

Source: Federal Emergency Management Agency, 2015.

4.4 DEVELOPMENT PROFILE

4.4.1 Historical Development

The Clark County area was inhabited by multiple indigenous peoples, predominately the Cowlitz and Chinook Indians. While historic population estimate are difficult to find, the Lower Cowlitz were said to occupy 30 villages dotting the Cowlitz River. Currently, there are an estimated 1,400 tribal members living in the area. (Irwin, 1994) The Cowlitz Indian Tribe was federally recognized in 2000 and the Cowlitz Reservation was established in 2010 near Ridgefield, WA. The Chinook Indians' population was estimated to be several thousand in 1806 by the Lewis and Clark expedition, from The Dalles to the coast. Later, the British Hudson's Bay Company estimated the Chinook population in 1825 to be 2,500. An illness—most likely malaria or influenza—later destroyed most of the local population (Hanable, 2004).

The area that is now Clark County was an early trading center and an agriculture market. The Hudson's Bay Company established Fort Vancouver in 1825, the oldest permanent, non-native settlement in the Pacific Northwest. Fort Vancouver, named for British naval captain and explorer George Vancouver, provided access to the Columbia River, facilitating easier trade of local products. The Hudson's Bay Company's agricultural investments stretched for 30 miles along the Columbia (Hanable, 2004).

The County was incorporated as the District of Vancouver on June 27, 1844, by the Oregon Provisional Government. The name was changed to County of Vancouver in 1845 and to County of Clarke in 1849. Clarke County became a political subdivision of Washington Territory upon that territory's establishment in 1853. The state legislature corrected the spelling of the county's name in 1925. The City of Vancouver incorporated in 1857 as a jurisdiction in the Washington Territory (Hanable, 2004).

While Clark County's economy originally centered on agriculture, Vancouver eventually acquired lumber and paper mills, docks, grain elevators, and canneries. Local growth was enhanced by the West Coast gold rush, and in 1870 the Northern Pacific Railroad connected Vancouver to Puget Sound (Hanable, 2004).

World Wars I and II brought additional industries to the county, including the world's largest spruce mill and the west's first aluminum manufacturing plant. Tourism became a much more important economic driver for Clark County after World War I; this change was enabled by the construction of the Pacific Highway, US 99, in the 1920s. Fort Vancouver's designation as a National Historic Monument and the reconstruction of the Hudson Bay's Company post facilitated tourist interest. Today, a large number of sites (64 total) are recorded on both the National Historic Register and the Clark County Heritage Register (CRESA, 2004).

4.4.2 Current Land Use

Clark County land use has remained relatively unchanged since 2007. It consists of predominantly forest lands in the eastern side of the county, and scattered agriculture, parks/open space, and rural lands throughout the remaining portions of Clark County. Commercial, residential, and industrial land uses are the predominant land uses within the County's incorporated cities and towns (Clark County, 2016b). For recreation, residents and visitors can access the Gifford Pinchot National Forest and Lewis River, and municipal park systems also abound.

Land use information is analyzed in this plan for each identified hazard that has a defined spatial extent and location. For hazards that lack this spatial reference, land use summary information in Table 4-3 serves as a baseline estimate of land use and exposure for the planning area. Future trends in development are discussed in Section 4.4.4.

Table 4-4 shows the type and distribution of structures throughout the planning area.
This data was not updated in the 2022 update due to the inability to utilize Hazus in this update. The comprehensive growth plan has not changed since the previous plan, but an increase in developed lands and a decrease in vacant or uncategorized lands is assumed.

Table 4-3. Present Land Use in Planning Area[a]

Present Use Classification[b]	Area (acres) [c, d]	% of total
Agriculture/Resource Land	112,261	24.1%
Commercial	20,261	4.4%
Education	2,923	0.6%
Governmental Services	3,742	0.8%
Industrial	2,535	0.5%
Religious Services	1,062	0.2%
Residential	291,365	62.7%
Vacant or uncategorized	30,710	6.6%
Total	**464,858**	**100%**

a. Present land use information in this plan is for planning purposes only. Discrepancies may exist between these estimates and official records maintained by participating jurisdictions.
b. Present use classification provided by Clark and Cowlitz County assessor's data assigned to best fit occupancy classes in FEMA's Hazus model (see Section 6.3.1). Parcels for which conflicting information on current development was available were assumed to be improved. Some designated resource land may also be included in the vacant or uncategorized category.
c. Acreage covers only mapped parcels; it excludes many rights of way and major water features.
d. Acreage includes Clark County and the incorporated areas of the City of Woodland.

Table 4-4. Structure Type in the Planning Area

	Number of Structures[a]							
	Residential	Commercial	Industrial	Agriculture/ Forestry	Religion	Government	Education	Total
Battle Ground	5,558	237	4	10	17	3	25	5,854
Camas	7,109	272	19	26	47	15	25	7,513
La Center	1,051	39	1	5	1	7	6	1,110
Ridgefield	2,176	106	12	8	5	13	8	2,328
Vancouver	47,275	2,387	53	60	167	43	113	50,098
Washougal	5,212	248	7	15	25	19	13	5,539
Woodland	1,642	170	26	1	16	4	5	1,864
Yacolt	489	24		8	7	4	1	533
Unincorporated County	72,392	1,424	29	708	184	54	111	74,902
Total	**142,904**	**4,907**	**151**	**841**	**469**	**162**	**307**	**149,741**

a. Structure type assigned to best fit Hazus occupancy classes based on present use classifications provided by Clark and Cowlitz County assessor's data. Where conflicting information was present in the available data, parcels were assumed to be improved.

4.4.3 Critical Facilities and Infrastructure

The Steering Committee selected the following definition of critical facilities and infrastructure:

> Facilities and infrastructure that are critical to the health and welfare of the population and that are especially important following hazard events.

For this planning process, critical facilities and infrastructure meeting this definition were inventoried from the best available databases under the following sectors:

- Communication facilities
- Dams
- Emergency services
- Energy
- Government facilities
- Hazardous materials
- Healthcare and public health
- Information technology
- Schools
- Transportation systems
- Water and sanitation systems.

Information on data sources for these facilities can be found in Chapter 6 of this volume. The location of critical facilities and infrastructure within the unincorporated areas and cities participating in this plan are shown in Figure 4-2 and summarized in Table 4-5

Due to the sensitivity of this information, a detailed list of facilities is not provided. The list is on file with each planning partner.

Table 4-5. Critical Facilities and Infrastructure by Jurisdiction and Category

	Commu-nication Facilities	Dams	Emer-gency Services	Energy	Govern-ment Facilities	Hazardous Materials	Health Care & Public Health	Infor-mation Technol-ogy	Schools	Trans-portation Systems	Water & Sanitation Systems	Total
Battle Ground			2	2	4	6	5		9	2	18	**48**
Camas	1	2	4	6	3	8	9		17	10	57	**117**
La Center	1		2	1	2		1		3	1	7	**18**
Ridgefield	0	0	3	1	2	4	1	0	4	3	12	**30**
Vancouver	4	0	13	24	37	62	165	0	60	126	54	**545**
Washougal	0	0	3	2	3	11	7	0	5	3	28	**62**
Woodland	0	0	3	1	0	2	0	0	5	0	0	**11**
Yacolt	2	0	2	0	1	1	0	0	1	0	0	**7**
Unincorporated	1	2	29	35	8	21	163	0	53	125	217	**654**
Total	**9**	**4**	**61**	**72**	**60**	**115**	**351**	**0**	**157**	**270**	**393**	**1,492**

Critical Facilities & Infrastructure

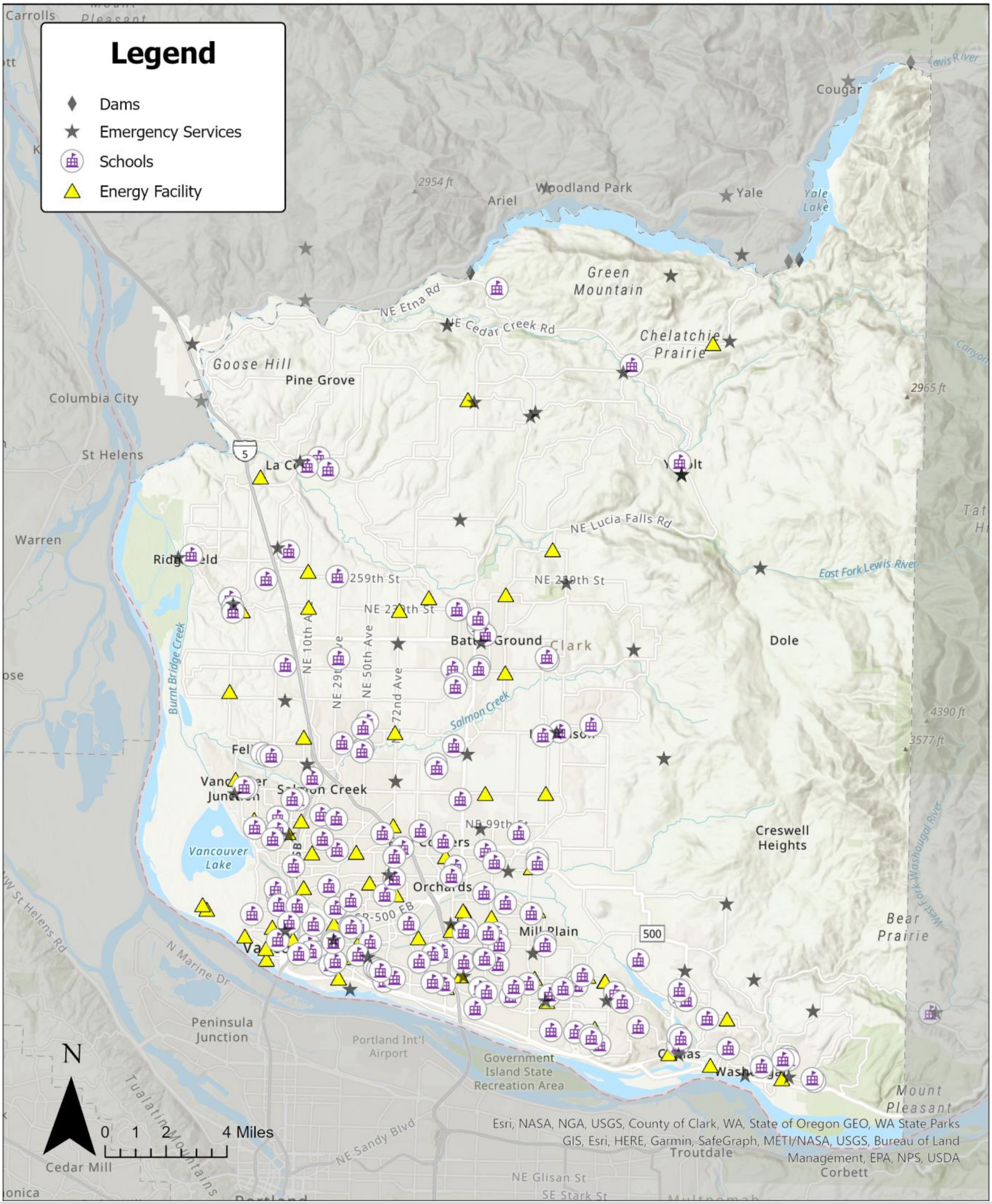


Figure 4-2. Critical Facilities and Infrastructure

4.4.4 Future Trends in Development

The municipal planning partners have adopted comprehensive plans that govern land-use decision-making and policy-making in their jurisdictions. The Community Framework Plan adopted in 1993 as Clark County's long-term vision of what the county could become guides the development of each jurisdiction's growth management comprehensive plan. It embodies countywide planning policies and envisions urban growth areas (UGAs) with specific boundaries and rural centers within larger natural resource and rural areas (Clark County, 2016b).

The Framework Plan emphasizes distinctions between urban, rural and resource lands. It encourages growth in UGAs and rural centers, with each center of development distinct from the others. These centers of development are of different sizes; they contain different combinations of housing, shopping, and employment areas. Each provides places to live and work. The centers are oriented and developed around neighborhoods to create a distinct sense of community (Clark County, 2016b).
In order to achieve this development pattern, each UGA designates a mix of land uses with housing, businesses, and services appropriate to its character and location. Residential development appropriate to the needs of workers and residents is encouraged nearby. Outside of UGAs, the land is predominantly rural with farms, forests, open space, and large lot residences. Shopping and businesses are located in rural centers. Most of northern Clark County remains in rural use, with some resource-based industries (Clark County, 2016b).

This hazard mitigation plan will work together with local programs to support wise land use in the future by providing vital information on the risk associated with natural hazards in the planning area. All municipal planning partners will incorporate this hazard mitigation plan update in their comprehensive plans by reference. This will ensure that future development trends can be established with the benefits of the information on risk and vulnerability to natural hazards identified in this plan.
Risks to future development are analyzed in this plan for each identified hazard that has a defined spatial extent and location. For hazards that lack this spatial reference, buildable lands summary information in Table 4-6 summarizes buildable land area by use category for the planning area.

Table 4-6. Buildable Lands in Planning Area Urban Growth Areas[a]

Urban Growth Area Name	Residential (acres)	Commercial (acres)	Industrial (acres)	Total (acres)
Battle Ground	1,070	412	188	1,670
Camas	891	337	495	1,724
La Center	373	44	49	466
Ridgefield	1,009	192	542	1,743
Vancouver	3,620	971	2,414	7,005
Washougal	477	88	268	833
Woodland	25	0	0	25
Yacolt	44	11	29	83
Total	**7,509**	**2,055**	**3,984**	**13,548**

a. Buildable lands information in this plan is for planning purposes only. Discrepancies may exist between these estimates and official records maintained by participating jurisdictions.
b. Unincorporated areas outside of urban growth areas are excluded from this assessment. Development in these areas consists largely of rural lands, open space and large residential lots. Changes in development can be assessed through
c. Acreage covers only mapped parcels; it excludes many rights of way and major water features.
d. Acreage includes Clark County and the incorporated areas of the City of Woodland.

4.5 DEMOGRAPHICS

Some populations are at greater risk from hazard events because of decreased resources or physical abilities. Research has shown that people living near or below the poverty line, the elderly, socially-isolated persons, people with disabilities, women, children, ethnic minorities and renters all experience, to some degree, more severe effects from disasters than the general population. They may vary from the general population in risk perception, living conditions, access to information, capabilities during a hazard event, and access to resources for post-disaster recovery. These populations often overlap spatially and live in the most vulnerable locations. Detailed spatial analysis to locate areas where there are higher concentrations of vulnerable community members would assist the County in extending focused public outreach and education to these most vulnerable residents.

4.5.1 Population Characteristics

Information about the composition of the population and how it has changed in the past and how it may change in the future is a critical part of planning because it directly relates to land needs such as housing, industry, public services, and transportation. The Washington Office of Financial Management estimated the total Clark County population at 503,311 as of the 2020 Census (WSOFM, 2022). Table 4-7 presents current and recent population estimates for the county as a whole and for individual jurisdictions within it. Most of the population resides in the incorporated cities, which are mostly along the banks of the Columbia River. The City of Vancouver far surpasses the rest of the cities in population, with over 190,000 residents, although the unincorporated county has a larger total population, with about 233,000 (WSOFM, 2022).

Table 4-7. Clark County City and Unincorporated Area Population, 1990 - 2020

	Population Estimate			
	1990	2000	2010	2020
Battle Ground	3,758	9,322	17,571	20,743
Camas	6,798	12,534	19,355	26,065
La Center	483	1,654	2,800	3,424
Ridgefield	1,332	2,147	4,763	10,319
Vancouver	46,380	143,560	161,791	190,915
Washougal	4,764	8,595	14,095	17,039
Woodland	2,500	3,780	5,509	6,531
Yacolt	600	1,055	1,566	1,668
Unincorporated	173,844	166,279	203,339	233,054
Clark County Total[a]	**238,053**	**345,238**	**425,363**	**503,311**

a. County total is less than the sum of jurisdictions because Woodland includes population outside Clark County.
Source: WSOFM, 2022

Population change is also an important socio-economic indicators. A growing population generally indicates a growing economy, while a decreasing population signifies economic decline. Both incorporated and unincorporated areas in Clark County have continued to grow, as shown in Table 4-7 and Figure 4-3. Unincorporated-area population declined from 1990 to 2000, largely due to annexation of unincorporated areas; since then, unincorporated population has grown, remaining about 48 percent of the total county population.

Source: Washington OFM, 2022

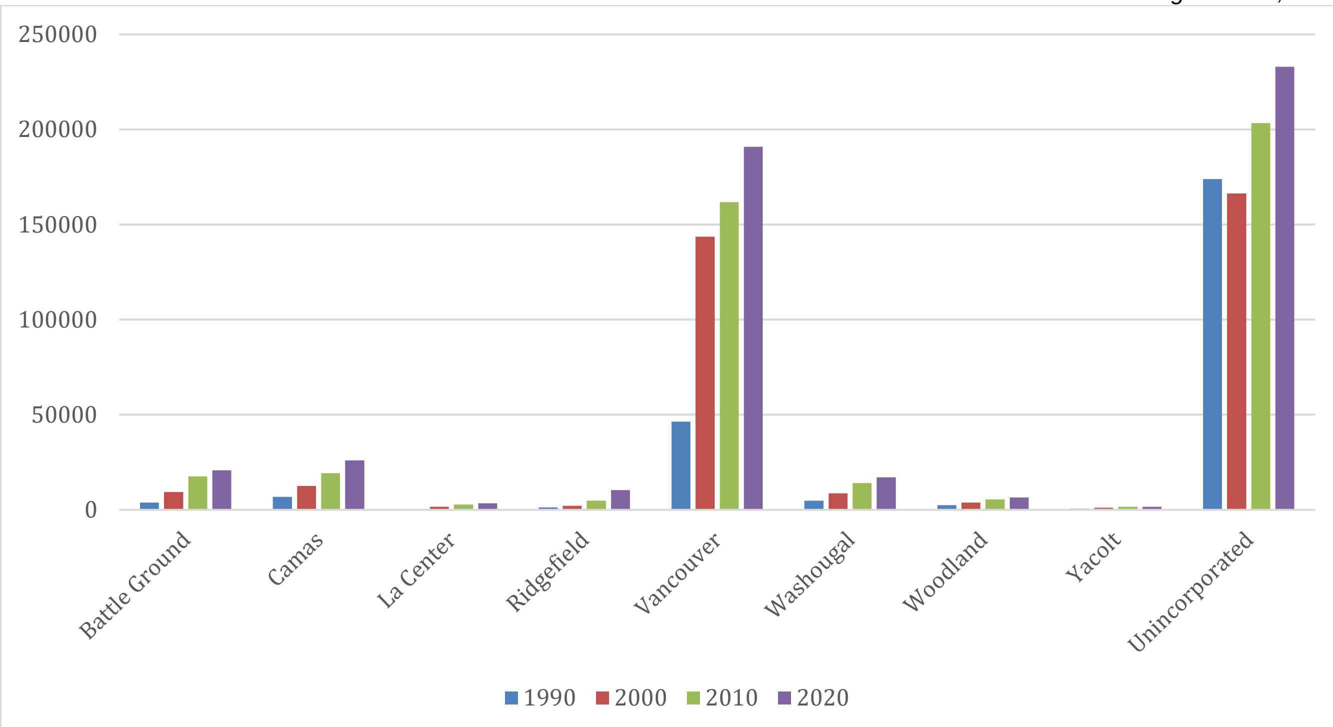


Figure 4-3. Clark County City and Unincorporated Area Population, 1990 - 2022

Overall, Clark County has experienced significant population growth recently. The State of Washington notes that Clark County was the fastest growing county with 1.9% growth between 2020-2021 (State of Washington 2015). Figure 4-4 shows the overall population growth rate in the planning area from 1910 to 2010 compared to that of the State of Washington. Clark County's 10-year growth rate has been slightly higher than the statewide rate, except for the 1950s.

4.5.2 Age Distribution

As a group, the elderly are more likely than the general population to lack the physical and economic resources to respond to hazard events and are more likely to suffer health-related consequences. They are more likely to be vision, hearing, and/or mobility impaired, and more likely to experience mental impairment. The elderly are more likely to live in assisted-living facilities where emergency preparedness occurs at the discretion of facility operators. These facilities are typically identified as "critical facilities" by emergency managers, and they require extra notice to implement evacuation. Elderly residents living in their own homes may have more difficulty evacuating and could be stranded in hazard events. This population is more likely to need medical attention, which may not be readily available during natural disasters due to isolation caused by the event. Specific planning attention for the elderly is an important consideration given the current aging of the American population.

Children are vulnerable to disaster events because of their young age and dependence on others for basic necessities. Very young children may additionally be vulnerable to injury or sickness; this vulnerability can be worsened during a natural disaster because they may not understand the measures that need to be taken to protect themselves from hazards.

The age distribution for the planning area is shown in Figure 4-5. Based on U.S. Census estimates, 12.1 percent of the county's population is 65 or older and 21.6 percent is 14 or younger (U.S. Census Bureau, 2015).

Source: WSOFM, 2022

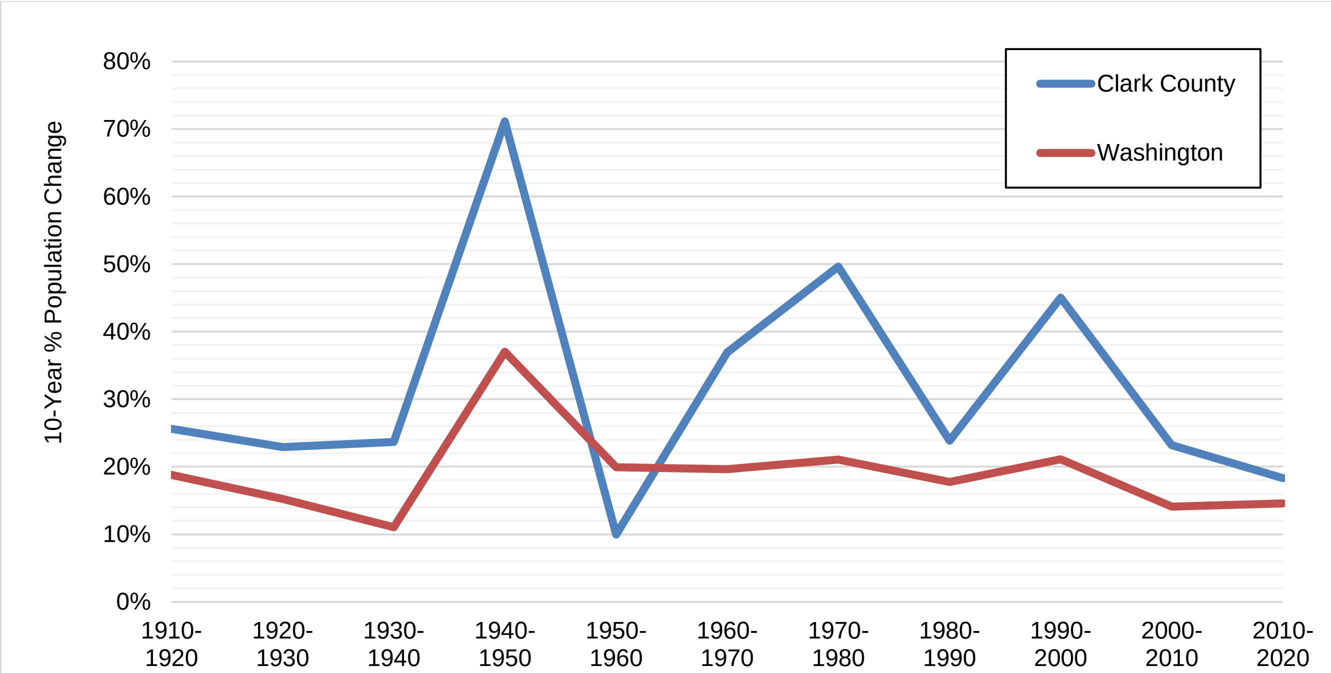


Figure 4-4. Washington and Clark County Population Growth

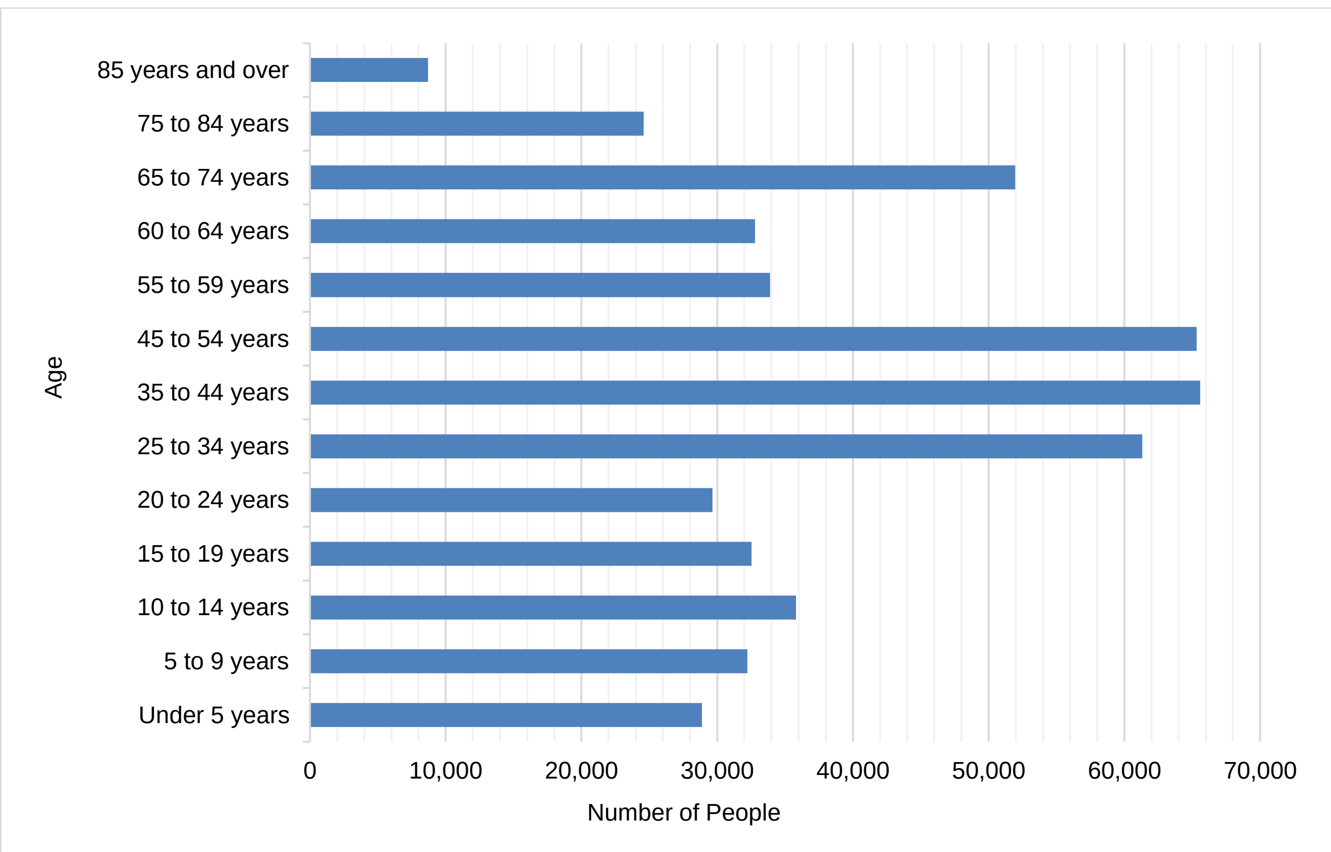


Figure 4-5. Planning Area Age Distribution

4.5.3 Race, Ethnicity and Language

Research shows that minorities are less likely to be involved in pre-disaster planning and experience higher mortality rates during a disaster event. Post-disaster recovery can be ineffective and is often characterized by cultural insensitivity. Higher proportions of ethnic minorities live below the poverty line than the majority white population, and poverty can compound vulnerability. According to the U.S. Census, the racial composition of the planning area is predominantly white, at 85.7 percent. The largest minority populations are Asian at 4.09 percent, “Two or More Races” at 4.12 percent, and “Some Other Race” at 2.67 percent. Figure 4-6 shows the racial distribution in the planning area (U.S. Census Bureau, 2015).

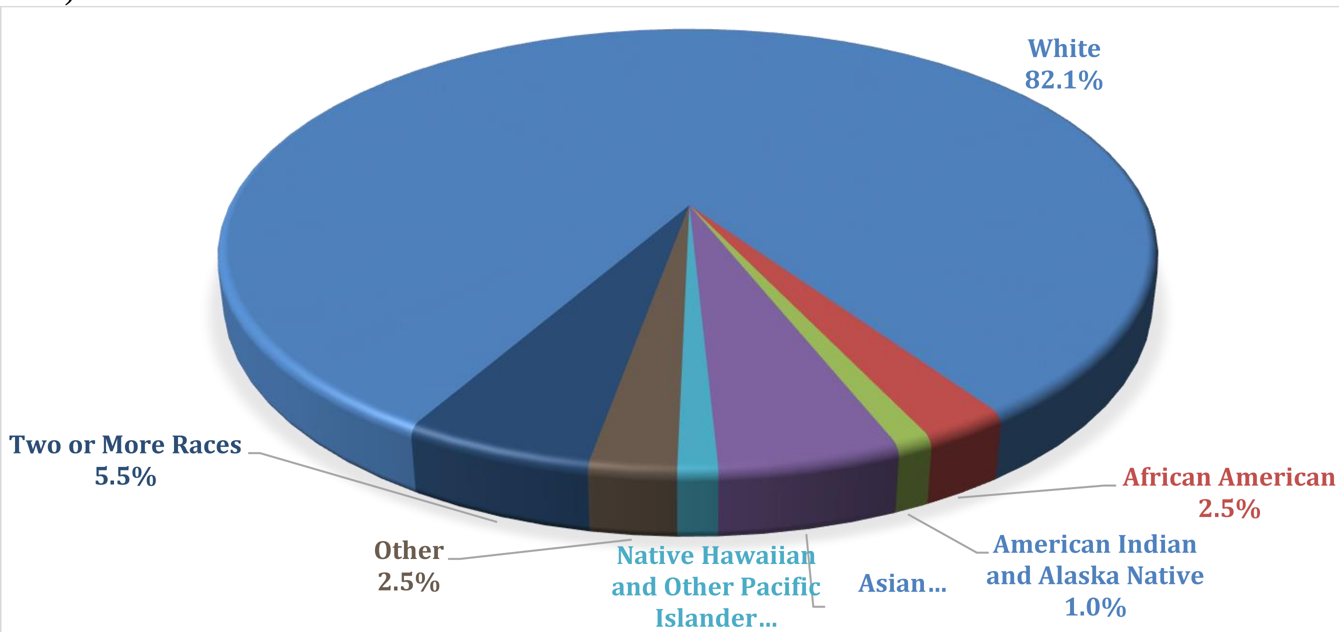


Figure 4-6. Planning Area Race Distribution

The planning area has a 9.95-percent foreign-born population. Other than English, the most commonly spoken languages in the planning area are Indo-European languages. The census estimates 6 percent of residents speak English “less than very well” (U.S. Census Bureau, 2022).

4.5.4 Persons with Disabilities or with Access and Functional Needs

Persons with disabilities or others with access and functional needs are more likely to have difficulty responding to a hazard event than the general population. Local government is the first level of response to assist these individuals, and coordination of efforts to meet their access and functional needs is paramount to life safety efforts. It is important for emergency managers to distinguish between functional and medical needs in order to plan for incidents that require evacuation and sheltering. Knowing the percentage of population with a disability will allow emergency management personnel and first responders to have personnel available who can provide services needed by those with access and functional needs.

According to U.S. Census estimates, 12.1 percent of the Clark County population has some form of disability, including 33.4 percent of those 65 and older (U.S. Census Bureau, 2022).

4.6 ECONOMY

The economy of Clark County is significantly affected by its location within the Portland Metropolitan Area. One-fifth of the county's labor force—nearly 50,000 workers—commutes to Portland on a daily basis; only 9,500 commute in the opposite direction. The lack of a sales tax in Oregon has led to significant leakage of retail sales in Clark County, lowering both retail investment and tax revenues for local governments (Washington ESD, 2014).

4.6.1 Income

In the United States, individual households are expected to use private resources to prepare for, respond to and recover from disasters to some extent. This means that households living in poverty are automatically disadvantaged when confronting hazards. Additionally, the poor typically occupy more poorly built and inadequately maintained housing. Mobile or modular homes, for example, are more susceptible to damage in earthquakes and floods than other types of housing. In urban areas, the poor often live in older houses and apartment complexes, which are more likely to be made of un-reinforced masonry, a building type that is particularly susceptible to damage during earthquakes. Furthermore, residents below the poverty level are less likely to have insurance to compensate for losses incurred from natural disasters. This means that residents below the poverty level have a great deal to lose during an event and are the least prepared to deal with potential losses. Personal household economics significantly impact people's decisions on evacuation. Individuals who cannot afford gas for their cars will likely decide not to evacuate.

Based on U.S. Census Bureau American Community Survey estimates the median household income was $77,184. It is estimated that 37 percent of households receive an annual income of $100,000 or more. An estimated 12 percent of households in the county made less than $25,000 per year in 2020, and 6 percent of families had incomes below the poverty level. The Census Bureau estimates that 2.65 percent of the population under age 18 and 1 percent of the population 65 or older has an income below the poverty line (U.S. Census Bureau, 2020).

4.6.2 Industry, Businesses and Institutions

Major industry sectors in Clark County include healthcare and social assistance (25,000 jobs in 2020), retail trade (24,800 jobs), construction (20,600 jobs) and manufacturing (25,800 jobs). In addition, government employed 23,700, half of which were in public education (Washington ESD, 2014).

Figure 4-7 shows the U.S. Census Bureau breakdown of industry types in Clark County (U.S. Census Bureau, 2015).

4.6.3 Employment Trends and Occupations

Over the past 20 years, Clark County nonfarm employment has grown more than twice as fast as the nation's and much faster than the state's. Pre-recession employment peaked in November 2007. Employment hit bottom in February 2010, when the county had lost 6 percent of its jobs. Unemployment during the recession was exacerbated by higher than average job losses for county residents working in Portland. The recovery was slow in 2011 and 2012, but job growth began accelerating in mid-2013 and has been rapid since then (Washington ESD, 2014).

Clark County's unemployment rate was lower than state and national averages during the 1990s; however, it has been higher than state and national averages since 2000. Figure 4-8 compares Washington and Clark County unemployment trends from 2000 through 2014. In the past 15 years, the county unemployment rate was lowest in 2007, at 5.6 percent. It then rose to 14.0 percent in 2010, and has gradually decreased since then. According to the 2013 American Community Survey, 64.6 percent of Clark County's population age 16 and older is in the labor force (U.S. Census Bureau, 2015).

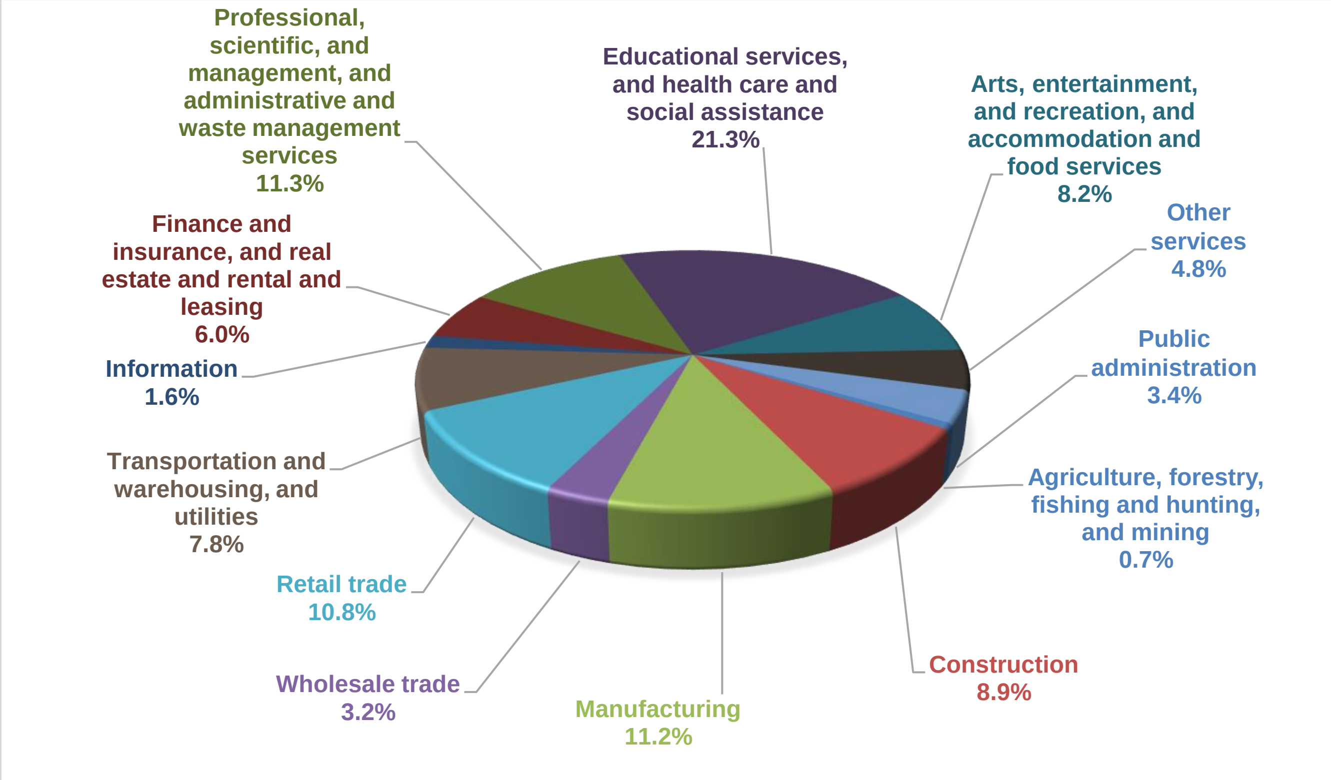


Figure 4-7. Industry in the Planning Area

Source: Washington ESD, 2015

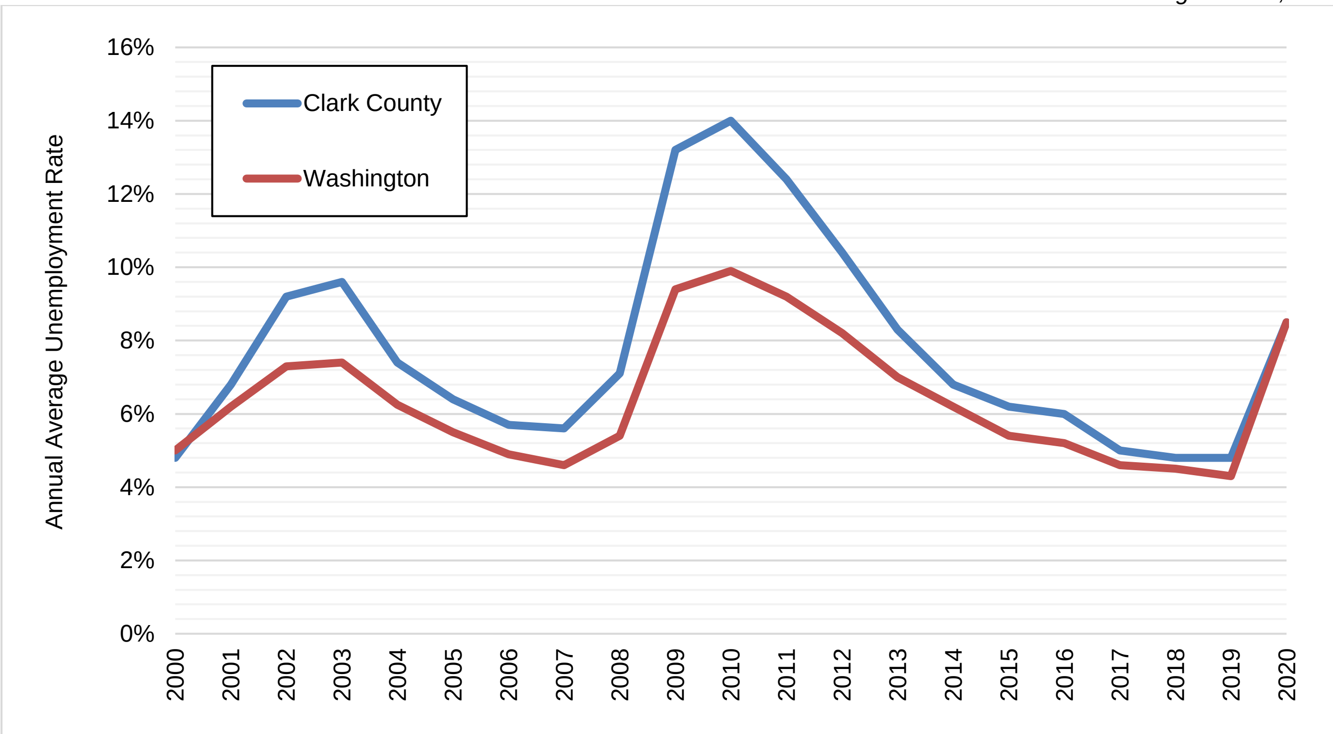


Figure 4-8. Clark County and Washington State Unemployment Rate

Over one-third of employed workers in Clark County (38.3 percent) are in management, business science and arts occupations. Another 21 percent have sales and office jobs, and 16.8 percent are in service occupations (see Figure 4-9) (U.S. Census Bureau, 2020).

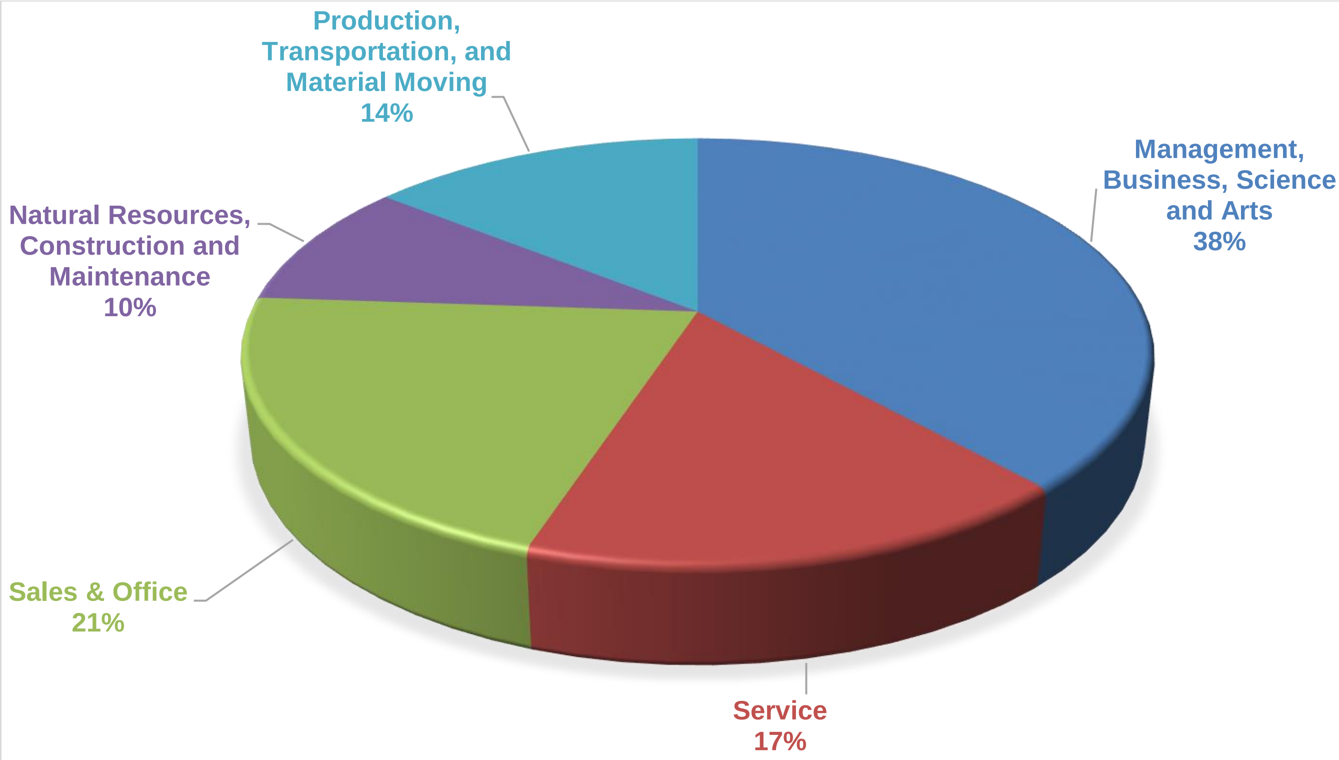


Figure 4-9. Occupations in the Planning Area

The largest employer in Clark County is PeaceHealth (4,374 full time equivalent employees as of 2015), followed by the Bonneville Power Administration (2,946 employees in 2015), and Evergreen Public Schools (2,764 employees as of 2015). Other large employers in the county are Vancouver Public Schools, Fred Meyer Stores, Clark County Government, Battle Ground Public Schools, Legacy Salmon Creek Medical Center, the Vancouver Clinic Inc., and WaferTech LLC (Vancouver Business Journal, 2015).

The U.S. Census estimates that 76.8 percent of Clark County workers commute alone to work (by car, truck or van), and mean travel time to work is 27.4 minutes (U.S. Census Bureau, 2020).

4.7 LAWS, ORDINANCES AND PROGRAMS

Existing laws, ordinances and plans at the federal, state and local level can support or impact hazard mitigation actions identified in this plan. Hazard mitigation planning must include review and incorporation, if appropriate, of existing plans, studies, reports and technical information (44 CFR, Section 201.6(b)(3)). This section provides a review of laws, ordinances and programs in effect within the planning area that can affect hazard mitigation actions. Goals, objectives, policies and actions identified in these programs were reviewed during the development of this plan and used to inform the development of the mitigation strategy. Each planning partner conducted an assessment of its regulatory, technical and financial capabilities to implement hazard mitigation actions (see Volume 2). These jurisdiction-specific capabilities were also used to inform the development of each planning partner's mitigation strategy.

During emergency situations, some Federal, State and Local laws and programs may have emergency protocols that go into effect to waive or expedite certain requirements or procedures. These modifications are limited in scope and duration and all mitigation and recovery projects should be planned for and implemented in ways that they meet all federal, state and local laws.

4.7.1 Federal

Disaster Mitigation Act

The DMA is the current federal legislation addressing hazard mitigation planning. It emphasizes planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before Hazard Mitigation Grant Program funds are available to communities. This plan is designed to meet the requirements of DMA, improving the planning partners' eligibility for future hazard mitigation funds.

Endangered Species Act

The federal Endangered Species Act (ESA) was enacted in 1973 to conserve species facing depletion or extinction and the ecosystems that support them. The act sets forth a process for determining which species are threatened and endangered and requires the conservation of the critical habitat in which those species live. The ESA provides broad protection for species of fish, wildlife and plants that are listed as threatened or endangered. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species and contains exceptions and exemptions. It is the enabling legislation for the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Criminal and civil penalties are provided for violations of the ESA and the Convention. Federal agencies must seek to conserve endangered and threatened species and use their authorities in furtherance of the ESA's purposes. The ESA defines three fundamental terms:

- Endangered means that a species of fish, animal or plant is "in danger of extinction throughout all or a significant portion of its range." (For salmon and other vertebrate species, this may include subspecies and distinct population segments.)
- Threatened means that a species "is likely to become endangered within the foreseeable future." Regulations may be less restrictive for threatened species than for endangered species.
- Critical habitat means "specific geographical areas that are…essential for the conservation and management of a listed species, whether occupied by the species or not."

Five sections of the ESA are of critical importance to understanding it:

- **Section 4: Listing of a Species**—The National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries) is responsible for listing marine species; the U.S. Fish and Wildlife Service is responsible for listing terrestrial and freshwater aquatic species. The agencies may initiate reviews for listings, or members of the public may petition for them. A listing must be made "solely on the basis of the best scientific and commercial data available." After a listing has been proposed, agencies receive comment and conduct further scientific reviews for 12 to 18 months, after which they must decide if the listing is warranted. Economic impacts cannot be considered in this decision, but it may include an evaluation of the adequacy of local and state protections. Critical habitat for the species may be designated at the time of listing.
- **Section 7: Consultation**—Federal agencies must ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed or proposed species or adversely modify its critical habitat. This includes private and public actions that require a federal permit. Once a final listing is made, non-federal actions are subject to the same review, termed a "consultation." If the listing agency finds that an action will "take" a species, it must

propose mitigations or "reasonable and prudent" alternatives to the action; if the proponent rejects these, the action cannot proceed.

- **Section 9: Prohibition of Take**—It is unlawful to "take" an endangered species, including killing or injuring it or modifying its habitat in a way that interferes with essential behavioral patterns, including breeding, feeding or sheltering.
- **Section 10: Permitted Take**—Through voluntary agreements with the federal government that provide protections to an endangered species, a non-federal applicant may commit a take that would otherwise be prohibited as long as it is incidental to an otherwise lawful activity (such as developing land or building a road). These agreements often take the form of a "Habitat Conservation Plan."
- **Section 11: Citizen Lawsuits**—Civil actions initiated by any citizen can require the listing agency to enforce the ESA's prohibition of taking or to meet the requirements of the consultation process.

With the listing of salmon and trout species as threatened or endangered, the ESA has impacted most of the Pacific coast states. Some areas have been more impacted by the ESA than others due to the known presence of listed species, but the entire region is impacted by mandates, programs and policies based on the presumption of the presence of listed species. Most West Coast jurisdictions must now take into account the impact of their programs on habitat. According to the Municipal Research Services Center, "Recent court decisions and federal administrative actions connected to the U.S. Endangered Species Act (ESA) have required 122 units of local and tribal governments in the Puget Sound region in Washington State to make changes in how they administer the National Flood Insurance Program (NFIP). This is an ongoing process due to pending litigation and the complexities of determining the needed changes. Although presently limited to the Puget Sound region, future lawsuits or decisions by FEMA may extend the geographic area covered to more areas in Washington." (MRSC, 2016).

According to the U.S. Fish and Wildlife Service, there are a number of threatened or endangered species thought to occur in Clark County, including bull trout, chum, chinook, coho and steelhead. Clark County has established a variety of regulations to protect these species including: development codes; habitat protection; enhancement programs; and education and outreach (Clark County Environmental Services, 2016).

Federally funded projects, such as those awarded pre-disaster mitigation or flood mitigation assistance grants, cannot jeopardize the continued existence of endangered or threatened species or adversely modify critical habitat (FEMA, 2015a).

Clean Water Act

The federal Clean Water Act (CWA) employs regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's surface waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."

Evolution of CWA programs over the last decade has included a shift from a program-by-program, source-by-source, pollutant-by-pollutant approach to more holistic watershed-based strategies. Under the watershed approach, equal emphasis is placed on protecting healthy waters and restoring impaired ones. A full array of issues are addressed, not just those subject to CWA regulatory authority. Involvement of stakeholder groups in the development and implementation of strategies for achieving and maintaining water quality and other environmental goals is a hallmark of this approach.

The CWA is important to hazard mitigation in several ways. There are often permitting requirements for any construction within 200 feet of water of the United States, which may have implications for mitigation projects identified by a local jurisdiction. Additionally, CWA requirements apply to wetlands, which serve important functions related to preserving and protecting the natural and beneficial functions of floodplains and are linked with a community's floodplain management program. Finally, the National Pollutant Discharge Elimination System is part of the CWA and addresses local stormwater management programs. Stormwater management plays a critical role in hazard mitigation by addressing urban drainage or localized flooding issues within jurisdictions. In Washington State, the Department of Ecology develops and administers National Pollutant Discharge Elimination System municipal stormwater permits.

National Flood Insurance Program

The National Flood Insurance Program provides federally backed flood insurance in exchange for communities enacting floodplain regulations. Participation in the NFIP is voluntary; however, participation and good standing under NFIP are prerequisites to grant funding eligibility under the Robert T. Stafford Act. The County and most of the partner cities for this plan participate in the NFIP and have adopted regulations that meet the NFIP requirements.

National Incident Management System

The National Incident Management System (NIMS) is a systematic approach for government, nongovernmental organizations, and the private sector to work together to manage incidents involving hazards. The NIMS provides a flexible but standardized set of incident management practices. Incidents typically begin and end locally, and they are managed at the lowest possible geographical, organizational, and jurisdictional level. In some cases, success depends on the involvement of multiple jurisdictions, levels of government, functional agencies, and emergency responder disciplines. These cases necessitate coordination across a spectrum of organizations. Communities using NIMS follow a comprehensive national approach that improves the effectiveness of emergency management and response personnel across the full spectrum of potential hazards (including natural hazards, terrorist activities, and other human-caused disasters) regardless of size or complexity. Although participation is voluntary, Federal departments and agencies are required to make adoption of NIMS by local and state jurisdictions a condition to receive Federal Preparedness grants and awards (Washington Emergency Management Division, 2016).

Americans with Disabilities Act and Amendments

The Americans with Disabilities Act (ADA) seeks to prevent discrimination against people with disabilities in employment, transportation, public accommodation, communications, and government activities. Title II of the ADA deals with compliance with the Act in emergency management and disaster-related programs, services, and activities. It applies to state and local governments as well as third parties, including religious entities and private nonprofit organizations.

The ADA has implications for sheltering requirements and public notifications. During an emergency alert, officials must use a combination of warning methods to ensure that all residents have all necessary information. Those with hearing impairments may not hear radio, television, sirens, or other audible alerts, while those with visual impairments may not see flashing lights or visual alerts. Two technical documents issued for shelter operators address physical accessibility needs of people with disabilities as well as medical needs and service animals.

The ADA intersects with disaster preparedness programs in regards to transportation, social services, temporary housing, and rebuilding. Persons with disabilities may require additional assistance in evacuation and transit (e.g., vehicles with wheelchair lifts or paratransit buses). Evacuation and other response plans should address the unique needs of residents. Local governments may be interested in implementing a special-needs registry to identify the home addresses, contact information, and needs for residents who may require more assistance.

Civil Rights Act of 1964

The Civil Rights Act of 1964 prohibits discrimination based on race, color, religion, sex or nation origin and requires equal access to public places and employment. The Act is relevant to emergency management and hazard mitigation in that it prohibits local governments from favoring the needs of one population group over another. Local government and emergency response must ensure the continued safety and well-being of all residents equally, to the extent possible.

Rural Development Program

The mission of the U.S. Department of Agriculture (USDA) Rural Development Program is to help improve the economy and quality of life in rural America. The program provides project financing and technical assistance to help rural communities provide the infrastructure needed by rural businesses, community facilities, and households. The program addresses rural America’s need for basic services, such as clean running water, sewage and waste disposal, electricity, and modern telecommunications and broadband. Loans and competitive grants are offered for various community and economic development projects and programs, such as the development of essential community facilities including fire stations (USDA, 2015b).

Community Development Block Grant Disaster Resilience Program

In response to disasters, Congress may appropriate additional funding for the Community Development Block Grant programs as Disaster Recovery grants (CDBG-DR) to rebuild the affected areas and provide crucial seed money to start the recovery process. Since CDBG-DR assistance may fund a broad range of recovery activities, The U.S. Department of Housing and Urban Development can help communities and neighborhoods that otherwise might not recover due to limited resources. CDBG-DR grants often supplement disaster programs of the Federal Emergency Management Agency, the Small Business Administration, and the U.S. Army Corps of Engineers. Housing and Urban Development generally awards noncompetitive, nonrecurring CDBG-DR grants by a formula that considers disaster recovery needs unmet by other Federal disaster assistance programs. CDBG-DR monies must be used to: address a disaster-related impact (direct or indirect) in a presidentially declared county for the covered disaster; be a CDBG eligible activity (according to regulations and waivers); and meet a national objective. Incorporating preparedness and mitigation into these actions is encouraged as the goal is to rebuild in ways that are safer and stronger.

Emergency Watershed Program

The USDA Natural Resources Conservation Service (NRCS) administers the Emergency Watershed Protection (EWP) Program, which responds to emergencies created by natural disasters. Eligibility for assistance is not dependent on a national emergency declaration. The program is designed to help people and conserve natural resources by relieving imminent hazards to life and property caused by floods, fires, wind-storms, and other natural occurrences. EWP is an emergency recovery program.
EWP eligible activities include providing financial and technical assistance to:

- Remove debris from stream channels, road culverts, and bridges
- Reshape and protect eroded banks
- Correct damaged drainage facilities

- Establish cover on critically eroding lands
- Repair levees and structures
- Repair conservation practices (National Resources Conservation Service, 2016).

Presidential Executive Orders 11988 and 13690

Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities" for the following actions:

- Acquiring, managing, and disposing of federal lands and facilities
- Providing federally-undertaken, financed, or assisted construction and improvements
- Conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities (FEMA, 2015e).

Executive Order 13690 amends and expands Executive Order 11988 acknowledges that the impacts of flooding are anticipated to increase over time due to the effects of climate change and other threats and mandates a Federal Flood Risk Management Standard, which is a flexible framework to increase resilience against flooding and help preserve the natural values of floodplains. This standard expands management of flood issues from the current base flood level to a higher vertical elevation and corresponding horizontal floodplain to address current and future flood risk and ensure that projects funded with taxpayer dollars last as long as intended (Office of the Press Secretary, 2015).

Presidential Executive Orders 11990

Executive Order 11990 requires federal agencies to provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; and (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities (National Archives, 2016).

Emergency Relief for Federally Owned Roads Program

The U.S. Forest Service’s Emergency Relief for Federally Owned Roads Program was established to assist federal agencies with repair or reconstruction of tribal transportation facilities, federal lands transportation facilities, and other federally owned roads that are open to public travel and have suffered serious damage by a natural disaster over a wide area or by a catastrophic failure. The program funds both emergency and permanent repairs (Office of Federal Lands Highway, 2016).

4.7.2 State

Washington State Enhanced Mitigation Plan

The 2018 Washington State Enhanced Hazard Mitigation Plan provides guidance for hazard mitigation throughout Washington (Washington Emergency Management Division, 2018). The plan identifies hazard mitigation goals, objectives, actions and initiatives for state government to reduce injury and damage from natural hazards. By meeting federal requirements for an enhanced state plan (44 CFR parts

201.4 and 201.5), the plan allows the state to seek significantly higher funding from the Hazard Mitigation Grant Program following presidential declared disasters (20 percent of federal disaster expenditures vs. 15 percent with a standard plan).

The *Clark Regional Natural Hazard Mitigation Plan* must be consistent with the Washington State Plan. One major example of this is that the Clark County plan must, at a minimum, address those hazards identified as impacting Clark County in the State Plan.

Growth Management Act

The 1990 Washington State Growth Management Act (Revised Code of Washington (RCW) Chapter 36.70A) mandates that local jurisdictions adopt land use ordinances protect the following critical areas:

- Wetlands
- Critical aquifer recharge areas
- Fish and wildlife habitat conservation areas
- Frequently flooded areas
- Geologically hazardous areas.

The Growth Management Act regulates development in these areas, and therefore has the potential to affect hazard vulnerability and exposure at the local level.

Planning for natural hazards is an integral element of Washington's statewide land use planning program under the Growth Management Act. Other related parts of the planning framework include the Shoreline Master Program rules and guidelines, which now provide for the integration of master programs and comprehensive plans. Natural Hazard Mitigation Elements are an optional element under the Growth Management Act. The continuing challenge faced by local officials and state government is to keep a network of coordinated local plans effective in responding to changing conditions and needs of communities. This is particularly true in the case of planning for natural and technological hazards, where communities must balance development pressures with detailed information on the nature and extent of hazards. Washington's land use program has given its communities and residents a unique opportunity to ensure that natural and technological hazards are addressed in the development and implementation of local comprehensive plans.

Shoreline Management Act

The 1971 Shoreline Management Act (RCW 90.58) was enacted to manage and protect the shorelines of the state by regulating development in the shoreline area. A major goal of the act is to prevent the "inherent harm in an uncoordinated and piecemeal development of the state's shorelines." Its jurisdiction includes the Pacific Ocean shoreline and the shorelines of Puget Sound, the Strait of Juan de Fuca, and rivers, streams and lakes above a certain size. It also regulates wetlands associated with these shorelines.

Shoreline management activities "implement policies and regulations to help protect water quality for our marine waters, lakes and stream systems; increase protection of lives and property from flood and landslide damage; protect critical habitat as well as fish and wildlife; promote recreational opportunities in shoreline areas." Often these policies and programs complement or are critical in mitigation programs for communities. Shoreline management programs are local capabilities relevant to mitigation activities.

Washington State Building Code

The Washington State Building Code Council has adopted the 2015 editions of national model codes, with some amendments. The Council also adopted changes to the Washington State Energy Code and Ventilation and Indoor Air Quality Code. Washington's state-developed codes are mandatory statewide for residential and commercial buildings. The 2015 codes went into effect as the Washington model code on July 1, 2016.

The adoption and enforcement of appropriate building codes is a significant component for hazard mitigation loss avoidance. Using the most up to date and relevant codes reduces risk and increases capability.

Comprehensive Emergency Management Planning

Washington's Comprehensive Emergency Management Planning law (RCW 38.52) establishes parameters to ensure that preparations of the state will be adequate to deal with disasters, to ensure the administration of state and federal programs providing disaster relief to individuals, to ensure adequate support for search and rescue operations, to protect the public peace, health and safety, and to preserve the lives and property of the people of the state. It achieves the following:

- Provides for emergency management by the state, and authorizes the creation of local organizations for emergency management in political subdivisions of the state.
- Confers emergency powers upon the governor and upon the executive heads of political subdivisions of the state.
- Provides for the rendering of mutual aid among political subdivisions of the state and with other states and for cooperation with the federal government with respect to the carrying out of emergency management functions.
- Provides a means of compensating emergency management workers who may suffer any injury or death, who suffer economic harm including personal property damage or loss, or who incur expenses for transportation, telephone or other methods of communication, and the use of personal supplies as a result of participation in emergency management activities.
- Provides programs, with intergovernmental cooperation, to educate and train the public to be prepared for emergencies.

It is policy under this law that emergency management functions of the state and its political subdivisions be coordinated to the maximum extent with comparable functions of the federal government and agencies of other states and localities, and of private agencies of every type, to the end that the most effective preparation and use may be made of manpower, resources, and facilities for dealing with disasters.

Washington Administrative Code 118-30-060(1)

Washington Administrative Code (WAC) 118-30-060 (1) requires each political subdivision to base its comprehensive emergency management plan on a hazard analysis, and makes the following definitions related to hazards:

- Hazards are conditions that can threaten human life as the result of three main factors:
  - Natural conditions, such as weather and seismic activity
  - Human interference with natural processes, such as a levee that displaces the natural flow of floodwaters
  - Human activity and its products, such as homes on a floodplain.
- The definitions for hazard, hazard event, hazard identification, and flood hazard include related concepts:
  - A hazard may be connected to human activity.
  - Hazards are extreme events.

Hazards generally pose a risk of damage, loss, or harm to people and/or their property

Washington State Floodplain Management Law

Washington's floodplain management law (RCW 86.16, implemented through WAC 173-158) states that prevention of flood damage is a matter of statewide public concern and places regulatory control with the Department of Ecology. RCW 86.16 is cited in floodplain management literature, including FEMA's national assessment, as one of the first and strongest in the nation. A major challenge to the law in 1978, Maple Leaf Investors v. Ecology, is cited in legal references to floodplain management issues. The court upheld the law, declaring that denial of a permit to build residential structures in the floodway is a valid exercise of police power and did not constitute a taking. RCW Chapter 86.12 (Flood Control by Counties) authorizes county governments to levy taxes, condemn properties and undertake flood control activities directed toward a public purpose.

This provision also task Counties to develop comprehensive flood control management plans. Following adoption by the county, city, or town, a comprehensive flood control management plan shall be binding on each jurisdiction and special district that is located within an area included in the plan. If within one hundred twenty days of the county's adoption, a city or town does not adopt the comprehensive flood control management plan, the city or county shall request arbitration on the issue or issues in dispute. If parties cannot agree to the selection of an arbitrator, the arbitrator shall be selected according to the process described in *RCW 7.04.050.

Washington State/Ecology Grant Sources

Washington's first flood control maintenance program was passed in 1951, and was called the Flood Control Maintenance Program. In 1984, the state Legislature established the Flood Control Assistance Account Program (FCAAP) (RCW 86.26; State Participation in Flood Control Maintenance) to assist local jurisdictions in comprehensive planning and flood control maintenance efforts. FCAAP rules are found in WAC 173-145. This is one of very few state programs in the country that provides grant funding to local governments for flood plain management planning and implementation actions. The account is funded at $4 million per state biennium, unless modified by the state legislature. Projects include comprehensive flood hazard management planning, maintenance projects, feasibility studies, purchase of flood prone properties, match for federal projects, and emergency projects. FCAAP grants for non-emergency projects may not exceed $500,000 per county. However, applications are not currently being accepted for this program due to funding cuts, with the exception of emergency projects.
Floodplains by Design (FbD) is an emerging partnership of local, state, federal and private organizations focused on coordinating investment in and strengthening the integrated management of floodplain areas through Washington State. In 2013, the Washington State Legislature authorized $44 million in new funding for integrated projects consistent with Floodplains by Design; and a similar level of funding was also authorized in the 2015-17 Biennium. The Washington State Department of Ecology's Floods and Floodplain Management Division administers the Floodplains by Design grant program under a biennial funding cycle. Ecology awards grants on a competitive basis to eligible entities for collaborative and innovative projects throughout Washington State that support the integration of flood hazard reduction with ecological preservation and restoration. Proposed projects may also address other community needs, such as preservation of agriculture, improvements in water quality, or increased recreational opportunities provided they are part of a larger strategy to restore ecological functions and reduce flood hazards.

Washington Silver Jackets

The Washington Silver Jackets team was formed in 2010 and is a mix of Federal and State agencies that work together to address state flood risk priorities in the State. Federal agencies include the U.S. Army Corps of Engineers Seattle District, which facilitates coordination within the group, and individuals from FEMA, NOAA, and USGS. Participating state agencies include the Department of Ecology, Emergency Management Division, and Department of Transportation. The team has been awarded three interagency projects over the last three years. Each project and routine coordination and communication between Silver Jackets agencies is intended to address state needs and ultimately improve flood risk management throughout the full flood life cycle (Silver Jackets, 2016).

Land and Water Conservation Fund

The Land and Water Conservation Fund provides funding to preserve and develop outdoor recreation resources, including parks, trails, and wildlife lands. Congress established the fund in 1965 with the passage of the Land and Water Conservation Fund Act that authorizes the Secretary of the Interior to provide financial assistance to the states for the acquisition and development of public outdoor recreation areas. Funding comes from a portion of federal revenue from selling and leasing off-shore oil and gas resources. Eligible projects include land acquisition and development or renovation projects, such as natural areas and open space. The Washington State Recreation and Conservation Office administers the program (Washington State Recreation and Conservation Office, 2016a).

Salmon Recovery Fund

In 1999, the Washington State Legislature created the Salmon Recovery Funding Board. The board provides grants to protect or restore salmon habitat and assist related activities. Funded projects may include activities that protect existing, high quality habitats for salmon, and that restore degraded habitat to increase overall habitat health and biological productivity; undertake feasibility assessments to determine future projects and for other salmon related activities. Projects may include the actual habitat used by salmon and the land and water that support ecosystem functions and processes important to salmon (Washington State Recreation and Conservation Office, 2016b).

State Environmental Policy Act

The State Environmental Policy Act (SEPA) provides a way to identify possible environmental impacts that may result from governmental decisions. These decisions may be related to issuing permits for private projects, constructing public facilities, or adopting regulations, policies, or plans. Information provided during the SEPA review process helps agency decision-makers, applicants, and the public understand how a proposal will affect the environment. This information can be used to change a proposal to reduce likely impacts, or to condition or deny a proposal when adverse environmental impacts are identified. Actions identified in hazard mitigation plans are frequently subject to SEPA review requirements before implementation (Washington Department of Ecology, 2016b).

4.7.3 Local Programs

Each planning partner has prepared a jurisdiction-specific annex to this plan (see Volume 2). In preparing these annexes, each partner completed a capability assessment that looked at its regulatory, technical and financial capability to carry out proactive hazard mitigation. Refer to these annexes for a review of regulatory codes and ordinances applicable to each planning partner. This section provides an overview of programs in Clark County that can support or enhance the initiatives identified in this plan and apply countywide.

Clark County Comprehensive Plan Update

Clark County is in the process of updating its Comprehensive Growth Management Plan. The County has completed a draft Supplemental Environmental Impact Statement (DSEIS) for the plan (Clark County, 2016b) and is currently developing the update. The draft plan and other relevant documents will be made available as completed on the project website. The DSEIS assesses the impact of various growth management alternatives on potential hazard areas, including waterways, open spaces, liquefiable soils, landslide hazard areas, and wildlife habitat. The DSEIS evaluates how these areas may have changed since the last update in 2007.

The Land Use and Shoreline Use Elements of the County's comprehensive plan determine the general distribution, location and extent of land uses—agriculture, timber production, housing, commerce, industry, recreation, open spaces, public utilities, public facilities, and other uses, as well as transitions between rural and urban areas. These comprehensive plan elements include population densities, building intensities, and estimates of future population growth inside and outside the UGAs. The Environmental Element of the comprehensive plan contains policies to protect shoreline and critical areas and to develop regulations addressing land use issues such as protection of groundwater, stormwater runoff, flooding, and drainage problems (Clark County, 2016b).

Hazard Impact and Vulnerability Analysis

In 2011, CRESA developed a guidance document to assess hazards and vulnerabilities for the County and its cities (not including Woodland). The analysis identified vulnerability to the following natural and technological hazards (CRESA, 2011):

- Flooding
- Windstorm and tornado
- Severe winter weather
- Earthquake
- Landslide
- Drought
- Chemical emergency
- Terrorism
- Transportation accidents
- Dam failure
- Volcano
- Wildfire.

Each hazard analysis includes a description of the hazard and its potential range of impact and history in the County.

Clark Regional Comprehensive Emergency Management Plan

CRESA prepared a plan in 2018 to identify how it, along with the seven incorporated cities in Clark County (not including Woodland) and partnering agencies, would prepare for, respond to, recover from, and mitigate against hazard events (CRESA, 2018). The plan consists of appendices that delineate authorities, responsibilities, and appropriate references, along with emergency support function and incident annexes, which primarily focus on manmade hazard events.

Region IV Public Health Emergency Response Plan

In 2013, the Counties of Clark, Cowlitz, Skamania, and Wahkiakum (Region IV Public Health) coordinated to develop a regional public health emergency response plan (Region IV Public Health, 2013). Under this plan, the four local health departments in southwest Washington (Clark County Public Health, Cowlitz County Health Department, Skamania County Community Health and Wahkiakum County Health & Human Services), together with the Cowlitz Indian Tribe, have combined efforts and resources to ensure adequate response capacity to events affecting single or multiple jurisdictions. The plan provides each department guidance in ensuring appropriate response according to state, federal, and tribal agency requirements.

Vacant Buildable Lands Model Maps and Data

Clark County uses its Vacant Buildable Lands Model (Clark County, 2015b) as a planning tool to analyze residential, commercial, and industrial lands in urban growth areas. The model is used to monitor growth patterns for comprehensive growth management plan updates and interim periods. It models residential and employment capacity for each urban growth area, based on underutilized and vacant properties. Reports and maps are available free of charge for the County and for its eight incorporated cities (including Woodland).

Hazard mitigation plans must describe current and future risk to the hazards of concern. The Vacant Buildable Lands Model allows for the analysis of areas where future development may occur that may overlap with identified risk areas.

Clark County Local Emergency Planning Committee

CRESA’s Local Emergency Planning Committee works closely with the business community to form a safety net around the chemical industry in order to protect the general population from hazardous material incidents. The following committee activities demonstrate its ability to support County emergency management and preparedness initiatives (CRESA, 2015a):

- Clark County Hazardous Materials Response Plan maintenance
- Making chemical inventory information available to the public
- Industrial and transportation-related chemical hazard analysis
- Training and exercise development and coordination
- Public-private preparedness partnerships
- Public education on chemical hazard preparedness and response.

Clark County Volunteer Programs

CRESA promotes several volunteer response organizations to offer local residents a way to safely become involved in disaster management. These programs include the following (CRESA, 2015b):

- Clark Citizen Corps Council—Maintains the Community Emergency Response Teams, Medical Reserve Corps, American Red Cross, Neighbors on Watch, and Volunteer Connections
- Search and Rescue—Volunteers must belong to a recognized and qualified search and rescue team.
- Amateur Radio
- Trauma Intervention Program
- Emergency Operations Center Training and Volunteering.

5. HAZARDS OF CONCERN FOR RISK ASSESSMENT

Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards. The DMA requires hazard mitigation planning to include risk assessment (44 CFR, Section 201.6(c)(2)). The risk assessment for the *Clark Regional Natural Hazard Mitigation Plan* evaluates all natural hazards that are prevalent in the defined planning area. The first step in the process was to identify which hazards to include in the assessment. This chapter describes the process of identifying these hazards of concern.

5.1 FOCUS ON NATURAL HAZARDS

Natural hazards are naturally occurring severe events that have the potential to result in the loss of life and property. Technological or human-caused hazards also have the potential to result in the loss of life and property, but originate from human activities. Federal hazard mitigation planning guidelines require risk assessment for all natural hazards of concern; risk assessment of non-natural hazards (technological and/or human-caused) is optional. The Steering Committee decided that this plan will focus on natural hazards of concern, based on several factors:

- The federal funding streams for which this plan creates eligibility are focused on natural hazards of concern.
- Clark County already has several plans and programs that address non-natural hazards of concern such as the Hazard Identification and Vulnerability Assessment (CRESA, 2011) and the Comprehensive Emergency Response Plan (CRESA, 2013).
- The expertise needed to identify and implement appropriate mitigation actions for non-natural hazards of concern differs from the expertise needed for assessing natural hazards. The Steering Committee was formed with an emphasis on knowledge of and experience with natural hazards.
- It is difficult to develop a relative ranking of the risk of natural and non-natural hazards because of differences between the two types of hazard in probabilities, consequences and spatial extent.

Clark County's 2004 hazard mitigation plan addressed two non-natural hazards: terrorism and hazardous materials release. Terrorism was not addressed in the 2016 plan update, but the potential for hazardous material releases is discussed for each natural hazard profile as a potential secondary impact.

5.2 IDENTIFIED HAZARDS OF CONCERN

The Steering Committee considered the full range of natural hazards that could impact the planning area and selected those that present the greatest concern. The process incorporated review of state and local hazard planning documents, as well as information on the frequency, magnitude and costs associated with hazards that have impacted or could impact the planning area. Anecdotal information regarding the perceived vulnerability of planning area assets to natural hazards was used as appropriate. Based on the review, this plan addresses the following hazards of concern (in alphabetical order; this listing does not indicate relative risk):

- Dam failure
- Drought
- Earthquake
- Flood
- Landslide
- Severe weather
- Volcano
- Wildfire

All natural hazards identified in the 2004 plan were included in the 2016 plan, and two hazards of concern were added:

- Dam failure—Although dams and the reservoirs behind them are human-constructed, the dam failure hazard shares many characteristics with natural hazards. Inundation resulting from a dam failure has a defined extent and results in damage similar to damage from natural flooding that can be modeled using existing software. Additionally, dam failure is considered to be a flooding hazard that should be addressed in plans seeking approval under the Community Rating System (see Section 10.1.3). The dam failure risk assessment for this plan focuses on impacts on people and property, not the impacts on dam operations.
- Drought—The 2013 Washington State Enhanced Hazard Mitigation Plan (Washington Emergency Management Division, 2014) identifies drought as a hazard of concern and the 2011 Clark County Hazard Identification and Vulnerability Assessment (CRESA, 2011) identifies drought as a moderate risk hazard.

5.3 OTHER HAZARDS NOT ASSESSED

In addition to the hazards of concern listed above, the 2013 Washington State Enhanced Hazard Mitigation Plan identifies avalanche and tsunami as hazards of concern in Washington. Clark County is not identified in the state plan as a jurisdiction vulnerable to either of these hazards. The state plan does not list any major transportation systems in the County as transportation routes threatened by avalanche.

6. RISK ASSESSMENT METHODOLOGY

6.1 OVERALL RISK ASSESSMENT APPROACH

The risk assessments in Chapter 7 through Chapter 14 describe the risks associated with each identified hazard of concern. Each chapter describes the hazard, the planning area's exposure and vulnerability, and probable event scenarios. The planning team reviewed existing studies, reports and technical information to determine the best available data to utilize in the risk assessment (44 CFR, Section 201.6(b)(3)). Information from these sources was incorporated into the hazard profiles and forms the basis of the exposure and vulnerability assessment (see Section 6.6). The following steps were used to define the risk of each hazard:

- Profile each hazard—The following information is given for each hazard:
  - Summary of past events
  - Geographic area most affected by the hazard
  - Event frequency estimates
  - Severity estimates
  - Warning time likely to be available for response
  - Secondary hazards associated with or resulting from the hazard of concern
  - Future trends that may impact risk, including future development and climate trends
  - Worst-case event scenario
  - Key issues related to mitigation of the hazard in the planning area.
- Determine exposure to each hazard—Exposure was determined by overlaying hazard maps with demographic information and an inventory of structures, facilities and systems to determine which of them would be exposed to each hazard. For each hazard of concern, the best available existing data was used to delineate the hazard area, based on scale, age and source. Data available in a GIS-compatible format with coverage of the full extent of the planning area was preferred when available.
- Assess the vulnerability of exposed facilities—Vulnerability of exposed structures and infrastructure was determined by interpreting the probability of occurrence of each event and assessing structures, facilities, and systems that are exposed to each hazard. FEMA's hazard-modeling program, Hazus-MH was used to perform this assessment for some hazards; GIS-based spatial analysis or qualitative assessments were used for others.

6.2 MAPPING

National, state and county databases were reviewed to locate spatially based data relevant to this planning effort. Maps were produced using GIS software to show the spatial extent and location of identified hazards when such data was available. These maps are included in the hazard profile chapters of this document and many of them are available on the CRESA Hazard Mitigation Plan Project website. Additionally, municipal planning partners have jurisdiction-scale maps included in their annexes in Volume 2 of this plan. Information on the data sources and methodologies used for hazard mapping is provided in Appendix E.

6.3 DAM FAILURE, EARTHQUAKE AND FLOOD

6.3.1 Overview of FEMA's Hazus-MH Software

- FEMA developed the Hazards U.S., or Hazus, model in 1997 to estimate losses caused by earthquakes and identify areas that face the highest risk and potential for loss. Hazus was later expanded into a multi-hazard methodology, Hazus-MH, with new models for estimating potential losses from hurricanes and floods. The use of Hazus-MH for hazard mitigation planning offers numerous advantages:
  - Provides a consistent methodology for assessing risk across geographic and political entities.
  - Provides a way to save data so that it can readily be updated as population, inventory, and other factors change and as mitigation planning efforts evolve.
  - Facilitates the review of mitigation plans because it helps to ensure that FEMA methodologies are incorporated.
  - Supports grant applications by calculating benefits using FEMA definitions and terminology.
  - Produces hazard data and loss estimates that can be used in communication with local stakeholders.
  - Is administered by the local government and can be used to manage and update a hazard mitigation plan throughout its implementation.

Hazus-MH is a GIS-based software program used to support risk assessments, mitigation planning, and emergency planning and response. It provides a wide range of inventory data, such as demographics, building stock, critical facilities, transportation and utility lifeline, and multiple models to estimate potential losses from natural disasters. The program can be used to map hazard data and the results of damage and economic loss estimates for buildings and infrastructure.

6.3.2 Levels of Detail for Evaluation

Hazus-MH provides default data for inventory, vulnerability and hazards; this default data can be supplemented with local data to provide a more refined analysis. The model can carry out three levels of analysis, depending on the format and level of detail of information about the planning area:

- **Level 1**—All of the information needed to produce an estimate of losses is included in the software's default data. This data is derived from national databases and describes in general terms the characteristic parameters of the planning area.
- **Level 2**—More accurate estimates of losses require more detailed information about the planning area. To produce Level 2 estimates of losses, detailed information is required about local geology, hydrology, hydraulics and building inventory, as well as data about utilities and critical facilities. This information is needed in a GIS format.
- **Level 3**—This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize it for the planning area.

6.3.3 Application for This Plan

The Hazus model was used as follows for the hazards evaluated in this plan:

- **Flood**—A Level 2, user-defined analysis was performed for general building stock and for critical facilities and infrastructure. GIS building and assessor data (replacement cost values and detailed structure information) were loaded into Hazus-MH. Critical facility default data was updated whenever possible with locally available datasets. Current planning area flood mapping was used to delineate flood hazard areas and estimate potential losses from the 100- and 500-year flood events. To estimate damage that would result from a flood, Hazus uses pre-defined relationships between flood depth at a structure and resulting damage, with damage given as a percent of total replacement value. Curves defining these relationships have been developed for damage to structures and for damage to typical contents within a structure. By inputting flood depth data and known property replacement cost values, dollar-value estimates of damage were generated.

- **Dam Failure**—The basis for this analysis was the Lewis River Projects dam failure inundation mapping for the Merwin, Swift and Yale dams. This data was imported into Hazus-MH and a Level 2 analysis was run using the flood methodology described above.
- **Earthquake**—A Level 2 analysis was performed to assess earthquake risk and exposure. Earthquake shake maps and probabilistic data prepared by the U.S. Geological Survey (USGS) were used for the analysis of this hazard. An updated general building stock inventory was developed using replacement cost values and detailed structure information from assessor tables. Critical facility default data was updated whenever possible with locally available datasets. Two scenario events and two probabilistic events were modeled:
  - The scenario events were a Magnitude-9.0 event on the Cascadia Subduction Zone and a Magnitude-6.5 event on the Portland Hills Fault.
  - The standard Hazus analysis was run for the 100- and 500-year probabilistic events.

6.4 LANDSLIDE, SEVERE WEATHER, WILDFIRE AND VOLCANO

For landslide, severe weather, volcano and wildfire, historical data was not adequate to model future losses. However, areas and inventory susceptible to some of the hazards of concern were mapped by other means and exposure was evaluated. For other hazards, a qualitative analysis was conducted using the best available data and professional judgment.

6.5 DROUGHT

The risk assessment methodologies used for this plan focus on damage to structures. Because drought does not impact structures to the same degree as other hazards, the risk assessment for drought was more limited and qualitative than the assessment for the other hazards of concern.

6.6 SOURCES OF DATA USED IN RISK ASSESSMENT

6.6.1 Building Count and Replacement Cost Value

GIS building and assessor data (replacement cost values and detailed structure information) were loaded into Hazus-MH and utilized in GIS spatial analysis. When available, an updated inventory was used in place of the Hazus-MH defaults for critical facilities and infrastructure.

Replacement cost is the cost to replace the entire structure with one of equal quality and utility. Replacement cost is based on industry-standard cost-estimation models published in *RS Means Square Foot Costs* (RS Means, 2015). It is calculated using the estimated cost for a structure based on the Hazus occupancy class (e.g., multi-family residential, commercial retail trade) and the square footage of the structure from tax assessor data. For single-family residential, the construction class and number of stories also factor into the square foot costs.

6.6.2 Data Used for Spatial Analysis

Table 6-1 describes the data used for spatially based exposure and vulnerability assessments. If no database was available, it was noted as a gap.

Table 6-1. Summary of Data Used for Spatial Analysis

Data	Source
Base Map Data	County and city boundaries, roads, water features, district boundaries from Clark County GIS.
	Aerial photos from Clark County GIS.
	Base map data for City of Woodland from Cowlitz County.
General Building Stock Update	Building footprints, tax lots, address points from Clark County GIS.
	Parcel data and assessor data extract from Cowlitz County for City of Woodland.
	Assessor data extract from Clark County GIS.
Critical Facility Database Update[a,b]	Communication facilities from Clark County Assessor and Hazus Comprehensive Data Management System.
	Dams from U.S. Army Corps National Inventory of Dams.
	Emergency services from Clark County GIS.
	Energy from Clark County GIS and Hazus Comprehensive Data Management System.
	Government facilities from Clark County GIS.
	Hazardous materials from Clark County GIS.
	Healthcare and public health from Clark County GIS.
	Information technology was not available.
	Schools from Clark County GIS, Camas School District and Battle Ground School District.
	Transportation systems from Clark County GIS, Port of Vancouver, and Hazus Comprehensive Data Management System.
	Water and sanitation systems from Clark County GIS, Clark Regional Wastewater District, Clark Public Utilities, City of Vancouver, City of Battleground and City of Camas.
Flood	Effective digital Flood Insurance Rate Maps downloaded from FEMA website.
	2002 10-foot resolution digital elevation model from Clark County GIS.
	Washington State levee inventory data downloaded from Washington Department of Ecology website.
	Repetitive loss data acquired from FEMA.
	3-meter resolution digital elevation model for City of Woodland area downloaded from USGS website.
Earthquake	Shake maps for Cascadia M-9.0 and Portland Hills M-6.5 downloaded from USGS website.
	Liquefaction susceptibility and National Earthquake Hazard Reduction Program soils data downloaded from Washington Department of Natural Resources website. https://www.dnr.wa.gov/geologyportal
	Earthquake hazard areas data from Clark County GIS.
	Faults data downloaded from Washington Department of Natural Resources website.
Landslide	Landslide and soil erosion hazard data from Clark County GIS.
	Landslides and landforms data downloaded from Washington Department of Natural Resources website. https://www.dnr.wa.gov/geologyportal

Dam Failure	Lewis River Projects inundation data from CRESA (includes inundation areas for Merwin, Swift, and Yale dams).
	Dams data from Clark County GIS.
Wildfire	Wildland urban interface data from Clark County GIS.
	Wildland urban interface data from the City of Vancouver.
Volcano	Mt. Hood Region, Mount St. Helens, and Mount Adams Region volcano hazards data downloaded from USGS CVO website.
Demographics	2010 Census block boundaries available in Hazus database.
	2010 Census statistical data downloaded from the U.S. Census Bureau website.
Current and Future Land Use	Land use, zoning, comprehensive plan designations, urban growth area boundary, vacant buildable lands and critical lands (environmental constraints) data from Clark County GIS.

Note: Additional information on hazard data can be found in Appendix E.
a. Hazus-MH default data was used as appropriate for the City of Woodland.
b. Not all requested data was received, so gaps in the database are present. Future planning efforts will work to address these gaps.

6.7 LIMITATIONS

6.7.1 General Limitations

Loss estimates, exposure assessments and hazard-specific vulnerability evaluations rely on the best available data and methodologies. However, results are subject to uncertainties associated with the following factors:

- Incomplete scientific knowledge about natural hazards and their effects on the built environment
- Approximations and simplifications necessary to conduct a study
- Incomplete or outdated inventory, demographic or economic parameter data
- The unique nature, geographic extent and severity of each hazard
- Mitigation measures already employed
- The amount of advance notice residents have to prepare for a specific hazard event.

Hazus-MH currently represents the industry best management practice for assessing risk in support of hazard mitigation planning. However, Hazus and other models used for this risk assessment are limited by the availability of data to support their working components. Such models must assumptions where firm data are not available. Assumptions are used, for example, to estimate ground deformation caused by liquefaction. These model limitations can lead to an understatement or overstatement of risk. These factors can affect loss estimates by a factor of two or more. Therefore, potential exposure and loss estimates are approximate and should be used only to understand relative risk. Over the long term, Clark County and its planning partners will collect additional data to assist in estimating potential losses associated with other hazards.

6.7.2 Specific Limitations Noted During the Planning Process

The following are limitations specific to the datasets used in this planning process:

- Clark County assessor data lacked detailed information on building and foundation type (e.g. masonry construction and slab-on-grade, respectively). Default information was used, which impacts the accuracy of vulnerability estimates because building and foundation type play a major role in how structures will behave during hazard events.

- Model data input requirements necessitate the conversion of building footprints into single point features. Building locations are represented by single points located in the centroid of the building footprint.
- Data used in the wildfire assessment is dated and does not cover the entire planning area.
- Not all critical facility data was available in a digital format. Best available datasets were used.

6.7.3 How Climate Change Affects Hazard Mitigation

An essential aspect of hazard mitigation is predicting the likelihood of hazard events in a planning area. Typically, predictions are based on statistical projections from records of past events. This approach assumes that the likelihood of hazard events remains essentially unchanged over time. Thus, averages based on the past frequencies of, for example, floods are used to estimate future frequencies: if a river has flooded an average of once every five years for the past 100 years, then it can be expected to continue to flood an average of once every five years.

For hazards affected by climate conditions, the assumption that future behavior will be equivalent to past behavior is not valid if climate conditions are changing. As flooding is generally associated with precipitation frequency and quantity, for example, the frequency of flooding will not remain constant if broad precipitation patterns change over time. The risks of landslide, severe weather, and wildfire are all affected by climate patterns as well. Changing risk from climate change to the volcano and earthquake hazard is less understood at this time, but may also be significant.

For this reason, an understanding of climate change is pertinent to efforts to mitigate natural hazards. Information about how climate patterns are changing provides insight on the reliability of future hazard projections used in mitigation analysis. Information pertaining to the likely or expected impacts of climate change on each of hazard of concern is discussed in the hazard profiles.

Part 2. RISK ASSESSMENT

7. DAM FAILURE

7.1 GENERAL BACKGROUND

7.1.1 Causes of Dam Failure

Dam failures in the United States typically occur in one of four ways:

- Overtopping of the primary dam structure, which accounts for 34 percent of all dam failures, can occur due to inadequate spillway design, settlement of the dam crest, blockage of spillways, and other factors.
- Foundation defects due to differential settlement, slides, slope instability, uplift pressures, and foundation seepage can also cause dam failure. These account for 30 percent of all dam failures.
- Failure due to piping and seepage accounts for 20 percent of all failures. These are caused by internal erosion, erosion along hydraulic structures such as spillways, erosion due to animal burrows, and cracks in the dam structure.
- Failure due to problems with conduits and valves, typically caused by the piping of embankment material into conduits through joints or cracks, constitutes 10 percent of all failures.

The remaining 6 percent of U.S. dam failures are due to miscellaneous causes. Many dam failures in the United States have been secondary results of other disasters. The prominent causes are earthquakes, landslides, extreme storms, massive snowmelt, equipment malfunction, structural damage, foundation failures, and sabotage (ASDSO, 2016).

Poor construction, lack of maintenance and repair, and deficient operational procedures are preventable or correctable by a program of regular inspections. Terrorism and vandalism are serious concerns that all operators of public facilities must plan for; these threats are under continuous review by public safety agencies.

7.1.2 Regulatory Oversight

The dam failure risk assessment and mitigation strategies developed for this plan focus on impacts on people and property once a dam failure has occurred. The focus is not on dam operations to prevent dam failures from occurring, although a brief synopsis of regulatory programs impacting dam operations is included for reference.

National Dam Safety Act

The potential for catastrophic flooding due to dam failures led to passage of the National Dam Safety Act (Public Law 92-367). The National Dam Safety Program requires a periodic engineering analysis of every major dam in the country. The goal of this FEMA-monitored effort is to identify and mitigate the risk of dam failure so as to protect the lives and property of the public. The program is a partnership between states, federal agencies, and other stakeholders that encourages individual and community responsibility for dam safety. State assistance funds have allowed participating states to improve their programs through increased inspections, emergency action planning, and the purchase of needed equipment. FEMA has also expanded existing and initiated new training programs. Grant assistance from FEMA provides support for improvement of dam safety programs that regulate most of the dams in the United States (FEMA, 2013b).

Washington Department of Ecology Dam Safety Program

The Dam Safety Office (DSO) of the Washington Department of Ecology regulates over 1,000 dams in the state that impound at least 10 acre-feet of water. The DSO has developed dam safety guidelines to provide dam owners, operators, and design engineers with information on activities, procedures, and requirements involved in the planning, design, construction, operation and maintenance of dams in Washington. The authority to regulate dams in Washington and to provide for public safety is contained in the following laws:

- State Water Code (1917)—RCW 90.03
- Flood Control Act (1935)—RCW 86.16
- Department of Ecology (1970)—RCW 43.21A.

Where water projects involve dams and reservoirs with a storage volume of 10 acre-feet or more, the laws provide for the Department of Ecology to conduct engineering review of the construction plans and specifications, to inspect the dams, and to require remedial action as necessary to ensure proper operation, maintenance, and safe performance. The DSO was established within Ecology's Water Resources Program to carry out these responsibilities.

The DSO's five-year periodic inspection program for dams with high and significant hazard classifications achieves the following purposes (Washington Department of Ecology, 2022):

- Assess the structural integrity and stability of project elements.
- Identify obvious defects, especially due to aging.
- Assess the stability of the structure under earthquake conditions.
- Determine the adequacy of the spillways to accommodate major floods.
- Evaluate project operation and maintenance.

The inspections, performed by professional engineers from the DSO, consist of the following elements (Washington Department of Ecology, 2022):

- Review and analysis of available data on the design, construction, operation and maintenance of the dam and its appurtenances
- Visual inspection of the dam and its appurtenances
- Evaluation of the safety of the dam and its appurtenances, which may include an assessment of hydrological and hydraulic capabilities, structural stabilities, seismic stabilities, and any other condition that could constitute a hazard to the integrity of the structure
- Evaluation of the downstream hazard classification
- Evaluation of the operation, maintenance and inspection procedures employed by the owner and/or operator
- Review of the emergency action plan for the dam, including review or update of the dam-breach inundation map.

The DSO provides assurance that impoundment facilities will not pose a threat to lives and property, but dam owners bear primary responsibility for the safety of their structures, through proper design, construction, operation, and maintenance.

U.S. Army Corps of Engineers Dam Safety Program

The U.S. Army Corps of Engineers is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety

Act. The Corps has inventoried dams; surveyed each state and federal agency's capabilities, practices and regulations regarding design, construction, operation and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety (U.S. Army Corps of Engineers, 2011). The Corps' National Inventory of Dams lists the following dates of the most recent inspection dates for Clark County dams:

- Anderson Dam: N/A
- Binford Reservoir Dam: N/A
- Cadman Lewisville S&G Pit: February 14, 2020
- Crisman Reservoir Dam: N/A
- Curtis Dam: July 24, 2017
- Elmer Dam: October 25, 2020
- Erickson Dam: June 31, 2018
- Fargher Lake Dam: N/A
- Green Mountain Pond: N/A
- Haigh Reservoir Dam: July 8, 2019
- Jones Dam: N/A
- Lacamas and Round Lakes, Lower Dam: September 14, 2017
- Lacamas and Round Lakes, Upper Dam: September 14, 2017
- Malar Dam: N/A
- Merwin Dam: September 30, 2020
- North Aeration Stabilization Basin Lady Island: May 17, 2017
- Shillapoo Lake Dikes: N/A
- Swift No 2 Hydroelectric Project: August 23, 2019
- Tri-Mountain Estates Dam: July 25, 2020
- Warman Waterski Lake Dam: N/A
- Yale Dam: September 30, 2020

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) cooperates with a large number of federal and state agencies to ensure and promote dam safety. More than 3,000 dams are part of regulated hydroelectric projects in the FERC program. Two-thirds of these are more than 50 years old. As dams age, concern about their safety and integrity grows, so oversight and regular inspection are important. FERC inspects hydroelectric projects on an unscheduled basis to investigate the following:

- Potential dam safety problems
- Complaints about constructing and operating a project
- Safety concerns related to natural disasters
- Issues concerning compliance with the terms and conditions of a license.

Every five years, an independent FERC-approved engineer must inspect and evaluate projects with dams higher than 32.8 feet (10 meters), or with a total storage capacity of more than 2,000 acre-feet.

FERC monitors and evaluates seismic research and applies it in structural analyses of hydroelectric projects. FERC also evaluates the effects of potential and actual large floods on the safety of dams. During and following floods, FERC visits dams and licensed projects, determines the extent of damage, if any, and directs any necessary studies or remedial measures the licensee must undertake. The FERC publication *Engineering Guidelines for the Evaluation of Hydropower Projects* guides the FERC engineering staff and licensees in evaluating dam safety. The publication is frequently revised to reflect current information and methodologies.

FERC requires licensees to prepare emergency action plans and conducts training sessions on how to develop and test these plans. The plans outline an early warning system if there is an actual or potential sudden release of water from a dam due to failure. The plans include operational procedures that may be used, such as reducing reservoir levels and reducing downstream flows, as well as procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that everyone knows what to do in emergency situations (FERC, 2005).

7.2 HAZARD PROFILE

7.2.1 Past Events

Dam failures can occur suddenly and without warning. They may occur during normal operating conditions or during a large storm event. Significant rainfall can quickly inundate an area and cause floodwaters to overwhelm a reservoir. If the spillway of the dam cannot safely pass the resulting flows, water will begin flowing in areas not designed for such flows, and a failure may occur.

According to the Association of State Dam Safety Officials, there have been no recorded dam incidents in Clark County (ASDSO, 2020). Between 1954 and 2020, FEMA has not included the State of Washington in any dam/levee break-related disaster declarations. One incident has been recorded in Skamania County, near the border of Clark County. On April 21, 2002, the retention structure at the west end of Swift Canal catastrophically failed. While there were no injuries, State Route (SR) 503 was completely washed out (CRESA, 2011).

7.2.2 Location

In Clark County, there are 29 dams that impound 10 acre-feet of water or more. Table 7-1 lists the dams in Clark County that the Dam Safety Office rates as High Hazard Class (1A, 1B, 1C). In addition to the dams located in Clark County, dams located on the Lewis River upstream of the County could impact residents. These dams are regularly inspected, well-staffed, and well-maintained (CRESA, 2011). The location of dams within the County can be seen on Figure 4-2.

Table 7-1. High Hazard Class Dams in Clark County (1A, 1B, 1C)

	Hazard Category	National ID #	Water Course	Owner	Year Built	Dam Type[a]	Crest Length (feet)	Height (feet)	Storage Capacity (acre-feet)	Drainage area (sq. mi.)
Merwin Dam	1A	WA00474	Lewis River	PacifiCorp	1931	Concrete single arch	1,250	313	423,000	731
Curtis Dam	1C	WA01980	Not available	Curtis Dam	1978	Earth Fill	Not available	15	24	1.37

Erikson Dam	1B	WA00102	Tributary – Rock Creek	Adrian Navarro	1968	Earth fill	500	22	210	2.03
Tri Mountain Estates Dam	1C	WA00103	Tributary – Mason Creek	Tri-Mountain Estates LLC	1953	Earth fill	180	30	102	0.22
Haight Reservoir Dam	1C	WA01039	Tributary – Columbia River	Camas City Public Works	1951	Earth Fill	480	12	20	0.02
Yale Dam (Cowlitz County)	1A	WA00148	Lewis River	PacifiCorp	1953	Earth Fill	1500	323	402,000	600
Yale Saddle Dam (Cowlitz County)	1A	WA00135	Lewis River	PacifiCorp	1953	Earth Fill	1600	42	129,000	596

Source: Washington Department of Ecology 2020

7.2.3 Frequency

Dam failure events are infrequent and often coincide with other hazard events that cause them, such as earthquakes, landslides and excessive rainfall and snowmelt. There is a "residual risk" associated with dams. Residual risk is the risk that remains after safeguards have been implemented. For dams, the residual risk is associated with events beyond those that the facility was designed to withstand. However, the probability of any type of dam failure is low in today's dam safety oversight environment.

7.2.4 Severity

The DSO classifies regulated dams in Washington by hazard class, based on the at-risk population living in the area that could be inundated if the dam fails. The hazard class definitions and number of Clark County dams in each class are as follows (Washington Department of Ecology, 2020):

- 1 Hazard Class 1A (High - a downstream at-risk population of more than 300)
- 0 Hazard Class 1B (High - a downstream at-risk population of 31 to 300)
- 3 Hazard Class 1C (High -a downstream at-risk population of 7 to 30)
- 3 Hazard Class 2 (Significant - a downstream at-risk population of 1 to 6)
- 22 Hazard Class 3 (Low - no downstream at-risk population).

Four high-hazard dams and three significant hazard dams are located in Clark County—on the Lewis River, Rock Creek, Mason Creek, and Lacamas Creek (CRESA, 2011). These dams could cause a countywide concern were they to fail Localized problems could occur if one of the minor dams in the county failed.

The U.S. Army Corps of Engineers developed the classification system shown in Table 7-2 for the hazard potential of dam failures. The DSO and Corps of Engineers hazard rating systems are based only on the potential consequences of a dam failure; they do not take into account the probability of such failures.

Table 7-2. Corps of Engineers Hazard Potential Classification

Hazard Category[a]	Direct Loss of Life[b]	Lifeline Losses[c]	Property Losses[d]	Environmental Losses[e]
Low	None (rural location, no permanent structures for human habitation)	No disruption of services (cosmetic or rapidly repairable damage)	Private agricultural lands, equipment, and isolated buildings	Minimal incremental damage
Significant	Rural location, only transient or day-use facilities	Disruption of essential facilities and access	Major public and private facilities	Major mitigation required
High	Certain (one or more) extensive residential, commercial, or industrial development	Disruption of essential facilities and access	Extensive public and private facilities	Extensive mitigation cost or impossible to mitigate

a. Categories are assigned to overall projects, not individual structures at a project.
b. Loss of life potential based on inundation mapping of area downstream of the project. Analyses of loss of life potential should take into account the population at risk, time of flood wave travel, and warning time.
c. Indirect threats to life caused by the interruption of lifeline services due to project failure or operational disruption; for example, loss of critical medical facilities or access to them.
d. Damage to project facilities and downstream property and indirect impact due to loss of project services, such as impact due to loss of a dam and navigation pool, or impact due to loss of water or power supply.
e. Environmental impact downstream caused by the incremental flood wave produced by the project failure, beyond what would normally be expected for the magnitude flood event under which the failure occurs.

Source: U.S. Army Corps of Engineers, 1995

7.2.5 Warning Time

Warning time for dam failure varies depending on the cause of the failure. In events of extreme precipitation or massive snowmelt, evacuations can be planned with sufficient time. In the event of a structural failure due to earthquake, there may be no warning time. A dam's structural type also affects warning time. Earthen dams do not tend to fail completely or instantaneously. Once a breach is initiated, discharging water erodes the breach until either the reservoir water is depleted or the breach resists further erosion. Concrete gravity dams also tend to have a partial breach as one or more monolith sections are forced apart by escaping water. The time of breach formation ranges from a few minutes to a few hours (U.S. Army Corps of Engineers, 1997).

7.3 SECONDARY HAZARDS

Dam failure can cause severe downstream flooding, depending on the magnitude of the failure. Other potential secondary hazards of dam failure are landslides around the reservoir perimeter, bank erosion on the downstream watercourse, and destruction of downstream habitat. Hazardous materials spills are also a potential secondary hazard of dam failure if storage tanks rupture and spill.

7.4 EXPOSURE

The flood module of Hazus-MH was used for a Level 2 assessment of dam failurein 2016. Hazus-MH uses census data at the block level, which has a level of accuracy acceptable for planning purposes. Where possible, the Hazus-MH data was enhanced for this risk assessment using GIS data from county, state and federal sources. The exposure and vulnerability analyses use inundation mapping for a cascading failure of the Swift, Yale and Merwin dams, which are part of the PacifiCorp Lewis River project. The mapping used a risk-based approach to establish the inflow design flood, which allows for the evaluation of downstream consequences for a range of hydrologic dam failure events. This assessment does not capture all risk from all dams in the county, but was selected because of the substantial impacts and available data. Inundation maps were prepared for this analysis, but are not included in the publicly available version of this plan due to security concerns.

7.4.1 Population

All populations in a dam failure inundation zone would be exposed to the risk of a dam failure. The potential for loss of life is affected by the capacity and number of evacuation routes available to populations living in areas of potential inundation. The estimated population living in the mapped inundation areas within the planning area is 34,346 or 7.6 percent of the county's population. Table 7-3 summarizes the at-risk population in the planning area by jurisdiction.

Table 7-3. Population within Dam Failure Inundation Areas[c]

	Population Exposed[a]	% of Total Population
Battle Ground	0	0.0%
Camas	2,304	10.9%
La Center	165	5.3%
Ridgefield	1,262	19.7%
Vancouver	9,031	5.3%
Washougal	1,183	7.8%
Woodland	5,839	99.9%
Yacolt	0	0.0%
Unincorporated	14,562	6.8%
Total	**34,346**	**7.6%b**

a. Represents the percent of total buildings that are exposed multiplied by the estimated 2015 per-household population
b. Represents the total affected population as a percent of total Clark County population.
c. These estimates are derived from the planning scenario event, not for all possible dam failure risk in the county.

7.4.2 Property

Table 7-4 summarizes the value of planning area buildings in the mapped inundation area. Over 10 percent of the total replacement value of the planning area is exposed to the dam failure hazard. Table 7-5 lists the structure type of buildings in the inundation areas. Residential properties make up over 90 percent of this exposure. The distribution of land uses in dam inundation area is in Table 7-6.

Table 7-4. Value of Structures in Dam Failure Inundation Area[b]

	Value Exposed			% of Total
	Building	Contents	Total	Replacement Value[a]
Battle Ground	$0	$0	$0	0.0%
Camas	$651,757,000	$596,720,000	$1,248,477,000	16.5%
La Center	$53,074,000	$48,780,000	$101,854,000	12.7%
Ridgefield	$206,190,000	$152,250,000	$358,440,000	17.3%
Vancouver	$2,741,206,000	$2,423,901,000	$5,165,107,000	10.8%
Washougal	$447,433,000	$390,519,000	$837,952,000	20.1%
Woodland	$948,973,000	$827,704,000	$1,776,677,000	99.9%
Yacolt	$0	$0	$0	0.0%
Unincorporated	$1,553,548,000	$976,661,000	$2,530,209,000	5.6%

	Value Exposed			% of Total Replacement Value[a]
	Building	Contents	Total	
Total	$6,602,181,000	$5,416,535,000	$12,018,716,000	**10.6%**

a. Percentages are based on the total replacement value for individual jurisdictions, not for the planning area as a whole. The “total” percentage shown is based on the sum of replacement values for jurisdictions in this table.
b. These estimates are derived from the planning scenario event, not for all possible dam failure risk in the county.
Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

Table 7-5. Structure Type in Dam Failure Inundation Areas[b]

	Number of Structures[a]							
	Residential	Commercial	Industrial	Agriculture/ Forestry	Religion	Government	Education	Total
Battle Ground	0	0	0	0	0	0	0	0
Camas	726	67	11	4	5	3	0	816
La Center	49	5	0	3	0	1	1	59
Ridgefield	434	13	5	2	1	4	0	459
Vancouver	2,349	262	17	17	1	5	4	2,655
Washougal	340	79	3	2	5	3	0	432
Woodland	1,641	169	26	1	16	4	5	1,862
Yacolt	0	0	0	0	0	0	0	0
Unincorporated County	4,939	44	1	88	9	2	0	5,083
Total	**10,478**	**639**	**63**	**117**	**37**	**22**	**10**	**11,366**

a. Structure type assigned to best fit Hazus occupancy classes based on present use classifications provided by Clark and Cowlitz County assessor’s data. Where conflicting information was present in the available data, parcels were assumed to be improved.
b. These estimates are derived from the planning scenario event, not for all possible dam failure risk in the county.

Table 7-6. Present Land Use in Planning Area[a]

Present Use Classification[b]	Area in Dam Inundation Hazard Areas (acres)[c, d]	% of total exposed acreage
Agriculture/Resource Land	9,216.29	18.2%
Commercial	5,926.12	11.7%
Education	134.08	0.3%
Governmental Services	241.08	0.5%
Industrial	1,259.56	2.5%
Religious Services	57.81	0.1%
Residential	27,997.70	55.1%
Vacant or uncategorized	5,938.74	11.7%
Total	50,771.38	**100%**

a. Present land use information in this plan is for planning purposes only. Discrepancies may exist between these estimates and official records maintained by participating jurisdictions.
b. Present use classification provided by Clark and Cowlitz County assessor’s data assigned to best fit occupancy classes in the Hazus model (see Section 6.3.1). Parcels for which conflicting information on current development was available were assumed to be improved. Some designated resource land may also be included in the vacant or uncategorized category.
c. Acreage covers only mapped parcels; it excludes many rights of way and major water features.
d. Acreage includes Clark County and the incorporated areas of the City of Woodland.

7.4.3 Critical Facilities

GIS analysis determined that there are 167 critical facilities in the mapped inundation area (see Table 7-7). In addition, the following linear features are exposed to the dam failure hazard:

- Interstate 5
- Interstate 205
- State Route 14
- State Route 500
- State Route 501
- State Route 503
- Northwest Pipeline
- Olympic Pipeline
- All watercourse levees.

Additional critical facilities and infrastructure are likely to be located in inundation areas where mapping was not available.

Table 7-7. Critical Facilities and Infrastructure in the Swift Dam Inundation Area

	Communication Facilities	Dams	Emergency Services	Energy	Government Facilities	Hazardous Materials	Health Care & Public Health	Information Technology	Schools	Transportation Systems	Water & Sanitation Systems	Total
Battle Ground	0	0	0	0	0	0	0	0	0	0	0	**0**
Camas	0	0	0	0	0	0	0	0	0	4	13	**17**
La Center	0	0	0	0	0	0	0	0	0	0	0	**0**
Ridgefield	0	0	0	0	0	0	0	0	0	0	2	**2**
Vancouver	0	0	0	6	0	20	1	0	0	66	20	**113**
Washougal	0	0	2	0	0	1	0	0	0	0	2	**5**
Woodland	0	0	3	1	0	2	0	0	5	0	0	**11**
Yacolt	0	0	0	0	0	0	0	0	0	0	0	**0**
Unincorporated	0	2	0	1	0	0	0	0	0	11	5	**19**
Total	**0**	**2**	**5**	**8**	**0**	**23**	**1**	**0**	**5**	**81**	**42**	**167**

7.4.4 Environment

The environment would be exposed to a number of risks in the event of dam failure. The inundation could introduce many foreign elements into local waterways, including hazardous materials. This could result in destruction of downstream habitat and could have detrimental effects on many species of animals, especially endangered species, such as salmon.

7.5 VULNERABILITY

7.5.1 Population

Vulnerable populations are all populations downstream from dam failures that are incapable of escaping the area within the allowable time frame. This includes the elderly and young, who may be unable to get themselves out of the inundation area. Vulnerable populations also include those who would not have adequate warning from a television or radio emergency warning system. Impacts on persons and households in the planning area were estimated for dam failure events through the Level 2 Hazus-MH analysis. Table 7-8 summarizes the results.

Table 7-8. Estimated Dam Failure Impact on Persons and Households[a, c]

	Displaced Households		Persons Requiring Short-Term Shelter	
	Number	% of Population	Persons	% of Population
Battle Ground	0	0.0%	0	0.0%
Camas	702	3.3%	556	2.6%
La Center	30	1.0%	15	0.5%
Ridgefield	58	0.9%	27	0.4%

	Displaced Households		Persons Requiring Short-Term Shelter	
	Number	% of Population	Persons	% of Population
Vancouver	2,241	1.3%	1,996	1.2%
Washougal	410	2.7%	322	2.1%
Woodland[b]	5,839	99.9%	4,788	81.9%
Yacolt	0	0.0%	0	0.0%
Unincorporated	1,968	0.9%	1,515	0.7%
Total	**11,248**	**2.5%**	**9,219**	**2.0%**

a. Displaced population and shelter need estimates were based on updated general building stock dataset at a census block analysis level.
b. Due to the way Hazus calculates results inside each county, the City of Woodland results for displaced population and short-term shelter needs using Cowlitz County data were higher than total population. To compensate, the displaced population for the City of Woodland was calculated by multiplying the estimated 2015 population by the percentage of population exposed. The short-term shelter requirements were determined by calculating the percentage of total scenario short-term shelter requirements over displaced population and applying it to the City of Woodland displaced population.
c. These estimates are derived from the planning scenario event, not for all possible dam failure risk in the county.

7.5.2 Property

Vulnerable properties are those closest to the dam inundation area. These properties would experience the largest, most destructive surge of water. Low-lying areas are also vulnerable since they are where the dam waters would collect. Table 7-9 summarizes estimated losses associated with planning area buildings in the mapped inundation area. About 2.5 percent of the total replacement value of the planning area is vulnerable to the dam failure hazard.

Table 7-9. Loss Estimates for Structures in Dam Failure Inundation Area[a]

	Estimated Loss Associated with Dam Failure			% of Total Replacement Value
	Building	Contents	Total	
Battle Ground	$0	$0	$0	0.00%
Camas	$84,485,000	$127,631,000	$212,116,000	2.80%
La Center	$2,514,000	$4,111,000	$6,625,000	0.82%
Ridgefield	$37,402,000	$46,564,000	$83,966,000	4.05%
Vancouver	$396,975,000	$589,260,000	$986,235,000	2.05%
Washougal	$17,267,000	$29,195,000	$46,462,000	1.12%
Woodland	$607,581,000	$628,226,000	$1,235,807,000	69.51%
Yacolt	$0	$0	$0	0.00%
Unincorporated	$161,955,000	$128,100,000	$290,055,000	0.65%
Total	**$1,308,179,000**	**$1,553,087,000**	**$2,861,266,000**	**2.52%**

a. These estimates are derived from the planning scenario event, not for all possible dam failure risk in the county.
Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

7.5.3 Critical Facilities

On average, critical facilities expected to sustain damage during a dam failure event would receive 42.9 percent damage to the structure and 96.5 percent damage to the contents during a dam failure event. The estimated time to restore these facilities to 100 percent of their functionality is 846 days. In addition, transportation routes are vulnerable to dam inundation and have the potential to be wiped out, creating isolation issues. This includes all roads, railroads and bridges in the path of the dam inundation. Those that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge. Utilities such as overhead power lines, cable and phone lines could also be vulnerable. Loss of these utilities could create additional isolation issues for the inundation areas. Estimated damage to critical facilities and infrastructure in the dam inundation area is summarized in Table 7-10.

Table 7-10. Estimated Damage to Critical Facilities and Infrastructure from Dam Failure

	Number of Facilities Affected	Average % of Total Value Damaged		Days to 100% Functionality
		Building	Content	
Communication Facilities	0	--	--	--
Dams	0	--	--	--
Emergency Services	5	59.8%	93.0%	792
Energy	5	18.7%	--	--
Government Facilities	0	--	--	--
Hazardous Materials	17	22.8%	--	--
Health Care & Public Health	0	--	--	--
Information Technology	0	--	--	--
Schools	5	94.0%	100.0%	900
Transportation Systems[a]	27	N/A	N/A	N/A
Water & Sanitation Systems	31	19.1%	--	--
Total	**90**	**42.9%**	**96.5%**	**846**

a. Due to an issue with the Hazus software, analysis of transportation facilities was not able to be conducted for this scenario. It expected that there would be extensive impacts to many of the facilities in the inundation area.

7.5.4 Environment

The extent of the vulnerability of the environment is the same as the exposure of the environment. As with any significant natural hazard event, large of amounts of debris generated from the damaged buildings and infrastructure could have significant environmental impacts. These impacts were estimated for the dam failure event through the Level 2 Hazus-MH analysis. Table 7-11 summarizes the results.

Table 7-11. Estimated Dam Failure-Caused Debris

	Debris to Be Removed (tons) [a]	Truck Loads[b]
Battle Ground	0	0
Camas	31,791,450	1,271,658
La Center	179,750	7,190
Ridgefield	6,175,230	247,009
Vancouver	80,547,430	3,221,897
Washougal	1,586,430	63,457
Woodland	68,553,860	2,742,154
Yacolt	0	0
Unincorporated	24,637,680	985,507
Total	**213,471,830**	**8,538,873**

a. Debris generation estimates were based on updated general building stock dataset at a Census Block analysis level.
b. Hazus assumes 25 tons per truck.
Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

7.5.5 Economic Impact

In general, dam failure presents the potential for significant disruption, including loss of life, massive property damage, and other long-term consequences. All of these are likely to impact the local economy, directly and indirectly. Economic losses can include the cost to rebuild structures and properties, the cost of response, and recovery, downstream damage, and long-term costs to repair environmental damage. It can also have a hidden impact, by reducing public morale and confidence, resulting in decreased spending in local stores and businesses near the event's occurrence. Such indirect and cascading impacts, however, are difficult to quantify, even though FEMA recognizes their significance and probability. FEMA provides resources to assist jurisdictions in estimating both direct and indirect economic consequences after a dam failure (Homeland Security, 2011).

7.6 FUTURE TRENDS

7.6.1 Development

Land use in the planning area will be directed by local comprehensive plans adopted under state law. The planning partners have established comprehensive policies regarding sound land use in identified flood hazard areas. While some of the areas vulnerable to the more severe impacts from dam failure intersect the mapped flood hazard areas, the inundation areas from a dam failure cover a much larger portion of the planning area.

Flood-related policies in these comprehensive plans and in the local municipal code will help to reduce the risk associated with the dam failure hazard for development in the planning area, but will be unlikely to help reduce risk to all structures within the dam inundation area. Table 7-12 shows the land acreage identified as underutilized or vacant in urban growth areas in the County that intersect the dam failure inundation areas.

Table 7-12. Buildable Lands in Planning Area Urban Growth Areas that Intersect Dam Inundation Areas[a]

Urban Growth Area Name[b]	Residential		Commercial (acres)	Industrial (acres)	Total (acres)[c]
	Acres	Units			
Battle Ground	0	0	0	0	**0**
Camas	19.03	114	2.54	28.35	**49.92**
La Center	13.10	52	1.97	0	**15.06**
Ridgefield	28.94	174	0.27	0	**29.21**
Vancouver	114.27	914	26.63	674.78	**815.68**
Washougal	4.42	26	20.67	33.29	**58.37**
Woodland[d]	25.24	101	0	0	**25.24**
Yacolt	0	0	0	0	**0**
Total	**205.00**	**1,381**	**52.08**	**736.42**	**993.48**

a. Buildable lands information in this plan is for planning purposes only. Discrepancies may exist between these estimates and official records maintained by participating jurisdictions.
b. Unincorporated areas outside of urban growth areas are excluded from this assessment. Development in these areas consists largely of rural lands, open space and large residential lots.
c. Acreage covers only mapped parcels; it excludes many rights of way and major water features.
d. Acreage estimates exclude the portions of the City of Woodland in Cowlitz County and thus may be underestimated.

7.6.2 Climate Change

Dams are designed partly based on assumptions about a river's flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. If the hygrograph changes, it is conceivable that the dam can lose some or all of its designed margin of safety, also known as freeboard. If freeboard is reduced, dam operators may be forced to release increased volumes earlier in a storm cycle in order to maintain the required margins of safety. Such early releases of increased volumes can increase flood potential downstream.

Dams are constructed with safety features known as “spillways.” Spillways are put in place on dams as a safety measure in the event of the reservoir filling too quickly. Spillway overflow events, often referred to as “design failures,” result in increased discharges downstream and increased flooding potential. Although climate change will not increase the probability of catastrophic dam failure, it may increase the probability of design failures.

The climate of Washington state is already changing and will continue to change over the course of this century. The number of extreme weather events is increasing, and warmer temperatures are resulting in greater amounts of rain (as opposed to snow) during winter months. This results in higher winter stream flows and more frequent floods, earlier spring snowmelt, and earlier peak spring stream flow (already 10-30 days earlier than in 1948) (Washington Department of Ecology, 2015). While most of these predicted concerns relate to limited water supply, the potential increase in flooding could impact dams’ capacities to contain excess water.

7.7 SCENARIO

An earthquake in the region could lead to liquefaction of soils around a dam. This could occur without warning during any time of the day. Failure of a high hazard dam in the county would likely result in the loss of life, roadways, structures and property and cause severe impacts on the local economy. While the possibility of failure is remote, results of such an event would be devastating.

While the probability of dam failure is very low, the probability of flooding associated with changes to dam operational parameters in response to climate change is higher. Dam designs and operations are developed based on hydrographs from historical records. If these hydrographs experience significant changes over time due to the impacts of climate change, the dam design and operations may no longer be valid for the changed condition. Specified release rates and impound thresholds may have to be changed. This would result in increased discharges downstream of these facilities, thus increasing the probability and severity of flooding.

7.8 ISSUES

In the late 1980s, the Department of Ecology DSO was reorganized to better use its resources to minimize public safety problems. The DSO has recognized the key role of other government agencies in carrying out its public safety charge. For example, the dam approval process now requires that dams located above populated areas develop emergency action plans in conjunction with local and county emergency management agencies.

The most significant issue associated with dam failure involves properties and populations in the inundation zones. Flooding as a result of a dam failure would significantly impact these areas. In certain scenarios there would be little or no warning time. Dam failure events are frequently associated with other natural hazard events such as earthquakes, landslides or severe weather, which limits their predictability and compounds the hazard. Important issues associated with dam failure hazards include the following:

- The dam failure scenario utilized in the risk assessment brings forward the following issues:
  - More than 11,000 people would be displaced and more than 9,000 people would require short term shelter following the scenario event.

- More than $2.8 billion (2.5 percent) in damages to the expected building stock would be expected. More than half of this damage would be expected within the City of Woodland.
- More than 213 million tons of debris from structures impacted would be expected.
- There are estimated to be more than 11,300 structures located within inundation areas. More than 92 percent are residential structures.
  - It is unclear whether dam failure warning and notification strategies will be viable if dam failure occurs as a result of a significant earthquake that interrupts communication systems.
  - Changes in hydrographs in the region as a result of climate change are likely to include more instances of winter flooding. This could alter dam operations and increase the potential for design failures.
  - Downstream populations are often not aware that they are located in a dam failure inundation area and do not know the risks associated with probable dam failure.
  - Balancing the need to address security concerns and the need to inform the public of the risk associated with dam failure is a challenge for public officials.
  - Dam failure inundation areas are often located outside of special flood hazard areas under the National Flood Insurance Program, so flood insurance coverage in these areas is not common.
  - Most dam failure mapping required at federal levels requires determination of the probable maximum flood. While the probable maximum flood represents a worst-case scenario, it is generally the event with the lowest probability of occurrence. For non-federal-regulated dams, mapping of dam failure scenarios that are less extreme than the probable maximum flood but have a higher probability of occurrence can be valuable to emergency managers and community officials downstream of these facilities. This type of mapping can show areas potentially impacted by more frequent events, to be used in support of emergency response and preparedness measures.
  - Limited financial resources for dam maintenance during economic downturns result in decreased attention to dam structure operational integrity, because available funding is often directed to more urgent needs. This could increase the potential for maintenance failures.
  - Unpermitted dams may exist within the planning area. These dams may present risks to people and property. In 2008 Washington DOE inspected 95 unpermitted dams, 30 of which were classified as high hazard. Eleven of these high hazard dams (36.6 percent) were determined to need immediate repairs (Washington Department of Ecology, 2016).
  - Model results indicate that more than 90 critical facilities would sustain damages from the dam failure scenario modeled for this assessment. Some of these facilities may require almost 2.5 years to regain full functionality after the event.
  - Exposure to the dam failure hazard may increase in the planning area. It is anticipated that new development will occur within the mapped inundation area, including up to 1,381 residential units.

8. DROUGHT

8.1 GENERAL BACKGROUND

Drought is a normal phase in the climatic cycle of most geographical regions. Drought originates from a deficiency of precipitation over an extended period of time, usually a season or more, and results in a water shortage for some activity, group or environmental sector. Unlike most disasters, droughts normally occur slowly but last a long time. There are four generally accepted operational definitions of drought (National Drought Mitigation Center, 2006):

- **Meteorological drought** is an expression of precipitation's departure from normal over some period of time. Meteorological measurements are the first indicators of drought. Definitions are usually region-specific, and based on an understanding of regional climatology. A definition of drought developed in one part of the world may not apply to another, given the wide range of meteorological definitions.
- **Agricultural drought** occurs when there is not enough soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought happens after meteorological drought but before hydrological drought. Agriculture is usually the first economic sector to be affected by drought.
- **Hydrological drought** refers to deficiencies in surface and subsurface water supplies. It is measured as stream flow and as lake, reservoir and groundwater levels. There is a time lag between lack of rain and less water in streams, rivers, lakes and reservoirs, so hydrological measurements are not the earliest indicators of drought. After precipitation has been reduced or deficient over an extended period of time, this shortage is reflected in declining surface and subsurface water levels. Water supply is controlled not only by precipitation, but also by other factors, including evaporation (which is increased by higher than normal heat and winds), transpiration (the use of water by plants), and human use.
- **Socioeconomic drought** occurs when a physical water shortage starts to affect people, individually and collectively. Most socioeconomic definitions of drought associate it with the supply and demand of an economic good.

Defining when drought begins is a function of the impacts of drought on water users, and includes consideration of the supplies available to local water users as well as the stored water they may have available in surface reservoirs or groundwater basins. Different local water agencies have different criteria for defining drought conditions in their jurisdictions. Some agencies issue drought watch or drought warning announcements to their customers. Determinations of regional or statewide drought conditions are usually based on a combination of hydrologic and water supply factors. Washington has a statutory definition of drought (RCW 43.83B.400), defining an area as being in a drought condition when the water supply for the area is below 75 percent of normal and water uses and users in the area are likely to incur undue hardships because of the water shortage.

8.2 HAZARD PROFILE

Droughts originate from a deficiency of precipitation resulting from an unusual weather pattern. If the weather pattern lasts a short time (a few weeks or months), the drought is considered short-term. If the weather pattern becomes entrenched and the precipitation deficits last for several months or years, the drought is considered to be long-term. It is possible for a region to experience a long-term circulation pattern that produces drought, and to have short-term changes in this long-term pattern that result in short-term wet spells. Likewise, it is possible for a long-term wet circulation pattern to be interrupted by short-term weather spells that result in short-term drought. According to the Washington State Emergency Management Division, drought in Washington usually results from low snow accumulation (from low precipitation or warm winter temperatures) or early melt of the snowpack due to warm weather in late winter or early spring (Washington Emergency Management Division, 2014).

8.2.1 Past Events

In the past century, Washington has experienced a number of droughts, including several that lasted for more than a single season—1928 to 1932, 1992 to 1994, and 1996 to 1997. The most recent droughts in the state occurred in 2005, 2015, 2019, 2021, and 2022 (Washington Emergency Management Division, 2013; Washington Department of Ecology, 2015). NOAA's National Climatic Data Center does not list any drought events impacting Clark County between 1950 and 2020.

Between 1954 and 2015, Washington experienced one FEMA-declared drought-related emergency (EM-3037). This was the 1977 event, which has been identified as the worst drought in state history; however, Clark County was not included in the declaration (FEMA, 2022). The U.S. Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans to agricultural producers suffering losses due to drought. One-half to two-thirds of the counties in the U.S. have been designated as drought disaster areas in each of the past several years. Between 2012 and 2021, Washington has been included in 246 USDA drought declarations. Clark County has been included in 6 of these declarations (USDA, 2022).

8.2.2 Location

NOAA has developed several indices to measure drought impacts and severity and to map their extent and locations. These indices change regularly depending on local weather patterns and are snapshots of drought impacts at a specific point in time:

- The ***Palmer Crop Moisture Index*** measures short-term drought on a weekly scale and is used to quantify drought's impacts on agriculture during the growing season. Figure 8-1 shows this index for the week ending January 30, 2016.
- The ***Palmer Z Index*** measures short-term drought on a monthly scale. Figure 8-2 shows this index for December 2015.
- The ***Palmer Drought Index*** measures the duration and intensity of long-term drought-inducing circulation patterns. Long-term drought is cumulative, so the intensity of drought during a given month is dependent on the current weather patterns plus the cumulative patterns of previous months. Weather patterns can change quickly from a long-term drought pattern to a long-term wet pattern, and the Palmer Drought Index can respond fairly rapidly. Figure 8-3 shows this index for December 2015.
- The hydrological impacts of drought (e.g., reservoir levels, groundwater levels, etc.) take longer to develop and it takes longer to recover from them. The ***Palmer Hydrological Drought Index***, another long-term index, was developed to quantify hydrological effects. The Palmer Hydrological Drought Index responds more slowly to changing conditions than the Palmer Drought Index. Figure 8-4 shows this index for August 2015.

- While the Palmer indices consider precipitation, evapotranspiration and runoff, the ***Standardized Precipitation Index*** considers only precipitation. In the Standardized Precipitation Index, an index of zero indicates the median precipitation amount; the index is negative for drought and positive for wet conditions. The Standardized Precipitation Index is computed for time scales ranging from one month to 72 months. Figure 8-5 shows the 12-month Standardized Precipitation Index map for December 2014 to December 2015.

Source: Climate Prediction Center, NOAA

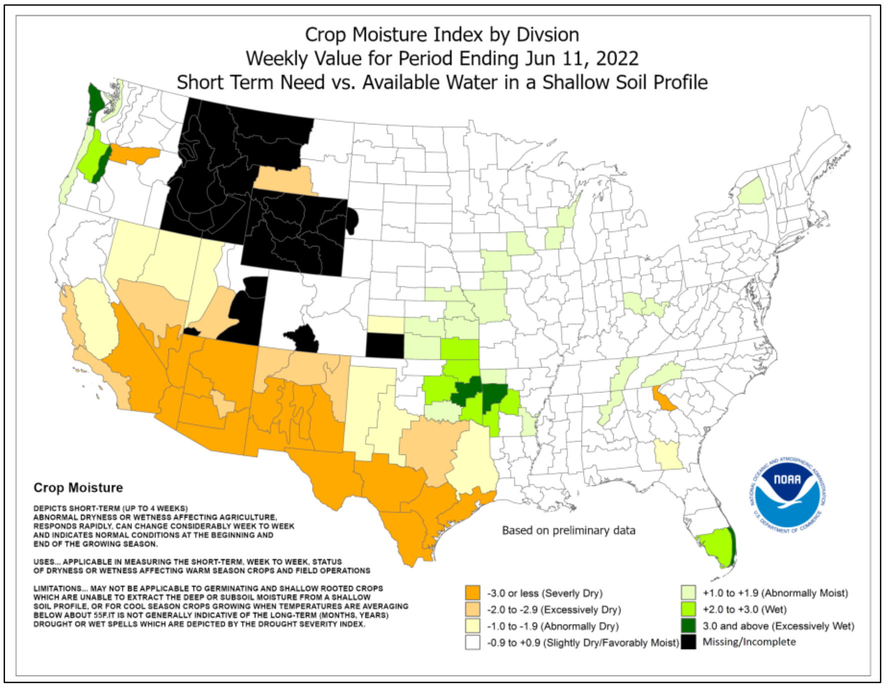


Figure 8-1. Crop Moisture Index for Week Ending June 11, 2022

Source: National Centers for Environmental Information, NOAA

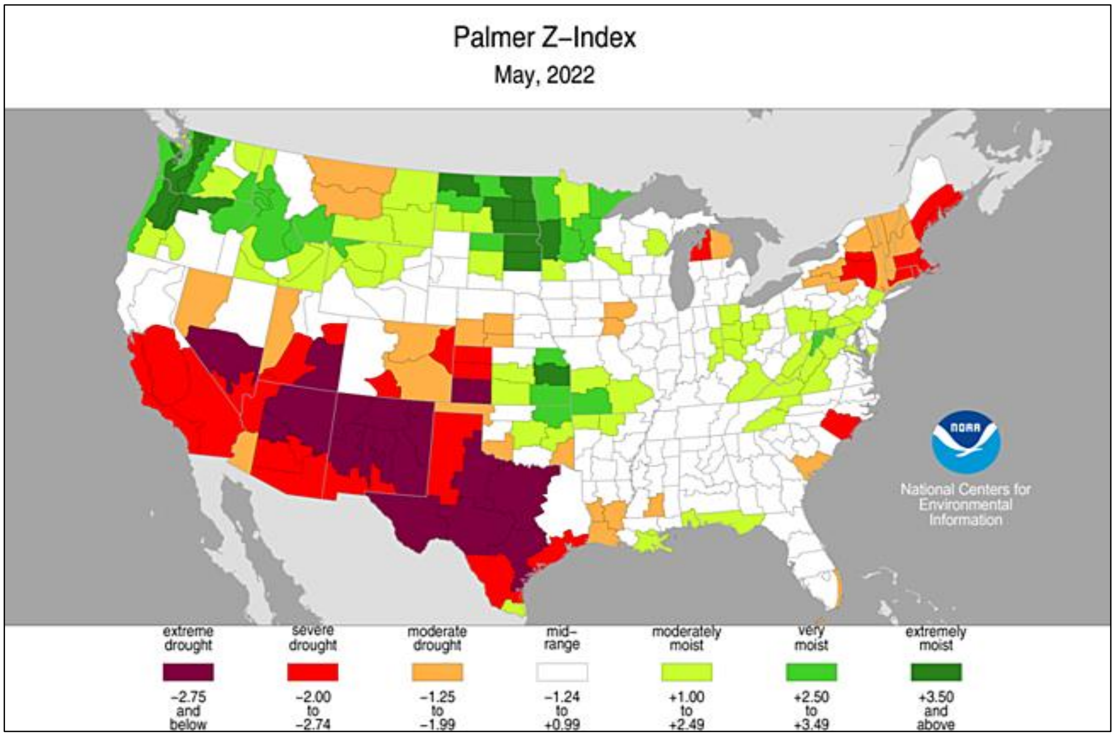


Figure 8-2. Palmer Z Index Short-Term Drought Conditions (May 2022)

Source: National Centers for Environmental Information, NOAA

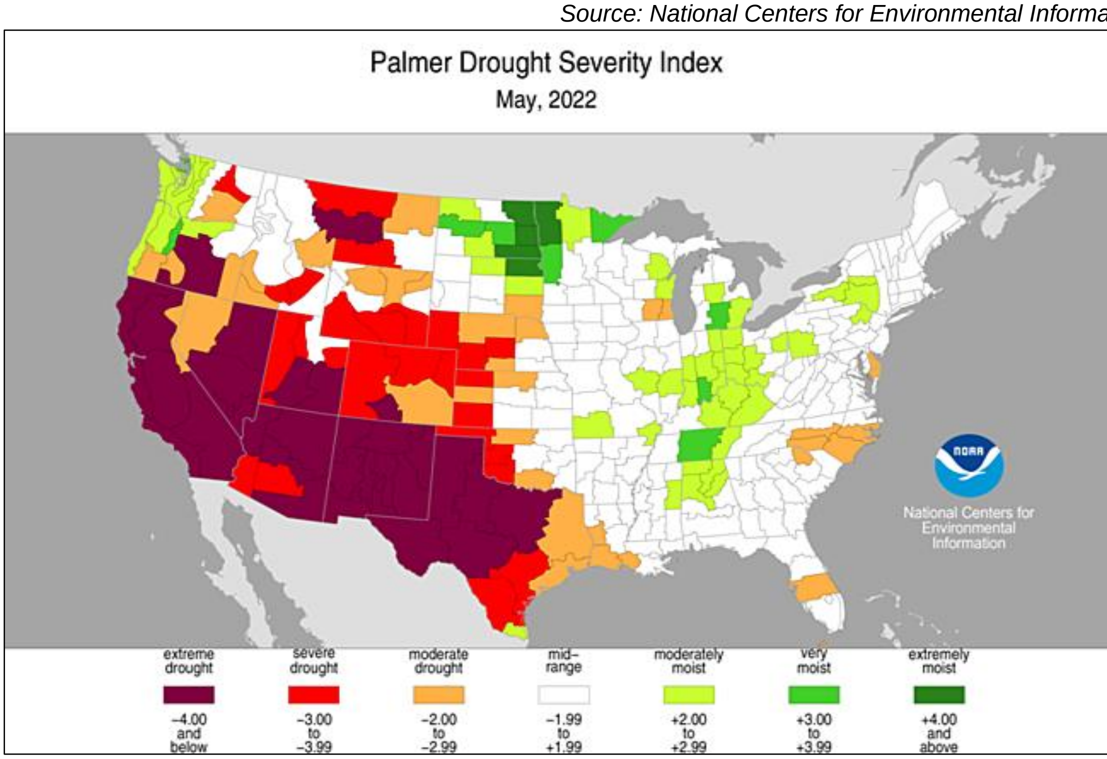


Figure 8-3. Palmer Drought Severity Index (May 2022)

Source: National Centers for Environmental Information, NOAA

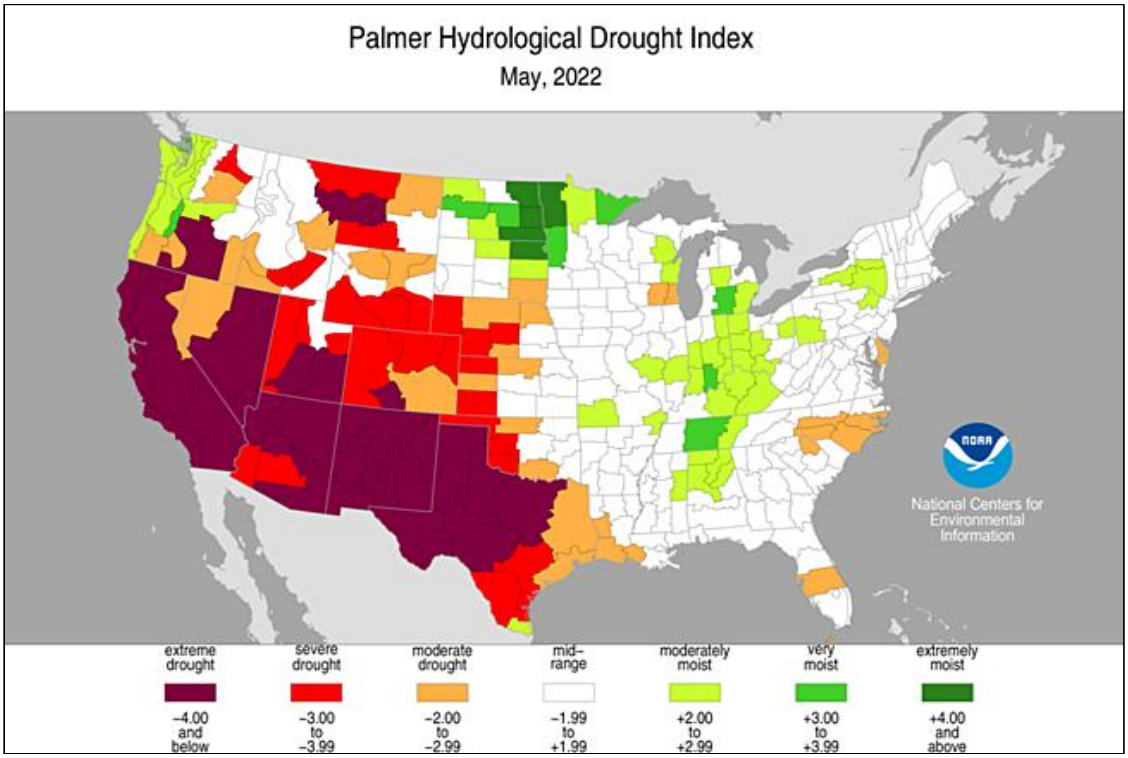


Figure 8-4. Palmer Hydrological Drought Index Long-Term Hydrologic Conditions (May 2022)

Source: Western Regional Climate Center

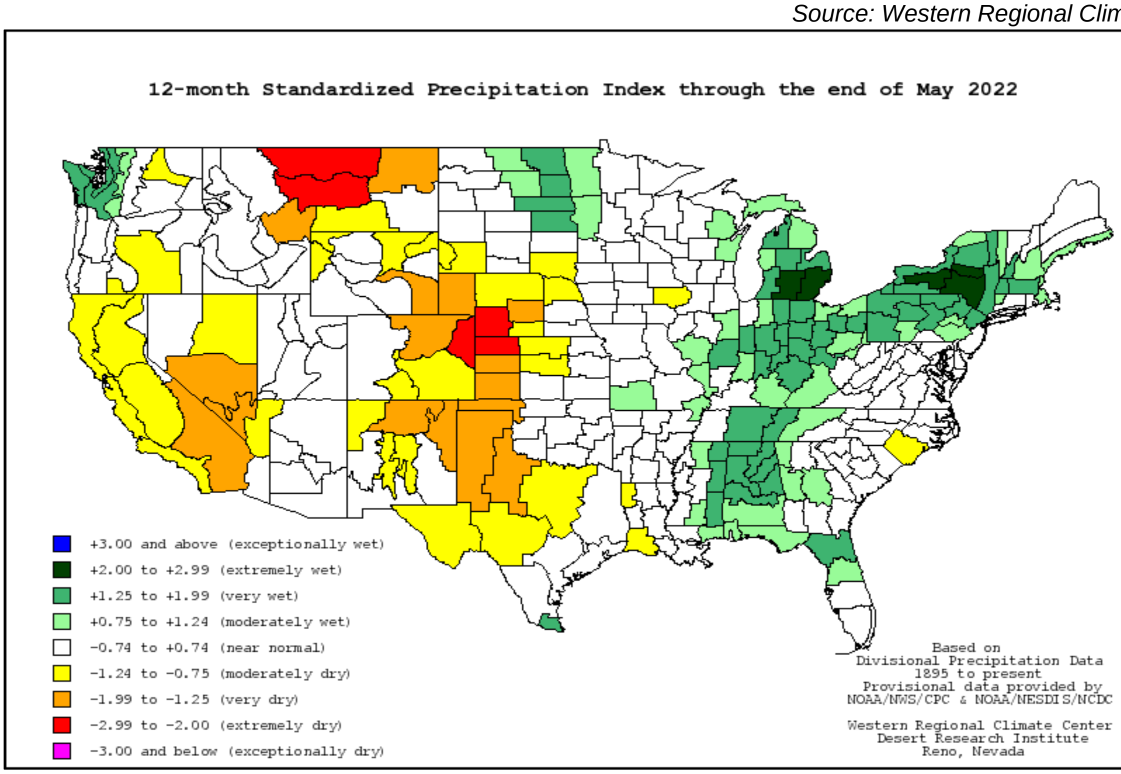


Figure 8-5. 12-Month Standardized Precipitation Index (May 2022)

8.2.3 Frequency

According to the Washington State Emergency Management Division, the numbers of variables required to determine drought frequency make it extremely difficult to predict future drought events, though drought forecasting continues to improve (Washington Emergency Management Division, 2020). Climate change is expected to contribute to increasing drought risk in the future (Washington Department of Ecology, 2016a).

8.2.4 Severity

Drought can have a widespread impact on the environment and the economy, depending upon its severity, although it typically does not result in loss of life or damage to property, as do other natural disasters. The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the drought and the larger the area impacted, the more severe the potential impacts. From 1980 to 2021 there have been 29 drought events in the United States with losses exceeding $1 billion. Of these, nine included losses in the State of Washington (NOAA, 2022b).

When measuring the severity of droughts, analysts typically look at economic impacts on a planning area. A drought directly or indirectly impacts all people in affected areas. All people could pay more for water if utilities increase their rates due to shortages. Agricultural impacts can result in loss of work for farm workers and those in related food processing jobs. Other water- or electricity-dependent industries are commonly forced to shut down all or a portion of their facilities, resulting in further layoffs. A drought can harm recreational companies that use water (e.g., swimming pools, water parks and river rafting companies) as well as landscape and nursery businesses because people will not invest in new plants if water is not available to sustain them. In Washington, where hydroelectric power plants generate nearly three-quarters of the electricity produced, drought also threatens the supply of electricity, with the potential to affect the cost of power.

8.2.5 Warning Time

Droughts are climatic patterns that occur over long periods of time. Predicting drought depends on the ability to forecast precipitation and temperature. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depends on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on the global scale.

Because drought conditions in Washington State are often related to deficiencies in snowpack accumulation, some warning is available through monitoring snowpack accumulation through the winter. The U.S. Natural Resources Conservation Service's snow survey and water supply forecasting program conducts snow surveys to develop accurate and reliable water supply forecasts (USDA, 2014). The system, called SNOTEL (short for Snow Telemetry) provides information for local governments, water consumers and providers and the general public on snowpack conditions that may impact water resources in future months. When snowpack levels are below average, communities may make changes to their water management programs and practices to reduce impacts from a possible future drought. NOAA's National Integrated Drought Information System launched a Drought Early Warning System for the Pacific Northwest in February 2016. The early warning system draws upon new and existing federal, tribal, state, local and academic partner networks to make climate and drought science readily available, easily understandable and usable for decision makers. The system improves stakeholders' abilities to monitor, forecast, plan for and cope with the impacts of drought (NIDIS, 2016).

8.3 SECONDARY HAZARDS

The secondary hazard most commonly associated with drought is wildfire. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends.

Drought also is often accompanied by extreme heat. When temperatures reach 90ºF and above, people are vulnerable to sunstroke, heat cramps and heat exhaustion. Pets and livestock are also vulnerable to heat-related injuries, and agricultural crops can suffer.

Due to the prevalence of hydroelectric power generation in Washington State, Clark County businesses and residents may also experience a decrease in power supply or an increase in electric supply costs as the result of a prolonged drought. In extreme cases, planned power outages throughout the region may be implemented.

8.4 EXPOSURE

All people, property and environments in the planning area would be exposed to some degree to the impacts of moderate to extreme drought conditions.

8.5 VULNERABILITY

Drought produces a complex web of impacts that spans many sectors of the economy and reaches well beyond the area experiencing physical drought. This complexity exists because water is integral to the ability to produce goods and provide services. Drought can affect a wide range of economic, environmental and social activities. The vulnerability of an activity to the effects of drought usually depends on its water demand, how the demand is met, and what water supplies are available to meet the demand.

8.5.1 Population

No significant life or health impacts are anticipated as a result of drought within the planning area.

8.5.2 Property

No structures are likely to be directly affected by drought conditions, though some structures may become vulnerable to wildfires, which are more likely following years of drought. Droughts can also have significant impacts on landscapes, which could cause a financial burden on property owners. However, these impacts are not considered critical in planning for impacts from the drought hazard.

8.5.3 Critical Facilities

Critical facilities as defined for this plan will continue to be operational during a drought. Local water providers have plans in place including alternate water sources and memorandums of agreement to ensure operations continue during severe drought conditions. The risk to critical facilities will be largely aesthetic. For example, when water conservation measures are in place, landscaped areas will not be watered and may die. These aesthetic impacts are not considered significant.

8.5.4 Environment

Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has led public officials to focus greater attention and resources on these effects. Environmental losses from drought are associated with damage to plants, animals, wildlife habitat, and air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for a longer time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes and vegetation.

However, many species will eventually recover from this temporary aberration. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity. Reductions in groundwater replenishment can impact streams, especially during the summer when precipitation is sparse and all snowmelt has occurred. During these times, much of stream flow comes from groundwater sources. This means that reductions to groundwater can reduce stream flow when it is already low (Washington Emergency Management Division, 2014).

8.5.5 Economic Impact

The economic impact of drought is largely associated with industries that use water or depend on water for their business. For example, landscaping businesses are affected as the demand for their service significantly declines because landscaping is not being watered. Livestock owners experience increased expenses for watering their herds. Agricultural industries are impacted if water usage is restricted for irrigation. Drought can lead to a reduction in power-generating capacity in hydroelectric-dominated systems, such as those found in Washington. Reductions in capacity can lead to interruptions in the power supply that may have economic impacts in the region.

8.6 FUTURE TRENDS

8.6.1 Development

Clark County is updating its Comprehensive Plan, with the goal of completing the draft plan by December 2015 and adopting the plan no later than June 2016. The Comprehensive Plan will include policies directing land use and dealing with water supply issues and water resource protection. The Environmental Element, where these concerns will be addressed, also will prioritizes the regulation of development in a manner that protects water quality and quantity (Clark County, 2016b).

8.6.2 Climate Change

Although there is still some uncertainty regarding climate change impacts on the water cycle, most current models project increases in precipitation in winter, spring and fall and decreases in precipitation in summer. This decrease in precipitation, coupled with higher average summer temperatures, may contribute to an increase in the frequency, severity and duration of droughts in the region (Dalton et al., 2013). More frequent extreme events such as droughts could end up being more cause for concern than the long-term change in temperature and precipitation averages. According to the Washington State Department of Ecology, Washington has experienced unusually dry periods almost every year since 2000 (Washington Department of Ecology, 2007).

The potential for water shortages may increase as the timing and duration of precipitation events change. Winter snowpack is crucial to water resource management strategies in Washington and much of the west. Some projections indicate that snowpack in the Cascade Mountain range may decrease as much as 40 percent by the 2040s (Payne et al., 2004). The Washington State Department of Ecology reports that the average mountain snowpack in the North Cascades has declined at 73 percent of mountain sites studied (Washington Department of Ecology, 2007). These declines impact social, natural and built systems within and surrounding Clark County. For example, summer hydropower production may decline 9 to 11 percent by the 2020s, while summer demand for energy increases, due to higher electricity needs from an increase in cooling days coupled with population growth (Washington Department of Ecology, 2012). Additionally, snowmelt is pivotal for the recharge of underground water supply. A decreased snowpack and increased winter rain could create greater stormwater runoff (as opposed to a slow recharge). Increased temperatures in the summer, along with less summer rainfall, would then lead to drier soil. This could lead to wells going dry, as well as potential conflicts over senior water rights and new water rights (Washington Department of Ecology, 2016a).

Historically, drought patterns in the West are related to large-scale climate patterns in the Pacific and Atlantic oceans. The El Niño–Southern Oscillation in the Pacific varies on a 5- to 7-year cycle, the Pacific Decadal Oscillation varies on a 20- to 30-year cycle, and the Atlantic Multidecadal Oscillation varies on a 65- to 80-year cycle. As these large-scale ocean climate patterns vary in relation to each other, drought conditions in the U.S. shift from region to region. El Niño years bring drier conditions to the Pacific Northwest.

Water resource managers need to start addressing current stresses on water supplies and build flexibility and robustness into existing systems. Flexibility helps to ensure a quick response to changing conditions, and robustness helps people prepare for and survive the worst conditions. Washington State's Integrated Climate Response Strategy identifies five strategies for water resource management in response to a changing climate (Washington Department of Ecology, 2016a):

- Use integrated water resource management approaches in highly vulnerable basins.
- Involve decision-makers and communities in finding balanced sustainable solutions.
- Improve water supply and water quality in vulnerable basins.
- Apply water conservation and efficiency programs to reduce the amount of water needed for irrigation, municipal, and industrial users.
- Build the capacity of state and local governments, tribes, watershed groups, water managers, and communities to identify risks and reduce vulnerability to climate impacts.

With this approach to planning, water system managers will be better able to adapt to the impacts of climate change.

8.7 SCENARIO

The worst-case scenario is an extreme multiyear drought impacting the region. Combinations of low summer precipitation and low winter snowpack accumulation could stretch water resources, resulting in increased pressures to meet all users' needs. Intensified by such conditions, wildfires could threaten the planning area, increasing the need for water. Surrounding communities, also in drought conditions, could increase their demand for water supplies relied upon by Clark County, causing social and political conflicts. If such conditions persist for several years, the local economy could experience setbacks, especially in water-dependent industries and on local farms.

8.8 ISSUES

The planning team identified the following drought-related issues:

- Changes in the timing, frequency and duration of precipitation events may present challenges for current water storage and management practices in the region. Climate change may also increase the frequency and duration of meteorological drought conditions.
- Water resource management strategies have changed significantly over the last several decades. Managers must now consider the needs of communities, industries, power-generating facilities and the environment. Issues associated with meeting the needs of these competing demands with limited resources will likely increase as population growth continues and the impacts of climate change intensify.
- The use and promotion of water-saving and reclamation technologies even during non-drought periods may decrease the effects of drought in the planning area.
- Recent droughts have resulted in the need to stop pumping from some water courses due to limited stream flow.

- Predicting droughts can be challenging, although warning systems are currently under development.

9. EARTHQUAKE

9.1 GENERAL BACKGROUND

9.1.1 How Earthquakes Happen

An earthquake is the vibration of the earth's surface following a release of energy in the earth's crust. This energy can be generated by a sudden dislocation of the crust or by a volcanic eruption. Most destructive quakes are caused by dislocations of the crust. The crust may first bend and then, when the stress exceeds the strength of the rocks, break and snap to a new position. In the process of breaking, vibrations called "seismic waves" are generated. These waves travel outward from the source of the earthquake at varying speeds.

Earthquakes tend to reoccur along faults, which are zones of weakness in the crust. Even if a fault zone has recently experienced an earthquake, there is no guarantee that all the stress has been relieved. Another earthquake could still occur.

9.1.2 Types of Earthquakes

The earth's crust is divided into eight major pieces (or plates) and many minor plates. In Western Washington, the primary plates of interest are the Juan De Fuca and North American plates. The Juan De Fuca plate moves northeastward with respect to the North America plate at a rate of about 3 to 4 centimeters per year. The boundary where these two plates converge, the Cascadia Subduction Zone, lies approximately 50 miles offshore and extends from the middle of Vancouver Island in British Columbia to northern California. As it collides with North America, the Juan De Fuca plate slides beneath the continent and sinks into the earth's mantle. The collision of the Juan De Fuca and North America plates produces three types of earthquakes, as shown on Figure 9-1 and described below.

Subduction Zone Earthquakes

Subduction Zone earthquakes occur at the interface between tectonic plates. A subduction zone earthquake affecting Clark County would be centered in the Cascadia Subduction zone off the coast of Washington or Oregon. Such earthquakes typically have a minute or more of strong ground shaking, and are quickly followed by damaging tsunamis and numerous large aftershocks. The potential exists for large earthquakes along the Cascadia Subduction Zone, up to an earthquake measuring 9 or more on the Richter scale. This could cause coastal areas to drop up to 6 feet in minutes and could produce a tsunami all along the fault line from British Columbia to Mendocino, California. Such an earthquake would last several minutes and produce catastrophic damage in the region.

Source: USGS

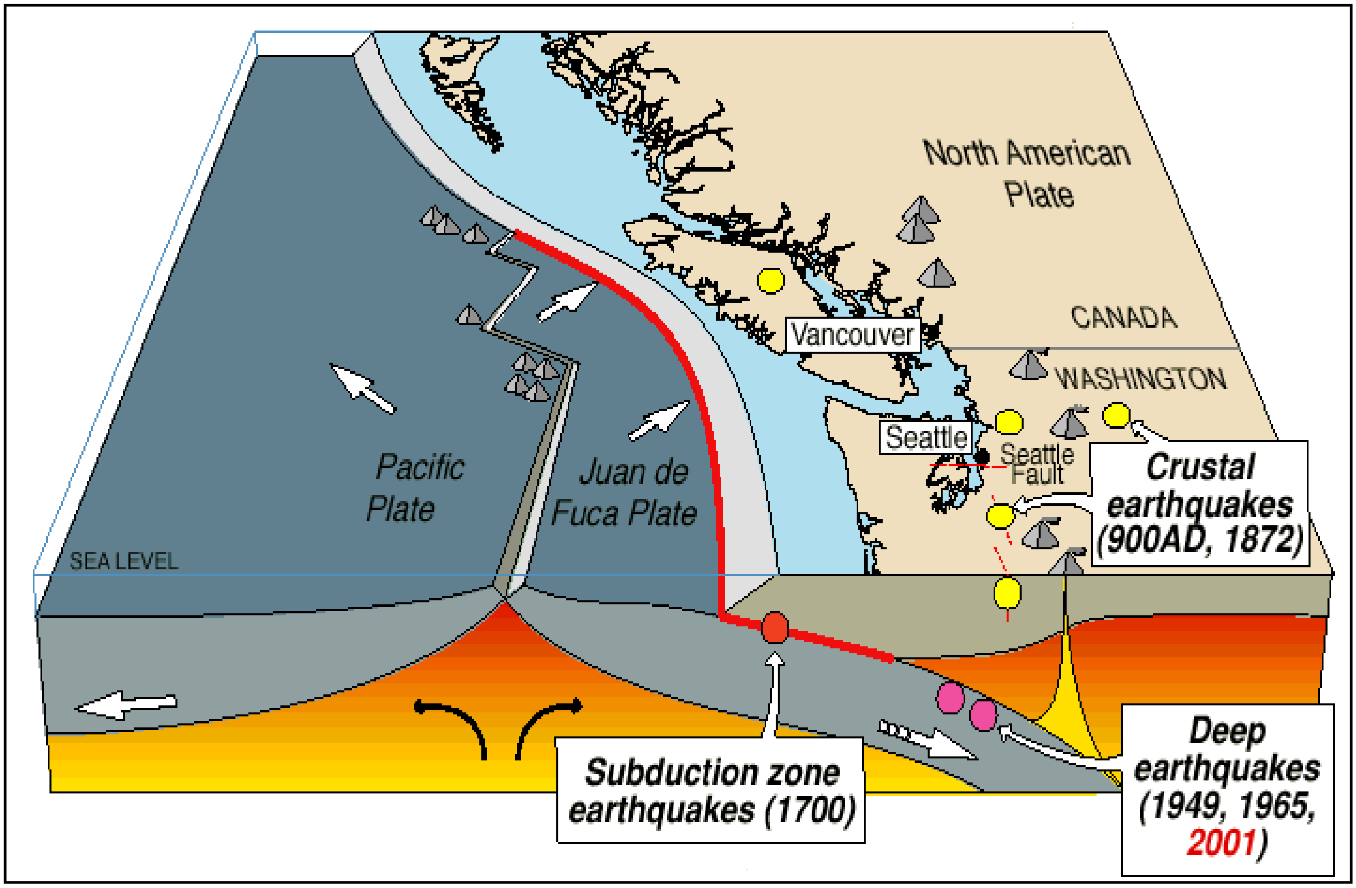


Figure 9-1. Earthquake Types in the Pacific Northwest

Benioff Zone (Deep) Earthquakes

Benioff Zone earthquakes occur within the Juan De Fuca plate as it sinks into the Earth's mantle. These are primarily deep earthquakes, 25 to 100 kilometers in depth. Due to their depth, aftershocks are typically not felt in association with these earthquakes. These earthquakes are caused by mineral changes as the plate moves deeper into the mantle. Minerals that make up the plates are altered to denser, more stable forms as temperature and pressure increase. This results in a decrease in the size of the plate, and stresses build up that pull the plate apart (Washington Department of Natural Resources, 2014). Deep earthquakes generally last 20 to 30 seconds and have the potential of reaching 7.5 on the Richter scale. Geologists have concluded that Benioff earthquakes are a phenomenon centered in the Puget Sound basin and as such their epicenters are at a considerable distance from Clark County. Their impact on Clark County is expected to be minimal to moderate (CRESA 2004).

Shallow Crustal Earthquakes

Shallow crustal earthquakes occur within the North America plate at depths of 30 kilometers or less. Shallow earthquakes within the North America plate account for most of the earthquakes in the region around Clark County. Most are relatively small but the potential exists for major shallow earthquakes as well. Generally, these earthquakes are expected to have magnitudes less than 8 and last from 20 to 60 seconds. Of the three types of earthquake, crustal events are the least understood.

9.1.3 Faults

Geologists classify faults by their relative hazards. Active faults, which represent the highest hazard, are those that have ruptured to the ground surface within the last 11,000 years. Potentially active faults are those that displaced layers of rock within the last 1,800,000 years. Determining if a fault is "active" or "potentially active" depends on geologic evidence, which may not be available for every fault. Additionally, earthquakes may occur on faults that have not been mapped and identified.

Faults are more likely to have earthquakes on them if they have more rapid rates of movement, have had recent earthquakes along them, experience greater total displacements, and are aligned so that movement can relieve accumulating tectonic stresses. A direct relationship exists between a fault's length and location and its ability to generate damaging ground motion at a given site. In some areas, smaller, local faults produce lower magnitude quakes, but ground shaking can be strong, and damage can be significant as a result of the fault's proximity to the area. In contrast, large regional faults can generate great magnitudes but, because of their distance and depth, may result in only moderate shaking in the area.

9.1.4 Earthquake Classifications

Earthquakes are typically classified in one of two ways: By the amount of energy released, measured as **magnitude**; or by the impact on people and structures, measured as **intensity**. Magnitude describes the size at the focus of an earthquake and intensity describes the overall felt severity of shaking during the event.

Magnitude

An earthquake's magnitude is a measure of the energy released at the source of the earthquake. It is expressed by ratings on the Richter scale or the moment magnitude scale. Currently the most commonly used magnitude scale is the moment magnitude (M_w) scale, with the follow classifications of magnitude:

- Great—$M_w \geq 8$
- Major—$M_w = 7.0 - 7.9$
- Strong—$M_w = 6.0 - 6.9$
- Moderate—$M_w = 5.0 - 5.9$
- Light—$M_w = 4.0 - 4.9$
- Minor—$M_w = 3.0 - 3.9$
- Micro—$M_w < 3$

Estimates of moment magnitude roughly match the local magnitude scale (ML) commonly called the Richter scale. One advantage of the moment magnitude scale is that, unlike other magnitude scales, it does not saturate at the upper end. That is, there is no value beyond which all large earthquakes have about the same magnitude. For this reason, moment magnitude is now the most often used estimate of large earthquake magnitudes.

Intensity

The intensity of an earthquake is based on the observed effects of ground shaking on people, buildings and natural features. Intensity of a given earthquake varies with location. The Modified Mercalli (MMI) scale expresses intensity of an earthquake and describes how strong a shock was felt at a particular location. Table 9-1 summarizes earthquake intensity as expressed by the Modified Mercalli scale.

Table 9-1. Mercalli Scale and Peak Ground Acceleration Comparison

Modified Mercalli Scale	Perceived Shaking	Potential Structure Damage		Estimated PGA[a] (%g)
		Resistant Buildings	Vulnerable Buildings	
I	Not Felt	None	None	<0.17%
II-III	Weak	None	None	0.17% - 1.4%
IV	Light	None	None	1.4% - 3.9%
V	Moderate	Very Light	Light	3.9% - 9.2%
VI	Strong	Light	Moderate	9.2% - 18%
VII	Very Strong	Moderate	Moderate/Heavy	18% - 34%
VIII	Severe	Moderate/Heavy	Heavy	34% - 65%
IX	Violent	Heavy	Very Heavy	65% - 124%
X – XII	Extreme	Very Heavy	Very Heavy	>124%

a. PGA measured in percent of g, where g is the acceleration of gravity
Sources: USGS, 2008; USGS, 2010

9.1.5 Ground Motion

Earthquake hazard assessment is also based on expected ground motion. This involves determining the annual probability that certain ground motion accelerations will be exceeded, then summing the annual probabilities over the time period of interest. The most commonly mapped ground motion parameters are the horizontal and vertical peak ground accelerations (PGA) for a given soil or rock type. Instruments called accelerographs record levels of ground motion due to earthquakes at stations throughout a region. These readings are recorded by state and federal agencies that monitor and predict seismic activity.

Maps of PGA values form the basis of seismic zone maps that are included in building codes such as the International Building Code. Building codes that include seismic provisions specify the horizontal force due to lateral acceleration that a building should be able to withstand during an earthquake. PGA values are directly related to these lateral forces that could damage "short period structures" (e.g. single-family dwellings). Longer period response components determine the lateral forces that damage larger structures with longer natural periods (apartment buildings, factories, high-rises, bridges). Table 9-1 lists damage potential and perceived shaking by PGA factors, compared to the Mercalli scale.

9.1.6 Effect of Soil Types

The impact of an earthquake on structures and infrastructure is largely a function of ground shaking, distance from the source of the quake, and liquefaction, a secondary effect of an earthquake in which soils lose their shear strength and flow or behave as liquid, thereby damaging structures that derive their support from the soil. Liquefaction generally occurs in soft sedimentary soils. A program called the National Earthquake Hazard Reduction Program (NEHRP) creates maps based on soil characteristics to help identify locations subject to liquefaction. Table 9-2 summarizes NEHRP soil classifications. NEHRP Soils B and C typically can sustain ground shaking without much effect, dependent on the earthquake magnitude. The areas that are commonly most affected by ground shaking have NEHRP Soils D, E and F. In general, these areas are also most susceptible to liquefaction.

Table 9-2. NEHRP Soil Classification System

NEHRP Soil Type	Description	Mean Shear Velocity to 30 m (m/s)
A	Hard Rock	1,500
B	Firm to Hard Rock	760-1,500
C	Dense Soil/Soft Rock	360-760
D	Stiff Soil	180-360
E	Soft Clays	< 180
F	Special Study Soils (liquefiable soils, sensitive clays, organic soils, soft clays >36 m thick)	

9.2 HAZARD PROFILE

9.2.1 Past Events

Like most of the northwestern coast of the United States, Clark County is susceptible to Cascadia Subduction Zone events, which are generally major in scale. On January 26, 1700, an approximate Magnitude 9 Cascadia Subduction Zone earthquake occurred. This earthquake inundated coastal areas from British Columbia to northern California and lowered coastal land elevations by as much as 6 feet (CRESA 2004).

Clark County has also been susceptible to shallow, crustal earthquakes. The 1872 earthquake in the North Cascades was the largest crustal earthquake in the recorded history of Washington and Oregon. It had an estimated magnitude of 7.4 and was followed by many aftershocks. In 1993, a Magnitude 5.6 earthquake in the Willamette Valley of Oregon caused $28 million in damage, including damage to the Oregon State capital building in Salem. A pair of earthquakes near Klamath Falls, Oregon of Magnitude 5.9 and 6.0 caused two fatalities and $7 million in damage (CRESA 2004).

The two most damaging Benioff earthquakes in Washington occurred in 1949 and 1965. The 1949 earthquake occurred near Olympia and had a magnitude of 7.1. The earthquake of 1965 occurred between Seattle and Tacoma with a magnitude of 6.5. These were centered in the Puget Sound region and had little impact on Clark County (CRESA 2004).

On February 28, 2001, the Nisqually earthquake, with a magnitude of 6.8, occurred northeast of Olympia, Washington. Most of the damage was concentrated in localized areas in central Puget Sound with poor site conditions and older construction. This earthquake caused minor damage in some areas of Clark County as well (CRESA 2004).

The USGS notes a moderately strong earthquake on November 5, 1962. This earthquake reportedly caused minor damage in Vancouver, Washington and nearby towns. The Magnitude 4.75 event was felt over an approximately 20,000-square-mile area (USGS, 1978).

Figure 9-2 is a Washington State map of historical earthquakes in the state. Most of the events were well north of Clark County, though some smaller magnitude events occurred in the county. Larger magnitude events that occurred in the surrounding region may also have been felt by Clark County residents.

Source: USGS, 2022

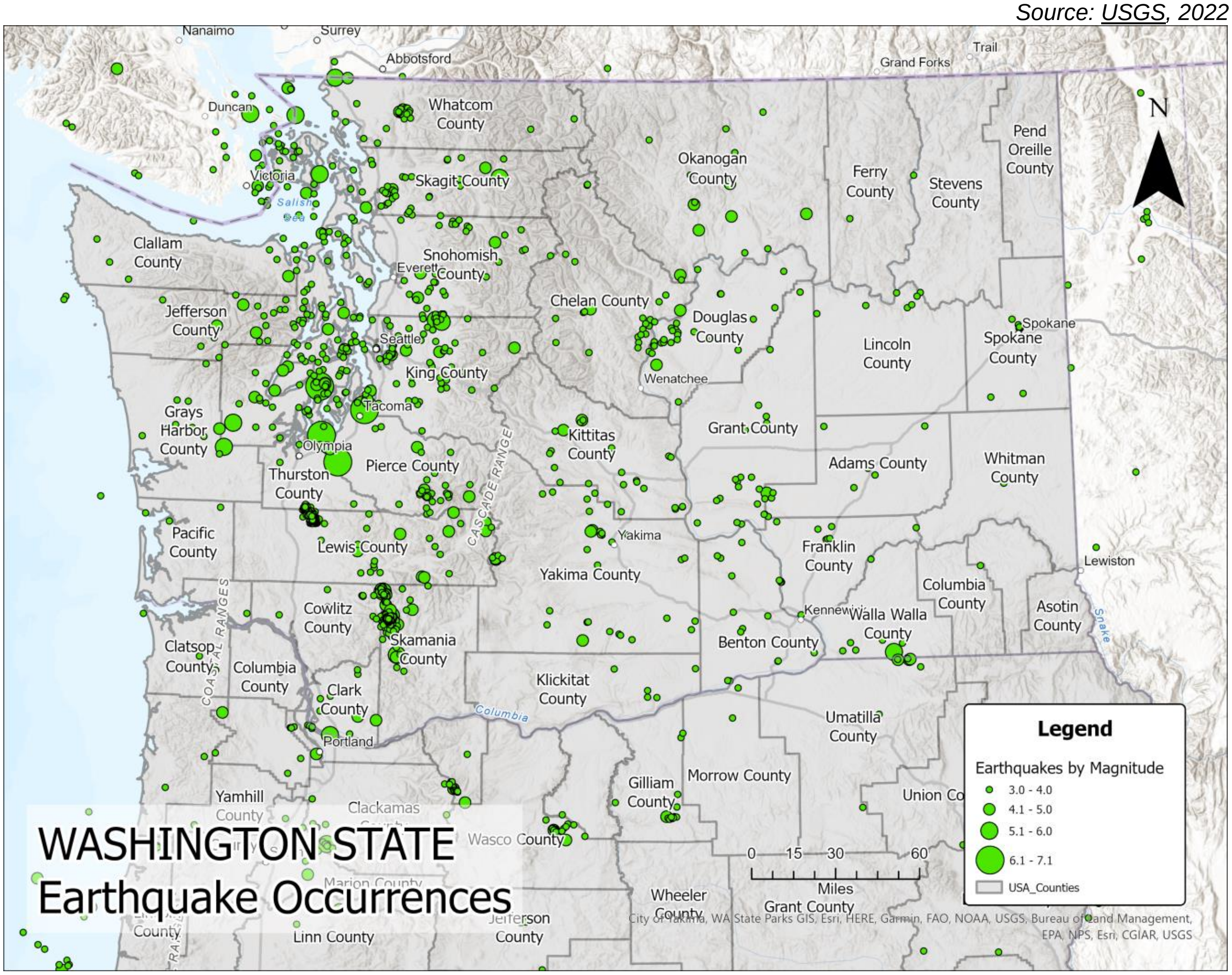


Figure 9-2. Historic Earthquakes in Washington State

9.2.2 Location

Identifying the extent and location of an earthquake is not as simple as it is for hazards such as flood, landslide or wildfire. The impact of an earthquake is largely a function of the following components:

- Ground shaking (ground motion accelerations)
- Liquefaction (soil instability)
- Distance from the source (both horizontally and vertically).

Mapping that shows the impacts of these components was used to assess the risk of earthquakes within the planning area as described below. While the impacts from each of these components can build upon each other during an earthquake, the mapping looks at each component individually.

Identified Faults

In 1993, the U.S. Geological Survey began developing a database of Quaternary faults and folds in the United States. The database includes information on geographic, geologic, and seismic parameters for making assessments of seismic hazards. There is only one known fault within Clark County: the Lacamas Lake Fault. The geologic age of the fault is estimated to be greater than 750,000 years (mid- to late-Quaternary) and the magnitude of an event on the fault is likely to be about 6.5 (USGS, 2014).

Faults outside the planning area but nearby, such as the Portland Hills fault in northern Oregon, may also cause damage in Clark County. The Portland Hills fault is about 30-miles long and runs northwest to southeast through Portland (CRESA 2004). Geophysical studies suggest that earthquakes of Magnitude 6 or larger should occur in the Portland region every 300 to 350 years, and an event of Magnitude 6.5 or larger every 800 to 900 years (CRESA, 2011). Figure 9-3 shows the identified faults in and near the planning area.

Source: http://earthquake.usgs.gov/hazards/qfaults/map/

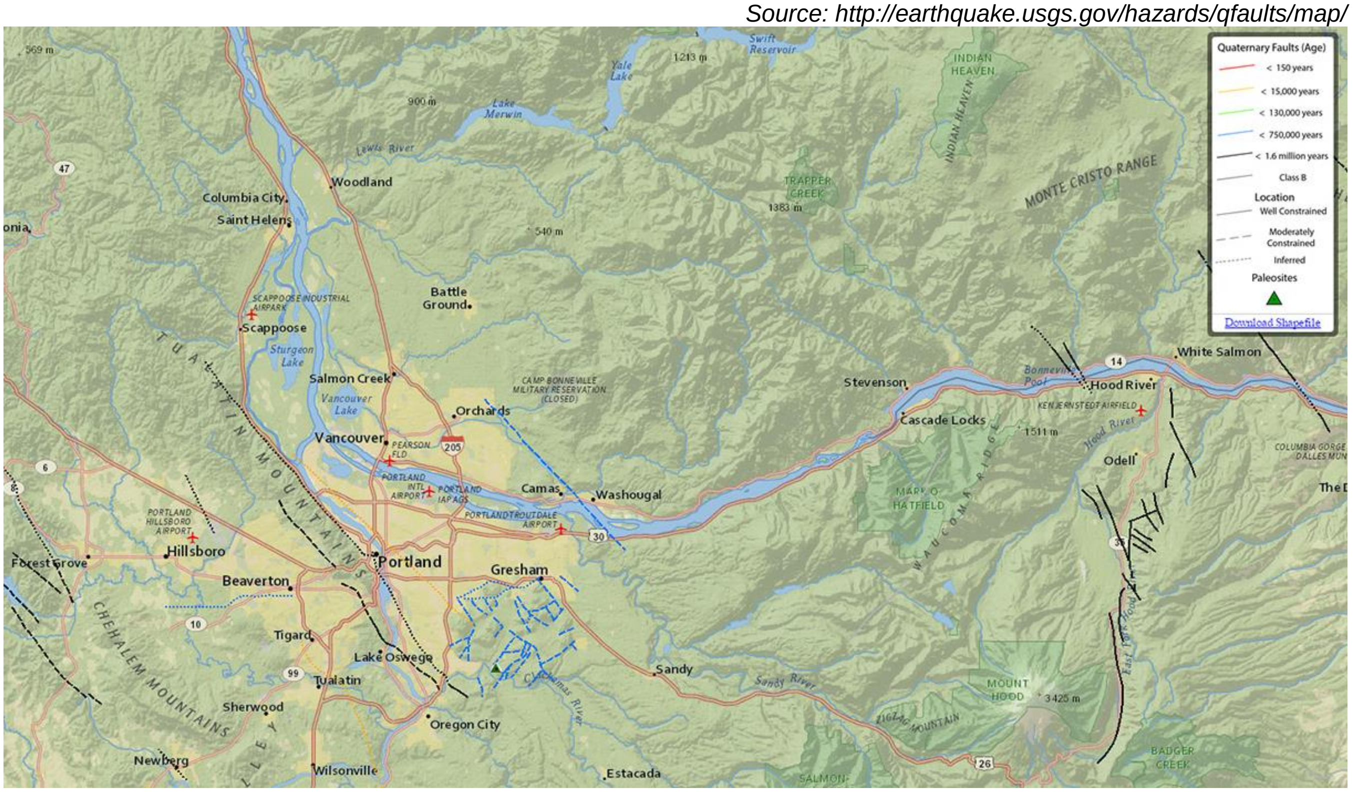


Figure 9-3. Planning Area Active Faults and Folds

Shake Maps

A shake map is a representation of ground shaking produced by an earthquake. The information it presents is different from the earthquake magnitude and epicenter that are released after an earthquake because shake maps focus on the ground shaking resulting from the earthquake, rather than the parameters describing the earthquake source. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region, depending on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth's crust. A shake map shows the extent and variation of ground shaking in a region immediately following significant earthquakes. Ground motion and intensity maps are derived from peak ground motion amplitudes recorded on seismic sensors (accelerometers), with interpolation based on estimated amplitudes where data are lacking, and site amplification corrections. Color-coded instrumental intensity maps are derived from empirical relations between peak ground motions and Modified Mercalli intensity. Two types of shake map are typically generated from the data:

- A probabilistic seismic hazard map shows the hazard from earthquakes that geologists and seismologists agree could occur. The maps are expressed in terms of probability of exceeding a certain ground motion, such as the 10-percent probability of exceedance in 50 years. This level of ground shaking has been used for designing buildings in high seismic areas. **Error! Reference source not found.** and **Error! Reference source not found.** show the estimated ground motion for the 100-year and 500-year probabilistic earthquakes in the planning area

- Earthquake scenario maps describe the expected ground motions and effects of hypothetical large earthquakes for a region. Maps of these scenarios can be used to support all phases of emergency management. Two scenarios were chosen for this plan:
  - Cascadia Subduction Zone Scenario—A Magnitude 9.0 event off the Pacific Coast. See Figure 9-4.
  - Portland Hills Fault Scenario—A Magnitude 6.5 event with the epicenter southwest of the planning area, near the border of Washington and Oregon. See Figure 9-5.

NEHRP Soil Maps

NEHRP soil types define locations that will be significantly impacted by an earthquake. NEHRP Soils B and C typically can sustain low-magnitude ground shaking without much effect. The areas most commonly affected by ground shaking have NEHRP Soils D, E and F. Figure 9-6 shows NEHRP soil classifications in Clark County.

Liquefaction Maps

Soil liquefaction maps are useful tools to assess potential damage from earthquakes. When the ground liquefies, sandy or silty materials saturated with water behave like a liquid, causing pipes to leak, roads and airport runways to buckle, and building foundations to be damaged. In general, areas with NEHRP Soils D, E and F are also susceptible to liquefaction. If there is a dry soil crust, excess water will sometimes come to the surface through cracks in the confining layer, bringing liquefied sand with it, creating sand boils. Figure 9-7 shows the liquefaction susceptibility in the planning area.

9.2.3 Frequency

Earthquake events occurring along the Cascadia Subduction Zone reoccur on average every 500 to 600 years, although the recurrence interval appears to be irregular. The intervals between earthquakes in this subduction zone have ranged from 200 years to more than 1,000 years. The probability of a magnitude 9.0 earthquake occurring along the subduction zone is estimated to be about 10 percent in the next 50 years (Cascadia Region Earthquake Workgroup, 2013).

A Portland Hills earthquake is a surface event with lower likelihood of occurrence, about 2 percent in the next 50 years (CRESA, 2004).

9.2.4 Severity

The severity of an earthquake can be expressed in terms of intensity or magnitude. Intensity represents the observed effects of ground shaking on people, buildings, and natural features. The USGS has created ground motion maps based on current information about several fault zones. These maps show the PGA that has a certain probability (2 percent or 10 percent) of being exceeded in a 50-year period. The PGA is measured in numbers of g's (the acceleration associated with gravity). Figure 9-8 shows the PGAs with a 2-percent exceedance chance in 50 years in the United States.

Magnitude is related to the amount of seismic energy released at the hypocenter of an earthquake. It is determined by the amplitude of the earthquake waves recorded on instruments. Whereas intensity varies depending on location with respect to the earthquake epicenter, magnitude is represented by a single, instrumentally determined value for each earthquake event.

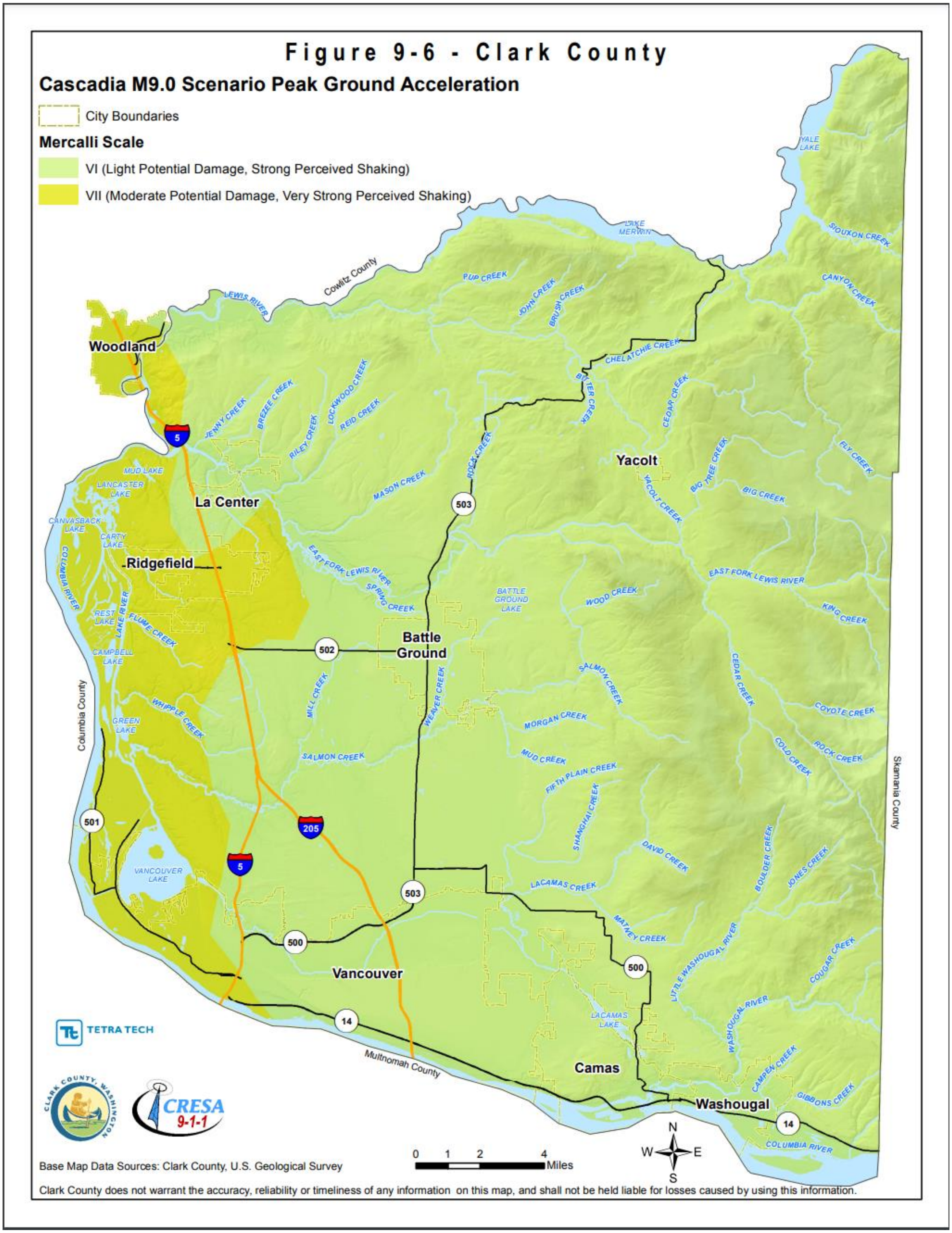


Figure 9-4. Cascadia M9.0 Scenario Peak Ground Acceleration

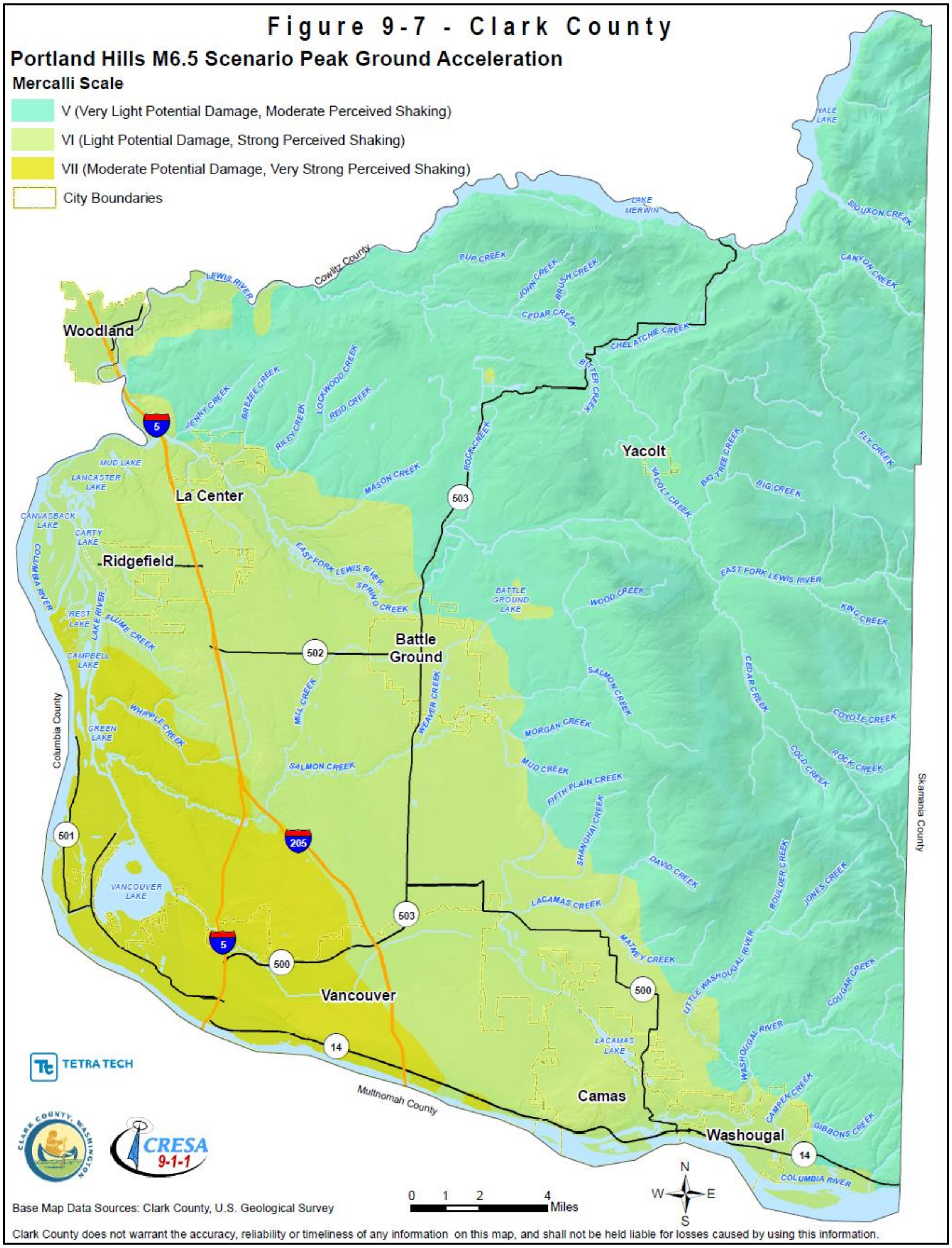


Figure 9-5. Portland Hills M6.5 Scenario Peak Ground Acceleration

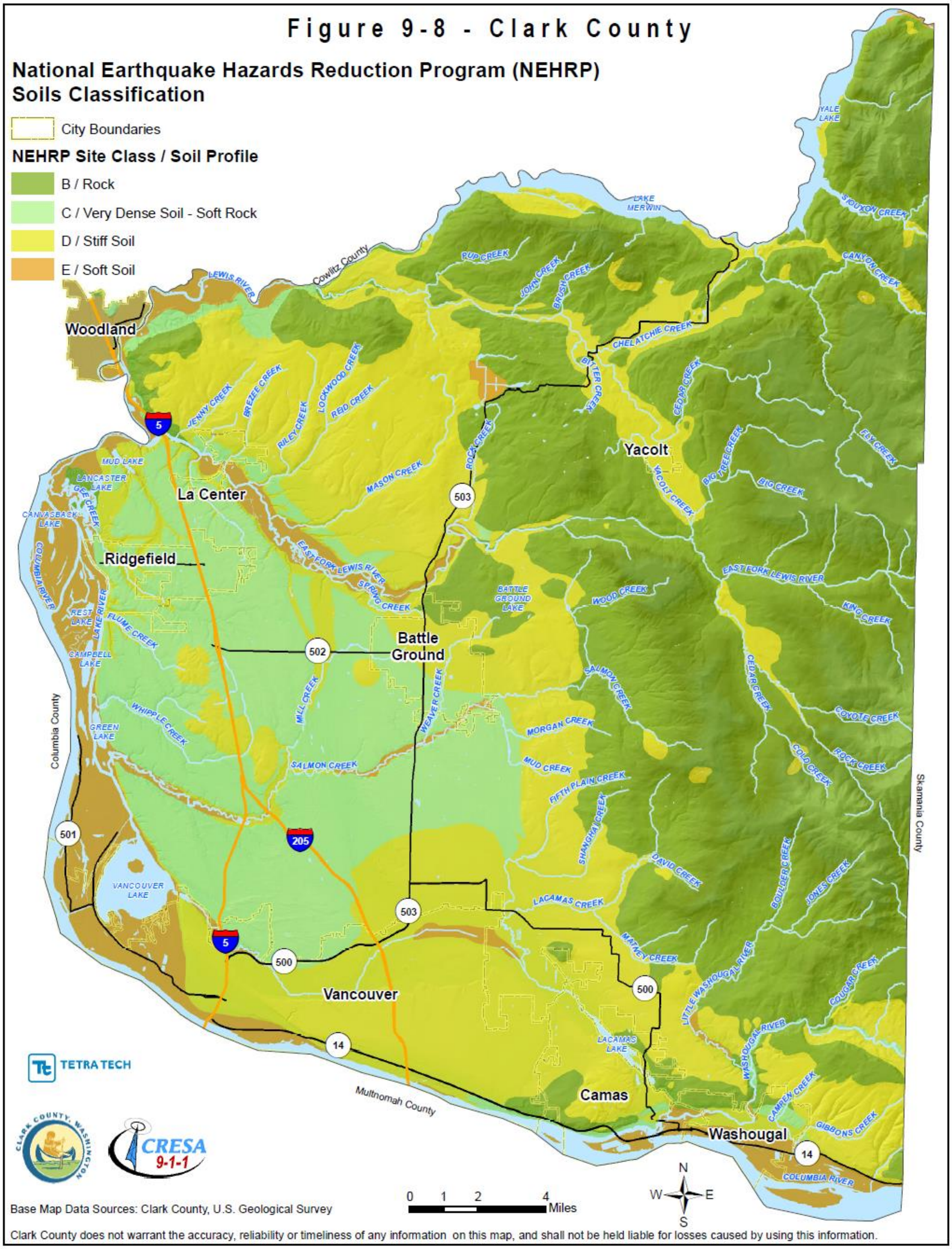


Figure 9-6. National Earthquake Hazard Reduction Program Soils Classification

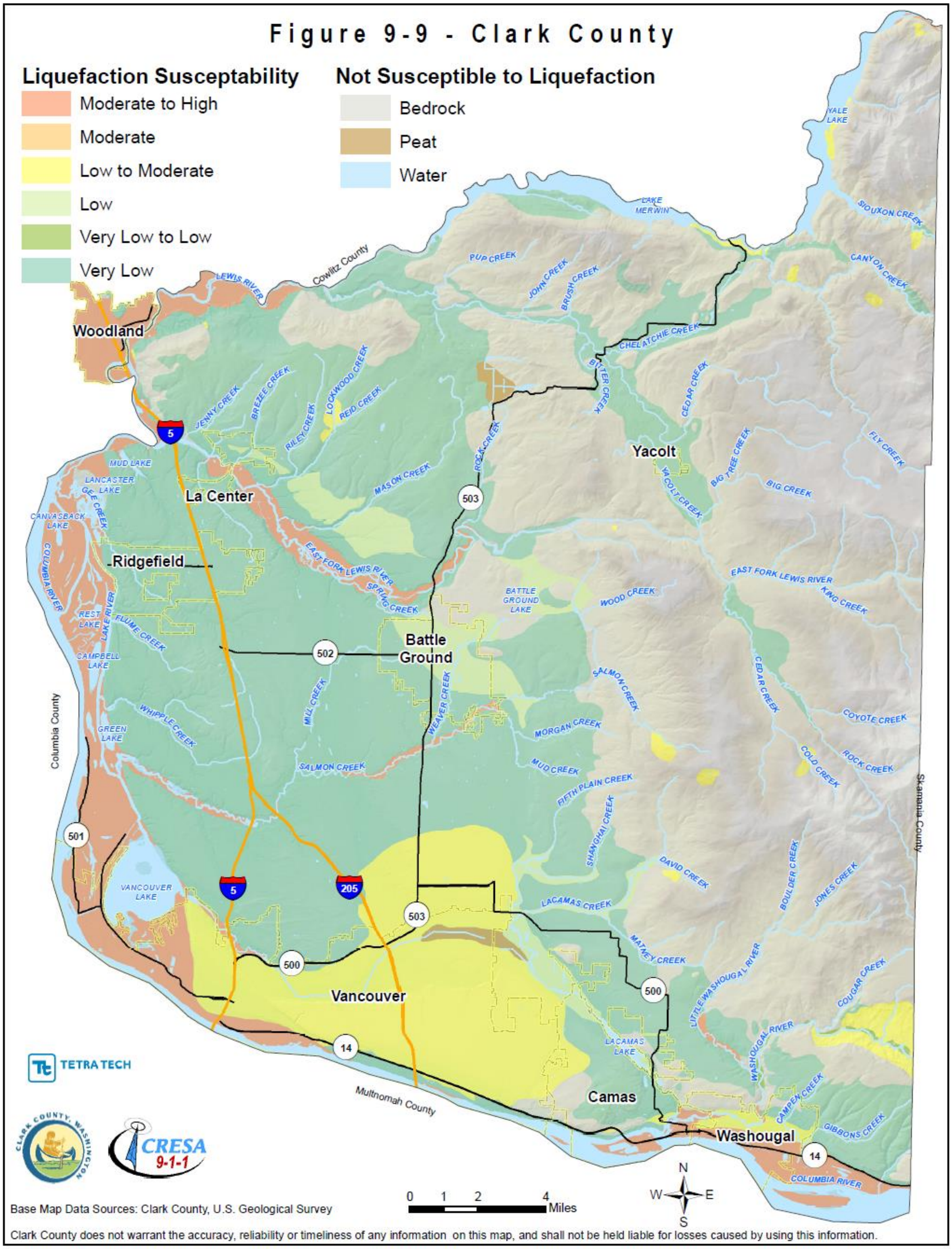


Figure 9-7. Liquefaction Susceptibility

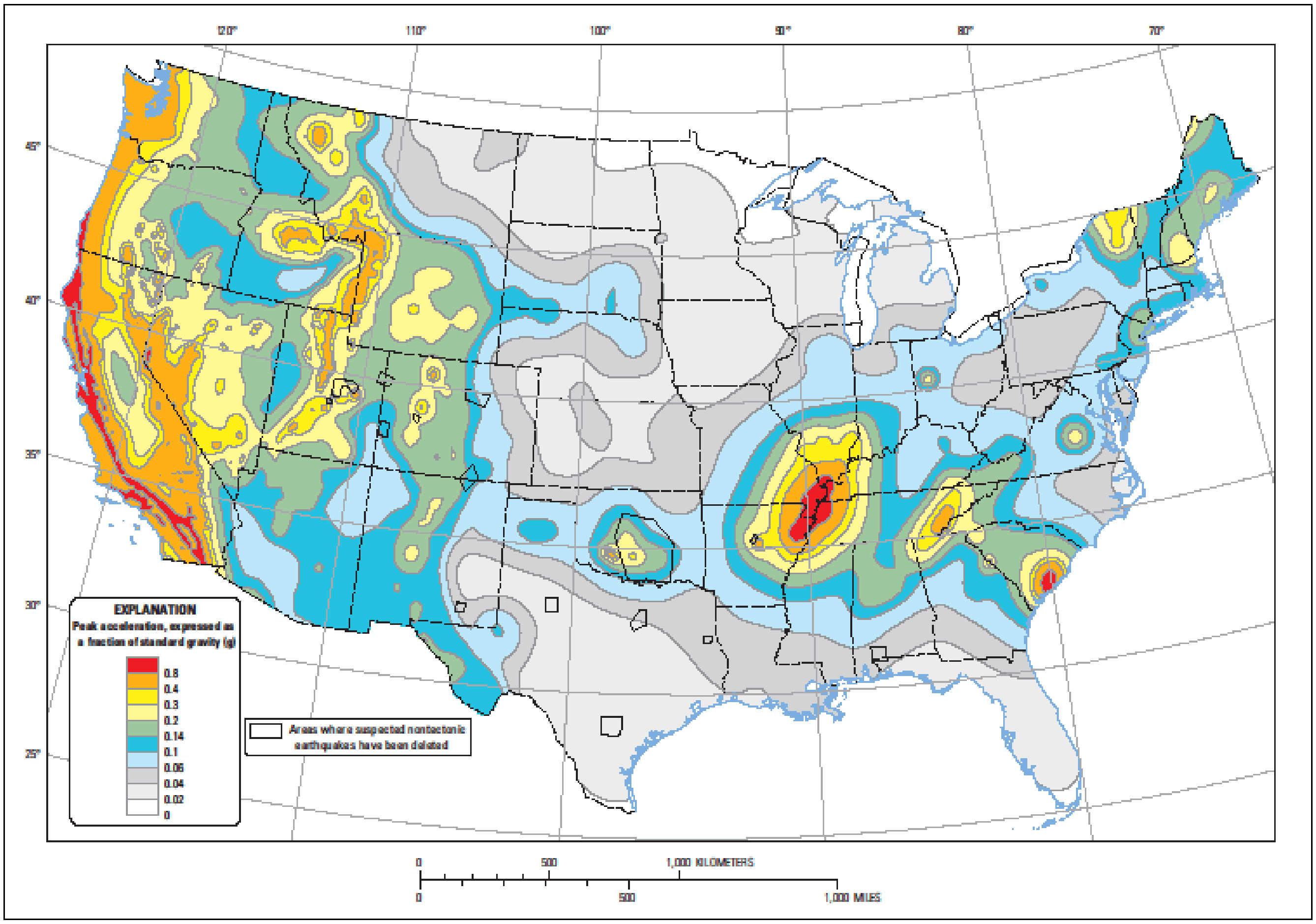


Figure 9-8. PGA with 2-Percent Probability of Exceedance in 50 Years

In simplistic terms, the severity of an earthquake event can be measured in the following terms:

- How hard did the ground shake?
- How did the ground move? (Horizontally or vertically)
- How stable was the soil?
- What is the fragility of the built environment in the area of impact?

9.2.5 Warning Time

There is currently no reliable way to predict the day or month that an earthquake will occur at any given location. An earthquake early warning system has been implemented in Washington State, Oregon, and California that uses the low energy waves that precede major earthquakes to provide warning of ground movement. The USGS and university partners have developed an early warning system called ShakeAlert for the West Coast of the United States. The potential warning ranges from a few seconds to tens of seconds notice that a major earthquake is about to occur (Earthquake Early Warning, 2022). The warning time is very short but it could allow for someone to get under a desk, step away from a hazardous material they are working with, or shut down a computer system.

It is known that fore- and aftershocks are likely to precede and follow both subduction and Portland Hills events, so there might be some preparation for these. It is likely that aftershocks may be close in timing to the actual earthquake event (CRESA, 2004).

9.3 SECONDARY HAZARDS

Earthquakes can cause large and sometimes disastrous landslides and mudslides. River valleys are vulnerable to slope failure, often as a result of loss of cohesion in clay-rich soils. Soil liquefaction occurs when water-saturated sands, silts or gravelly soils are shaken so violently that the individual grains lose contact with one another and float freely in the water, turning the ground into a pudding-like liquid. Building and road foundations lose load-bearing strength and may sink into what was previously solid ground. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people. Earthen dams and levees are highly susceptible to seismic events and the impacts of their eventual failures can be considered secondary risks for earthquakes. Disruptions in utility services, including power, communication, gas, wastewater and potable water, may also occur. Structure fires also pose a significant hazard after earthquake events.

9.4 EXPOSURE

9.4.1 Population

The entire population of Clark County is potentially exposed to direct and indirect impacts from earthquakes. The degree of exposure is dependent on many factors, including the age and construction type of the structures people live in, the soil type their homes are constructed on, their proximity to fault location, etc. Whether directly impacted or indirectly impacted, the entire population will have to deal with the consequences of earthquakes to some degree. Business interruption could keep people from working, road closures could isolate populations, and loss of functions of utilities could impact populations that suffered no direct damage from an event itself.

9.4.2 Property

According to County Assessor records, there are 149,741 buildings in the planning area, with a total replacement value of $113.5 billion. Since all structures in the planning area are susceptible to earthquake impacts to varying degrees, this total represents the countywide property exposure to seismic events. Most of the buildings (approximately 95 percent) are residential.

9.4.3 Critical Facilities and Infrastructure

All critical facilities in the planning area are exposed to the earthquake hazard.

Table 4-5 lists the number of each type of facility by jurisdiction.

9.4.4 Environment

Secondary hazards associated with earthquakes will likely have some of the most damaging effects on the environment. Earthquake-induced landslides can significantly impact surrounding habitat. It is also possible for streams to be rerouted after an earthquake. This can change water quality, possibly damaging habitat and feeding areas. There is a possibility of streams fed by groundwater drying up because of changes in underlying geology or that new flows may be released. Major concentrations of hazardous materials on port industrial lands along the Columbia River shoreline upriver of the Lake Vancouver wetland area and the Ridgefield National Wildlife Refuge create significant exposure for the natural environment (CRESA 2004).

9.5 VULNERABILITY

Earthquake vulnerability data was evaluated using a Level 2 Hazus-MH analysis by Tetra Tech in 2017. A follow-up analysis was conducted at a regional level by the Oregon Department of Geology and Mineral Industries (DOGAMI). The vulnerability was updated with DOGAMI's data where applicable throughout this section. Once the location and size of a hypothetical earthquake are identified, Hazus-MH estimates the intensity of the ground shaking, the number of buildings damaged, the damage to critical facilities and infrastructure, the number of people displaced from their homes, and additional information that can be used to estimate the costs of repair and cleanup.

9.5.1 Population

DOGAMI estimated there to be (307,471) people in over (114,988) households living on soils with moderate to high liquefaction potential or peat soils in the planning area. This was substantially higher than Tetra Tech's analysis of 13,093 households. DOGAMI Attributes this to differences in modeling techniques (DOGAMI, 2020). Two groups are particularly vulnerable to earthquake hazards:

- **Population Below Poverty Level**—Tetra Tech estimated 2,265 households in the planning area census blocks with moderate to high liquefaction potential or peat soils have household incomes less than $20,000 per year. This is about 17 percent of all households located on moderate to high liquefaction potential or peat soils. These households may lack the financial resources to improve their homes to prevent or mitigate earthquake damage. Economically disadvantaged residents are also less likely to have insurance to compensate for losses in earthquakes.
- **Population Over 65 Years Old**—Tetra Tech estimated 4,316 residents in the planning area census blocks with moderate to high liquefaction potential or peat soils are over 65 years old. This is about 12 percent of all residents in these census blocks. This population group is vulnerable because they are more likely to need special medical attention, which may not be available due to isolation caused by earthquakes. Elderly residents also have more difficulty leaving their homes during earthquake events and could be stranded in dangerous situations.

Impacts on persons and households in the planning area were estimated for the 100-year and 500-year earthquakes and the two scenario events through the Level 2 Hazus-MH analysis. Table 9-3 summarizes the results.

Table 9-3. Estimated Earthquake Impact on Persons and Households

	Number of Displaced Households/ Persons	Number of Persons Requiring Short-Term Shelter
100-Year Earthquake	23 Households	14
500-Year Earthquake	1,350 Households	822
Cascadia Fault, M9.0 Scenario	3,801 (Dry) – 24,695 (Wet) Persons[1]	215

Portland Hills Fault, M6.5 Scenario	2,819 (Dry) – 28, 986 (Wet) Persons[1]	91

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.
[1] – Analysis conducted by DOGAMI. All others conducted by Tetra Tech.

9.5.2 Property

Building Age

Table 9-4 identifies significant milestones in building and seismic code requirements that directly affect the structural integrity of development. Using these time periods, the planning team used Clark County and Cowlitz County assessor's data to identify the number of structures in the planning area by date of construction. The number of structures does not reflect the number of total housing units, as many multi-family units and attached housing units are reported as one structure. Approximately 23.8 percent of the planning area's structures were constructed before there were state minimums regarding residential seismic construction standards. Approximately 41.8 percent were built after seismic Zone 3 standards were required.

Table 9-4. Age of Structures in Planning Area

Time Period	Number of Current Planning Area Structures Built in Period[a]	Significance of Time Frame
Pre-1972	33,339	Adoption of building codes was at the discretion of individual cities and counties. There were no state minimums regarding residential construction, although newly constructed schools, hospitals and places of assembly were required to withstand a lateral force of 5 percent of the building weight.
1972-1993	48,623	Houses built after 1972 are in compliance with the 1970 Uniform Building Code, which required that all structures be constructed to Zone 2 seismic standards.
1994-2003	37,148	Zone 3 standards of the Uniform Building Code went into effect in western Washington in 1994, requiring all new construction to be capable of withstanding the effects of 0.3 times the force of gravity.
2004-2006	12,532	Adoption of new codes that became effective in July of 2004 brought Washington State's building codes to the highest level nationwide addressing the state's seismic hazard.
2007-present	32,155	Amendments to the International Building Code that took effect in July of 2007 included provisions for structural design for earthquake loads and flood hazards. The code applies to all building permits in the state of Washington. The codes are driven in part by soil and liquefaction maps prepared.
Total	**163,797**	

a. Year built information was collected from Clark and Cowlitz County tax assessor data. When year built information was unavailable, it was estimated based on census block or county-wide average year built dates.

Source: Western States Seismic Policy Council, 2016

Liquefaction Potential

Table 9-5 shows the estimated number of structures located on moderate to high potential liquefaction areas or peat soils based on the analysis by Tetra Tech. There are estimated to be 2,234 such structures in the planning area that were built before 1972 (32.9 percent). An estimated 429 structures on liquefiable soils have been built since 2007 (6.3 percent).

Table 9-5. Structures Located on Moderate to High Liquefaction Potential

Jurisdiction	Structures on Liquefiable Soils	Total Structures	Percent of Total Structures
Battle Ground	0	5,854	0.0%
Camas	349	7,513	4.6%
La Center	0	1,110	0.0%

Jurisdiction	Structures on Liquefiable Soils	Total Structures	Percent of Total Structures
Ridgefield	54	2,328	2.3%
Vancouver	2,209	50,098	4.4%
Washougal	1,416	5,539	25.6%
Woodland	1,849	1,864	99.2%
Yacolt	0	533	0.0%
Unincorporated	894	74,902	1.2%
Total	**6,771**	**149,741**	**4.5%**

Loss Potential

Structural and Non-Structural Loss

Property losses were estimated through the Level 2 Hazus-MH analysis for the 100-year and 500-year earthquakes and the two scenario events. Table 9-6 and Table 9-7 show the results for two types of property loss: structural loss (damage to building structures); and non-structural loss (the value of lost contents).

Table 9-6. Loss Estimates for Probabilistic Earthquakes

	Estimated Loss Associated with Earthquake							
	100- Year Earthquake				500- Year Earthquake			
Jurisdiction	Structure	Contents	Total	% of Total Value	Structure	Contents	Total	% of Total Value
Battle Ground	$7,702,384	$2,504,623	$10,207,007	0.3%	$126,603,887	$36,962,449	$163,566,336	4.1%
Camas	$21,150,784	$7,508,475	$28,659,259	0.4%	$434,388,396	$141,940,597	$576,328,993	7.6%
La Center	$1,669,746	$557,716	$2,227,461	0.3%	$23,089,793	$7,439,052	$30,528,845	3.8%
Ridgefield	$4,508,121	$1,506,279	$6,014,400	0.3%	$81,460,429	$25,484,320	$106,944,749	5.2%
Vancouver	$129,170,801	$44,902,228	$174,073,029	0.4%	$2,883,634,647	$871,943,387	$3,755,578,034	7.8%
Washougal	$15,754,583	$5,214,119	$20,968,702	0.5%	$346,332,544	$105,512,514	$451,845,057	10.9%
Woodland	$12,468,825	$4,592,914	$17,061,739	1.0%	$247,836,758	$89,373,231	$337,209,990	19.0%
Yacolt	$123,362	$33,080	$156,443	0.1%	$1,973,430	$755,599	$2,729,028	0.9%
Unincorporated	$60,313,915	$18,209,930	$78,523,845	0.2%	$984,008,141	$306,616,992	$1,290,625,133	2.9%
Total	**$252,862,521**	**$85,029,364**	**$337,891,885**	**0.3%**	**$5,129,328,025**	**$1,586,028,142**	**$6,715,356,166**	**5.9%**

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

Table 9-7. Loss Estimates for Cascadia and Portland Hills Fault Scenario Earthquakes

	Estimated Loss Associated with Earthquake							
	Cascadia Fault, M9.0				Portland Hills Fault, M6.5			
Jurisdiction	Structure	Contents	Total	% of Total	Structure	Contents	Total	% of Total
Battle Ground	$55,961,241	$15,037,033	$70,998,274	1.8%	$12,565,086	$6,270,833	$18,835,919	0.5%
Camas	$78,513,607	$24,461,975	$102,975,582	1.4%	$28,095,911	$13,994,049	$42,089,959	0.6%
La Center	$5,933,361	$2,373,416	$8,306,776	1.0%	$626,988	$386,700	$1,013,688	0.1%
Ridgefield	$50,081,043	$13,081,752	$63,162,795	3.0%	$5,690,364	$3,278,681	$8,969,044	0.4%
Vancouver	$1,096,996,587	$262,385,378	$1,359,381,965	2.8%	$639,121,124	$232,439,643	$871,560,767	1.8%
Washougal	$30,283,011	$8,453,341	$38,736,351	0.9%	$10,958,868	$5,712,285	$16,671,153	0.4%
Woodland	$87,133,236	$23,773,277	$110,906,513	6.2%	$10,177,446	$3,846,130	$14,023,576	0.8%
Yacolt	$949,658	$455,241	$1,404,899	0.5%	$118,443	$85,610	$204,053	0.1%
Unincorporated	$544,728,735	$155,275,222	$700,003,957	1.6%	$325,936,412	$133,643,686	$459,580,098	1.0%
Total	**$1,950,580,479**	**$505,296,633**	**$2,455,877,112**	**2.2%**	**$1,033,290,641**	**$399,657,617**	**$1,432,948,257**	**1.3%**

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

A summary of the property-related loss results is as follows:

- For a 100-year probabilistic earthquake, the estimated damage potential is $337.9 million, or 0.3 percent of the total replacement value for the planning area.
- For a 500-year probabilistic earthquake, the estimated damage potential is $6.7 billion or 5.9 percent of the total replacement value for the planning area.
- For a 9.0-magnitude Cascadia Fault event, the estimated damage potential is $2.5 billion, or 2.2 percent of the total replacement value for the planning area.
- For a 6.5-magnitude Portland Hills Fault event, the estimated damage potential is $1.4 billion, or 1.3 percent of the total replacement value for the planning area.

Building Damage

Damage states vary for each type of structure. Moderate to very heavy damage will occur in older residential neighborhoods, business districts, communities with concentrations of non-seismically designed buildings, and areas built on soft soils. Particularly vulnerable are homes built before 1950, turn of the century un-reinforced masonry buildings, homes that were built prior to the 1970 Uniform Building Code that required anchoring to foundations, pre-1980 tilt-up buildings, and buildings with large windows or parking doors that weaken the first floor. Least vulnerable are structures built since 1994 when the earthquake Zone 3 standards of the Uniform Building Code were applied (CRESA 2004). The Hazus-MH analysis estimated the expected building damage by occupancy for the least damaging and most damaging earthquake events—the 100-year and 500-year events, respectively.

- For a 100-year probabilistic earthquake, about 1 percent (1,267) of planning area buildings are expected to be at least moderately damaged. Less than 0.1 percent are expected to be damaged beyond repair.
- For a 500-year probabilistic earthquake, about 12.5 percent (almost 19,000) of planning area buildings are expected to be at least moderately damaged. Less than 1 percent (753) are expected to be damaged beyond repair, including more than 270 residential structures.

Damage would be especially severe in taller buildings, which would experience large displacements. The movement of taller buildings may damage adjacent buildings by pounding against them, causing significant damage to buildings that otherwise would have been undamaged (CRESA 2004).

Earthquake-Caused Debris

The Hazus-MH analysis estimated the amount of earthquake-caused debris in the planning area for the 100-year and 500-year earthquakes and the two scenario events, as summarized in Table 9-8.

Table 9-8. Estimated Earthquake-Caused Debris

	Debris to Be Removed (tons)[a]	Estimated Number of Truckloads[b]
100-Year Earthquake	94,070	3,763
500-Year Earthquake	2,416,280	96,651
Cascadia Fault, M9.0 Scenario	1,827,000	73,080
Portland Hills Fault, M6.5 Scenario	1,795,000	71,800

a. Debris generation estimates were based on updated general building stock dataset at a Census Tract analysis level.
b. Hazus-MH assumes 25 tons/trucks
Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

9.5.3 Critical Facilities and Infrastructure

Level of Damage

Hazus-MH classifies the vulnerability of critical facilities to earthquake damage in five categories: no damage, slight damage, moderate damage, extensive damage, or complete damage. The model was used to assign a vulnerability category to each critical facility in the planning area. The analysis was performed for the Cascadia M9.0 scenario and 500-year probabilistic events. Results are summarized in Table 9-9 and Table 9-10.

Table 9-9. Estimated Damage to Critical Facilities from Cascadia M9.0 Scenario Earthquake

	Damage Extent				
Category[a]	None	Slight	Moderate	Extensive	Complete
Communication Facilities	8	1	0	0	0
Dams[b]	--	--	--	--	--
Emergency Services	61	0	0	0	0
Energy	56	16	0	0	0
Government Facilities	0	60	0	0	0
Hazardous Materials	0	116	0	0	0
Health Care & Public Health	5	345	0	0	0
Information Technology	--	--	--	--	--
Schools	157	0	0	0	0
Transportation Systems	211	54	0	0	0
Water & Sanitation Systems	337	56	0	0	0
Total	**835**	**648**	**0**	**0**	**0**

a. Damage extent was determined by selecting the highest probability damage state for each facility.
b. Hazus-MH does not produce damage estimates for dams. It is likely that owner/operators have already performed in depth, site-specific seismic hazard analysis.
Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

Table 9-10. Estimated Damage to Critical Facilities from 500-Year Earthquake

	Damage Extent				
Category[a]	None	Slight	Moderate	Extensive	Complete
Communication Facilities	0	9	0	0	0
Dams	--	--	--	--	--
Emergency Services	61	0	0	0	0
Energy	1	59	12	0	0
Government Facilities	0	56	0	0	4
Hazardous Materials	0	73	0	0	43
Health Care & Public Health	5	343	0	0	2
Information Technology	--	--	--	--	--
Schools	157	0	0	0	0
Transportation Systems	256	4	0	0	5
Water & Sanitation Systems	78	254	57	0	4
Total	**558**	**798**	**69**	**0**	**58**

a. Damage extent was determined by selecting the highest probability damage state for each facility.
b. Hazus-MH does not produce damage estimates for dams. It is likely that owner/operators have already performed in depth, site-specific seismic hazard analysis.

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

Time to Return to Functionality

Hazus-MH estimates the time to restore critical facilities to fully functional use. Results are presented as probability of being functional at specified time increments: 1, 3, 7, 14, 30 and 90 days after the event. For example, Hazus-MH may estimate that a facility has 5 percent chance of being fully functional at Day 3, and a 95-percent chance of being fully functional at Day 90. Results from the 100-year probability event and the 500-year probability event are summarized in Table 9-11 and Table 9-12.

Table 9-11. Functionality of Critical Facilities for Cascadia M9.0 Scenario Earthquake

	# of Critical Facilities	Probability of Being Fully Functional (%)[a]					
		at Day 1	at Day 3	at Day 7	at Day 14	at Day 30	at Day 90
Communication Facilities	9	92	99	99	100	100	100
Dams[a]	3	--	--	--	--	--	--
Emergency Services	61	88	88	98	98	99	99
Energy	72	67	88	94	97	99	100
Government Facilities	60	4	6	55	55	81	94
Hazardous Materials	115	4	7	56	56	81	92
Health Care & Public Health	350	5	8	59	59	84	96
Information Technology	0	--	--	--	--	--	--
Schools	157	87	88	99	99	99	99
Transportation Systems	265	93	95	96	97	97	98
Water & Sanitation Systems	393	37	50	78	78	90	96
Total/Average	**1,485**	**53**	**59**	**82**	**82**	**92**	**97**

a. Hazus-MH does not produce functionality estimates for dams. It is likely that owner/operators have already performed in depth, site-specific seismic hazard analysis.

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

Table 9-12. Functionality of Critical Facilities for 500-Year Earthquake

	# of Critical Facilities	Probability of Being Fully Functional (%)[a]					
		at Day 1	at Day 3	at Day 7	at Day 14	at Day 30	at Day 90
Communication Facilities	9	82	95	97	99	100	100
Dams[a]	3	--	--	--	--	--	--
Emergency Services	61	65	65	87	88	95	95
Energy	72	47	70	83	90	95	99
Government Facilities	60	2	4	44	44	71	88
Hazardous Materials	116	2	3	37	37	63	81
Health Care & Public Health	350	3	6	49	49	76	91
Information Technology	0	--	--	--	--	--	--
Schools	157	66	67	90	90	96	96
Transportation Systems	265	83	88	90	90	91	94
Water & Sanitation Systems	393	27	43	64	64	79	89
Total/Average	**1,485**	**42**	**49**	**71**	**72**	**85**	**93**

a. Hazus-MH does not produce functionality estimates for dams. It is likely that owner/operators have already performed in depth, site-specific seismic hazard analysis.

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

Liquefaction Potential

Structures located with the Port of Vancouver facilities and containing hazardous materials are particularly susceptible to liquefaction and flow into the Columbia impacting down river wetlands. When liquefaction occurs, the ground loses the capability to support structures, resulting in subsidence and/or tipping of buildings and bridge supports. Lateral spreading pulls apart some types of buildings and rupture pipelines. Several tall grain elevators could potentially fail. (CRESA 2004).

In addition other facilities located on liquefiable soil may be particularly vulnerable to the earthquake hazards. The following infrastructure is located on or passes through these areas:

- Interstate 5
- Interstate 205
- State Route 14
- State Route 500
- State Route 501
- State Route 503
- Northwest Pipeline
- Olympic Pipeline
- All watercourse levees.

9.5.4 . Environment

The environment vulnerable to earthquake hazard is the same as the environment exposed to the hazard.

9.5.5 Economic Impact

Economic impact will be largely associated with the disruption of services caused by an earthquake event. In general, significant events may cause damage to land, buildings, transportation infrastructure, and businesses. With an event of such significance, economic recovery could take years depending on available recovery funds.

9.6 FUTURE TRENDS

9.6.1 Development

Land use in the planning area will be directed by comprehensive plans adopted under Washington’s Growth Management Act. The information in this plan provides the participating partners a tool to ensure that there is no increase in exposure in areas of high seismic risk. Development in the planning area will be regulated through building standards and performance measures so that the degree of risk will be reduced. The geologic hazard portions of the planning area are regulated under each jurisdiction’s critical areas ordinances. The most recently adopted building codes take liquefaction and soil mapping into account in their standards.

Areas targeted for future growth and development have been identified across the County. It is anticipated that the human exposure and vulnerability to earthquake impacts in newly developed areas will be similar to those that currently exist within the County. New development in areas with softer NEHRP soil classes, liquefaction and landslide-susceptible areas may be more vulnerable to the earthquake hazard. Table 9-13 shows the area identified as underutilized or vacant in urban growth areas in the County that intersect moderate to high liquefaction potential or peat soils. Development in these areas has the potential to increase vulnerability to the earthquake hazard if proper structural measures are not taken. Critical areas ordinances in the planning area may restrict development in portions of these parcels where liquefaction is likely.

9.6.2 Climate Change

The impacts of global climate change on earthquake probability are unknown. Some scientists say that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of weight are shifted on the earth’s crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity, according to research into prehistoric earthquakes and volcanic activity. NASA and USGS scientists found that retreating glaciers in southern Alaska may be opening the way for future earthquakes (NASA, 2004).

Secondary impacts of earthquakes could be magnified by climate change. Soils saturated by repetitive storms could experience liquefaction or an increased propensity for slides during seismic activity due to the increased saturation. Dams storing increased volumes of water due to changes in the hydrograph could fail during seismic events. There are currently no models available to estimate climate-change related impacts on the earthquake hazard.

Table 9-13. Buildable Lands in Planning Area Urban Growth Areas that Intersect Liquefaction Areas[a]

Urban Growth Area Name[b]	Residential		Commercial (acres)	Industrial (acres)	Total (acres)[c]
	Acres	Units			
Battle Ground	22.8	137	2.1	0	24.9
Camas	17.3	104	3.1	19.2	39.6
La Center	0	0	0	0	0
Ridgefield	0		0	0	0
Vancouver	141.6	1,132	35.0	830.6	1,007.1
Washougal	51.4	308	51.1	73.1	175.5
Woodland[d]	25.2	101	0	0	25.2
Yacolt	0	0	0	0	0
Total	**258.2**	**1,782**	**91.2**	**922.9**	**1,272.3**

a. Buildable lands information in this plan is for planning purposes only. Discrepancies may exist between these estimates and official records maintained by participating jurisdictions.
b. Unincorporated areas outside of urban growth areas are excluded from this assessment. Development in these areas consists largely of rural lands, open space and large residential lots. Changes in development can be assessed through an increase in structures located outside of incorporated areas.
c. Acreage covers only mapped parcels; it excludes many rights of way and major water features.
d. Acreage estimates exclude the portions of the City of Woodland in Cowlitz County and thus may be underestimated.

9.7 SCENARIO

Any seismic activity of 6.0 or greater on faults within the planning area's general region would have significant impacts throughout the planning area. An earthquake in the Cascadia subduction zone would have disastrous consequences for the entire state and the region. Potential warning systems could give a few seconds' notice that a major earthquake is about to occur. This would not provide adequate time for preparation.

Large magnitude earthquakes in the region could lead to massive structural failure of property on liquefiable soils. Structural failure may be intensified if the earthquake occurs during winter when soils are saturated. Heavy damage would also occur in areas with poor site conditions, older construction, or construction especially vulnerable to long duration, long period ground motions (CRESA, 2004). Dams, levees and revetments built on poor soils would likely fail, representing a loss of critical infrastructure. Access to and from the County would be challenging, given the likelihood that bridges and major transportation routes may be impassable. These events could cause secondary hazards, including landslides and mudslides that would further damage structures.

9.8 ISSUES

Important issues associated with an earthquake include the following:

- It is estimated that up to 60% percent of the total population in the planning area resides on soils with moderate to high liquefaction potential or peat soils.

- Approximately 17 percent of households living in moderate to high liquefaction potential areas have household incomes less than $20,000 per year.
- Approximately 12 percent of the population living in moderate to high liquefaction potential areas are 65 years or older and may require special medical attention or be unable to evacuate without assistance.
- The results of the earthquake scenario events chosen for analysis indicate that between 23 and 1,350 households will be displaced and that between 14 and 822 residents may require short term shelter.
- Over 58 percent of the planning area's building stock was built prior to 1994, when Zone 3 seismic standards were incorporated into the building code.
- Critical facility owners should be encouraged to create or enhance continuity of operations plans using the information on risk and vulnerability contained in this plan.
- Geotechnical standards should be established that take into account the probable impacts from earthquakes in the design and construction of new or enhanced facilities.
- Earthquakes could trigger other natural hazard events such as dam failures, levee failures and landslides, which could severely impact the planning area or regional critical facilities.
- There are likely additional faults in or around Clark County that have not yet been discovered.
- After a major seismic event, Clark County is likely to experience disruptions in the flow of goods and services due to the destruction of major transportation infrastructure across the broader region.
- Major arterials in the planning area cross liquefiable soils and could be impassable after an event.
- The county vehicular intra-county transportation system is generally characterized by the lack of redundancy and dependency on bridges. The County north/south vehicular corridors include Interstate 5 (I-5) and Interstate 205 (I-205). There is limited north/south redundancy via a series of local roads. east/west traffic is restricted to Route 14 along the Washington side of the Columbia River and Route 30 on the Oregon side. Limited East/West redundancies are possible along East Mill Plain Boulevard, NE Fourth Plain, NE 76th Street, and SR 500. Most corridors include numerous bridges (CRESA, 2004).
- Residents are expected to be self-sufficient up to three days following a major earthquake without government response agencies, utilities, private sector services and infrastructure components. Education programs are currently in place to facilitate the development of individual, family, neighborhood and business earthquake preparedness. Government alone can never make this region fully prepared. It takes individuals, families, and communities working in concert with one another to truly be prepared for disaster.
- Natural hazards have a devastating impact on businesses. Of all businesses that close following a disaster, more than 43 percent never reopen, and an additional 29 percent close for good within the next two years. The Institute of Business and Home Safety has developed "Open for Business," which is a disaster planning toolkit to help guide businesses in preparing for and dealing with the adverse effects of natural hazards. The kit integrates protection from natural disasters into companies' risk reduction measures to safeguard employees, customers, and the investment itself. The guide helps businesses secure human and physical resources during disasters, and helps to develop strategies to maintain business continuity before, during, and after a disaster occurs.
- An early warning system, ShakeAlert, is currently under development, but is not ready for public use.

- County government buildings, including the Clark Regional Emergency Services Agency, which contains the Emergency Operation Center where all response activities are coordinated, are located within a consolidated campus in Vancouver. Because many government functions are located close together, serious damage in that area could be devastating.
- Many city offices are older and located with their respective jurisdictions (CRESA, 2004).
- Masonry construction is scattered throughout the county. Un-reinforced masonry structures are most common, though not predominant, in downtown Vancouver, downtown Camas, and the Walnut Grove area (CRESA, 2004).
- Model estimates indicate that debris removal from earthquake events would require approximately 3,700 to almost 100,000 truckloads, depending on the event scenario.

10. FLOOD

10.1 GENERAL BACKGROUND

A floodplain is the area adjacent to a river, creek or lake that becomes inundated during a flood. Floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon.

Connections between a river and its floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, natural, built-in benefits can be lost, altered, or significantly reduced.

10.1.1 Measuring Floods and Floodplains

The frequency and severity of flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels. The flood frequency equals 100 divided by the discharge probability. For example, the 100-year discharge has a 1-percent chance of being equaled or exceeded in any given year. The “annual flood” is the greatest flood event expected to occur in a typical year. These measurements reflect statistical averages only; it is possible for two or more floods with a 100-year or higher recurrence interval to occur in a short time period. The same flood can have different recurrence intervals at different points on a river. For example, the December 1977 flood event exceeded a 500-year flood (0.2 percent annual chance) on the Washougal River at USGS Gage # WASW1 but was less than a 100-year flood on some of its tributaries.

The extent of flooding associated with a 1-percent annual probability of occurrence (the base flood or 100-year flood) is used as the regulatory boundary by many agencies. Also referred to as the special flood hazard area, this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.

10.1.2 Effects of Human Activities

Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate in floodplains for a number of reasons: water is readily available; land is fertile and suitable for farming; transportation by water is easily accessible; and land is flatter and easier to develop. But human activity in floodplains frequently interferes with the natural function of floodplains. It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels. This increases flood potential in two ways: it reduces the stream’s capacity to contain flows, and it increases flow rates or velocities downstream during flood events. Human activities can interface effectively with a floodplain as long as steps are taken to mitigate the activities' adverse impacts on floodplain functions.

10.1.3 Federal Flood Programs

National Flood Insurance Program

The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities. For most participating communities, FEMA has prepared a detailed Flood Insurance Study. The study presents water surface elevations for floods of various magnitudes, including the 1-percent annual chance flood and the 0.2-percent annual chance flood (the 500-year flood). Base flood elevations and the boundaries of the 1-percent and 0.2-percent annual chance floodplains are shown on Flood Insurance Rate Maps (FIRMs), which are the principle tool for identifying the extent and location of the flood hazard. FIRMs are the most detailed and consistent data source available, and they represent the minimum area of oversight for many communities' floodplain management programs.

Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, participating jurisdictions must ensure that the following criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the base flood.
- New floodplain development must not aggravate existing flood problems or increase damage to other properties.
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on listed threatened/endangered species.

Communities participating in the NFIP may adopt regulations that are more stringent than those contained in 44 CFR 60.3, but not less stringent. The Washington State Building Code Act requires new construction to be elevated to 1 foot above the base flood elevation or to the design flood elevation, whichever is higher. Some communities in Clark County have adopted more stringent standards. For example, a 1-foot freeboard (height above the base flood elevation) is standard for most structures in unincorporated Clark County.

In NFIP participating communities, structures permitted or built in the planning area before NFIP and related building code regulations went into effect are called "pre-FIRM" structures, and structures built afterwards are called "post-FIRM." Historically, the insurance rate has been different for the two types of structures. However, recent flood insurance reform legislation (Biggert-Waters Flood Insurance Reform Act of 2012) changes the way flood insurance is rated, with a move to full actuarial rates based on flood risk.

Clark County and all cities and towns in it except La Center are participants in NFIP. All participating communities are currently in good standing with the provisions of the NFIP. All cities and towns have identified actions to regain or maintain continued compliance with the provisions of the NFIP. The current effective FIRM for Clark County is dated September 5, 2012. The City of Woodland lies in both Clark and Cowlitz Counties, and most of its floodplain is in Cowlitz County. The preliminary FIRM for Cowlitz County was issued August 16, 2013.

In Washington, the Department of Ecology is the coordinating agency for floodplain management. Ecology works with FEMA and local governments by providing grants and technical assistance, evaluating community floodplain management programs, reviewing local floodplain ordinances, and participating in statewide flood hazard mitigation planning. Compliance is monitored by FEMA regional staff and by Ecology. Maintaining compliance under the NFIP is an important component of flood risk reduction. All planning partners that participate in the NFIP have identified actions to maintain their compliance and good standing. Planning partners who do not currently participate have identified actions to consider re-enrollment in the program.

The Community Rating System

The CRS is a voluntary program within the NFIP that encourages floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions meeting the following three goals of the CRS:

- Reduce flood losses.
- Facilitate accurate insurance rating.
- Promote awareness of flood insurance.

For participating communities, flood insurance premium rates are discounted in increments of 5 percent. Class 1 communities receive a 45-percent premium discount, and Class 9 communities receive a 5-percent discount. (Class 10 communities are those that do not participate in the CRS; they receive no discount.) The CRS classes are based on 18 creditable activities in the following categories:

- Public information
- Mapping and regulations
- Flood damage reduction
- Flood preparedness.

Figure 10-1 shows the nationwide number of CRS communities by class as of October 1, 2015, when there were 1,368 communities receiving flood insurance premium discounts under the CRS program. In Washington there are 36 CRS communities. Although CRS communities represent only 6 percent of the over 22,000 communities participating in the NFIP, more than 70 percent of all flood insurance policies are written in CRS communities. CRS activities can help to save lives and reduce property damage.

Source: FEMA, 2015

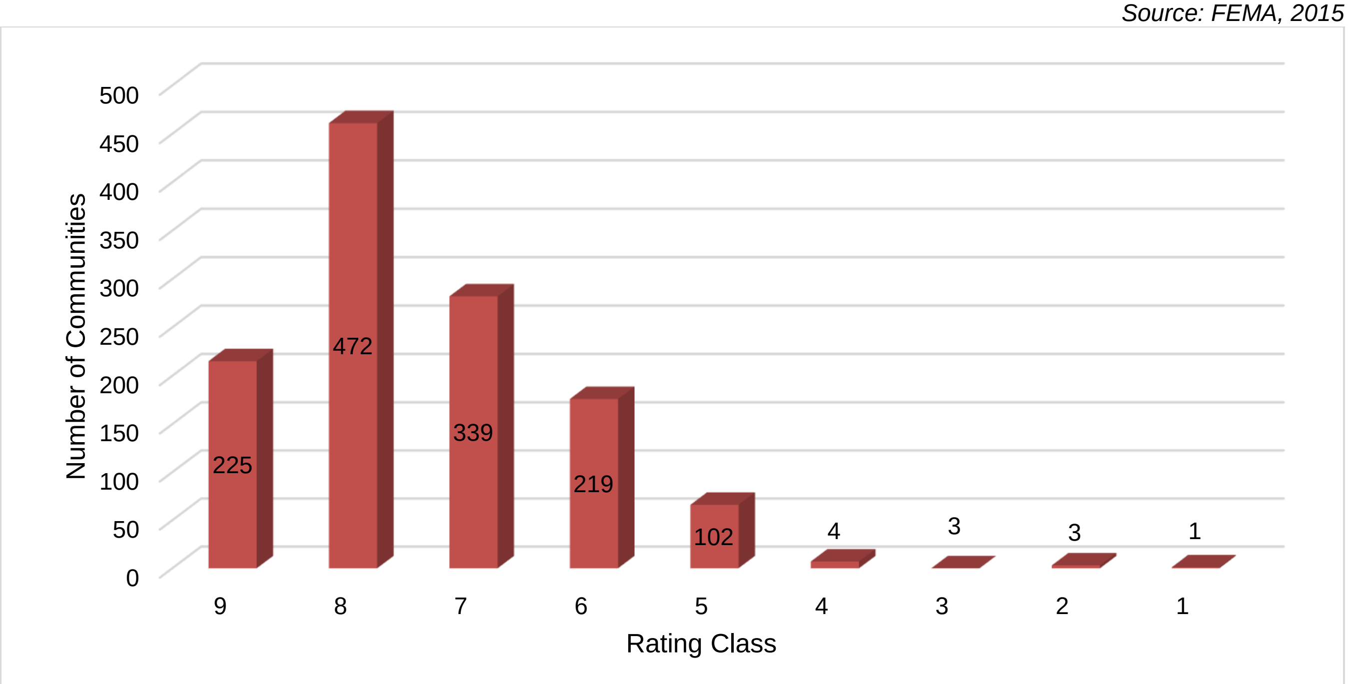


Figure 10-1. CRS Communities by Class Nationwide as of October 1, 2015

Clark County, the only CRS participant in the planning area, has participated in the program since 2004. The County has a Class 5 rating, so citizens who live in a special flood hazard area can receive a 25-percent discount on flood insurance; outside the 1-percent annual chance flood hazard area they receive a 10-percent discount. This equates to a savings of $56 to $314 per policy, for a total county-wide premium savings of $93,393. To maintain or improve its rating, the County goes through an annual recertification and a re-verification every five years. The County is among 12 Washington CRS communities with a Class 5 rating; 21 have a better (lower) rating and three have a worse (higher) rating.

10.1.4 The Value of Floodplains

Floodplains are a natural component of the Clark County environment. Understanding and protecting their natural function can reduce flood damage and protect people and property. The benefits of preserving floodplains include the following:

- Flood and erosion control. Floodplains are natural sponges, storing and slowly releasing floodwaters. This reduces the height of a flood and the speed of a river. When a river is cut off from its floodplain by levees and dikes, flood heights often increase and downstream damage can be greater.
- Water quality improvement. As water travels through floodplains, plants serve as natural filters, trapping sediments and capturing pollutants. Floodplains help to moderate temperature fluctuations that can harm aquatic life. They also reduce sedimentation (soil and pollutants in the water) that can harm aquatic life.
- Groundwater recharge. Floodplains promote infiltration and recharge of underlying aquifers.
- Fish and wildlife habitat. Floodplains maintain biodiversity. They provide breeding and feeding grounds, create and enhance waterfowl areas, and protect habitat for rare and endangered species.

The natural processes of flooding add sediment and nutrients to fertile floodplain areas. When floodwaters recede after a flood event, they leave behind layers of rock and mud. These gradually build up to create a new floor of the floodplain. Floodplains generally contain accumulations of sand, gravel, loam, silt, and/or clay, often extending below the bed of the stream. These sediments provide a natural filtering system, with water percolating back into the ground and replenishing groundwater. These are often important aquifers, the water drawn from them being filtered compared to the water in the stream. Fertile, flat reclaimed floodplain lands are commonly used for agriculture, commerce and residential development.

As buildable land becomes scarce with ongoing urban development, pressure builds to develop in floodplains. Building homes and businesses in floodplains not only puts people in harm’s way, but it also reduces the environmental benefits of floodplains (Clark County, 2016b).

10.2 HAZARD PROFILE

10.2.1 Types of Flood Related Hazards

Riverine Flooding

Riverine flooding is the overbank flooding of rivers and streams. Flooding in large river systems typically results from large-scale weather systems that generate prolonged rainfall over a wide geographic area, causing flooding in hundreds of smaller streams, which then drain into the major rivers. Shallow area flooding is a special type of riverine flooding. FEMA defines shallow flood hazards as areas that are inundated by the base flood with flood depths of only 1 to 3 feet. These areas are generally flooded by low velocity sheet flows of water. Two types of flood hazards are generally associated with riverine flooding:

- **Inundation**—Inundation occurs when there is floodwater and debris flowing through an area that is not normally covered by water. Such events cause minor to severe damage, depending on the velocity and depth of flows, the duration of the flood event, the quantity of logs and other debris carried by the flows, and the amount and type of development and personal property along the floodwater's path.
- **Channel Migration**—Channel migration results when erosion to flowing water wears away banks and soils due. This erosion, combined with sediment deposition, causes the migration or lateral movement of a river channel across a floodplain. A channel can also move by abrupt change in location, called avulsion, which can shift the channel location a large distance in as short a time as one flood event.

Urban Flooding

In urbanized areas, localized or urban flooding not associated with stream overflow can occur where there are no drainage facilities to control flows or when runoff volumes exceed the design capacity of drainage facilities. As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Urbanization of a watershed changes the hydrologic systems of the basin. Heavy rainfall collects and flows faster on impervious concrete and asphalt surfaces. The water moves from the clouds to the ground and then into streams at a much faster rate in urban areas. Adding these elements to the hydrological systems can result in floodwaters that rise rapidly and peak with violent force. During periods of urban flooding, streets can become swiftly moving rivers and basements can fill with water. Storm drains often back up with vegetative debris, causing additional, localized flooding. Urban flooding issues are generally addressed through stormwater management plans at the local level.

10.2.2 Principal Flooding Sources

Floods occur in Clark County every few years, and major events occur with some frequency. There have been seven major events since 1964. In Clark County, flooding is most likely to occur due to a severe winter storm that brings snow to higher elevations, followed by warmer weather and rain. The sudden influx of new rain and melting snow can overwhelm both natural and man-made water drainage systems (CRESA 2004). Floods in Clark County can generally be classified into four different types (CRESA 2004):

- Flooding resulting from overflow of the Columbia River, distinct from general riverine flooding both because of the magnitude of flooding possible and because of the slow rising nature of these floods.
- Riverine flooding, which occurs primarily in designated floodplains in the interior of the county and side drains to the Columbia River.
- Shallow flooding or ponding in "sink areas," which may occur well outside of mapped floodplains and generally results either from areas of very high water table (which can oversaturate during storm events), or from areas of poor soil percolation (where rain water does not drain effectively during storm events).
- Isolated urban flooding from clogged or overflowing storm drainage systems and culverts.

Columbia River Flooding

Historically, most development in Clark County has been along the Columbia River, which forms the southern and western boundaries of the county. The river is the major inland waterway in the northwestern United States. It drains approximately 241,000 square miles of southwestern Canada and the northwestern United States upstream of Vancouver. Although many large Columbia River floods have occurred in Clark County, existing flood control storage structures (reservoirs and dams) reduce flood elevations and provide increased warning time for those who live in the flood's path (CRESA 2004).

The entire Columbia River Basin includes more than 50 storage projects, significantly reducing flood levels. The following Clark County flood control structures provide varying levels of flood protection (CRESA 2004; FEMA 2012a):

- The drainage districts along the Columbia River in Clark County have levees of varying flood protection capacities. Thus, safe water levels have been established by the Corps of Engineers. The safe water level is the highest flood elevation, considering surveillance and minor remedial work, for which reasonable assurance can be given that a levee system will not fail. The determination of the levee safe water level was based on need for freeboard, structural deficiencies observed in the field, knowledge of levee and foundation materials, and flood fighting records. Although the perimeter levee of a particular drainage district may be capable of withstanding large floods, major rainstorms could cause extensive interior ponding in low areas if runoff exceeds the capacity of the dewatering-drainage pumps.
- In the vicinity of Vancouver, some protection from Columbia River flooding is provided by levees along the Lower River Road and at Fruit Valley. However, known deficiencies in their design and maintenance limit the degree of protection to below the 1-percent-annual-chance flood level for the Lower River Road area and below the 0.2-percent-annual-chance flood level for the Fruit Valley area.
- Two projects southwest of Ridgefield at Lake River Delta and Bachelor Island include levees, pumping stations, tide boxes, and interior drainage canals. However, known deficiencies limit the degree of protection they provide to well below 1-percent-annual-chance flood levels.
- The Washougal Area Drainage District, constructed by the Corps of Engineers in 1965 and 1966, extends 5.5 miles along the Columbia River from Lawton Creek west to Camas and includes levee embankment, revetment, tide box, and freshwater inlets, and a pumping plant with interior drainage canals.

These flood control structures have reduced the frequency and severity of flooding along the Columbia River. The floodplain is well defined and residents have experienced several weeks' notice of approaching floodwaters. However, continued maintenance is crucial if these structures are to remain successful. Should they be ignored, the severity of the impact of a future flood would be greater than if the structures had not been built to begin with (CRESA 2004).

Riverine Flooding

Clark County watercourses generally flow west and south from sources in the steep timberland watershed, pass through lower reaches of gently sloping agricultural and developing residential lands, and flow into the Columbia River. Flooding along these rivers and streams differs from Columbia River flooding in two ways (CRESA 2004):

- The rivers have less capacity for carrying water, so the flooding, while no less severe for those experiencing it, affects a smaller number of homes.
- There are fewer dams and reservoirs along the interior rivers, making flooding less predictable.

In general, minor flooding occurs along the banks of the upper reaches of most streams. However, when two streams merge, floodwaters can back up into the smaller stream, creating a backwater that can mean more severe and more frequent flooding for residents near the confluence. In the 1995 floods, this scenario was the principle cause of flooding along the Lewis River. Floodwaters from the Columbia backed up into the Lewis, flooding the area. Salmon Creek, the East Fork of the Lewis River, the Washougal River, Burnt Bridge Creek, and Mill Creek all follow this pattern of flooding (CRESA 2004).

Washougal River

The largest flood on the Washougal River since a USGS stream gauge was installed in 1944 was in December 1977, 6 miles upstream of the City of Washougal. There was little damage however, largely because at that time there was limited development along that stretch of the river. As development increased over time, damage from future floods may be more likely (CRESA 2004).

Lewis River

The Lewis River is regulated by three storage projects: Swift Reservoir, Yale Reservoir and Lake Merwin Reservoir, all of which are operated by Pacific Power and Light (PP&L). The largest flood on the Lewis River occurred in 1933 before these were built. Under the present Federal Energy Regulatory Commission license, PP&L is not required to reserve storage for flood protection. However, on August 18, 1983, FEMA and PP&L agreed to make approximately 70,000 acre-feet available for flood control storage on the Lewis River System at Merwin Dam, thus reducing the 100-year discharge at Woodland from 128,000 cubic feet per second to 102 cubic feet per second, further reducing the risk of flooding to Woodland residents (CRESA 2004). PP&L has prepared emergency operation procedures for three danger conditions:

- Non-failure emergency (high flows)
- Potentially hazardous conditions
- Failure is imminent or has occurred.

PP&L has not established the risk of each condition occurring, but states that the dams are in very good condition as certified by independent consultants (CRESA 2004). Chapter 7 provides additional discussion on the dam failure hazard.

Shallow Flooding and Urban Flooding

Much of the south and western urban growth area has poorly to moderately drained soils, a condition that leads to the ponding of water in lower elevations. During heavy rainstorms, water neither seeps into the soil nor drains off, instead collecting into ponds and potentially flooding homes (CRESA, 2004). An analysis after the 1995 floods showed drainage structures to be a major contributor to ponding and flooding during the event. Many culverts and drainages were judged to have been inadequate to efficiently move the rainwater that fell onto urban infrastructures (road, roofs, sidewalks, etc.) into rivers. This led to urban flooding distant from mapped floodplains and floodways. According to this post-1995 flood engineering report, a lack of well-functioning storm sewer structures and increasing runoff from urbanization had led to an increasing number of drainage problems during storms. Limited resources meant that maintenance crews were unable to respond to flooding problems in many areas in a timely manner. The report commented that maintenance crews can manage some drainage problems, such as plugged inlets, but capacity problems (under-designed subdivision storm systems) require significantly more complex solutions. Operations crews were unable to prevent flooding in these situations (CRESA, 2004).

In rural counties, drainage problems tend to be minimal and are manageable within the limits of a rural public services budget. However, Clark County has experienced significant growth in recent decades and County funding may not be sufficient to provide a reasonable level of drainage and flood control services to county citizens. Significant capital funding may need to be developed to provide drainage and flood control infrastructure extensions and improvements within the County. Alternatively, the use of “softer structures” such as contouring, engineered swales and introduced vegetation, may present opportunities for improved stormwater management (CRESA, 2004).

In some cases, blocked drainage structures can provide important retention functions, and actually slow the process of water moving downstream in the same way that a natural system, such as a wetland, might. Basin-wide analysis is necessary to determine which drainages should be improved to speed the flow of stormwater, and which should be maintained (CRESA, 2004).

10.2.3 Past Events

Seven federal flood-related disaster declarations have affected Clark County since 1964 (see Table 10-1). An example of the type of flooding typical throughout the county is the event that occurred on November 29, 1995. It resulted from an extended series of rainstorms generated over the Pacific Ocean that moved north and east across California, Oregon and Washington. Flooding in Clark County occurred when relatively intense rain fell on saturated ground surfaces and already swollen creeks and rivers. Runoff from snowmelt also contributed to high flows in the North and East Forks of the Lewis River, and the Little Washougal and Washougal Rivers. Peak flows in county streams ranged from approximately a 2-year flood in Burnt Bridge Creek to a 25-year flood in Salmon Creek (CRESA, 2004).

Table 10-1. History of Flood Events

Date	Declaration #	Type of event	Estimated Damage
December 29, 1964	DR-185	Heavy Rains and Flooding	N/A
December 10, 1977	DR-545	Severe Storms, Mudslides, Flooding	N/A
November 7, 1995	DR-1079	Storms, High Winds, Floods	$862,992[a]
January 26, 1996	DR-1100	Severe Storms, Flooding	N/A
December 26, 1996	DR-1159	Severe Winter Storms, Flooding	N/A
November 2, 2006	DR-1671	Severe Storms, Flooding, Landslides, and Mudslides	N/A
December 1, 2015	DR-4253	Severe Winter Storm, Straight Line Winds, Flooding, Landslides, Mudslides, Tornado	N/A

a. Data obtained from Spatial Hazard Events and Losses Database for the United States
N/A = Information is not available

The storm of November 1995 was not considered to be a major flood-producing storm for the Columbia River. However, relatively high stream base flows and tides did combine to produce river levels exceeding flood stage within the portion of the Columbia River flowing through Clark County. Ten houseboats were evacuated at Ridgefield due to sewer problems caused by high river elevations. Higher Columbia River elevations also produced backwater in the lower reaches of Salmon Creek, requiring evacuation of 15 additional houses. Some condominiums and restaurants also experienced flooding along the Columbia River (CRESA, 2004).

10.2.4 Location

Flooding in Clark County has been documented by gage records, high water marks, damage surveys and personal accounts. This documentation was the basis for the September 5, 2012, Flood Insurance Study that is incorporated in the currently effective FIRMs for Clark County and the preliminary FIRMs (issued August 8, 2016) for the City of Woodland. The FIRMs are the most detailed and consistent data source available for determining flood extent. The 2012 and 2013 Flood Insurance Studies are the sole source of data used in this risk assessment to map the extent and location of the flood hazard, as shown in Figure 10-2. Mapped 1-percent annual chance flood hazard areas cover about 2.5 percent of the planning area.

10.2.5 Frequency

Based on the seven flood declarations affecting Clark County since 1964 (see Table 10-1), major floods in Clark County can be expected on average about once every seven years. The County also typically experiences one episode of minor river flooding each winter. Urban portions of the county annually experience nuisance flooding related to drainage issues.

Flood Hazard Areas

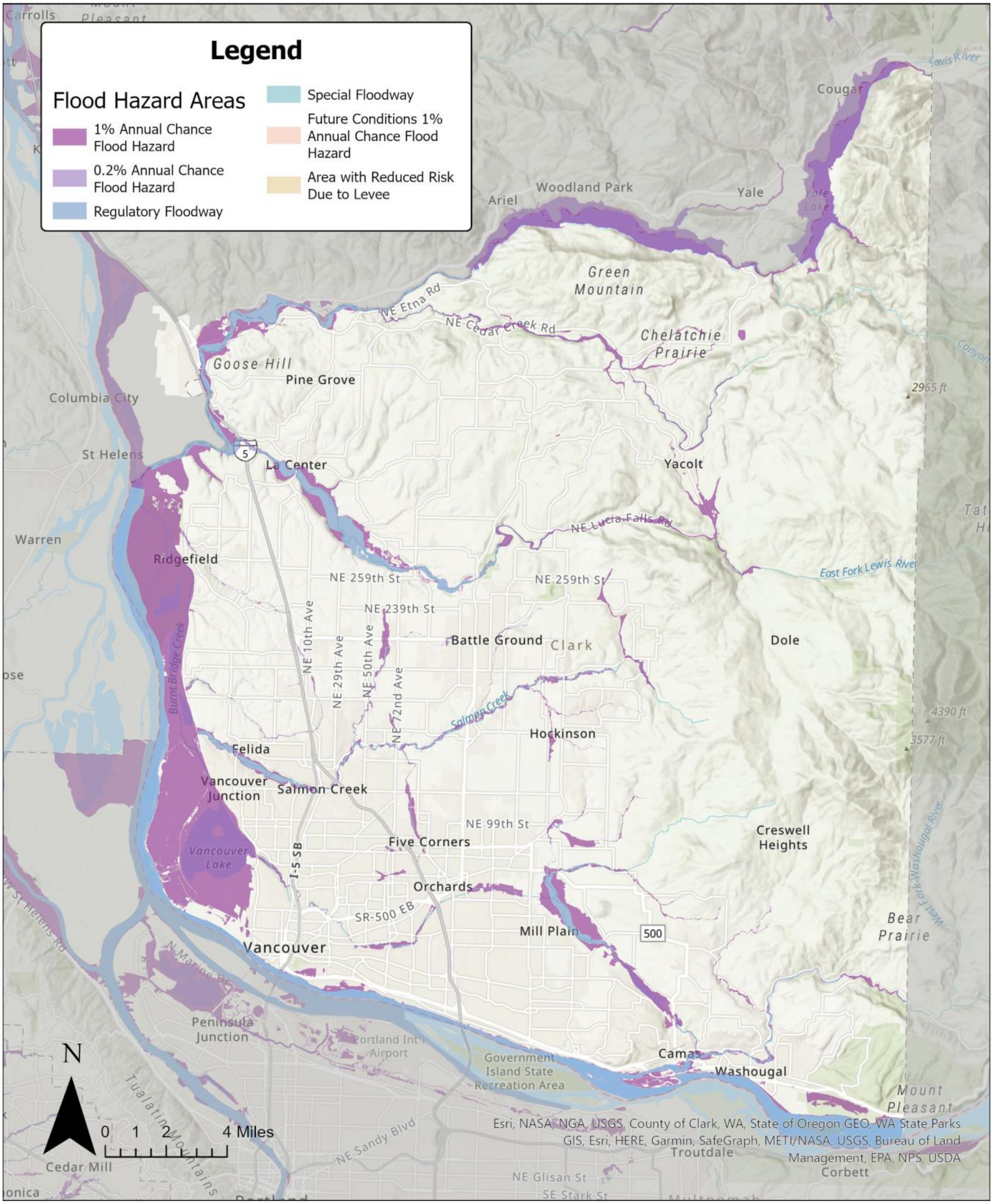


Figure 10-2. FEMA DFIRM Flood Hazard Areas

10.2.6 Severity

The principal factors affecting flood damage are flood depth and velocity. The deeper and faster flood flows become, the more damage they can cause. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. This is especially true when a channel migrates over a broad floodplain, redirecting high velocity flows and transporting debris and sediment. Flood severity is often evaluated by examining peak discharges; Table 10-2 lists peak flows used by FEMA to map the floodplains of Clark County.

Table 10-2. Summary of Peak Discharges in Clark County

Source/Location	Drainage area (sq. mi.)	Discharge (cubic feet/second)			
		10-Year	50-Year	100-Year	500-Year
Burnt Bridge Creek					
At Mouth	22.5	115	220	255	330
At USGS Gage	19.8	120	230	270	340
At N.E. 112th Ave	5.0	55	110	135	180
China Ditch					
At Mouth	8.9	495	665	740	915
Curtin Creek					
At Mouth	11.0	335	460	520	670
At N.E. 109th St	4.5	225	360	405	530
At N. E. 83rd St	1.0	60	85	95	130
E. Fork Lewis River					
At Mouth	212.0	19,200	24,400	26,900	32,000
Upstream of confluence with Lockwood Creek	185.0	17,000	21,700	23,800	28,300
Approximately 17,000' downstream of Daybreak Rd.	165.0	20,650	28,630	32,200	40,900
At Daybreak Rd.	152.0	18,600	26,050	29,300	37,210
At Lewisville Park	150.0	15,300	19,400	21,400	25,400
Fifth Plain Creek					
At Mouth	20.2	1,280	1,750	1,960	2,460
Upstream of China Ditch	9.0	650	895	1,000	1,260
Upstream of Shanghai Creek	4.6	360	495	555	700
At 119th St.	2.6	225	315	330	445
Gee Creek					
At Burlington Northern Railroad	13	850	1,010	1,080	1,260
At County Rd.	9	580	695	745	870
Lacamas Creek					
At Goodwin Rd.	52.8	4,170	5,740	6,430	8,080
At Fourth Plain Rd.	22.7	1,990	2,740	3,060	3,850
Lewis River					
At Mouth	1,046	75,000[a]	114,000[a]	132,700[a]	181,000[a]
At Woodland	820	54,400[a]	86,300[a]	102,000[a]	142,000[a]
At USGS Gage near Ariel	731	49,000[a]	79,000[a]	94,000[a]	132,000[a]
Mill Creek					
At Mouth	11.5	670	985	1,140	1,570
Downstream of unnamed tributary (RM 0.85)	11.0	595	860	1,000	1,370
Upstream of unnamed tributary (RM 0.85)	9.1	510	780	915	1,300
At confluence with unnamed tributary (RM 3.12)	6.7	285	585	685	975
At N.E. 199th St.	4.8	290	415	480	655
Packard Creek					

Source/Location	Drainage area (sq. mi.)	Discharge (cubic feet/second)			
		10-Year	50-Year	100-Year	500-Year
At Mouth	2.4	135	180	200	250
Upstream of unnamed tributary (RM 1.0)	0.6	43	58	64	79
Padden Creek					
At confluence with Curtin Creek	1.0	39	45	48	53
Downstream of N.E. 76th St.	0.8	21 2	21 2	22 2	22[b]
At Interstate 205	0.7	43	57	64	79
Salmon Creek					
At Mouth	88	3,230	4,460	5,020	6,490
At County gage SMN020, Klineline Park	80	2,970	4,100	4,620	5,970
Below Mill Creek	72	2,710	3,730	4,210	5,430
Downstream of confluence with Curtin Creek	60	2,330	3,250	3,700	4,860
At County gage SMN045, N.E. 156th St.	45	1,960	2,740	3,110	4,090
Downstream of confluence with Morgan Creek	31	1,290	1,920	2,240	3,140
At County gage S-01, Battle Ground, WA	18.0	1,130	1,770	2,110	3,120
Spring Branch Creek					
At Mouth	1.8	105	140	155	190
Unnamed Tributary to Gee Creek					
At Mouth	1.7	85	100	105	125
Washougal River					
At Mouth	168	29,800	39,000	43,000	51,900
At USGS gage (RM 9.2)	108	21,500	28,400	31,300	38,000
Weaver Creek					
At Mouth	7.1	350	495	565	755
At N.E. 199th St.	5.9	310	440	500	665
Upstream of unnamed tributary (RM 3.45)	4.4	225	330	385	535
At N.E. 167th Ave.	1.5	85	125	150	205
Whipple Creek					
At mouth Upstream of unnamed tributary (RM 1.19)	11.1	510	685	755	925
Upstream of unnamed tributary (RM 1.19)	9.5	450	600	665	815
Upstream of Packard Creek (RM 2.47)	6.4	320	430	475	580
Upstream of N.E. 157th Ave. (RM 4.53)	4.5	240	320	355	430
Upstream of Interstate 5 Freeway (RM 6.45)	1.9	115	150	170	210
Upstream of NE 179th Street (RM 7.74)	0.9	55	75	85	110
Lewis River[c]					
At confluence with Columbia River	1,046	75,000[a]	114,100[a]	132,700[a]	181,000[a]
At CC Street Bridge	820	54,400[a]	86,300[a]	102,000[a]	142,000[a]
At USGS Gage No. 14220500	731	49,000[a]	79,000[a]	94,000[a]	132,000[a]

Source: FEMA, 2012a and FEMA, 2013a

a. Regulated by Merwin Dam

b. Maximum flow passing NE 76th Street Culvert. Additional flow is diverted out of the basin by NE 76th Street

c. Cowlitz County Flood Insurance Study

10.2.7 Warning Time

Due to the sequential pattern of meteorological conditions needed to cause serious flooding, it is unusual for a flood to occur without warning. Warning times for floods can be between 24 and 48 hours. Flash flooding can be less predictable, but potential hazard areas can be warned in advanced of potential flash flooding danger.

The National Oceanic and Atmospheric Administration and the Washington State Department of Ecology operate river gauges. NOAA stations also provide 4-10 day trend forecasts of near-term river levels. These gauges allow residents to monitor river levels before, during and after a flood. Clark County provides links to seven gauge stations at: https://www.clark.wa.gov/public-works/river-gauge-data.

The National Weather Service Seattle Forecast Office provides weather observations and forecasts for western Washington and issues warnings for many types of hazards, including floods, severe weather, windstorms, snowstorms and fire conditions. The National Weather Service issues a statement when heavy rain is expected to cause flooding or aggravate existing flood conditions. These statements are generally issued two to three days before the potential event. Flood watches for specific areas and rivers are issued one to two days before an event. Flood warnings are issued up to one day in advance when flooding is imminent. This applies to a specific river forecast point that is expected to exceed a flood stage based on predictive computer river modeling output, including dam operation information, and to other streams and urban areas. For large storms and major floods, the National Weather Service conducts direct internet briefings and uses follow-up phone calls to Clark County. National Weather Service statements and information are communicated to other government agencies and the public via NOAA Weather Radio, radio and television, the Internet, telephone recordings and media outlets.

10.3 SECONDARY HAZARDS

The main secondary hazard for flooding is bank erosion, which in some cases can be more harmful than actual flooding. This is especially true in the upper courses of rivers with steep gradients, where floodwaters may pass quickly and without much damage but scour the banks, edging properties closer to the floodplain or causing them to fall in. Flooding is also responsible for hazards such as landslides when high flows over-saturate soils on steep slopes, causing them to fail. Hazardous materials spills are also a secondary hazard of flooding if storage tanks rupture and spill into streams, rivers or storm sewers. Septic systems may cause additional water contamination.

10.4 EXPOSURE

The Level 2 (user-defined) Hazus-MH protocol was used to assess the risk and vulnerability to flooding in the planning area. The model used census data at the block level and FEMA floodplain data, which has a level of accuracy acceptable for planning purposes. Where possible, the Hazus-MH default data was enhanced using local GIS data from county, state and federal sources.

10.4.1 Population

Population counts of those living in the floodplain in the planning area were generated by estimating the percent of the total buildings in each jurisdiction within the 1 percent and 0.2 percent annual chance flood hazard areas and multiplying this percentage by the total population in the planning area. Using this approach, it was estimated that the exposed population for the entire county is 6,720 persons within the 1-percent annual chance flood hazard area (1.5 percent of the total county population) and 12,199 within the 0.2-percent annual chance flood hazard area (2.7 percent of the total). For unincorporated portions of the county, it is estimated that the exposed population is 2,702 within the 1 percent annual chance flood hazard area (1.3 percent of the total unincorporated county population) and 4,028 within the 0.2 percent annual chance flood hazard area (1.9 percent of the total). Table 10-3 shows the population estimates by jurisdiction.

Table 10-3. Population within Flood Hazard Areas

	1-Percent Annual Flood Hazard		0.2-Percent Annual flood hazard	
	Population Exposed[a]	% of Total Population	Population Exposed[a]	% of Total Population
Battle Ground	72	0.4%	112	0.6%
Camas	133	0.6%	342	1.6%
La Center	8	0.3%	8	0.3%
Ridgefield	159	2.5%	162	2.5%
Vancouver	616	0.4%	4,449	2.6%
Washougal	159	1.0%	299	2.0%
Woodland	2,758	47.2%	2,935	50.2%
Yacolt	49	3.0%	49	3.0%
Unincorporated	2,702	1.3%	4,028	1.9%
Total	**6,656**	**1.5%[b]**	**12,199**	**2.7%[b]**

a. Represents the percent of total buildings that are exposed multiplied by the estimated 2015 per-household population
b. Represents the total affected population as a percent of total Clark County population.

10.4.2 Property

Structures in the Floodplain

Table 10-4 and Table 10-5 summarize the total area and number of structures in the floodplain by municipality. Spatial analysis determined that there are 2,199 structures within the 1-percent annual chance flood hazard area and 3,992 structures within the 0.2-percent annual chance flood hazard area. In the 1-percent annual chance flood hazard area, about 40 percent of the structures are in the City of Woodland and 43 percent are in unincorporated County areas. It is assumed that 92 percent (2,023) of the structures in the 1-percent annual chance flood hazard area are residential.

Table 10-4. Area and Structures in the 1-Percent Annual Chance Flood Hazard Area

	Area in Floodplain (Acres)	Number of Structures in Floodplain							
		Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Battle Ground	144	16	6	0	0	0	0	0	22
Camas	1,885	39	6	0	0	2	0	0	47
La Center	34	2	0	0	1	0	0	0	3
Ridgefield	163	53	5	0	0	0	0	0	58
Vancouver	5,901	134	43	2	2	0	0	0	181
Washougal	960	37	17	4	0	0	0	0	58
Woodland	533	859	5	1	0	5	1	0	871
Yacolt	17	14	0	0	2	0	0	0	16
Unincorporated	35,218	869	25	0	41	4	3	1	943
Total	**44,855**	**2,023**	**107**	**7**	**46**	**11**	**4**	**1**	**2,199**

Table 10-5. Area and Structures in the 0.2-Percent Annual Chance Flood Hazard Area

	Area in Floodplain (Acres)	Number of Structures in Floodplain							
		Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Battle Ground	171	20	14	0	0	0	0	0	34

	Area in Floodplain (Acres)	Number of Structures in Floodplain							
		Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Camas	2,114	101	11	5	1	2	1	0	121
La Center	35	2	0	0	1	0	0	0	3
Ridgefield	186	54	5	0	0	0	0	0	59
Vancouver	7,124	1,173	123	7	5	0	0	0	1,308
Washougal	992	88	17	4	0	0	0	0	109
Woodland	585	923	5	1	0	5	1	1	936
Yacolt	17	14	0	0	2	0	0	0	16
Unincorporated	36,873	1,302	46	2	42	6	5	3	1,406
Total	**48,098**	**3,677**	**221**	**19**	**51**	**13**	**7**	**4**	**3,992**

Exposed Value
Table 10-6 and Table 10-7 summarize the estimated value of exposed buildings in the planning area. This methodology estimated $2 billion worth of building-and-contents exposed to the 1-percent annual chance flood, representing 1.8 percent of the total replacement value of the planning area, and $4.65 billion worth of building-and-contents exposed to the 0.2-percent annual chance flood, representing 4.1 percent of the total.

Land Use in the Floodplain
Some land uses, such as single-family homes, are more vulnerable to flooding than others, such as agricultural land or parks. Table 10-8 shows the existing land use of parcels that intersect the 1-percent annual chance flood hazard area and 0.2-percent annual chance flood hazard area. More than 21 percent of the parcels that intersect the 1-percent annual chance flood hazard area are estimated to be agriculture, vacant, or uncategorized uses. These are favorable, lower-risk uses for the floodplain. The majority of the acreage of land area in the floodplain is categorized as residential, although, much of this acreage is likely to be zoned for low densities given that most floodplain acreage in the County is located in the unincorporated areas.

10.4.3 Critical Facilities and Infrastructure
Critical facilities and infrastructure in the 1-percent annual chance flood hazard area and 0.2-percent annual chance flood hazard area of the planning area are summarized in Table 10-9 and Table 10-10. Details are provided in the following sections.

Hazardous Material Facilities
Tier II facilities are those that use or store materials that can harm the environment if damaged by a flood. The planning area includes 7 businesses in the 1-percent annual chance flood hazard area and 18 businesses in the 0.2-percent annual chance flood hazard area that report having Tier II hazardous materials. During a flood event, containers holding these materials can rupture and leak into the surrounding area, having a disastrous effect on the environment as well as residents.

Table 10-6. Value of Structures in 1-Percent Annual Chance Flood Hazard Area

	Value Exposed			% of Total Replacement value
	Structure	Contents	Total	
Battle Ground	$18,084,598	$16,738,872	$34,823,470	0.9%
Camas	$80,316,052	$71,731,971	$152,048,023	2.0%
La Center	$3,462,254	$3,342,247	$6,804,500	0.8%

	Value Exposed			% of Total Replacement value
	Structure	Contents	Total	
Ridgefield	$9,204,301	$5,923,557	$15,127,858	0.7%
Vancouver	$278,749,595	$265,720,572	$544,470,168	1.1%
Washougal	$86,686,255	$88,425,937	$175,112,192	4.2%
Woodland	$188,416,451	$110,077,142	$298,493,593	16.8%
Yacolt	$8,640,290	$7,542,385	$16,182,674	5.3%
Unincorporated County	$435,510,126	$329,454,660	$764,964,787	1.7%
Total	**$1,109,069,922**	**$898,957,343**	**$2,008,027,265**	**1.8%**

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

Table 10-7. Value of Structures in 0.2-Percent Annual Chance Flood Hazard Area

	Value Exposed			% of Total Replacement value
	Structure	Contents	Total	
Battle Ground	$35,145,967	$34,400,310	$69,546,277	1.7%
Camas	$225,726,464	$260,645,291	$486,371,755	6.4%
La Center	$3,462,254	$3,342,247	$6,804,500	0.8%
Ridgefield	$9,356,528	$5,999,671	$15,356,199	0.7%
Vancouver	$1,201,876,649	$1,135,344,038	$2,337,220,687	4.9%
Washougal	$100,510,404	$95,338,012	$195,848,415	4.7%
Woodland	$209,535,680	$124,872,914	$334,408,594	18.8%
Yacolt	$8,640,290	$7,542,385	$16,182,674	5.3%
Unincorporated County	$679,908,753	$510,421,979	$1,190,330,732	2.7%
Total	**$2,474,162,989**	**$2,177,906,847**	**$4,652,069,833**	**4.1%**

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

Table 10-8. Present Land Use Within Parcels Intersecting the Floodplain[a]

Land Use[b]	1-Percent Annual Chance Flood Hazard Area		0.2-Percent Annual Chance Flood Hazard Area	
	Area (acres)[c]	% of Total Area	Area (acres)[c]	% of Total Area
Agriculture/Resource Land	9,561	12.8%	10,216	12.6%
Commercial	7,726	10.3%	8,406	10.4%
Education	423	0.6%	319	0.4%
Governmental Services	311	0.4%	346	0.4%
Industrial	1,130	1.5%	1,142	1.4%
Religious Services	88	0.1%	93	0.1%
Residential	49,133	65.6%	53,684	66.4%
Vacant or uncategorized	6,823	9.1%	6,987	8.6%
Total	**75,195**	**100%**	**81,193**	**100%**

a. Present land use information in this plan is for planning purposes only. Discrepancies may exist between these estimates and official records maintained by participating jurisdictions.
b. Present use classification provided by Clark and Cowlitz County assessor's data assigned to best fit occupancy classes in the Hazus model (see Section 6.3.1). Parcels for which conflicting information on current development was available were assumed to be improved. Some designated resource land may also be included in the vacant or uncategorized category.
c. Acreage covers only mapped parcels; it excludes many rights of way and major water features. Acreage includes Clark County and the incorporated areas of the City of Woodland.

Table 10-9. Critical Facilities in 1-Percent Annual Chance Flood Hazard Area

	Communication Facilities	Dams	Emergency Services	Energy	Government Facilities	Hazardous Materials	Health Care & Public Health	Information Technology	Schools	Transportation Systems	Water & Sanitation Systems	Total
Battle Ground	0	0	0	0	0	0	0	0	0	1	1	**2**
Camas	0	2	0	1	0	0	0	0	0	5	6	**14**
La Center	0	0	0	0	0	0	0	0	0	0	0	**0**
Ridgefield	0	0	0	0	0	0	0	0	0	1	1	**2**
Vancouver	0	0	0	2	0	4	0	0	0	18	2	**26**
Washougal	0	0	0	0	0	3	0	0	0	0	3	**6**
Woodland	0	0	1	1	0	0	0	0	0	0	0	**2**
Yacolt	0	0	0	0	0	0	0	0	0	0	0	**0**
Unincorporated	0	1	0	2	0	0	0	0	0	38	9	**50**
Total	**0**	**3**	**1**	**6**	**0**	**7**	**0**	**0**	**0**	**63**	**22**	**102**

Table 10-10. Critical Facilities in 0.2-Percent Annual Chance Flood Hazard Area

	Communication Facilities	Dams	Emergency Services	Energy	Government Facilities	Hazardous Materials	Health Care & Public Health	Information Technology	Schools	Transportation Systems	Water & Sanitation Systems	Total
Battle Ground	0	0	0	0	0	0	0	0	0	1	1	**2**
Camas	0	2	0	4	0	0	0	0	0	5	7	**18**
La Center	0	0	0	0	0	0	0	0	0	0	0	**0**
Ridgefield	0	0	0	0	0	0	0	0	0	1	1	**2**
Vancouver	0	0	0	3	0	13	0	0	0	37	14	**67**
Washougal	0	0	0	0	0	3	0	0	0	0	3	**6**

Woodland	0	0	1	1	0	0	0	0	1	0	0	**3**
Yacolt	0	0	0	0	0	0	0	0	0	0	0	**0**
Unincorporated	0	1	0	2	0	2	0	0	1	40	13	**59**
Total	**0**	**3**	**1**	**10**	**0**	**18**	**0**	**0**	**2**	**84**	**39**	**157**

Utilities and Infrastructure

Flood damage to infrastructure presents numerous risks. Roads or railroads that are blocked or damaged can isolate residents and can prevent access throughout the county, including for emergency service providers needing to get to vulnerable populations or to make repairs. Bridges washed out or blocked by floods or debris also can cause isolation. Floodwaters can back up drainage systems, causing localized flooding. Culverts can be blocked by debris from flood events, also causing localized urban flooding. Floodwaters can get into drinking water supplies, causing contamination. Sewer systems can be backed up, causing waste to spill into homes, neighborhoods, rivers and streams. Underground utilities can also be damaged. Dikes and levees can fail or be overtopped, inundating the land that they protect.

Roads and Bridges

The following major roads pass through the 1-percent annual chance flood hazard area and thus are exposed to flooding:

- Interstate 205
- Interstate 5
- State Road 500
- State Route 501
- State Route 502
- State Road 503
- State Road 14.

Some of these roads are built above the flood level, and others function as levees to prevent flooding. Still, in severe flood events these roads can be blocked or damaged, preventing access to some areas. Flooding can affect bridges that provide access to neighborhoods. There are 39 bridges in or over the 1-percent annual chance flood hazard area and 41 bridges in or over the 0.2-percent annual chance flood hazard area.

Levees

Clark County's flood protection system includes more than 49 miles of levees. Levee locations can be seen in Figure 10-2. The mileage on each watercourse is as follows (FEMA, 2012a):

- Bachelor Island Slough—6.79 miles
- Columbia River —29.97 miles
- East Fork Lewis River—1.33 miles
- Lake River—3.66 miles
- Lewis River—0.38 miles.

10.4.4 Environment

Flooding is a natural event, and floodplains provide many natural and beneficial functions. Nonetheless, with human development factored in, flooding can impact the environment in negative ways. Migrating fish can wash into roads or over dikes into flooded fields, with no possibility of escape. Pollution from roads, such as oil, and hazardous materials can wash into rivers and streams. During floods, these can settle onto normally dry soils, polluting them for agricultural uses. Human development such as bridge abutments and levees, and logjams from timber harvesting can increase stream bank erosion, causing rivers and streams to migrate into non-natural courses.

Many species of mammals, birds, reptiles, amphibians and fish live in Clark County in plant communities that are dependent upon streams, wetlands and floodplains. Changes in hydrologic conditions can result in a change in the plant community. Wildlife and fish are impacted when plant communities are eliminated or fundamentally altered to reduce habitat. Wildlife populations are limited by shelter, space, food and water. Since water supply is a major limiting factor for many animals, riparian communities are of special importance. Riparian areas are the zones along the edge of a river or stream that are influenced by or are an influence upon the water body. Human disturbance to riparian areas can limit wildlife's access to water, remove breeding or nesting sites, and eliminate suitable areas for rearing young. Wildlife relies on riparian areas and is associated with the flood hazard in the following ways:

- Mammals depend upon a supply of water for their existence. Riparian communities have a greater diversity and structure of vegetation than other upland areas. Beavers and muskrats are now recolonizing streams, wetlands and fallow farm fields, which are converted wetlands. As residences are built in rural areas, there is an increasing concern with beaver dams causing flooding of low-lying areas and abandoned farm ditches being filled in, which can lead to localized flooding.
- A great number of birds are associated with riparian areas. They swim, dive, feed along the shoreline, or snatch food from above. Rivers, lakes and wetlands are important feeding and resting areas for migratory and resident waterfowl. Other threatened or endangered species (such as the bald eagle or the peregrine falcon) eat prey from these riparian areas.
- Amphibians and reptiles are some of the least common forms of wildlife in riparian areas. However, some state threatened species, such as the western pond turtle and the spotted frog, are known to inhabit the waterways and wetlands.
- Fish habitat throughout the county varies widely based on natural conditions and human influence. Many ditches were dug throughout the county to make low, wet ground better for farming. As the water drained away and the wetlands were converted to farm fields, natural stream conditions were altered throughout the county. Agriculture along many rivers extends to the water's edge and smaller side channels have been tiled to drain better. Within developing areas, small streams were placed in pipes and wetland was filled in to support urban development. While salmonids prefer clear, free-flowing streams, other species like the Olympic mud-minnow inhabit the calm, backwater areas of sloughs and wetlands.

10.5 VULNERABILITY

10.5.1 Columbia River Vulnerabilities

Few residential structures are directly exposed to flooding from the Columbia River, in part because much of the area along the river is not residentially zoned. Residential structures that are impacted by high water when the Columbia River floods are generally flooded as a result of the restricted flows of rivers and streams draining into the Columbia (CRESA, 2004).

The commercial development vulnerable to the flooding of the Columbia River includes primarily hotels and restaurants. During the 1995 flood, most commercial uses along the river were interrupted. Newer commercial development is appropriately elevated above the 1-percent annual chance flood level. Since these floodplain fringe areas did not experience high floodwater velocities or large debris in the flows, the elevated structures fared well in the floods. Older structures, however, are more vulnerable (CRESA, 2004).

Industrial development along the floodplain is largely protected through a combination of building elevation and fill (as at the Port of Vancouver), or by levees. Perimeter levees of a drainage district may be capable of withstanding large floods, yet major rainstorms could cause extensive interior ponding in lower areas if runoff exceeds the capacity of the dewatering-drainage pumps. Without regular maintenance, the functionality of any levee will decline (CRESA, 2004).

Port facilities are protected by levee systems and fill and ring dikes around vulnerable structures, but an extreme flood on the Columbia River could breach dikes and lead to flooding in port areas. The port is a major employer and a regional economic driver. Any loss of function at the port would impact the entire region (CRESA, 2004).

The Vancouver water treatment facility is located in the floodplain and protected by a series of ring dikes. These were not severely damaged during the 1995 floods and operation was not interrupted (CRESA, 2004).

The Ridgefield National Wildlife Refuge, which lies downriver from the Port of Vancouver and the Vancouver sewage treatment facilities, is potentially vulnerable to floods and the pollution they may carry. During the 1995 event, floodwaters flowed over port lands and onto these critical areas. However, because the port chemical storage tanks and the Vancouver sewage treatment facilities remained intact, the sanctuary was not severely impacted (CRESA, 2004).

10.5.2 Riverine Flooding Vulnerabilities

The major issue related to riverine flooding in Clark County is the large number of new homes that could be constructed in floodplains. Any new development built in a floodplain increases the number of residences and other structures exposed to flooding, increasing risk to life and property along with the damage figures from any flood event. Large numbers of additional homes in the floodplain mean that even floods that are now considered minor could cause large amount of damage in the future (CRESA, 2004).

While new construction in Clark County floodplains exceeds the development standards required by the National Flood Insurance Program, risk is not entirely eliminated. Development, even when compliant with NFIP standards, is served by infrastructure that is vulnerable to flooding. Individual homes may be resistant to flooding, but the roads and drainage systems that serve them could flood, leading to isolation and property damage. Almost 80 percent of all of the structures insured through the NFIP cover structures constructed since 1980, and 60 percent have been built since 1990. Since flood insurance is required on new development if it falls within the floodplain, this figure evidences the increasing number of structures in flood-prone areas (CRESA, 2004).

10.5.3 Stormwater Problems and Shallow Flooding Areas

Much of southwestern Clark County is relatively flat, with poorly drained soils. During heavy rainstorms, water ponds in this area. In 1995, many homeowners suffered water damage that was not directly associated with flooding in a river (CRESA, 2004). This type of flooding is more than a nuisance to homeowners. Severe structural damage can result from wet shifting soils, and damp foundations can allow mildew and related harmful agents. These shallow flooding areas, while causing challenging building environments, often provide excellent natural habitat (CRESA, 2004).

Increased development and the accompanying built land cover are causing increased flood elevations and increased runoff in the stormwater system. With increased development, the vulnerability of local road and drainage systems would increase from overland flow and blocked culverts. These impacts could isolate some residents from emergency services during a major event (CRESA, 2004).

10.5.4 Population

Vulnerable Populations

A geographic analysis of demographics using the Hazus-MH model identified populations vulnerable to the flood hazard as follows:

- **Economically Disadvantaged Populations**—An estimated 14 percent (543) of households within the 1-percent annual chance flood hazard area are economically disadvantaged, defined as having household incomes of $20,000 or less.
- **Population over 65 Years Old**—An estimated 13 percent (1,390) of the population in the census blocks that intersect the 1-percent annual chance flood hazard area are over 65 years old.
- **Population under 16 Years Old**—An estimated 26 percent (2,717) of the population within census blocks located in or near the 1-percent annual chance flood hazard area are under 16 years of age.

Impacts on Persons and Households

Table 10-11 summarizes estimated impacts on persons in the planning area for the 1-percent annual chance and 0.2-percent annual chance flood events.

Table 10-11. Estimated Flood Impact on Persons[a]

	1 Percent Annual Chance		0.2 Percent Annual Chance	
	Displaced Persons	Persons Requiring Short-Term Shelter	Displaced Persons	Persons Requiring Short-Term Shelter
Battle Ground	235	95	304	153
Camas	459	360	546	456
La Center	30	18	30	19
Ridgefield	93	18	121	30
Vancouver	2,195	1,899	3,622	3,209
Washougal	302	226	405	336
Woodland	2,236	2,169	2,445	2,369
Yacolt	82	17	76	14
Unincorporated	4,433	2,491	6,191	3,846
Total	**10,065**	**7,293**	**13,740**	**10,432**

a. Hazus-MH results in this table are not intended to be precise estimates of damage after a hazard event. They represent generalized estimates of damage that may occur as the result of the modeled scenario, based on the available data.

Public Health and Safety

Floods and their aftermath present the following threats to public health and safety:

- **Unsafe food—**Floodwaters contain disease-causing bacteria, dirt, oil, human and animal waste, and farm and industrial chemicals. They carry away whatever lies on the ground and upstream. Their contact with food items, including food crops in agricultural lands, can make that food unsafe to eat and hazardous to human health. Power failures caused by floods damage stored food. Refrigerated and frozen foods are affected during the outage periods, and must be carefully monitored and examined prior to consumption. Foods kept inside cardboard, plastic bags, jars, bottles, and paper packaging are subject to disposal if contaminated by floodwaters. Even though the packages do not appear to be wet, they may be unhygienic with mold contamination and deteriorate rapidly.

- **Contaminated drinking and washing water and poor sanitation—**Flooding impairs clean water sources with pollutants. Contact with the contaminants—whether through direct food intake, vector insects such as flies, unclean hands, or dirty plates and utensils—can result in waterborne illnesses and life-threatening infectious disease. The pollutants also saturate into the groundwater or can infiltrate into sanitary sewer lines through the ground. Wastewater treatment plants, if flooded and caused to malfunction, can be overloaded with polluted runoff waters and sewage beyond their disposal capacity, resulting in backflows of raw sewage to homes and low-lying grounds. Private wells can be contaminated or damaged severely by floodwaters, while private sewage disposal systems can become a cause of infection if they are broken or overflow. Unclean drinking and washing water and sanitation, coupled with lack of adequate sewage treatment, can lead to disease outbreaks.
- **Mosquitoes and animals—**Prolonged rainfall and floods provide new breeding grounds for mosquitoes—wet areas and stagnant pools—and can lead to an increase in the number of mosquito-borne diseases such as malaria and dengue and West Nile fevers. Rats and other rodents and wild animals also can carry viruses and diseases. The public should avoid such animals and should dispose of dead animals in accordance with guidelines issued by local animal control authorities. Leptospirosis—a bacterial disease associated predominantly with rats—often accompanies floods in developing countries, although the risk is low in industrialized regions unless cuts or wounds have direct contact with disease-contaminated floodwaters or animals.
- **Mold and mildew—**Excessive exposure to mold and mildew can cause flood victims—especially those with allergies and asthma—to contract upper respiratory diseases, triggering cold-like symptoms. Molds grow in as short a period as 24 to 48 hours in wet and damp areas of buildings and homes that have not been cleaned after flooding, such as water-infiltrated walls, floors, carpets, toilets and bathrooms. Very small mold spores can be easily inhaled by human bodies and, in large enough quantities, cause allergic reactions, asthma episodes, and other respiratory problems. Infants, children, elderly people and pregnant women are considered most vulnerable to mold-induced health problems.
- **Carbon monoxide poisoning—**Carbon monoxide poisoning is as a potential hazard after major floods. In the event of power outages following floods, flood victims tend to use alternative sources of fuels for heating or cooking inside enclosed or partly enclosed houses, garages or buildings without an adequate level of air ventilation. Carbon monoxide can be found in combustion fumes such as those generated by small gasoline engines, stoves, generators, lanterns, gas ranges, or the burning of charcoal or wood. Built-up carbon monoxide from these sources can poison people and animals.
- **Hazards when reentering and cleaning flooded homes and buildings—**Flooded buildings can pose significant health hazards to people entering and cleaning damaged buildings or working to restore utility service after floodwaters recede. Electrical power systems, including fallen power lines, can become hazardous. Gas leaks from pipelines or propane tanks can trigger fire and explosion. Flood debris—such as broken bottles, wood, stones and walls—may cause wounds and injuries to those removing contaminated mud and cleaning damaged buildings. Containers of hazardous chemicals, including pesticides, insecticides, fertilizers, car batteries, propane tanks and other industrial chemicals, may be hidden or buried under flood debris. A health hazard can also occur when hazardous dust and mold in ducts, fans and ventilators of air-conditioning and heating equipment are circulated through a building and inhaled by those engaged in cleanup and restoration.

- **Mental stress and fatigue**—Having experienced a devastating flood and seen loved ones lost or injured and homes damaged or destroyed, flood victims can experience long-term psychological impact. The expense and effort required to repair flood-damaged homes places severe financial and psychological burdens on the people affected, in particular the unprepared and uninsured. Post-flood recovery—especially when it becomes prolonged—can cause mental disorders, anxiety, anger, depression, lethargy, hyperactivity, sleeplessness, and, in an extreme case, suicide. Behavior changes may also occur in children such as an increase in bed-wetting and aggression. There is also a long-term concern among the affected that their homes can be flooded again in the future.

Current loss estimation models such as Hazus are not equipped to measure public health impacts such as these. The best level of mitigation for these impacts is to be aware that they can occur, educate the public on prevention, and be prepared to deal with them in responding to flood events.

10.5.5 Property

Hazus-MH calculates flood losses to structures based on flooding depth and structure type. Using historical flood insurance claim data, Hazus-MH estimates the percentage of damage to structures and their contents by applying established damage functions to an inventory. For this analysis, local data on facilities was used instead of the default inventory data provided with Hazus-MH. The analysis is summarized in Table 10-12 and Table 10-13 for the 1-percent annual chance and 0.2-percent annual chance flood events, respectively.

Table 10-12. Loss Estimates for 1-Percent Annual Chance Flood Event

	Structures Impacted[a]	Estimated Loss Associated with Flood			% of Total Replacement value
		Structure	Contents	Total	
Battle Ground	22	$3,549,389	$10,326,798	$13,876,187	0.3%
Camas	38	$23,742,188	$27,038,281	$50,780,469	0.7%
La Center	3	$882,359	$2,187,192	$3,069,551	0.4%
Ridgefield	55	$1,531,604	$2,112,225	$3,643,828	0.2%
Vancouver	144	$15,911,588	$28,909,855	$44,821,442	0.1%
Washougal	41	$13,545,721	$23,465,441	$37,011,162	0.9%
Woodland	789	$24,378,452	$18,152,121	$42,530,573	2.4%
Yacolt	8	$254,442	$222,024	$476,466	0.2%
Unincorporated	813	$60,179,196	$78,011,896	$138,191,093	0.3%
Total	**1913**	**$143,974,939**	**$190,425,833**	**$334,400,771**	**0.3%**

a. Impacted structures are those structures with finished floor elevations below the 100-year water surface elevation. These structures are the most likely to receive significant damage in a 1-percent annual chance flood event

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

Table 10-13. Loss Estimates for 0.2-Percent Annual Chance Flood Event

	Structures Impacted[a]	Estimated Loss Associated with Flood			% of Total Replacement value
		Structure	Contents	Total	
Battle Ground	32	$6,591,957	$21,942,920	$28,534,877	0.7%
Camas	114	$65,196,208	$122,131,590	$187,327,798	2.5%
La Center	3	$1,289,064	$2,252,823	$3,541,886	0.4%
Ridgefield	57	$2,952,044	$3,788,517	$6,740,561	0.3%
Vancouver	1,176	$301,910,535	$527,418,002	$829,328,537	1.7%
Washougal	91	$18,005,170	$28,734,345	$46,739,516	1.1%
Woodland	925	$58,559,688	$51,536,180	$110,095,867	6.2%
Yacolt	7	$184,226	$197,653	$381,878	0.1%

	Structures Impacted[a]	Estimated Loss Associated with Flood			% of Total Replacement value
		Structure	Contents	Total	
Unincorporated	1,231	$99,413,476	$138,695,856	$238,109,333	0.5%
Total	**3,636**	**$554,102,368**	**$896,697,886**	**$1,450,800,253**	**1.3%**

a. Impacted structures are those structures with finished floor elevations below the 500-year water surface elevation. These structures are the most likely to receive significant damage in a 0.2-percent annual chance flood event

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

It is estimated that there would more than $334.4 million of flood loss from a 1-percent annual chance flood event in the planning area. This represents 16.7 percent of the total exposure to the 1-percent annual chance flood and 0.3 percent of the total replacement value for the planning area. It is estimated that there would be $1.45 billion of flood loss from a 0.2-percent annual chance flood event, representing 31 percent of the total exposure to a 0.2-percent annual chance flood event and 1.3 percent of the total replacement value.

National Flood Insurance Program

Table 10-14 lists flood insurance statistics for the jurisdictions in the planning area that participate in the NFIP. In these jurisdictions, 1,519 flood insurance policies provide $414.7 million in insurance coverage. According to FEMA, 145 flood insurance claims were paid between January 1, 1978 and November 30, 2015, for a total $2.84 million, an average of $19,618 per claim (FEMA, 2015b). During this time, 55 claims were closed without payment.

Table 10-14. Flood Insurance Statistics

Jurisdiction	Date of Entry Initial FIRM Effective Date	# of Flood Insurance Policies as of 3/28/2022	Insurance In Force	Total Annual Premium	Total Claims, 11/1978 to 3/28/2022	Value of Claims paid, 11/1978 to 3/28/2022
Battle Ground	04/15/81	17	$4,579,000	$9,025	3	$3,265
Camas	02/18/81	59	$18,212,900	$42,184	6	$13,710
La Center[a]	N/A	0	$0	$0	0	$0
Ridgefield	05/19/81	7	$2,312,000	$3,239	0	$0
Vancouver	08/17/81	401	$120,901,200	$332,621	12	$113,938
Washougal	03/02/81	64	$19,979,000	$41,289	13	$93,962
Woodland[b]	02/01/78	489	$130,721,100	$363,714	72	$962,920
Yacolt	09/05/12	4	$683,200	$7,719	0	$0
Unincorporated	08/02/82	432	$127,113,000	$336,931	113	$1,924,727
Total		**1,473**	**$424,501,400**	**$1,136,722**	**219**	**$3,112,522**

a. La Center has been suspended from the NFIP program as of September 6, 2012.

b. This number represents all of woodland, though only a portion of it is in Clark County.

Source: FEMA, 2015b and FEMA, 2015d

Repetitive Loss

A repetitive loss property is defined by FEMA as an NFIP-insured property that has experienced any of the following since 1978, regardless of any changes in ownership:

- Four or more paid losses in excess of $1,000
- Two paid losses in excess of $1,000 within any rolling 10-year period
- Three or more paid losses that equal or exceed the current value of the insured property.

Repetitive loss properties represent only 1 percent of all flood insurance policies, but historically they account for nearly one-third of the claim payments (National Wildlife Federation, 2006). The government has instituted programs encouraging communities to identify and mitigate the causes of repetitive losses. A report on repetitive losses by the National Wildlife Federation found that 20 percent of these properties are outside any mapped 1-percent annual chance flood hazard area (National Wildlife Federation, 1998). The key identifiers for repetitive loss properties are the existence of flood insurance policies and claims paid by the policies. With the potential for minor flood events every year and major events every five to seven years, the County and its planning partners consider all of the mapped floodplain areas as susceptible to repetitive flooding.

FEMA has identified 10 repetitive loss properties in the planning area as of March 28, 2022. FEMA records indicate that these properties fall in several communities within the County. A further review of the properties determined that 6 are in the 1-percent annual chance flood hazard area. The remaining property is located outside of the 1-percent and 0.2-percent annual chance flood hazard areas and is not located near any mapped flood hazard areas. The dates and amounts of loss were not provided by FEMA, so they cannot be correlated to any known flood or storm events. Based on this information, it is assumed that the repetitive losses are a result of localized drainage issues. All of the properties are single-family residential structures.

A repetitive loss area is the portion of a floodplain holding structures that FEMA has identified as meeting the definition of repetitive loss. The CRS requires participating communities to identify repetitive loss areas. Identifying the broader area helps to identify structures that are at risk but are not on FEMA's list of repetitive loss structures because no flood insurance policy was in force at the time of loss.

10.5.6 Critical Facilities and Infrastructure

Hazus-MH was used to estimate potential flood damage to critical facilities exposed to the flood risk. Using depth/damage function curves to estimate the percent of damage to the building and contents of critical facilities, Hazus-MH correlates these estimates into an estimate of functional down-time (the estimated time it will take to restore a facility to 100 percent of its functionality). This helps to gauge how long the planning area could have limited usage of facilities deemed critical to flood response and recovery. The Hazus critical facility results are shown in Table 10-15 and Table 10-16:

- **1-percent annual chance flood event**—On average, critical facilities would receive 22 percent damage to the structure and 70 percent damage to the contents during a 1-percent annual chance flood.
- **0.2-percent annual chance flood**—A 0.2-percent annual chance flood event would damage the structures an average of 22 percent and the contents an average 67 percent.

Table 10-15. Estimated Damage to Critical Facilities and Infrastructure from 1-Percent Annual Chance Flood

	Number of Facilities Affected	Average % of Total Value Damaged		Days to 100% Functionality
		Building	Content	
Communication Facilities	0	--	--	--
Dams[a]	N/A	N/A	N/A	N/A
Emergency Services	1	15%	70%	630
Energy	3	22%	N/A	N/A
Government Facilities	0	--	--	--
Hazardous Materials	7	28%	N/A	N/A
Health Care & Public Health	0	--	--	--
Information Technology	--	--	--	--

	Number of Facilities Affected	Average % of Total Value Damaged		Days to 100% Functionality
		Building	Content	
Schools	0	--	--	--
Transportation Systems	49	21%	N/A	N/A
Water & Sanitation Systems	22	23%	N/A	N/A
Total	**82**	**22%**	**70%**	**630**

a. Hazus-MH does not produce damage estimates for dams.

Table 10-16. Estimated Damage to Critical Facilities and Infrastructure from 0.2-Percent Annual Chance Flood

	Number of Facilities Affected	Average % of Total Value Damaged		Days to 100% Functionality
		Building	Content	
Communication Facilities	0	--	--	--
Dams[a]	N/A	N/A	N/A	N/A
Emergency Services	1	27%	100%	720
Energy	5	25%	--	--
Government Facilities	0	--	--	--
Hazardous Materials	16	25%	--	--
Health Care & Public Health	0	--	--	--
Information Technology	0	--	--	--
Schools	1	6%	33%	480
Transportation Systems	71	24%	--	--
Water & Sanitation Systems	33	26%	--	--
Total	**127**	**22%**	**67%**	**600**

a. Hazus-MH does not produce damage estimates for dams.

10.5.7 Environment

The environment vulnerable to flood hazard is the same as the environment exposed to the hazard. As with any significant natural hazard event, large of amounts of debris generated from the damaged buildings and infrastructure could have significant environmental impacts. These impacts were estimated for the flood hazard events through the Level 2 Hazus-MH analysis. Table 10-17 summarizes the results.

Table 10-17. Estimated Flood-Caused Debris

	1-percent annual chance event		0.2 percent annual chance event	
	Debris to Be Removed (tons) [a]	Truck Loads[b]	Debris to Be Removed (tons) [a]	Truck Loads[b]
Battle Ground	300.34	12	392.09	16
Camas	31,223.38	1,249	38,173.52	1,527
La Center	1,513.84	61	1,564.54	63
Ridgefield	1,126.04	45	3,050.12	122
Vancouver	74,823.08	2,993	141,288.97	5,652
Washougal	8,348.10	334	10,315.27	413
Woodland	2,447.70	98	4,634.97	185
Yacolt	45.39	2	45.44	2
Unincorporated	31,501.58	1,260	38,887.05	1,555

Total	**151,329.47**	**6,053**	**238,351.97**	**9,534**

a. Debris generation estimates were based on updated general building stock dataset at a Census Block analysis level.
b. Hazus assumes 25 tons per truck.
Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

At this time this is the best approximation available to measure environmental impacts of flood hazards. The best gauge of vulnerability of the environment would be a review of damage from past flood events. Loss data that segregates damage to the environment was not available at the time of this plan. Capturing this data from future events could be beneficial in measuring the vulnerability of the environment for future updates.

10.5.8 Economic Impact

Economic impact will be largely associated with the location in which flooding occurred. In such areas, commercial buildings may need to be renovated, causing a disruption in associated services. Additionally, many of the port facilities lie within flood hazard areas, which could cause significant economic disruption.

10.6 FUTURE TRENDS

10.6.1 Development

Municipal comprehensive plans guide development in the planning area. The County's Comprehensive Plan sets goals, objectives, policies and actions for frequently flooded areas. The County has developed several plans and initiatives to promote healthy watersheds and to manage stormwater runoff by directing future development away from flood risk areas. Clark County's critical areas regulations regulate how development and redevelopment can safely occur on lands that contain critical areas. Additionally, Clark County and all but one of the municipal planning partners participate in the NFIP and have adopted flood damage prevention regulations in response to its requirements.

Clark County's population increased an average of 1.7% per year between 2010 and 2020, a total of 16.98%. County plans and regulations will reduce the impacts of this future growth on floodplains and critical areas and lessen the impacts of flooding on future development. State-mandated growth management, stormwater management and critical areas regulations have been effective in limiting an increase in flood risk throughout Washington.

Table 10-18 shows the area identified as underutilized or vacant in urban growth areas in the County that intersect the 0.2 percent annual flood hazard, but are outside of the 1 percent annual flood hazard areas generally regulated pursuant to critical areas ordinances and the NFIP.

Table 10-18. Buildable Lands in Urban Growth Areas Intersecting the 0.2-Percent Annual Flood Hazard[a]

	Buildable Area[c] (acres)				
	Residential				
Urban Growth Area[b]	Acres	Units	Commercial	Industrial	Total
Battle Ground	60.59	364	54.10	0	**114.69**
Camas	21.18	127	12.62	55.97	**89.77**
La Center	4.92	20	0.29	0	**5.21**
Ridgefield	98.21	589	0	7.13	**105.33**
Vancouver	374.00	2,992	61.37	865.79	**2,991.99**
Washougal	13.96	84	3.36	0	**17.31**
Woodland[d]	24.97	100	0	0	**24.97**

Urban Growth Area[b]	Buildable Area[c] (acres)				
	Residential		Commercial	Industrial	Total
	Acres	Units			
Yacolt	0	0	0	0	**0**
Total	**597.83**	**4,276.00**	**131.74**	**928.89**	**3,349.27**

a. Buildable lands information in this plan is for planning purposes only. Discrepancies may exist between these estimates and official records maintained by participating jurisdictions.
b. Unincorporated areas outside of urban growth areas are excluded from this assessment. Development in these areas consists largely of rural lands, open space and large residential lots. Changes in development can be assessed through
c. Acreage covers only mapped parcels; it excludes many rights of way and major water features.
d. Acreage estimates exclude the portions of the City of Woodland in Cowlitz County and thus may be underestimated.

10.6.2 Climate Change

According to the University of Washington Climate Impacts Group, floods are expected to be more extreme and occur more often as a result of climate change. Warmer temperatures result in more winter precipitation falling as rain rather than snow throughout much of the Pacific Northwest. This change will result in the following (University of Washington Climate Impacts Group, 2013):

- Higher winter stream flows with more floods
- Less winter snow accumulation
- Earlier spring snowmelt.
- Earlier peak spring stream flow (already 10 to 30 days earlier than 1948)
- Lower summer stream flows.

Future floods are expected to exceed the capacity and protective abilities of existing flood protection facilities, threatening lives, property, major transportation corridors, communities and regional economic centers.

Changes in Hydrology

Use of historical hydrologic data has long been the standard of practice for designing and operating water supply and flood protection projects. For example, historical data are used for flood forecasting models and to forecast snowmelt runoff for water supply. This method of forecasting assumes that the climate of the future will be similar to that of the period of historical record. However, the hydrologic record cannot be used to predict changes in frequency and severity of extreme climate events such as floods. Going forward, model calibration or statistical relation development must happen more frequently, new forecast-based tools must be developed, and a standard of practice that explicitly considers climate change must be adopted. Climate change is already impacting water resources, and resource managers have observed the following:

- Historical hydrologic patterns can no longer be solely relied upon to forecast the water future.
- Precipitation and runoff patterns are changing, increasing the uncertainty for water supply and quality, flood management and ecosystem functions.
- Extreme climatic events will become more frequent, necessitating improvement in flood protection, drought preparedness and emergency response.

The amount of snow is critical for water supply and environmental needs, but so is the timing of snowmelt runoff into rivers and streams. Rising snowlines caused by climate change will allow more mountain area to contribute to peak storm runoff. High frequency flood events (e.g. 10-year floods) in particular will likely increase with a changing climate. Along with reductions in the amount of the snowpack and accelerated snowmelt, scientists project greater storm intensity, resulting in more direct runoff and flooding. Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. As stream flows and velocities change, erosion patterns will also change, altering channel shapes and depths, possibly increasing sedimentation behind dams, and affecting habitat and water quality. With potential increases in the frequency and intensity of wildfires due to climate change, there is potential for more floods following fire, which increase sediment loads and water quality impacts.

As hydrology changes, what is currently considered a 1-percent annual chance flood may strike more often, leaving many communities at greater risk. Planners will need to factor a new level of safety into the design, operation, and regulation of flood protection facilities such as dams, bypass channels and levees, as well as the design of local sewers and storm drains.

10.7 SCENARIO

A likely flooding event would be one similar to the winter 1995 flood. A rainy and cold winter would be broken by warm weather, causing mountain snow to melt and stream runoff to increase. A severe winter storm with strong winds and heavy precipitation would accompany the flooding. Creeks would be overwhelmed at the same time that soil would be less permeable because of frozen ground. The combination would lead to watersheds draining water at overcapacity. Streams would rise above their natural banks, flooding homes and streets in the floodplains. Drainage structures would be overwhelmed, a situation further complicated by blockage from branches downed by the wind. Water would pond and stagnate in flat areas and areas with already-high water tables. Continued warm, rainy weather in the larger Columbia watershed would result in flood stages along the Columbia River. Water would penetrate the levee system in several areas leading to ponding in low-lying industrial areas (CRESA, 2004).

This scenario could be more costly in the future. There would be increased development in mapped floodplains, meaning greater exposure as well as increased flood levels due to increased impervious surfaces. Flood stages would be higher. Ponding would occur for longer periods of time and be more extensive. More human debris would block a greater number of culverts. Existing ring dikes that had protected sewage treatment structures and chemical storage structures might fail, impacting downriver wildland sanctuaries and other critical habitat (CRESA, 2004).

More homes would be present on vulnerable slopes, leading to increased numbers of landslides, with potential to destroy homes and damage roadways. The county emergency services response operations could be over-taxed by such an event. Residents, especially those in the more rural parts of the county, would experience isolation (CRESA, 2004).

10.8 ISSUES

The planning team has identified the following flood-related issues relevant to the planning area:

- The following are issues associated with a 1-percent annual chance flood event:
  - More than 6,650 people are estimated to live within the special flood hazard area.
  - There may be more than 150 million tons of debris following a 1-percent annual chance flood.
  - More than $334 million in damage to building structure and contents would be expected.
  - More than 2,100 structures are within the special flood hazard area. Of these, 92 percent are residential.
- The following are issues associated with a 0.2-percent annual chance flood event:
  - More than 12,100 people are estimated to live within the special flood hazard area.

    - There may be more than 238 million tons of debris following a 0.2-percent annual chance flood.
    - More than $1.45 billion in damage to building structure and contents would be expected.
    - Almost 4,000 structures are within the special flood hazard area. Of these, 92 percent are residential structures.
- There are 10 repetitive loss properties in the planning area.
- A sustained effort should be made to gather historical damage data, such as high water marks on structures and damage reports. The collection of this information will assist with determining the cost-effectiveness of future mitigation projects and will provide more information on the nature of the hazard.
- Ongoing flood hazard mitigation will require funding from multiple sources.
- Flood hazards do not recognize jurisdictional boundaries, and actions in jurisdictions can impact upstream or downstream neighbors. Coordination is necessary to ensure that these connections are understood and hazards are effectively mitigated.
- Floodplain residents need to continue to be educated about flood preparedness and the resources available during and after floods. Flood preparedness can help residents reduce risk to property and lives. Resources that are made available after flood events can help residents make informed decisions that may mitigate future risk to lives and property.
- The risk associated with the flood hazard overlaps the risk associated with other hazards, such as earthquake and landslide. This provides an opportunity to seek mitigation alternatives that can reduce risk for multiple hazards.
- The location of hazardous materials within the floodplain could result in secondary hazards during or after a flood event. Additional risk analysis should be performed on any hazardous-material facilities in the County.
- FEMA maps do not recognize residual risk outside the mapped area. Where levees are accredited, there may be a misperception that there is no flood risk. Public outreach and awareness efforts should emphasize the residual risk behind levees.
- The concept of residual risk should be considered in the design of future capital flood control projects and should be communicated with residents living in the floodplain.
- The impacts of climate change on flooding in the planning area are uncertain.
- The promotion of flood insurance as a means of protecting private property owners from the economic impacts of frequent flood events should continue.
- Existing floodplain-compatible uses such as agricultural and open space need to be maintained. There is constant pressure to convert these existing uses to more intense uses within the planning area during times of moderate to high growth.

11. LANDSLIDE

11.1 GENERAL BACKGROUND

A landslide is a mass of rock, earth or debris moving down a slope. Landslides may be minor or very large, and can move at slow to very high speeds. They can be initiated by storms, earthquakes, fires, volcanic eruptions or human modification of the land. For more information see the Washington Geological Survey (WGS) landslide information page at https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/landslides

Mudslides (or mudflows or debris flows) are rivers of rock, earth, organic matter and other soil materials saturated with water. They develop in the soil overlying bedrock on sloping surfaces when water rapidly accumulates in the ground, such as during heavy rainfall or rapid snowmelt. Water pressure in the pore spaces of the material increases to the point that the internal strength of the soil is drastically weakened. The soil's reduced resistance can then easily be overcome by gravity, changing the earth into a flowing river of mud. A mudflow can move rapidly down slopes or through channels and can strike with little or no warning. The material can travel miles from its source, growing as it descends, picking up trees, boulders, cars and anything else in its path. Although these slides behave as fluids, they pack many times the hydraulic force of water due to the mass of material included in them.

Landslides can be some of the most destructive events in nature, posing a serious hazard to properties on or below hillsides. When landslides occur—in response to such changes as increased water content, earthquake shaking, addition of load, or removal of downslope support—they deform and tilt the ground surface. The result can be destruction of foundations, offset of roads, breaking of underground pipes, or overriding of downslope property and structures.

11.1.1 Landslide Failure Types and Runout

Landslides are commonly categorized by the type of initial ground failure. Figure 11-1 through Figure 11-4 show common types of slides (Washington Department of Ecology, 2014). The most common is the shallow colluvial slide, occurring particularly in response to intense, short-duration storms. The largest and most destructive are deep-seated slides, although they are less common than other types.

In addition to the failure type, landslide risk assessment evaluates the post-failure movement of loosened material, called "runout." Runout is assessed for its travel distance and velocity. Mapping of landslide risk areas generally indicates the location of the potential failure, but mapping of areas that would be affected by the runout after the failure is not currently well-developed.

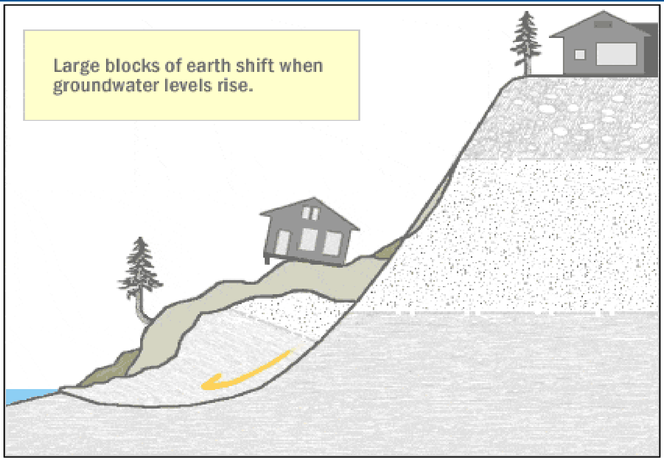


Figure 11-1. Deep Seated Slide

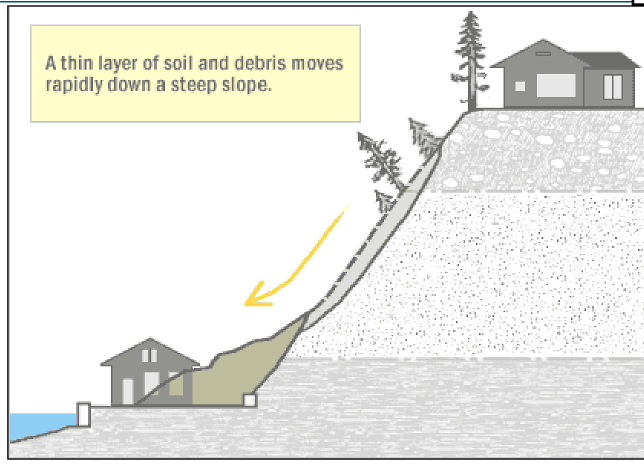


Figure 11-2. Shallow Colluvial Slide

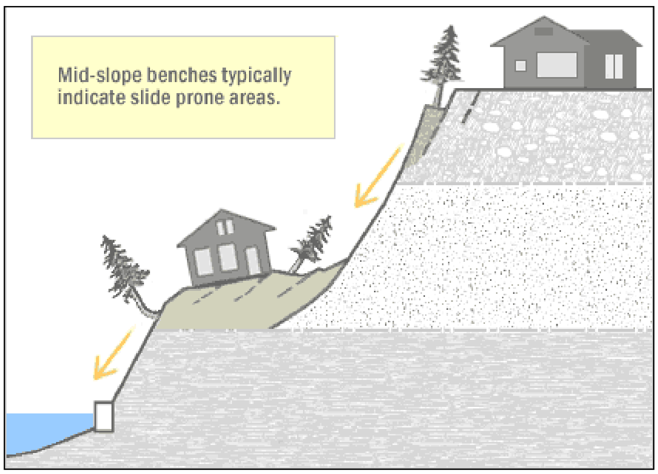


Figure 11-3. Bench Slide

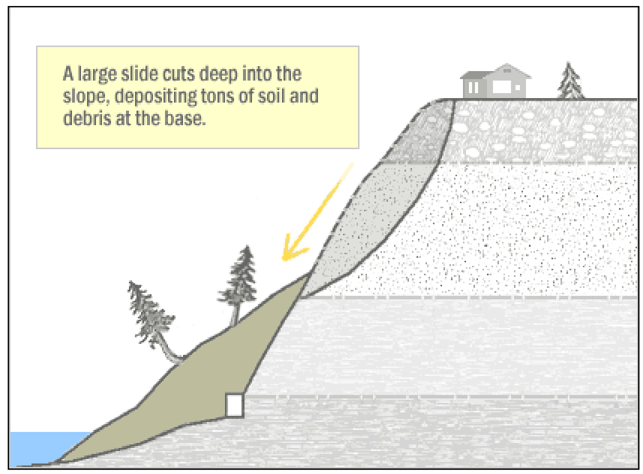


Figure 11-4. Large Slide

11.1.2 Landslide Causes

Mass movements are caused by a combination of geological and climate conditions, as well as the encroaching influence of urbanization. Vulnerable natural conditions are affected by human residential, agricultural, commercial and industrial development and the infrastructure that supports it. The following factors can contribute to landslide:

- Change in slope of the terrain
- Increased load on the land
- Shocks and vibrations
- Change in water content
- Groundwater movement
- Frost action
- Weathering of rocks
- Removing or changing the type of vegetation covering slopes.

Soil composition is also a factor, with many slides occurring on a slope at the contact between a permeable soil such as sand and an underlying impervious material such as clay. The Missoula flood deposits over much of central Clark County are characterized by alternating sand and clay layers (CRESA 2004).

Excavation and Grading

Slope excavation is common in the development of home sites or roads on sloping terrain. Grading can result in some slopes that are steeper than the pre-existing natural slopes. Since slope steepness is a major factor in landslides, these steeper slopes can be at an increased risk for landslides. The added weight of fill placed on slopes can also result in an increased landslide hazard. Small landslides can be fairly common along roads, in either the road cut or the road fill. Landslides occurring below new construction sites are indicators of the potential impacts stemming from excavation. In addition, historical landslide areas are more susceptible to construction-triggered sliding than are undisturbed slopes (CRESA 2004).

A study conducted by Burns and others (1998) at Portland State University found that changes to the slope through cutting or filling increased the risk of 76 percent of inventoried landslides in the Portland Metro region. The study documented 48 landslides that occurred in Oregon City in February 1996 and found that only about half the slides were considered natural. A Seattle landslide study found that human influence played some role in 84 percent of recorded slides (Winters 2015).

Drainage and Groundwater Alterations

Water flowing through or above ground is often the trigger for landslides. Any activity that increases the amount of water flowing into landslide-prone slopes can increase landslide hazards. Broken or leaking water or sewer lines can be especially problematic, as can water retention facilities that direct water onto slopes. However, even lawn irrigation and minor alterations to small streams in landslide prone locations can result in damaging landslides. Ineffective stormwater management and excess runoff can also cause erosion and increase the risk of landslide hazards. Drainage can be affected naturally by the geology and topography of an area. Development that results in an increase in impervious surface impairs the ability of the land to absorb water and may redirect water to other areas. Channels, streams, flooding, and erosion on slopes all indicate potential slope problems.

Road and driveway drains, gutters, downspouts, and other constructed drainage facilities can concentrate and accelerate flow. Ground saturation and concentrated velocity flow are major causes of slope problems and may trigger landslides.

Changes in Vegetation

Removing vegetation from very steep slopes can increase landslide hazards. A study by the Oregon Department of Forestry found that landslide hazards in three out of four steeply sloped areas were highest for a period of roughly 10 years after timber harvesting (Oregon Department of Forestry, 1999). A more recent study of a heavy rain event on Vancouver Island, Canada found that low forest density, indicating regrowth areas, and proximity to forest service roads were jointly associated with a 6- to 9-fold increase in the odds of a landslide (Goetz et al 2015). Areas that have experienced wildfire and land clearing for development may have long periods of increased landslide hazard. In addition, woody debris in stream channels (both natural and man-made from logging) may cause the impacts of debris flows to be more severe.

11.1.3 Landslide Management

While small landslides are often a result of human activity, the largest landslides are often naturally occurring phenomena with little or no human contribution. The sites of large landslides are typically areas of previous landslide movement that are periodically reactivated by significant precipitation or seismic events. Such naturally occurring landslides can disrupt roadways and other infrastructure lifelines, destroy private property, and cause flooding, bank erosion and rapid channel migration. Landslides can create immediate, critical threats to public safety, and engineering solutions to protect structures from large active landslides are often prohibitively expensive.

In spite of their destructive potential, landslides can serve beneficial functions to the natural environment. They supply sediment and large wood to a stream network, contributing to complexity and dynamic channel behavior critical for aquatic and riparian ecological diversity. Effective landslide management should include the following elements:

- Continuing investigation to identify natural landslides, understand their mechanics, assess their risk to public health and welfare, and understand their role in ecological systems
- Regulation of development in or near existing landslides or areas of natural instability.
- Preparation for emergency response to landslides to facilitate rapid, coordinated action among local government and state and federal agencies, and to provide emergency assistance to affected or at-risk residents.
- Evaluation of options including landslide stabilization or structure relocation where landslides are identified that threaten critical public structures or infrastructure.

Critical area ordinances at the local level reduce the impacts of human alterations on critical areas, which include geologically hazardous areas such as areas prone to landslide, erosion, mass-wasting, debris flows and rock falls. The designation of critical areas, including geologically hazardous areas, is a requirement of the Washington State Growth Management Act (WAC 365-190-080(4) and WAC 365-190-120 Geologically Hazardous Areas . The Clark County Title 40 Unified Development Code discourages development in landslide hazard areas; however, development may be allowed when certain requirements are met. In this same chapter, Chapter 40.430 – Geologic Hazard Areas, the County also establishes regulations for development on slopes greater than 40 percent (Clark County Code, 2015). In general, development in a landslide hazard area requires the following:

- A minimum buffer of 50 feet from the edge of the hazard area,
- Designation of the hazard areas and buffers as landslide protection areas,
- No decrease in slope stability on contiguous properties,
- Promotion of mitigation using best-available engineering
- Certification of all clearing and alteration by a registered geotechnical engineer or geologist licensed in the state.

11.2 HAZARD PROFILE

Clark County is topographically level to gently rolling in the southwestern areas, but the eastern and northern areas of the county contain steep, forested foothills and mountains of the Cascade Range. The elevation ranges from sea level to over 3,500 feet in the foothills in the eastern portion of the county. Historically, Clark County has experienced landslides as a result of slope instability, foundation distress, and poor drainage (Dames and Moore 2000). Landslides have become more common in the last decade and may be attributed to the rapid population growth and development, combined with the intense rainfall that occurs in this area (CRESA 2004).

11.2.1 Past Events

Most significant slide events in Clark County have occurred during or shortly after storm events. Four federal disaster declarations with listed landslide or mudslide impacts have affected Clark County since 1977. The Washington State Hazard Mitigation Plan lists the following landslide events as having impacted Clark County (FEMA, 2022; Washington Emergency Management Division 2020; CRESA 2004):

- **December 10, 1977**—Clark County was included in FEMA DR-545 for the Washington Severe Storms, Mudslides, Flooding.
- **1996-1997**—Heavy rains from a series of strong Pacific storms during the last week of December loosened hillsides throughout Southwest Washington. Numerous mudslides cut roads

and threatened homes during the first week of January. One major landslide occurred 2 miles north of Woodland (outside of Clark County) in which 32,000 cubic yards of material fell across all lanes of Interstate 5, blocking traffic for several hours. A large slide near Battle Ground slowly flowed down a hillside and threatened nearby homes through the month of January. A slide occurred near Jenny Creek in Northwest Clark County.

- **December 23, 2002**—A landslide blocked a portion of the Washougal River Road, producing traffic problems.
- **November 2-11, 2006**—Clark County was included in FEMA DR-1671 for the Washington Severe Storms, Flooding, Landslides, and Mudslides.
- **December 14-15, 2006**—Clark County was included in FEMA DR-1682 for the Washington Severe Storm, Landslides, and Mudslides.
- **January 2009**—A warm wet storm from the Pacific Ocean brought significant amounts of rainfall, flooding, and soil saturation to the state, causing over 1,500 landslides greater than 5,000 square feet in size. The landslides in Clark County were primarily along the Interstate 5 corridor, in the Kelso and Longview areas, and on or near Highway 504.
- **December 1, 2015**—Clark County was included in FEMA DR-4253 for the Washington Severe Winter Storms, Straight Line Winds, Flooding, Landslides, Mudslides and a Tornado. Northbound Interstate 5 was closed due to a slide near Woodland.

11.2.2 Location

Slides can occur in urban and rural areas throughout the County. In general, landslide hazard areas are where the land has characteristics that contribute to the risk of the downhill movement of material, such as the following (Washington Department of Community, Trade and Economic Development, 2007):

- Areas of historical failures
- Areas with all three of the following characteristics:
  - Slopes steeper than 15 percent
  - Hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock
  - Springs or groundwater seepage
- Areas that have shown movement within the last 11,000 years or that are underlain or covered by mass wastage debris of that time period
- Slopes that are parallel or subparallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials
- Slopes with gradients steeper than 80 percent subject to rock-fall during seismic shaking
- Areas potentially unstable as a result of rapid stream incision, stream bank erosion, and undercutting by wave action
- Areas that show evidence of, or that are at risk from, snow avalanches
- Areas in a canyon or on an active alluvial fan, presently or potentially subject to inundation by debris flows or catastrophic flooding
- Any area with a slope of 40 percent or steeper and with a vertical relief of 10 or more feet, except areas composed of consolidated rock.

According to the Washington State Hazard Mitigation Plan, the state has six major landslide provinces. Clark County is in the Southwest Washington landslide province, although the County has a lower frequency of major landslides than elsewhere in the state. Southwest Washington is primarily characterized by a lack of glaciation and local exposure to glacial melt water. Much of this area has deeply dissected terrain and areas of mid-slope benches and gentle slopes. The State Hazard Mitigation Plan notes that Crescent and similar intrusive rocks are the dominant lithology where shallow landslides occur. Deep-seated landslides are found more in surrounding marine and nearshore sediments (Washington Emergency Management Division, 2014).

Landslide hazard areas and steep slopes within the planning area are shown on Figure 11-5. The landslide areas presented are a combination of Clark County and Washington Department of Natural Resources datasets that show historical, potential or active landslide hazard areas compiled from a variety of landslide databases.

11.2.3 Frequency

Landslides are an annual event in Clark County, and significant events occur every five years on average. Landslides are often triggered by other natural hazards such as earthquakes, heavy rain, floods or wildfires, so landslide frequency is often related to the frequency of these other hazards.
Slides can occur at any time, although most occur during the rainy season. All of the significant landslides in Clark County have occurred in November, December or January. These landslides typically occur during and after major storms, so the potential for landslides largely coincides with the potential for sequential severe storms that saturate steep, vulnerable soils. Precipitation influences the timing of landslides on three scales: total annual rainfall, monthly rainfall, and single precipitation events. In general, landslides are most likely during periods of higher than average rainfall.

11.2.4 Severity

Landslides destroy property and infrastructure and can take the lives of people. Landslides in Clark County are typically not sudden releases of material and are a function of saturation from heavy rain and snowmelt (CRESA 2004). Landslide events often occur concurrently with other hazard events, so damage estimates specifically related to landslide are difficult to obtain. There are no records of fatalities attributed to mass movement in the County. However, deaths have occurred in neighboring Washington counties and across the west coast as a result of slides and slope collapses.
The State Road 530 landslide that occurred in Oso, Washington showed the devastating damage that can be caused by landslides. On March 22, 2014, the slide traveled over 60 mph, covering over a square mile of land and depositing a thickness of 15 to 75 feet in some areas. The slide caused 43 fatalities and 12 injuries, destroyed 37 homes, and destroyed State Route 530 for over a mile. The debris blocked the North Fork Stillaguamish River for over 24 hours, backing up a pool of water that flooded the valley about 2 miles upstream and reached approximately 20 feet deep, inundating an additional 6 homes. Total property damage was estimated at $60 million (NOAA 2015). Although Oso is located in the northern part of the state and Clark County in the southern part, the magnitude of this event as well as its occurrence in the same state have heightened the awareness of the severity of this hazard in the planning area.

Landslide Hazard Areas

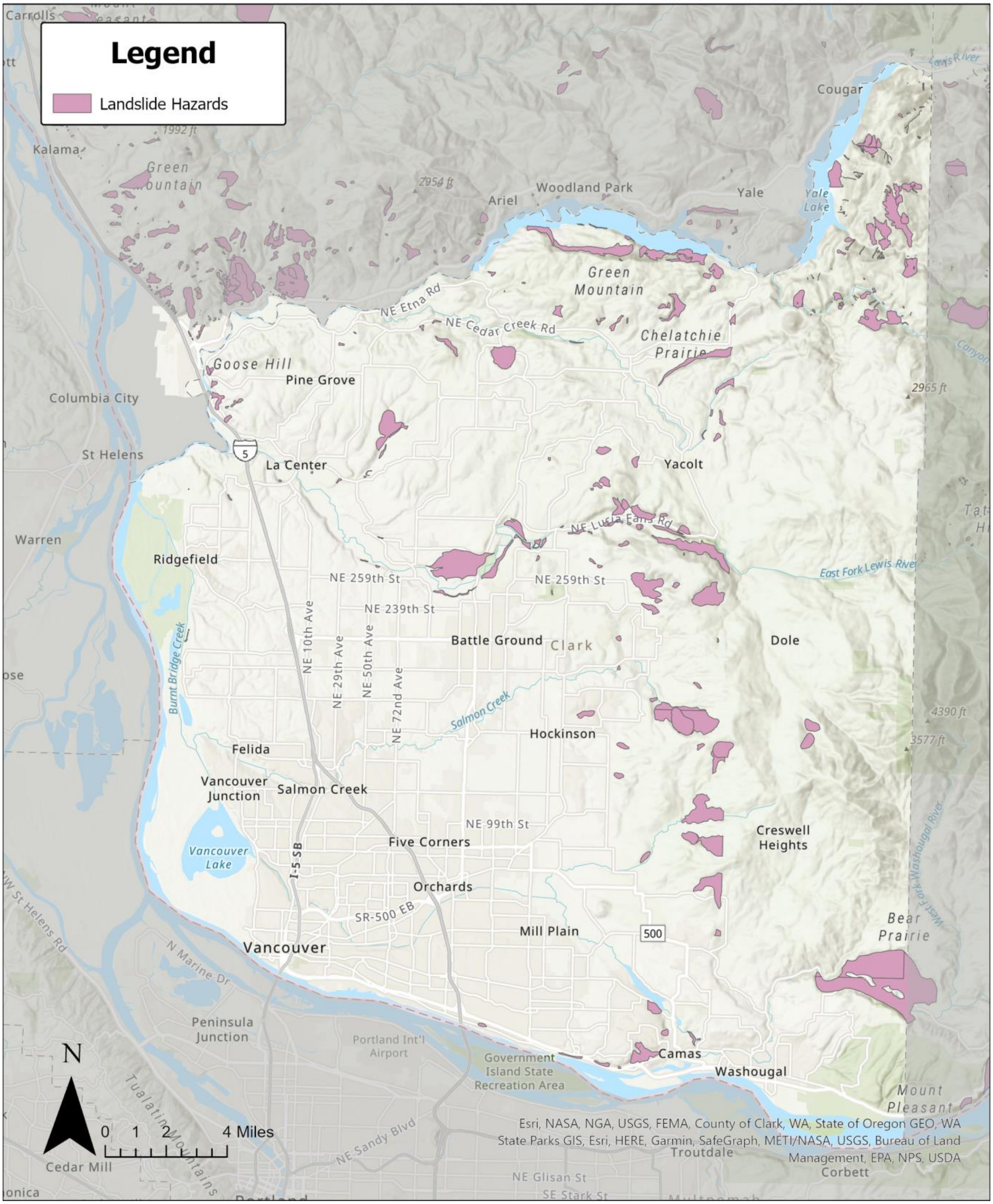


Figure 11-5. Landslide Hazard Areas

11.2.5 Warning Time

Mass movements can occur suddenly or slowly. The velocity of movement may range from inches per year to many feet per second, depending on slope angle, material and water content. Generally accepted warning signs for landslide activity include the following:

- Springs, seeps, or saturated ground in areas that have not typically been wet before
- New cracks or unusual bulges in the ground, street pavements or sidewalks
- Soil moving away from foundations
- Ancillary structures such as decks and patios tilting and/or moving relative to the main house
- Tilting or cracking of concrete floors and foundations
- Broken water lines and other underground utilities
- Leaning telephone poles, trees, retaining walls or fences
- Offset fence lines
- Sunken or down-dropped road beds
- Rapid increase in creek water levels, possibly accompanied by increased turbidity (soil content)
- Sudden decrease in creek water levels though rain is still falling or just recently stopped
- Sticking doors and windows, and visible open spaces indicating frames out of plumb
- A faint rumbling sound that increases in volume as the landslide nears
- Unusual sounds, such as trees cracking or boulders knocking together.

Some methods used to monitor mass movements can provide an idea of the type of movement and the amount of time prior to failure. Assessing the geology, vegetation and amount of predicted precipitation for an area can help in predictions of what areas are generally at risk. Currently, there is no practical warning system for individual landslides. The standard operating procedure is to monitor situations on a case-by-case basis and respond after an event has occurred.

The Washington Geological Survey, in cooperation with NOAA, has developed a generalized landslide awareness map for shallow landslides. Located here, WGS Mapped Landslides the forecasting model is based on recent and predicted rainfall data. The awareness map is not intended to forecast individual landslide events before they occur, but it will be a useful system for alerting residents to be more vigilant about landslide risk. The landslide awareness map associated with this system provides additional information by county for residents (Washington Department of Natural Resources, 2016b).

11.3 SECONDARY HAZARDS

Landslides can cause several types of secondary effects, such as blocking access to roads, which can isolate residents and businesses and delay commercial, public and private transportation. This could result in economic losses for businesses. Other potential problems resulting from landslides are power and communication failures. Vegetation or poles on slopes can be knocked over, resulting in possible losses to power and communication lines. Landslides also have the potential of destabilizing the foundation of structures, which may result in monetary loss for residents. They also can damage rivers or streams, potentially harming water quality, fisheries and other habitat.

11.4 EXPOSURE

Landslides exposure data is related to the landslide hazard area map shown in Figure 11-5 Landslide Hazard Area.

11.4.1 Population

Population could not be examined by landslide hazard area because census block group areas do not coincide with the hazard areas. A population estimate was made using the structure count of buildings within the landslide hazard areas and applying the census value of 2.7 persons per household for Clark County and 3.17 persons per household for the City of Woodland. Using this approach, the estimated population living in the landslide risk area is 10,580 or 2.3 percent of the total planning area population. This includes only populations within defined landslide risk areas; it does not include persons who may be impacted by landslide runout. Table 11-1 shows the estimated population exposure by city.

Table 11-1. Estimated Population Residing in Landslide Risk Areas

	Population Exposed[a]	% of Total Population
Battle Ground	251	1.3%
Camas	2,084	9.8%
La Center	176	5.7%
Ridgefield	257	4.0%
Vancouver	470	0.3%
Washougal	772	5.1%
Woodland	10	0.2%
Yacolt	162	10.0%
Unincorporated	6,399	3.0%
Total	**10,580**	**2.3%**

a. Value calculated as number of buildings exposed multiplied by 2.7 people (Clark Co) / 3.17 people (Woodland) per building. This multiplier is the number of persons per household per the U.S. Census Bureau, State, County and City Quick Facts 2009-2015.

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

11.4.2 Property

Table 11-2 shows the number and replacement value of structures exposed to the landslide risk. Table 11-3 shows the types of structures in landslide hazard areas. There are an estimated 3,918 structures on parcels in the landslide risk areas, with an estimated value of $1.88 billion. This represents 1.7 percent of the total replacement value for the planning area. Over 98 percent of the exposed structures are estimated to be residential structures. Table 11-4 shows the general land use of parcels exposed to landslides in Clark County. Most of the land area of parcels intersecting landslide hazard areas is residential (56.5 percent); agricultural/resource lands make up 29.3 percent.

Table 11-2. Exposure and Value of Structures in Landslide Risk Areas

	Buildings Exposed	Value Exposed			% of Total Replacement Value
		Structure	Contents	Total	
Battle Ground	93	$27,118,550	$13,559,275	$40,677,825	1.0%
Camas	772	$290,399,860	$179,019,753	$469,419,613	6.2%
La Center	65	$19,576,851	$10,324,107	$29,900,958	3.7%
Ridgefield	95	$28,711,585	$15,871,853	$44,583,438	2.1%
Vancouver	174	$65,356,297	$34,422,777	$99,779,073	0.2%
Washougal	286	$78,247,726	$39,123,863	$117,371,589	2.8%
Woodland	3	$534,793	$267,396	$802,189	0.0%
Yacolt	60	$7,772,765	$3,886,382	$11,659,147	3.8%
Unincorporated	2,370	$662,389,959	$407,534,166	$1,069,924,125	2.4%
Total	**3,918**	**$1,180,108,386**	**$704,009,572**	**$1,884,117,957**	**1.7%**

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

Table 11-3. Structures in Landslide Hazard Areas

	Number of Structures in Landslide Hazard Areas							
	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Battle Ground	93	0	0	0	0	0	0	93
Camas	763	6	0	2	0	0	1	772
La Center	64	1	0	0	0	0	0	65
Ridgefield	94	0	0	0	1	0	0	95
Vancouver	172	0	0	2	0	0	0	174
Washougal	286	0	0	0	0	0	0	286
Woodland	3	0	0	0	0	0	0	3
Yacolt	60	0	0	0	0	0	0	60
Unincorporated	2,317	6	0	41	4	2	0	2,370
Total	**3,852**	**13**	**0**	**45**	**5**	**2**	**1**	**3,918**

Table 11-4. Present Land Use in Parcels Intersecting Landslide Risk Areas[a]

Present Use Classification[b]	Area in Landslide Risk Area (acres)[c, d]	% of total exposed acreage
Agriculture/Resource Land	38,089	29.3%
Commercial	4,034	3.1%
Education	778	0.6%
Governmental Services	2,904	2.2%
Industrial	1,013	0.8%
Religious Services	64	0.0%
Residential	73,433	56.5%
Vacant or uncategorized	9,643	7.4%
Total	**129,957**	**100%**

a. Present land use information in this plan is for planning purposes only. Discrepancies may exist between these estimates and official records maintained by participating jurisdictions.
b. Present use classification provided by Clark and Cowlitz County assessor's data assigned to best fit occupancy classes in FEMA's Hazus model (see Section 6.3.1). Parcels for which conflicting information on current development was available were assumed to be improved. Some designated resource land may also be included in the vacant or uncategorized category.
c. Acreage covers only mapped parcels; it excludes many rights of way and major water features.
d. Acreage includes Clark County and the incorporated area of the City of Woodland.

11.4.3 Critical Facilities and Infrastructure

Table 11-5 summarizes the critical facilities exposed to the landslide hazard. The following infrastructure can be exposed to mass movements:

- Roads—Roads are frequently partially or completely blocked by landslides. Major roads in the planning area that intersect mapped hazard areas include Interstates 5 and 205 and State Routes 14, 500, 501, 502 and 503.
- Power Lines—Power lines are generally elevated above steep slopes, but a landslide can trigger failure of the soil underneath the towers supporting them, causing collapse and ripping down the lines.
- Rail Lines—The BNSF Railway and the Clark County Railroad cross Clark County. The BNSF Railway passes through Ridgefield along a slope currently classified as potentially unstable. The Lewis and Clark Railway passes between Battleground and Yacolt in an area that is classified as a slope of potential instability. The BNSF Railway also passes along dangerous slopes in Camas and Washougal, as well as areas where old landslide debris was located (CRESA 2004).

- Pipelines— Pipelines can de damaged or buried by landslides. Both the Northwest and Olympic pipelines cross through landslide hazard areas.

Table 11-5. Critical Facilities and Infrastructure Exposed to Landslide Hazard

	Commu-nication Facilities	Dams	Emer-gency Services	Energy	Govern-ment Facilities	Hazardous Materials	Health Care & Public Health	Infor-mation Technol-ogy	Schools	Trans-portation Systems	Water & Sanitation Systems	Total
Battle Ground	0	0	0	0	0	0	0	0	0	0	0	**0**
Camas	0	0	0	0	0	0	3	0	1	1	5	**10**
La Center	0	0	0	0	0	0	0	0	0	0	2	**2**
Ridgefield	0	0	0	0	0	0	0	0	0	0	1	**1**
Vancouver	0	0	0	0	0	0	0	0	0	1	0	**1**
Washougal	0	0	0	0	0	0	0	0	0	0	0	**0**
Woodland	0	0	0	0	0	0	0	0	0	0	0	**0**
Yacolt	0	0	0	0	0	0	0	0	0	0	0	**0**
Unincorporated	0	0	0	0	0	0	0	0	1	12	15	**28**
Total	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**2**	**14**	**23**	**42**

11.4.4 Environment

Landslides that fall into streams may significantly impact fish and wildlife habitat, as well as affecting water quality. Hillsides that provide wildlife habitat can be lost for prolonged periods due to landslides. Topography may shift, and sediment accumulation downslope can block waterways and roadways, impacting the quality of streams and other water bodies. However, landslides also provide resources for many ecosystems. They contribute sediment and wood needed for building complex in-stream habitats, estuarine marshes, and beaches that are important for fisheries, wildlife and recreation (Washington Department of Community, Trade and Economic Development, 2007).

11.5 VULNERABILITY

11.5.1 Population

Due to the nature of census block group data, it is difficult to estimate populations vulnerable to landslides. In general, all of the estimated 10,580 persons exposed to the landslide hazard are considered to be vulnerable. Increasing population, and the fact that many homes are built on view property atop or below bluffs and on steep slopes subject to mass movement, increases the number of lives endangered by this hazard. In addition, people may be impacted if transportation corridors are disrupted by the landslide hazard.

11.5.2 Property

Loss estimations for the landslide hazard are not based on modeling using damage functions, because no such damage functions have been generated. Instead, loss potential was developed representing 10 percent, 30 percent and 50 percent of the replacement value of exposed structures. This allows emergency managers to select a range of economic impact based on an estimate of the percent of damage to the general building stock. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction of the structure. Table 11-6 shows the general building stock loss estimates in landslide risk areas. It is highly unlikely that all landslide-prone areas would slide at the same time.

Table 11-6. Loss Potential for Landslide

	Exposed Value	Estimated Loss Potential from Landslide		
		10% Damage	30% Damage	50% Damage
Battle Ground	$40,677,825	$46,941,961	$140,825,884	$234,709,807
Camas	$469,419,613	$2,990,096	$8,970,287	$14,950,479
La Center	$29,900,958	$4,458,344	$13,375,031	$22,291,719
Ridgefield	$44,583,438	$9,977,907	$29,933,722	$49,889,537
Vancouver	$99,779,073	$11,737,159	$35,211,477	$58,685,795
Washougal	$117,371,589	$80,219	$240,657	$401,095
Woodland	$802,189	$1,165,915	$3,497,744	$5,829,574
Yacolt	$11,659,147	$46,941,961	$140,825,884	$234,709,807
Unincorporated	$1,069,924,125	$2,990,096	$8,970,287	$14,950,479
Total	**$1,884,117,957**	**$127,283,658**	**$381,850,973**	**$636,418,292**

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

11.5.3 Critical Facilities and Infrastructure

There are 42 critical facilities exposed to the landslide hazard to some degree. A more in-depth analysis of mitigation measures taken by these facilities should be done to determine if they could withstand impacts of a mass movement. No loss estimates were developed due to the lack of established damage functions for the landslide hazard.

All infrastructure and transportation corridors identified as exposed to the landslide hazard are considered vulnerable until more information becomes available. Protecting roads from hazards becomes particularly important in situations where they provide the only route into and out of an area. Particular areas of concern include some roads that occur in developments in Camas, Washougal, Ridgefield and La Center (CRESA 2004).

11.5.4 Environment

The environment vulnerable to landslide hazard is the same as the environment exposed to the hazard.

11.5.5 Economic Impact

The economic impact of a landslide depends on its severity and location. Minor landslides may not lead to any economic impact if they occur in the woods or non-populated areas. Minor landslides in more populated areas can have an economic impact, as they can lead to temporary road closures that cause isolation in neighborhoods and traffic delays for public and private transportation. This can result in losses for businesses if employees are unable to make it to work or if customers choose to not shop because of transportation difficulties. Landslide economic losses can be categorized in several ways (USGS 2001):

- Direct or indirect:
  - Direct losses include costs for replacement, repair, rebuilding, and maintenance resulting from landslide damage to property.
  - Indirect losses include the following:
    - Reduced real estate values in areas threatened by landslides
    - Loss of tax revenues on properties devalued by landslides
    - Loss of industrial, agricultural, and forest productivity, and of tourist revenues
    - Loss of human or domestic animal productivity because of death, injury, and psychological trauma
    - Costs of mitigation and prevention activities to reduce landslide risks.
- Private or public costs:

- Private costs are mainly incurred as damage to land and structures, such as private property or industrial facilities.
- Public costs are those borne by government agencies. The largest public cost is the repair or relocation of highways/roads and accessory structures (sidewalks, storm drains, etc.) after an event.

11.6 FUTURE TRENDS

11.6.1 Development

The State of Washington has adopted the International Building Code by reference in its Washington Building Standards Code. The International Building Code includes provisions for geotechnical analyses in steep slope areas that have soil types considered susceptible to landslide hazards. These provisions ensure that new construction is built to standards that reduce vulnerability to the landslide risk. In addition, all municipal planning partners have comprehensive plans that define landslide hazard areas as critical areas and have adopted critical areas ordinances that regulate development in landslide-prone areas. This will facilitate wise land use decisions as future growth impacts landslide hazard areas. It is anticipated that some new development will be exposed to landslide risk, as runout models do not yet exist and it is likely that not all landslide hazard areas have been identified.

Table 11-7 shows the area identified as underutilized or vacant in urban growth areas in the County that intersect identified landslide hazard areas. These estimates do not include area within parcels that have been designated as critical areas and, thus, are believed to be at the greatest risk from landslide hazards.

Table 11-7. Buildable Lands in Planning Area Urban Growth Areas Intersecting Landslide Hazard Areas[a]

	Buildable Area[c] (acres)				
	Residential				
Urban Growth Area[b]	Acres	Units	Commercial	Industrial	Total
Battle Ground	213.81	1,283	23.25	24.35	**261.41**
Camas	271.02	1,626	0.50	7.21	**278.73**
La Center	237.66	951	35.32	46.31	**319.29**
Ridgefield	576.54	3,459	24.65	136.19	**737.38**
Vancouver	451.57	3,612	51.05	80.31	**582.93**
Washougal	131.89	792	5.51	68.20	**206.60**
Woodland[d]	--	--	--	--	**--**
Yacolt	2.50	10	0	5.86	**8.36**
Total	**1,884.99**	**11,733**	**140.28**	**368.43**	**14,126.70**

a. Buildable lands information in this plan is for planning purposes only. Discrepancies may exist between these estimates and official records maintained by participating jurisdictions.
b. Unincorporated areas outside of urban growth areas are excluded from this assessment. Development in these areas consists largely of rural lands, open space and large residential lots. Changes in development can be assessed through
c. Acreage covers only mapped parcels; it excludes many rights of way and major water features.
d. Acreage estimates exclude the portions of the City of Woodland in Cowlitz County and thus may be underestimated.

11.6.2 Climate Change

Climate change may impact storm patterns, increasing the probability of more frequent, intense storms with varying duration. Increase in global temperature could affect the snowpack and its ability to hold and store water. Warming temperatures also could increase the occurrence and duration of droughts, which would increase the probability of wildfire, reducing the vegetation that helps to support steep slopes. All of these factors would increase the probability for landslide occurrences.

11.7 SCENARIO

The worst-case scenario for landslide in the planning area would be a severe storm with heavy rain that pushes precipitation levels above the thresholds identified by USGS, followed by an earthquake. This scenario is most likely to occur during late winter when the water table is high. An earthquake is likely to trigger landslides across the County that would complicate response and recovery efforts to the initial hazard event.

As a standalone event, a major landslide that occurred during a severe storm would create road obstructions and create isolation problems for residents and businesses in the more sparsely developed areas. It is likely that property owners located on steep slopes would suffer damage to property or structures. In addition to this, landslides carrying vegetation, such as shrubs and trees, may cause a break in power or communication lines, cutting off power and communication access to residents. Continued heavy rains and flooding would complicate this problem further. As emergency responders in Clark County attend to problems with flooding, it is possible they may be unavailable to assist with landslides occurring all over the county. This would worsen the problem of isolation for residents and business (CRESA 2004).

11.8 ISSUES

Landslides are often a secondary hazard related to other natural disasters. Landslide-triggering rainstorms often produce damaging floods. Earthquakes often induce landslides that can cause additional damage. The identification of areas susceptible to landslides is necessary to support grading, building, foundation design, housing density, and other land development regulations in reducing the risk of property damage and personal injury. The most significant effect of landslides in Clark County is the disruption of transportation and the destruction of private and public property. Important issues associated with landslides in the planning area include the following:

- It is estimated that more than 10,000 people (2.3 percent of the population) reside within landslide risk areas. This does not include residences that may be in landslide runout areas.
- An estimated 1.7 percent of the replacement value of the planning area ($1.88 million) is located in landslide hazard areas; 80 percent of this is in unincorporated areas of the county and the City of Camas.
- There are more than 3,900 structures in landslide hazard areas. About 98 percent of them are residential.
- Although known landslide hazard areas and steep slopes are subject to regulation under critical area ordinances, continued development pressures could lead to more homes in landslide risk areas. Furthermore, landslides may occur that threaten people and property outside of the mapped risk areas.
- Current maps show areas that might be unstable, but do not offer a complete picture of areas at risk, as they do not indicate runout (where a landslide might go). Mapping and assessment of landslide hazards are constantly evolving. As new data and science become available, assessments of landslide risk should be reevaluated.
- The impact of climate change on landslides is uncertain. Climate change impacts that alter vegetation patterns, increase the occurrence of wildfires, or alter precipitation patterns may increase exposure to landslide risks.
- Landslides may cause negative environmental consequences, including water quality degradation.
- Areas with significant landslide risk should be monitored, to the extent possible, immediately following a possible triggering event. Officials may need to focus the majority of attention on emergency response; however, the possibility for a secondary event should not be disregarded.

- Facilities that contain hazardous materials located in landslide hazard areas may present additional risks.
- Additional studies should be performed that assess the risks from seismically induced landslides.
- Landslides in the County often impact transportation corridors limiting ingress and egress and creating issues of isolation.
- There are 42 critical facilities located in mapped landslide hazard areas in the planning area. Most of these facilities are sanitation system and transportation facilities in Camas and unincorporated County areas.
- Buildable lands analysis indicates that there is the potential for exposure to landslide risk to increase in the planning area. Although the most susceptible areas are regulated through critical areas ordinances, exposure can increase as current regulations may not include run out.

12. SEVERE WEATHER

12.1 GENERAL BACKGROUND

Severe weather refers to any dangerous meteorological phenomena with the potential to cause damage, serious social disruption, or loss of human life. Severe weather, technically, is not the same as extreme weather, which refers to unusual weather events at the extremes of the historical distribution for a given area. It includes thunderstorms, hail storms, damaging winds, tornadoes, excessive heat, snowstorms, ice storms, blizzards, and extreme cold. The most common severe weather events that impact Clark County are winter weather (snowstorms, ice storms or extreme cold) and windstorms. All types of severe weather that affect the planning area are described in the following sections. Flooding issues associated with severe weather are discussed in Chapter 10.

12.1.1 Damaging Winds

Winds exceeding 60 mph are classified as damaging winds. There are seven types of damaging winds:

- **Straight-line winds**—Any thunderstorm wind that is not associated with rotation; this term is used mainly to differentiate from tornado winds. Most thunderstorms produce some straight-line winds as a result of outflow generated by the thunderstorm downdraft.
- **Downdrafts**—A small-scale column of air that rapidly sinks toward the ground.
- **Downbursts**—A strong downdraft with horizontal dimensions larger than 2.5 miles resulting in an outward burst or damaging winds on or near the ground. Downburst winds may begin as a microburst and spread out over a wider area, sometimes producing damage similar to a strong tornado. Although usually associated with thunderstorms, downbursts can occur with showers too weak to produce thunder.
- **Microbursts**—A small concentrated downburst that produces an outward burst of damaging winds at the surface. Microbursts are generally less than 2.5 miles across and short-lived, lasting only 5 to 10 minutes, with maximum wind speeds up to 168 mph. There are two kinds of microbursts: wet and dry. A wet microburst is accompanied by heavy precipitation at the surface. Dry microbursts occur with little or no precipitation reaching the ground.
- **Gust front**—A gust front is the leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. Sometimes the winds push up air above them, forming a shelf cloud or detached roll cloud.
- **Derecho**—A derecho is a widespread thunderstorm wind caused when new thunderstorms form along the leading edge of an outflow boundary (the boundary formed by horizontal spreading of thunderstorm-cooled air). The word “derecho” is Spanish and means “straight ahead.” Thunderstorms feed on the boundary and continue to reproduce. Derechos typically occur in summer when complexes of thunderstorms form over plains, producing heavy rain and severe wind. The damaging winds can last a long time and cover a large area.

- **Bow Echo—**A bow echo is a linear wind front bent outward in a bow shape. Damaging straight-line winds often occur near the center of a bow echo. Bow echoes can be 200 miles long, last for several hours, and produce extensive wind damage at the ground.

Damage from winds accounts for half of all severe weather reports in the continental U.S. Winds can reach speeds up to 100 mph and can produce a damage path extending for hundreds of miles. Windstorms in Washington typically occur from October through March (Washington Emergency Management Division, 2014).

12.1.2 Extreme Temperatures

Excessive Heat Events

Excessive heat events are defined by the U.S. EPA as "summertime weather that is substantially hotter and/or more humid than average for a location at that time of year" (U.S. EPA, 2006). Heat waves are excessive heat events that typically last two or more days (CDC, 2014b). Because extreme heat is relative to the usual weather in a region, criteria that define an extreme heat event may differ among jurisdictions and with the time of year. In general, extreme heat events can be characterized by temperatures greater than 90°F, warm stagnant air masses and consecutive nights with higher-than-usual minimum temperatures (CDC, 2009).

Heat Index

Extreme heat events are often a result of more than ambient air temperature. Heat index tables (see Figure 12-1) are commonly used to provide information about how hot it feels based on several meteorological conditions. Heat index values are for shady, light wind conditions; exposure to full sunshine can increase heat index values by up to 15°F. Strong winds with very hot, dry air also can be extremely hazardous (NWS, 2014b).

Source: National Weather Service/NOAA

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution Extreme Caution Danger Extreme Danger

Figure 12-1. Heat Index Chart

Heat Islands

Extreme heat events may be exacerbated in urban areas, where reduced air flow, reduced vegetation and increased generation of waste heat can contribute to temperatures that are several degrees higher than in surrounding rural or less urbanized areas. When urban buildings, roads and other infrastructure replace open land and vegetation, surfaces that were once permeable and moist become impermeable and dry. These changes cause urban areas to become warmer than the surrounding areas, serving as contiguous regions of higher temperatures. This phenomenon is known as urban heat island effect. Heat islands can affect communities by increasing peak summer energy demand, air pollution, greenhouse gas emissions, heat-related illness and death, and water quality degradation.

Extreme Cold and Wind Chill

Weather that constitutes extreme cold varies across different parts of the U.S. In regions relatively unaccustomed to winter weather, near freezing temperatures are considered extreme cold (CDC, 2014a). Extreme cold can often accompany severe winter storms. Wind can exacerbate the effects of cold temperatures by carrying heat away from the body more quickly, thus making it feel colder than is indicated by the temperature. This phenomenon is known as wind chill. Wind chill is the temperature that your body feels when the air temperature is combined with wind speed (CDC, 2014a). Figure 12-2 shows the value of wind chill based on ambient temperature and wind speed.

Source: National Weather Service/NOAA

Wind (mph)	Temperature (°F)																	
Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Figure 12-2. Wind Chill Chart

12.1.3 Severe Winter Weather

Blizzards and Snowstorms

The National Weather Service defines a winter storm as having significant snowfall, ice and/or freezing rain; the quantity of precipitation varies by elevation. Heavy snowfall is 4 inches or more in a 12-hour period, or 6 inches or more in a 24-hour period in non-mountainous areas; and 12 inches or more in a 12-hour period or 18 inches or more in a 24-hour period in mountainous areas. There are three key ingredients to a severe winter storm:

- Cold Air—Below-freezing temperatures in the clouds and near the ground are necessary to make snow and/or ice.
- Moisture—Moisture is required in order to form clouds and precipitation. Air blowing across a body of water, such as a large lake or the ocean, is a typical source of moisture.
- Lift—Lift is required in order to raise the moist air to form the clouds and cause precipitation. An example of lift is warm air colliding with cold air and being forced to rise over the cold dome. The boundary between the warm and cold air masses is called a front. Another example of lift is air flowing up a mountain side.

Areas most vulnerable to winter storms are those affected by convergence of dry, cold air from the interior of the North American continent and warm, moist air off the Pacific Ocean. When strong storms crossing the Pacific arrive at the coast, if the air is cold enough, snow falls. As the moisture rises into the mountains, heavy snow closes mountain passes and can cause avalanches. Cold air from the north has to filter through mountain canyons into basins and valleys to the south. If the cold air is deep enough, it can spill over a mountain ridge. As the air funnels through canyons and over ridges, wind speeds can reach 100 mph. High winds with snow results in a blizzard.

Ice Storms

The National Weather Service defines an ice storm as a storm that results in the accumulation of at least 0.25 inches of ice on exposed surfaces. Ice storms occur when rain falls from a warm, moist, layer of atmosphere into a below freezing, drier layer near the ground. The rain freezes on contact with the cold ground and exposed surfaces, causing damage to trees, utility wires, and structures (see Figure 12-3).

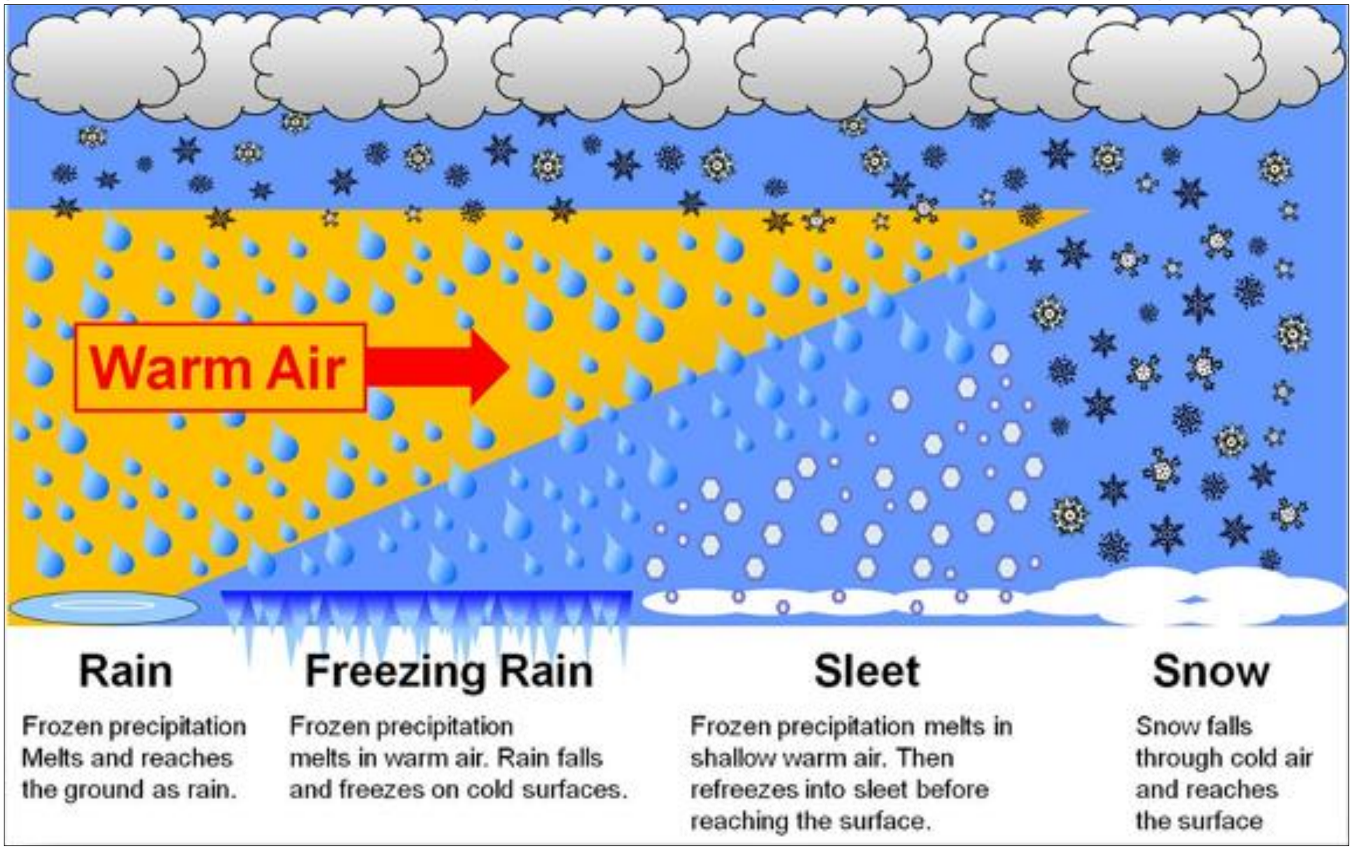


Figure 12-3. The Formation of Different Kinds of Precipitation

Ice accretion generally ranges from a trace to 1 inch. Accumulations between 1/4-inch and 1/2-inch can cause small branch and faulty limb breakage. Accumulations of 1/2-inch to 1 inch can cause significant breakage. Strong winds increase the potential for damage from ice accumulation.

12.1.4 Thunderstorms and Lightning

A thunderstorm is a rain event that includes thunder and lightning. A thunderstorm is classified as "severe" when it contains one or more of the following: hail with a diameter of three-quarter inch or greater, winds gusting in excess of 50 knots (57.5 mph), or tornado. Approximately 10 percent of the 100,000 thunderstorm that occur nationally every year are classified as severe (NOAA, 2014).

Three factors cause thunderstorms to form: moisture, rising unstable air (air that keeps rising when disturbed), and a lifting mechanism to provide the disturbance. The sun heats the surface of the earth, which warms the air above it. If this warm surface air is forced to rise (hills or mountains can cause rising motion, as can the interaction of warm air and cold air or wet air and dry air) it will continue to rise as long as it weighs less and stays warmer than the air around it. As the air rises, it transfers heat from the surface of the earth to the upper levels of the atmosphere (the process of convection). The water vapor it contains begins to cool and it condenses into a cloud. The cloud eventually grows upward into areas where the temperature is below freezing. Some of the water vapor turns to ice and some of it turns into water droplets. Both have electrical charges. Ice particles usually have positive charges, and rain droplets usually have negative charges. When the charges build up enough, they are discharged in a bolt of lightning, which causes the sound waves we hear as thunder. Thunderstorms have three stages (see Figure 12-4):

- The *developing stage* of a thunderstorm is marked by a cumulus cloud being pushed upward by a rising column of air (updraft). The cumulus cloud soon looks like a tower. There is little to no rain during this stage but occasional lightning. The developing stage lasts about 10 minutes.
- As the updraft continues, the thunderstorm enters the *mature stage* when precipitation begins to fall and a downdraft begins (a column of air pushing downward). When the downdraft and rain-cooled air spread out along the ground, they form a gust front, or a line of gusty winds. The mature stage is the most likely time for hail, heavy rain, frequent lightning, strong winds, and tornadoes. The storm occasionally has a black or dark green appearance.
- Eventually, a large amount of precipitation is produced and the updraft is overcome by the downdraft beginning the *dissipating stage*. At the ground, the gust front moves out a long distance from the storm and cuts off the warm moist air that was feeding the thunderstorm. Rainfall decreases in intensity, but lightning remains a danger.

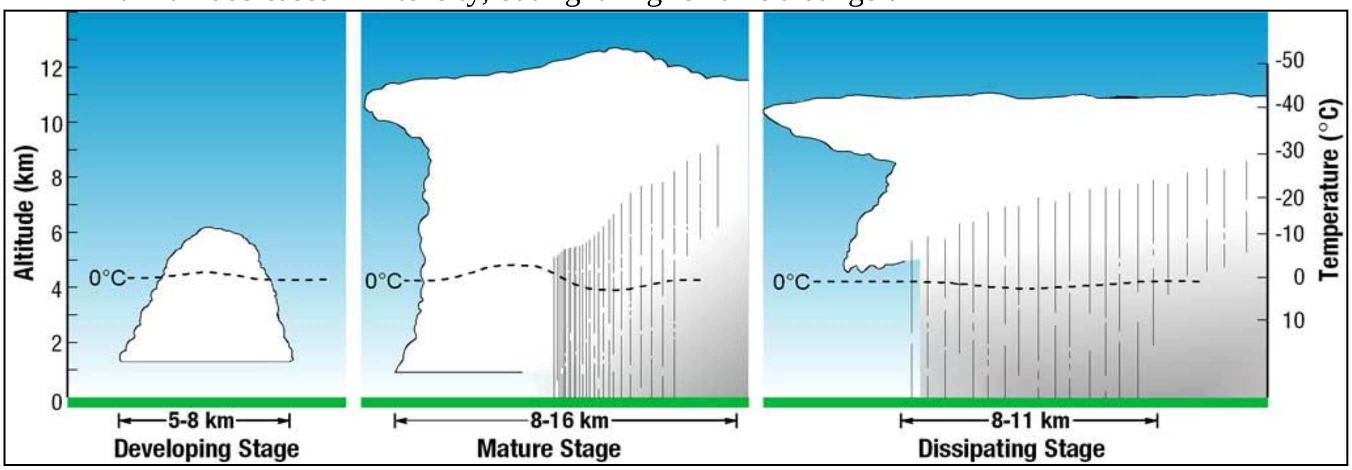


Figure 12-4. The Thunderstorm Life Cycle

There are four types of thunderstorms:

- **Single-Cell Thunderstorms**—Single-cell thunderstorms usually last 20 to 30 minutes. A true single-cell storm is rare, because the gust front of one cell often triggers the growth of another. Most single-cell storms are not usually severe, but a single-cell storm can produce a brief severe weather event. When this happens, it is called a pulse severe storm.
- **Multi-Cell Cluster Storm**—A multi-cell cluster is the most common type of thunderstorm. The multi-cell cluster consists of a group of cells, moving as one unit, with each cell in a different phase of the thunderstorm life cycle. Mature cells are usually found at the center of the cluster and dissipating cells at the downwind edge. Multi-cell cluster storms can produce moderate-size hail, flash floods and weak tornadoes. Each cell in a multi-cell cluster lasts only about 20 minutes; the multi-cell cluster itself may persist for several hours. This type of storm is usually more intense than a single cell storm.
- **Multi-Cell Squall Line**—A multi-cell line storm, or squall line, consists of a long line of storms with a continuous well-developed gust front at the leading edge. The line of storms can be solid, or there can be gaps and breaks in the line. Squall lines can produce hail up to golf-ball size, heavy rainfall, and weak tornadoes, in addition to strong downdrafts. Occasionally, a strong

downburst will accelerate a portion of the squall line ahead of the rest of the line to produce a bow echo. Bow echoes can develop with isolated cells as well as squall lines. Bow echoes are easily detected on radar but are difficult to observe visually.

- **Super-Cell Storm**—A super-cell is a highly organized thunderstorm that poses a high threat to life and property. It is similar to a single-cell storm in that it has one main updraft, but the updraft is extremely strong, reaching speeds of 150 to 175 miles per hour. Super-cells are rare. The main characteristic that sets them apart from other thunderstorms is the presence of rotation. The rotating updraft of a super-cell (called a mesocyclone when visible on radar) helps the super-cell to produce extreme weather events, such as giant hail (more than 2 inches in diameter), strong downbursts of 80 miles an hour or more, and strong to violent tornadoes.

Lightning occurs in all thunderstorms. There are two main types of lightning: intra-cloud lightning and cloud-to-ground lightning (NWS, 2014). More information on lightning can be found in the following section.

Lightning

Lightning is an electrical discharge between positive and negative regions of a thunderstorm. A lightning flash is composed of a series of strokes, with an average of about four. The average duration of each stroke is about 30 microseconds.

Lightning is one of the more dangerous weather hazards in the United States. Each year, lightning is responsible for deaths, injuries, and millions of dollars in property damage, including damage to buildings, communications systems, power lines, and electrical systems. Lightning also causes forest and brush fires and deaths and injuries to livestock and other animals. According to the National Lightning Safety Institute, property damage, increased operating costs, production delays, and lost revenue from lightning and secondary effects exceed $6 billion per year (NLSI, 2008). Impacts can be direct or indirect. People or objects can be directly struck, or damage can occur indirectly when the current passes through or near it.

Intra-cloud lightning is the most common type of discharge. This occurs between oppositely charged centers within the same cloud. Usually it takes place inside the cloud and looks from the outside of the cloud like a diffuse brightening that flickers. However, the flash may exit the boundary of the cloud, and a bright channel can be visible for many miles.

Although not as common, cloud-to-ground lightning is the most damaging and dangerous form of lightning. Most flashes originate near the lower-negative charge center and deliver negative charge to earth. However, many flashes carry positive charge to earth, often during the dissipating stage of a thunderstorm's life. Positive flashes are more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike as far as 5 or 10 miles from the storm in areas that most people do not consider to be a threat. Positive lightning also has a longer duration, so fires are more easily ignited. And, when positive lightning strikes, it usually carries a high peak electrical current, potentially resulting in greater damage.

The ratio of cloud-to-ground and intra-cloud lightning can vary significantly from storm to storm. Depending upon cloud height above ground and changes in electric field strength between cloud and earth, the discharge stays within the cloud or makes direct contact with the earth. If the field strength is highest in the lower regions of the cloud, a downward flash may occur from cloud to earth. Using a network of lightning detection systems, the United States monitors an average of 25 million strokes of lightning from the cloud-to-ground every year.

U.S. lightning statistics compiled by the National Oceanic and Atmospheric Administration between 1959 and 1994 indicate that most lightning incidents occur in June, July and August and during the afternoon hours from between 2 and 6 p.m.

Hail Storms

Hail occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into ice. Super-cooled water may accumulate on frozen particles near the back-side of a storm as they are pushed forward across and above the updraft by the prevailing winds near the top of the storm. Eventually, the hailstones encounter downdraft air and fall to the ground. Hailstones grow two ways: by wet growth or dry growth. In wet growth, a tiny piece of ice is in an area where the air temperature is below freezing, but not super cold. When the tiny piece of ice collides with a super-cooled drop, the water does not freeze on the ice immediately. Instead, liquid water spreads across tumbling hailstones and slowly freezes. Since the process is slow, air bubbles can escape, resulting in a layer of clear ice. Dry growth hailstones grow when the air temperature is well below freezing and the water droplet freezes immediately as it collides with the ice particle. The air bubbles are "frozen" in place, leaving cloudy ice.

Hailstones can have layers like an onion if they travel up and down in an updraft, or they can have few or no layers if they are "balanced" in an updraft. Hailstones can begin to melt and then re-freeze together, forming large and very irregularly shaped hail.

12.1.5 Tornado

A tornado is a violently rotating column of air extending between, and in contact with, a cloud and the surface of the earth. Tornadoes are often (but not always) visible as a funnel cloud. On a local-scale, tornadoes are the most intense of all atmospheric circulations, with wind that can reach speeds of more than 300 mph. A tornado's vortex is typically a few hundred meters in diameter, and damage paths can be up to 1 mile wide and 50 miles long. Tornadoes can occur throughout the year at any time of day but are most frequent in the spring during the late afternoon. Figure 12-5 illustrates the potential impacts and damage from tornadoes of different magnitudes.

As shown in Figure 12-6, Washington has a very low to relatively low risk of tornadoes compared to states in the Midwestern and Southern U.S. Washington has experienced tornadoes on occasion. Some have produced significant damage, injury or death. Washington's tornadoes can be formed in association with large Pacific storms arriving from the west. Most of them, however, are caused by intense local thunderstorms. These storms also produce lightning, hail and heavy rain, and are more common during the warm season from April to October.

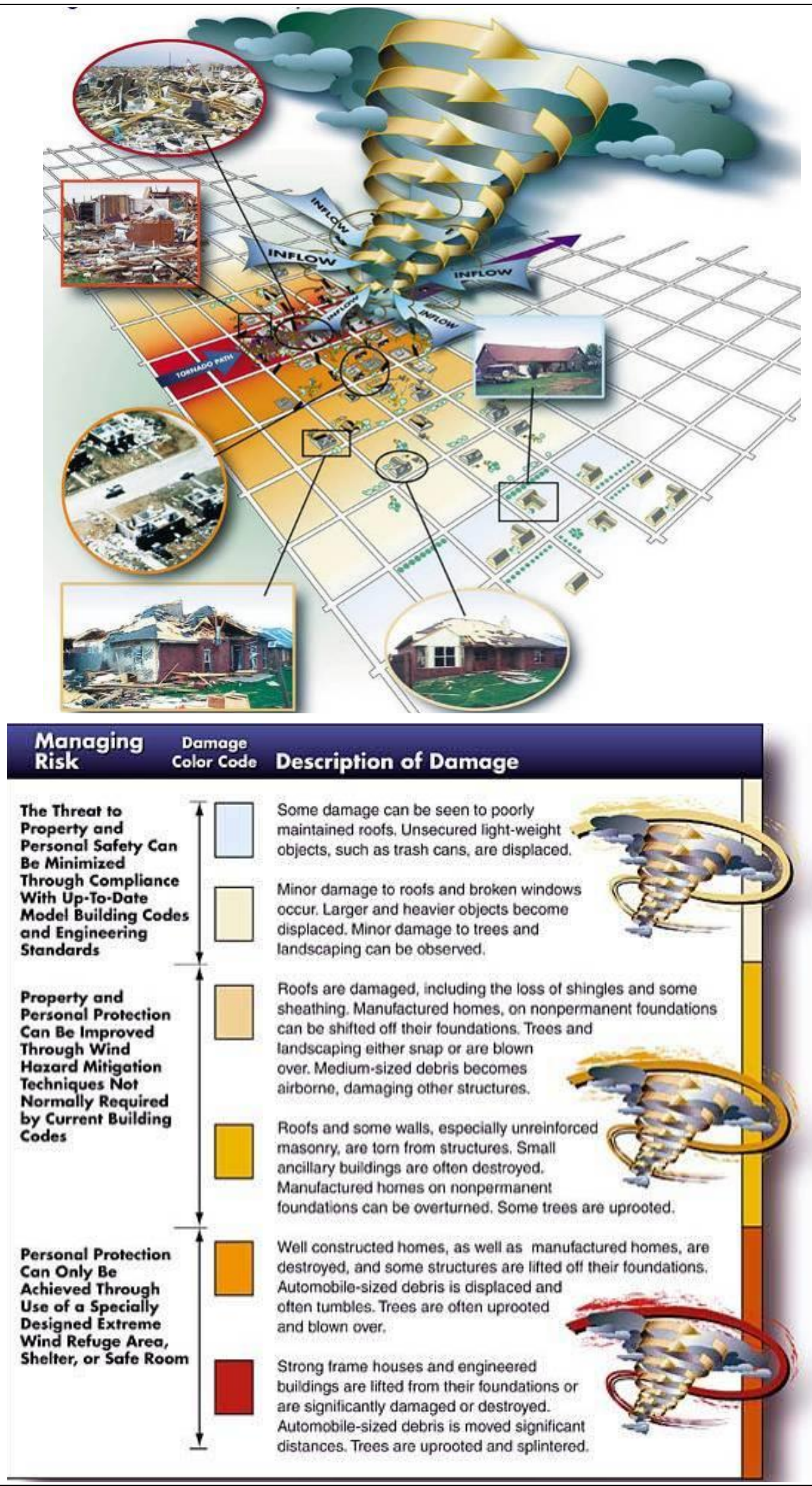


Figure 12-5. Potential Impact and Damage from a Tornado

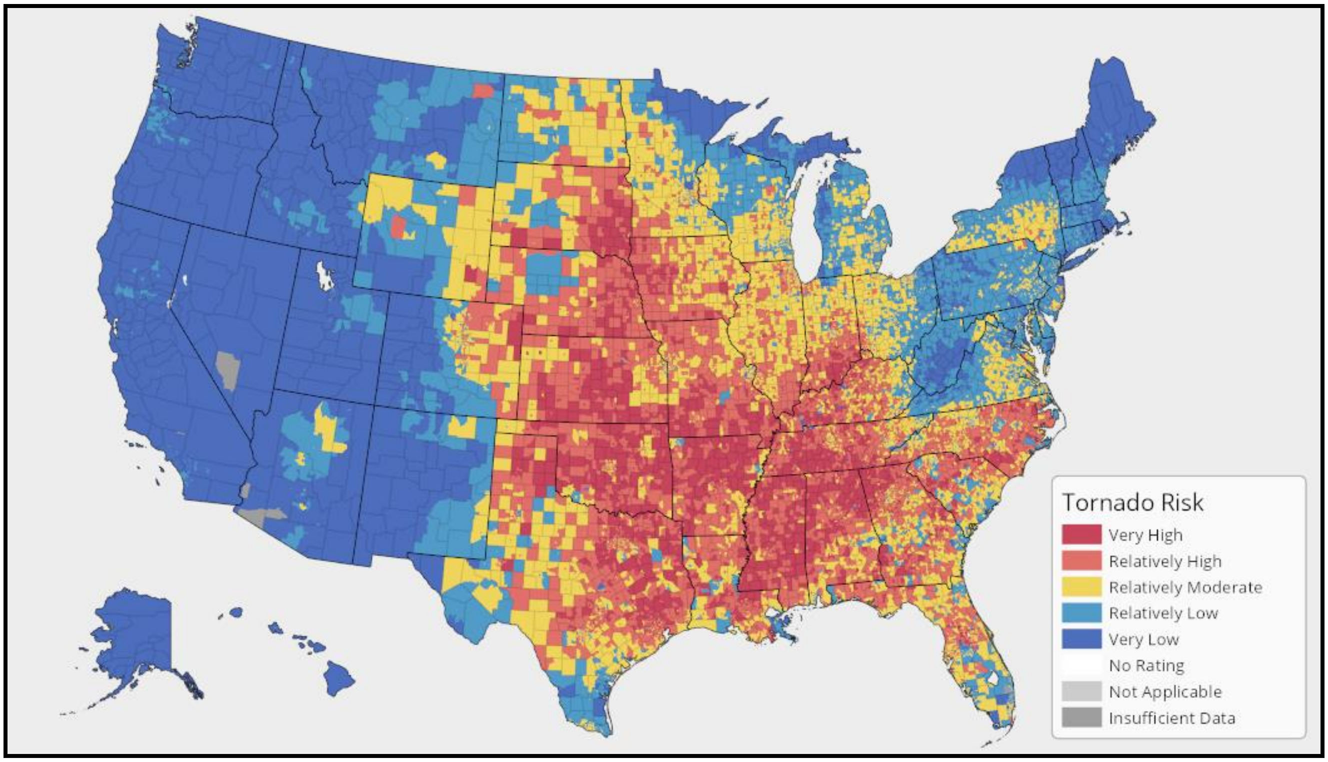


Figure 12-6. Tornado Risk Areas in the United States

12.2 HAZARD PROFILE

12.2.1 Past Events

Table 12-1 provides detailed descriptions of severe weather events in the planning area since 1996 that were reported to cause death, injuries or property damages. Table 12-2 summarizes all severe weather events in the planning area since 1950, as recorded by the National Oceanic and Atmospheric Administration (NOAA).

Table 12-1. Past Severe Weather Events Impacting Planning Area

Date	Type	Deaths or Injuries	Property Damage
4/5/1972	Tornado (F3)	306	$25,000,000
5/1/1976	Thunderstorm Wind	0	$0
5/1/1976	Hail (1.0 inches)	0	$0
10/13/1984	Tornado (F1)	0	$25,000
6/29/1989	Tornado (F1)	1	$2,500
1/27/1996	Ice Storm	0	$0
11/23/1996	Ice Storm	0	$0
Freezing rain disrupted travel in and near the western end of the Columbia River Gorge. Ice accumulation was reported at Washougal.			
12/26/1996	Ice Storm	0	$0
A severe ice storm crippled travel and communication within the Columbia Gorge and the Vancouver area. Camas and Washougal as well as towns within the Gorge sustained numerous downed trees and prolonged power outages.			
12/28/1996	Heavy Snow	0	$0

Cold air to the east of the Cascade Mountains funneled through the Columbia River Gorge and produced heavy snow within the gorge and near the western end of the gorge. Skamania received 5 inches of snow and Washougal 6 inches.			
1/27/1997	Ice Storm	0	$0
Rain falling through cold air in the Columbia River Gorge produced significant accumulations of ice on roads and surfaces in the Gorge and near the western end of the gorge at Vancouver.			
3/30/1997	High Wind	0	$0
Winds gusted to 60 mph at Hockinson at 1150 AM.			
5/31/1997	Tornado (F0)	0	$10,000
A weak tornado briefly touched down in the Walnut Grove area of Vancouver, near I-205 and 4th Plain. A car was damaged, the roofing of a house was damaged, and a small shed was blown over.			
6/21/1997	Lightning	0	$10,000
Lightning struck a house in Hockinson and caused a brief fire and damaged home electronics.			
9/10/1997	Lightning	0	$0
A lightning strike caused a widespread power outage that left 20000 homes without power for about 3 hours. A large school and several businesses closed for the day, and 3/4 of the traffic lights in Vancouver were out of service.			
9/15/1997	Tornado (F0)	0	$0
A weak tornado near Yacolt knocked down 3 trees and a telephone pole.			
12/22/1997	Heavy Snow	0	$0
A weak Pacific front reached Southwest Washington with enough cold air trapped in lower elevations to drop up to two inches of snow in parts of Clark county before turning to rain.			
1/10/1998	Winter Storm	0	$0
The area of Southwest Washington and western Columbia River Gorge experienced the same storm as described in the narrative for Oregon zones 001-004 and 006-009. See that narrative for details.			
1/11/1998	Ice Storm	0	$250,000
The area of Southwest Washington and western Columbia River Gorge experienced the same storm as described in the narrative for Oregon zones 001-004 and 006-009. See that narrative for details.			
10/3/1998	Hail (0.75 inches)	0	$0
11/23/1998	High Wind (50 knots)	0	$0
The strong storm that brought high winds to Oregon also struck southwest Washington, where a gust to 58 mph was reported by a spotter around 530 pm.			
12/5/1998	Heavy Snow	0	$0
Snow accumulations of 1 to 3 inches were reported in Southwest Washington. Battle Ground reported 3 inches of new snow.			
12/18/1998	Cold/Wind Chill	0	$0
An extensive arctic airmass spread over the entire Pacific Northwest the week before Christmas. Temperatures fell sharply beginning December 18 and were coldest around the Winter Solstice December 21. High temperatures were only in the teens and 20s then. The lowest temperatures in Southwest Washington were in the Cascades, where overnight lows fell into the teens below zero. Light snow, less than one inch amounts, fell on the 19th and 21st, causing widespread traffic problems. Numerous accidents on Interstate 5 near the Oregon/Washington border during rush hour on the 21st caused a massive traffic jam. Plumbers were kept busy repairing frozen and burst water pipes.			
12/24/1998	Heavy Snow	0	$0

A Christmas Eve storm threatened to deliver a white Christmas to Southwest Washington. However, the 2 to 5 inches of snow that feel from around midnight to mid morning melted by afternoon as temperatures warmed. Battle Ground reported 4 inches of new snow, while the Vancouver area had around 3 inches.			
2/5/1999	Heavy Snow	0	$0
A Pacific weather system dumped large amounts of snow over the Washington and Oregon Cascades. Up to 33 inches of snow were reported (Mt. Hood Meadows Ski Area). Oregon Dept. of Transportation measured 30 inches of snow from this storm at Santiam Pass on Hwy 20. The heavy snow briefly closed roads and made travel across the mountains very difficult.			
2/6/1999	High Wind (39 knots)	0	$20,000
One of the stronger Pacific storms of the winter season resulted in damaging winds when it moved over the coastal area and interiors of Northwest Oregon and Southwest Washington. One of the more dramatic events associated with this storm was the destruction of a Keizer, Oregon mobile home when a 200 foot douglas fir tree was toppled by winds and crushed the structure. Many thousands of residents were without power at various times as falling limbs and trees cut power lines. At higher elevations in the Cascade Mountains, very strong wind gusts were reported. Mt. Bachelor ski area reported a wind gust of 120 MPH. Mt Hood Meadows ski area reported a 103 mph wind gust. No injuries were reported. A newspaper reported very strong winds downing trees in the South Washington Cascades. Winds at the higher evelvations were inferred to be in excess of 100 mph at times. The Portland NWS Doppler Radar measured wind speeds at 110 mph at 7000 feet during the height of the storm.			
8/4/1999	Lightning	0	$15,000
Lightning from one of the many intense thunderstorms in Northwest Oregon and Southwest Washington struck a maple tree on the BS Ranch in Northeast Clark county and killed four beef cows and a bull.			
1/10/2000	Heavy Snow	0	$0
The winter storm that brought heavy snow to Northwest Oregon also dumped 2 to 3 inches of snow in Vancouver, while other Southwestern Washington totals included White Salmon 3 inches, Willapa Hills 4 to 7 inches, Bear Prairie 8 inches and Camas 3 inches.			
1/16/2000	High Wind (95 knots)	0	$0
An intense low pressure center moved over the area from the Pacific bringing very strong winds to the area. Cape Disappointment reported gusts to 109 mph, Ocean Park estimated gusts at 85 to 100 mph with many trees down, and Bay Center reported gusts to 65 mph. Inland, Vancouver had gusts to 67 mph, Hockinson 68 mph, Raymond gusts to 65 lmph and Camas 39 mph with gusts to 54 mph. Numerous downed trees and power outages were reported.			
2/3/2000	High Wind (95 knots)	0	$0
Localized strong winds 25 to 40 mph with gusts to 65 mph downed trees in the east Clark County - Brush Prairie area.			
5/11/2000	Tornado (F0)	0	$10,000
A weak tornado moved through Battleground. Three houses had minor damage as did a restaurant (blew away a sign and some metal strips of the awning). A pickup canopy resting on sawhorses was blown about 100 feet. In addition, a section of wooden fence was blown down, and 2 to 4 inch limbs were broken off of a tree. No injuries were reported.			
12/13/2000	High Wind (57 knots)	0	$0
A winter storm brought strong winds to Clark County and the Southwest Washington coast. Vancouver reported gusts to 63 mph and La Center gusts to 52 mph. Ocean Park reported gusts to 60			

mph. Damage from this storm included toppled trees, and widespread power lines down and associated power outages.			
6/27/2001	Thunderstorm Wind	5	$25,000
Portland Radar tracked a Severe Thunderstorm through Clark County into Cowlitz County. The Portland Oregonian, Vancouver Columbian and KOIN TV reported uprooted trees falling on vehicles and trailer houses, downed power lines and localized flooding of Interstate 5 and Highway 99 in the Battleground area. Clark Public Utilities reported 2600 lost power. Five were injured, two seriously; one when a tree fell across the trailer house she was in and the other was struck by a limb of a falling tree.			
10/5/2001	High Wind (45 knots)	0	$0
High winds downed power lines, knocking out power to more than 2300 users in Vancouver and northern Clark County.			
12/12/2001	High Wind (48 knots)	0	$0
A strong winter storm brought high winds to Southwest Washington resulting in gusts to 55 mph in Grays Harbor County. In Vancouver winds gusts reached 50 mph. Pacific County P.U.D. reported some power outages...the size of the outage was not reported.			
1/19/2002	Heavy Snow	0	$0
A strong winter storm brought heavy snows to the Southwest Washington area. Vancouver received 1 to 2 inches and 6+ inches was reported on Livingston Mt.			
1/24/2002	Heavy Snow	0	$0
Another winter storm brought heavy snows to the area. Brush Prairie reported 6 inches.			
1/27/2002	Heavy Snow	0	$0
Brush Prairie reported receiving 2 inches of snow.			
1/29/2002	Heavy Snow	0	$0
Kelso, Battle Ground and La Center reported 1 to 2 inches and up to 6 inches was reported at the higher elevations around Battle Ground.			
3/15/2002	Heavy Snow	0	$0
Snow blanketed Southwest Washington with 3 inches at Stevenson, 4 inches on Livingston Mountain, 3 inches at Brush Prairie, 2 inches at Salmon Creek, Camas, and Vancouver, and 1 inch at Washougal.			
12/26/2002	High Wind (57 knots)	0	$0
A Pacific storm moving across the area produced strong winds that downed trees and caused widespread power outages. Ilwaco reported gusts to 65 mph. Cathlamet reported gusts to 66 mph which ripped off metal roofs and downed trees. County wide power outages were reported in Wahkiakum County. The Columbian reported a gust of wind blew the 555 foot grain ship, "Pacific Trader" off its anchor and pushed it into a dock at Berth 8. Trees were reportedly downed in the Vancouver-Salmon Creek-Hazel Dell areas damaging two homes and disrupting traffic. No injuries were reported.			
11/17/2003	Winter Storm	0	$0
Over the three day period a series of strong Pacific storms brought strong winds to the coastal areas, heavy rain and/or snow to most of the CWA. The coastal areas were buffeted by 40 to 50 mph winds. Generous amounts of rain were reported. In 6 hours, Vancouver recorded 1.16 inches and Camas 1.02 inches. In 12 hours, Francis recorded 1.70 inches, Dixie Mt 1.00 inches, and Cougar 0.63 inches. In addition Long Beach reported 2.00 inches in 18 hours, Ocean Park 1.71 inches in 18 hours, and Camas 1.75 in 19 hours. Cold air followed in the wake of the heavy rains bringing a blanket of snow to most of the area. Some of accumulations included 8 inches at Mt Livingston, 5 inches in north Washougal, 4 inches at Camas, 2 inches in east Vancouver, and 1 inch in Longview.			

12/4/2003	High Wind (52 knots)	0	$0
Strong easterly winds raised havoc in Southwest Washington. Winds reached 60 mph in Hockinson, were estimated to reach 60 mph in Battleground and 61 mph in Vancouver. Power was lost in Hockinson and Battleground. In Vancouver an 80 foot Douglas Fir tree with a diameter of 18 to 24 inches blew down. In Orchards a 30 foot Douglas Fir fell across the roof of a rental home. 6000 customers reportedly lost power. No injuries were reported.			
1/6/2004	Winter Storm	0	$0
A strong winter storm packing the powerful punch of a frigid arctic airmass, heavy snow, sleet and freezing rain, along with strong east winds through and near the Columbia River Gorge snarled travel, forced the closure of most schools and businesses, and resulted in widespread power outages and properly damage in Southwest Washington. Strong high pressure built up east of the Cascade Mountains by January 5th, which forced frigid air through the Columbia River Gorge into Southwest Washington. A Pacific low pressure system brought moist Pacific air over the top of this cold dome, producing the widespread snow...sleet...and freezing rain throughout the area, and blizzard conditions in Columbia River Gorge. Snowfall totals ranged from 3 inches in Camas to 5 inches at Raymond and Longview, 7 inches in Vancouver, 8 inches in Grays River, and two feet in the South Washington Cascades. Accumulations of up to 2 inches of sleet and freezing rain followed the snowfall. Blizzard conditions in the Columbia River Gorge resulted in the closure of Interstate 84 between Troutdale, Oregon and Hood River Oregon, and Washington State Route 14 between Washougal, Washington and White Salmon, Washington during the same period, halting east-west travel through the Gorge and stranding hundreds of trucks at both ends of the Gorge. Weight from the snow and ice buildup resulted in widespread downed trees and power lines, leaving 2000 customers without power in Clark County. Clark Public Utilities estimated the storm cost between $1 and $1.5 million, while the city of Vancouver estimates up to $500,000 in damages.			
1/23/2004	Heavy Snow	0	$0
A winter storm brought a blanket of snow the the area. Hockinson received one inch.			
3/24/2004	Hail (0.75 inches)	0	$0
4/21/2004	Hail (0.5 inches)	0	$7,500
About an inch of hail one half inch in diameter accumulated on Interstate Highway 5. The Washington Highway Patrol reported 14 vehicles were involved in accidents on the slippery highway, including at least one multi-car accident. At least 7 cars had damage more than $750, three of which required towing.			
5/17/2004	Hail (1.0 inches)	0	$0
One inch hail in Brush Prairie was reported by both an off duty National Weather Service employee and a Trained Spotter.			
5/27/2004	Tornado (F0)	0	$0
A tornado reportedly touched down 2 miles northeast of La Center and uprooted a 1 1/2 foot diameter tree and tore off part of a barn roof.			
9/13/2004	Tornado (F0)	0	$0
A tornado ripped through the Ridgefield Wildlife Refuge, lifting and damaging a mobile home office, blowing down trees and snapping large tree limbs. A tree was blown down on top of a car.			
9/13/2004	Thunderstorm Wind (50 knots)	0	$0
Strong thunderstorms moved through Clark county generating strong winds. The Clark County Emergency Manager reported numerous trees were blown down at the Ridgefield Wildlife Refuge.			
12/12/2004	High Wind (59 knots)	0	$0

1/6/2005	Winter Weather	0	$0
A Pacific weather system brought a mixture of snow...sleet..and freezing rain to Southwest Washington. There was a dusting of snow in the Vancouver and Camas areas, sleet near Brush Prairie, and freezing rain in the Cascade foothills, Vancouver, and near Kelso, with heaviest freezing rain in the Cascade foothills.			
1/15/2005	Winter Storm	0	$0
A moisture-laden Pacific storm rode over cold air pouring out of the Columbia River Gorge, resulting in widespread moderate to heavy freezing rain in SW Washington. Accumulations ranged from one quarter to one half inch, with heaviest amounts near the Columbia River Gorge. The freezing rain turned to liquid rain away from the Gorge by early in the day January 16, but lasted through most of January 18 in the Gorge. The storm forced closure of bridges around the Portland/Vancouver metropolitan area. The storm also resulted in cancellation of 225 flights from Portland International Airport, 5000 power outages, and over 200 motor vehicle accidents in SW Washington and NW Oregon. Numerous trees were toppled by ice accumulation, mainly near the Gorge.			
4/22/2005	Thunderstorm Wind (60 knots)	0	$0
5/20/2005	Lightning	0	$6,000
Scattered thunderstorms produced heavy rain over the area. A storm near Ridgefield, WA produced heavy rains, sending 6 to 8 inches of water into a pump station. During that same storm, a lightning strike hit the pump station, burning out a control panel and disabling the station.			
11/5/2005	High Wind (40 knots)	0	$0
A strong Pacific storm caused sustained winds of 46 mph at Cape Disappointment on the South Washington Coast. Sustained winds of 46 mph near Toutle in and reported strong winds near Kelso downed numerous foot to foot and a half diameter trees that contributed to widespread power outages in Cowlitz county.			
12/18/2005	High Wind (58 knots)	0	$10,000
A strong winter storm brought strong winds to inland portions of southwest Washington. Multiple reports were received of trees blown down in the Vancouver and Camas areas, some of which caused significant damage. In Vancouver, a tree was reported to fall through the roof of a home; in Camas, a roof was partially torn from a home, and an 80-foot tree snapped in two, damaging another roof. Nearly 40,000 customers were without power during the storm.			
12/18/2005	Winter Weather	0	$0
A strong winter storm brought a mix of snow, sleet, and freezing rain to lower elevations of southwest Washington. Several reports were received of sleet and heavy freezing rain blanketing the area. Multiple damage reports were received due to ice accumulating on tree branches and power lines, especially in areas near the Columbia River Gorge.			
12/24/2005	High Wind (58 knots)	0	$0
A strong Pacific low pressure system brought strong winds to the northwest Oregon and southwest Washington coastlines. Some of the strong winds reported with this system include: 50 mph gusts to 59 mph at Clatsop Spit gusts to 59 mph at Desdemona Lighthouse Damaging winds were also reported over inland portions of northwest Oregon and southwest			

Washington. Trees were reported down in the Hockinson and Vancouver areas. A reported 30,000 customers were without power for a portion of the day.			
2/3/2006	Strong Wind (38 knots)	0	$100,000
A strong winter storm brought high winds to portions of southwest Washington. Following are some high winds reported with this storm: Bay Center reported frequent gusts to 50 knots Ocean Park reported frequent gusts to 63 knots Toke Point reported 39 knots with gusts to 54 knots Tongue Point reported 35 knots with gusts to 54 knots Desdemona Lighthouse reported 41 knots with gusts to 56 knots Many residents experienced power outages due to trees blown down by strong winds. An estimated 6300 residents of Cowlitz County were without power for portions of the night. Additionally, 38-year-old Ingrid Davis was killed after high winds blew down a tree which struck her car on State Route 4 near Cathlamet. The 13-year-old passenger, Alea Davis, was treated for a head injury and cuts.			
2/9/2006	Strong Wind (31 knots)	0	$200,000
A strong east wind event brought very gusty conditions to inland portions of southwest Washington. Following are some strong wind observations made during this event: Vancouver Airport reported 17 knots with gusts to 31 knots Larch Mountain RAWS reported 28 knots with gusts to 65 knots Coldwater Ridge Visitors Center reported 31 knots with gusts to 57 knots Locks RAWS reported 10 knots with gusts to 30 knots Many trees were knocked down due to high winds, and multiple power outages and areas of damage ensued. In Vancouver, a 110-foot tall tree 3 feet in diameter fell through the roof of a home, causing significant damage.			
9/14/2006	Hail (0.88 inches)	0	$0
Thunderstorms broke out under a warm, moist, unstable airmass over Washington. A few of these storms produced severe hail as well as wind gusts.			
12/14/2006	High Wind (69 knots)	0	$0
A very strong Pacific storm system plowed across the Pacific Northwest, bringing strong and damaging winds to southwest Washington. Wind speeds near 100 mph were seen on the coast and in the Willapa Hills, as well as winds speeds of 60-80 mph in Clark county and through the Columbia River Gorge. The storm brought widespread downed trees and power lines, and at the peak of the storm left nearly 500,000 homes across the region without power - some for days to come. Many roads and highways were left impassable due to downed trees.			
1/10/2007	Heavy Snow	0	$0
The new year brought a blast of cold air to the region along with and following a strong Pacific frontal system. This brought snow to every area in the county warning area, including heavy amounts of snow to areas along the coast. Schools all over the region were closed for at least one day, more in places were driving remained perilous. A minimum of 1 to 4 inches of snow fell over the entire area, with heavier amounts reported on the coast, in the Coast Range and Cascades, and in portions of the Willamette Valley.			
1/16/2007	Heavy Snow	0	$0
In the wake of a Pacific low pressure storm, cold air was entrenched over southwest Washington. As a result, post-frontal unstable shower activity resulted in additional snow accumulations over the lower			

elevations. Schools in the greater Portland and Vancouver metro area were closed for a total of two-and-a-half days due to somewhat hazardous traveling conditions on smaller roads.			
1/10/2008	Tornado (EF1)	0	$525,000
In the wake of a rapidly advancing cold front, a severe thunderstorm moved through Clark county in southwest Washington and spawned a tornado. The tornado touched down near Vancouver Lake, moved east into Hazel Dell, then continued eastward to Hockinson while experiencing multiple touchdowns.			
5/24/2008	Hail (0.75 inches)	0	$0
An unstable airmass with southerly flow moved over the forecast area, and many thunderstorms developed in the evening hours. Some of these storms became severe, and produced hail and lightning.			
6/29/2008	Thunderstorm Wind (50 knots)	0	$0
Under the influence of an unstable airmass and favorable south to southeasterly flow, thunderstorms broke out over eastern Oregon and over the Oregon Cascades, and advanced across the forecast area. A few of these storms became severe.			
12/17/2008	Winter Storm	0	$0
A strong and very cold Pacific system brought heavy snow accumulations to southwest Washington.			
12/20/2008	Winter Storm	0	$1,540,000
The third in a series of an unusually cold storm systems brought heavy snow accumulations to southwest Washington. The heavy snowfall created a significant impact to many communities across southwest Washington.			
12/24/2008	Winter Storm	0	$0
Another cold storm system brought heavy snow accumulations to southwest Washington.			
1/18/2009	High Wind (50 knots)	0	$0
Strong east winds occurred through the Columbia River Gorge and Clark County.			
11/16/2009	High Wind (50 knots)	0	$10,000
A strong Pacific system brought strong winds to much of the Pacific Northwest.			
12/17/2010	High Wind (57 knots)	0	$0
A strong low approaching the coast from the southwest brought strong southerly winds to the Pacific Northwest...especially along the south Washington coast and interior portions of southwest Washington.			
2/24/2011	Heavy Snow	0	$0
A low pressure system off the Pacific Northwest Coast brought snow showers...heavy at times...to southwest Washington. An intense band of showers brought higher accumulations of snow over the Interstate 5 Corridor in Cowlitz County.			
3/13/2011	High Wind (50 knots)	0	$0
A squall line associated with a cold frontal passage moved across the Pacific Northwest Sunday afternoon bringing sudden strong winds to the area.			
1/17/2012	Heavy Snow	0	$0
With a cold air mass in place over the Pacific Northwest, two strong and very moist Pacific weather systems brought snow to the area with heavy snow in the mountains and snow levels down to the valley floor.			
12/16/2012	High Wind (52 knots)	0	$100,000
A strong low pressure system brought strong southerly winds to portions of Southwest Washington.			

3/21/2013	Tornado (EF0)	0	$10,000
A tornado touched down in Clark county near Hockinson.			
6/19/2013	Funnel Cloud	0	$0
A cool trough of low pressure produced a funnel cloud over the Columbia River.			
1/23/2014	Strong Wind (35 knots)	0	$20,000
A strong upper level ridge resulted in gusty easty winds through the Columbia River Gorge and Vancouver Area. These winds resulted in minor damage including tipping over a semi-trailer on the Glen Jackson Bridge.			
2/6/2014	Heavy Snow	0	$0
A preceding cold arctic air mass combined with a moist Pacific storm resulted in widespread heavy snow for Southwest Washington. East winds through the Columbia River Gorge maintained colder air to the north where the precipitation fell mainly as snow.			
2/8/2014	Winter Storm	0	$0
A Weather system brought additional snow and ice to Southwest Washington March 8th. This is the third cold weather event in a series where there was a widespread snow/ice event on March 7th that followed a widespread heavy snow event on the 6th.			
2/8/2014	Ice Storm	0	$0
A Weather system brought additional snow and ice to Southwest Washington February 8th. This is the third cold weather event after a widespread snow/ice event on the 7th, and a widespread heavy snow event on the 6th.			
7/1/2014	Excessive Heat	0	$0
An upper level ridge combined with a surface thermal trough and low level offshore winds resulted in a hot day across Southwest Washington where inland temperatures peaked in the upper 90s inland and the upper 80s along the coast. The NWS Portland office had a heat advisory in effect. Many people flocked to the rivers to cool from the heat and there were unfortunately a drowning. Another man was hospitalized after rescuing a woman and two children from the Toutle River.			
10/25/2014	High Wind (61 knots)	0	$10,000
A 983mb low pressure system approached from the Southwest and moved north along the Central Oregon Coast before making landfall near Gray's Harbor, Washington. This low resulted in Gusty winds for the coast and coast range as well as damaging winds across Clark County.			
11/11/2014	High Wind (52 knots)	0	$28,000
Cold air plunged south out of the Canadian Rockies and created an east wind and down-slope wind storm across Southwest Washington. Eastern Clark County was hit the hardest with more than 60,000 customers losing power and several homes damaged by downed trees.			
12/11/2014	High Wind (52 knots)	0	$5,000
A 974 millibar surface low moved northward paralleling the Oregon coast around 80 miles offshore, and resulted in one of the strongest wind storms that Northwest Oregon had experienced in past several of years. The strongest winds occurred as high pressure filled in behind the low. Southwest Washington was less affected than Northwest Oregon, but still saw its fair share of gusty winds along the coast and the Vancouver metro area.			
3/15/2015	High Wind (50 knots)	0	$0
A surface low produced strong gusty winds across Northwest Oregon as it moved north offshore the Central and Northern Oregon coasts before making landfall in Southwest Washington. Soils were well saturated due to a prolonged period of heavy rain, and many trees were downed.			
6/26/2015	Excessive Heat	0	$0

<table>
<tr><td colspan="4">A strong upper level ridge of high pressure resulted in hot temperatures across Southwest Washington. Afternoon temperatures peaked in the low to mid 90s which are around 20 degrees warmer than the seasonal normals. Monsoonal moisture and onshore winds resulted in fairly high humidities (40 to 50% in the afternoons) making the temperatures feel 2 to 5 degrees warmer than they were. The mid-level moisture also added to an increase of thunderstorms around the region. Clouds from these thunderstorms limited overnight radiation cooling. Nighttime temperatures were warm with minimum temperatures 10 to 15 degrees warmer than the seasonal normals.</td></tr>
<tr><td>12/10/2015</td><td>Tornado (EF1)</td><td>0</td><td>$311,000</td></tr>
<tr><td colspan="4">A tornado with winds up to 104 mph touched down southwest of Battleground around 1115 am. There were at least two touch down points along the 2 mile path. No injuries or fatalities were reported, but residences and businesses sustained property damage.</td></tr>
<tr><td>12/21/2015</td><td>High Wind (52 knots)</td><td>0</td><td>$15,000</td></tr>
<tr><td colspan="4">High winds impacted Southwest Washington as a 980 millibar low moved onshore in Pacific County. The winds resulted in widespread tree damage and power outages.</td></tr>
<tr><td>1/3/2016</td><td>Winter Weather</td><td>0</td><td>$0</td></tr>
<tr><td colspan="4">East winds through the Columbia River Gorge maintained below freezing surface temperatures for the Columbia Gorge, and areas of Clark County as a couple of precipitating events moved over the area Jan 3 and Jan 4. This resulted transportation challenges and school closures. There were a lot of car accidents and minor injuries from slips and falls on the ice.</td></tr>
<tr><td>3/1/2016</td><td>Strong Wind (40 knots)</td><td>0</td><td>$8,000</td></tr>
<tr><td colspan="4">A cold front backed by a deep surface low resulted in strong winds across Southwest Washington. The winds took down several trees and power lines.</td></tr>
<tr><td>3/13/2016</td><td>Strong Wind (35 knots)</td><td>0</td><td>$3,000</td></tr>
<tr><td colspan="4">A strong low pressure system produced strong winds across the region. The winds took down trees and power lines resulting in traffic obstructions and minor property damage.</td></tr>
<tr><td>10/15/2016</td><td>High Wind (50 knots)</td><td>0</td><td>$3,000</td></tr>
<tr><td colspan="4">A deepening low pressure system passed north along the Coast bringing strong winds to Southwest Washington.</td></tr>
<tr><td>12/8/2016</td><td>Strong Wind (45 knots)</td><td>0</td><td>$3,000</td></tr>
<tr><td colspan="4">An approaching strong frontal system brought strong winds and a mix of snow, sleet, and freezing rain down to the Valley Floor.</td></tr>
<tr><td>12/8/2016</td><td>Winter Storm</td><td>0</td><td>$0</td></tr>
<tr><td colspan="4">An approaching strong frontal system brought strong winds and a mix of snow, sleet, and freezing rain down to the Valley Floor.</td></tr>
<tr><td>12/14/2016</td><td>Heavy Snow</td><td>0</td><td>$0</td></tr>
<tr><td colspan="4">East winds ahead of an approaching low pressure system brought temperatures down below freezing across the area ahead of the approaching precipitation. This lead to a moderate snow event majorly impacting the evening commute.</td></tr>
<tr><td>1/7/2017</td><td>Winter Storm</td><td>0</td><td>$0</td></tr>
<tr><td colspan="4">A broad shortwave trough brought multiple rounds of precipitation, including a wintry mix of snow and ice for many locations across Southwest Washington. Strong easterly pressure gradients generated high winds through the Columbia River Gorge as well on January 8.</td></tr>
<tr><td>1/10/2017</td><td>Heavy Snow</td><td>0</td><td>$30,000</td></tr>
<tr><td colspan="4">A strong low pressure system moved up from the southwest. Surface temperatures as precipitation started were just above freezing, but with heavy showers, rain quickly turned over to snow during the</td></tr>
</table>

early evening. Embedded thunderstorms enhanced snowfall rates around the Vancouver Metro for a crippling snowstorm Tuesday evening, with snow continuing to fall through Wednesday morning.			
1/17/2017	Ice Storm	0	$0
An approaching low pressure system brought rain across the Columbia River Gorge, while cold air was trapped at the surface and was slow to clear out. This brought a tremendous amount of freezing rain to the Columbia Gorge, closing I-84 and SR-14 to travel through the Gorge. Freezing rain was observed as far west as the Vancouver Airport, impacting the east side of the Vancouver Metro as well, mainly near the Columbia River.			
3/24/2017	Tornado (EF0)	0	$2,000
A upper-level low bringing a cold front across the area generated showers and a few thunderstorms across southwest Washington. One of these thunderstorms produced a weak tornado in Orchards, WA northeast of Vancouver.			
10/12/2017	Tornado (EF0)	0	$2,000
A low pressure system moving into Washington brought showers and thunderstorms across southwest Washington. These storms had been showing weak rotation. One of these storms produced a tornado near Vancouver.			
12/24/2017	Winter Weather	0	$0
Low pressure system moving into the Pacific Northwest pulled cold air from the Columbia Basin west of the Cascades, through the Columbia River Gorge. As this system started to bring moisture and precipitation into SW Washington, temperatures were around or below freezing, allowing for a mix of snow and ice to fall all the way to sea level around the Vancouver Metro, Lower Columbia River Valley, and in the Columbia River Gorge.			
2/20/2018	Heavy Snow	0	$0
A low pressure system slid down the coast and stayed offshore, pulling cold air from east of the Cascades into southwest Washington. This brought snow levels down to sea level, and moisture from the low pressure system meant snow down to sea level around Vancouver and along the lower Columbia River.			
6/9/2018	Thunderstorm Wind (43 knots)	0	$3,000
A cool upper-level trough moved over the Pacific Northwest, generating enough instability for thunderstorms which produced gusty winds and small hail.			
1/5/2019	Strong Wind (36 knots)	0	$250,000
A strong low pressure system moving up the coast from the south brought strong southerly winds across all of southwest Washington. The strongest winds were recorded along the coast, but winds observed in the southwest interior weren't much weaker than what was observed along the coast.			
2/8/2019	Heavy Snow	0	$0
A low pressure system dropped south along the coast from Victoria Island. The low pressure system brought arctic air south out of Canada into SW Washington. This system brought heavy snow to the Willapa Hills, Cascade Foothills, and the Columbia Gorge. It also brought snow down to the Valley floor in the Vancouver Metro area.			
4/29/2019	Strong Wind (30 knots)	0	$0
A upper-level trough generated a few stronger showers up across southwest Washington. One of these showers produced a downburst of winds, enough to bring down a private plane causing two fatalities.			
9/8/2019	Funnel Cloud	0	$0

A spotter called to report seeing a funnel cloud. Radar was used to estimate the exact location of the funnel cloud.			
9/7/2020	High Wind (52 knots)	0	$100,000,000
After a period of upper level ridging brought a return to above normal temperatures in early September, very strong easterly downslope and offshore winds off the Cascades and Coastal Ranges occurred. Winds increased rapidly during the afternoon and evening of September 7 with the passage of an unseasonably strong backdoor cold front, and persisted through much of the following day. This resulted in extremely critical fire weather conditions when the strong winds combined with extremely low relative humidity and exceptionally dry existing fuel conditions. The result was explosive growth of ongoing wildfires, and the new start and explosive spread of numerous new wildfires. Widespread wind gusts from 50-70 mph were common on ridge tops and numerous other in exposed areas, including portions of the greater Portland metro area, the Willamette Valley, and areas of the Oregon coast. Strong winds caused widespread damage to trees, and downed numerous power lines across the region, which started at least 13 additional wildfires. Large portions of the cities of Detroit, Mehama, and Gates were destroyed, and significant portions of Idanha, Mill City, and Lyons also burned. Resultant large wildfires included these named incidents - In Oregon: Beachie Creek, Chehalem Mountain/Bald Peak, Riverside, and Lionshead, and in Washington: Big Hollow. Rapidly spreading wildfires resulted in multiple fatalities, hundreds of displaced persons for many weeks, and billions of dollars in damage.			
1/13/2021	Strong Wind (34 knots)	0	$1,500
A series of strong slow moving fronts brought periods of heavy rain along with strong winds. This resulted in high surf, coastal and river flooding.			
2/11/2021	Winter Storm	0	$1,000,000
A deep upper trough drove an arctic airmass into southwest Washington. As multiple Pacific fronts moved over the area, a major elevation winter storm with heavy snow and freezing rain occurred over a multi-day period. This was a major, widespread, multi-faceted winter storm that caused major problems across the forecast area, even (and especially) in the lowlands.			
2/14/2021	Ice Storm	0	$1,000,000
A deep upper trough drove an arctic airmass into southwest Washington. As multiple Pacific fronts moved over the area, a major elevation winter storm with heavy snow and freezing rain occurred over a multi-day period. This was a major, widespread, multi-faceted winter storm that caused major problems across the forecast area, even (and especially) in the lowlands.			
6/26/2021	Excessive Heat	3	$0
A high pressure heat dome over the region led to stretch of extreme heat, shattering records from June 26 through June 29. Hot temperatures resulted in many people seeking locations to cool off in local rivers and beaches, which led to one drowning, as well as multiple people going to local hospitals for treatment of typical heat-related medical symptoms, including one reported death.			
8/11/2021	Excessive Heat	0	$0
Hot weather began to develop August 9, peaking August 11-12, but temperatures continued above normal into the weekend. Peak afternoon temperatures of 100 to 105 degrees drove people to seek relief in or near bodies of water.			
9/27/2021	Tornado (EF0)	0	$40,000
On the evening of Monday September 27, 2021 showers in the area were quite active as a cool upper trough moved into the region. One storm cell produced an EF-0 tornado in Battle Ground, WA.			
10/24/2021	Thunderstorm Wind (56 knots)	0	$10,000

A deep low pressure system off the Pacific NW coast pushed a strong front across northwest Oregon and southwest Washington, resulting in strong winds and scattered thunderstorms. One severe thunderstorm developed in the afternoon across northern Clark County. This storm produced wind damage from Woodland, WA to near Lake Merwin. Wind knocked out power to over 5000 residents in Clark County.			
11/15/2021	Strong Wind (35 knots)	0	$0
A strong cold front pushed onshore on the morning which brought high winds to the coastal areas.			
12/25/2021	Winter Weather	0	$0
A low pressure system and strong cold front moved through the Pacific Northwest on the evening of December 25, 2021 through the day on December 26th, 2021. This storm brought a significant amount of snow throughout the Pacific Northwest, including along the south Washington coast, but especially in the Cascades. Snow resulted in significant travel issues for the holiday weekend.			
4/10/2022	Winter Storm	0	$0
Unseasonably cold air was in place over the Pacific Northwest, with temperatures marginally cold enough for a low elevation snow event from the Portland metro northward. A storm system moved over northwest Oregon and southwest Washington bringing widespread snowfall to many areas north of Salem, Oregon. This system brought several inches of snow to the Willamette Valley in addition to the Coast Range and Cascades. By the late morning/early afternoon, much of the snow west of the Columbia River Gorge had transitioned to rain. This was not just your standard snowfall as it ended up being the first measurable lowland snowfall in the month of April.			

Source: http://www.ncdc.noaa.gov/stormevents/

Table 12-2. Summary of Severe Weather Event Impacts in the Planning Area

Hazard Types Includes	# of Reported Events[a]	# of Events with Deaths, Injuries[a, b]	Amount of Property Loss[a,b]
Damaging Winds			
Strong Wind	7	0	$584,000
High Wind	26	0	$201,000
Extreme Temperatures			
Excessive Heat	2	0	$0
Extreme Cold/Wind Chill	1	0	$0
Severe Winter Weather			
Ice Storm	7	0	$250,000
Heavy Snow	21	0	$30,000
Winter Storm	10	0	$1,540,000
Blizzard	0	0	$0
Winter Weather	4	0	$0
Sleet	0	0	$0
Thunderstorms and Lightning			
Lightning	4	0	$31,000
Thunderstorm Wind	6	1	$28,000
Hail	7	0	$7,500
Tornado			
Funnel Cloud	1	0	$0
Tornado	13	2	$25,897,500
Total	**153**	**30**	

a. Reported events since 1950.
b. Only events that listed injuries and/or dollar amounts are included in these estimates. Some event descriptions include property damage that was not quantified.

Source: http://www.ncdc.noaa.gov/stormevents/

12.2.2 Location

All areas in the County are potentially exposed to severe weather events.

Damaging Winds

All of Clark County is subject to high winds from thunderstorms and other severe weather events. Southwesterly winds are associated with strong storms moving onto the coast from the Pacific Ocean. Southern winds parallel to the Cascade Mountains are the strongest and most destructive winds. Strong eastern winds originate from the Columbia Gorge when high atmospheric pressure is over the Upper Columbia River Basin and low pressure is over the Pacific Ocean. The narrow point of the gorge acts as a funnel, concentrating the intensity of the winds. Strong winds are generated at the outlet of the gorge near Camas and Washougal. Windstorms tend to damage ridgelines that face into the winds (CRESA 2004).

According to FEMA, Clark County is located in Wind Zone I, where wind speeds can reach up to 130 mph. The County is also located in a special wind region along the west coast from Washington to Oregon. Figure 12-7 indicates how the frequency and strength of windstorms impacts the United States and the general location of the most wind activity. This is based on 40 years of tornado data and 100 years of hurricane data collected by FEMA.

Source: FEMA 2010

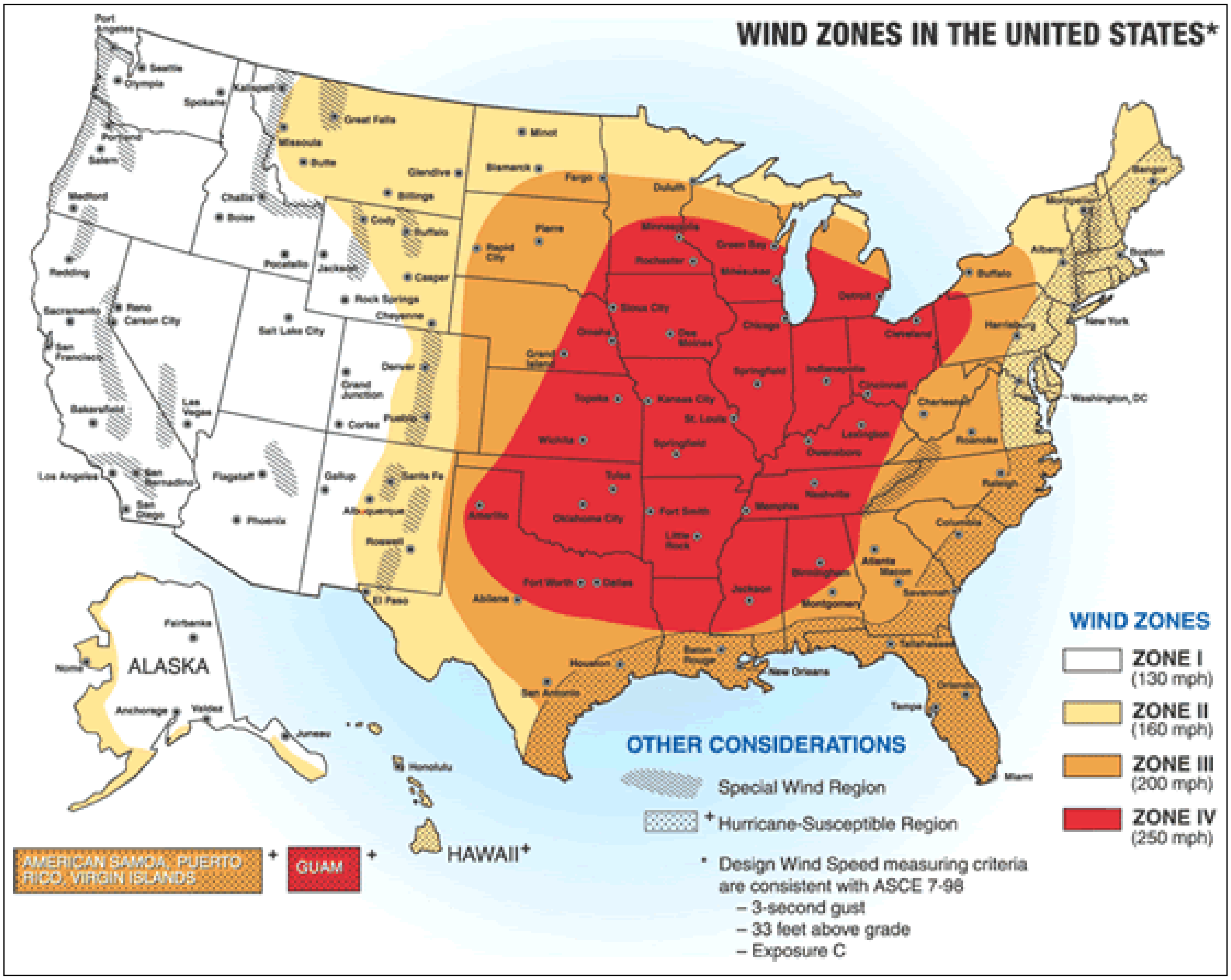


Figure 12-7. Wind Zones in the United States

Extreme Temperatures

Temperature extremes can occur throughout the planning area. The Western Regional Climate Center notes several factors that have a significant impact on the local climate including terrain (such as the Cascade Range), the Pacific Ocean, and low pressure regions over the North Pacific Ocean. These climactic controls can cause significant climate differences in relatively short distances.

In Western Washington, summers tend to be cool and dry, and winters are mild, wet, and cloudy. Specifically in areas west of the Cascade Mountains, minimum temperatures typically range from 30ºF (in lower elevations) to 20ºF (in higher elevations). Minimum temperatures as low as 0ºF to –17ºF have been recorded (WRCC 2014).

According to the Office of the Washington State Climatologist, Vancouver has the warmest annual average temperature in the state (averaged from 1981-2010) at 54.1ºF (OWSC 2015).

Severe Winter Weather

Snowstorms are a more frequent occurrence in the higher elevations of eastern Clark County, but they can occur in the lower elevations as well. In general, the Cascade Mountain Range acts as a barrier to cold air developing in the eastern part of the state, reducing the likelihood of snowstorms in Clark County. However, cooler air can enter the valley through low points or advance downriver through the Columbia Gorge. When this occurs, it can cause snowstorms in even the lower elevations of the county. Typically, the snow melts rapidly as a result of the warmer air in the valley (CRESA 2004).

Thunderstorms and Lightning

Thunderstorms affect relatively small localized areas, rather than large regions like winter storms and extreme temperature events. Thunderstorms can strike all regions of the United States, although they are most common in central and southern states. It is estimated that there are as many as 40,000 thunderstorms each day worldwide. Clark County can experience an average of 10 to 20 thunderstorm days each year (National Weather Service, 2010).

Tornadoes

Approximately 1,200 tornadoes occur in the United States each year, with the central portion of the country experiencing the most. Tornadoes can occur at any time of the year, with peak seasons at different times for different states (National Severe Storms Laboratory, 2015). The State of Washington and Clark County have a lower risk for tornados than elsewhere in the country. Tornadoes are usually localized. Severe thunderstorms can result in conditions favorable to the formation of numerous or long-lived tornadoes.

12.2.3 Frequency

Many of the severe weather events for Clark County shown in Table 12-1 are related to high winds and severe winter weather. The planning area can expect to experience exposure to some type of severe weather event at least annually. According to records, in 65 years, the county has experienced 153 severe weather events, for an average of 2 to 3 events per year.

According to the Washington State Hazard Mitigation Plan, Clark County is vulnerable to high winds. Counties considered vulnerable to high winds are those that were most affected by conditions that lead to high winds and those with a recurrence rate of 100 percent (i.e., that experienced at least one damaging high wind event per year). Clark County has a recurrence rate of 130 percent.

Clark County is also considered one of the counties most vulnerable to winter storms. This means that the county has a recurrence rate of at least 50 percent, or it experiences at least one damaging winter storm event every two years. Per the State Washington State Hazard Mitigation Plan, Clark County has a recurrence rate of 85 percent.

Six instances of extreme heat events are listed for the planning area between 1996 and 2015; however, this data likely underestimates the occurrence of such events in the planning area. Extreme heat events can occur several times per year, especially in the summer. Three extreme cold events were reported between 1996 and 2015. The actual number may be underreported, and some extreme cold events may be entered under another category, such as winter weather; the more visible impacts of a winter storm or blizzard may reduce the attention paid to extreme cold temperatures.

12.2.4 Severity

The most common problems associated with severe storms are immobility and loss of utilities. Fatalities are uncommon, but can occur. Roads may become impassable due to flooding, downed trees or a landslide. Power lines may be downed due to high winds or ice accumulation, and services such as water or phone may not be able to operate without power. Lightning can cause severe damage and injury. Physical damage to homes and facilities can be caused by wind or accumulation of snow or ice. Even a small accumulation of snow can cause havoc on transportation systems due to a lack of snow clearing equipment and experienced drivers and the hilly terrain.

Windstorms can be a frequent problem in the planning area and have been known to cause damage to utilities. The predicted wind speed given in wind warnings issued by the National Weather Service is for a one-minute average; gusts may be 25 to 30 percent higher. Lower wind speeds typical in the lower valleys are still high enough to knock down trees and power lines and cause other property damage. Mountainous sections of the County experience much higher winds under more varied conditions.

Ice storms accompanied by high winds can have especially destructive impacts, especially on trees, power lines, and utility services. While sleet and hail can create hazards for motorists when they accumulate, freezing rain can cause the most dangerous conditions within the planning area. Ice buildup can bring down trees, communication towers and wires, creating hazards for property owners, motorists and pedestrians. Rain can fall on frozen streets, cars, and other sub-freezing surfaces, creating dangerous conditions.

The severity of an extreme heat event depends on how early the event occurs in the summer and the number of consecutive days it lasts (U.S. EPA, 2006). Urban heat island effect can exacerbate the severity of an extreme heat event. While the severity of an extreme heat event may vary, impacts include increased energy consumption, elevated emissions of air pollutants and greenhouse gases, compromised human health and comfort, and impaired water quality (U.S. EPA, 2015). Extreme heat can also impact infrastructure by warping bridges, causing roads to buckle, melting runways, and more.

Lightning severity is typically investigated for both property damage and life safety (injuries and fatalities). The number of reported injuries from lightning is likely to be low. County infrastructure losses can be up to thousands of dollars each year.

Tornadoes are potentially the most dangerous of local storms, but they are not common in the planning area. If a major tornado were to strike within the populated areas of the county, damage could be widespread. Businesses could be forced to close for an extended period or permanently, fatalities could be high, many people could be homeless for an extended period, and routine services such as telephone or power could be disrupted. Buildings could be damaged or destroyed.

12.2.5 Warning Time

Meteorologists can often predict the likelihood of a severe storm or other severe weather event with several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of the event. Some storms come on more quickly and have only a few hours of warning time. The Seattle and Spokane Offices of the National Weather Service (NWS) monitor weather stations and issue watches and warnings when appropriate. The Seattle Office is the closest NWS office in Washington, but the Portland, Oregon NWS office provides more accurate watches and warnings for Clark County due to its proximity. Watches and warnings are broadcast over NOAA weather radio and are forwarded to local media for retransmission using the Emergency Alert System. NWS and NOAA also issue outlooks, watches, warnings and advisory information for extreme heat.

12.3 SECONDARY HAZARDS

The most significant secondary hazards associated with severe weather are floods, falling and downed trees, landslides and downed power lines. Rapidly melting snow combined with heavy rain can overwhelm both natural and man-made drainage systems, causing overflow and property destruction. Landslides occur when the soil on slopes becomes oversaturated and fails. Excessive heat events can cause failure of motorized systems, such as ventilation systems used to control temperatures inside buildings, if these systems are operating above typical operating standards. Demand for cooling systems during these events can overload energy systems and result in controlled or unexpected power outages. Fires (both structural and wild), along with power outages, can occur as a result of lightning strikes.

12.4 EXPOSURE

12.4.1 Population

It is assumed that the entire planning area is exposed to some extent to severe weather events. Certain areas are more exposed due to geographic location and local weather patterns. People living at higher elevations with large stands of trees or power lines may be more susceptible to wind damage and lightning strikes. People in low-lying areas are at risk for possible flooding. People in densely populated urban areas without air conditioning are likely to be more exposed to extreme heat events.

12.4.2 Property

According to the Clark and Cowlitz County Assessor records used for this analysis, there are 149,741 structures within the planning area. Most of these buildings (95.4 percent) are residential. All of these buildings are considered to be exposed to the severe weather hazard.

12.4.3 Critical Facilities and Infrastructure

Critical facilities exposed to floods are at risk from severe weather with heavy rain or snowmelt. Critical facilities on higher ground may be exposed to wind damage, damage from falling trees, heavy snow and ice accumulation, tornadoes, lightning strikes and extreme temperatures. The most common problems associated with severe weather are loss of utilities. The following systems also are at risk (CRESA, 2004):

- Transportation Systems—High winds can cause significant damage to trees and power lines, disrupting ingress and egress on roads with obstructing debris. Snowstorms significantly impact the transportation system and the availability of public safety services. Of particular concern are roads providing access to isolated areas and bridges, which tend to become icy before and after other areas are clear.
- Power and communication lines—Ice and severe windstorms can create serious impacts on power and above-ground communication lines. Freezing of power and communication lines can cause them to break, disrupting both electricity and communication for households. They can also break as a result of falling trees. This can result in isolation.
- Water and Sewer lines—Severe local storms can cause water and sewer lines to freeze, which may crack pipes. This could result in a loss of potable water to households or exposed sewage causing public health hazards. However, extreme and prolonged freezing weather is required to cause underground pipes to crack, which is not likely to occur in Clark County. Above-ground pipes leading to and from individual homes are more likely vulnerabilities than large mainlines.

12.4.4 Environment

Severe local storms can have significant effects on the environment. Heavy rains cause the ground to become saturated and rivers and streams to rise. This results in the potential for flooding and landslides. Additionally, snowmelt after snowstorms can cause riverine flooding, which has the potential to damage riparian habitat (CRESA, 2004).

12.5 VULNERABILITY

12.5.1 Population

Vulnerable populations from severe weather hazards tend to be the elderly, low income or linguistically isolated populations, people with life-threatening illnesses, residents living in areas that are isolated from major roads, and residents who lack proper shelter. Power outages can be life threatening to those dependent on electricity for life support. Isolation of these populations is a significant concern. These populations face isolation and exposure during severe weather events and could suffer more secondary effects of the hazard. Population vulnerabilities to specific types of severe weather event are as follows:

- **Damaging Winds—**Debris carried by extreme winds and trees felled by gusty conditions can contribute directly to loss of life and indirectly to the failure of protective building envelopes. Utility lines brought down by thunderstorms have also been known to cause fires, which start in dry roadside vegetation. Electric power lines falling down to the pavement create the possibility of lethal electric shock.
- **Extreme Temperatures—**Individuals with physical or mobility constraints, cognitive impairments, economic constraints, or social isolation are typically at greater risk to the adverse effects of excessive heat events. The average summertime mortality for excessive heat events is dependent upon the methodology used to derive such estimates. Certain medical conditions, such as heat stroke, can be directly attributable to excessive heat, while others may be exacerbated by excessive heat, resulting in medical emergencies. Individuals who lack shelter and heating are particularly vulnerable to extreme cold and wind chill.
- **Severe Winter Weather—**Many of the deaths that result from severe winter weather are indirectly related to the actual weather event, including deaths resulting from traffic accidents on icy roads and heart attacks while shoveling snow. Icy road conditions that lead to major traffic accidents can make it difficult for emergency personnel to travel. This may pose a secondary threat to life if police, fire, and medical personnel cannot respond to calls. Homeless populations that lack adequate shelter are also vulnerable to severe winter weather events.
- **Thunderstorms—**Nationally, lighting is one of the leading causes of weather-related fatalities (CDC, 2013). Lightning strikes are far more common in other areas of the country than they are in the Pacific Northwest. The majority of injuries and deaths associated with lighting strikes occur when people are outdoors; however, almost one-third of lightning-related injuries occur indoors. Males are five times more likely than females to be struck by lighting and people between the ages of 15 and 34 account for 41 percent of all lightning strike victims (CDC, 2013).
- **Tornado—**All residents in the path of a tornado are vulnerable, especially if there is not adequate warning that tornado spawning conditions are likely.

12.5.2 Property

All property is vulnerable during severe weather events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Structures in higher elevations and on ridges may be more prone to wind damage. Those that are located under or near overhead lines or near large trees may be damaged in the event of a collapse.

Loss estimates for the severe weather hazard are not based on damage functions, because no such damage functions have been generated. Instead, estimates were developed representing 10 percent, 30 percent and 50 percent of the replacement value of planning area structures. This allows emergency managers to select a range of potential economic impact based on an estimate of the percent of damage to the general building stock. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction of the structure. Table 12-3 lists the estimates of potential loss.

Table 12-3. Loss Potential for Severe Weather

	Total Replacement value	Estimated Loss Potential from Severe Weather		
		10% Damage	30% Damage	50% Damage
Battle Ground	$4,036,379,864	$403,637,986	$1,210,913,959	$2,018,189,932
Camas	$7,575,016,927	$757,501,693	$2,272,505,078	$3,787,508,464
La Center	$805,148,506	$80,514,851	$241,544,552	$402,574,253
Ridgefield	$2,075,091,625	$207,509,162	$622,527,487	$1,037,545,812
Vancouver	$47,993,433,972	$4,799,343,397	$14,398,030,192	$23,996,716,986
Washougal	$4,159,958,945	$415,995,894	$1,247,987,683	$2,079,979,472
Woodland	$1,777,992,519	$177,799,252	$533,397,756	$888,996,259
Yacolt	$306,406,962	$30,640,696	$91,922,089	$153,203,481
Unincorporated	$44,797,390,449	$4,479,739,045	$13,439,217,135	$22,398,695,224
Total	**$113,526,819,769**	**$11,352,681,976**	**$34,058,045,931**	**$56,763,409,883**

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

12.5.3 Critical Facilities and Infrastructure

Incapacity and loss of roads are the primary transportation failures resulting from severe weather. Snow and ice storms can significantly impact the transportation system and the availability of public safety services. Landslides caused by heavy prolonged rains can block roads. High winds can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating population, and disrupting ingress and egress. Of particular concern are roads providing access to isolated areas and to the elderly.

Downed trees and ice can create serious impacts on power and above-ground communication lines. Freezing of power and communication lines can cause them to break, disrupting electricity and communication. Loss of electricity and phone connection would leave certain populations isolated because residents would be unable to call for assistance. Water systems may also be impacted during severe winter weather events. The most frequent water system problem related to cold weather is a break in cast iron mainlines. Breaks frequently occur during severe freeze events, as well as during extreme cooling periods in October, November and December. Another common problem during severe freeze events is the failure of commercial and residential water lines. Inadequately insulated potable water and fire sprinkler pipes can rupture and cause extensive damage to property.

Heavy snow can immobilize a region and paralyze a city, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse buildings and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. The cost of snow removal, repairing damage, and loss of business can have large economic impacts on cities and towns.

12.5.4 Environment

The vulnerability of the environment to severe weather is the same as the exposure.

12.5.5 Economic Impact

Prolonged obstruction of major routes due to snow, debris, or floodwaters can disrupt the shipment of goods and other commerce. Large and prolonged storms can have negative economic impacts for an entire region.

12.6 FUTURE TRENDS

12.6.1 Development

All future development will be affected by severe weather. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. The planning partners have adopted the International Building Code in response to Washington State mandates. This code is equipped to deal with the impacts of severe weather events. Land use policies identified in comprehensive plans within the planning area also address many of the secondary impacts (flood and landslide) of the severe weather hazard. To combat the effects of urban heat island effect, communities can implement design standards and urban planning principles that reduce the impacts of excessive heat events. With these tools, the planning partnership is well equipped to deal with future growth and the associated impacts of severe weather.

12.6.2 Climate Change

Climate change presents a challenge for risk management associated with severe weather. One impact of climate change is an increase in average ambient temperatures. This has several impacts including:

- A likely decrease in the frequency of winter cold spells
- An increased probability of severe weather events (see Figure 12-8)
- More intense heat waves
- Changes in the intensity, duration and frequency of storm events.

As ambient temperatures increase, more water evaporates from land and water sources. The timing, frequency, duration and type of precipitation events will be affected by these changes. In general, more precipitation will fall as rain rather than snow; however, the amount of snowfall may increase where temperatures remain below freezing (U.S. EPA, 2013). Snowfall may also change if typical storm track patterns are altered. Snowfall is already changing in the United States. The EPA reports the following trends (see Figure 12-9; U.S. EPA, 2013):

- Total snowfall has decreased in most parts of the country since widespread observations became available in 1930, with 57 percent of stations showing a decline.
- More than three-fourths of the stations across the contiguous 48 states have experienced a decrease in the proportion of precipitation falling as snow.
- The Pacific Northwest has seen a decline in both total snowfall and the proportion of precipitation falling as snow.

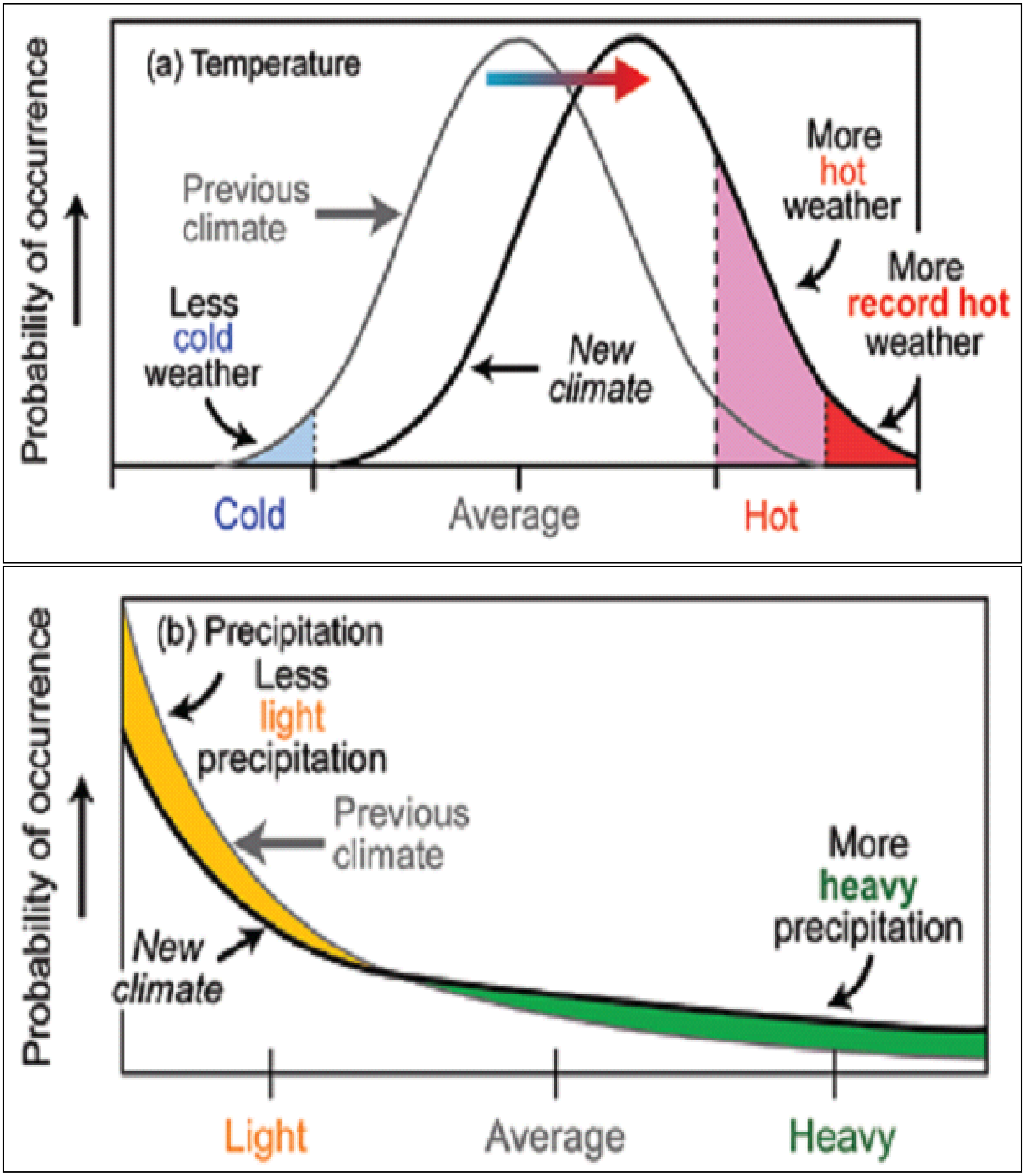


Figure 12-8. Severe Weather Probabilities in Warmer Climates

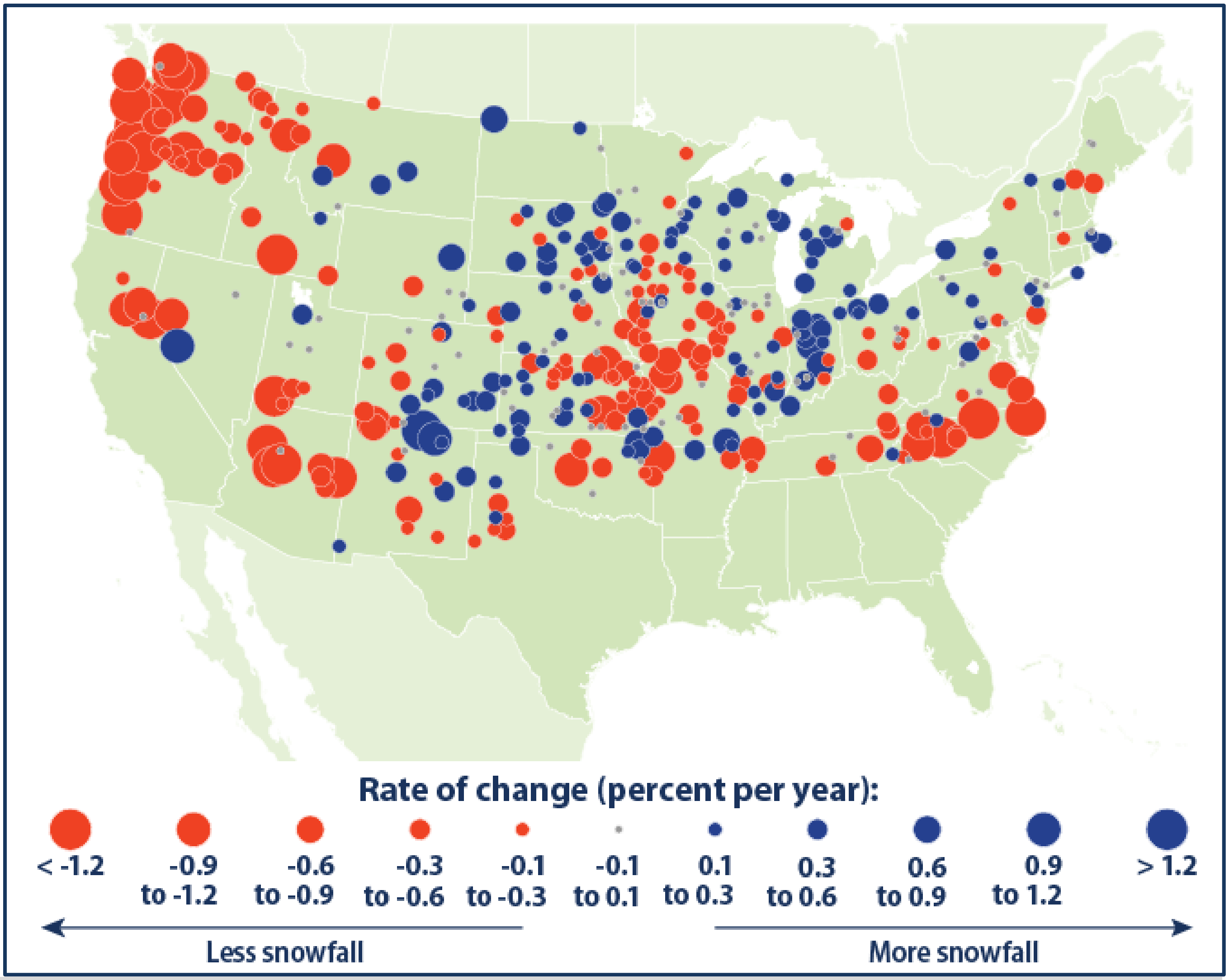


Figure 12-9. Change in Snowfall, 1930-2007

12.7 SCENARIO

Although severe local storms are infrequent, impacts can be significant, particularly when secondary hazards of flood and landslide occur in tandem. A worst-case event would involve prolonged high winds during a snowstorm accompanied by freezing temperatures, followed by warmer weather and continued rain. Such an event would have both short-term and longer-term effects. Initially, schools and roads would be closed due to snow and downed tree obstructions. Power outages would be common throughout the county. In the more rural areas, some subdivisions in unincorporated areas could experience limited ingress and egress. Later, as the weather warms and snow turns to rain, the sudden runoff could produce flooding, overtopped culverts with ponded water on roads, and landslides on steep slopes. Flooding and landslides could further obstruct roads and bridges, further isolating residents (CRESA, 2004).

This combination in November 1995 resulted in flood damage to roads and bridges, dikes and storm drainage systems, residences, businesses and farms throughout Clark County. Power lines were down throughout the county. Total damage was estimated at about $25 million. Rainfall was measured at approximately 10 inches above average for that period (CRESA, 2004).

12.8 ISSUES

Severe local storms are probably the most common widespread hazard. They affect large numbers of people in the planning area when they occur. Severe storms can quickly overwhelm city and county resources. Residents should be prepared for these types of storms: family plans should be developed, disaster kits should be put in homes, workplaces, schools and cars, and every family member should be taught how to shut off household utilities. Early dismissal from schools and businesses is an effective mitigation measure and should be encouraged.

Severe weather cannot be prevented, but measures can be taken to mitigate the effects. Critical infrastructure and utilities can be hardened to prevent damage during an event. The secondary effect of flooding can be addressed through decreasing runoff and water velocity. Important issues associated with severe weather in the planning area include the following:

- Redundancy of power supply throughout the planning area must be evaluated to better understand what areas may be vulnerable.
- The capacity for backup power generation is limited.
- The County has numerous isolated population centers.
- Public education on dealing with the impacts of severe weather needs to continue so that residents can be better informed and prepared for severe weather events.
- Debris management (downed trees, etc.) must be addressed, because debris can impact the severity of severe weather events, requires coordination efforts, and may require additional funding.
- Older building stock in the planning area is built to low code standards or none at all. These structures could be highly vulnerable to severe winter weather effects such as snow loads or high winds.
- Street tree management programs should be evaluated to help reduce impacts from tree-related damages.
- Priority snow removal routes should continue to be cleared first to ensure navigable routes through and between jurisdictions.

13. VOLCANO

13.1 GENERAL BACKGROUND

A volcano is a vent in the earth's crust through which magma, rock fragments, gases, and ash are ejected from the earth's interior. Over time, accumulation of these products on the earth's surface creates a volcanic mountain. Hazards associated with volcanoes are related to the ways in which volcanic materials and other debris flow from the volcano (CRESA 2004).

13.1.1 Cascade Range Volcanoes

Clark County is near the Cascade Range, an 800-mile-long chain of volcanoes that extends from northern California to southern British Columbia (see Figure 13-1). The volcanoes are the result of a slow slide of dense oceanic crust as it has passed below the North American continent, which releases water and melts overlying rock (USGS, 2013).

13.1.2 Stratovolcanoes and Types of Hazards

The volcanoes in the Cascade Range surrounding Clark County are all stratovolcanoes. They are typically steep-sided, symmetrical cones of large dimension, built of alternating layers of lava, volcanic ash, cinders and blocks of rock. They may rise as much as 8,000 feet above their bases. The sections below describe the hazards associated with Cascade Range volcanoes (CRESA, 2011).

Pyroclastic Flows and Surges

Pyroclastic flows are avalanches of hot (300ºC to 800°C), dry, volcanic rock fragments and gases that descend a volcano's flanks at speeds up to 200 miles per hour. They originate from the explosion related to an eruption. Pyroclastic flows and surges are a lethal hazard. They result in incineration, asphyxiation, and burial. Because of their speed they cannot be outrun. Pyroclastic flows are heavier than air and seek topographically low areas. Hot mixtures of gas and rock will flow above the ground and may go over topographical barriers such as ridges and hills.

Lava Flows

Lava flows are normally the least hazardous threat posed by volcanoes. The speed and viscosity of a lava flow are determined by the silica content of the lava. The higher the silica content, the more viscous (thick) the lava becomes. Low silica basalt lava can move 10 to 30 mph. High silica andesite and dacite tend to move more slowly and travel short distances. Cascade volcanoes are normally associated with slow moving andesite or dacite lava. However, 2,000 years ago Mount St. Helens produced a large amount of basalt.

Large lava flows may destroy property and cause forest fires but, since they are slow moving, they pose little threat to human life. The greater hazard presented by lava flows is that their extreme heat can cause snow and ice to melt very quickly, adding to flooding hazards or the lahar and debris avalanche hazards described below.

Source: USGS, 2013

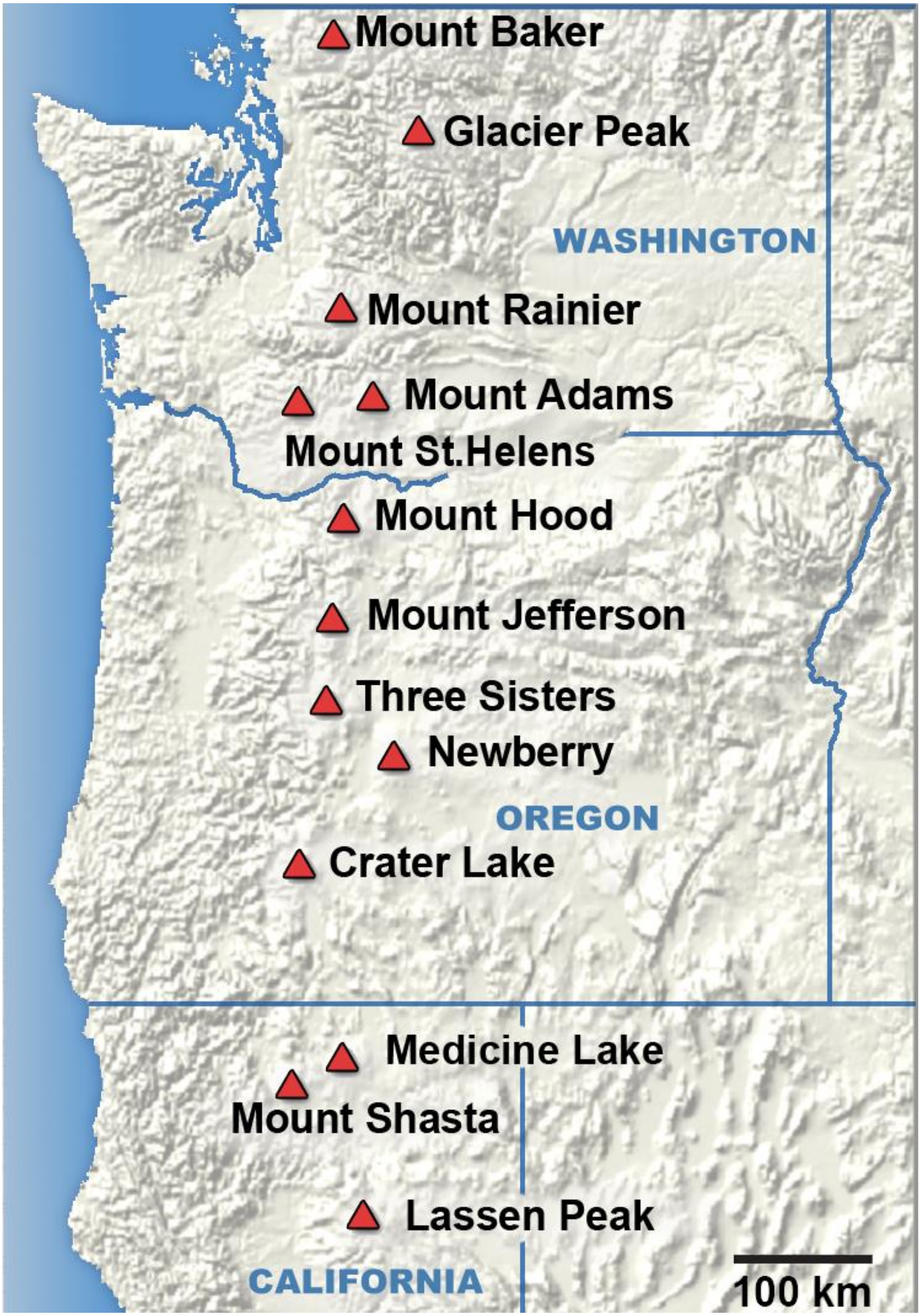


Figure 13-1. Cascade Range Volcanoes

Ash Fall

Ash and large volcanic projectiles can erupt from a volcano into the atmosphere. These materials are sometimes called tephra. The largest fragments (bombs, >64 mm) fall back to the ground fairly near the vents, as close as a few yards and as far as 6 miles. The smallest rock fragments (ash) are composed of rock, minerals, and glass that are less than 2 millimeters in diameter. Tephra plume characteristics are affected by wind speed, particle size, and precipitation.

Ash fall poses a variety of threats. Ash only 1 cm thick can impede the movement of most vehicles and disrupt transportation, communication, and utility systems. During the past 15 years, about 80 commercial jets have been damaged by inadvertently flying into ash, and several have nearly crashed. Airborne tephra will seldom kill people who are a safe distance from the vent. However, ash may cause eye and respiratory problems, particularly for those with existing medical conditions. Short-term exposure should not have any long-term health effects. Some ash fall materials may have acidic aerosol droplets that adhere to them. This may cause acid rain or corrosion of metal surfaces they fall on.

Ash may also clog ventilation systems and other machinery. When ash is mixed with rain it becomes a much greater nuisance. Wet ash is much heavier and it can cause structures to collapse. Most of the 330 deaths associated with the Mt. Pinatubo eruption were caused by roofs collapsing under the weight of rain-soaked ash. Wet ash may also cause electrical shorts. Ash fall also decreases visibility and may cause psychological stress and panic.

Lahars

Lahars are rapidly flowing mixtures of water and rock debris that originate from volcanoes. While lahars are most commonly associated with eruptions, heavy rains, debris accumulation, and even earthquakes may also trigger them. They may also be termed debris or mud flows. Lahars can travel over 50 miles downstream, reaching speeds between 20 and 40 mph. The highest recorded speed of a lahar during the 1980 Mount St. Helens eruption was 88 mph. Beyond the flanks of a volcano, lahars will normally be channeled into waterways. The threat from lahars comes from their speed and from the debris they carry. Abrasion from the heavy sediment and impacts from heavy debris can destroy forests as well as human-made structures, including bridges, dams, roads, pipelines, buildings, and farms. Lahars may also fill in channels, obstructing shipping lanes and impacting a channel’s ability to handle large volumes of water.

Debris Avalanches

Volcanoes are prone to debris and mountain rock avalanches that can approach speeds of 100 mph. Volcanoes are characterized by steep slopes of weak rock. Volcanic rock material is weakened by the acidic groundwater that seeps through rock cracks and turns rigid rock into clay. Minor eruptions, earthquakes, or releases of built up water and debris may trigger large avalanches of this material.

Volcanic Gases

All active volcanoes emit gases. These gases may include steam, carbon dioxide, sulfur dioxide, hydrogen sulfide, hydrogen, and fluorine. Sometimes, these chemicals can be absorbed by ash and impact groundwater, livestock, and metal objects. Even when a volcano is not erupting, gases can escape through small surface cracks. The greatest danger to people comes when large quantities of toxic gases are emitted from several sources or when there are topographic depressions that collect gases that are heavier than air. These gases can accumulate to the point where people or animals can suffocate. Neither of these conditions exists in Cascade volcanoes, though this could change if magma were to come close to the surface. Mount St. Helens emitted thousands of tons of sulfur dioxide every day in the early 1980s. These gases were easily dispersed by the wind.

Lateral Blast

Lateral blasts are explosive events in which energy is directed horizontally instead of vertically from a volcano. They are gas-charged, hot mixtures of rock, gas and ash that are expelled at significantly high speeds. Lateral blasts vary in size, but large ones are fairly rare, with only a few historical examples worldwide. The most recent was the 1980 eruption of Mount St. Helens when almost everything within the blast zone (about 230 square miles) perished. The Mount St. Helens lateral blast is estimated to have reached a velocity of 670 mph, and there have been speculations that the velocity may have gone even higher, reaching a supersonic rate of 735+ mph for at least a few moments (USGS, 1997).

13.2 HAZARD PROFILE

13.2.1 Past Events

Cascade Range volcanoes in the U.S. have erupted more than 200 times during the past 12,000 years, for an average of nearly two eruptions per century (CRESA, 2011). Seven Cascade volcanoes have erupted since the beginning of the 18th century (USGS, 2013). At least five of these eruptions have occurred during the past 150 years (CRESA, 2011). Figure 13-2 summarize past eruptions in the Cascades.

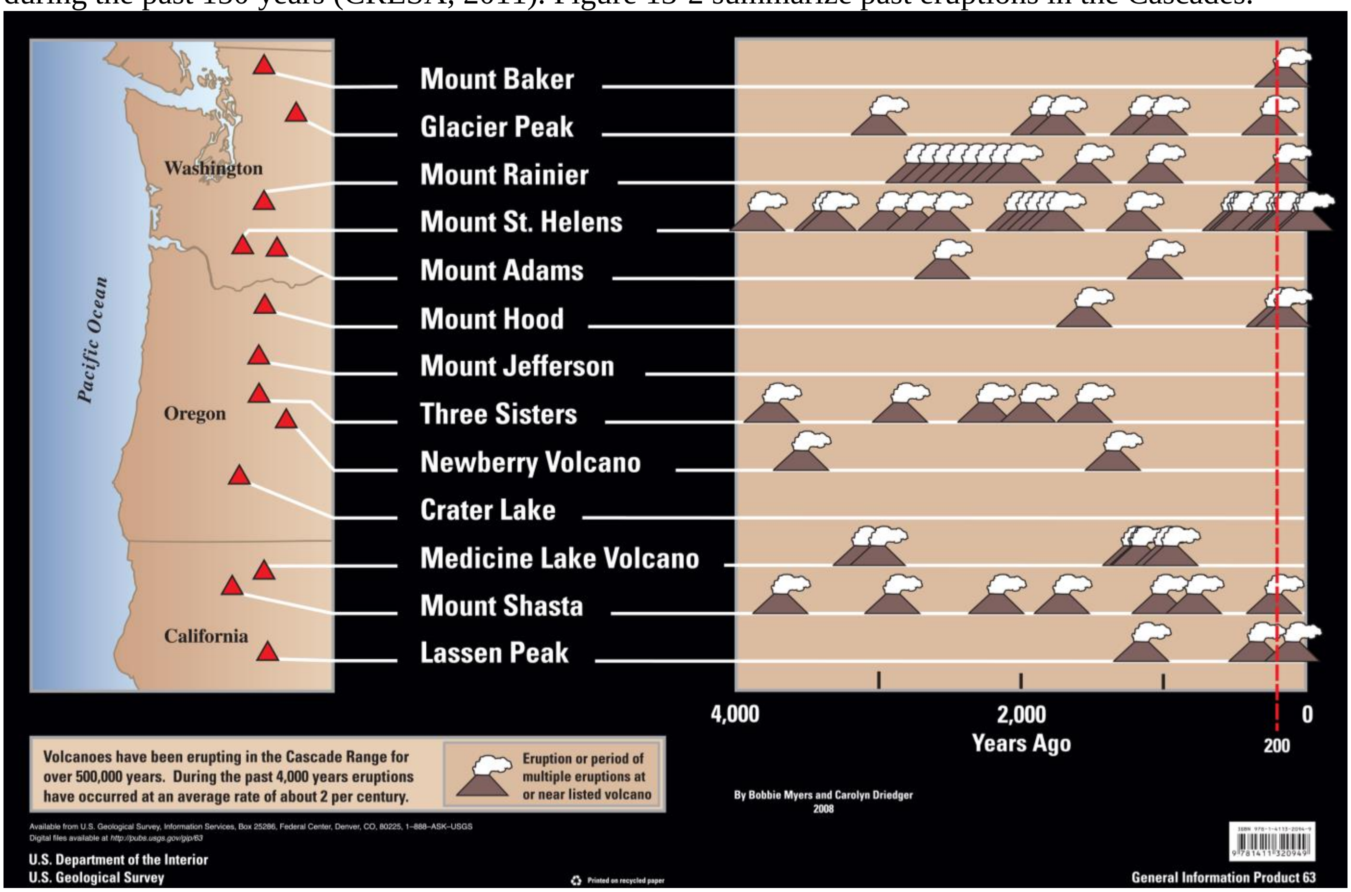


Figure 13-2. Cascade Range Eruptions in the Past 4,000 Years

The most recent major eruptions in the Cascade Range are the well-documented 1980-1986 eruptions of Mount St. Helens. The primary, major eruption on May 18, 1980 claimed 57 lives and caused nearly a billion dollars in damage and response costs. The effects were felt throughout the Northwest (CRESA, 2011). Mount St. Helens also experienced activity from 2004 to 2008, producing a series of lava spines and millions of small earthquakes (Washington Emergency Management Division, 2014).

In 1781, Mount Hood erupted, which resulted in lahar flows that reached the Columbia River (USGS, 2013). There were additional reports of eruptive activity in 1859 and 1865 from early settlers. Reports included sightings of fire, smoke, flying rock, and steaming (USGS, 2012b).

13.2.2 Location

None of the Cascade volcanoes are located in Clark County. The nearest are Mount Hood in northern Oregon and Mount Adams and Mount St. Helens in southern Washington. Expected impacts from these volcanoes are generally referred to as "distal" hazards, meaning that the hazard areas are relatively far from the volcano itself. Hazard mapping conducted by the USGS indicates that major eruptions of Mount Hood and Mount St. Helens could have direct impacts on small portions of the planning area:

- In the event of a Mount Hood eruption, a small part of the southeastern portion of the county, located along the Columbia River, may experience bank erosion and flooding caused by lahars and sediment-rich floods from the Sandy and Hood Rivers (see Figure 13-3 and Figure 13-5).
- An eruption of Mount St. Helens may directly impact a very small area of the northeastern portion of the county; however, there are no structures within that mapped hazard area (see Figure 13-4).

Ash fall from an eruption of any of the Cascade volcanoes could potentially reach the planning area depending on weather events at the time of the eruption.

13.2.3 Frequency

Mount St. Helens is currently the most active volcano in the Cascades, with four major explosive eruptions in the last 515 years as well as dozens of smaller eruptions. Still, the probability of an eruption in any given year is extremely low. Figure 13-6 shows the annual probability of an ash fall accumulation of 4 inches or more (10 cm). Clark County is in an area of varying probability for such ash fall accumulation, ranging from 0.1 percent in the eastern portion of the county to less than 0.01 percent in the western portion.

13.2.4 Severity

Although Clark County is near both Mount St. Helens and Mount Hood, the planning area does not have a large degree of exposure to direct impacts, aside from ash fall. The severity of impacts from distal hazards would likely depend on the severity of the eruption. The severity of impacts from ash fall accumulation would be related to the extent of the accumulation. Ash fall often causes damage to buildings and building systems. This can range from complete or partial roof collapse to damage to exterior materials or interior rooms and appliances. Effects are dependent on the thickness of the ash, whether it is wet or dry, the roof and building design, air-handling systems, and the amount of ash inside the building. Buildings whose mechanical systems are shut down prior to ash fall typically experience less interior damage.

In addition to the concern for structural collapse, ash is corrosive and can be electrically conductive. This can lead to metallic roof surfaces experiencing increased deterioration. The abrasive and corrosive nature of ash not only causes potential minor but painful burns to humans, it can also damage computer and electronic systems. While volcanic ash is most often associated with structural instability, it can also cause issues with agriculture, health, power supply, water supply, transportation, and wastewater (USGS, 2015a).

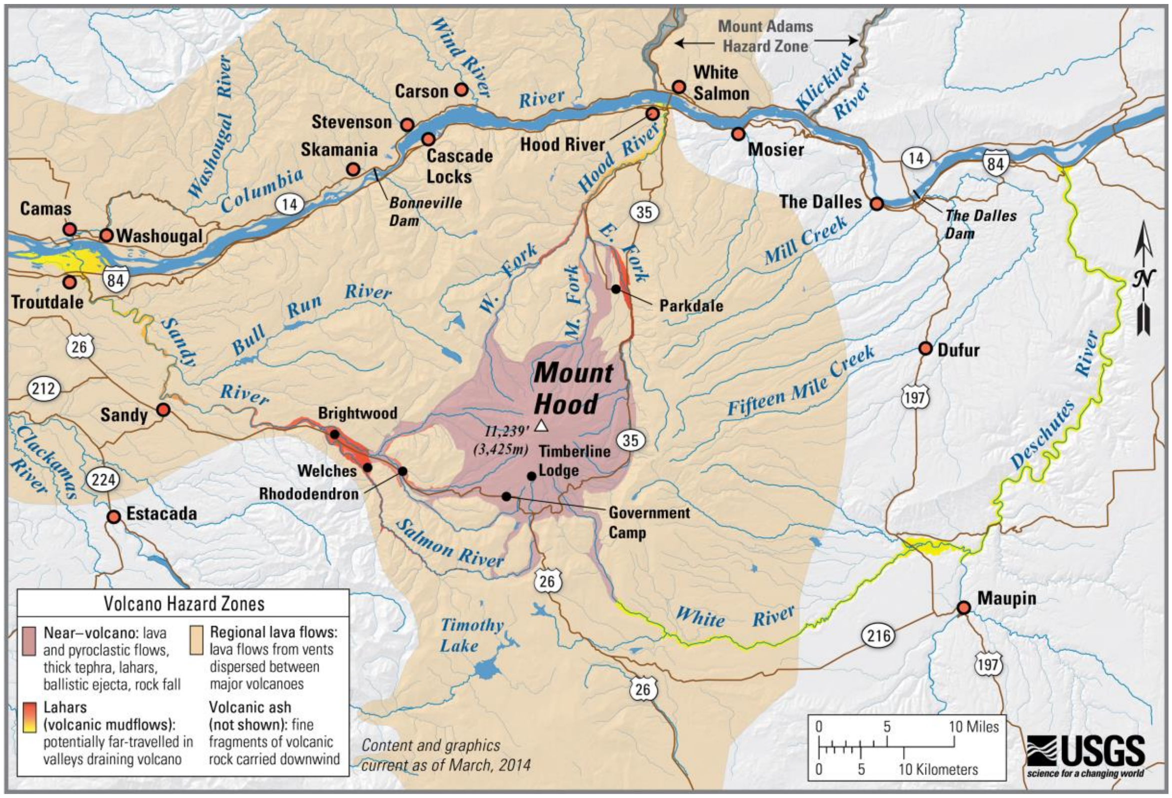


Figure 13-3. Potential Impact Area for Ground-Based Hazards during a Mount Hood Event

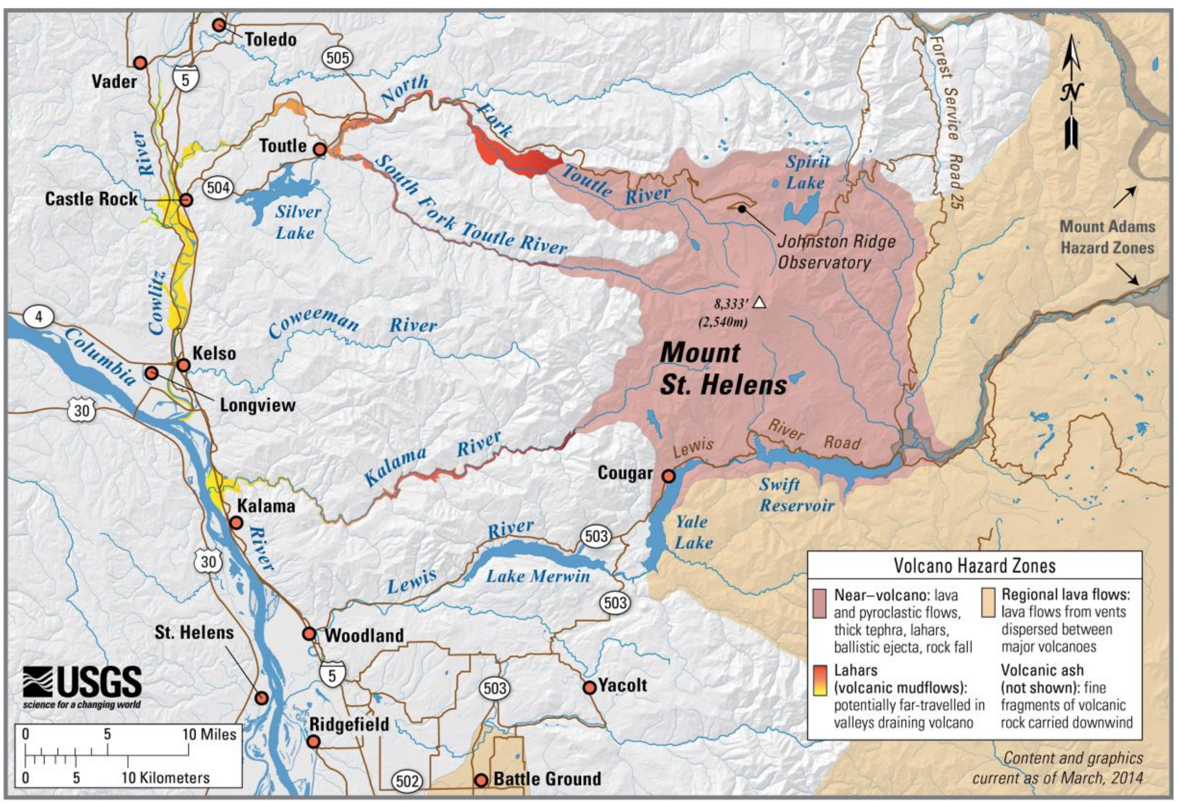


Figure 13-4. Potential Impact Area for Ground-Based Hazards during a Mount Saint Helens Event

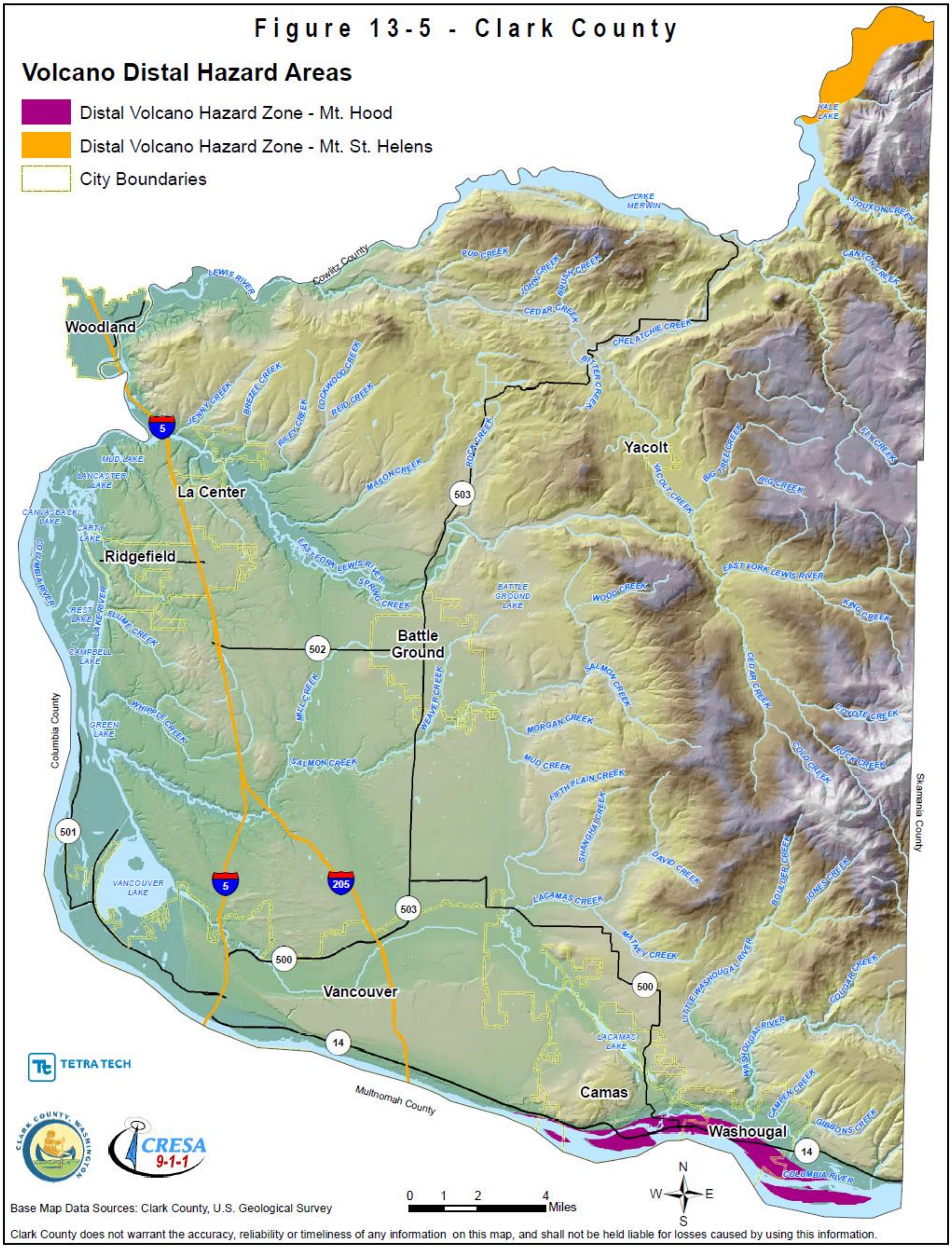


Figure 13-5. Volcano Distal Hazard Areas

Source: Hoblitt and Scott, 2011

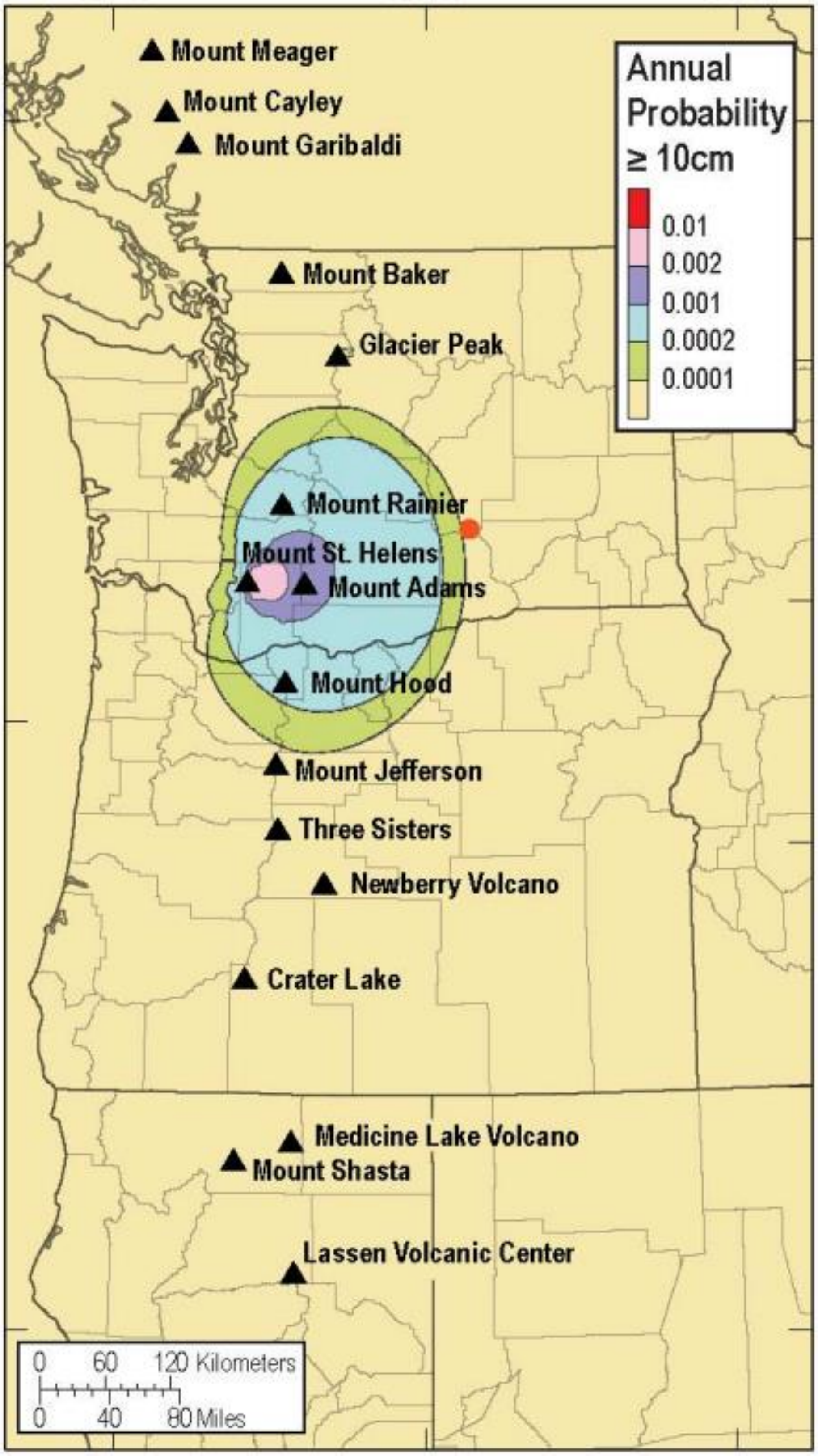


Figure 13-6. Preliminary Probabilistic Ash Fall Hazard Map

13.2.5 Warning Time

The best warning of a volcanic eruption is one that specifies when and where an eruption is likely and what type and size eruption should be expected. Such accurate predictions are sometimes possible but still rare. The most accurate warnings are those in which scientists indicate an eruption is probably only hours to days away, based on significant changes in a volcano's earthquake activity, ground deformation, and gas emissions. Experience from around the world has shown that most eruptions are preceded by such changes over a period of days to weeks. A volcano may begin to show signs of activity several months to a few years before an eruption. However, a warning that specifies months or years in advance when it might erupt are extremely rare.

Monitoring Volcanic Activity

The USGS and the Pacific Northwest Seismograph Network at the University of Washington conduct seismic monitoring of all Cascade volcanoes in Washington and Oregon. During the past decade, monitoring networks on Mount Hood and Mount St. Helen's have been expanded.

Volcanic Event Notification

Members of the public may sign up for the USGS Volcano Notification Service email subscription service on the USGS website. Notifications include several types: volcano activity notices; daily, weekly or monthly updates; status reports; volcano observatory notices for aviation; and information statements. Volcano-alert notifications are based on analysis of data from monitoring networks, direct observations, and satellite sensors. They are issued for both increasing and decreasing volcanic activity and include text about the nature of the activity and about potential or current hazards. Scientists describe a volcano's status using alert levels and color codes and issue different types of notifications to address specific information needs. These alert levels consist of two parts (USGS, 2016):

- Ranked terms to inform people on the ground about a volcano's status:
  - **Normal**—Volcano is in typical background, non-eruptive state or, after a change from a higher level, volcanic activity has ceased and volcano has returned to non-eruptive background state.
  - **Advisory**—Volcano is exhibiting signs of elevated unrest above known background level or, after a change from a higher level, volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.
  - **Watch**—Volcano is exhibiting heightened or escalating unrest with increased potential of eruption, timeframe uncertain, OR, eruption is underway but poses limited hazards.
  - **Warning**—Hazardous eruption is imminent, underway, or suspected.
- Ranked colors to inform the aviation sector about airborne hazards (green, yellow, orange and red generally correspond to alert level term definitions).

This alert level ranking offers a framework that the public and civil authorities can use to gauge and coordinate a response to a developing volcano emergency.

Lahar Travel Times

According to a recent study by the Oregon Department of Geology and Mineral Industries (2016), it would take more than 3.5 hours for distal hazard impacts to reach the planning area (see Figure 13-7).

Source: USGS Simplified from Gardner et al. 2000

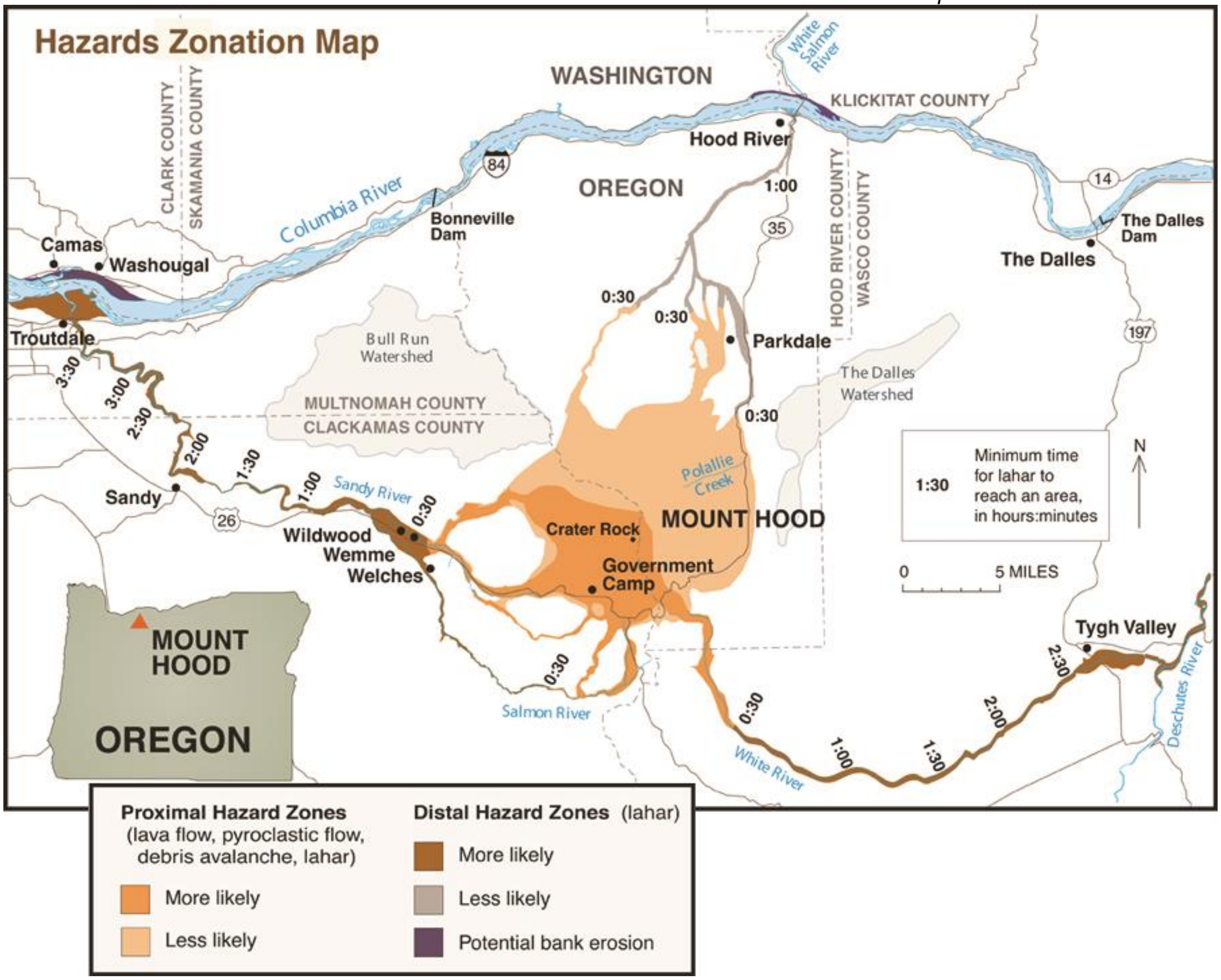


Figure 13-7. Mount Hood Hazard Zones and Lahar Travel rimes

13.3 SECONDARY HAZARDS

Ground movement often accompanies volcanic eruption. Such movement can result in subsidence, surface ruptures, earthquakes, and potentially tsunamis. Other secondary hazards can include traffic disruptions (such as if ash coats roadways and runways); utility failures (from the weight of ash or the infiltration of ash into electronic systems, particularly with communications, power, and water quality); and structural or building collapse. Areas impacted by volcanic ash and toxic gases can experience long-term secondary public health impacts associated with soil quality. Acid rain may damage water supplies, foliage, paint, machinery, and fabric.

13.4 EXPOSURE

All of the Clark County planning area would be exposed to ash fall from volcanic eruptions in the Cascade Range to some degree. The location of the event as well as the prevailing wind direction would influence the extent of this impact.

13.4.1 Population

The entire population of Clark County is exposed to the effects of ash fall. Populations along the Columbia River islands and areas along the Washington shore could be impacted by distal hazards. Population could not be examined by distal hazard zone because census block groups do not coincide with the hazard risk areas. However, population was estimated using the structure count of buildings within the distal hazard zones and applying the census value for Clark County of 2.7 persons per household. Using this approach, it is estimated that the exposed population is 3,297 (less than 1 percent of the total planning area population). Table 13-1 shows the estimated population exposure by jurisdiction.

Table 13-1. Estimated Population Residing in Distal Hazard Areas

	Population Exposed[a]	% of Total Population
Battle Ground	0	0.0%
Camas	1,291	6.1%
La Center	0	0.0%
Ridgefield	0	0.0%
Vancouver	3	0.0%
Washougal	1,979	13.0%
Woodland	0	0.0%
Yacolt	0	0.0%
Unincorporated	24	0.0%
Total	**3,297**	**0.7%**

a. Value calculated as number of buildings exposed multiplied by 2.7 people (Clark County) / 3.17 people (Woodland) per building. This multiplier is the number of persons per household per the U.S. Census Bureau, State, County and City Quick Facts 2009-2015.

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

13.4.2 Property

Distal Hazards

All of the exposure to distal hazards is in the southern portion of the planning area along the Columbia River islands and areas along the river shore. All property in the distal hazard zones would be exposed to bank erosion and flooding. It is possible that dikes and bulkheads along the north bank of the Columbia River could help to protect property from the effects of a lahar-induced flood (CRESA, 2004). The number and value of planning area structures in the distal hazard zones is summarized in Table 13-2. The type of structure is shown in Table 13-3. The breakdown of the present land use in the distal hazard areas is shown in Table 13-4.

Exposed property in the planning area is located in Camas, Washougal, Vancouver and unincorporated areas. The majority of exposed structures are residential (75 percent), although there is substantial exposure of commercial and industrial activities in the Port of Washougal, accounting for the high percentage of the estimated replacement value. Residential and industrial uses make up the majority of exposed land uses in the hazard areas.

Ash Fall

All property in the planning area would be exposed to ash fall accumulation in the event of a volcanic eruption.

Table 13-2. Exposure and Value of Structures in Distal Hazard Zone

Jurisdiction	Buildings Exposed	Value Exposed			% of Total Replacement Value
		Structure	Contents	Total	
Battle Ground	0	$0	$0	$0	0.0%
Camas	478	$479,346,070	$500,824,519	$980,170,589	12.9%
La Center	0	$0	$0	$0	0.0%
Ridgefield	0	$0	$0	$0	0.0%
Vancouver	1	$1,029,215	$1,029,215	$2,058,429	0.0%
Washougal	733	$991,165,458	$914,612,600	$1,905,778,058	45.8%
Woodland	0	$0	$0	$0	0.0%
Yacolt	0	$0	$0	$0	0.0%
Unincorporated	9	$5,911,142	$4,566,691	$10,477,833	0.0%
Total	**1,221**	**$1,477,451,884**	**$1,421,033,025**	**$2,898,484,909**	**2.6%**

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

Table 13-3. Structure Type in Distal Hazard Zone

	Number of Structures[a]							
	Residential	Commercial	Industrial	Agriculture/ Forestry	Religion	Government	Education	Total
Battle Ground	0	0	0	0	0	0	0	**0**
Camas	393	71	11	0	1	2	0	**478**
La Center	0	0	0	0	0	0	0	**0**
Ridgefield	0	0	0	0	0	0	0	**0**
Vancouver	0	1	0	0	0	0	0	**1**
Washougal	513	175	7	2	11	17	8	**733**
Woodland	0	0	0	0	0	0	0	**0**
Yacolt	0	0	0	0	0	0	0	**0**
Unincorporated County	8	0	0	1	0	0	0	**9**
Total	**914**	**247**	**18**	**3**	**12**	**19**	**8**	**1,221**

a. Structure type assigned to best fit Hazus occupancy classes based on present use classifications provided by Clark and Cowlitz County assessor's data. Where conflicting information was present in the available data, parcels were assumed to be improved.

Table 13-4. Present Land Use in Planning Area[a]

Present Use Classification[b]	Area (acres)[c, d]	% of total
Agriculture/Resource Land	362	8.6%
Commercial	793	18.8%
Education	3	0.1%
Governmental Services	13	0.3%
Industrial	943	22.3%
Religious Services	4	0.1%
Residential	1,491	35.3%
Vacant or uncategorized	618	14.6%
Total	4,227	100%

a. Present land use information in this plan is for planning purposes only. Discrepancies may exist between these estimates and official records maintained by participating jurisdictions.

b. Present use classification provided by Clark and Cowlitz County assessor's data assigned to best fit occupancy classes in FEMA's Hazus model (see Section 6.3.1). Parcels for which conflicting information on current development was available were assumed to be improved. Some designated resource land may also be included in the vacant or uncategorized category.
c. Acreage covers only mapped parcels; it excludes many rights of way and major water features.
d. Acreage includes Clark County and the incorporated areas of the City of Woodland.

13.4.3 Critical Facilities and Infrastructure

Distal Hazard Zones

All critical facilities and infrastructure in the mapped hazard areas are exposed to distal hazards, as summarized in Table 13-5. In addition the following linear features are exposed:

- Northwest pipeline
- State Route 14
- State Route 500
- 6.02 miles of Columbia River levees.

Table 13-5. Critical Facilities and Infrastructure Exposed to Distal Hazards

	Commu-nication Facilities	Dams	Emer-gency Services	Energy	Govern-ment Facilities	Hazardous Materials	Health Care & Public Health	Infor-mation Technol-ogy	Schools	Trans-portation Systems	Water & Sanitation Systems	Total
Battle Ground	0	0	0	0	0	0	0	0	0	0	0	**0**
Camas	0	0	2	1	0	0	0	0	0	4	17	**24**
La Center	0	0	0	0	0	0	0	0	0	0	0	**0**
Ridgefield	0	0	0	0	0	0	0	0	0	0	0	**0**
Vancouver	0	0	0	0	0	0	0	0	0	0	0	**0**
Washougal	0	0	2	1	3	8	0	0	0	2	7	**23**
Woodland	0	0	0	0	0	0	0	0	0	0	0	**0**
Yacolt	0	0	0	0	0	0	0	0	0	0	0	**0**
Unincorporated	0	0	0	0	0	0	0	0	0	0	0	**0**
Total	**0**	**0**	**4**	**2**	**3**	**8**	**0**	**0**	**0**	**6**	**24**	**47**

Ash Fall

All critical facilities and infrastructure in the planning area are potentially exposed to ash fall.

13.4.4 Environment

The environment is highly exposed to the effects of a volcanic eruption. Even if ash fall from a volcanic eruption were to fall elsewhere, it could still be spread throughout the county by surrounding rivers and streams. Additionally, excess sediment in rivers and streams could impact water quality and substantially disrupt habitat.

13.5 VULNERABILITY

13.5.1 Population

Distal Hazards

Since there is generally adequate warning time before a volcanic event, the population vulnerable to distal hazards consists of those who choose not to evacuate or are unable to evacuate. The latter includes the elderly, the very young, and those with access and functional needs.

Ash Fall

The entire population of the planning area is vulnerable to the damaging effects of volcanic ash fall in the event of a volcanic eruption. The elderly, very young and those who experience ear, nose and throat problems are especially vulnerable to the ash fall hazard. Ash is harsh, acidic, gritty, and smelly. Although the gases are usually too diluted to constitute danger to a person in normal health, the combination of acidic gas and ash may cause lung problems. Extremely heavy ash can clog breathing passages and cause death. When an ash cloud combines with rain, sulfur dioxide in the cloud combines with water to form diluted sulfuric acid that may cause minor, but painful burns to the skin, eyes, nose, and throat. Hydrochloric acid rains following eruptions have also been reported. Additionally, ash fall decreases visibility and may cause psychological stress and panic.

13.5.2 Property

Distal Hazards

There are currently no generally accepted damage functions for volcanic hazards in risk assessment platforms such as Hazus-MH. All properties listed in Table 13-2 are considered vulnerable to distal hazards. The most vulnerable structures would be those that are located closest to the Columbia River hazard areas, and those that are not structurally sound. Loss estimates for distal hazards are shown in Table 13-6 representing 10, 30, and 50 percent of the exposed property value.

Ash Fall

All of the property exposed to nature in the planning area is exposed to the effects of ash fall. The most vulnerable structures are those that are not as structurally sound and may collapse under the excessive weight of ash and possible rainfall. A 1-inch deep layer of ash weighs an average of 10 pounds per square foot, causing danger of structural collapse.

Vulnerable property includes equipment and machinery left out in the open, such as combines, whose parts can become clogged by the fine dust. Infrastructure, such as drainage systems, is potentially vulnerable to the effects of ash fall, since the fine ash can clog pipes and culverts. This may be more of a problem if an eruption occurs during winter or early spring when precipitation is highest and floods are most likely.

Table 13-6. Loss Estimates for Volcano Distal Hazards

		Estimated Loss Potential from Distal Hazards		
	Exposed Value	10% Damage	30% Damage	50% Damage
Battle Ground	$0	$0	$0	$0
Camas	$980,170,589	$98,017,058.90	$294,051,176.70	$490,085,294.50
La Center	$0	$0	$0	$0
Ridgefield	$0	$0	$0	$0
Vancouver	$2,058,429	$205,842.90	$617,528.70	$1,029,214.50

	Exposed Value	Estimated Loss Potential from Distal Hazards		
		10% Damage	30% Damage	50% Damage
Washougal	$1,905,778,058	$190,577,805.80	$571,733,417.40	$952,889,029.00
Woodland	$0	$0	$0	$0
Yacolt	$0	$0	$0	$0
Unincorporated	$10,477,833	$1,047,783.30	$3,143,349.90	$5,238,916.50
Total	**$2,898,484,909**	**$289,848,491**	**$869,545,473**	**$1,449,242,455**

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

To estimate the loss potential for this hazard, a qualitative approach was used, based on recommendations from FEMA guidelines on state and local mitigation planning. For this analysis, 0.1 percent of total replacement valuations was selected as the loss ratio for the ash fall hazard. The results are summarized in Table 13-7.

Table 13-7. Loss Estimates for Ash Fall

Jurisdiction	Exposed Value	Estimated Loss Potential @ 0.1% Damage
Battle Ground	$4,036,379,864	$4,036,380
Camas	$7,575,016,927	$7,575,017
La Center	$805,148,506	$805,149
Ridgefield	$2,075,091,625	$2,075,092
Vancouver	$47,993,433,972	$47,993,434
Washougal	$4,159,958,945	$4,159,959
Woodland	$1,777,992,519	$1,777,993
Yacolt	$306,406,962	$306,407
Unincorporated	$44,797,390,449	$44,797,390
Total	**$113,526,819,768**	**$113,526,820**

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

13.5.3 Critical Facilities and Infrastructure

Distal Hazards

All critical facilities and infrastructure in the hazard areas are vulnerable to distal hazards. Flood protection may offer some protection for some facilities, depending on design specifications. Excess sedimentation and resulting bank erosion may significantly impact the Columbia River shipping channel.

Ash Fall

Ash fall accumulation of less than one-half inch is capable of creating temporary disruptions of transportation operations and sewage disposal and water treatment systems. Highways and roads could be closed for hours, days, or weeks afterwards. The gritty ash can cause substantial problems for internal-combustion engines and other mechanical and electrical equipment. The ash can contaminate oil systems, clog air filters, and scratch moving surfaces. Fine ash can also cause short circuits in electrical transformers, which in tum cause power blackouts.

Heavy airborne ash blots out light. Sudden heavy demand for electric light and air conditioning may cause a drain on power supplies, leading to a partial or full power failure. Ash clogs machinery of all kinds and poses a serious threat to aviation because particles can damage aircraft systems and jet engines. It drifts into roadways, railways, and runways, where it is slippery and dangerous. Its weight may cause structural collapse. Because winds and air currents easily carry it, it remains a hazard to machinery and transportation (particularly aviation) for months after the eruption

13.5.4 Environment

The increased sedimentation and bank erosion resulting from a volcanic eruption could be damaging to rivers and streams and could redirect water flow and cause changes in water courses. Ash fall would expose the local environment to lower air quality and other effects that could harm vegetation and water quality. The sulfuric acid contained in volcanic ash could be damaging to area vegetation, waters, wildlife and air quality. Secondary impacts from hazardous materials released in distal hazard areas could cause significant damage to the environment and waterways.

13.5.5 Economic Impact

Volcanic eruptions can disrupt the normal flow of commerce and daily human activity without causing severe physical harm or damage. Ash that is a few inches thick can halt traffic, cause rapid wear of machinery, clog air filters, block drains, creeks and water intakes, and impact agriculture. Removal and disposal of large volumes of deposited ash can have significant impacts on government and business. The interconnectedness of the region’s economy can be disturbed after a volcanic eruption. Roads, railroads and bridges can be damaged by lahars and mudflows. The Mount St. Helens May 1980 eruption demonstrated the negative effect on the tourism industry. Conventions, meetings, and social gatherings were canceled or postponed in cities and resorts throughout Washington and Oregon in areas not initially affected by the eruption. However, the eruption did lead to the creation of a thriving tourist industry for decades following the event.

The disruption of regional activity is further demonstrated by the 2010 eruption of Iceland’s Eyjafallajokull volcano, which led to European air travel being halted for several days. The movement of goods via major highways can also be halted due to tephra in the air. The Mount St. Helens event in May 1980 cost trade and commerce an estimated $50 million in only two days, as ships were unable to navigate the Columbia River. Clouds of ash often cause electrical storms that start fires, and damp ash can short-circuit electrical systems and disrupt radio communication. Volcanic activity can also lead to the closure of nearby recreation areas as a safety precaution long before the activity ever culminates in an eruption.

13.6 FUTURE TRENDS

13.6.1 Development

Distal Hazards

Mapped distal hazard areas in Clark County overlap significantly with special flood hazard areas, which are held to more restrictive standards for development. These areas are predominantly zoned for commercial and industrial uses. Comprehensive plans will guide future development in these areas. Table 13-8 shows the area identified as underutilized or vacant in urban growth areas in the County that intersect identified distal hazard areas.

Table 13-8. Buildable Lands in Planning Area Urban Growth Areas that Intersect Distal Hazard Areas[a]

Urban Growth Area[b]	Buildable Area[c] (acres)				
	Residential		Commercial	Industrial	Total
	Acres	Units			
Battle Ground	0		0	0	**0**
Camas	11.94		1.83	33.62	**47.39**
La Center	0		0	0	**0**
Ridgefield	0		0	0	**0**
Vancouver	1.98		0	0	**1.98**
Washougal	31.76		50.87	73.06	**155.69**
Woodland[d]	0		0	0	**0**
Yacolt	0		0	0	**0**
Total	**45.68**		**52.70**	**106.68**	**205.06**

a. Buildable lands information in this plan is for planning purposes only. Discrepancies may exist between these estimates and official records maintained by participating jurisdictions.
b. Unincorporated areas outside of urban growth areas are excluded from this assessment. Development in these areas consists largely of rural lands, open space and large residential lots.
c. Acreage covers only mapped parcels; it excludes many rights of way and major water features.
d. Acreage estimates exclude the portions of the City of Woodland in Cowlitz County and thus may be underestimated.

Ash Fall

All future development in the planning area will be susceptible to potential impacts from volcanic eruptions causing ash fall in the region. While this potential impact on the built environment is not considered to be significant, the economic impact on industries that rely on machinery and equipment, such as agriculture or civil engineering projects, could be significant. Since the extent and location of this hazard is difficult to gauge because it is dependent upon many variables, the ability to institute land use recommendations based on potential impacts of this hazard is limited. While the impacts of ash fall are sufficient to warrant risk assessment for emergency management purposes, they are not sufficient to dictate land use decisions.

13.6.2 Climate Change

Climate change is not likely to affect the risk associated with volcanoes; however, volcanic activity can affect climate change. Volcanic clouds absorb terrestrial radiation and scatter a significant amount of incoming solar radiation. By reducing the amount of solar radiation reaching the Earth's surface, large-scale volcanic eruptions can lower temperatures in the lower atmosphere and change atmospheric circulation patterns. The massive outpouring of gases and ash can influence climate patterns for years following a volcanic eruption. Additionally, while climate change is not likely to increase the frequency of eruptions, changes in precipitation amounts could increase the potential for lahars or debris avalanches in volcanic areas.

13.7 SCENARIO

Two volcanic scenarios are most likely to impact Clark County. The first would be an event similar to the 1980 eruption of Mt. Saint Helens. Such an event seems unlikely to directly impact the county, as the eruption would likely happen on the northern side of the volcano. However, depending on wind direction and velocity, ash could be an issue (CRESA, 2004).

The other possibility is a Mt. Hood event, which could trigger a mudflow along the Hood River and the Sandy River into the Columbia River below Cascade Locks. This could cause flooding in Clark County along the Columbia River (CRESA, 2004). This scenario event formed the basis of the risk assessment for this hazard.

13.8 ISSUES

The following issues have been identified for the volcano hazard:

- Researchers continue to develop methods to predict volcanic eruptions accurately. Indications that an eruption may be imminent include swarms of small earthquakes as the magma rises up through the volcano, increases in gas emissions, and physical swelling or deformation of mountain slopes. Although warning time should be sufficient to prevent loss of life, the advent of these signs and the beginning of eruptive activity may be short.
- More than 3,200 people are estimated to live in distal hazard zones in the planning area. The entire population of the planning are could be exposed to ash fall, depending on weather conditions at the time of an eruption.
- Residents may not be aware that they live in distal hazard areas.
- Distal hazard exposure is predominantly concentrated in Camas and Washougal.
- More than $2.89 billion in structure and content value is exposed to distal hazards. The exposure accounts for 2.6 percent of the total value of the planning area and 13 and 46 percent of the total value of Camas and Washougal, respectively.
- Ash fall from volcanic eruptions can cause significant damage to heating and air conditioning systems, combustion systems, electronic devices and other mechanical equipment.
- Ash fall increases in weight significantly when wet, complicating cleanup efforts.
- Ash fall can cause significant impacts on the local economy due to interruptions to the transportation system and disruptions to tourism-related industries.
- A substantial number of critical facilities and infrastructure in the planning area would be impacted by distal hazards or ash fall.
- A regional Mount Hood Coordination plan has been developed to coordinate and plan for response activities in the event of an eruption. This plan should continue to be updated.

14. WILDLAND FIRE

14.1 GENERAL BACKGROUND

The term wildland fire refers to any uncontrolled burning of grasslands, brush or woodland areas. Forest fire is a kind of wildland fire—specifically the uncontrolled burning of forestland. The wildland-urban interface/intermix area is the area that is susceptible to wildland or forest fires because wildland vegetation and urban or suburban development occur together (CRESA, 2004).

14.1.1 Factors Influencing Wildfires

Wildfires advance through the transmission of heat in the form of conduction, convection and radiation. During the day, fires generally travel uphill. Convection currents and radiation ahead of the fire preheat the fuels and air upslope, allowing the fire to expand rapidly. Radiation has an extreme impact when the fire enters a "chimney," or a v-shaped area on a slope, such as a drainage gully. South and west facing slopes tend to be warmest and driest. Heavy dry fuels on a southwest-facing slope with chimneys on a hot day will allow for near explosive expansion of a fire. Wind can strengthen and spread a fire, though large fires can generate their own wind. The heat rising from a large fire will create a thermal column that can rise hundreds or thousands of vertical feet. These vertical columns carry burning embers that are often picked up by prevailing winds and spread. At night, the fire slows and travels downhill, following the cooling airflow (CRESA, 2004).

Fire experts attribute the generally worsening wildfire risk to increases in the presence of dry, hazardous fuel. This has been brought about by an overall decline in forest health. Forests that have been clear-cut become crowded with trees struggling against each other for nutrition, water and sunlight. This can weaken them, making them vulnerable to insects and diseases. In Washington State, trees burn hot and fast (CRESA, 2004).

Wildfires can be ignited by lightning or by human activity such as smoking, campfires, equipment use, and arson. Controlled burns are not considered hazards unless they escape control. Wildland fires are influenced by the amount and condition of fuel present, topography, and weather conditions. These factors are described in the following sections.

Fuels

Fuels for wildfires are living and dead vegetation on the ground, brush and small trees on the surface, and tree canopies above the ground. They are assessed by the following conditions:

- **Fuel loading**—Fuel loading, often expressed in tons per acre, is the amount of vegetative material available. If fuel loading doubles, the energy released also can be expected to double.
- **Burn index**—Each fuel type is given a burn index, which is an estimate of the amount of potential energy that may be released, the effort required to contain a fire in a given fuel, and the expected flame length. Different fuels have different burn qualities. Some fuels burn more easily or release more energy than others. Lighter fuels such as grasses, leaves and needles quickly

expel moisture and burn rapidly, while heavier fuels such as tree branches, logs and trunks take longer to warm and ignite.

- **Fuel continuity**—Continuity of fuels is expressed in terms of horizontal and vertical dimensions. Horizontal continuity represents the distribution of fuels over the landscape. Vertical continuity links fuels at the ground surface with tree crowns. Trees killed or defoliated by forest insects and diseases are more susceptible to wildfire. As of 2019, almost 3 percent (658,000) of Washington's 22.4 million acres of forestland showed some level of tree mortality, tree defoliation or foliar disease (Washington Department of Natural Resources, 2020).
- **Fuel moisture**—Fuel moisture is expressed as a percentage of total saturation and varies with antecedent weather. Low fuel moistures indicate the probability of severe fires. Given the same weather conditions, moisture in fuels of different diameters changes at different rates. A 1,000-hour fuel, which has a 3- to 8-inch diameter, changes more slowly than a 1- or 10-hour fuel.

Topography

Topography can have a powerful influence on wildfire behavior. The movement of air over the terrain tends to direct a fire's course. Gulches and canyons can funnel air and act as a chimney, intensifying fire behavior and inducing faster rates of spread. Saddles on ridge tops offer lower resistance to the passage of air and will draw fires. Solar heating of drier, south-facing slopes produces upslope thermal winds that can complicate behavior.

Slope is an important factor. If the percentage of uphill slope doubles, the rate of spread of wildfire will likely double. On steep slopes, fuels on the uphill side of a fire are closer physically to the source of heat. Radiation preheats and dries the fuel, thus intensifying fire behavior. Fire travels downslope much more slowly than it does upslope, and ridge tops often mark the end of wildfire's rapid spread.

Weather

Of all the factors influencing wildfire behavior, weather is the most variable. Extreme weather leads to extreme fire events, and it is often a moderation of the weather that marks the end of a wildfire's growth and the beginning of successful containment. High temperatures and low humidity can produce vigorous fire activity. The cooling and higher humidity brought by sunset can dramatically quiet fire behavior. Fronts and thunderstorms can produce winds that are capable of radical and sudden changes in speed and direction, causing similar changes in fire activity. The rate of spread of a fire varies directly with wind velocity. Winds may play a dominant role in directing the course of a fire. Strong, dry winds produce extreme fire conditions. Such winds generally reach peak velocities during the night and early morning. The effect of wind on fire behavior is a primary safety concern for firefighters. The most damaging firestorms are usually marked by high winds.

14.2 HAZARD PROFILE

14.2.1 Past Events

Fire is a normal part of most forest and range ecosystems in temperate regions of the world. Fires historically burn on a fairly regular cycle, recycling carbon and nutrients stored in the ecosystem and strongly affecting the species within the ecosystem. Annual acreage consumed by wildfires in the lower 48 states of the U.S. dropped from about 40 to 50 million acres per year in the 1930s to under 5 million acres by 1970 (Cohen, 2008).

Clark County's fire season usually runs from mid-May through October (CRESA, 2011). However, changes in climatic conditions, such as drought, snowpack and localized weather, can expand the length of the fire season. In July through early September, lightning strikes are the cause of most wildland fires in Washington State. Human-caused fires are more prevalent at the beginning and end of the fire season. Only 30 percent of fires in the state are in Western Washington (Washington Emergency Management Division, 2020). Large fires reported in Clark County since the turn of the century include the following (CRESA, 2011; Washington Emergency Management Division, 2014):

- 1902 Yacolt Fire—38 lives lost and 238,900 acres burned in Clark and Skamania Counties
- 1919 Sunset Fire—26,900 acres burned in Clark and Skamania Counties
- 1929 Dole Valley Fire—227,500 acres burned in Clark and Skamania Counties.

The Washington Department of Natural Resources' database of wildfires since 1970 on lands protected by the agency lists more than 1,050 fires in Clark County. Table 14-1 lists the 27 that were reported to have burned 10 acres or more.

Table 14-1. Wildfires in Clark County Greater than 10 Acres, 1970-2016 (January)

Incident ID	Fire Name	Cause	Start Date	Area Burned (acres)[a]
11334	N/A	Fireworks	7/22/1972	40
13989	N/A	Debris Burn	9/1/1974	11
14008	N/A	Debris Burn	9/21/1974	12
16739	N/A	Debris Burn	1/24/1977	15
18939	N/A	Debris Burn	10/3/1979	24
26505	N/A	Sparks from Vehicle	8/3/1987	15
26588	N/A	Debris Burn	10/6/1987	10
26598	N/A	Debris Burn	10/10/1987	68
26604	N/A	Debris Burn	10/11/1987	20
27916	N/A	Railroad (Hot brakes)	9/2/1988	16
29101	N/A	Railroad (Carbon)	7/5/1989	15
29146	N/A	Debris Burn	10/6/1989	10
33865	N/A	Children	8/17/1992	35
36831	N/A	Recreation	9/2/1994	14
38603	N/A	Debris Burn	5/31/1995	30
41321	N/A	Debris Burn	11/15/1997	20
46367	N/A	Debris Burn	4/15/1999	10
4710	RV	Vehicle Fire	8/15/2008	10
6062	Alworth Fire	Debris Burn	10/26/2008	12
11362	Jackson 3	Arson	10/11/2009	60
16861	Hilltop	Recreation	8/14/2010	110
29648	Steigerwald	Smoker	10/5/2012	140
40452	South Jones	Under Investigation	6/11/2015	10
41045	South Padden	Arson	7/4/2015	13
41703	Big Creek One	Under Investigation	7/17/2015	12
66527	Wiehl	Power Generator	9/7/2020	15
66624	Fruit Valley	Unknown	9/8/2020	166

a. Area may not represent the full extent of the fire across all ownerships. It may, in some cases represent only the area of Washington Department of Natural Resources managed land.

Source: Washington Department of Natural Resources Fire Statistics, 1970-2007, http://fortress.wa.gov/dnr/app1/dataweb/dmmatrix.html; Washington Department of Natural Resources Fire Statistics, 2008 – Present, http://fortress.wa.gov/dnr/app1/dataweb/dmmatrix.html

14.2.2 Location

The probability of a wildland fire in any one locality on a particular day depends on fuel conditions, topography, the time of year, the past and present weather conditions, and activities (debris burning, land clearing, camping, etc.) taking place (CRESA, 2011).

Communities at Risk

The Washington Department of Natural Resources and its federal and local partners have determined that five communities in Clark County are at a high risk of wildfire: Amboy, Hockinson, Washougal, Woodland, and Yacolt. According to the Washington State Emergency Management Division, areas of significant fire hazards are mapped based on fire behavior potential, fire protection capability, and risk to social, cultural and community resources. Risk is determined based on area fire history, type and density of vegetative fuels, extreme weather conditions, topography, number and density of structures and their distance from fuels, location of municipal watershed, and likely loss of housing or business (Washington Emergency Management Division, 2014).

Local Risk Area Designations

Clark County GIS maintains a database of areas in unincorporated Clark County with increased fire hazard as urban type development occurs in areas once considered wilderness. This data is used by the County's Department of Community Development during development review to determine minimum fire protection requirements needed to protect life, property, and natural wilderness resources from wildfire (Clark County, 2016).

Infrastructure and buildings in wildland-urban interface/intermix areas are especially susceptible to wildfires because they are close to fire fuel sources (trees and undergrowth in forests) and because their presence increases the likelihood that a wildfire will begin. Some of the triggers that can cause fire are natural, such as lightning, but fires are more likely to be caused by human activity. Humans can directly cause fires with careless campfires, sparks from ATVs, or inappropriate disposal of lit cigarettes. Downed electric lines during windstorms can also cause fires (CRESA, 2004). Clark County Code (Section 15.13.030) defines wildland-urban interface/intermix areas as areas at elevation of 500 feet or more that meet any of the following criteria (CRESA, 2004):

- Slope equal to or greater than 25 percent
- Forest type vegetation
- Outside an organized fire protection district.

If more than half of a parcel meets the criteria, the entire parcel is included in the wildland urban interface/intermix area.

The City of Vancouver maintains a dataset of wildfire risk areas similar to the County's wildland-urban interface/intermix area designation. While this definition and the resulting regulations are only applicable in unincorporated Clark County and to some extent the City of Vancouver, they provide the best available data to assess wildfire risk for planning. Figure 14-1 shows the wildfire risk areas in the County.

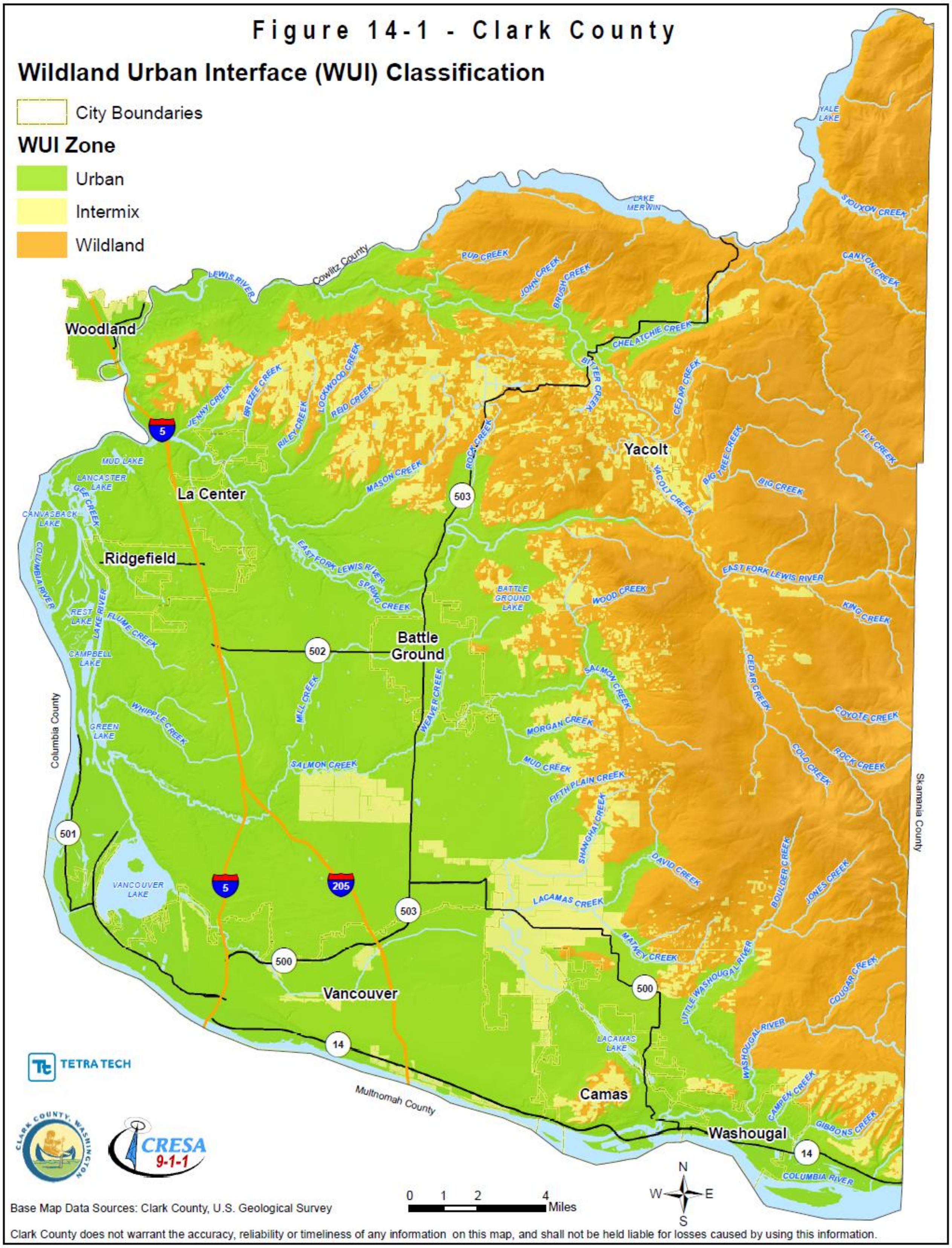


Figure 14-1. Wildland Urban Interface (WUI) Classification

Frequency

Fire Regime Mapping

The LANDFIRE project (a program of the U.S. Forest Service and the U.S. Department of the Interior, under the direction of the Wildland Fire Leadership Council) produces maps of historical fire regimes and vegetation and maps of current vegetation and its departure from historical conditions. The maps categorize mean fire return intervals and fire severities into five fire regimes (Hann et al., 2004):

- Fire Regime I—0 to 35 year frequency, low to mixed severity
- Fire Regime II—0 to 35 year frequency, replacement severity
- Fire Regime III—35 to 200 year frequency, low to mixed severity
- Fire Regime IV—35 to 200 year frequency, replacement severity
- Fire Regime V—200+ year frequency, any severity.

These maps support fire and landscape management planning outlined in the goals of the National Fire Plan, Federal Wildland Fire Management Policy, and the Healthy Forests Restoration Act. Figure 14-2 shows fire regimes in the planning area based on LANDFIRE models. The vast majority of Clark County falls within Fire Regime V, although all regimes are present in the county. Higher frequency regimes occur in the southwestern portion of the county, often near population centers.

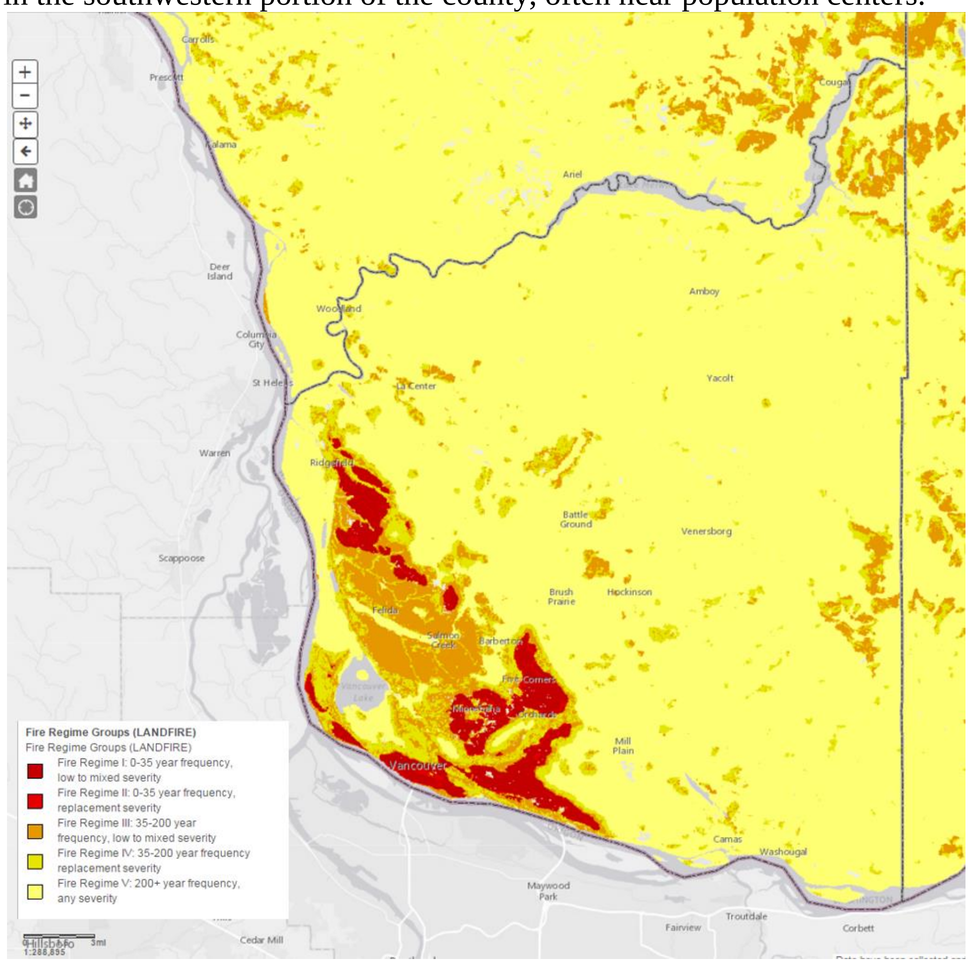


Figure 14-2. Fire Regime Groups (LANDFIRE)
Source:Washington Department of Natural Resources, Fire Prevention & Fuel Management Mapping System

The Washington Department of Natural Resources maintains an on-line Fire Prevention and Fuel Management mapping system, which provides wildfire-related information such as fire statistics, large fire burn areas and LANDFIRE fire regime groups (Washington Department of Natural Resources, 2016a).

Natural Fire Rotation

Natural fire rotation is defined as the number of years necessary for fires to burn over an area equal to that of the study area. Natural fire rotation is calculated from the historical record of fires by dividing the length of the record period in years by the percentage of total area burned during that period. It represents the average period between fires under a presumed historical fire regime. Since 1970, Clark County has seen an average of 23 wildfires per year. The vast majority of these fires burn less than 10 acres, with an overall average of 1.6 acres per incident. Fires occur annually, but fires that burn more than 10 acres occur only once every 2 years, on average.

14.2.3 Severity

Wildfires can range from isolated burns affecting a few acres to severe events that burn hundreds of thousands of acres. Large fires usually occur when groups of smaller fires merge. Property damage from wildfires can be severe and can significantly alter entire communities. The source of ignition should be discounted in evaluating the wildfire risk. If conditions are right for a major fire, any source of ignition—natural or human-caused—will bring about the same end results. Lightning on dry fuels, recreational uses, interface development or arson can all trigger fires. Mitigation efforts that limit human interaction with fuels can extend the fire cycle or change the location of ignition. However, if the fire cycle is extended and the fuel load is not mitigated, the ultimate fire will burn hotter, move faster, and generate more secondary fires. Such a fire can rapidly overwhelm response capabilities (CRESA, 2004).

14.2.4 Warning Time

Wildfires are often caused by humans, intentionally or accidentally. There is no way to predict when a human-caused wildfire might break out. Since fireworks often cause brush fires, extra diligence is warranted around the Fourth of July when the use of fireworks is highest. Dry seasons and droughts are factors that greatly increase fire likelihood. Dry lightning may trigger wildfires. Severe weather can be predicted, so special attention can be paid during weather events that may include lightning. Reliable National Weather Service lightning warnings are available on average 24 to 48 hours prior to a significant electrical storm.

If a fire does break out and spread rapidly, residents may need to evacuate within days or hours. A fire's peak burning period generally is between 1 p.m. and 6 p.m. Once a fire has started, fire alerting is reasonably rapid in most cases. The rapid spread of cellular and two-way radio communications in recent years has further contributed to a significant improvement in warning time.

The Washington Department of Natural Resources maintains an online Burn Risk Map. Residents can view current information about the wildfire danger in Washington, as well as any information on outdoor burning restrictions. This site provides information on when conditions are right for destructive wildfires (Washington Department of Natural Resources, 2016).

14.3 SECONDARY HAZARDS

Wildland fires can generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. Fires can cause direct economic losses in the reduction of harvestable timber and indirect economic losses in reduced tourism. Wildland fires cause the contamination of reservoirs, destroy transmission lines and contribute to flooding. Landslides can be a significant secondary hazard of wildfires. Wildfires strip slopes of vegetation, exposing them to greater amounts of rain and run-off. This in turn can weaken soils and cause failures on slopes. Major landslides can occur several years after a wildfire (CRESA, 2004). Most wildfires burn hot and for long durations that can bake soils, especially those high in clay content, thus increasing the imperviousness of the ground. This increases the runoff generated by storm events, thus increasing the chance of flooding.

14.4 EXPOSURE

14.4.1 Population

Exposed population for the wildfire risk areas (wildland-urban interface/intermix areas) was estimated using the percentage of total building value in these areas multiplied by the total population. The results are shown in Table 14-2. Approximately 3.4 percent of the total County population lives in areas identified as wildland and 6.2 percent of the total population lives in areas identified as intermix.

Table 14-2. Population Within Wildland Fire Hazard Areas

	Wildland (Relatively High)			Intermix (Relatively Moderate)		
		Population			Population	
	Buildings	Number	% of Total	Buildings	Number	% of Total
Battle Ground	9	20	0.1%	0	0	0.0%
Camas	819	1,347	6.3%	1,624	3,142	14.8%
La Center	0	0	0.0%	0	0	0.0%
Ridgefield	0	0	0.0%	0	0	0.0%
Vancouver	0	0	0.0%	1,629	4,703	2.8%
Washougal	50	206	1.4%	155	267	1.8%
Woodland	0	0	0.0%	269	213	3.6%
Yacolt	42	240	14.8%	491	1,380	85.2%
Unincorporated	5,929	13,571	6.3%	6,102	18,757	8.7%
Total	**6,849**	**15,384**	**3.4%**	**10,270**	**28,462**	**6.2%**

In addition to the populations living in wildfire risk areas, people working or recreating in resource lands, such as loggers and hikers, are exposed to the wildfire risk. Firefighting crews are exposed as they work to combat fires and to protect property. All county residents are potentially exposed to the health-related impacts of reduced air quality from wildland fires.

14.4.2 Property

Table 14-3 and Table 14-4 show the number of structures in the planning area that are located in the wildland and intermix areas and their values.

Parcels that intersect designated wildland areas and intermix areas were analyzed to assess the types of land uses that are exposed. Table 14-5 shows the area of present land uses exposed to this hazard and the percent of total exposed area for each land use. Agricultural/resource lands and vacant areas combined make up 59 percent of the total exposed acres in the wildland risk area. An additional 38 percent is residential. In the intermix risk area, more than 72 percent of exposed area is residential. It is estimated that 47 percent and 21 percent of the land area of the County is within wildland and intermix hazard areas, respectively.

Table 14-3. Exposure and Value of Structures in Wildland (Relatively High) Areas

Jurisdiction	Buildings Exposed	Value Exposed			% of Total Replacement value
		Structure	Contents	Total	
Battle Ground	9	$2,854,388	$1,427,194	$4,281,582	0.1%
Camas	819	$308,680,888	$172,296,984	$480,977,872	6.3%
La Center	0	$0	$0	$0	0.0%
Ridgefield	0	$0	$0	$0	0.0%
Vancouver	0	$0	$0	$0	0.0%
Washougal	50	$31,933,485	$24,480,983	$56,414,468	1.4%
Woodland	0	$0	$0	$0	0.0%
Yacolt	42	$24,529,095	$20,918,921	$45,448,015	14.8%
Unincorporated	5,929	$1,730,292,816	$1,102,850,918	$2,833,143,735	6.3%
Total	**6,849**	**$**2,098,290,672	**$**1,321,975,000	**$**3,420,265,672	**3.0%**

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

Table 14-4. Exposure and Value of Structures in Intermix (Relatively Moderate) Areas

Jurisdiction	Buildings Exposed	Value Exposed			% of Total Replacement value
		Structure	Contents	Total	
Battle Ground	0	$0	$0	$0	0.0%
Camas	1,624	$671,729,875	$450,389,080	$1,122,118,954	14.8%
La Center	0	$0	$0	$0	0.0%
Ridgefield	0	$0	$0	$0	0.0%
Vancouver	1,629	$821,506,677	$503,178,488	$1,324,685,165	2.8%
Washougal	155	$48,728,506	$24,364,253	$73,092,759	1.8%
Woodland	269	$42,682,361	$22,120,936	$64,803,297	3.6%
Yacolt	491	$145,374,966	$115,583,981	$260,958,947	85.2%
Unincorporated	6,102	$2,308,816,716	$1,606,952,258	$3,915,768,974	8.7%
Total	**10,270**	**$**4,038,839,101	**$**2,722,588,996	**$**6,761,428,096	**6.0%**

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations

Table 14-5. Present Land Use in Planning Area Parcels Intersecting Wildland Fire Hazard Areas[a]

Present Use Classification[b]	Wildland (Relatively High)		Intermix (Relatively Moderate)	
	Area (acres)[c, d]	% of total	Area (acres)[c, d]	% of total
Agriculture/Resource Land	105,300.02	48.5%	15,541.60	16.0%
Commercial	2,160.26	1.0%	1,837.64	1.9%
Education	54.24	0.0%	202.09	0.2%
Governmental Services	3,189.00	1.5%	2,014.88	2.1%
Industrial	208.02	0.1%	341.04	0.4%
Religious Services	111.11	0.1%	217.82	0.2%
Residential	83,109.03	38.3%	70,778.68	72.7%
Vacant or uncategorized	22,802.54	10.5%	6,406.44	6.6%
Total	**216,934.22**	**100%**	**97,340.19**	**100%**

a. Present land use information in this plan is for planning purposes only. Discrepancies may exist between these estimates and official records maintained by participating jurisdictions.
b. Present use classification provided by Clark and Cowlitz County assessor's data assigned to best fit occupancy classes in FEMA's Hazus model (see Section 6.3.1). Parcels for which conflicting information on current development was available were assumed to be improved. Some designated resource land may also be included in the vacant or uncategorized category.
c. Acreage covers only mapped parcels; it excludes many rights of way and major water features.
d. Acreage is likely overestimated as all parcels that intersect hazard areas were included.

14.4.3 Critical Facilities and Infrastructure

Table 14-6 and Table 14-7 identify critical facilities and infrastructure exposed to the wildfire hazard areas in the county. In addition the following linear features are exposed to the wildfire hazard:

- State Route 500
- State Route 503
- State Route 14
- A small portion of Interstate 205
- The Northwest pipeline, although the vast majority of the pipeline is located in areas designated as "urban."

Table 14-6. Critical Facilities in Wildland (Relatively High) Risk Areas

	Commu-nication Facilities	Dams	Emer-gency Services	Energy	Govern-ment Facilities	Hazardous Materials	Health Care & Public Health	Infor-mation Technol-ogy	Schools	Trans-portation Systems	Water & Sanitation Systems	Total
Battle Ground	0	0	0	0	0	0	0	0	0	0	0	**0**
Camas	0	0	0	0	0	0	0	0	0	0	2	**2**
La Center	0	0	0	0	0	0	0	0	0	0	0	**0**
Ridgefield	0	0	0	0	0	0	0		0	0	0	**0**
Vancouver	0	0	0	0	0	0	0	0	0	0	0	**0**
Washougal	0	0	0	0	0	0	0	0	0	0	1	**1**
Woodland	0	0	0	0	0	0	0	0	0	0	0	**0**
Yacolt	0	0	0	0	0	0	0	0	0	0	0	**0**
Unincorporated	0	1	6	2	0	1	1	0	0	1	40	**52**
Total	**0**	**1**	**6**	**2**	**0**	**1**	**1**	**0**	**0**	**1**	**43**	**55**

Table 14-7. Critical Facilities in Intermix (Relatively Moderate) Risk Areas

	Commu-nication Facilities	Dams	Emer-gency Services	Energy	Govern-ment Facilities	Hazardous Materials	Health Care & Public Health	Infor-mation Technol-ogy	Schools	Trans-portation Systems	Water & Sanitation Systems	Total
Battle Ground	0	0	0	0	0	0	0	0	0	0	0	**0**
Camas	1	0	0	0	0	0	5	0	2	0	3	**11**
La Center	0	0	0	0	0	0	0	0	0	0	0	**0**
Ridgefield	0	0	0	0	0	0	0	0	0	0	0	**0**
Vancouver	0	0	0	0	0	0	0	0	0	0	0	**0**
Washougal	0	0	0	0	0	0	0	0	0	0	0	**0**
Woodland	0	0	0	0	0	0	0	0	0	0	0	**0**
Yacolt	2	0	2	0	1	1	0	0	1	0	0	**7**
Unincorporated	0	0	5	1	0	2	2	0	2	1	34	**47**
Total	**3**	**0**	**7**	**1**	**1**	**3**	**7**	**0**	**5**	**1**	**37**	**65**

14.4.4 Environment

Fire is a natural and critical process in most ecosystems, dictating in part the type, structure, and spatial extent of native vegetation. However, wildfires can cause severe environmental impacts:

- Damaged Fisheries—Critical trout fisheries throughout the west and salmon and steelhead fisheries in the Pacific Northwest can suffer from increased water temperatures, sedimentation, and changes in water quality and chemistry.
- Soil Erosion—The protective covering provided by foliage and dead organic matter is removed, leaving the soil fully exposed to wind and water erosion. Accelerated soil erosion occurs, causing landslides and threatening aquatic habitats.
- Spread of Invasive Plant Species—Non-native woody plant species frequently invade burned areas. When weeds become established, they can dominate the plant cover over broad landscapes and become difficult and costly to control.
- Disease and Insect Infestations—Unless diseased or insect-infested trees are swiftly removed, infestations and disease can spread to healthy forests and private lands. Timely active management actions are needed to remove diseased or infested trees.
- Destroyed Endangered Species Habitat—Catastrophic fires can have devastating consequences for endangered species. For instance, the Biscuit Fire in Oregon destroyed up to 150,000 acres of spotted owl habitat.
- Soil Sterilization—Topsoil exposed to extreme heat can become water repellant, and soil nutrients may be lost. It can take decades or even centuries for ecosystems to recover from a fire. Some fires burn so hot that they can sterilize the soil.

Many ecosystems are adapted to historical patterns of fire. These patterns, called fire regimes, include temporal attributes (e.g., frequency and seasonality), spatial attributes (e.g., size and spatial complexity), and magnitude attributes (e.g., intensity and severity), each of which have ranges of natural variability. Ecosystem stability is threatened when any of the attributes for a given fire regime diverge from its range of natural variability.

14.5 VULNERABILITY

Structures, above-ground infrastructure, critical facilities and natural environments are all vulnerable to the wildfire hazard. There is currently no validated damage function available to support wildfire mitigation planning. Except as discussed in this section, vulnerable populations, property, infrastructure and environment are assumed to be the same as described in the section on exposure.

14.5.1 Population

All population that is exposed to wildfire risk is vulnerable to wildfire risk. The most vulnerable individuals are those who are not able to evacuate risk areas quickly, such as older populations or those with access and functional needs. Wildfires also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

Smoke and air pollution from wildfire can be a severe health hazard for those living near or downwind from wildfires. This is especially true for sensitive populations, including children, the elderly and those with respiratory and cardiovascular diseases. Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

Generally, few people die in wildfires because warning time is sufficient to allow for evacuation. However, many lives are disrupted. Beyond the immediate effects of disruption to life patterns, the longer-term economic effects from loss of property can be devastating (CRESA, 2004).

14.5.2 Property

All property that is exposed to the wildfire hazard is vulnerable. Home building in and near forests increases risks from forest fires. Often, structures are built and maintained with minimal awareness of the need for protection from exterior fire sources or the need to minimize interior fires from spreading to forested lands (CRESA, 2004).

Pre-1993 Construction

Properties constructed before 1993 may be more vulnerable to wildfire because they were built prior to development codes that established more stringent requirements for fire protection. A major vulnerability issue is with subdivisions platted and developed before fire codes were adopted. Water supplies may be limited within these pre-ordinance subdivisions. Many homes on wells may also have access problems, including inadequate ingress and egress and insufficient roadway width and road grade to enable evacuation or fire suppression (CRESA, 2004). There are estimated to be 5,400 parcels in intermix areas that were developed before 1993.

Post-1993 Construction

As of 1993, all new subdivisions must have adequate access, connecting bridges, turn-around areas and driveway widths to allow for fire suppression equipment. Current Clark County code requires that development and construction be designed, located and constructed to minimize the possibility of wildland fires involving structures, as well as to reduce the possibility that structural fires will ignite a wildland fire. Code incorporates the standards included in the National Fire Protection Association's *Protection of Life and Property from Wildfire* standards (NFSP-299). These standards apply to the following (CRESA, 2004):

- Setbacks from slopes
- Defensible space
- Vehicular access

- Roofing materials
- Siding materials
- Balconies and porches
- Eves and overhangs
- Access to water.

However, development after 1993 is not invulnerable to fire just because it meets current code. Any development in the intermix zone or in the wildland zone can be exposed to fire (CRESA, 2004). According to recent research, most residential areas destroyed in wildfires are not ignited by advancing flames of a large crown fire, but rather from embers falling on a non-resistant roof, radiant heat igniting a curtain or pine needles, or a forgotten gas can near a home. Without these conditions, a fire can burn quickly through a development without igniting structures. This research emphasizes the importance of fireproofing and "ring of safety" approaches advocated by such programs as FireWise. Small fuel removal efforts and building material choices around the home can save an entire subdivision from destruction (CRESA, 2004).

Loss Estimates

Loss estimations for the wildfire hazard are not based on damage functions, because no such damage functions have been generated. Instead, loss estimates were developed representing 10 percent, 30 percent and 50 percent of the replacement value of exposed structures in hazard areas. This allows emergency managers to select a range of economic impact based on an estimate of the percent of damage to the general building stock. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction of the structure. Table 14-8 lists the loss estimates for the general building stock for assets in jurisdictions that have an exposure to the wildland and intermix risk areas.

Table 14-8. Loss Estimates for Wildfire

		Estimated Loss Potential from Wildfire		
	Exposed Value	10% Damage	30% Damage	50% Damage
Battle Ground	$4,281,582	$428,158	$1,284,475	$2,140,791
Camas	$1,603,096,826	$160,309,683	$480,929,048	$801,548,413
La Center	$-	$-	$-	$-
Ridgefield	$-	$-	$-	$-
Vancouver	$1,324,685,165	$132,468,517	$397,405,550	$662,342,583
Washougal	$129,507,227	$12,950,723	$38,852,168	$64,753,614
Woodland	$64,803,297	$6,480,330	$19,440,989	$32,401,649
Yacolt	$306,406,962	$30,640,696	$91,922,089	$153,203,481
Unincorporated	$6,748,912,709	$674,891,271	$2,024,673,813	$3,374,456,355
Total	**$8,574,315,360.00**	**$857,431,537.00**	**$2,572,294,609.00**	**$4,287,157,682.00**

Note: Values shown are accurate only for comparison among results in this plan. See Section 6.7 for a discussion of data limitations.

14.5.3 Critical Facilities and Infrastructure

Critical facilities of wood frame construction are especially vulnerable during wildfire events. Most roads and railroads would be without damage except in the worst scenarios. Power lines are the most at risk from wildfire because most poles are made of wood and susceptible to burning. Fires can create conditions that block or prevent access and can isolate residents and emergency service providers. Wildfire typically does not have a major direct impact on bridges, but it can create conditions in which bridges are obstructed. Many bridges in areas of high to moderate fire risk are important because they provide the only ingress and egress to large areas and in some cases to isolated neighborhoods. In the event of a wildfire, pipelines could provide a source of fuel and lead to a catastrophic explosion. Currently there are four registered Tier II hazardous material containment sites in wildfire risk zones (one in the wildland area and two in the intermix area both located in unincorporated areas of the County). During a fire event, hazardous materials storage containers could rupture due to heat and act as fuel for the fire, escalating the fire to unmanageable levels. In addition they could leak into surrounding areas, saturating soils and seeping into surface waters, and have a disastrous effect on the environment.

14.5.4 Environment

Fire hazards present a considerable risk to vegetation and wildlife habitat (CRESA, 2004). The vulnerability risks are the same as those described for exposure.

14.5.5 Economic Impact

The destruction of large tracts of forest land would have immediate economic impact on the community through lost jobs, reduced taxes, and increased public support. Collateral economic and social effect could impact the County for years (CRESA, 2011). Damage to utilities (electrical lines and substations), loss of revenue from workers unable to work, and the expense incurred fighting a fire would also result in economic impacts.

14.6 FUTURE TRENDS

14.6.1 Development

The highly urbanized portions of the planning area have little or no wildfire risk exposure. Urbanization tends to alter the natural fire regime, and can create the potential for the expansion of urbanized areas into wildland areas. The expansion of the wildland urban interface can be managed with strong land use and building codes. The planning area is well equipped with these tools and this planning process has asked each planning partner to assess its capabilities with regards to the tools. Table 14-9 shows the area identified as underutilized or vacant in urban growth areas in the County that intersect identified wildfire hazard areas. As interface areas become more developed, they will likely transition to urban risk designations. Similarly, as wildland areas are developed designations may transition to intermix.

Table 14-9. Buildable Lands in Planning Area Urban Growth Areas that Intersect Wildland Risk Areas[a]

Urban Growth Area[b]	Buildable Area[c] (acres)				
	Residential		Commercial	Industrial	Total
	Acres	Units			
Battle Ground	15.76	95	0	0	**15.76**
Camas	262.48	1,575	53.23	50.43	**366.14**
La Center	0	0	0	0	**0**
Ridgefield	0	0	0	0	**0**
Vancouver	880.36	7,043	95.73	81.60	**1,057.69**
Washougal	204.59	1,227	31.75	176.33	**412.67**
Woodland[d]	--	--	--	--	**--**
Yacolt	43.72	175	10.57	28.50	**82.79**
Total	**1,406.91**	**10,115**	**190.28**	**336.86**	**1,935.05**

a. Buildable lands information in this plan is for planning purposes only. Discrepancies may exist between these estimates and official records maintained by participating jurisdictions.

b. Unincorporated areas outside of urban growth areas are excluded from this assessment. Development in these areas consists largely of rural lands, open space and large residential lots. Changes in development can be assessed through
c. Acreage covers only mapped parcels; it excludes many rights of way and major water features.
d. Acreage estimates exclude the portions of the City of Woodland in Cowlitz County and thus may be underestimated.

14.6.2 Climate Change

Wildfire in western ecosystems is determined by climate variability, local topography, and human intervention. Climate change has the potential to affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot dry spells create the highest fire risk. Increased temperatures may intensify wildfire danger by warming and drying out vegetation. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods.

When climate alters fuel loads and fuel moisture, forest susceptibility to wildfires changes. Forest response to increased atmospheric carbon dioxide could contribute to more tree growth and thus more fuel for fires, although the effects of carbon dioxide on mature forests are still largely unknown. Increased high-elevation wildfires could release stores of carbon and further contribute to the buildup of greenhouse gases.

Historically, drought patterns in the West are related to large-scale climate patterns in the Pacific and Atlantic oceans. El Niño years bring drier conditions to the Pacific Northwest and more fires.

14.7 SCENARIO

With increased intermix development, a wildland fire in the Clark County foothills has the potential to cause even greater damage than the 1902 Yacolt Burn. A 21st century firestorm could burn an area approaching the size of the Yacolt Burn, and because of increased development in the area, it would destroy much more property and put more lives at risk (CRESA, 2004).

A major conflagration might begin with a wet spring, adding to the fuels that are already present on the forest floor. Flashy fuels would build throughout the spring. A dry summer with insect infestation could follow the wet spring, exacerbated by dry hot Chinook winds. The Labor Day holiday brings many hikers and campers to the area. Careless campfires or a tossed lit cigarette, or a sudden lighting storm could trigger a multitude of small isolated fires. The embers from smaller fires could be carried miles by the hot, dry winds, falling deep in the forests and intermix zones. Fires that start in flat areas would move more slowly, but wind would still push them. It is not unusual for a wildfire pushed by wind to burn the ground fuel and later climb into the crown and reverse its track. This is one of many ways that fires can escape containment, typically during periods when response capabilities are overwhelmed. As small fires eventually merge, suppression resources would be redirected from protecting natural resources to saving remote subdivisions (CRESA, 2004).

Even if the existence and spread of the fire is known, it may not be possible to respond to it adequately. The worst-case scenario in Clark County would coincide with an active fire season in the entire American west, spreading resources thin. “Hot shot” teams that are exhausted or committed to fighting conflagrations elsewhere would be unavailable to assist Clark County. Many federal assets would be responding to other fires that started earlier in the season. Local fire districts would be useful in the urban intermix areas, but they have limited wildfire capabilities and would have a difficult time responding to the ignition zones. Thus an initially manageable fire could become significant before meaningful resources are dispatched (CRESA, 2004).

To further complicate the problem, heavy rains could follow, causing flooding and landslides and releasing tons of sediment into rivers, permanently changing the floodplains of the county and damaging sensitive habitat and riparian areas. Such a fire followed by rain could release millions of cubic yards of sediment into streams for years, creating new floodplains and changing existing ones. With forests removed from the watershed, discharges could easily double. Floods that previously could be expected every 50 years might occur every couple of years. With the streambeds unable to carry this increased discharge because of increased sediment, the floodplains and floodplain elevations would increase. The number of homes subject to flooding would increase substantially in a post wildland fire situation (CRESA, 2004).

14.8 ISSUES

The following are issues identified for the wildfire hazard:

- Residents should know the proper way to handle fire. Public education programs on fire safety, fire alarms and fire response are important. People should be encouraged to purchase fire insurance if not included in standard homeowner or renter policies and understand building codes.
- Since people start the vast majority of wildfires, wildfire prevention education and enforcement programs can significantly reduce the total number of wild land fires (CRESA, 2011).
- An effective early fire detection program and an emergency communications system are essential. The importance of immediately reporting any wildfire must be impressed upon local residents and persons using forest areas (CRESA, 2011).
- An effective warning system is essential to notify local inhabitants and persons in the area of the fire. An evacuation plan detailing primary and alternate escape routes is also important (CRESA, 2011).
- Fire-safe development planning should be done with local government planners to reduce the risk to local residents and businesses. Safety recommendations to implement could include the following (CRESA, 2011):
  - Sufficient fuel-free areas around structures
  - Fire-resistant roofing materials
  - Adequate two-way (ingress and egress) routes and turnarounds for emergency response units
  - Adequate water supplies with backup power generation equipment or other means to cost-effectively support firefighting efforts
  - Development of local ordinances to control human-caused fires (from debris burning, fireworks, campfires, etc.)
- Road criteria to ensure adequate escape routes for new sections of development in forest areas (CRESA, 2011).
- Road closures to be increased during peak fire periods to reduce the access to fire-prone areas (CRESA, 2011).
- Steps by the public to better protect lives, property, and the environment from wildfires (CRESA, 2011):
  - Maintaining defensible space around homes
  - Providing adequate access routes (two-way with turnaround) to homes for emergency equipment
  - Minimizing “fuel hazards” adjacent to homes
  - Using fire-resistant roofing materials
  - Maintaining adequate water supplies
  - Ensuring home addresses are visible to first responders.
- Some forest fires should be allowed to burn in limited areas as part of forest management.

- During peak wildfire season, if resources from Clark County are deployed to other areas of the State, the availability of firefighting resources could play a role in the severity of wildfire and the size of area effected.

15. PLANNING AREA RISK RANKING

A risk ranking was performed for the hazards of concern described in this plan. This risk ranking assesses the probability of each hazard's occurrence as well as its likely impact on the people, property, and economy of the planning area. The risk ranking methodology and results were reviewed, discussed and approved by the Planning Committee. When available, estimates of risk were generated with data from Hazus-MH or GIS analysis using methodologies promoted by FEMA. For hazards of concern with less robust datasets, qualitative assessments were used. As appropriate, results were adjusted based on local knowledge and other information not captured in the quantitative assessments. The results are used in establishing mitigation priorities.

15.1 PROBABILITY OF OCCURRENCE

The probability of occurrence of a hazard is indicated by a probability factor based on likelihood of annual occurrence:

- High—Hazard event is likely to occur within 25 years (Probability Factor = 3)
- Medium—Hazard event is likely to occur within 100 years (Probability Factor =2)
- Low—Hazard event is not likely to occur within 100 years (Probability Factor =1)
- No exposure—There is no probability of occurrence (Probability Factor = 0)

The assessment of hazard frequency is generally based on past hazard events in the area. Table 15-1 summarizes the probability assessment for each hazard of concern for this plan.

Table 15-1. Probability of Hazards

Hazard Event	Probability (high, medium, low)	Probability Factor
Dam Failure	Low	1
Drought	High	3
Earthquake[a]	High	3
Flood[b]	High	3
Landslide	High	3
Severe weather	High	3
Volcano	Low	1
Wildfire	Medium	2

a. 100-year probabilistic results are used for risk ranking
b. 1 percent annual chance flood event is used for risk ranking

15.2 IMPACT

Hazard impacts were assessed in three categories: impacts on people, impacts on property and impacts on the local economy. Numerical impact factors were assigned as follows:

- **People**—Values were assigned based on the percentage of the total ***population exposed*** to the hazard event. The degree of impact on individuals will vary and is not measurable, so the calculation assumes for simplicity and consistency that all people exposed to a hazard because they live in a hazard zone will be equally impacted when a hazard event occurs. It should be noted that planners can use an element of subjectivity when assigning values for impacts on people. Impact factors were assigned as follows:

  - High—30 percent or more of the population is exposed to a hazard (Impact Factor = 3)
  - Medium—15 percent to 29 percent of the population is exposed to a hazard (Impact Factor = 2)
  - Low—14 percent or less of the population is exposed to the hazard (Impact Factor = 1)
  - No impact—None of the population is exposed to a hazard (Impact Factor = 0)

- **Property**—Values were assigned based on the percentage of the total ***property value exposed*** to the hazard event:
  - High—25 percent or more of the total replacement value is exposed to a hazard (Impact Factor = 3)
  - Medium—10 percent to 24 percent of the total replacement value is exposed to a hazard (Impact Factor = 2)
  - Low—9 percent or less of the total replacement value is exposed to the hazard (Impact Factor = 1)
  - No impact—None of the total replacement value is exposed to a hazard (Impact Factor = 0)
- **Economy**—Values were assigned based on the percentage of the total ***property value vulnerable*** to the hazard event. Values represent estimates of the loss from a major event of each hazard in comparison to the total replacement value of the property exposed to the hazard. For some hazards, such as wildfire, landslide and severe weather, vulnerability was considered to be the same as exposure due to the lack of loss estimation tools specific to those hazards. Loss estimates separate from the exposure estimates were generated for the earthquake and flood hazards using Hazus-MH.
  - High—Estimated loss from the hazard is 15 percent or more of the total replacement value (Impact Factor = 3)
  - Medium—Estimated loss from the hazard is 5 percent to 14 percent of the total replacement value (Impact Factor = 2)
  - Low—Estimated loss from the hazard is 4 percent or less of the total replacement value (Impact Factor = 1)
  - No impact—No loss is estimated from the hazard (Impact Factor = 0)

The impacts of each hazard category were assigned a weighting factor to reflect the significance of the impact. These weighting factors are consistent with those typically used for measuring the benefits of hazard mitigation actions: impact on people was given a weighting factor of 3; impact on property was given a weighting factor of 2; and impact on the economy was given a weighting factor of 1.

Table 15-2, Table 15-3 and Table 15-4 summarize the impacts for each hazard.

15.3 RISK RATING AND RANKING

The risk rating for each hazard was determined by multiplying the probability factor by the sum of the weighted impact factors for people, property and economy, as summarized in Table 15-5. Based on these ratings, a priority of high, medium or low was assigned to each hazard. The hazards ranked as being of highest concern are earthquake and severe weather. Hazards ranked as being of medium concern are flood, landslide and wildfire. The hazards ranked as being of lowest concern are volcano, drought and dam failure. Table 15-6 shows the hazard risk ranking.

Table 15-2. Impact on People from Hazards

Hazard Event	Impact (high, medium, low)	Impact Factor	Multiplied by Weighting Factor (3)
Dam Failure	Low (7.6%)	1	(1x3) = 3
Drought[a]	None	0	(0x3) = 0
Earthquake	High (100%)	3	(3x3) = 9
Flood	Low (1.5%)	1	(1x3) = 3
Landslide	Low (2.3%)	1	(1x3) = 3
Severe weather	High (100%)	3	(3x3) = 9
Volcano[b]	Medium (100% / 0.7%)	2	(2x3) = 6
Wildfire[c]	Medium (100% / 3.4%)	2	(2x3) = 6

a. All people in the planning area would be exposed to drought, but impacts on the health and safety of people would be minimal.
b. Impact from ash fall is high (100%), impacts from distal hazards are low (0.7%).
c. Estimated population in relatively high exposure areas is low (3.4%); however, impacts from air quality are high (100%).

Table 15-3. Impact on Property from Hazards

Hazard Event	Impact (high, medium, low)	Impact Factor	Multiplied by Weighting Factor (2)
Dam Failure	Medium (10.6%)	2	(2x2) = 4
Drought[a]	Low	1	(1x2) = 2
Earthquake	High (100%)	3	(3x2) = 6
Flood	Low (1.8%)	1	(1x2) = 2
Landslide	Low (1.7%)	1	(1x2) = 2
Severe weather	High (100%)	3	(3x2) = 6
Volcano[b]	Medium (100% / 2.6%)	2	(2x2) = 4
Wildfire[c]	Low (3.0%)	1	(1x2) = 2

a. All property in the planning area would be exposed to drought, but impacts on structures would be minimal.
b. Impact from ash fall is high (100%), impacts from distal hazards are low (2.6%).
c. Based on relatively high property exposure.

Table 15-4. Impact on Economy from Hazards

Hazard Event	Impact (high, medium, low)	Impact Factor	Multiplied by Weighting Factor (1)
Dam Failure	Low (2.5%)	1	(1x1) = 1
Drought	Low (less than 0.1%)	1	(1x1) = 1
Earthquake[a, c]	Medium (0.3%)	1	(1x1) = 1
Flood[b, c]	Medium (0.3%)	1	(1x1) = 1
Landslide	Low (less than 1%)	1	(1x1) = 1
Severe weather[c]	Medium (less than 1%)	1	(1x1) = 1
Volcano	Low (less than 1%)	1	(1x1) = 1
Wildfire	Low (less than 1%)	1	(1x1) = 1

a. Based on 100-year probabilistic results.
b. Based on 1 percent annual chance flood event.
c. Impacts were adjusted to medium due to the disruption in critical facilities and infrastructure expected from these hazards.

Table 15-5. Hazard Risk Rating

Hazard Event	Probability Factor	Sum of Weighted Impact Factors	Total (Probability x Impact)
Dam Failure	1	(3+4+1) = 8	(1x8) = 8
Drought	3	(0+2+1) = 3	(3x3) = 9
Earthquake	3	(9+6+2) = 17	(3x17) = 51
Flood	3	(3+2+2) = 7	(3x7) = 21
Landslide	3	(3+2+1) = 6	(3x6) = 18
Severe weather	3	(9+6+2) = 17	(3x17) =51
Volcano	1	(6+4+1) = 11	(1x11) = 11
Wildfire	2	(6+2+1) = 9	(2x9) = 18

Table 15-6. Hazard Risk Ranking

Hazard Ranking	Hazard Event	Category
1	Earthquake	High
1	Severe weather	High
2	Flood	Medium
2	Landslide	Medium
2	Wildfire	Medium
3	Volcano	Low
4	Drought	Low
5	Dam failure	Low

Part 3. MITIGATION PLAN

16. PURPOSE, GOALS AND OBJECTIVES

Hazard mitigation plans must identify goals for reducing long-term vulnerabilities to identified hazards (44 CFR Section 201.6(c)(3)(i)). The Planning Committee reviewed the goals from the 2017 plan and determined that they are no need to make any major changes to them. The Planning Committee reviewed goals and objectives from other relevant plans and programs such as the Washington State Hazard Mitigation Plan and the Clark County Comprehensive Plan and adapted them for the hazard mitigation plan as appropriate in 2016. Hazard mitigation specific goals and objectives were also selected. These selections were revisited throughout the planning process after the completion of the risk assessment and public engagement to ensure they accurately reflected needs within the planning area. The purpose statement, goals, objectives and actions in this plan all support each other. Goals were selected to support the purpose statement. Objectives were selected that met multiple goals. Actions were prioritized based on the action meeting multiple objectives.

16.1 PURPOSE STATEMENT

A purpose statement focuses the range of goals and, therefore, objectives and actions to be considered. This statement is not a goal because it does not describe a hazard mitigation outcome, and it is broader than a hazard-specific objective. The purpose statement for the *Clark Regional Natural Hazard Mitigation Plan* is as follows:

> Define natural hazard risk and, through collaboration and partnerships, establish strategies and actions for reducing the impacts of disasters in Clark County.

16.2 GOALS

The following are the mitigation goals for this plan:

- Reduce and prevent the loss of life and property.
- Protect public services and critical facilities from the impacts of natural disasters.
- Increase public awareness of vulnerability to natural hazards and educate on risk reduction strategies.
- Promote community resilience.
- Protect environmental resources and utilize natural systems to reduce natural hazard impacts.
- Develop and implement cost-effective mitigation strategies.

The effectiveness of a mitigation strategy is assessed by determining how well these goals are achieved.

16.3 OBJECTIVES

Each objective meets multiple goals, serving as a stand-alone measurement of the effectiveness of a mitigation action, rather than as a subset of a goal. The objectives also are used to help establish priorities. The objectives are as follows (numbering is provided as a point of reference, not as an indication of priority):

1. Inform the public on the risk exposure to natural hazards and ways to increase the public's capability to prepare, respond, recover and mitigate the impacts of these events.
2. Reduce the impacts of hazards on vulnerable populations.
3. Improve and maintain systems that provide warning and emergency communications.
4. Work cooperatively with stakeholders in planning for and reducing the impacts of natural hazards.
5. Incorporate risk reduction strategies in new and updated infrastructure and development plans to reduce the impacts of natural hazards.
6. Integrate natural hazard mitigation goals and objectives into other existing plans and programs within the planning area.
7. Provide incentives for development and land use techniques that reduce risks.
8. Strengthen and build redundancy into infrastructure, prioritizing areas that may be potentially isolated areas.
9. Retrofit, purchase, or relocate structures in high hazard areas, especially those known to be repetitively damaged.
10. Avoid, minimize or mitigate risks to critical facilities and infrastructure.
11. Support and enhance environmental protection and sustainability activities that may also accomplish mitigation objectives.
12. Use the best available data, science and technologies to implement mitigation strategies.

17. MITIGATION BEST PRACTICES

Catalogs of hazard mitigation best practices were developed that present a broad range of alternatives to be considered for use in the planning area, in compliance with 44 CFR (Section 201.6(c)(3)(ii)). One catalog was developed for each hazard of concern evaluated in this plan as well as a catalog for all hazards. The catalogs for each hazard are listed in Table 17-1 through Table 17-9. The catalogs present alternatives that are categorized in two ways:

- By what the alternative would do:
  - Manipulate a hazard
  - Reduce exposure to a hazard
  - Reduce vulnerability to a hazard
  - Increase the ability to respond to or be prepared for a hazard
- By who would have responsibility for implementation:
  - The general public - individuals
  - The private sector - businesses
  - Government.

Hazard mitigation actions recommended in this plan were selected from among the alternatives presented in the catalogs or inspired by a review of the catalogs. The catalogs provide a baseline of mitigation alternatives that are backed by a planning process, are consistent with the planning partners' goals and objectives, and are within the capabilities of the partners to implement. Some of these actions may not be feasible based on the selection criteria identified for this plan. The purpose of the catalog was to equip the planning partners with a list of what could be considered to reduce risk from natural hazards within the planning area. All actions identified in Volume 2 of this plan were selected based on the selection criteria described in Chapter 1 of Volume 2. Actions in the catalog that are not included for the partnership's action plan were not selected for one or more of the following reasons:

- The action is not feasible.
- The action is already being implemented.
- There is an apparently more cost-effective alternative.
- The action does not have public or political support.

Table 17-1. Catalog of Mitigation Best Practices—All Hazards

Public (Individual) Scale	Private (Business) Scale	Government Scale
Manipulate Hazard		
• None	• None	• None
Reduce Exposure		
• None	• None	• Relocate critical facilities out of known hazard areas • Prohibit or limit public expenditures for capital improvements in known hazard areas • Acquire safe sites for public facilities (e.g., schools, police/fire stations, etc.) • Prohibit new facilities for persons with special needs/mobility concerns in hazard areas. • Prohibit animal shelters in known hazard areas
Reduce Vulnerability		
• Apply for permits as required and follow established building codes • Perform a vulnerability check on personal property	• Establish/participate in a business-to-business mitigation mentoring program. • Perform a vulnerability check on property	• Retrofit critical facilities within known hazard areas. • Organize a managed retreat from very high-risk areas. • Promote open space uses in identified high hazard areas via techniques such as: PUD's, easements, setbacks, greenways, sensitive area tracks

Public (Individual) Scale	Private (Business) Scale	Government Scale
Increase Capability		
• Educate yourself on risk reductions methods • Educate yourself on early warning procedures • Purchase insurance for your home and valuables • Volunteer on community mitigation projects. • Develop household mitigation plan, such as creating a retrofit savings account, communication capability with outside, 2 week self-sufficiency during an event • Prepare a family post-disaster action plan • Get to know your neighbors • Participate in perishable data capture programs	• Educate your employees on the probable impacts from hazard events • Develop a Continuity of Operations Plan • Participate in perishable data capture programs	• Develop an all hazards public education campaign and resource center • Promote the purchase of insurance in known hazard areas • Establish a process to coordinate with local, state and federal agencies to maintain up-to-date hazard data, maps, and assessments. • Designate high-risk zones as special assessment districts (to fund necessary hazard mitigation projects) • Incorporate a stand-alone element for hazard mitigation into the local comprehensive (land use) plan. • Develop a post-disaster reconstruction plan to facilitate decision making following a hazard event. • Involve citizens in comprehensive planning activities that identify and mitigate hazards • Adopt a post-disaster recovery ordinance based on a plan to regulate repair activity, generally depending on property location. • Adopt the International Building Code and International Residential Code • Increase the local Building Code Effectiveness Grading Schedule classification through higher building code standards and enforcement practices. • Identify a funding mechanism for a local match to Federal funds that can fund private mitigation practices. • Identify and strengthen facilities so that they can function as public shelters • Provide hazard vulnerability checklists for homeowners to conduct their own inspections • Establish a technical assistance program for residents to access data or resources for mitigation purposes • Develop mutual aid agreements with other local governments/organizations • Warehouse critical infrastructure components such as pipe, power line, and road repair material • Develop a Continuity of Government Plan • Provide technical information and guidance during permitting and development process • Maintain existing hazard databases and establish a program for collection perishable data after hazard events • Form a citizen plan implementation steering committee to monitor progress of local mitigation actions. Include a mix of representatives from neighborhoods, local businesses, and local government.

Table 17-2. Catalog of Mitigation Best Practices —Dam Failure

Public (Individual) Scale	Private (Business) Scale	Government Scale
Manipulate Hazard		
• None	• Remove privately owned Dams • Strengthen privately owned Dams	• Remove government owned Dams • Strengthen government owned Dams
Reduce Exposure		
• Relocate out of Dam Failure Inundation areas.	Replace earthen dams with hardened structures	• Replace earthen dams with hardened structures
Reduce Vulnerability		
• Elevate your home to appropriate levels • Flood-proof your home to appropriate levels	• Flood proof facilities within Dam Failure Inundation areas • Continue/ensure regularly scheduled engineering assessments of privately owned dams	• Adopt higher regulatory floodplain standards in mapped Dam Failure/Inundation areas. • Consider low density land uses within identified Dam Failure/Inundation areas. • Continue/ensure regularly scheduled engineering assessments • Create easements in impoundment and downstream inundation areas • Study and evaluate impacts from climate change on dam operations
Increase Capability		
• Learn the evacuation routes for a dam failure event • Educate yourself on early warning procedures. • Purchase flood insurance	• Develop and update Emergency Action Plans • Educate employees on dam failure evacuation routes • Educate employees on early warning procedures.	• Create, maintain and update scenario based Dam Failure/Inundation area maps. • Enhance Emergency Operations Plan to include a dam failure component. • Institute monthly communications checks with dam operators. Maintain up to date communications list. • Inform the public on risk reduction techniques and develop a communication plan • Adopt real-estate disclosure requirements for the re-sale of property located within Dam Inundation areas. • Establish early warning systems downstream of high hazard dams. • Update evacuation routes and educate the public on those routes • Promote the purchase of flood insurance in inundation areas

Table 17-3. Catalog of Mitigation Best Practices—Drought

Public (Individual) Scale	Private (Business) Scale	Government Scale
Manipulate Hazard		
• None	• None	• Promote groundwater recharge through stormwater management • Implement cloud seeding techniques during dry season.
Reduce Exposure		
• Install stored water/captured water techniques, such as rain barrels or down spout gardens • Use permeable paving techniques whenever feasible	• Install stored water/captured water techniques, such as rain barrels or down spout gardens • Use permeable paving techniques whenever feasible.	• Identify and create ground water back up sources • Create/identify new impounded water supply points • Use permeable paving techniques whenever feasible
Reduce Vulnerability		
• Plant drought resistant landscapes • Reduce water system losses (e.g. fix drips) • Modify plumbing systems, i.e. water saving kits or grey water systems	• Plant drought resistant landscapes • Reduce private water system losses • Identify alternate water supply sources • Plant drought-resistant crop varieties • Develop and implement grey water systems	• Plant drought resistant landscapes on community owned facilities • Distribute water saving kits to community members • Implement storm water retention in regions ideally suited for groundwater recharges • Reduce water system losses through regular maintenance • Design water delivery systems to accommodate drought events
Increase Capability		
• Practice active water conservation	• Practice active water conservation techniques • Develop a water conservation plan	• Identify alternative water supplies for time of drought • Develop a drought contingency plan • Develop criteria triggers for drought related actions • Improve accuracy of water supply forecasts • Modify rate structures to influence active water conservation techniques • Consider providing incentives to property owners that utilize drought resistant landscapes in the design of their home • Develop/Implement drought education/notification systems and communication plan • Emphasize droughts relationship to other hazards in hazard awareness messaging • Increase capability to enforce water restrictions when such restrictions are in place.

Table 17-4. Catalog of Mitigation Best Practices—Earthquake

Public (Individual) Scale	Private (Business) Scale	Government Scale
Manipulate Hazard		
• None	• None	• None
Reduce Exposure		
• Locate outside of hazard area (off soft soils)	• Locate or relocate mission-critical functions outside hazard area where possible	• Locate critical facilities or functions outside hazard area where possible
Reduce Vulnerability		
• Retrofit structure (e.g. anchor house structure to foundation) • Secure household items that can cause injury or damage such as water heaters, bookcases, and other appliances • Build to higher design standards • Install window film to prevent injuries from shattered glass	• Build redundancy for critical functions/facilities • Retrofit critical buildings/areas housing mission critical functions • Perform non-structural assessments and mitigation activities (e.g. anchor bookcases to the wall) • Anchor rooftop-mounted equipment (i.e., HVAC units, satellite dishes, etc.).	• Harden infrastructure • Provide redundancy for critical functions • Encourage mitigation of private property • Perform non-structural assessments and mitigation activities (e.g. anchor bookcases to the wall) • Require bracing of generators, elevators, and other vital equipment in hospitals. • Review construction plans for all bridges to determine their susceptibility to collapse and retrofit problem bridges. • Use flexible piping when extending water, sewer, or natural gas service. • Install shutoff valves and emergency connector hoses where water mains cross fault lines. • Install window film to prevent injuries from shattered glass • Anchor rooftop-mounted equipment (i.e., HVAC units, satellite dishes, etc.). • Include retrofitting/replacement of critical system elements in Capital Improvements Plan (CIP) • Store emergency water supply sufficient for students and staff at school for at least one day

Public (Individual) Scale	Private (Business) Scale	Government Scale
Increase Capability		
• Practice "drop, cover and hold" • Participate in drills such as the Great Shakeout • Purchase earthquake insurance	• Adopt higher standard for new construction -- Consider "performance based design' when building new structures • Increase capability by having cash reserves for reconstruction • Inform your employees on the possible impacts of earthquake and how to deal with them at your work facility • Participate in drills such as the Great Shakeout	• Produce more accurate hazard maps (e.g. liquefaction and soils maps) • Initiate triggers guiding improvements such as: (< 50% substantial damage/improvements) • Further enhance seismic risk assessment to target high hazard buildings for mitigation opportunities (e.g. older structures, unreinforced masonry) • Develop a debris management plan • Participate in drills such as the Great Shakeout • Communicate earthquake secondary hazards to public (e.g. landslides, dam failure, fires, hazardous material spills) • Assess emergency response routes and determine back-up options in case of damage or disruption • Educate K-12, residents, developers and businesses on earthquake safety and building codes. • Require/encourage rapid damage assessment training for City staff • Develop and distribute guidelines or pass ordinances that require developers and building owners to locate lifelines, buildings, critical facilities, and hazardous materials out of areas subject to significant seismic hazards. • Support financial incentives, such as low interest loans or tax breaks, for home and business owners who seismically retrofit their structures. • Use Hazus to quantitatively estimate potential losses from an earthquake • Establish a school survey procedure and guidance document to inventory structural and non-structural hazards in and around school buildings • Use rapid visual screening to quickly inspect a building and identify disaster damage or potential seismic structural and non-structural weaknesses to prioritize retrofit efforts, inventory high-risk structures and critical facilities, or assess post-disaster risk to determine if buildings are safe to re-occupy • Develop a technical assistance information program for homeowners. • Create a seismic safety committee to provide policy recommendations, evaluate and recommend changes in seismic safety standards, and give an annual assessment of local and statewide implementation of seismic safety improvements • Develop an inventory of public and commercial buildings that may be particularly vulnerable to earthquake damage.

Table 17-5. Catalog of Mitigation Best Practices—Flood

Public (Individual) Scale	Private (Business) Scale	Government Scale
Manipulate Hazard		
• Clear stormwater drains and culverts	• Clear stormwater drains and culverts	• Develop and adopt a storm drain program • Dredge, construct levees, provide retention areas • Invest in structural flood control: levees, dams, channelization, revetments • Construct regional stormwater control facilities • Harden areas with significant erosion concerns • Promote/retain natural vegetation in areas with significant erosion concerns
Reduce Exposure		
• Locate outside of hazard area • Elevate utilities above base flood elevation • Institute low impact development techniques on property	• Locate business critical facilities or functions outside hazard area • Institute low impact development techniques on property	• Acquire or relocate identified repetitive loss properties • Adopt land development techniques such as density transfers or clustering • Institute low impact development techniques on property • Adopt sediment and erosion control regulations • Adopt zoning and erosion overlay districts • Prohibit any fill in floodplain areas • Encourage the use of porous pavement, vegetative buffers, and islands in large parking areas. • Use stream restoration to ensure adequate drainage and diversion of stormwater.

Public (Individual) Scale	Private (Business) Scale	Government Scale
Reduce Vulnerability		
• Retrofit structure (elevate house above base flood elevation) • Elevate items within house above base flood elevation • Build new homes above base flood elevation • Floodproof non-residential structures	• Build redundancy for critical functions/ retrofit critical buildings • Provide flood-proofing measures when new critical infrastructure must be located in floodplains	• Adopt appropriate regulatory standards such as cumulative substantial improvement/damage, freeboard, lower substantial damage threshold, compensatory storage • Develop and implement stormwater management regulations and master planning • Adopt "no-adverse impact" floodplain management policies that strive to not increase the flood risk on down-stream communities • Perform regular inspections/assessments of locally owned or maintained flood control infrastructure • Replace undersized culverts • Provide permanent protection for pump stations at risk of flooding • Identify/mitigate drainage issues resulting in ponding • Enhance road drainage programs or elevate/relocate roads subject to frequent flooding • Ensure permitting process is consistent with the adopted floodplain management ordinance • Develop an erosion protection program for high hazard areas • Construct open foundation systems on buildings to minimize scour • Construct deep foundations in erosion hazard areas • Establish a green infrastructure program • Use subdivision design standards to require elevation data collection during platting and to have buildable space on lots above the base flood elevation • Require tie downs of propane tanks • Require a drainage study with new development • Design a “natural runoff” or “zero discharge” policy for stormwater in subdivision design • Require and maintaining FEMA elevation certificates for all new and improved buildings located in floodplains • Extend the freeboard requirement past the mapped floodplain to include an equivalent land elevation • Include requirements in the local floodplain ordinance for homeowners to sign non-conversion agreements for areas below base flood elevation. • Offer incentives for building above the required freeboard minimum (code plus). • Inspect bridges and identify if any repairs or retrofits are needed to prevent scour • Floodproof critical facilities and infrastructure located in flood hazard areas • Require all critical facilities to meet requirements of Executive Order 11988 and be built 1 foot above the 500-year flood elevation

Public (Individual) Scale	Private (Business) Scale	Government Scale
Increase Capability		
• Comply with National Flood Insurance Program • Purchase flood insurance	• Increase capability by having cash reserves for reconstruction • Support and implement hazard disclosure for the sale/re-sale of property in identified risk zones • Solicit 'cost-sharing" through partnerships with public sector stake holders on projects with multiple benefits	• Produce more accurate flood hazard maps or identify areas for further study • Join Community Rating System (CRS) program or maintain/improve class • Provide training for staff and decision-makers in floodplain management (e.g. maintain certified floodplain managers on staff) • Create a building and elevation inventory of structures in the floodplain • Develop a Flood Task Force • Pre-stage flood response equipment before events • Integrate floodplain management policies into other planning mechanisms within the planning area • Develop framework/continue efforts for cooperation between agencies/districts in flood mitigation activities (e.g. sand and sand bag deployment) • Retain good standing in National Flood Insurance Program • Participate in information sharing with other agencies (e.g. U.S. Army Corps of Engineers, NWS) • Identify and mitigate sources of nuisance flooding • Review and update floodplain damage prevention ordinances • Identify debris collection sites • Require/encourage rapid damage assessment training for staff • Map locations of storm drains, catch basins and dry wells so that they may be located and cleared • Identify and map erosion hazard areas • Develop a tracking program for erosion hazards and their impacts on the community • Pass and enforce an ordinance that regulates dumping in streams and ditches • Develop a stormwater committee • Form a regional watershed council • Incorporate digital floodplain and topographic data into GIS systems, in conjunction with Hazus, to assess risk • Conduct NFIP community workshops to provide information and incentives for property owners to acquire flood insurance. • Increase drainage or absorption capacities with detention and retention basins, relief drains, spillways, drain widening/dredging or rerouting, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, or channel redirection

Table 17-6. Catalog of Mitigation Alternatives—Landslide

Public (Individual) Scale	Private (Business) Scale	Government Scale
Manipulate Hazard		
• Stabilize slope (de-water, armor toe) • Reduce weight on top of slope • Minimize vegetation removal and the addition • Install rip rap boulders of geotextile fabric • Using bioengineered bank stabilization techniques. • Use a rock splash pad to direct run off and minimize the potential for erosion	• Stabilize slope (de-water, armor toe) • Reduce weight on top of slope • Minimize vegetation removal and the addition of impervious surfaces • Using bioengineered bank stabilization techniques. • Use a rock splash pad to direct run off and minimize the potential fort erosion	• Monitor/review accumulated effects from piecemeal development on steep slopes • Implement post-fire vegetation management plans • Coordinate with resource management agencies to identify potential issues from resource extraction activities • Using bioengineered bank stabilization techniques.
Reduce Exposure		
• Locate structures outside of hazard area (off unstable land and away from slide-run out area)	• Locate structures outside of hazard area (off unstable land and away from slide runout area)	• Acquire properties located in high risk landslide areas • Adopt land use policies that prohibit the placement of habitable structures in high risk landslide areas • Adopt land use policies that limit accumulated effects in landslide risk areas
Reduce Vulnerability		
• Retrofit homes on steep slopes	• Retrofit at-risk facilities.	• Adopt higher regulatory standards for new development within unstable slope areas • Armor/retrofit critical infrastructure from the impact of landslides • Post signage in landslide hazard areas • Prohibit removal of natural vegetation from slopes • Assess vegetation in wildfire-prone areas to prevent landslides after fires (e.g., encourage plants with strong root systems).
Increase Capability		
• Sign up for warning systems • Learn the warning signs that indicate a landslide may occur • Educate yourself on risk reduction techniques for landslide hazards	• Sign up for warning system and develop evacuation plan • Increase capability by having cash reserves for reconstruction • Educate your employees on the potential exposure to landslide hazards and your emergency response protocol	• Produce landslide hazard risk maps • Enact tools to help manage development in hazard areas: better land controls, tax incentives, information, limit new impervious/pervious surfaces • Collect and compile landslide event history database • Develop plan/strategy for communicating risk to property owners/communities recently affected by wildfires • Increase regulatory authority for post-fire mitigation enforcement • Establish and communicate post-event repair responsibilities (e.g. roads that are impacted) • Conduct geological/engineering studies of potential slide areas • Notify property owners in high-risk areas • Develop a brochure describing risk and potential mitigation techniques

Table 17-7. Catalog of Mitigation Best Practices—Severe Weather

Public (Individual) Scale	Private (Business) Scale	Government Scale
Manipulate Hazard		
• Increase tree plantings around buildings to shade parking lots and along public rights-of-way	• Increase tree plantings around buildings to shade parking lots and along public rights-of-way.	• Increase tree plantings around buildings to shade parking lots and along public rights-of-way.
Reduce Exposure		
• None	• None	• None
Reduce Vulnerability		
• Insulate house • Provide redundant heat and power • Plant appropriate trees near home and power lines ("Right tree, right place" National Arbor Day Foundation Program) • Incorporate passive ventilation in the site design. • Secure loose items (i.e., patio furniture)	• Relocate critical infrastructure, such as power lines, underground • Install tree wire • Install lightning protection devices and methods, such as lightning rods and grounding, on communications infrastructure and other critical facilities • Install and maintain surge protection on critical electronic equipment. • Avoid placing flag poles or antennas near buildings	• Trim trees back from power lines • Designate snow routes and strengthen critical road sections and bridges • Continue/expand participation in Storm Ready programs • Continue to support/maintain/improve notification and warning systems • Support/continue/formalize shelter agreements • Ensure critical facilities have back-up power generation capabilities • Install lightning protection devices on critical facilities and communications equipment • Inspect/ensure facilities can withstand high winds • Encourage construction of guard rails where appropriate • Ensure critical facilities/shelters can easily transition to generator produced power • Stockpile response/preparedness supplies • Install and maintain surge protection on critical electronic equipment • Review building codes and structural policies to ensure they are adequate to protect older structures from wind damage • Use natural environmental features as wind buffers in site design • Incorporate inspection and management of hazardous trees into the drainage system maintenance process. • Preemptively test power line holes to determine if they are rotting • Use designed-failure mode for power line design to allow lines to fall or fail in small sections rather than as a complete system to enable faster restoration • Avoid placing flag poles or antennas near buildings • Convert traffic lights to mast arms

Public (Individual) Scale	Private (Business) Scale	Government Scale
Increase Capability		
• Trim or remove trees that could affect power lines • Obtain a NOAA weather radio • Obtain an emergency generator • Identify locations of emergency shelters • Participate in amateur radio groups • Sign up for reverse 911 systems/other notification options • Post address so as to be visible to first responders • Teach school children about the dangers of lightning and how to take safety precautions.	• Trim or remove trees that could affect power lines • Create redundancy in critical systems • Equip facilities with a NOAA weather radio • Equip vital facilities with emergency power sources	• Support/continue programs such as "Tree Watch" that proactively manage problem areas by use of selective removal of hazardous trees, tree replacement, etc. • Establish and enforce building codes that require all roofs to withstand snow loads and wind speeds • Improve communication alternatives/redundancy • Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines • Provide NOAA weather radios to the public • Encourage coordination with amateur radio groups • Identify/ear mark funding opportunities for generator purchases • Develop evacuation/ emergency road plans and prioritize roads for response efforts • Encourage residents to sign-up for reverse 911 services or other notification services • Encourage/require residents to post addresses where they are visible to first responders • Include safety strategies for severe weather in driver education classes and materials. • Organize outreach to vulnerable populations, including establishing and promoting accessible heating centers in the community

Table 17-8. Catalog of Mitigation Best Practices—Volcano

Public (Individual) Scale	Private (Business) Scale	Government Scale
Manipulate Hazard		
• None	• None	• None
Reduce Exposure		
• Identify equipment/resources that may be negatively impacted by ash fall and develop plan to move indoors/protect	• Identify equipment/resources that may be negatively impacted by ash fall and develop plan to move indoors/protect	• Identify equipment/resources that may be negatively impacted by ash fall and develop plan to move indoors/protect
Reduce Vulnerability		
• None	• Build redundancy for critical facilities and functions	• Retrofit older building stock to be able to support accumulated ash fall loads
Increase Capability		
• Sign up for early warning systems and notifications	• Educate employees on impacts and emergency plans	• Support detailed wind/ash fall studies • Develop post-event cleanup plan

Table 17-9. Catalog of Mitigation Best Practices—Wildfire

Public (Individual) Scale	Private (Business) Scale	Government Scale
Manipulate Hazard		
• Clear potential fuels on property: dry, overgrown underbrush, diseased trees	• Clear potential fuels on property: dry underbrush, diseased trees	• Clear fuels (dry underbrush, diseased trees) on land that can trigger and maintain wildfires • Implement "Best Management Practices" on public lands • Partner with local communities to create fire breaks
Reduce Exposure		
• Create and maintain defensible space around structures • Reduce exposure --Locate outside of hazard area • Mow regularly • Stay clear of hazard areas during a wildfire event	• Create and maintain defensible space around structures and infrastructure • Reduce exposure -- Locate outside of hazard area	• Create and maintain defensible space around structures and infrastructure • Enhance building code to include use of fire resistant materials in high hazard areas • Reduce exposure -- Locate outside of hazard area
Reduce Vulnerability		
• Create and maintain defensible space around structures, provide water on site. • Use fire-retardant building materials • Create defensible spaces around your home	• Create and maintain defensible space around structures and infrastructure, provide water on site • Use fire-retardant building materials	• Create and maintain defensible space around structures and infrastructure • Use fire-retardant building materials • Develop/implement higher regulatory standards in wildfire hazard areas • Develop/support biomass reclamation initiatives • Increase regulatory requirements/code enforcement for fire risk reduction or incentivize higher standards • Develop fire smart building code regulations • Implement road side vegetation management best practices • Conduct pre-construction building inspections that include fire prevention requirements and provide emphasis on a fire resistant structure • Develop programs to identify/install wildland fire water supply systems such as cisterns, ponds and dry hydrants • Involve fire protection agencies in determining guidelines and standards and in development and site plan review procedures • Enclose the foundations of homes and other buildings in wildfire-prone areas, rather than leaving them open and potentially exposing undersides to blown embers or other materials. • Prohibit wooden shingles/wood shake roofs on any new development in areas prone to wildfires. • Routinely inspect the functionality of fire hydrants • Use prescribed burning to reduce fuel loads that threaten public safety and property.

Public (Individual) Scale	Private (Business) Scale	Government Scale
Increase Capability		
• Employ "Firewise" techniques to safeguard your home • Identify alternative water supplies for fire fighting • Install/replace roofing material with non-combustible roofing materials • Ensure that all fuel-burning equipment should be vented to the outside • Install carbon monoxide monitors and alarms.	• Support "Firewise" community initiatives • Create /establish stored water supplies to be utilized for fire fighting	• Seek alternative water supplies in urban wildland interface areas • Become a "Firewise" community • Utilize academia to study impacts/solutions to wildfire risk • Create/implement/update wildfire protection plans • Develop evacuation/ emergency road plans and prioritize roads for response efforts • Provide public outreach to increase understanding of forest management practices • Enhance/provide redundant communication infrastructure • Require/encourage rapid damage assessment training • Pre-plan responses to wildland urban interface areas • Use zoning and/or a special wildfire overlay district to designate high-risk areas and specify the conditions for the use and development of specific areas • Develop a vegetation management plan • Work with insurance companies, utility providers, and others to include wildfire safety information in materials provided to area residents

18. MITIGATION ACTIONS AND IMPLEMENTATION

18.1 STATUS OF PREVIOUS PLAN INITIATIVES

Table 1-8 summarized the initiative that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 18-1 Previous Hazard Mitigation Plan Initiatives

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
Establish a county-wide repository of perishable data from hazard events and develop a standard form for capturing information.		X	
***Comment**: GIS Partners from multiple jurisdictions have met to discuss this issue, but more work is required.*			
Develop a county-wide recovery/resiliency plan.		X	
***Comment**: Clark County participated in a regional recovery framework development process with the other 4 counties of the Portland-Vancouver Metro Region and completed a regional framework. Funding had been identified to develop local level framework with a consulting team that would tie into the regional framework, but COVID-19 required a change of priorities. We still intend to move the project forward when new funding can be identified and partners have available bandwidth.*			
Participate in the plan implementation hazard mitigation working group by sharing lessons learned and mitigation success stories and actively participating in progress reporting		X	
***Comment**: The workgroup was ongoing before COVID-19 response. The workgroup will be rebooted following the approval of this plan.*			
Support and guide the technology for regional hazard warning systems	X		
***Comment**: CRESA maintains a new hazard warning system which is used by CRESA Emergency Management and the municipalities within Clark County. CRESA also works with neighboring counties to share standard operating practices and develop regional use standards.*			
Ensure that a link to the hazard mitigation plan website hosted by CRESA is posted conspicuously on each planning partner website		X	
***Comment**: CRESA is in the process of having a new website developed. Once the new website is active, links will need to be updated.*			
Support regional collaboration and consistency in hazard mitigation implementation and programs		X	
***Comment**: This is ongoing through both local and regional workgroups*			

Where appropriate, support retro-fitting, relocating or acquisition from willing property owners of structures located in hazard-prone areas to protect structures from future damage, with repetitive and severe repetitive loss as a priority. Seek opportunities to leverage partnerships within the planning area in these pursuits		X	
***Comment**: This is an on-going task.*			
Utilize information contained within the Clark Regional Natural Hazard Mitigation Plan to support updates to other emergency management plans in effect within the planning area		X	
***Comment**: This is an on-going task.*			
Utilize information contained within the Clark Regional Natural Hazard Mitigation Plan to support updates to other plans in effect within the planning area		X	
***Comment**: This is an on-going task.*			
Develop the capacity for a regional post-disaster volunteer coordination program		X	
***Comment**: The Clark County Community Organizations Active in Disaster (COAD) began discussions around re-developing a program. At this time, there is no developed program.*			
Explore opportunities with all community stakeholders to implement, identify and fund mitigation actions		X	
***Comment**: This is an on-going task*			
Continue regional partnerships to improve and enhance mitigation efforts in the larger region		X	
***Comment**: This is an on-going task*			
Establish guidelines to increase communication and coordination of mitigation actions across agencies whenever feasible		X	
***Comment**: This is an on-going task*			
Continue to work with planning partners and other stakeholders to clearly articulate and define emergency management roles and responsibilities within the County, including the implementation of identified mitigation actions.		X	
***Comment**: This is an on-going task.*			

18.2 SELECTED COUNTY-WIDE MITIGATION ACTIONS

The Steering Committee determined that some actions could be implemented to provide hazard mitigation benefits county-wide. Table 18-2 lists the recommended county-wide actions and their implementation details. Table 18-3 lists the implementation and grant pursuit priorities for the recommended actions. Explanations for categorizations in these tables are in the sections that follow.

18.2.1 Timeline

Timelines for actions are defined as:

- Short-term: action can be completed in 1 to 5 years
- Long-term: action can be completed in 5 years or greater
- Ongoing: action is a continual program.

18.2.2 Benefit/Cost Review

The action plan must be prioritized according to a benefit/cost analysis of the proposed actions and their associated costs (44 CFR, Section 201.6(c)(3)(iii)). The benefits of proposed actions were weighed against estimated costs as part of the action prioritization process. The benefit/cost analysis was not of the detailed variety required by FEMA for action grant eligibility under relevant grant programs. A less formal approach was used because some actions may not be implemented for up to 10 years, and associated costs and benefits could change dramatically in that time. Therefore, a review of the apparent benefits versus the apparent cost of each action was performed. Parameters were established for assigning subjective ratings (high, medium, and low) to the costs and benefits of these actions.

Benefit ratings were defined as follows:

- High: Action will have an immediate impact on the reduction of risk exposure to life and property.
- Medium: Action will have a long-term impact on the reduction of risk exposure to life and property, or action will provide an immediate reduction in the risk exposure to property.
- Low: Long-term benefits of the action are difficult to quantify in the short term.

Cost ratings were defined as follows:

- High: Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed action.
- Medium: Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the action would have to be spread over multiple years.
- Low: Possible to fund under existing budget. Action is or can be part of an existing ongoing program.

Using this approach, actions with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial. For many of the strategies identified in this action plan, the partners may seek financial assistance under the Hazard Mitigation Grant Program or Pre-Disaster Mitigation Assistance programs, both of which require detailed benefit/cost analyses. These analyses will be performed on actions at the time of application using the FEMA benefit-cost model. For actions not seeking financial assistance from grant programs that require detailed analysis, the partners reserve the right to define “benefits” according to parameters that meet the goals and objectives of this plan.

18.2.3 Prioritization

Two prioritization categories were established for this planning process: implementation and grant pursuit.

Implementation priorities were established using the following considerations:

- High Priority—An action that meets multiple objectives, has benefits that exceed cost, has funding secured or is an ongoing action and meets eligibility requirements for a grant program. High priority actions can be completed in the short term (1 to 5 years). The key factors for high priority actions are that they have funding secured and can be completed in the short term.
- Medium Priority—An action that meets multiple objectives, that has benefits that exceed costs, and for which funding has not yet been secured, but is eligible for funding. Action can be completed in the short term, once funding is secured. Medium priority actions will become high priority actions once funding is secured. The key factors for medium priority actions are that they

are eligible for funding, but do not yet have funding secured, and they can be completed within the short term.

- Low Priority—An action that will mitigate the risk of a hazard, that has benefits that do not exceed the costs or are difficult to quantify, for which funding has not been secured, that is not eligible for grant funding, and for which the time line for completion is long term (1 to 10 years). Low priority actions may be eligible for grant funding from other programs that have not yet been identified. Low priority actions are generally “blue-sky” or “wish-list.” actions. Financing is unknown, and they can be completed over a long term.

Grant pursuit priories were established using the following considerations:

- High Priority—An action that has been identified as meeting grant eligibility requirements, assessed to have high benefits, is listed as high or medium priority, and where local funding options are unavailable or where dedicated funds could be utilized for actions that are not eligible for grant funding.
- Medium Priority—An action that has been identified as meeting grant eligibility requirements, assessed to have medium or low benefits, is listed as medium or low priority, and where local funding options are unavailable.
- Low Priority—An action that has not been identified as meeting grant eligibility requirements, or has low benefits.

Table 18-2. County-Wide Action Plan Matrix

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding[a]	Timeline
CW-1—Establish a county-wide repository of perishable data from hazard events and develop a standard form for capturing information.						
New and existing	All hazards	4, 12	CRESA	Low	Staff time	Short-term
CW-2—Develop a county-wide recovery/resiliency plan.						
New and existing	All hazards	2, 4, 6	CRESA	High	Local, possible grant funding (UASI)	Short-term
CW-3—Participate in the plan implementation hazard mitigation working group by sharing lessons learned and mitigation success stories and actively participating in progress reporting						
New and existing	All hazards	1, 4, 6, 12	Planning Partners/ facilitated by CRESA	Low	Staff time	Ongoing
CW-4—Ensure that a link to the hazard mitigation plan website hosted by CRESA is posted conspicuously on each planning partner website						
N/A	All hazards	1, 4	Planning Partners	Low	Staff time	Short-term
CW-5—Support regional collaboration and consistency in hazard mitigation implementation and programs						
New and existing	All hazards	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	Clark County/CRESA	Low	Staff time	Ongoing
CW-6—Where appropriate, support retro-fitting, relocating or acquisition from willing property owners of structures located in hazard-prone areas to protect structures from future damage, with repetitive and severe repetitive loss as a priority. Seek opportunities to leverage partnerships within the planning area in these pursuits						
Existing	All hazards	4, 5, 7, 9, 10	Planning Partners	High	HMGP, PDM, FMA, CDBG-DR	Ongoing
CW-7—Utilize information contained within the Clark Regional Natural Hazard Mitigation Plan to support updates to other emergency management plans in effect within the planning area						
New and existing	All hazards	2, 4	CRESA	Low	Staff time	Ongoing
CW-8—Utilize information contained within the Clark Regional Natural Hazard Mitigation Plan to support updates to other plans in effect within the planning area						
New and existing	All hazards	2, 4, 5	Planning Partners	Low	Staff time	Ongoing
CW-9—Develop the capacity for a regional post-disaster volunteer coordination program						
N/A	All hazards	1, 2, 3, 4	CRESA	Medium	Staff time, Local funds	Long-term
CW-10—Explore opportunities with all community stakeholders to implement, identify and fund mitigation actions						
New and existing	All hazards	1, 2, 4,12	CRESA	Medium	Staff time, Local funds	Ongoing
CW-11—Continue regional partnerships to improve and enhance mitigation efforts in the larger region						
New and existing	All hazards	1, 4	CRESA	Low	Staff-time	Ongoing
CW-12—Establish guidelines to increase communication and coordination of mitigation actions across agencies whenever feasible						
New and existing	All hazards	4	CRESA	Low	Staff time	Short-term
CW-13— Continue to work with planning partners and other stakeholders to clearly articulate and define emergency management roles and responsibilities within the County, including the implementation of identified mitigation actions.						
New and existing	All hazards	1, 4, 6	CRESA	Low	Staff time	Ongoing

a. HMGP = Hazard Mitigation Grant Program; FMA = Flood Mitigation Assistance = PDM = Pre-Disaster Mitigation Assistance; CDBG-DR = Community Development Block Grants Disaster Recovery; UASI = Urban Area Security Initiative

Table 18-3. Mitigation Strategy Priority Schedule

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Action Grant-Eligible?	Can Action Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
CW-1	2	Medium	Low	Yes	No	Yes	High	Low
CW-2	3	Medium	High	No	Yes	Maybe	Medium	Medium
CW-3	4	Low	Low	Yes	No	Yes	High	Low
CW-4	2	Low	Low	Yes	No	Yes	High	Low
CW-5	12	Medium	Low	Yes	No	Yes	High	Low
CW-6	5	High	High	Yes	Yes	Maybe	Medium	High
CW-7	2	Medium	Low	Yes	No	Yes	High	Low
CW-8	3	Medium	Low	Yes	No	Yes	High	Low
CW-9	4	Medium	Medium	Yes	No	Maybe	Medium	Low
CW-10	4	Medium	Medium	Yes	No	Yes	High	Low
CW-11	2	Medium	Low	Yes	No	Yes	High	Low
CW-12	1	Low	Low	Yes	No	Yes	Low	Low
CW-13	4	Medium	Low	Yes	No	Yes	High	Low

18.3 PLAN ADOPTION

A hazard mitigation plan must document that it has been formally adopted by the governing body of the jurisdiction requesting federal approval of the plan (44 CFR Section 201.6(c)(5)). For multi-jurisdictional plans, each jurisdiction requesting approval must document that is has been formally adopted. This plan will be submitted for a pre-adoption review prior to adoption to Washington State Emergency Management Division and FEMA's Community Rating System contractor, the Insurance Services Office. Once pre-adoption approval has been provided, all planning partners will formally adopt the plan. All partners understand that DMA compliance and its benefits cannot be achieved until the plan is adopted. Copies of the resolutions adopting this plan for all planning partners can be found in Appendix F of this volume.

18.4 PLAN IMPLEMENTATION AND MAINTENANCE STRATEGY

A hazard mitigation plan must present a plan maintenance process that includes the following (44 CFR Section 201.6(c)(4)):

- A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan over a 5-year cycle.
- A process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate.
- A discussion on how the community will continue public participation in the plan maintenance process.

18.4.1 Plan Implementation

The effectiveness of the hazard mitigation plan depends on its implementation and the incorporation of its action items into partner jurisdictions' existing plans, policies and programs. Together, the action items in the plan provide a framework for activities that the partnership can implement over the next 5 years. The Planning Team has established goals and objectives and have prioritized mitigation actions that will be implemented through existing plans, policies, and programs.

The plan will be evaluated by how successfully the implementation of identified actions have moved the planning partnership toward reaching the goals and objectives identified in this plan. This will be assessed at the next update by a review of the changes in risk that occurred over the performance period and by the degree to which mitigation goals and objectives were incorporated into existing plans, policies and programs.

CRESA will have lead responsibility for coordinating and tracking the plan implementation and maintenance strategy. Plan implementation and evaluation will be a shared responsibility among all planning partnership members and agencies identified as lead agencies in the mitigation action plans (see planning partner annexes in Volume 2 of this plan).

Integration with Other Planning Initiatives

The information on hazard, risk, vulnerability and mitigation contained in this plan update is based on the best science and technology currently available. This information can be invaluable in making decisions required through other planning efforts, such as critical areas designation, growth management planning, and capital facilities planning. All partners will use information from this updated plan as the best available science and data on natural hazards impacting Clark County. Each planning partner has identified existing linkages between the hazard mitigation plan and opportunities for linkage that can be pursued over the performance period of this plan (see planning partner annexes in Volume 2). Many of these opportunities for linkage are included as actions in planning partner annexes. As the identified plans and programs are updated and revised, the information contained in this plan will be used to inform their development. Those plans and programs where linkages already exist will incorporate the newly compiled information available in this plan at the next point of update. Examples of these planning processes and programs to be coordinated with the recommendations of the hazard mitigation plan include the following:

- Critical areas regulations
- Comprehensive plans
- Capital improvement plans and programs
- Shoreline management programs
- Stormwater management programs
- Emergency management plans and programs
- Strategic plans
- Facility acquisition plans.

As information becomes available from other planning mechanisms that can enhance this plan, that information will be incorporated via the update process.

Hazard Mitigation Plan Working Group

The hazard mitigation Planning Team was a total volunteer body that oversaw the development of the plan and made recommendations on key elements of the plan, including the implementation and maintenance strategy. It was the Planning Team’s position that an oversight committee with representation similar to that of the Planning Team should have an active role in the plan implementation and maintenance. Therefore, it is recommended that a hazard mitigation working group remain a viable body involved in key elements of the plan implementation and maintenance strategy. This working group should strive to include representation from stakeholders in the planning area as well as planning partners. The hazard mitigation working group will work toward fulfilling the following three responsibilities:

- Coordinating project implementation through the discussion of potential opportunities for partnership and regional coordination and the sharing of success stories and lessons learned;
- Reviewing the annual progress report; and
- Providing input and recommendations on possible enhancements to be considered at the next plan update.

Future plan updates will be overseen by a working group similar to the one that participated in this plan development process, so keeping an interim group in tact will provide a head start on future updates.

Implementation Coordination

It is anticipated that upon completion of this plan, there will be interest among the planning partnership in pursuing grant funding under FEMA hazard mitigation grant programs and other relevant programs. In order to keep planning partners informed of these opportunities, the CRESA staff person charged with coordinating the implementation of this plan will strive to:

- Coordinate with planning partners and stakeholders through scheduling hazard mitigation plan working group meetings on a quarterly basis; and
- Monitor grant funding opportunities identified in this plan and notify planning partners when such funding opportunities become available.

Planning partners will be responsible for developing proposals in pursuit of any available grants. CRESA staff will simply provide notices of funding availability to the planning partnership.

Annual Progress Report

The planning partnership will evaluate the progress on the action plan during a 12-month performance period. This review will include items such as the following:

- Summary of any hazard events that occurred during the performance period and the impact these events had on the planning area;
- Review of mitigation success stories;
- Review of continuing public involvement;
- Brief discussion about why targeted strategies were not completed;
- Reevaluation of the action plan to determine if the timeline for identified projects needs to be amended (such as changing a long-term project to a short-term project because of new funding);
- Recommendations for new projects;
- Changes in or potential for new funding options (grant opportunities);
- Impacts of changes in other planning programs or initiatives that involve hazard mitigation; and
- Identification of training needs within the partnership, such as benefit-cost analysis or E-grants.

The planning team has created a template for preparing a progress report (see Appendix G). The hazard mitigation working group and all planning partners will provide feedback to the CRESA support staff on items included in the template. CRESA staff will compile the information into a formal annual report on the progress of the plan, which will be presented to the hazard mitigation plan working group for their review and comment. This report should be used as follows:

- Posted on the CRESA website dedicated to the hazard mitigation plan;
- Provided to the local media through a press release;

- Presented to the governing bodies of planning partners to inform them of the progress of mitigation initiatives implemented during the reporting period; and
- Provided as part of the CRS annual re-certification package for those planning partners participating in CRS.

It is recommended that the annual progress report be finalized before October 1 of each year.

Plan Update

Clark County and its planning partners intend to update the hazard mitigation plan on a 5-year cycle from the date of final plan approval. This cycle may be accelerated to less than 5 years based on the following triggers:

- A federal disaster declaration that impacts the planning area;
- A hazard event that causes loss of life; or
- A comprehensive update of the Clark County Comprehensive Plan.

It will not be the intent of future updates to develop a complete new hazard mitigation plan for the planning area. The update will, at a minimum, include the following elements:

- The update process will be convened through a planning team.
- The goals and objectives will be reviewed to evaluate the effectiveness of the plan.
- The hazard risk assessment will be reviewed and, if necessary, updated using best available information and technologies.
- The action plan will be reviewed and revised to account for any actions completed, dropped, or changed and to account for changes in the risk assessment or new policies identified under other planning mechanisms.
- The draft update will be sent to appropriate agencies and organizations for comment.
- The public will be given an opportunity to comment on the update prior to adoption.
- The governing body of each planning partner will adopt the updated plan.

18.4.2 Opportunities for Continued Public Access and Participation

The public will continue to be apprised of the plan’s progress through the hazard mitigation plan working group, the hazard mitigation plan website and through the provision of copies of the annual progress reports to the media. The website will not only house the final plan, it will become the one-stop shop for information regarding the plan and plan implementation. The website will continue to provide contact information where members of the public wishing to ask questions or provide comments on the plan may do so. Upon initiation of future update processes, a new public involvement strategy will be initiated based on guidance from a new planning team. This strategy will be based on the needs and capabilities of the planning partnership at the time of the update.

REFERENCES

Association of State Dam Safety Officials (ASDSO). 2020. Dam Incident Database Search. Available online at https://damsafety.org/incidents

Association of State Dam Safety Officials (ASDSO). 2016. "Dam Failures and Incidents." The website of the ASDSO, accessed January 2016, http://www.damsafety.org/news/?p=412f29c8-3fd8-4529-b5c9-8d47364c1f3e

Burns, Scott F., William J. Burns, David H. James, Jason C. Hinkle. 1998. Landslides in the Portland, Oregon Metropolitan Area Resulting from the Storm of February 1996: Inventory Map, Database and Evaluation. Available online at http://nwdata.geol.pdx.edu/Landslides/PDX-Landslide/metrosld.pdf

Cascadia Region Earthquake Workgroup. 2013. Cascadia Subduction Zone Earthquakes: A Magnitude 9.0 Earthquake Scenario. Available online at http://file.dnr.wa.gov/publications/ger_ic116_csz_scenario_update.pdf

Centers for Disease Control and Prevention (CDC). 2009. Climate and Health: Heat Waves. The website of the CDC, last updated December 14, 2009, http://www.cdc.gov/climateandhealth/effects/heat.htm.

Centers for Disease Control and Prevention (CDC). 2013. Emergency Preparedness and Response: Lightning: Victim Data. The website of the CDC, last reviewed December 23, 2013, http://www.bt.cdc.gov/disasters/lightning/victimdata.asp.

Centers for Disease Control and Prevention (CDC). 2014a. Extreme Cold: A Prevention Guide to Promote Your Personal Health and Safety. Accessed March 2014 at http://www.bt.cdc.gov/disasters/winter/pdf/extreme-cold-guide.pdf.

Centers for Disease Control and Prevention (CDC). 2014b. Climate Change: Extreme Heat. The website of the CDC, last updated July 1, 2014, http://ephtracking.cdc.gov/showClimateChangeExtremeHeat.action

City of Covington. 2005. Hazard Identification and Vulnerability Analysis. http://www.covingtonwa.gov/docs/hiva.pdf

Clark County. 2015. Vacant Buildable Lands Model Maps and Data. Website of Clark County, Washington: http://gis.clark.wa.gov/vblm/

Clark County. 2016a. Geographic Information Systems, "WildlandUrbanInterface." Last accessed February 2016, https://gis.clark.wa.gov/gishome/Metadata/?pid=metadata.layer&dbsID=84

Clark County. 2016b. 2015-2035 Clark County Comprehensive Growth Management Plan. Prepared by Clark County. June 2016. Available online: https://www.clark.wa.gov/community-planning/process-and-documents

Clark County Environmental Services. 2016. "Endangered Species Act." The website of Clark County, last accessed January 2016, https://www.clark.wa.gov/environmental-services/endangered-species-act

Clark Regional Emergency Services Agency (CRESA). 2004. Clark County Multi-Jurisdictional All-Hazard Mitigation Plan; For Clark County and the Cities of Battle Ground, Camas, La Center, Ridgefield, Vancouver, Washougal and Yacolt. Prepared by Clark Regional Emergency Services Agency and the University of Washington.

Clark Regional Emergency Services Agency (CRESA). 2011. Clark County Hazard Identification Vulnerability Analysis; A Comprehensive Guide to Natural and Technological Hazards in Clark County and Its Cities. Available online: http://cresa911.org/wp-content/uploads/2014/06/ClarkHIVA2011.pdf

Clark Regional Emergency Services Agency (CRESA). 2013. Clark Regional Comprehensive Emergency Management Plan; The Emergency Operations Plan for Clark County, Its Seven Cities, and Partnering Agencies. December 2013. Available online: http://cresa911.org/wp-content/uploads/2014/06/cemp.pdf

Clark Regional Emergency Services Agency (CRESA). 2015a. Clark County Local Emergency Planning Committee. CRESA web page: http://cresa911.org/emergency-management/lepc/

Clark Regional Emergency Services Agency (CRESA). 2015b. Volunteer Programs. CRESA web page: http://cresa911.org/get-involved/

Cohen, Jack. 2008. "The Wildland-Urban Interface Fire Problem: A Consequence of the Fire Exclusion Paradigm." Forest History Today: Fall 2008. Available online at http://www.fs.fed.us/rm/pubs_other/rmrs_2008_cohen_j002.pdf

Cowlitz Tribe. 2015. Cowlitz Tribe Has Reservation. Website of the Cowlitz Indian Tribe. Accessed online at http://www.cowlitz.org/index.php/reservation-menu/267-cowlitz-reservation-2.

Dalton, Meghan M., Philip W. Mote, and Amy K. Snover. 2013. Climate Change in the Northwest: Implications for Our Landscapes, Waters and Communities. Island Press. http://cses.washington.edu/db/pdf/daltonetal678.pdf

Dames & Moore. February 28, 2000. Geotechnical Hazard Identification, Clark County Road System.

Federal Emergency Management Agency (FEMA). 2010. http://www.fema.gov. Website accessed 2009, 2010, 2011

Federal Emergency Management Agency (FEMA). 2012a. Flood Insurance Rate Study: Clark County Washington and Incorporated Areas. Study number 53011CV001A.

Federal Emergency Management Agency (FEMA). 2012b. Disaster Declaration Summary. Retrieved December 10, 2012, from FEMA Open Government Dataset: http://www.fema.gov/library/viewRecord.do?id=6292

Federal Emergency Management Agency (FEMA). 2013a. Flood Insurance Rate Study: Cowlitz County Washington and Incorporated Areas (revised preliminary study). Study number 53015CV002A.

Federal Emergency Management Agency (FEMA). 2013b. Federal Guidelines for Dam Safety: Emergency Action Planning for Dams. FEMA 64/July 2013. Available online at: http://www.fema.gov/media-library-data/5b20db599c212f77fd5e85d256f471a3/EAP+Federal+Guidelines_FEMA+P-64.pdf

Federal Emergency Management Agency (FEMA). 2015a. Hazard Mitigation Assistance Program Digest 2015. Available online at http://www.fema.gov/media-library-data/1444240033001-518cdc8d447ef79a1360763e3145d17e/HMA_Program_Digest_508.pdf

Federal Emergency Management Agency (FEMA). 2015b. Loss Statistics: Washington" As of November 30, 2015. Data is updated regularly and is available at http://bsa.nfipstat.fema.gov/reports/1040.htm#53

Federal Emergency Management Agency (FEMA). 2015d. Policy Statistics. As of November 30, 2015. Data is updated regularly and is available online at http://bsa.nfipstat.fema.gov/reports/1011.htm#WAT

Federal Emergency Management Agency (FEMA). 2015e. Washington Severe Winter Storm, Straight-Line Winds, Flooding, Landslides, Mudslides, and a Tornado (DR-4253). The website of FEMA. Last updated February 2016. Available online at https://www.fema.gov/executive-order-11988-floodplain-management

Federal Emergency Management Agency (FEMA). 2016. Executive Order 11988: Floodplain Management. The website of FEMA. Last updated April 23, 2015. Available online at http://www.fema.gov/disaster/4253

Federal Emergency Management Agency (FEMA). 2022. Declared Disasters. Website of FEMA. Last accessed 2022. Available online at https://www.fema.gov/disaster/declarations

Federal Energy Regulatory Commission. (FERC). "Dam Safety Performance Monitoring Program." January 1, 2005. Accessed June 1, 2022. https://www.ferc.gov/sites/default/files/2020-04/chap14.pdf

Fischer, Amy. 2016. "Emergency Preparedness Event Gets County Ready to Rumble." Published on the website of The Columbian on March 25, 2016. Available online at http://www.columbian.com/news/2016/mar/25/emergency-preparedness-event-gets-county-ready-to-rumble/

Floodplains by Design. 2016. The website of Floodplains by Design. Last accessed June 2016. Available online at http://www.floodplainsbydesign.org/new-approach/

Goetz, J.N., R.H. Guthrie, and A. Brenning. 2015. Forest Harvesting is associated with increased landslide activity during an extreme rainstorm on Vancouver Island, Canada. Published in Natural

Hazards and Earth System Sciences 15: 1311-1330. doi:10.5194/nhess-15-1311-2015. Available online at http://www.nat-hazards-earth-syst-sci.net/15/1311/2015/nhess-15-1311-2015.pdf

Governor's Ad hoc Executive Water Emergency Committee. 1977. History of Droughts in Washington State. Olympia, Washington: State of Washington Office of the Governor.

Hanable, William S. 2004. Clark County Thumbnail History. HistoryLink.org Essay 5644. HistoryLink.org web page available at: http://historylink.org/index.cfm?DisplayPage=output.cfm&file_id=5644

Hann, W.; Shlisky, A.; Havlina, D.; Schon, K.; Barrett, S.; DeMeo, T.; Pohl, K.; Menakis, J.; Hamilton, D.; Jones, J.; Levesque, M.; Frame, C. 2004. Interagency Fire Regime Condition Class Guidebook. Last update January 2008: Version 1.3.0 [Homepage of the Interagency and The Nature Conservancy fire regime condition class website, USDA Forest Service, US Department of the Interior, The Nature Conservancy, and Systems for Environmental Management]. [Online]. Available: www.frcc.gov.

Hoblitt, Richard P., and William E. Scott. 2011. Estimate of Tephra Accumulation Probabilities for the U.S. Department of Energy's Hanford Site, Washington. USGS Open File Report 2011-1064. Available online at http://pubs.usgs.gov/of/2011/1064/of2011-1064.pdf

Hofmeister, Jon, John Duval, and John Horne. Final Report: Geotechnical Hazard Identification, Clark County Road System, Clark County, Washington. For: Clark County Public Works, Prepared by Dames and Moore Group.

Homeland Security. 2011. Dams Sector: Estimating Economic Consequences for Dam Failure Scenarios. Available online at: http://www.damsafety.org/media/Documents/Security/DamsSectorConsequenceEstimation-EconomicConsequences.pdf

Irwin, Judith W. 1994. The Dispossessed: The Cowlitz Indians in Cowlitz Corridor. Published in The Columbian in Summer of 1994. Available Online at https://www.cowlitz.org/23-the-dispossessed.html

Municipal Research and Services Center of Washington (MRSC). 2016. "The National Flood Insurance Program and the Impacts of the Biological Opinion," website accessed June 9, 2016, available online at http://mrsc.org/Home/Explore-Topics/Public-Safety/Emergency-Services/Flood-Hazard-Management-Planning-(1)/The-National-Flood-Insurance-Program-and-the-Impac.aspx

National Aeronautics and Space Administration (NASA). 2004. http://earthobservatory.nasa.gov/Newsroom/view.php?id=25145 NASA Earth Observatory News Web Site Item, dated August 2, 2004.

National Archives. 2016. Federal Register: Executive Order 11990—Protection of wetlands. The website of the National Archives. Last visited June 2016. Available online at http://www.archives.gov/federal-register/codification/executive-order/11990.html

National Drought Mitigation Center. 2006. Types of Drought. Website of the National Drought Mitigation Center. Last accessed 2006. Available online at http://drought.unl.edu/DroughtBasics/TypesofDrought.aspx

National Integrated Drought Information System (NIDIS). 2016. "About the Pacific Northwest DEWS." Website of the U.S. Drought Portal. Accessed February 2016, https://www.drought.gov/drought/dews/pacific-northwest/about

National Lightning safety Institute (NLSI). 2008. Lightning Costs and Losses from Attributed Sources. The website of the NLSI. Last updated June 11, 2016. Available online at http://lightningsafety.com/nlsi_lls/nlsi_annual_usa_losses.htm

National Oceanic and Atmospheric Administration (NOAA). 2014. NOAA Severe Weather website. Accessed 2014 at http://www.noaawatch.gov/themes/severe.php

National Oceanic and Atmospheric Administration (NOAA). 2015a. National Centers for Environmental Information Climate Data Online website, accessed December 31, 2015: http://www.ncdc.noaa.gov/cdo-web/datatools/findstation

National Oceanic and Atmospheric Administration (NOAA). 2022a. National Centers for Environmental Information Climate Data Online website, accessed May 25, 2022: https://www.ncei.noaa.gov/access/search/data-search/normals-monthly-1991-2020

National Oceanic and Atmospheric Administration (NOAA). 2015b. NOAA National Climatic Data Center website. Accessed 2015 at http://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornado-climatology.

National Oceanic and Atmospheric Administration (NOAA). 2022b. Billion-Dollar Weather and Climate Disasters: Mapping." Website of the National Oceanic and Atmospheric Administration. Accessed June 2022, http://www.ncdc.noaa.gov/billions/mapping

National Resources Conservation Service. 2016. Emergency Watershed Protection Program. The website of the USDA. Last accessed 2016. Available online at http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/

National Severe Storms Laboratory. 2015. Severe Weather 101: Tornado Basics." The website of the National Severe Storms Laboratory. Last accessed 2015. Available online at http://www.nssl.noaa.gov/education/svrwx101/tornadoes/

National Weather Service. 2010. Average Number of Thunderstorm Days in the U.S. Available online at http://www.srh.noaa.gov/jetstream/tstorms/tstorms_intro.htm

National Weather Service. 2014. Heat: A Major Killer. Last updated June 20, 2014, http://www.nws.noaa.gov/os/heat/index.shtml.

National Wildlife Federation. 2006. The Evaluation of the National Flood Insurance Report. Available online at http://www.fema.gov/media-library-data/20130726-1602-20490-1463/nfip_eval_final_report.pdf

Office of Federal Lands Highway. 2016. Emergency Relief for Federally Owned Roads. The website of Federal Highway Administration. Last accessed June 2016. Available online at https://flh.fhwa.dot.gov/programs/erfo/

Office of the Press Secretary. 2015. Executive Order – Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input. The website of the White House. Posted online January 30, 2015. Available online at: https://www.whitehouse.gov/the-press-office/2015/01/30/executive-order-establishing-federal-flood-risk-management-standard-and-

Office of the Washington State Climatologist (OWSC). No date. WA State Records. Last accessed 2015. Available online at https://climate.washington.edu/state-records/

Oregon Department of Geology and Mineral Industries. 2016. Multihazard and Risk Study for Mount Hood. The website of the Department of Geology and Mineral Industries. Available online at http://volcanoes.usgs.gov/volcanoes/mount_hood/mount_hood_hazard_68.html

Oregon Department of Geology and Mineral Industries (DOGAMI). 2020. Earthquake Regional Impact Analysis for Columbia County, Oregon and Clark County, Washington. Available online at: https://rdpo.net/dogami-earthquake-impact-analysis

Oregon Department of Forestry. 1999. Storm Impacts and Landslides of 1996 Final Report.

Payne, J. T., A. W. Wood, A. F. Hamlet, R.N. Palmer, and D. P. Lettenmaier. 2004. Mitigating the effects of climate change on the water resources of the Columbia River basin. Climatic Change 62(1-3):233-256.

Region IV Public Health. 2013. Region IV Public Health Emergency Response Plan for Clark County Public Health, Cowlitz County Public Health, Skamania County Community Health, Wahkiakum County Health and Human Services and the Cowlitz Indian Tribe. December 5, 2013. Available online: https://www.clark.wa.gov/sites/default/files/BasicERP_131205.pdf

RS Means. 2015. RS Means Square Foot Costs. RS Means Company.

Earthquake Early Warning. 2016. ShakeAlert. Last accessed January 2016. Available online at http://www.shakealert.org/

Silver Jackets. 2016. Washington. The website of the Silver Jackets. Last accessed June 2016. Available online at http://silverjackets.nfrmp.us/State-Teams/Washington

Townsend, Katherine L and John T. Figge. 2002. “Northwest Origins: An Introduction to the Geological History of Washington State. the website of the Burke Museum, last accessed March 2014, http://www.burkemuseum.org/static/geo_history_wa/index.htm.

University of Washington Climate Impacts Group. 2013. Northwest Climate Assessment Report (2013). Available online at https://cig.uw.edu/resources/special-reports/

U.S. Army Corp of Engineers. 2011. Safety of Dams – Policy and Procedures. Engineer Regulation 1110-2-1156. Available online at https://www.publications.usace.army.mil/Portals/76/Users/182/86/2486/ER_1110-2-1156.pdf?ver=2020-01-29-103920-173

U.S. Census Bureau. 2015. American Community Survey 2013 5-Year Estimates from United States Census Bureau American Fact Finder website: http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_5YR_S0101&prodType=tablehttp://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t

U.S. Department of Agriculture (USDA). 2014. SNOTEL and Snow Survey & Water Supply Forecasting. Last revised January 2014, http://www.wcc.nrcs.usda.gov/snotel/SNOTEL-brochure.pdf

U.S. Department of Agriculture (USDA). 2015. "Disaster Designation Information." Website of the United States Department of Agriculture. Accessed February 2016, http://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index

U.S. Department of Agriculture. (USDA). 2015b. USDA Rural Development Programs: Washington State. Available online at http://www.rd.usda.gov/files/WA_Program_Guide_2015.pdf

U.S. Environmental Protection Agency (EPA). 2006. Excessive Heat Events Guidebook. EPA 430-B-06-005. Available online at http://www.epa.gov/heatisld/about/pdf/EHEguide_final.pdf.

U.S. Environmental Protection Agency (EPA). 2013. Climate Change Indicators in the United States: Snowfall. http://www.epa.gov/climatechange/science/indicators/snow-ice/snowfall.html.

U.S. Environmental Protection Agency (EPA). 2015. Heat Island Impacts. The website of the EPA. Last updated October 1, 2015. Available online at http://www2.epa.gov/heat-islands/heat-island-impacts

U.S. Geological Survey (USGS). 1978. "Washington: earthquake History." The website of the USGS. Abridges from Earthquake Information Bulletin, Volume 10, Number 1, January-February 1978, Carl A. von Hake. Available online at http://earthquake.usgs.gov/earthquakes/states/washington/history.php

U.S. Geological Survey (USGS). 1997. Lateral Blast. The website of the USGS. Last updated June 25, 1997. Available online at http://pubs.usgs.gov/gip/msh/lateral.html

U.S. Geological Survey (USGS). 2001. Socioeconomic and environmental Impacts of Landslides in the Western Hemisphere. USGS Open-File report 01-0276. Available online at http://pubs.usgs.gov/of/2001/ofr-01-0276/

U.S. Geological Survey (USGS). 2008. An Atlas of ShakeMaps for Selected Global Earthquakes. U.S. Geological Survey Open-File Report 2008-1236. Prepared by Allen, T.I., Wald, D.J., Hotovec, A.J., Lin, K., Earle, P.S. and Marano, K.D.

U.S. Geological Survey (USGS). 2010. PAGER—Rapid Assessment of an Earthquake's Impact. U.S. Geological Survey Fact Sheet 2010-3036. September 2010.

U.S. Geological Survey (USGS). 2012a. 'Earthquake Hazards Program: Pacific Northwest." Last modified July 18, 2012. Available on-line at http://earthquake.usgs.gov/regional/pacnw/.

U.S. Geological Survey (USGS). 2012b. Eruption History of Mount Hood, Oregon. The website of the USGS. Page last modified April 4, 2012. Available online at http://volcanoes.usgs.gov/volcanoes/mount_hood/mount_hood_geo_hist_94.html

U.S. Geological Survey (USGS). 2013. Why Study Cascade Volcanoes? The website of the USGS Volcano Hazards Program. Last updated August 28, 2013. Available online at https://volcanoes.usgs.gov/observatories/cvo/cascade_volcanoes.html

U.S. Geological Survey (USGS). 2014. 2014 National Seismic hazard Maps – Source Parameters. The website of the USGS. Last accessed January 24, 2016. Available online at http://geohazards.usgs.gov/cfusion/hazfaults_2014_search/view_fault.cfm?cfault_id=880

U.S. Geological Survey (USGS). 2015. Volcanic Ash and Mitigation Impacts. The website of the USGS. Last modified December 14, 2015. Available online at https://volcanoes.usgs.gov/volcanic_ash/

U.S. Geological Survey (USGS). 2016. Volcanic alert-levels characterize conditions at U.S. volcanoes. The website of the USGS volcano hazard program. Last updated January 7, 2016. Available online at https://volcanoes.usgs.gov/vhp/about_alerts.html

Vancouver Business Journal. 2015. From the List: Clark County's Largest Employers. Published on the website of the Vancouver SW Washington Business Journal. Available online at http://www.vbjusa.com/news/top-stories/from-the-list-clark-countys-largest-employers/

Washington Department of Community, Trade and Economic Development. 2007. Critical Areas Assistance Handbook: Protecting Critical Areas within the Framework of the Washington State Growth Management Act. Available online at https://www.commerce.wa.gov/wp-content/uploads/2016/08/gms-ca-handbook-critareas-2007.pdf.

Washington Department of Ecology. 2006. 2005 Drought Response: Report to the Legislature. Publication number 06-11-001, https://fortress.wa.gov/ecy/publications/publications/0611001.pdf.

Washington Department of Ecology. 2007. Facts about Washington's retreating glaciers and declining snow pack. Publication 07-11-016. https://fortress.wa.gov/ecy/publications/publications/0711016.pdf

Washington Department of Ecology. 2012. Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy. https://fortress.wa.gov/ecy/publications/documents/1201004.pdf

Washington Department of Ecology. 2014. Puget Sound Landslides Website, Accessed in 2014 at http://www.ecy.wa.gov/programs/sea/landslides/about/about.html

Washington Department of Ecology. 2022. "Drought preparedness & response." Website of the Washington Department of Ecology. Last accessed July 16, 2022, https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-availability/Statewide-conditions/Drought-2022/

Washington Department of Ecology. 2016a. "Climate Change Effects on Water Resources." Website of the Washington Department of Ecology. Accessed February 2016, http://www.ecy.wa.gov/climatechange/2012ccrs/water.htm

Washington Department of Ecology. 2016b. State Environmental Policy Act website of the Washington Department of Ecology. Accessed June 2016. Available online at http://www.ecy.wa.gov/programs/sea/sepa/e-review.html

Washington Department of Ecology. 2020. Inventory of Dams in the State of Washington. Report data current to September 2020. Publication #94-16. Available online at: https://fortress.wa.gov/ecy/publications/documents/94016.pdf

Washington Department of Natural Resources. 2016a. “Fire Danger and Outdoor Burning.” The website of the Washington Department of Natural Resources. Last accessed March 2016, https://fortress.wa.gov/dnr/protection/firedanger/

Washington Department of Natural Resources. 2016b. Shallow Landslide Hazard Forecast Map. The website of the Washington Department of Natural Resources. Accessed June 2016. Available online at http://www.dnr.wa.gov/slhfm

Washington Department of Natural Resources. 2020. Forest Health Highlights in Washington-2019. Available online at https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd733577.pdf

Washington Emergency Management Division. 2020. 2018 Washington State Enhanced Hazard Mitigation Plan. FEMA Approval October 1, 2018. Updated July 19, 2020. Available online: http://mil.wa.gov/other-links/enhanced-hazard-mitigation-plan

Washington Emergency Management Division. 2016. Incident Command System (ICS) and the National Incident Management System (NIMS). The website of the Washington Emergency Management Division. Last accessed 2016. Available online at http://mil.wa.gov/emergency-management-division/training-and-exercise/incident-command-system-ics-and-the-national-incident-management-system-nims

Washington Employment Security Department (ESD). 2014. Clark County Profile. Web article prepared by Regional Labor Economist Scott Bailey. November 2014. Available online: https://fortress.wa.gov/esd/employmentdata/reports-publications/regional-reports/county-profiles/clark-county-profile

Washington Employment Security Department (ESD). 2015. Historical Estimates of Local Unemployment Statistics, Not Seasonally Adjusted. Retrieved December 30, 2015, from Washington Employment Security Department: https://fortress.wa.gov/esd/employmentdata/reports-publications/regional-reports/local-unemployment-statistics

Washington State Office of Financial Management (WSOFM). 2012. Decennial Census Counts of Population for the State, Counties, Cities and Towns. Prepared by the Forecasting and Research Division of the Office of Financial Management. October 12, 2012. Accessed online at http://www.ofm.wa.gov/pop/april1/hseries/default.asp

Washington State Office of Financial Management (WSOFM). 2022. State of Washington 2021 Population Trends. Prepared by the Forecasting and Research Division of the Office of Financial Management. March 2022. Accessed online at https://ofm.wa.gov/sites/default/files/public/dataresearch/pop/april1/ofm_april1_poptrends.pdf

Washington State Office of Financial Management (WSOFM). 2015b. Postcensal Estimates of April 1 Population, 1960 to Present. Prepared by the Forecasting and Research Division of the Office of

Financial Management. June 25, 2015. Accessed online at http://www.ofm.wa.gov/pop/april1/hseries/default.asp

Washington State. 2015. Washington State Tribal Directory. Prepared by the Governor's Office of Indian Affairs. Olympia, WA. Updated March 2015. Accessed online: http://www.goia.wa.gov/Tribal-Directory/TribalDirectory.pdf

Washington State Recreation and Conservation Office. 2016a. Land and Water Conservation Fund. The website of the Washington State Recreation and Conservation Office. Last accessed June 2016. Available online at http://www.rco.wa.gov/grants/lwcf.shtml

Washington State Recreation and Conservation Office. 2016b. Salmon Recovery Grants. The website of the Washington State Recreation and Conservation Office. Last accessed June 2016. Available online at http://www.rco.wa.gov/grants/salmon.shtml

Western Regional Climate Center (WRCC). No date. "Climate of Washington." Last accessed 2015, https://wrcc.dri.edu/Climate/narrative_wa.php

Western States Seismic Policy Council. 2016. Washington: Washington Earthquake Hazards Mitigation Legislation. The website of the Western States Seismic Policy Council. Last accessed January 2016. Available online at http://www.wsspc.org/public-policy/legislation/washington/

Winters, Chris. 2015. Living in a slide zone. The website of the Seattle Times. Published on June 10, 2011 and updated October 26, 2015. Available online at http://www.seattletimes.com/business/real-estate/living-in-a-slide-zone/

Clark Regional Natural Hazard Mitigation Plan: Volume 1—Planning Area-Wide Elements

Appendix A. Acronyms and Definitions

A. ACRONYMS AND DEFINITIONS

ACRONYMS

ADA—Americans with Disabilities Act
CDBG-DR—Community Development Block Grant Disaster Resilience
CFR—Code of Federal Regulations
CIP—Capital Improvement Plan or Program
CRESA—Clark Regional Emergency Services Agency
CRS—Community Rating System
CWA—Clean Water Act
DEWS—Drought Emergency Warning System
DFIRM—Digital Flood Insurance Rate Map
DHS—Department of Homeland Security
DMA—Disaster Mitigation Act
DR—Major Disaster Declaration
DSEIS—Draft Supplemental Environmental Impact Statement
DSO—Dam Safety Office
EM—Emergency Declaration
EPA—U.S. Environmental Protection Agency
ESA—Endangered Species Act
ESD—Washington State Employment Security Department
EWP—Emergency Watershed Protection Program
FCAAP—Flood Control Assistance Account Program
FEMA—Federal Emergency Management Agency
FERC—Federal Energy Regulatory Commission
FIRM—Flood Insurance Rate Map
FMA—Flood Mitigation Assistance
GIS—Geographic Information System
Hazus-MH—Hazards, United States-Multi Hazard
HMGP—Hazard Mitigation Grant Program
HMP—Hazard Mitigation Plan
HUD—United States Department of Housing and Urban Development
HVAC—Heating, Ventilation and Air Conditioning System
LiDAR—Light Detection and Ranging
ML—Local Magnitude Scale
MMI— Modified Mercalli Intensity Scale
MRSC—Municipal Research Services Center
NASA—National Aeronautics and Space Administration
NEHRP—National Earthquake Hazards Reduction Program

NFIP—National Flood Insurance Program
NIDIS—National Integrated Drought Information System
NIMS—National Incident Management System
NOAA—National Oceanic and Atmospheric Administration
NRCS—National Resource Conservation Services
NWS—National Weather Service
PDM—Pre-Disaster Mitigation Grant Program
PGA—Peak Ground Acceleration
PP&L—Pacific Power and Light
RCW—Revised Code of Washington
SEPA—State Environmental Policy Act
SNOTEL—Snow Telemetry
SR—State Route
UASI—Urban Area Security Initiative
UGA—Urban Growth Area
USDA—United States Department of Agriculture
USGS—U.S. Geological Survey
WAC—Washington Administrative Code
WSU-Vancouver—Washington State University-Vancouver

DEFINITIONS

100-Year Flood: The term "100-year flood" can be misleading. The 100-year flood does not necessarily occur once every 100 years. Rather, it is the flood that has a 1 percent chance of being equaled or exceeded in any given year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The Federal Emergency Management Agency (FEMA) defines it as the 1 percent annual chance flood, which is now the standard definition used by most federal and state agencies and by the National Flood Insurance Program.

Acre-Foot: An acre-foot is the amount of water it takes to cover 1 acre to a depth of 1 foot. This measure is used to describe the quantity of storage in a water reservoir. An acre-foot is a unit of volume. One acre foot equals 7,758 barrels; 325,829 gallons; or 43,560 cubic feet. An average household of four will use approximately 1 acre-foot of water per year.

Asset: An asset is any man-made or natural feature that has value, including, but not limited to, people; buildings; infrastructure, such as bridges, roads, sewers, and water systems; lifelines, such as electricity and communication resources; and environmental, cultural, or recreational features such as parks, wetlands, and landmarks.

Base Flood: The flood having a 1% chance of being equaled or exceeded in any given year, also known as the "100-year" or "1% chance" flood. The base flood is a statistical concept used to ensure that all properties subject to the National Flood Insurance Program are protected to the same degree against flooding.

Basin: A basin is the area within which all surface water—whether from rainfall, snowmelt, springs, or other sources—flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains, and ridges. Basins are also referred to as "watersheds" and "drainage basins."

Benefit: A benefit is a net project outcome and is usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of benefit-cost analysis of proposed mitigation measures, benefits are limited to specific, measurable, risk reduction factors, including reduction in expected property losses (buildings, contents, and functions) and protection of human life.

Benefit/Cost Analysis: A benefit/cost analysis is a systematic, quantitative method of comparing projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

Building: A building is defined as a structure that is walled and roofed, principally aboveground, and permanently fixed to a site. The term includes manufactured homes on permanent foundations on which the wheels and axles carry no weight.

Capability Assessment: A capability assessment provides a description and analysis of a community's current capacity to address threats associated with hazards. The assessment includes two components: an inventory of an agency's mission, programs, and policies, and an analysis of its capacity to carry them out. A capability assessment is an integral part of the planning process in which a community's actions to reduce losses are identified, reviewed, and analyzed, and the framework for implementation is identified. The following capabilities were reviewed under this assessment:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability

Community Rating System (CRS): The CRS is a voluntary program under the NFIP that rewards participating communities (provides incentives) for exceeding the minimum requirements of the NFIP and completing activities that reduce flood hazard risk by providing flood insurance premium discounts.

Critical Area: An area defined by state or local regulations as deserving special protection because of unique natural features or its value as habitat for a wide range of species of flora and fauna. A sensitive/critical area is usually subject to more restrictive development regulations.

Critical Facility: Facilities and infrastructure that are critical to the health and welfare of the population. These become especially important after any hazard event occurs. For the purposes of this plan, critical facilities include:

- Structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic and/or water reactive materials;
- Hospitals, nursing homes, and housing likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a hazard event.
- Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for disaster response before, during, and after hazard events, and
- Public and private utilities, facilities and infrastructure that are vital to maintaining or restoring normal services to areas damaged by hazard events.
- Government facilities.

Cubic Feet per Second: Common unit of measurement for river discharge or flow. One cubic foot is about 7.5 gallons of liquid.

Dam: Any artificial barrier or controlling mechanism that can or does impound 10 acre-feet or more of water.

Dam Failure: Dam failure refers to a partial or complete breach in a dam (or levee) that impacts its integrity. Dam failures occur for a number of reasons, such as flash flooding, inadequate spillway size, mechanical failure of valves or other equipment, freezing and thawing cycles, earthquakes, and intentional destruction.

Debris Avalanche: Volcanoes are prone to debris and mountain rock avalanches that can approach speeds of 100 mph.

Debris Flow: Dense mixtures of water-saturated debris that move down-valley; looking and behaving much like flowing concrete. They form when loose masses of unconsolidated material are saturated, become unstable, and move down slope. The source of water varies but includes rainfall, melting snow or ice, and glacial outburst floods.

Debris Slide: Debris slides consist of unconsolidated rock or soil that has moved rapidly down slope. They occur on slopes greater than 65 percent.

Disaster Mitigation Act of 2000 (DMA); The DMA is Public Law 106-390 and is the latest federal legislation enacted to encourage and promote proactive, pre-disaster planning as a condition of receiving financial assistance under the Robert T. Stafford Act. The DMA emphasizes planning for disasters before they occur. Under the DMA, a pre-disaster hazard mitigation program and new requirements for the national post-disaster hazard mitigation grant program were established.

Drainage Basin: A basin is the area within which all surface water- whether from rainfall, snowmelt, springs or other sources- flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains and ridges. Drainage basins are also referred to as **watersheds** or **basins**.

Drought: Drought is a period of time without substantial rainfall or snowfall from one year to the next. Drought can also be defined as the cumulative impacts of several dry years or a deficiency of precipitation over an extended period of time, which in turn results in water shortages for some activity, group, or environmental function. A hydrological drought is caused by deficiencies in surface and subsurface water supplies. A socioeconomic drought impacts the health, well-being, and quality of life or starts to have an adverse impact on a region. Drought is a normal, recurrent feature of climate and occurs almost everywhere.

Earthquake: An earthquake is defined as a sudden slip on a fault, volcanic or magmatic activity, and sudden stress changes in the earth that result in ground shaking and radiated seismic energy. Earthquakes can last from a few seconds to over 5 minutes, and have been known to occur as a series of tremors over a period of several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties may result from falling objects and debris as shocks shake, damage, or demolish buildings and other structures.

Exposure: Exposure is defined as the number and dollar value of assets considered to be at risk during the occurrence of a specific hazard.

Extent: The extent is the size of an area affected by a hazard.

Extreme Heat Event/Heat Wave: Summertime weather that is substantially hotter and/or more humid than average for a location at that time of year. Typically a heat wave lasts two or more days.

Fire Behavior: Fire behavior refers to the physical characteristics of a fire and is a function of the interaction between the fuel characteristics (such as type of vegetation and structures that could burn), topography, and weather. Variables that affect fire behavior include the rate of spread, intensity, fuel consumption, and fire type (such as underbrush versus crown fire).

Fire Frequency: Fire frequency is the broad measure of the rate of fire occurrence in a particular area. An estimate of the areas most likely to burn is based on past fire history or fire rotation in the area, fuel conditions, weather, ignition sources (such as human or lightning), fire suppression response, and other factors.

Flash Flood: A flash flood occurs with little or no warning when water levels rise at an extremely fast rate

Flood Insurance Rate Map (FIRM): FIRMs are the official maps on which the Federal Emergency Management Agency (FEMA) has delineated the Special Flood Hazard Area.

Flood Insurance Study: A report published by the Federal Insurance and Mitigation Administration for a community in conjunction with the community’s Flood Insurance rate Map. The study contains such background data as the base flood discharges and water surface elevations that were used to prepare the

FIRM. In most cases, a community FIRM with detailed mapping will have a corresponding flood insurance study.

Floodplain: Any land area susceptible to being inundated by flood waters from any source. A flood insurance rate map identifies most, but not necessarily all, of a community's floodplain as the Special Flood Hazard Area.

Floodway: Floodways are areas within a floodplain that are reserved for the purpose of conveying flood discharge without increasing the base flood elevation more than 1 foot. Generally speaking, no development is allowed in floodways, as any structures located there would block the flow of floodwaters.

Floodway Fringe: Floodway fringe areas are located in the floodplain but outside of the floodway. Some development is generally allowed in these areas, with a variety of restrictions. On maps that have identified and delineated a floodway, this would be the area beyond the floodway boundary that can be subject to different regulations.

Fog: Fog refers to a cloud (or condensed water droplets) near the ground. Fog forms when air close to the ground can no longer hold all the moisture it contains. Fog occurs either when air is cooled to its dew point or the amount of moisture in the air increases. Heavy fog is particularly hazardous because it can restrict surface visibility. Severe fog incidents can close roads, cause vehicle accidents, cause airport delays, and impair the effectiveness of emergency response. Financial losses associated with transportation delays caused by fog have not been calculated in the United States but are known to be substantial.

Freeboard: Freeboard is the margin of safety added to the base flood elevation.

Frequency: For the purposes of this plan, frequency refers to how often a hazard of specific magnitude, duration, and/or extent is expected to occur on average. Statistically, a hazard with a 100-year frequency is expected to occur about once every 100 years on average and has a 1 percent chance of occurring any given year. Frequency reliability varies depending on the type of hazard considered.

Fujita Scale of Tornado Intensity: Tornado wind speeds are sometimes estimated on the basis of wind speed and damage sustained using the Fujita Scale. The scale rates the intensity or severity of tornado events using numeric values from F0 to F5 based on tornado wind speed and damage. An F0 tornado (wind speed less than 73 miles per hour (mph)) indicates minimal damage (such as broken tree limbs), and an F5 tornado (wind speeds of 261 to 318 mph) indicates severe damage.

Goal: A goal is a general guideline that explains what is to be achieved. Goals are usually broad-based, long-term, policy-type statements and represent global visions. Goals help define the benefits that a plan is trying to achieve. The success of a hazard mitigation plan is measured by the degree to which its goals have been met (that is, by the actual benefits in terms of actual hazard mitigation).

Geographic Information System (GIS): GIS is a computer software application that relates data regarding physical and other features on the earth to a database for mapping and analysis.

Hazard: A hazard is a source of potential danger or adverse condition that could harm people and/or cause property damage.

Hazard Mitigation Grant Program: Authorized under Section 202 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, the Hazard Mitigation Grant Program is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster

Hazards U.S. Multi-Hazard (Hazus-MH) Loss Estimation Program: Hazus-MH is a GIS-based program used to support the development of risk assessments as required under the DMA. The Hazus-MH software program assesses risk in a quantitative manner to estimate damage and losses associated with natural hazards. Hazus-MH is FEMA's nationally applicable, standardized methodology and software program and contains modules for estimating potential losses from earthquakes, floods, and wind hazards. Hazus-MH has also been used to assess vulnerability (exposure) for other hazards.

Hydraulics: Hydraulics is the branch of science or engineering that addresses fluids (especially water) in motion in rivers or canals, works and machinery for conducting or raising water, the use of water as a prime mover, and other fluid-related areas.

Hydrology: Hydrology is the analysis of waters of the earth. For example, a flood discharge estimate is developed by conducting a hydrologic study.

Intensity: For the purposes of this plan, intensity refers to the measure of the effects of a hazard.

Inventory: The assets identified in a study region comprise an inventory. Inventories include assets that could be lost when a disaster occurs and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

Landslide: Landslides can be described as the sliding movement of masses of loosened rock and soil down a hillside or slope. Fundamentally, slope failures occur when the strength of the soils forming the slope exceeds the pressure, such as weight or saturation, acting upon them.

LiDAR: A remote sensing technology that measures distance by illuminating a target with a laser and analyzing the reflected light.

Lightning: Lightning is an electrical discharge resulting from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a "bolt," usually within or between clouds and the ground. A bolt of lightning instantaneously reaches temperatures approaching 50,000ºF. The rapid heating and cooling of air near lightning causes thunder. Lightning is a major threat during thunderstorms. In the United States, 75 to 100 Americans are struck and killed by lightning each year (see http://www.fema.gov/hazard/thunderstorms/thunder.shtm).

Liquefaction: Liquefaction is the complete failure of soils, occurring when soils lose shear strength and flow horizontally. It is most likely to occur in fine grain sands and silts, which behave like viscous fluids when liquefaction occurs. This situation is extremely hazardous to development on the soils that liquefy, and generally results in extreme property damage and threats to life and safety.

Local Government: Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

Magnitude: Magnitude is the measure of the strength of an earthquake, and is typically measured by the Richter scale. As an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

Mass movement: A collective term for landslides, mudflows, debris flows, sinkholes and lahars.

Mitigation: A preventive action that can be taken in advance of an event that will reduce or eliminate the risk to life or property.

Mitigation Actions: Mitigation actions are specific actions to achieve goals and objectives that minimize the effects from a disaster and reduce the loss of life and property.

Objective: For the purposes of this plan, an objective is defined as a short-term aim that, when combined with other objectives, forms a strategy or course of action to meet a goal. Unlike goals, objectives are specific and measurable.

Peak Ground Acceleration: Peak Ground Acceleration (PGA) is a measure of the highest amplitude of ground shaking that accompanies an earthquake, based on a percentage of the force of gravity.

Preparedness: Preparedness refers to actions that strengthen the capability of government, residents, and communities to respond to disasters.

Prevention: Prevention refers to building capabilities necessary to avoid, prevent or stop a threatened or actual act of terrorism.

Presidential Disaster Declaration: These declarations are typically made for events that cause more damage than state and local governments and resources can handle without federal government assistance. Generally, no specific dollar loss threshold has been established for such declarations. A Presidential Disaster Declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, designed to help disaster victims, businesses, and public entities.

Probability of Occurrence: The probability of occurrence is a statistical measure or estimate of the likelihood that a hazard will occur. This probability is generally based on past hazard events in the area and a forecast of events that could occur in the future. A probability factor based on yearly values of occurrence is used to estimate probability of occurrence.

Repetitive Loss Property: Any NFIP-insured property that, since 1978 and regardless of any changes of ownership during that period, has experienced:

- Four or more paid flood losses in excess of $1000.00; or
- Two paid flood losses in excess of $1000.00 within any 10-year period since 1978 or
- Three or more paid losses that equal or exceed the current value of the insured property.

Recovery: A phase of emergency management where activities are intended to restore essential services and repair damages caused by the event.

Response: A phase of emergency management that is comprised of activities that are immediate actions to save lives, protect property and the environment and meet basic human needs.

Return Period (or Mean Return Period): This term refers to the average period of time in years between occurrences of a particular hazard (equal to the inverse of the annual frequency of occurrence).

Riverine: Of or produced by a river. Riverine floodplains have readily identifiable channels. Floodway maps can only be prepared for riverine floodplains.

Risk: Risk is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. Risk measures the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment: Risk assessment is the process of measuring potential loss of life, personal injury, economic injury, and property damage resulting from hazards. This process assesses the vulnerability of people, buildings, and infrastructure to hazards and focuses on (1) hazard identification; (2) impacts of hazards on physical, social, and economic assets; (3) vulnerability identification; and (4) estimates of the cost of damage or costs that could be avoided through mitigation.

Risk Ranking: This ranking serves two purposes, first to describe the probability that a hazard will occur, and second to describe the impact a hazard will have on people, property, and the economy. Risk estimates for the City are based on the methodology that the City used to prepare the risk assessment for this plan. The following equation shows the risk ranking calculation:

Risk Ranking = Probability + Impact (people + property + economy)

Robert T. Stafford Act: The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 100-107, was signed into law on November 23, 1988. This law amended the Disaster Relief Act of

1974, Public Law 93-288. The Stafford Act is the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs.

Sinkhole: A collapse depression in the ground with no visible outlet. Its drainage is subterranean. It is commonly vertical-sided or funnel-shaped.

Special Flood Hazard Area: The base floodplain delineated on a Flood Insurance Rate Map. The special flood hazard area is mapped as a Zone A in riverine situations and zone V in coastal situations. The special flood hazard area may or may not encompass all of a community's flood problems

Stakeholder: Business leaders, civic groups, academia, non-profit organizations, major employers, managers of critical facilities, farmers, developers, special purpose districts, and others whose actions could impact hazard mitigation.

Stream Bank Erosion: Stream bank erosion is common along rivers, streams and drains where banks have been eroded, sloughed or undercut. However, it is important to remember that a stream is a dynamic and constantly changing system. It is natural for a stream to want to meander, so not all eroding banks are "bad" and in need of repair. Generally, stream bank erosion becomes a problem where development has limited the meandering nature of streams, where streams have been channelized, or where stream bank structures (like bridges, culverts, etc.) are located in places where they can actually cause damage to downstream areas. Stabilizing these areas can help protect watercourses from continued sedimentation, damage to adjacent land uses, control unwanted meander, and improvement of habitat for fish and wildlife.

Steep Slope: Different communities and agencies define it differently, depending on what it is being applied to, but generally a steep slope is a slope in which the percent slope equals or exceeds 25%. For this study, steep slope is defined as slopes greater than 33%.

Sustainable Hazard Mitigation: This concept includes the sound management of natural resources, local economic and social resiliency, and the recognition that hazards and mitigation must be understood in the largest possible social and economic context.

Thunderstorm: A thunderstorm is a storm with lightning and thunder produced by cumulonimbus clouds. Thunderstorms usually produce gusty winds, heavy rains, and sometimes hail. Thunderstorms are usually short in duration (seldom more than 2 hours). Heavy rains associated with thunderstorms can lead to flash flooding during the wet or dry seasons.

Tornado: A tornado is a violently rotating column of air extending between and in contact with a cloud and the surface of the earth. Tornadoes are often (but not always) visible as funnel clouds. On a local scale, tornadoes are the most intense of all atmospheric circulations, and winds can reach destructive speeds of more than 300 mph. A tornado's vortex is typically a few hundred meters in diameter, and damage paths can be up to 1 mile wide and 50 miles long.

Vulnerability: Vulnerability describes how exposed or susceptible an asset is to damage. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damage, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. Flooding of an electric substation would affect not only the substation itself but businesses as well. Often, indirect effects can be much more widespread and damaging than direct effects.

Watershed: A watershed is an area that drains downgradient from areas of higher land to areas of lower land to the lowest point, a common drainage basin.

Wildfire: These terms refer to any uncontrolled fire occurring on undeveloped land that requires fire suppression. The potential for wildfire is influenced by three factors: the presence of fuel, topography, and air mass. Fuel can include living and dead vegetation on the ground, along the surface as brush and small trees, and in the air such as tree canopies. Topography includes both slope and elevation. Air mass includes temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount, duration, and the stability of the atmosphere at the time of the fire. Wildfires can be ignited by lightning and, most frequently, by human activity including smoking, campfires, equipment use, and arson.

Windstorm: Windstorms are generally short-duration events involving straight-line winds or gusts exceeding 50 mph. These gusts can produce winds of sufficient strength to cause property damage. Windstorms are especially dangerous in areas with significant tree stands, exposed property, poorly constructed buildings, mobile homes (manufactured housing units), major infrastructure, and aboveground utility lines. A windstorm can topple trees and power lines; cause damage to residential, commercial, critical facilities; and leave tons of debris in its wake.

Zoning Ordinance: The zoning ordinance designates allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map

Appendix B. Concepts and Methods Used for Hazard Mapping

B. Concepts and Methods Used for Hazard Mapping

EARTHQUAKE

Shake Maps

A shake map is designed as a rapid response tool to portray the extent and variation of ground shaking throughout the affected region immediately following significant earthquakes. Ground motion and intensity maps are derived from peak ground motion amplitudes recorded on seismic sensors (accelerometers), with interpolation based on both estimated amplitudes where data are lacking, and site amplification corrections. Color-coded instrumental intensity maps are derived from empirical relations between peak ground motions and Modified Mercalli intensity.

Cascadia Subductions Zone Scenario

- Magnitude: 9.0
- Epicenter: N45.7329 W125.125
- Depth: 0km

Portland Hills Scenario

- Magnitude: 6.5
- Epicenter: N45.5544 W122.798
- Depth: 0km

Probabilistic Peak Ground Acceleration

Probabilistic Peak Ground Acceleration data generated by Hazus-MH 2.2. In Hazus' probabilistic analysis procedure, the ground shaking demand is characterized by spectral contour maps developed by the United States Geological Survey (USGS) as part of a 2008 update of the National Seismic Hazard Maps. USGS probabilistic seismic hazard maps are revised about every six years to reflect newly published or thoroughly reviewed earthquake science and to keep pace with regular updates of the building code. Hazus includes maps for eight probabilistic hazard levels: ranging from ground shaking with a 39% probability of being exceeded in 50 years (100 year return period) to the ground shaking with a 2% probability of being exceeded in 50 years (2500 year return period).

Soil Classification

Soil classification data provided by Washington State Department of Natural Resources, Geology and Earth Resources Division. The dataset identifies site classes for approximately 33,000 polygons derived from the geologic map of Washington. The methodology chosen for developing the site class map required the construction of a database of shear wave velocity measurements. This database was created by compiling shear wave velocity data from published and unpublished sources, and through the collection of a large number of shear wave velocity measurements from seismic refraction surveys conducted for this project. All of these sources of data were then analyzed using the chosen methodologies to produce the statewide site class maps. The polygons were classified with site classes based on criteria described in Palmer, S. P.; Magsino, S. L.; Bilderback, E. L.; Poelstra, J. L.; Folger, D. S.; and Niggemann, R. A., 2004, Liquefaction susceptibility and site class maps of Washington State, by county: Washington Division of Geology and Earth Resources Open-file Report 2004-20, 78 sheets, with 45 p. text.

Liquefaction Susceptibility

Liquefaction data provided by the Washington State Department of Natural Resources, Division of Geology and Earth Resources. Data is based solely on surficial geology published at a scale of 1:100,000. A liquefaction susceptibility map provides an estimate of the likelihood that soil will liquefy as a result of earthquake shaking. This type of map depicts the relative susceptibility in a range that varies from very low to high. Areas underlain by bedrock or peat are mapped separately as these earth materials are not liquefiable, although peat deposits may be subject to permanent ground deformation caused by earthquake shaking.

Liquefaction is a phenomenon in which strong earthquake shaking causes a soil to rapidly lose its strength and behave like quicksand. Liquefaction typically occurs in artificial fills and in areas of loose sandy soils that are saturated with water, such as low-lying coastal areas, lakeshores, and river valleys. When soil strength is lost during liquefaction, the consequences can be catastrophic. Movement of liquefied soils can rupture pipelines, move bridge abutments and road and railway alignments, and pull apart the foundations and walls of buildings.

FLOOD

Flood hazard areas as depicted on FEMA Digital Flood Insurance Rate Maps (DFIRM)

LANDSLIDE

The landslide areas presented in this map are a combination of Clark County and Washington State Department of Natural Resources datasets. Clark County Landslide Areas data acquired from Clark County GIS Services. This dataset contains unstable slopes and landslide polygon coverage of historical, potential or active landslide areas.

Washington Department of Natural Resources Landslide Areas data provided by the Washington State Department of Natural Resources, Division of Geology and Earth Resources. This dataset contains 1:24,000 & 1:100,000-scale polygons defining the extent of mapped landslides in the state of Washington. This dataset is compiled chiefly from pre-existing landslide databases created in different divisions of the Washington State Department of Natural Resources to meet a variety of purposes.

VOLCANO

Distal Volcano Hazard Zones are Columbia River islands and areas along the Washington shore that could be affected by bank erosion and flooding induced by lahars and sediment-rich floods from Sandy and Hood Rivers during and immediately following eruptions. Volcano data provided by the Cascade Volcano Observatory.

WILDFIRE

The wildfire areas presented in this map are a combination of Clark County, City of Vancouver and Washington State Department of Natural Resources datasets. Clark County Wildfire data acquired from Clark County GIS Services. This dataset contains classifications of the Wildland Urban Interface. Intermix areas are generally defined as where elevations exceed five hundred feet, where slopes exceed twenty-five percent, forest type vegetation exists, or is outside of an organized fire protection district.

Clark Regional Natural Hazard Mitigation Plan: Volume 1—Planning Area-Wide Elements

Appendix C. Plan Adoption Resolutions from Planning Partners

C. Plan Adoption Resolutions from Planning Partners

To be completed as adoption resolutions are received.

Clark Regional Natural Hazard Mitigation Plan: Volume 1—Planning Area-Wide Elements

Appendix D. Progress Report Template

D. PROGRESS REPORT TEMPLATE

Clark County
Hazard Mitigation Plan Update
Annual Progress Report

Reporting Period: *(Insert reporting period)*
Background: Clark County and participating cities and special purpose districts in the county developed a hazard mitigation plan to reduce risk from natural hazards by identifying resources, information, and strategies for risk reduction. The federal Disaster Mitigation Act of 2000 requires state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. To prepare the plan, the participating partners organized resources, assessed risks from natural hazards within the county, developed planning goals and objectives, reviewed mitigation alternatives, and developed an action plan to address probable impacts from natural hazards. By completing this process, these jurisdictions maintained compliance with the Disaster Mitigation Act, achieving eligibility for mitigation grant funding opportunities afforded under the Robert T. Stafford Act. The plan can be viewed on-line at:

INSERT LINK

Summary Overview of the Plan's Progress: The performance period for the Hazard Mitigation Plan became effective on ____, 2023, with the final approval of the plan by FEMA. The initial performance period for this plan will be 5 years, with an anticipated update to the plan to occur before ______, 2022. As of this reporting period, the performance period for this plan is considered to be __% complete. The Hazard Mitigation Plan has targeted __ hazard mitigation actions to be pursued during the 5-year performance period. As of the reporting period, the following overall progress can be reported:

- __ out of __ actions (__%) reported ongoing action toward completion.
- __ out of __ actions (__%) were reported as being complete.
- __ out of __ actions (___%) reported no action taken.

Purpose: The purpose of this report is to provide an annual update on the implementation of the action plan identified in the *Clark Regional Natural Hazard Mitigation Plan*. The objective is to ensure that there is a continuing and responsive planning process that will keep the Hazard Mitigation Plan dynamic and responsive to the needs and capabilities of the partner jurisdictions. This report discusses the following:

- Natural hazard events that have occurred within the last year
- Changes in risk exposure within the planning area (all of Clark County and the incorporated area of the City of Woodland)
- Mitigation success stories
- Review of continuing public involvement

- Review of the action plan
- Changes in capabilities that could impact plan implementation
- Recommendations for changes/enhancement
- Relevant training needs identified within the planning partnership.

The Hazard Mitigation Work Group: The Hazard Mitigation Plan Work Group, made up of planning partners and stakeholders within the planning area, reviewed and approved this progress report at its meeting held on _____, 202_. It was determined through the plan's development process that a working group would remain in service to oversee maintenance of the plan. At a minimum, the work group will provide technical review and oversight on the development of the annual progress report. It is anticipated that there will be turnover in the membership annually, which will be documented in the progress reports. For this reporting period, the work group membership is as indicated in Table 1.

Table 1. Hazard Mitigation Work Group

Name	Title	Jurisdiction/Agency

Natural Hazard Events within the Planning Area: During the reporting period, there were __ natural hazard events in the planning area that had a measurable impact on people or property. A summary of these events is as follows:

- ____________________________
- ____________________________

Changes in Risk Exposure in the Planning Area: *(Insert brief overview of any natural hazard event in the planning area that changed the probability of occurrence or ranking of risk for the hazards addressed in the hazard mitigation plan)*

Mitigation Success Stories: *(Insert brief overview of mitigation accomplishments during the reporting period)*

Continued Public Involvement: *(Insert brief overview of any continued public involvement related to hazard mitigation during the reporting period)*

Review of the Action Plan: Table 2 reviews the action plan, reporting the status of each action. Reviewers of this report should refer to the Hazard Mitigation Plan for more detailed descriptions of each action and the prioritization process.

Address the following in the "status" column of the following table:

- *Was any element of the action carried out during the reporting period?*
- *If no action was taken, why?*
- *Is the timeline for implementation for the action still appropriate?*

- *If the action was completed, does it need to be changed or removed from the action plan?*
- *Do any newly identified actions need to be added as a result in a change of capabilities or the next step in a completed action?*

Table 2. Action Plan Matrix

Action Taken? (Yes or No)	Time Line	Priority	Status	Status (X, O,✓)
Action #__—____________________[description]				
Action #__—____________________[description]				
Action #__—____________________[description]				
Action #__—____________________[description]				
Action #__—____________________[description]				
Action #__—____________________[description]				
Action #__—____________________[description]				
Action #__—____________________[description]				
Action #__—____________________[description]				
Action #__—____________________[description]				
Action #__—____________________[description]				
Action #__—____________________[description]				

Completion status legend:
✓= Project Completed
O = Action ongoing toward completion
X = No progress at this time

Changes That May Impact Implementation of the Plan: *(Insert brief overview of any significant changes in the planning area that would have a profound impact on the implementation of the plan. Specify any changes in technical, regulatory and financial capabilities identified during the plan's development)*

Need for Training: *(Insert brief overview of any training needs identified within the planning partnership)*

Recommendations for Changes or Enhancements: Based on the review of this report by the Hazard Mitigation Work Group, the following recommendations will be noted for future updates or revisions to the plan:

- ______________________________
- ______________________________
- ______________________________
- ______________________________

Public review notice: *The contents of this report are considered to be public knowledge and have been prepared for total public disclosure. Copies of the report have been provided to the governing boards of all planning partners and to local media outlets and the report is posted on the Clark Regional Natural Hazard Mitigation Plan website. Any questions or comments regarding the contents of this report should be directed to:*
Insert Contact Info Here

Clark Regional Natural Hazard Mitigation Plan: Volume 1—Planning Area-Wide Elements

Appendix E. FEMA Review Crosswalk

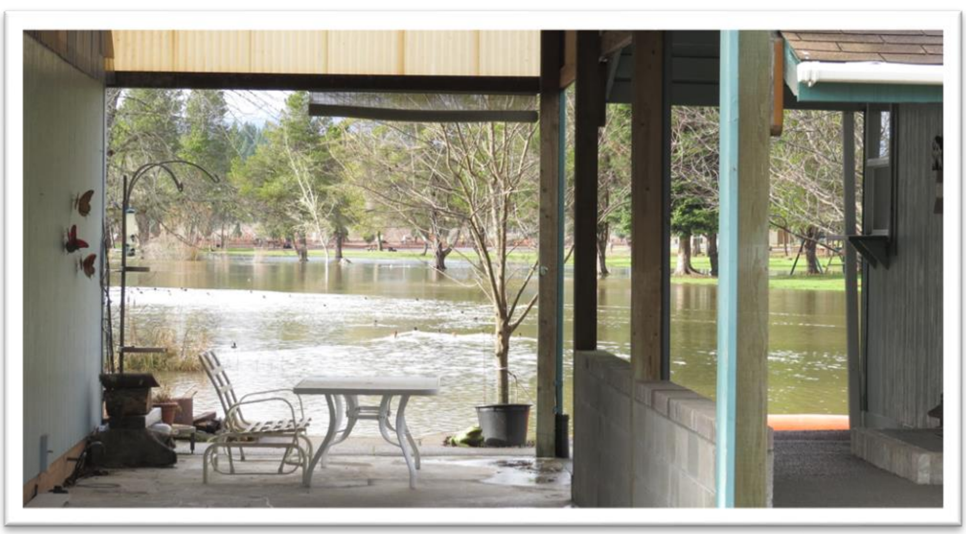
E. FEMA PLAN REVIEW CROSSWALK

To be completed.

Clark Regional Emergency Services Agency

Clark Regional Natural Hazard Mitigation Plan Volume 2—Planning Partner Annexes

Approved: March 31, 2023



March 31, 2023

Clark Regional Natural Hazard Mitigation Plan: Volume 2—Planning Partner Annexes

March 31, 2023 – Final Adopted Plan

PREPARED BY

Clark Regional Emergency Services Agency
710 W. 13th Street
Vancouver, WA 98660

CONTENTS

Appendices

List of Tables

INTRODUCTION

BACKGROUND

The Federal Emergency Management Agency (FEMA) encourages multi-jurisdictional planning for hazard mitigation. All participating jurisdictions must meet the requirements of Chapter 44 of the Code of Federal Regulations (44 CFR):

> "Multi-jurisdictional plans (e.g. watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan." (Section 201.6.a(4))

For the *Clark Regional Natural Hazard Mitigation Plan*, a Planning Partnership was formed to leverage resources and to meet requirements of the federal Disaster Mitigation Act (DMA) for as many eligible local governments in Clark County as possible. The DMA defines a local government as follows:

> "Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity."

There are two types of planning partners that participated in this process, with distinct needs and capabilities:

- Incorporated municipalities (seven cities, one town and the County)
- Special purpose districts.

Each participating planning partner has prepared a jurisdiction-specific annex to this plan. These annexes, as well as information on the process by which they were created, are contained in this volume.

THE PLANNING PARTNERSHIP

Initial Solicitation and Letters of Intent

The planning team solicited the participation of the County, incorporated cities and towns and all County-recognized special purpose districts at the outset of this project. A kickoff meeting was held on Sept 28, 2022 to identify potential stakeholders and planning partners for this process. The purpose of the meeting was to introduce the planning process to jurisdictions in the County that could have a stake in the outcome of the planning effort. All eligible local governments within the planning area were invited to attend. The goals of the meeting were as follows:

- Provide an overview of the Disaster Mitigation Act.
- Introduce the Planning Team for the project.
- Outline the Clark County plan update work plan.
- Describe the benefits of multi-jurisdictional planning.

- Outline planning partner expectations.
- Solicit planning partners.

All interested local governments were provided with a list of planning partner expectations developed by the planning team and were informed of the obligations required for participation. Local governments wishing to join the planning effort were asked to provide the planning team with a “notice of intent to participate” that agreed to the planning partner expectations (see Appendix A) and designated a point of contact for their jurisdiction. In all, formal commitment was received from 19 planning partners by the planning team, and the Clark Regional Planning Partnership was formed.

Planning Partner Expectations

Groups Involved in The Planning Process

One of the goals of the multi-jurisdictional approach to natural hazard mitigation planning is to efficiently achieve compliance with the Disaster Mitigation Act (DMA) for all participating members in the planning effort. Several groups were involved in this process at different levels:

- **Project Manager—**The Clark Regional Emergency Services Agency (CRESA) staff responsible for the facilitation of the planning process and the development of the plan document.
- **Planning Partners—**Jurisdictions or special purpose districts that are developing an annex to the regional plan.
- **Planning Stakeholders—**The individuals, groups, businesses, academia, etc., from which the planning team gains information to support the various elements of the plan. This group may also be referred to as coordinating stakeholders.

Definition of Participation

DMA requires that planners identify at the start what the participation requirements are for involved jurisdictions and special districts. Any agency may submit an annex to the plan, so long as they meet these participation requirements. To achieve compliance for *all* planning partners, the plan must clearly document how each planning partner that is seeking linkage to the plan participated in the plan’s development. For this planning process, planning partners met the following participation requirements:

- **Complete administrative tasks.** Participation in this plan included the following administrative tasks:
  - **Complete a letter of intent.** Provide a “Letter of Intent to participate” or a Resolution to participate to the planning team (see exhibit A).
  - **Designate points of contact.** Designate a primary and secondary point of contact. These designees will be listed as the hazard mitigation points of contact for your jurisdiction in the plan.
  - **Approve the steering committee.** The steering committee was approved via an email vote.
- **Participate, as able, in additional opportunities**. Attendance or participation in the following opportunities was also recorded. These records were used to document participation for each planning partner. No thresholds were established as minimum levels of participation for these events. However, each planning partner was expected to attempt to attend all possible meetings and events:
  - Attend steering committee meetings.
  - Attend or host public meetings or open houses.
  - Participate in and advertise the public review and comment period prior to adoption.
- **Support the public involvement strategy.** The planning team requested support from the partnership during the implementation of the public involvement strategy developed by the steering committee.

Support was in the form of providing venues for public meetings, attending these meetings as meeting participants, providing technical support, providing access to mailing lists, providing existing public information materials, etc.

- **Complete the jurisdictional annex template.** Each planning partner completed a jurisdictional annex template. Templates and instructions to aid in their completion were provided to all committed planning partners in a phased approach to extend the level of effort over a series of months. Key components of the annex completion effort were as follows:

  - **Perform a capability assessment.** All planning partners conducted a capability assessment. This required a review of existing documents (plans, studies and ordinances) as well as technical and financial capabilities pertinent to each jurisdiction that can support hazard mitigation.
  - **Review the risk assessment**. Each partner was asked to review the risk assessment and identify hazards and vulnerabilities specific to its jurisdiction. The planning team provided jurisdiction-specific mapping and technical consultation to aid in this task, but the determination of risk and vulnerability was up to each partner (through a facilitated process during the mandatory workshop).
  - **Review county-wide mitigation recommendations.** Each partner was asked to review and determine if the mitigation recommendations chosen in the base plan meet the needs of its jurisdiction.
  - **Develop a mitigation action plan.** All planning partners developed an action plan that identifies each project, who will oversee the task, how it will be financed and when it is estimated to occur. Projects within each jurisdiction consistent with the base plan recommendations were identified and prioritized, and reviewed to determine their benefits vs. costs.

- **Adopt the plan.** The natural hazard mitigation plan must be formally adopted by each jurisdiction. Once this plan is completed, and FEMA approval has been received for each partner, maintaining that eligibility will be dependent upon each partner implementing the plan implementation-maintenance protocol identified in the plan.

Estimated Time Commitment

The time commitment to meet the participation requirements for a planning partner was 36 to 46 hours over a 12-month period. Most of this time was devoted to completing the jurisdictional annex template.

Linkage Procedures

Eligible local jurisdictions that did not participate in development of this plan update may comply with DMA requirements by linking to this plan following the procedures outlined in Appendix B.

ANNEX-PREPARATION PROCESS

Templates

Templates were created to help the planning partners prepare their jurisdiction-specific annexes. Since special purpose districts operate differently from incorporated municipalities, separate templates were created for the two types of jurisdictions. The templates were created so that all criteria of Section 201.6 of 44 CFR would be met, based on the partners' capabilities and mode of operation. Templates available for the planning partners' use were specific as to whether the partner is a municipality or a special purpose district and whether the annex is an update to a previous natural hazard mitigation plan or a first-time hazard plan. Each partner was asked to participate in a technical assistance workshop during which key elements of the template were completed by a designated point of contact for each partner and a member of the planning team. The templates were set up to lead each partner through a series of steps that would generate the DMA-required elements that are specific for each partner. The templates and their instructions can be found in Appendix C to this volume of the Natural Hazard Mitigation Plan.

Prioritization

44 CFR requires actions identified in the action plan to be prioritized (Section 201.c.3.iii). The planning team and steering committee developed a methodology for prioritizing the action plans that meets the needs of the partnership and the requirements of 44 CFR. The actions were prioritized according to the following criteria:

Implementation priorities were established using the following considerations:

- **High Priority**—An action that meets multiple objectives, has benefits that exceed cost, has funding secured or is an ongoing action and meets eligibility requirements for a grant program. High priority actions can be completed in the short term (1 to 5 years). The key factors for high priority actions are that they have funding secured and can be completed in the short term.
- **Medium Priority**—An action that meets multiple objectives, that has benefits that exceed costs, and for which funding has not yet been secured, but is eligible for funding. Action can be completed in the short term, once funding is secured. Medium priority actions will become high priority actions once funding is secured. The key factors for medium priority actions are that they are eligible for funding, but do not yet have funding secured, and they can be completed within the short term.
- **Low Priority**—An action that will mitigate the risk of a hazard, that has benefits that do not exceed the costs or are difficult to quantify, for which funding has not been secured, that is not eligible for grant funding, and for which the time line for completion is long term (1 to 10 years). Low priority actions may be eligible for grant funding from other programs that have not yet been identified. Low priority actions are generally “blue-sky” or “wish-list.” actions. Financing is unknown, and they can be completed over a long term.

Grant pursuit priories were established using the following considerations:

- **High Priority**—An action that has been identified as meeting grant eligibility requirements, assessed to have high benefits, is listed as high or medium priority, and where local funding options are unavailable or where dedicated funds could be utilized for actions that are not eligible for grant funding.
- **Medium Priority**—An action that has been identified as meeting grant eligibility requirements, assessed to have medium or low benefits, is listed as medium or low priority, and where local funding options are unavailable.
- **Low Priority**—An action that has not been identified as meeting grant eligibility requirements, or has low benefits.

Benefit/Cost Review

44 CFR requires the prioritization of the action plan to emphasize a benefit/cost analysis of the proposed actions. Because some actions may not be implemented for up to 10 years, benefit/cost analysis was qualitative and not of the detail required by FEMA for project grant eligibility under relevant grant programs. A review of the apparent benefits versus the apparent cost of each project was performed. Parameters were established for assigning subjective ratings (high, medium, and low) to costs and benefits as follows:

Benefit ratings were defined as follows:

- **High**—Action will have an immediate impact on the reduction of risk exposure to life and property.
- **Medium**—Action will have a long-term impact on the reduction of risk exposure to life and property, or action will provide an immediate reduction in the risk exposure to property.
- **Low**—Long-term benefits of the action are difficult to quantify in the short term.

Cost ratings were defined as follows:

- **High**—Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed action.
- **Medium**—Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the action would have to be spread over multiple years.
- **Low**—Possible to fund under existing budget. Action is or can be part of an existing ongoing program.

Using this approach, actions with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial. For many of the strategies identified in this action plan, the partners may seek financial assistance under the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation (PDM) Program, both of which require detailed benefit/cost analyses. These analyses will be performed on actions at the time of application using the FEMA benefit-cost model. For actions not seeking financial assistance from grant programs that require detailed analysis, the partners reserve the right to define "benefits" according to parameters that meet the goals and objectives of this plan.

Analysis of Mitigation Initiatives

Each planning partner reviewed its recommended initiatives to classify each initiative based on the hazard it addresses and the type of mitigation it involves. Mitigation types used for this categorization are as follows:

- **Prevention**—Government, administrative or regulatory actions that influence the way land and buildings are developed to reduce hazard losses. Includes planning and zoning, floodplain laws, capital improvement programs, open space preservation, and stormwater management regulations.
- **Property Protection**—Modification of buildings or structures to protect them from a hazard or removal of structures from a hazard area. Includes acquisition, elevation, relocation, structural retrofit, storm shutters, and shatter-resistant glass.
- **Public Education and Awareness**—Actions to inform citizens and elected officials about hazards and ways to mitigate them. Includes outreach projects, real estate disclosure, hazard information centers, and school-age and adult education.
- **Natural Resource Protection**—Actions that minimize hazard loss and preserve or restore the functions of natural systems. Includes sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- **Emergency Services**—Actions that protect people and property during and immediately after a hazard event. Includes warning systems, emergency response services, and the protection of essential facilities.
- **Structural Projects**—Actions that involve the construction of structures to reduce the impact of a hazard. Includes dams, setback levees, floodwalls, retaining walls, and safe rooms.

Hazard Maps

Maps for each participating city or town are provided in the individual annex for that city this volume. Maps showing the location of participating special purpose districts by district type are included in Appendix D. These maps will be updated periodically as changes to the partnership occur, either through linkage or by a partner dropping out due to a failure to participate.

COMPATIBILITY WITH PREVIOUSLY APPROVED PLANS

Of the 17 committed planning partners, sixteen were covered by the 2017 plan approved by FEMA, which was a major update to the 2004 plan which only involved 8 partners. The COVID-19 pandemic affected the ability to undertake the Hazard Mitigation Plan update to the extent that had been originally intended. The Project Manager's role in the community response, and the higher priority responsibilities the pandemic placed upon the staff of partner organizations, delayed the kickoff of the planning team and limited involvement. Additionally, the pandemic prevented in-person meetings and required the team to utilize virtual work environments. The chapters of this plan describing the plan update process and the tools and techniques that were utilized address these topics as if they were being completed for the first time. When relevant, the update discusses correlations with the 2017 plan, especially when data or information is being carried over to this update.

FINAL COVERAGE UNDER THE PLAN

Of the 17 committed planning partners, they all fully met the participation requirements specified by the Planning Team. The planning partner who was unable to complete the process indicated that the decision to leave the partnership resulted from severe understaffing. If desired, that planning partner can follow the linkage procedure described in Appendix B of this volume to rejoin the partnership at a later date. Table 1 lists the jurisdictions that submitted letters of intent and their ultimate status in this plan.

Table 1 - **Planning Partner Status**

Municipalities	Annex Completed
Clark County	Yes
City of Battle Ground	Yes
City of Camas	Yes
City of La Center	Yes
City of Ridgefield	Yes
City of Vancouver	Yes
City of Washougal	Yes
Town of Yacolt	Yes
Special Purpose Districts	
Battle Ground Public Schools	Yes
Clark County Public Utilities District #1	Yes
Clark Regional Wastewater District	Yes
C-TRAN Public Transit Benefit Ares	Yes
Clark Fire Protection District #3	Yes
Evergreen Public Schools	Yes
Port of Vancouver USA	Yes
Ridgefield School District	Yes
Vancouver Public Schools	Yes

ACRONYMS AND ABBREVIATIONS

The following terms are used in the planning partner annexes:

- BCEGS—Building Code Effectiveness Grading Schedule
- CDBG-DR—Community Development Block Grant Disaster Resilience
- CEMP—Comprehensive Emergency Management Plan
- CERT—Citizens Emergency Response Training
- CFR—Code of Federal Regulations
- CRESA—Clark Regional Emergency Services Agency
- CRS—Community Rating System
- DMA—Disaster Mitigation Act
- EPA—U.S. Environmental Protection Agency
- FEMA—Federal Emergency Management Agency
- FMA—Flood Mitigation Assistance
- GIS—Geographic Information System
- GMA—Growth Management Act

- Hazus-MH—Hazards, United States-Multi Hazard
- HMGP—Hazard Mitigation Grant Program
- IBC—International Building Code
- IRC—International Residential Code
- NEHRP—National Earthquake Hazards Reduction Program
- NFIP—National Flood Insurance Program
- NHMP—Natural Hazard Mitigation Plan
- NWS—National Weather Service
- PDM—Pre-Disaster Mitigation Grant Program
- RCW—Revised Code of Washington
- UASI—Urban Area Security Initiative
- USGS—U.S. Geological Survey
- WUI—Wildland Urban Interface

1. CLARK COUNTY

1.1 HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact
Mike Lewis
Emergency Management/Security Coordinator
1300 Franklin Street 402 / PO Box 9810
Vancouver, WA 98666
Telephone: 360-397-4838
e-mail Address: Mike.lewis@clark.wa.gov

Alternate Point of Contact
Melissa Tracy
Planning Technician II
1300 Franklin Street 402 / PO Box 9810
Vancouver, WA 98666
Telephone: 360-397-5843
e-mail Address:
Melissa.tracy@clark.wa.gov

1.2 JURISDICTION PROFILE

The following is a summary of key information about the jurisdiction and its history:

- Date of Incorporation—1849
- Current Population— 513,100 (County), 236,200 (unincorporated Clark County) as of April 2021 (2021 Office of Finance estimates).
- Population Growth—Based on data tracked by the Office of Finance, Clark County has experienced an increasing rate of growth over the past 10 years. The overall population has increased 18.33 percent since 2010. Significantly, Clark County experienced a 1.94 percent rate of growth in the last year, ranking it second in rate of growth among counties in Washington State.
- Location and Description—Clark County is located in the southern part of Washington State. Clark County is the state's seventh smallest county, encompassing an area of 656 square miles. The county is bordered by the Columbia River and State of Oregon to the south and west, the Lewis River drainage system, including Lake Merwin and Yale Lake as well as Cowlitz County to the north and Skamania County to the east. Clark County is the home of Washington State University's Vancouver campus. The Port of Vancouver, a deep draft port is located in the southwestern corner of the county. Interstates 5 and 205 and State Route 14 are the major highways within the county.
- Brief History—Clark County began as the Vancouver District in 1844. In 1845 the name was changed to Vancouver County. On September 3, 1849 the Oregon Territorial Legislation changed the name to Clark County in honor of explorer William Clark. Originally covering the area north of the Columbia River, east to the Rockies and south of Alaska, the County was divided and subdivided until reaching its present size in 1880. Clark County has a long and storied cultural, economic, industrial, and military history. From Fort Vancouver and Vancouver Barracks to WWI and WWII, the county has a rich history in many areas such as logging, lumber mills, railroad, aviation, and shipbuilding. In 1989, Washington State University Vancouver was established, conducting virtual classrooms until 1996 when the campus located in the Salmon Creek area opened. The County has a mix of rural and urban areas and has become a regional hub for transportation and commerce.

- Climate—Clark Counties weather is typical of the central valley in the Pacific Northwest, with the strong influences of the Pacific Ocean and Cascade Mountain Range producing mild summers and cool wet winters. The average annual rainfall is 42 inches, but varies quite a bit, ranging from 38 inches on the west side to 80 inches in Yacolt. Mountainous areas in northeastern Clark County can receive over 120 inches of annual rainfall. Seventy percent of the county's rainfall occurs between November and March. The average annual snowfall ranges from 7 inches on the western side to several feet in the mountains, although snow does not occur every year. The average year-round temperature is 50°F. The average high in July is 80°F and average low in January is 34°F. Prevailing winds over most of the county are from the northwest in the summer and southeast in the winter.
- Governing Body Format—Clark County is governed under the Home Rule Charter, which took effect in January 2015 and as amended by the Charter Review Commission in 2021. It includes a five-member council, one of which is elected chair by the council, and a county manager. Other elected officials include the Assessor, Auditor, Clerk, District Court, Prosecuting Attorney, Sheriff, Superior Court and Treasurer. Under the direction of the County Manager are six external departments: Council and County Managers Office, Community Development, Community Planning, Community Services, Public Health, Public Works and one Internal Services department. The County has over 35 boards, commissions, committees and advisory groups, which report to the Council. The Board of County Councilors assumes responsibility for the adoption of this plan; the County Manager will oversee its implementation.
- Development Trends—Anticipated development levels for Clark County are moderate to high, consisting of residential and commercial development. The majority of recent development has included development of areas within the existing urban growth boundaries as urban infrastructure capacity is extended and increased to support development activity. Residential development has consisted primarily of single family homes and some multi-family developments. Clark County is currently in cycle to update its growth management plan effective June 30, 2025. The prior plan update was in 2016. Plan policies for the 2025 update continue to be developed.

1.3 CAPABILITY ASSESSMENT

An assessment of legal and regulatory capabilities is presented in Table 1-1. An assessment of fiscal capabilities is presented in Table 1-2. An assessment of administrative and technical capabilities is presented in Table 1-3. Information on National Flood Insurance Program (NFIP) compliance is presented in Table 1-4. Classifications under various community mitigation programs are presented in Table 1-5. An assessment of education and outreach capabilities is presented in Table 1-6.

In addition to the capabilities listed below, it should be noted that Clark County is a member of the Discovery Clean Water Alliance, which was legally formed on January 4, 2013 under the Joint Municipal Utility Services Act (RCW 39.106). The Alliance serves four Member agencies – the City of Battle Ground, Clark County, Clark Regional Wastewater District and the City of Ridgefield. The Alliance Members jointly own and jointly manage regional wastewater assets under Alliance ownership. The Alliance seeks to optimize the long-term framework for delivery of regional wastewater transmission and treatment services to the urban growth areas in the central portion of Clark County, Washington.

Table 1-1. **Legal and Regulatory Capability**

CODE	Local Authority	Other Jurisdiction Authority	State Mandated
Building Code	Yes	No	Yes
Comment: Clark County Code Title 14- Buildings and Structures & Title 15- Fire Prevention- adopted July 2016			
Zoning Code	Yes	No	Yes

CODE	Local Authority	Other Jurisdiction Authority	State Mandated
Comment: Clark County Code Title 40- Clark County, Washington Unified Development Code Consolidates all development related codes into one document			
Subdivisions Comment: Clark County Code Chapter 40.540 – Boundary Line Adjustments and Land Divisions Section 40.540.040 - Subdivisions	Yes	No	Yes
Stormwater Management Comment: Clark County Code Chapter 40.386 – Stormwater and Erosion Control Clark County Stormwater Management Plan (March 2022)	Yes	No	Yes
Post-Disaster Recovery Comment: N/A	No	No	No
Real Estate Disclosure Comment: N/A	No	No	No
Growth Management Comment: Clark County Comprehensive Plan –Adopted June 2016 (latest amendment December 2021) Update due June 30, 2025	Yes	No	Yes
Site Plan Review Comment: Clark County Code Chapter 40.520 – Permits and Reviews Section 40.520.040 – Site Plan Review All new commercial and residential projects require Building and Fire review of the site plan for County requirements.	Yes	No	Yes
Environmental Protection Comment: Critical Areas Ordinances (CAO)- Clark County Code Subtitle 40.4- Critical Areas and Shorelines	Yes	No	Yes
Flood Damage Prevention Comment: Critical Areas Ordinances (CAO)- Clark County Code Chapter 40.420 – Flood Hazard Areas- Adopted July 2012	Yes	No	Yes
Emergency Management Comment: Clark County Code Chapter 2.48A – Emergency Management *Clark Regional Emergency Services Agency Interlocal Cooperation Agreement *Washington State Emergency Management Division	Yes	Yes	Yes
Climate Change Comment: N/A	No	No	No
Other Comment: N/A	No	No	No
General or Comprehensive Plan Comment: Clark County Comprehensive Plan –Adopted June 2016 (latest amendment December 2021) Update due June 30, 2025	Yes	No	Yes
Capital Improvement Plan Clark County Comprehensive Plan –Appendix E- Capital Facilities Plan Comment:	Yes	No	Yes
Floodplain or Watershed Plan Comment: Clark County Code Chapter 40.420 – Flood Hazard Areas Clark County Code Chapter 40.410- Critical Aquifer Recharge Areas * Lower Columbia Fish Recovery Board & Washington State DEQ	Yes	Yes*	No
Stormwater Plan Comment: Clark County Code Chapter 40.386- Stormwater and Erosion Control Clark County Stormwater Management Plan (March 2022)	Yes	No	Yes
Habitat Conservation Plan Comment: Clark County Code Chapter 40.440- Habitat Conservation Clark County Code Chapter 40.450- Wetland Protection	Yes	No	No

CODE	Local Authority	Other Jurisdiction Authority	State Mandated
Economic Development Plan	Yes	Yes*	Yes – dependent on funding
Comment: Clark County Code Chapter 40.230- Commercial, Business, Mixed Use and Industrial Districts Clark County Economic Development Plan – September 2011 Clark County Comprehensive Plan – Chapter 9 -Adopted June 2016 (latest amendment December 2021) Update due June 30, 2025 * Columbia River Economic Development Council			
Shoreline Management Plan	Yes	No	Yes
Comment: Clark County Code Chapter 40.460 – Shoreline Master Program – last amendment December 2020 Clark County Comprehensive Plan- Chapter 13			
Community Wildfire Protection Plan	Yes	No	No
Comment: Clark County Code Chapter 15.13- Wildland Urban Interface/Intermix Ordinance Clark County Forest Stewardship Plan – Camp Bonneville – October 2017- Appendix 4- Wildfire Suppression Plan			
Forest Management Plan	Yes	No	No
Comment: Clark County Forest Stewardship Plan – Camp Bonneville – October 2017			
Climate Action Plan	No	No	No
Comment: N/A			
Other	Yes	Yes	No
Comment: Clark Regional Disaster Debris Management Plan – February 2019 .			
Comprehensive Emergency Management Plan	Yes	No	Yes
Comment: Clark Regional Comprehensive Emergency Management Plan – December 2018			
Threat & Hazard Identification & Risk Assessment	Yes	Yes*	No
Comment: Clark County Hazards Identification Vulnerability Analysis- 2011 *Clark Regional Emergency Services Agency *Regional Disaster Preparedness Organization (RDPO) and Portland Urban Area Security Initiative(UASI)			
Post-Disaster Recovery Plan	No	No	No
Comment: N/A			
Continuity of Operations Plan	Yes*	No	No
Comment: Clark County Code Section 2.48A.050- Continuity of Government			
Public Health Plan	Yes	No	No
Comment: Clark County Code Title 24- Public Health Clark County Public Health Strategic Plan 2018 – 2025 Region IV Public Health Emergency Response Plan – June 2019			

Table 1-2. **Fiscal Capability**

Financial Resources	Accessible or Eligible to Use?
Community Development Block Grants	Yes
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	No
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	Yes
Withhold Public Expenditures in Hazard-Prone Areas	Yes
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	Yes
Other Legacy Lands Program	Yes

Table 1-3. **Administrative and Technical Capability**

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Clark County Dept. of Community Development – Land Use Clark County Dept. of Public Works / Clark County Public Health Dept
Engineers or professionals trained in building or infrastructure construction practices	Yes	Clark County Dept. of Community Development- Building Safety: Inspectors Plans Examiners Administrative Staff Clark County Dept. of Community Development- Fire Marshal's Office: Deputy Fire Marshal's Administrative Staff Clark County Public Works Dept. Project Managers Construction Engineering
Planners or engineers with an understanding of natural hazards	Yes	Clark County Public Works Dept.
Staff with training in benefit/cost analysis	Yes	Clark County Budget Office Clark County Auditor's Office Clark County Risk Management
Surveyors	Yes	Clark County Public Works Dept.
Staff capable of making substantial damage estimates	Yes	Buildings – Clark County Dept. of Community Development Bridges/Infrastructure/Soils – Clark County Public Works Dept. – Also has GEO-Tech Contractors on immediate contract
Personnel skilled or trained in GIS applications	Yes	Clark County GIS Department Includes: GIS Manager – 1 GIS Coordinator/Project Mgr – 3 (2) GIS Coordinator/ GIS DBA – 1 GIS Analysts – 6 (1) HAZUS/EOC trained GIS Technicians – 5 Land Records Technicians - 4
Scientist familiar with natural hazards in local area	Yes	Clark County Public Works Dept.: Cleanwater Access to CVO, NWS and other organizations
Emergency manager	Yes	Clark Regional Emergency Services Agency (CRESA) – Emergency Management Division Manager
Grant writers	Yes	Multiple depending on subject

Table 1-4. **National Flood Insurance Program Compliance**

Criteria	Response
When did the community enter the NFIP?	08/02/82
When did the Flood Insurance Rate maps become effective?	09/5/2012
What local department is responsible for floodplain management?	Clark County Public Works Dept.

Criteria	Response
Who is your floodplain administrator? (department/position) • Is this a primary or auxiliary role?	Clark County Public Works – Engineering Division Manager (moving to Clean Water Division Manager in 2022) Auxiliary
Are any certified floodplain managers on staff in your jurisdiction?	No
What is the date of adoption of your flood damage prevention ordinance? • Does your floodplain management program meet or exceed minimum requirements? • If so, in what ways?	July 15, 2012 Exceed Exceeds due to higher regulatory standards and participation in the Community Rating System. The County has adopted higher regulatory standards then the NFIP requirements. These include • New residential, commercial and industrial construction, as well as substantial improvements shall have the lowest floor (including basement) elevated at least one foot above based flood elevation. • No net loss of conveyance or storage capacity for all channels during 100-year flood event. • Adoption of both the IRC and IBC. • All manufactured homes to be placed or substantially improved within a special flood hazard area shall be elevated on a permanent foundation such that the lowest floor of the manufactured home is at least one (1) foot above the base elevation.
When was the most recent Community Assistance Visit or Community Assistance Contact?	September 24, 2008
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed? • If so, please state what they are.	No
Do your flood hazard maps adequately address the flood risk within your jurisdiction? • If no, please state why.	Yes
Does your floodplain management staff need any assistance or training to support its floodplain management program? • If so, what type of assistance/training is needed?	Yes E072 – Hazus – MH for Flood E0194- Advanced Floodplain Management Concepts E0272- Managing the Floodplain Post-Disaster

Criteria	Response
	E0273- Managing Floodplain through NFIP E0278- NFIP / Community Rating System E0282- Advanced Floodplain Concepts II CFM Certification training program if available.
Does your jurisdiction participate in the Community Rating System (CRS)?	Yes
• If so, is your jurisdiction seeking to improve its CRS Classification?	Yes the County would like to improve its CRS rating to 4
• If not, is your jurisdiction interested in joining the CRS program?	Already participate in CRS
• How many Flood Insurance policies are in force in your jurisdiction?[a]	432
• What is the insurance in force? [a]	$127,113,000
• What is the premium in force? [a]	$336, 931
• How many total loss claims have been filed in your jurisdiction? [a]	113
• How many claims were closed without payment/are still open? [a]	0
• What were the total payments for losses? [a]	$1,924,727.00

a. According to FEMA records as of 11/30/15.

Table 1-5. **Community Classifications**

	Participating?	Classification	Date Classified
Community Rating System	Yes	5	October 2015
Building Code Effectiveness Grading Schedule	Yes	3	November 2015
Public Protection	Yes	Varies by Fire District	Varies – Information available at each Fire District
Storm Ready	No	N/A	N/A
Firewise	No	N/A	N/A

Table 1-6. **Education and Outreach**

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes – The Communications Office reports directly to the County Manager. Public Works and Public Health have PIOs as well.
Do you have personnel skilled or trained in website development?	Yes – PIO has a Graphic Designer Information Technology Dept. – Web design team
Do you have hazard mitigation information available on your website?	Minimal and on individual department sites. Plan to have a one stop website with links in the future.
• If yes, please briefly describe.	Hazard Mitigation Plan on its own site.
Do you utilize social media for hazard mitigation education and outreach?	Yes
• If yes, please briefly describe.	Currently- Facebook, Twitter, Floodplain Newsletter Future- Possibly Youtube
Do you have any citizen boards or commissions that address issues related to hazard mitigation?	Yes
• If yes, please briefly specify.	Development & Engineering Advisory Board Works with Public Works and community development to review policy and code changes

Criteria	Response
	Planning Commission Advises the BOCC on matters related to physical development in unincorporated areas. Stakeholder Advisory Committee High level guidance for update of codes and design governing stormwater management. Technical Committee Advise on technical aspect of stormwater design and codes. Board of Health Exercises final authority over all matters pertaining to preservation of life and health of the people of Clark County
Do you have any other programs already in place that could be used to communicate hazard-related information? • If yes, please briefly describe.	Yes Internally- Employee FYI weekly newsletter, monthly safety committee meetings External- News releases, Clark-Vancouver Television (CVTV), Clark County Neighborhood Associations, various County mailings (ie. The Public Works annual newsletter to the special flood hazard area Clark County Fire Marshal Spring Wildfire Campaign
Do you have any established warning systems for hazard events? • If yes, please briefly describe.	Yes Internal to County Government: Emergency Notification System (ENS) –desktop application. External: Clark Regional Emergency Services Agency (CRESA) – Public Alerts system (Everbridge - wireless, VOIP, emails)

1.4 INTEGRATION WITH OTHER PLANNING INITIATIVES

The following describe the jurisdiction’s process for integrating the hazard mitigation plan into local planning mechanisms.

1.4.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan:

- Currently – Risk assessments from the 2017 Hazard Mitigation Plan were used to inform the 2019 Regional Disaster Debris Management Plan as well as planning efforts in Public Works.
- A direct linkage enabling future integration, was included in the 2016 update to the County Comprehensive Plan adopted June 30, 2016.

- Title 40- Clark County Washington, Unified Development Code addresses many aspects of integration in its various sections, including Shoreline Master Program, Land Use, Development, Permitting and specific Hazard Areas. However, Title 40 needs a thorough review specifically looking at integration with this plan. That action is captured in 1.4.2

1.4.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan, but provide an opportunity for future integration:

- County Department Engagement –
  Engage all County Departments and make them aware of the contents of the Hazard Mitigation Plan and the associated risk assessment. Upon plan approval, the point of contact for the plan will meet with the directors of each county department and seek their support in using the risk assessment and identifying opportunities for integration in plans, projects and programs for which they are responsible.

- Clark County Comprehensive Plan-
  Look for opportunities to integrate goals and use the risk assessment info to in multiple chapters of the Comp Plan including the Land use, Environmental, Parks, Recreation and Open Space. Consider developing a new Mitigation Chapter in the Comp Plan. As integration opportunities are identified they will be accomplished during the Comp Plan annual update process.

  Public Works Emergency Response Plans/SOP/Ops Manual-
  Continue to integrate goals where applicable and use the risk assessment information to inform the planning efforts in Public Works. Seek opportunities to implement mitigation actions in Public Works projects as feasible.

- Regional Disaster Debris Management Plan-
  Continue to integrate goals where applicable. Use the risk assessment information and debris estimates from the Mitigation Plan in future updates.

- Clark County Stormwater Management Plan-
  Integrate goals where applicable. Use the risk assessment information to inform planning processes. Engage with Stormwater staff and look for opportunities to include mitigation considerations and action during Stormwater construction projects. The Public Works – Clean Water Division Manager will be taking over as the floodplain administrator in 2022, which should assist in identifying opportunities for integration.

- Applicable sections of Clark County Code. Some examples are Titles 12, 13,14, 15 and 40-
  Work with responsible department directors and managers to integrate the goals from the Mitigation Plan into applicable sections of the Clark County Code. Assist them in working with leadership to gain approval and updates to the code. Use the risk assessment information to inform the planning and updates. Title 12 – Streets and Roads, Title 13- Public Works, Title 14- Buildings and Structures, Title 15- Fire Prevention, Title 40 Clark County Unified Development Code.

- Clark Regional Comprehensive Emergency Management Plan and annexes (CEMP)-
  As one of the planning partners, support the integration of goals into the planning updates to the CEMP and its annexes. Where possible support mitigation actions that relate to this plan including those of other partners. Use the risk assessment information to inform planning, exercises and plan updates.

1.5 JURISDICTION-SPECIFIC NATURAL HAZARD EVENT HISTORY

Table 1-7 lists notable past occurrences of natural hazards within the jurisdiction.

Table 1-7. Natural Hazard Events

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment[a]
Severe storm, high wind	N/A	9/8/2020	N/A
Severe storm, high wind	N/A	1/6/2019	$252,860
Tornado	N/A	10/12/2017	N/A
Tornado	N/A	3/24/2017	N/A
Severe winter storm, heavy snow, wind, ice	N/A	1/10/2017	$31,526
Severe storm, flooding, tornado	4253	12/1/2015	$712,833
Severe storm, tornado	N/A	3/21/2013	$10,162
Severe storm, high wind	N/A	12/16/2012	$103,110
Flood	N/A	6/1/2011	$1,262,934
Flood	N/A	5/26/2011	$315,733
Severe winter storm-Snow	1825	12/12/2008	$611,898
Tornado	N/A	1/10/2008	$577,262
Severe winter storm, landslides, mudslides	1682	12/14/2006	N/A
Severe storms, flooding, landslides and mudslides	1671	11/02/2006	N/A
Severe storm, high wind	N/A	2/10/2006	$234,857
Earthquake	1361	2/28/2001	N/A
Tornado	N/A	5/11/2000	$13,747
Severe winter storm – ice storm	N/A	1/14/1998	$181,546
Tornado	N/A	5/31/1997	$14.749
Severe winter storms, land & mudslides, flooding	1159	12/26/1996	$377,208
Severe storm- high wind & flooding	1100	1/26/1996	N/A
Severe storms- high wind & flooding	1079	11/29/1995	$862,992
Flood	N/A	11/23/1990	$7,875,187
Tornado	N/A	6/29/1989	$954
Severe winter storm- high wind & snow	N/A	2/1/1989	$244,764
Flood	N/A	11/23/1986	$900,000
Tornado	N/A	10/13/1984	$11,392
Severe storm – high wind	N/A	12/24/1983	$2,971,084
Severe storm- high wind	N/A	11/24/1983	$108,039
Severe storm- high wind	N/A	11/14/1981	$333,891
Volcanic eruption- Mt St Helens	623	5/21/1980	N/A
Severe winter storm- snow	N/A	1/8/1980	$359,126
Severe storm- high wind	N/A	2/12/1979	$9,590,677
Severe storms- flood & mudslides	545	12/10/1977	N/A
Flood	N/A	12/2/1975	$169,242,207
Severe storm- high wind	N/A	1/8/1973	$666,486
Tornado	N/A	4/5/1972	$28,317,703
Severe storm- flooding & landslides	N/A	2/27/1972	$235,981
Flood	N/A	1/20/1972	$353,971
Severe storm- heavy rain & snow- flooding	185	12/29/1964	$979,057
Flood	146	3/2/1963	N/A
Severe storm- wind & rain	137	10/20/1962	$103,143
Flood	70	3/6/1957	N/A
Flood	50	2/25/1956	N/A

a. Note the Preliminary Damage Estimates are from SHELDUS and may not be exact/accurate. N/A indicates-unknown.

1.6 JURISDICTION-SPECIFIC VULNERABILITIES

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 8
- Number of FEMA-identified Severe-Repetitive-Loss Properties: Unknown
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 1

Other noted vulnerabilities include:

- No standardized method or system for capturing and retaining perishable data during and after significant events has been established. Some progress has been made, but more work is needed in this area.
- Public Works has knowledge of common localized urban shallow flooding areas and landslides areas throughout the County which affect transportation routes and may help identify areas of isolation. The information needs to be collected, reviewed, verified and mapped in GIS, then shared with our partners.
- Detailed seismic and other natural disaster assessments were not completed on County facilities.
- County Essential Functions have not been identified and prioritized.
- No back-up power is currently available at the vast majority of County Government facilities. At the few that have back-up power, the capacity is inadequate and only powers life safety systems like emergency lighting and fire suppression systems. Public Works has made some progress by installing a generator at the Operations Center and portable generator hook-ups at the rural sheds, but the maintenance facility still lacks backup power.
- Lack of alternate and back-up communications at County Facilities.
- Lack of integration of disaster, response and recovery planning efforts, internally and externally. No common references and resources used in plan development. General lack of awareness of other planning efforts.
- Many critical county and non-county facilities are located in liquefaction areas.
-
- The cascading effects from a very strong earthquake on Cascadia or Portland Hills is not well known.
- The Regional Debris Management Plan needs expanded to include pre-identifying contractors with necessary qualifications for key positions.

1.7 HAZARD RISK RANKING

Table 1-8 presents the ranking of the hazards of concern.

Table 1-8. **Hazard Risk Ranking**

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Severe Weather	51	High
2	Earthquake	48	High
3	Flood	21	High
4	Wildfire	19	Medium
5	Landslide	18	Medium
6	Dam Failure	6	Low
7	Volcano	4	Low
8	Drought	3	Low

1.8 STATUS OF PREVIOUS PLAN INITIATIVES

Table 1-9 summarizes the initiatives that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared. The actions identified in the following table were developed in 2016. It should be noted, that since their identification, the county experienced a reorganization and significant staff turnover including management in many of the programs that are instrumental in making progress on the initiatives. In addition, the COVID-19 Pandemic curtailed interaction with the public, greatly affecting outreach due to cancellation of in person events such as the Fair, home and garden shows, and many in person inspections and visits.

Table 1-9 Status of Previous Plan Initiatives

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
Where appropriate, support retro-fitting, relocation or acquisition from willing property owners of structures located in hazard prone areas to protect structures from future damage, with repetitive and severe repetitive loss as a priority. Seek opportunities to leverage partnerships within the planning area in these pursuits.		X	
Comment: Carry Over – Clark County will continue to look for and support these opportunities when appropriate. See Action # CC-1 in updated Action Plan.			
Integrate the hazard mitigation plan into other plans, programs, ordinances , codes and databases that dictate land use decisions, unified development, comprehensive planning, critical areas ordinances, stormwater etc. within the community. Ensure managers and planners within responsible departments are aware of the hazard mitigation plan, the information contained within it, and its potential for integration. Do so through direct engagement, training and education.		X	
Comment: Carry Over – The hazard mitigation plan has been used to inform other plans. The emergency management coordinator will continue to raise awareness among directors and managers in key departments and champion integration where possible. See Action #CC-2 in updated Action Plan.			
Develop and implement a program to capture perishable data during and after significant events (e.g. high water marks, preliminary damage estimates, damage photos) to support our partners and future mitigation efforts including the update, implementation and maintenance of the hazard mitigation plan. Support the establishment of a county-wide repository for capturing this information.		X	
Comment: Carry Over – Some basic mechanisms have been put in place to capture data. Clark County will look to expand these and integrate them into the response. See Action # CC-3 in updated Action Plan.			
Support the County-wide initiatives identified in Volume I of the hazard mitigation plan.	X	X	
Comment: Completed / Carry Over (Ongoing) – The county actively supports the County-wide initiatives. See Action # CC-4 in updated Action Plan.			
Actively participate in the plan maintenance protocols outlined in Volume I of the hazard mitigation plan. Share lessons learned and mitigation success stories and actively participate in progress reporting.	X	X	
Comment: Completed / Carry Over (Ongoing) – The county is an active partner and continues to participate in plan maintenance protocols, sharing of information and reporting. See Action # CC-5 in updated Action Plan.			
Continue to maintain good standing and compliance under the National Flood Insurance Program (NFIP). This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP.	X	X	
Comment: Completed / Carry Over (Ongoing) – The county has maintained its standing in the NFIP. See Action # CC-6 in updated Action Plan.			
Work with building officials to identify ways to improve our jurisdiction's BCEGS classification.		X	
Comment: Carry Over – The county will continue looking for ways to improve our BCEGS classification. See Action #CC-7 in updated Action Plan.			

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
In cooperation with our participating jurisdictional partners, finalize the Regional Disaster Debris Management Plan by incorporating changes that were recommended during the 2014 review of the draft plan. Identify, assess and document debris collection sites. Ensure the plan meets at least the minimum requirements for future review and approval.	X	X	
Comment: Completed - Carry Over (Modified)- The Regional Debris Management Plan was completed in February 2019 and approved by FEMA. Action Item will be carried over and modified to include plan review, maintenance and expansion as needed. See Action # CC-8 in updated Action Plan.			
Maintain the County CRS classification and where appropriate take steps to improve our CRS classification.	X	X	
Comment: Completed / Carry Over – The county has maintained CRS classification and will continue to do so while seeking improvement in classification as appropriate. See Action # CC-9 in updated Action Plan.			
Establish a program to encourage voluntary structural retro-fitting of older homes on vulnerable soils by providing information and resources during scheduled public outreach events and when requested. Comment: Carry Over – See Action #CC-10 in updated Action Plan.		X	
Establish a program to encourage voluntary non-structural and structural retro-fitting throughout the County by providing information and resources during scheduled public outreach events and when requested. Comment: Carry Over – See Action #CC-11 in updated Action Plan.		X	
Establish a program to encourage structural retro-fitting of hazardous materials containment during Clark County Fire Marshal operational permit inspections. Comment: Carry Over – See Action #CC-12 in updated Action Plan.		X	
Establish a program to encourage non-structural retro-fitting of hazardous materials containment during Clark County Fire Marshal annual facilities visits. Comment: Carry Over – See Action #CC-13 in updated Action Plan.		X	
Establish a program to encourage and assist residents in understanding the benefits of defensible space to minimize and reduce the impacts of fires during public outreach opportunities and the Spring Wildfire Campaign. Comment: Carry Over – See Action #CC-14 in updated Action Plan.		X	
Develop a program within the Community Development Department (Building Safety) to review the unincorporated area critical facilities list from the hazard mitigation plan, prioritize the list, and conduct outreach and education to owners concerning pre-disaster assessments.		X	
Comment: Carry Over – Community Development Building Safety is reviewing and verifying the list in conjunction with a project to enhance our capability to conduct post disaster rapid assessments on buildings and bridges. See Action #CC-15 in updated Action Plan.			
Develop a standard hazards planning map in GIS using the best available information. Include layers for each of the hazards identified in the hazard mitigation plan. In addition, create a map layer of the known shallow flood areas based on information from Public Works, and other layers including liquefaction and critical facilities and transportation infrastructure. Once complete, integrate this mapping into planning. New layers should be added as a need is identified. Share within the County Government and with our planning partners. Comment: Carry Over – See Action #CC-16 in updated Action Plan.		X	
Establish a hazard mitigation webpage on the Clark County internet website with links to pertinent hazard mitigation topics and information from County Departments (I.E. retro-fit information, defensible space, etc.) to support public outreach and education as well as other action items.		X	

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
Include a link to the hazard mitigation plan and information on CRESA's website. Comment: Carry Over (Modified) – Many departments have information and resources available on their individual webpages, including Community Development Building for commercial and residential and the Fire Marshals webpage. See Action #CC-17 in updated Action Plan.			
Expand our participation in the Great Washington SHAKEOUT drill throughout the County Government. Exercise the ENS system during the drill. Conduct de-briefings and collect lessons learned and improve our procedures to enhance earthquake preparedness and employee safety. Encourage the public to participate as well, using social media, website, and other public outreach methods. Comment: Completed / Carry Over (Ongoing) – Clark County government actively participates in the Great Washington SHAKEOUT each year and has implemented all the actions including AARs and process improvements as well as actively encouraging others to participate. See Action #CC-18 in updated Action Plan.	X	X	
Add a hazard mitigation information section to the annual newsletter mailing to the special flood hazard area. Include hazard information and resources as part of our public outreach. Comment: Completed / Carry Over (Ongoing) – Hazard mitigation information added to the annual newsletter. See Action #CC-19 in updated Action Plan.	X	X	
Where feasible, continue to encourage and support efforts to re-open/improve access roads into the County forest for fire suppression and fuel breaks. Comment: Completed / Carry Over (Modified) – County Parks has made significant progress in thinning, clearing and opening the county forest at Camp Bonneville, improving resilience to wildfire and access for suppression. See Action #CC-20 in updated Action Plan.	X	X	
Develop a County Continuity Of Operations Plan (COOP). Initial priority is to identify and prioritize County essential functions and critical facilities based on function during an event. Comment: Carry Over (Modified) – Minor progress has been made on COOP development at the department level. Primary focus will shift to facilities. See Action #CC-21 in updated Action Plan.		X	
Conduct pre-disaster assessments (seismic, flood, severe weather, back-up power, etc.) on County critical facilities based on information determined in Action #CC-21. Comment: Carry Over – See Action #CC-22 in updated Action Plan.		X	
Based on information from Action #CC-22, identify and prioritize County critical facilities to target for retro-fit and back-up power, or most likely to require an alternate site during a major event or disaster. Comment: Carry Over – See Action #CC-23 in updated Action Plan.		X	
Based on the information gathered in Actions #CC-22 & CC-23, procure and install alternate/back-up power generators and/or emergency generator quick connect hook-ups in County critical facilities as funding becomes available. Install and maintain surge protection on critical electronic equipment. Comment: Carry Over – Public Works has installed a permanent generator at the operations center and quick connect hook-ups at the rural shed locations for use with portable or trailer mounted generators. See Action #CC-24 in updated Action Plan.		X	

1.9 HAZARD MITIGATION ACTION PLAN AND EVALUATION OF RECOMMENDED ACTIONS

Table 1-10 lists the actions that make up the Clark County hazard mitigation action plan. Table 1-10 identifies the priority for each action. Table 1-11 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Table 1-10. **Hazard Mitigation Action Plan Matrix**

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency[a]	Estimated Cost	Sources of Funding	Timeline
CC-1—Where appropriate, support retro-fitting, relocation or acquisition from willing property owners of structures located in hazard prone areas to protect structures from future damage, with repetitive and severe repetitive loss as a priority. Seek opportunities to leverage partnerships within the planning area in these pursuits.						
Existing	All Hazards	4, 5, 7, 9, 10	Public Works-Construction & Design* / Community Development-Building Safety	High	HMGP, PDM, FMA, CDBG-DR	Short-term
CC-2—Integrate the hazard mitigation plan into other plans, programs, ordinances , codes and databases that dictate land use decisions, unified development, comprehensive planning, critical areas ordinances, stormwater etc. within the community. Ensure managers and planners within responsible departments are aware of the hazard mitigation plan, the information contained within it, and its potential for integration. Do so through direct engagement, training and education.						
New and Existing	All Hazards	2, 4	Community Planning*/ Community Development / Public Works/ Public Health / Emergency Management Coordinator(*engagement & education)	Low	Staff Time, General Funds	On-going
CC-3—Develop and implement a program to capture perishable data during and after significant events (e.g. high water marks, preliminary damage estimates, damage photos) and integrate into our response in order to support our partners and future mitigation efforts including the update, implementation and maintenance of the hazard mitigation plan. Support the establishment of a county-wide repository for capturing this information.						
Existing	All Hazards	1, 2, 4, 12	Emergency Management Coordinator* / Public Works- OPS	Low	Staff Time, General Funds	Short-term
CC-4—Support the County-wide initiatives identified in Volume I of the hazard mitigation plan.						
New and Existing	All Hazards	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	Emergency Management Coordinator* / All County Departments (as needed)	Low	Staff Time, General Funds	Ongoing
CC-5—Actively participate in the plan maintenance protocols outlined in Volume I of the hazard mitigation plan. Share lessons learned and mitigation success stories and actively participate in progress reporting.						

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency[a]	Estimated Cost	Sources of Funding	Timeline
New and Existing	All Hazards	1, 4	Emergency Management Coordinator	Low	Staff Time, General Funds	Ongoing
CC-6—Continue to maintain good standing and compliance under the National Flood Insurance Program (NFIP). This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP: • Enforcement of the flood damage prevention ordinance. • Participate in floodplain identification and mapping updates. • Provide public assistance/information on floodplain requirements and impacts.						
New and Existing	Flood	1, 4, 5, 9	Public Works-Construction & Design	Low	Staff Time, General Funds	On-going
CC-7— Work with building officials to identify ways to improve our jurisdiction's BCEGS classification.						
New	Earthquake, Flood, Landslide, Severe Weather, Volcano, Wildfire	5, 6, 7, 10, 12	Community Development-Building Safety	Low	Staff Time, General Funds	Short-term
CC-8—In cooperation with our participating jurisdictional partners, establish a schedule for review and maintenance of the Regional Disaster Debris Management Plan. Where feasible, seek opportunities to expand the Plan.						
Existing	All Hazards	1, 2, 4, 6	Public Works-Emergency Management Coordinator* / Public Health - Solid Waste / Internal Services - Procurement /	Medium	Staff Time, General Funds, Interns, EMPG	Short-term
CC-9— Maintain the County CRS classification and where appropriate take steps to improve our CRS classification.						
New and Existing	Flood, Dam Failure	1, 6, 7 ,9, 10, 11, 12	Public Works-Construction & Design	Low	Staff Time, General Funds	Short-term
CC-10—Establish a program to encourage voluntary structural retro-fitting of older homes on vulnerable soils by providing information and resources during scheduled public outreach events and when requested.						
Existing	Earthquake	1, 2, 8, 9	Community Development-Building Safety	Low	Staff Time, General Funds	Short-term
CC-11—Establish a program to encourage voluntary non-structural and structural retro-fitting throughout the County by providing information and resources during scheduled public outreach events and when requested.						
Existing	Earthquake	1, 2, 5, 9, 10,	Community Development-Building Safety	Low	Staff Time, General Funds	Short-term
CC-12—Establish a program to encourage structural retro-fitting of hazardous materials containment during Clark County Fire Marshal operational permit inspections.						
Existing	Earthquake, Flood, Severe Weather, Dam Failure	1, 4, 6, 8, 9, 10, 11	Community Development- Fire Marshal*	Low	Staff Time, General Funds	Short-term
CC-13— Establish a program to encourage non-structural retro-fitting of hazardous materials containment during Clark County Fire Marshal annual facilities visits.						
Existing	Earthquake	1, 4, 6, 8, 9, 10	Community Development- Fire Marshal*	Low	Staff Time, General Funds	Short-term

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency[a]	Estimated Cost	Sources of Funding	Timeline
CC-14—Establish a program to encourage and assist residents in understanding the benefits of defensible space to minimize and reduce the impacts of fires during public outreach opportunities and the Spring Wildfire Campaign.						
New and Existing	Wildfire	1, 2, 4, 6, 10	Community Development- Fire Marshal*	Low	Staff Time, General Funds	Short-term
CC-15— Develop a program within the Community Development Department (Building Safety) to review the unincorporated area critical facilities list from the hazard mitigation plan, prioritize the list, and conduct outreach and education to owners concerning pre-disaster assessments.						
Existing	Severe Weather, Flood, Landslide, Wildfire, Wildfire	1, 2, 8, 9, 10	Community Development- Building Safety*/ Fire Marshal	Medium	Staff Time, General Funds	Short-term
CC-16—Develop a standard hazards planning map in GIS using the best available information. Include layers for each of the hazards identified in the hazard mitigation plan. In addition, create a map layer of the known shallow flood areas based on information from Public Works, and other layers including liquefaction and critical facilities and transportation infrastructure. Once complete, integrate this mapping into planning. New layers should be added as a need is identified. Share within the County Government and with our planning partners.						
New and Existing	All Hazards	4, 6, 12	Clark County GIS Department* / Emergency Management Coordinator / Public Works/ Community Development / Public Health / CRESA	Low	Staff Time, General Funds	Short-term
CC-17—Verify, update, and expand the hazard mitigation information on county department internet websites. Establish a hazard mitigation webpage on the Clark County internet website with links to pertinent hazard mitigation topics and information from County Departments (I.E. retro-fit information, defensible space, etc.) to support public outreach and education as well as other action items. Include a link to the hazard mitigation plan and information on CRESA's website.						
New and Existing	All Hazards	1, 4, 6	Communications Office* / Emergency Management Coordinator / Community Planning / Community Development / Public Works / Public Health	Low	Staff Time, General Funds	Short-term
CC-18—Continue our participation in the Great Washington SHAKEOUT drill throughout the County Government. Exercise the ENS system during the drill. Conduct de-briefings and collect lessons learned and improve our procedures to enhance earthquake preparedness and employee safety. Encourage the public to participate as well, using social media, website, and other public outreach methods.						
Existing	Earthquake	1, 3, 10	Emergency Management Coordinator */ All Departments	Low	Staff Time, General Funds	On-going
CC-19—Continue the hazard mitigation information section in the annual newsletter mailing to the special flood hazard area. Include hazard information and resources as part of our public outreach.						

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency[a]	Estimated Cost	Sources of Funding	Timeline
New and Existing	Flood, Severe Weather	1, 6	Public Works-PIO* / Emergency Management Coordinator	Low	Staff Time, General Funds	Ongoing
CC-20— Where feasible, continue to encourage and support efforts to re-open/improve access roads into the County forest for fire suppression and fuel breaks. Maintain progress made and support thinning and other mitigation measures at Camp Bonneville.						
New and Existing	Wildfire	4, 10, 11	Public Works – Parks / Forestry	High	PDM	Short-term
CC-21— Identify and prioritize County critical facilities based on function and potential for use during incidents as a result of each hazard of concern. Take into account known vulnerabilities during prioritization. Where feasible, take advantage of opportunities to support County departments Continuity Of Operations Plan (COOP) development.						
Existing	All Hazards	2, 3, 4, 10	Emergency Management Coordinator* / County Manager & Directors of all County Departments	Medium	Staff Time, General Funds , EMPG	Short-term
CC-22—Conduct pre-disaster assessments (seismic, flood, severe weather, back-up power, etc.) on County critical facilities based on information determined in Action #CC-21.						
Existing	Severe Weather, Earthquake, Flood, Landslide, Wildfire	2, 3, 4, 8, 10	County Risk Manager* / Emergency Management Coordinator / Community Development-Building Safety / Public Works-Engineering / Internal Services-Facilities Management	Medium	Staff Time, General Funds	Short-term
CC-23- Based on information from Action #CC-22, identify and prioritize County critical facilities to target for retro-fit and back-up power, or most likely to require an alternate site during a major event or disaster.						
Existing	All Hazards	3, 6, 8, 10	Emergency Management Coordinator*/ Internal Services-Facilities Management	Low	Staff Time, General Funds	Short-term
CC 24—Based on the information gathered in Actions #CC-22 & CC-23, procure and install alternate/back-up power generators and/or emergency generator quick connect hook-ups in County critical facilities as funding becomes available. Install and maintain surge protection on critical electronic equipment.						
Existing	All Hazards	3, 6, 8, 10	Internal Services-Facilities Management* / Information Technology / Emergency	High	HMGP, PDM	Long-term

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency[a]	Estimated Cost	Sources of Funding	Timeline
			Management Coordinator			

a. * denotes lead agency

Table 1-11. **Mitigation Strategy Priority Schedule**

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
CC-1	5	High	High	Yes	Yes	No	Medium	High
CC-2	2	Medium	Low	Yes	No	Yes	High	Low
CC-3	4	Low	Low	Yes	No	Yes	High	Low
CC-4	12	Low	Low	Yes	No	Yes	High	Low
CC-5	2	Low	Low	Yes	No	Yes	High	Low
CC-6	4	Medium	Low	Yes	No	Yes	High	Low
CC-7	5	Medium	Low	Yes	No	Yes	High	Low
CC-8	4	Medium	Medium	Yes	Yes	No	Medium	High
CC-9	7	Medium	Low	Yes	No	Yes	High	Low
CC-10	4	Medium	Low	Yes	No	Yes	High	Low
CC-11	5	Medium	Low	Yes	No	Yes	High	Low
CC-12	7	Medium	Low	Yes	No	Yes	High	Low
CC-13	6	Medium	Low	Yes	No	Yes	High	Low
CC-14	5	Medium	Low	Yes	No	Yes	High	Low
CC-15	5	Medium	Medium	Yes	No	No	Medium	Low
CC-16	3	Low	Low	Yes	No	Yes	High	Low
CC-17	3	Low	Low	Yes	No	Yes	High	Low
CC-18	3	Medium	Low	Yes	No	Yes	High	Low
CC-19	2	Low	Low	Yes	No	Yes	High	Low
CC-20	3	High	High	Yes	Yes	No	Medium	High
CC-21	4	Medium	Medium	Yes	Yes	No	Medium	High
CC-22	5	Medium	Medium	Yes	No	No	Medium	Low
CC-23	4	Low	Low	Yes	No	Yes	High	Low
CC-24	4	Medium	High	No	Yes	No	Low	Medium

a. See the introduction to this volume for explanation of priorities.

Table 1-12. **Analysis of Mitigation Actions**

Hazard Type	Action Addressing Hazard, by Mitigation Type[a]					
	1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Dam Failure	CC-2, CC-3, CC-4, CC-5, CC-6, CC-8, CC-9, CC-16	CC-1, CC-6, CC-9, CC-12	CC-4, CC-6, CC-9, CC-12, CC-16, CC-17	CC-9	CC-8, CC-9, CC-16, CC-21, CC-23, CC-24	CC-9, CC-12

Hazard Type	Action Addressing Hazard, by Mitigation Type[a] 1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Drought	CC-2, CC-3, CC-4, CC-5	CC-1	CC-4, CC-17		CC-21, CC-24	
Earthquake	CC-2, CC-3, CC-4, CC-5, CC-7, CC-8, CC-18	CC-1, CC-7, CC-10, CC-11, CC-12, CC-13	CC-4, CC-10, CC-11, CC-12, CC-13, CC-15, CC-16, CC-17, CC-18, CC-22, CC-23		CC-8, CC-15, CC-16, CC-18, CC-21, CC-22, CC-23, CC-24	CC-12
Flood	CC-2, CC-3, CC-4, CC-5, CC-6, CC-7, CC-8, CC-9, CC-16	CC-1, CC-6, CC-7, CC-9, CC-12	CC-4, CC-6, CC-9, CC-12, CC-15, CC-16, CC-17, CC-19, CC-22, CC-23	CC-9	CC-8, CC-15, CC-16, CC-21, CC-22, CC-23, CC-24	CC-9, CC-12
Landslide	CC-2, CC-3, CC-4, CC-5, CC-7, CC-8, CC-16	CC-1, CC-7	CC-4, CC-15, CC-16, CC-17, CC-22, CC-23		CC-8, CC-15, CC-16, CC-21, CC-22, CC-23, CC-24	
Severe Weather	CC-2, CC-3, CC-4, CC-5, CC-7, CC-8	CC-1, CC-7, CC-12	CC-4, CC-12, CC-15, CC-16, CC-17, CC-19, CC-22, CC-23		CC-8, CC-15, CC-16, CC-21, CC-22, CC-23, CC-24	CC-12
Volcano	CC-2, CC-3, CC-4, CC-5, CC-7, CC-8	CC-1, CC-7	CC-4, CC-16, CC-17		CC-8, CC-21, CC-24	
Wildfire	CC-2, CC-3, CC-4, CC-5, CC-7, CC-14, CC-20	CC-1, CC-7	CC-4, CC-14, CC-15, CC-16, CC-17, CC-22, CC-23	CC-20	CC-8, CC-15, CC-16, CC-21, CC-22, CC-23, CC-24	

a. See the introduction to this volume for explanation of mitigation types.

1.10 Future Needs to Better Understand Risk/Vulnerability

The following information was identified as having the potential to increase the understanding of risk and vulnerability in Clark County:

- Detailed study of the cascading effects resulting from a large or very large earthquake on the Cascadia or Portland Hills fault.
- Detailed information on building stock construction types in the planning area.
- Detailed flood mapping of the Lewis River system.
- As science improves, better understanding and future mapping of landslide runout areas/zones.

2. CITY OF BATTLE GROUND

2.1 HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact
Mark Herceg, PE, Public Works Director
109 SW 1st Street, Suite 122
Battle Ground, Washington 98604
360-342-5075
mark.herceg@cityofbg.org

Alternate Point of Contact
Ryan Jeynes, PE, City Engineer
109 SW 1st Street, Suite 122
Battle Ground, Washington 98604
360-342-5078
ryan.jeynes@cityofbg.org

2.2 JURISDICTION PROFILE

The following is a summary of key information about the jurisdiction and its history:

- Date of Incorporation—June 18, 1951
- Current Population—20,743 as of April 1, 2020 (Washington State Office of Financial Management)
- Population Growth—The population of Battle Ground slowly grew from the 1950s through 1980s. Like many other cities within the county, Battle Ground experienced a large increase in population from the late 1990s through the 2000s. Since 2007, the City has experienced a period of rather slow growth. Upcoming growth projections anticipate an increase in population to 39,309 persons estimated in 2035.
- Location and Description—Battle Ground is located in the heart of Clark County, Washington, just six miles from Interstate 5. The community lies between the Pacific Ocean and the Cascade Mountains, providing citizens and visitors with scenic and pristine landscapes.
- Brief History—On the 26th of May, 1951, a special election was held to determine whether or not a corporation to be known as the Town of Battle Ground should be established. Voters approved the incorporation of the new town and at the same time elected its first city council and its first mayor, Mr. P.L. Rasmussen. Washington State recognized the incorporation of the Town of Battle Ground, population 742, on June 18, 1951. Eventually, the Town of Battle Ground became the City of Battle Ground and the population has grown to over 20,000.
- Climate—The City is sheltered by the Cascade Mountains to the east and the Coast Range to the west. The climate is generally mild, with average temperatures ranging from 42 degrees in winter to 76 degrees during the summer months. Battle Ground is at an altitude of 280 feet above sea level. The average annual precipitation is 69.06 inches.
- Governing Body Format—The citizens of Battle Ground voted to adopt the Council-Manager form of government in 1997. Under this form of government, the City Council is responsible for the legislative function of the city such as establishing policy, passing local ordinances, approving budget appropriations, and developing an overall vision. The Council appoints a professional City Manager to implement its policies, serve as advisor, and oversee administrative operations. The City Manager assumes responsibility for the adoption of this plan; the Public Works Director will oversee its implementation.

- Development Trends—Population and corresponding new development within the Urban Growth Area for the City of Battle Ground have grown significantly since 1995 resulting in the City annexing approximately 682 acres. The majority of this land has been designated for residential use, though some of this land has been designated for industrial and business park use. The City of Battle Ground's Comprehensive Plan will guide development in the City. The plan provides broad guidance on development practices within the City to address the concerns reflected in the Growth Management Act. The plan is intended to reflect expected growth for a 20-year period.

2.3 CAPABILITY ASSESSMENT

An assessment of legal and regulatory capabilities is presented in Table 2-1. An assessment of fiscal capabilities is presented in Table 2-2. An assessment of administrative and technical capabilities is presented in Table 2-3. Information on National Flood Insurance Program (NFIP) compliance is presented in Table 2-4. Classifications under various community mitigation programs are presented in Table 2-5. An assessment of education and outreach capabilities is presented in Table 2-6.

Table 2-1. Legal & Regulatory Capabilities

Code	Local Authority	Other Jurisdiction Authority	State Mandated
Building Code **Comment**: BGMC 15.104 Ord 95-769	Yes	No	Yes
Zoning Code **Comment**: BGMC 17.101 Ord 95-769	Yes	No	Yes
Subdivisions **Comment**: BGMC 16.115 Ord 99-008	Yes	No	Yes
Stormwater Management **Comment**: BGMC 18.250 Ord 96-802	Yes	No	Yes
Post-Disaster Recovery Comment: None	No	No	No
Real Estate Disclosure Comment: None	No	No	No
Growth Management **Comment** BGMC 17.101.020 Ord 95-769	Yes	No	Yes
Site Plan Review **Comment**: BGMC 17.143 Ord 95-769	Yes	No	No
Environmental Protection **Comment**: BGMC 18.100 Ord 00-015	Yes	No	Yes
Flood Damage Prevention **Comment** BGMC 18.310 Ord 04-025	Yes	No	Yes
Emergency Management **Comment**: BGMC 2.74 Ord 06-03	Yes	No	Yes
Climate Change Comment: None	No	No	No
Other Comment: None	No	No	No
General or Comprehensive Plan Is the plan equipped to provide linkage to this mitigation plan? No **Comment**: BGMC 17.101.040 Ord 95-769 1995	Yes	No	Yes
Capital Improvement Plan **Comment**: Water, Sewer, Stormwater, Transportation. Updated as necessary or required.	Yes	No	Yes
Floodplain or Watershed Plan	Yes	No	No

Table 2-1. Legal & Regulatory Capabilities

Code	Local Authority	Other Jurisdiction Authority	State Mandated
Comment: BGMC 18.310 Ord 04-025			
Stormwater Plan ***Comment:*** August 2015 Ord 15-07	Yes	Yes	Yes
Habitat Conservation Plan ***Comment*** BGMC 18.280 Ord 04-025	Yes	No	No
Shoreline Management Plan ***Comment:*** February 2021 Ord 2021-13	Yes	No	Yes
Community Wildfire Protection Plan **Comment**: None	No	No	No
Forest Management Plan **Comment**: None	No	No	No
Climate Action Plan Comment: None	No	No	No
Water System Emergency Response Plan ***Comment:*** December 2021	Yes	No	Federal
Comprehensive Emergency Management Plan ***Comment:*** BGMC 2.74 Ord 06-03	Yes	Yes	Yes
Threat & Hazard Identification & Risk Assessment Comment: None	No	No	No
Post-Disaster Recovery Plan Comment: None	No	No	No
Continuity of Operations Plan Comment: None	No	No	No
Public Health Plan ***Comment:*** None – Plan administered by the Clark County Public Health Dept.	No	Yes	No

Table 2-2. Fiscal Capability

Financial Resources	Accessible or Eligible to Use?
Community Development Block Grants	Yes
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	Yes – Utility Taxes
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	No
Withhold Public Expenditures in Hazard-Prone Areas	Yes
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	Yes
Other	No

Table 2-3. Administrative and Technical Capability

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Planning Department/ City of BG / Planning Supervisor
Engineers or professionals trained in building or infrastructure construction practices	Yes	Public Works Department / City of BG / City Engineer
Planners or engineers with an understanding of natural hazards	Yes	Public Works Department / City of BG / City Engineer

Staff/Personnel Resources	Available?	Department/Agency/Position
Staff with training in benefit/cost analysis	Yes	Public Works Department / City of BG / City Engineer
Surveyors	No	
Staff capable of making substantial damage estimates	Yes	Public Works Department / City of BG / City Engineer
Personnel skilled or trained in GIS applications	Yes	Public Works Department / City of BG / Engineering & Planning personnel
Scientist familiar with natural hazards in local area	No	
Emergency manager	No	The City considers CRESA as our emergency management provider
Grant writers	Yes	Public Works Department / City of BG / Engineering personnel

Table 2-4. National Flood Insurance Program Compliance

Criteria	Response
When did the community enter the NFIP?	04/15/1981
When did the Flood Insurance Rate maps become effective?	09/05/2012
What local department is responsible for floodplain management?	Community Development
Who is your floodplain administrator? (department/position)	Community Development / Community Development Director
Is this a primary or auxiliary role?	Primary
Are any certified floodplain managers on staff in your jurisdiction?	No
What is the date of adoption of your flood damage prevention ordinance?	2004
Does your floodplain management program meet or exceed minimum requirements? If so, in what ways?	Meet
When was the most recent Community Assistance Visit or Community Assistance Contact?	Unknown
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed? If so, please state what they are.	No
Do your flood hazard maps adequately address the flood risk within your jurisdiction? If no, please state why.	Yes
Does your floodplain management staff need any assistance or training to support its floodplain management program? If so, what type of assistance/training is needed?	No
Does your jurisdiction participate in the Community Rating System (CRS)? If so, is your jurisdiction seeking to improve its CRS Classification?	No
If not, is your jurisdiction interested in joining the CRS program?	No
How many Flood Insurance policies are in force in your jurisdiction?[a]	17
What is the insurance in force? [a]	$4,579,000
What is the premium in force? [a]	$9,025
How many total loss claims have been filed in your jurisdiction? [a]	3
How many claims were closed without payment/are still open? [a]	1
What were the total payments for losses? [a]	$3,265.40

a. According to FEMA records as of 3/30/2022.

Table 2-5. Community Classifications

	Participating?	Classification	Date Classified
Community Rating System	No	N/A	N/A
Building Code Effectiveness Grading Schedule	No	N/A	N/A
Public Protection	No	N/A	N/A
Storm Ready	No	N/A	N/A
Firewise	No	N/A	N/A

Table 2-6. Education and Outreach

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes – We have a dedicated Public Information Officer.
Do you have personnel skilled or trained in website development?	Yes
Do you have hazard mitigation information available on your website? If yes, please briefly describe.	No N/A
Do you utilize social media for hazard mitigation education and outreach? If yes, please briefly describe.	Yes City Website, Facebook
Do you have any citizen boards or commissions that address issues related to hazard mitigation? If yes, please briefly specify.	No
Do you have any other programs already in place that could be used to communicate hazard-related information? If yes, please briefly describe.	No
Do you have any established warning systems for hazard events? If yes, please briefly describe.	No

2.3.1 Discovery Clean Water Alliance

The City of Battle Ground is a member of the Discovery Clean Water Alliance, which was legally formed on January 4, 2013. The Alliance serves four Member agencies – the City of Battle Ground, Clark County, Clark Regional Wastewater District and the City of Ridgefield. The Members jointly own and jointly manage regional wastewater assets under Alliance ownership through an interlocal framework established under the Joint Municipal Utility Services Act (RCW 39.106). The Alliance seeks to optimize the long-term framework for delivery of regional wastewater transmission and treatment services to the urban growth areas in the central portion of Clark County, Washington.

2.4 INTEGRATION WITH OTHER PLANNING INITIATIVES

The following describe the jurisdiction's process for integrating the hazard mitigation plan into local planning mechanisms.

2.4.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan:

- Battle Ground Municipal Code 18.310 stipulates that the purpose of the chapter is to promote the public health, safety and general welfare, and to minimize public and private losses due to flood conditions in specific areas by methods and provisions designed for by restricting or prohibiting uses which are dangerous to health, safety and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities. This flood damage prevention ordinance regulates areas in the special flood hazard areas designated by FEMA. This data forms the basis of the flood risk assessment for the hazard mitigation plan.

- Battle Ground Municipal Code 18.320 stipulates the shoreline master program (SMP) is to implement the goals, policies, regulations, and procedures set forth by the Shoreline Management Act of 1971, as amended, and all applicable provisions contained in the Washington Administrative Code. All goals currently in place are consistent with Washington Administrative Code.

- Battle Ground Municipal Code 18.260 stipulates that the director, to the extent practical, shall review development for compliance with critical area regulations (with the triggering development application). Where there are no triggering applications, determination of the type of application shall be based upon the criteria in BGMC 17.200.035. Determinations of compliance with this title shall be appealable along with the decision on the underlying permit application through BGMC 17.200.140. (Ord. 04-025 § 3 (part), 2004).

1.4.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan, but provide an opportunity for future integration:

- Further development and involvement with Clark County, City of Ridgefield, and Clark Regional Wastewater District in the Discover Clean Water Alliance.
- Further development and involvement with Clark County and the City of Vancouver in the ongoing development of the Disaster Debris Response Plan.
- Further development of the City of Battle Ground Comprehensive Plan including the addition of the Hazard Mitigation Plan by reference.

2.5 JURISDICTION-SPECIFIC NATURAL HAZARD EVENT HISTORY

Table 2-7 lists all past occurrences of natural hazards within the jurisdiction.

Table 2-7. **Natural Hazard Events**

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Tornado	DR-4253	December 10, 2015	$23,970
Tornado	N/A	May 11, 2000	$11,392
Lightning	N/A	July 13, 1993	$819
Tornado	N/A	October, 1951	Unknown
Volcanic Eruption, Mt. St. Helens	DR-623	May 21, 1980	Unknown
Storms, High Winds, Floods	DR1079	November 7, 1995	Unknown
Earthquake	DR1361	February 28, 2001	Unknown
Severe Winter Storm, Landslides, and Mudslides	DR-1682	December 14, 2006	Unknown
Severe Winter Storm and Record and Near Record Snow	DR-1825	December 12, 2008	Unknown
COVID-19 Pandemic	DR-4481	January 20, 2020	Unknown

2.6 JURISDICTION-SPECIFIC VULNERABILITIES

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 0
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 0
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0

Other noted vulnerabilities include:

- The City's main water line which replenishes the city's water storage reservoirs crosses in the vicinity of potential landslide territory.
- Water Wells 4, 5, and 6 do not have backup generators.
- The Battle Ground Community Center would likely serve as a public shelter after a major event does not have a backup generator.

2.7 HAZARD RISK RANKING

Table 2-8 presents the ranking of the hazards of concern.

Table 2-8. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Severe Weather	51	Medium
2	Earthquake	48	Low
3	Landslide	18	Low
4	Flood	12	Low
5	Wildfire	8	Low
6	Drought	3	Low
7	Volcano	1	Low
8	Dam Failure	0	None

2.8 STATUS OF PREVIOUS PLAN INITIATIVES

Table 2-9 summarizes the initiatives that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared. It should be noted, that the actions identified in the following table were developed in 2004. Due to the significant amount of time and staff turnover that has occurred since their identification, the status of some actions may be unknown. Additionally, some action items were identified for jurisdictions where the lead agency identified for implementation was outside of the jurisdiction.

Table 2-9 Status of Previous Plan Initiatives

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
Encourage non-structural retrofitting throughout the County. Comment: Worked to be completed by CRESA – Unknown if this has been completed. No status Update.		X	
Support the retrofit of at-risk homes in subdivisions Comment: Continue to support the retrofitting of at-risk homes. No status update.		X	
Retrofit hazardous material containment areas. Comment: Continue to support the ongoing retrofitting of hazardous material containment. No status update		X	
Encourage non-structural retrofitting of hazardous materials containment Comment: Continue to support – No status update		X	
Develop public information packets ready to deploy following a disaster event Comment: No status update known.		X	
Expand weather radio systems to include all of Clark County Comment: Status update unknown.		X	
Conduct pre-earthquake assessments for critical and essential facilities and develop a risk-reduction strategy Comment: Status update unknown		X	
Determine critical government functions and establish redundancy for these functions. Comment: Status update unknown		X	
Develop preparedness efforts of Tier II hazardous material facilities.		X	

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
Comment: Status update unknown.			
Develop a contingency/Business resumption organization. Comment: Status update unknown.		X	
Develop integrated County stormwater basin-wide plans Comment: Work is ongoing		X	
Ensure emergency vehicle access to all residents to allow effective response and recovery from disaster events. Comment: Ongoing		X	
Develop priority routes throughout the county and improve these routes to a higher standard. Comment: Status update unknown		X	
Ensure appropriate equipment is available during events. Comment: Ongoing		X	

2.9 HAZARD MITIGATION ACTION PLAN AND EVALUATION OF RECOMMENDED ACTIONS

Table 2-10 lists the actions that make up the City of Battle Ground hazard mitigation action plan. Table 2-11 identifies the priority for each action. Table 2-12 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Table 2-10. **Hazard Mitigation Action Plan Matrix 2023-2028**

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency[a]	Estimated Cost	Sources of Funding	TImeline
BG-1 Encourage non-structural retrofitting throughout the County						
Existing	Earthquakes	1,2,4,7	CRESA – Lead Agency / Battle Ground Support Agency	Low	Owner's Expense/BG Staff time to assist in distributing information created by CRESA	On-going
BG–2 Support the retrofit of at-risk homes in subdivisions						
Existing	Wildland Fires	2,4,7,9	Fire Marshall Lead Agency/ BG Community Development Support Agency	Medium	Owner's Expense/BG Staff time to assist in distributing information created by the Fire Marshall's Office	On-going
BG–3 Retrofit hazardous material containment areas						
Existing	Earthquake	4,7,9,12	Fire Marshall Lead Agency/ BG Community Development Support Agency	High	Owner's Expense, SBA Loans, DHS/FEMA Grant/ BG Staff time to assist in distributing information created by the Fire Marshall's Office	Long-Term

BG–4 Encourage non-structural retrofitting of hazardous materials containment						
Existing	Earthquake	1,2,4,7	Fire Marshall & CRESA Lead Agencies/ BG Community Development Support Agency	Low	Owner's Expense/ BG Staff time to assist in distributing information created by the Fire Marshall's Office and/or CRESA	Ongoing
BG–5 Develop public information packets ready to deploy following a disaster event						
Existing	All Hazards	1,2,3,4	CRESA – Lead Agency / Battle Ground Support	Medium	BG Staff time to assist in distributing information created by CRESA	Short-Term
BG–6 Expand weather radio systems to include all of Clark County						
Existing	Severe Weather	3,8	CRESA – Lead Agency / Battle Ground Support	High	FEMA Grant	Long-Term
BG–7 Conduct pre-earthquake assessments for critical and essential facilities and develop a risk-reduction strategy						
Existing	Earthquake	6,10,12	BG Public Works/BG Building Dept.	Low	BG Staff Time / Operating Budget	Short-Term
BG–8 Determine critical government functions and establish redundancy for these functions						
Existing	All Hazards	6,12	BG Risk Management / CRESA Support	Low	BG & CRESA Staff Time / Operating Budget	Short-Term
BG–9 Develop preparedness efforts of Tier II hazardous material facilities						
Existing	Earthquakes	1,4,5,7	Fire Marshall Lead Agency / BG Community Development Support Agency	Low	BG Staff Time/ Owner's Expense	Long-Term
BG–10 Develop a contingency/Business resumption organization						
Existing	All Hazards	1,4,6,10	CRESA Lead Agency / BG Chamber of Commerce Support Agency / BG Support Agency	Medium	CRESA Staff Time / BG Staff Time	Long-Term
BG–11 Develop integrated County stormwater basin-wide plans						
Existing	Floods	4,6,11	Clark County Clean Water Services Lead Agency /BG Public Works Support Agency	Low	Clark County Staff Time / BG Staff Time / Operating Budget	Ongoing
BG–12 Ensure emergency vehicle access to all residents to allow effective response and recovery from disaster events						
Existing	All Hazards	2,4	Public Works Lead Agency	Medium	BG Staff Time / Operating Budget	Ongoing
BG–13 Develop priority routes throughout the county and improve these routes to a higher standard						
Existing	All Hazards	4	Clark County Public Works Lead Agency / BG Public Works support Agency / WSDOT Support Agency	High	Clark County Staff Time / BG Staff Time	Ongoing
BG–14 Ensure appropriate equipment is available during events						

Existing	All Hazards	4,10	BG Public Works	Low	Operating Budgets	Ongoing
BG–15 Where appropriate, support retro-fitting, purchase or relocation of structures located in high hazard areas and prioritize those structures that have experienced repetitive losses.						
Existing	All Hazards	4, 5, 7, 9, 10	BG Community Development	High	HMGP, PDM, FMA, CDBG-DR	Short-term
BG-16 Continue to maintain good standing and compliance under the National Flood Insurance Program (NFIP). This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP: Enforcement of the flood damage prevention ordinance Participate in floodplain identification and mapping updates Provide public assistance/information on floodplain requirements and impacts.						
New and Existing	Flood	1, 4, 5, 9	BG Community Development	Low	BG Staff Time / General Fund	Ongoing
BG-17 Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions within the community.						
New and Existing	All Hazards	2, 4	BG Community Development	Low	BG Staff Time / General Funds	Ongoing
BG-18 Install a back up generator at the community center to enable operation when the power is not available						
New	Earthquakes, Severe Storms	8	BG Public Works	High	FEMA Grant, General Funds	Medium-term
BG-19 Add generators or generator plug at well sites that don't have them						
New	Earthquakes, Severe Storms	8	BG Public Works	High	FEMA Grant, General Funds	Medium-term

Table 2-11. Mitigation Strategy Priority Schedule

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
BG–1	4	Medium	Low	Yes	No	Yes	Medium	Low
BG–2	4	Medium	Medium	Yes	No	No	High	Low
BG–3	4	Medium	High	No	Yes	No	Low	Medium
BG–4	4	Low	Low	Yes	No	Yes	Medium	Low
BG–5	4	Medium	Medium	Yes	No	No	Low	Low
BG-6	2	Medium	High	No	Yes	No	Medium	Low
BG–7	3	Medium	Low	Yes	No	Yes	Medium	Low
BG–8	2	High	Low	Yes	No	Yes	Medium	Low
BG–9	4	Low	Low	Yes	No	No	Low	Low
BG–10	4	Low	Medium	No	No	No	Low	Low
BG–11	4	Low	Medium	No	No	No	Low	Low
BG-12	2	High	Medium	Yes	No	Yes	High	Low
BG–13	1	High	Low	Yes	No	Yes	Medium	Low
BG–14	2	Medium	Low	Yes	No	Yes	Medium	Low
BG-15	5	High	High	Yes	Yes	No	Medium	High
BG-16	4	Medium	Low	Yes	No	Yes	High	Low
BG-17	2	Medium	Low	Yes	No	Yes	High	Low
BG-18	1	High	High	Yes	Yes	No	Medium	High
BG-19	1	High	High	Yes	Yes	No	Medium	Medium

a. See the introduction to this volume for explanation of priorities.

Table 2-12. Analysis of Mitigation Actions

	Action Addressing Hazard, by Mitigation Type[a]					
Hazard Type	1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Dam Failure	BG-8, BG-10, BG-16, BG-17	BG-15, BG-16	BG-5, BG-16		BG-12, BG-13, BG-14	
Drought	BG-8. BG-10, BG-17	BG-15	BG-5		BG-12, BG-13, BG-14	
Earthquake	BG-1, BG3, BG-4, BG-7, BG-8, BG-9, BG-10, BG-17	BG-1, BG-3, BG-15	BG-1, BG-4, BG-5, BG-9	BG-9	BG-3, BG-6, BG-8, BG-12, BG-13, BG-14, BG-18, BG-19	BG-6
Flood	BG-8, BG-10, BG-16, BG-17	BG-15, BG-16	BG-5, BG-16	BG-11	BG-12. BG-13, BG-14	
Landslide	BG-8, BG-10, BG-17	BG-15	BG-5		BG-12, BG-13, BG-14	
Severe Weather	BG-8, BG-10, BG-17	BG-15	BG-5		BG-6, BG-8, BG-12, BG-13, BG-14, BG-18, BG-19	BG-6
Volcano	BG-8, BG-10, BG-17	BG-15	BG-5		BG-12, BG-13, BG-14	
Wildfire	BG-8, BG-2, BG-10, BG-17	BG-2, BG-15	BG-2, BG-5		BG-12, BG-13, BG-14	

a. See the introduction to this volume for explanation of mitigation types.

3. CITY OF CAMAS

3.1 HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact
Lauren Hollenbeck, Senior Planner
616 NE 4th Avenue
Camas, WA 98607
Telephone: 360-817-1568
e-mail Address: lhollenbeck@cityofcamas.us

Alternate Point of Contact
Steve Wall, Public Works Director
616 NE 4th Avenue
Camas, WA 98607
Telephone: 360-834-6864
e-mail Address: swall@cityofcamas.us

3.2 JURISDICTION PROFILE

The following is a summary of key information about the jurisdiction and its history:

- Date of Incorporation—1906
- Current Population— 26,065 as of April 1, 2020 (2020 Office of Financial Management estimates)
- Population Growth—Based on data tracked by the Office of Financial Management, Camas has experienced a fairly steady growth rate. The overall population has increased approximately 12 percent from 22,843 in 2015 to 26,065 in 2020, an average 2.4 percent per year increase during this time frame.
- Location and Description—The City of Camas is located in Clark County, Washington, west of the Columbia River gorge and approximately 20 miles north of Portland, Oregon. The City is bordered by the Columbia River to the south, the City of Washougal and Woodburn Hill to the east, Lacamas Lake and Lacamas Lake Park to the north, and Grass Valley and the City of Vancouver to the west. It sits north of Highway 14 across the Columbia River from the City of Gresham, Oregon. Camas' downtown and older parts of the City are fairly flat, almost at the same level of the Columbia River, and surrounded by steep slopes.
- Brief History—In the late 1800's, hundreds of Native Americans camped along the Columbia River. The name for the City of Camas comes from the lily-like camas plant, an important part of the Native American diet in the Northwest, and widely found in this area. The first settlers arrived to Camas in the mid 1800's. In 1883, the LaCamas Colony Company of Portland selected this area for their new paper mill, the largest paper mill west of the Rocky Mountains. Mr. Henry L. Pittock, the owner of the Oregonian newspaper needed plenty of water to power paper-making machines for his newspaper and found it in the nearby lakes. Camas was incorporated in 1906 and by 1928 the paper mill was owned and operated by the Crown-Zellerbach Corporation. Today, Crown-Zellerbach is known as Georgia Pacific. From the 1990s through today, Camas experienced significant growth in residential development and in the technology and manufacturing industries due to land annexations.
- Climate—Camas' climate is influenced by the Coast and Cascade mountain ranges. Prevailing winds are from the northeast from April through September, and from the east-southeast for the rest of the year. Occasional high easterly winds occur year-round through the Columbia Gorge. Annual average precipitation is 51 inches. The month of December generally receives the most precipitation, with an

average of 6.5 inches, and July receives the least, with a half-inch. The average mid-winter temperature is 40 degrees, the summer average is 65 degrees, and the annual average temperature is 53 degrees.

- Governing Body Format—Camas uses the "Mayor-Council" form of government which consists of an elected mayor, who serves as the city's chief administrative officer, and a council, which serves as the municipality's legislative body. Additionally, the City has a professional City Administrator to assist the Mayor with administrative and polity related duties. The City consists of nine departments: City Administration, Community Development, Fire, Finance, IT, Library, Parks & Recreation, Police and Public Works. The City has 10 committees, commissions and task forces, which report to the City Council. The City Council assumes responsibility for the adoption of this plan; the City Administrator will oversee its implementation.
- Development Trends—Anticipated development levels for Camas are high, consisting primarily of residential development. In 2015, Camas approved the Green Mountain Planned Residential Development Mixed Use Master Plan to include 1,300-1,400 residential units and commercial uses, the largest mixed use development in the city's recent history. There has also been a focus on affordable housing and a push for more accessory dwelling units, secondary "mother-in-law" units, on properties. Camas adopted its comprehensive plan in 2016, which provides polices and recommendations to direct public and private decisions affecting future growth and development. City actions, such as those relating to growth, land use, transportation, public facilities and services, parks, and open space must be consistent with the plan.

3.3 CAPABILITY ASSESSMENT

An assessment of legal and regulatory capabilities is presented in Table 3-1. An assessment of fiscal capabilities is presented in Table 3-2. An assessment of administrative and technical capabilities is presented in Table 3-3. Information on National Flood Insurance Program (NFIP) compliance is presented in Table 3-4. Classifications under various community mitigation programs are presented in Table 3-5. An assessment of education and outreach capabilities is presented in Table 3-6.

Table 3-1. Legal and Regulatory Capability

	Local Authority	Other Jurisdiction Authority	State Mandated
Building Code	Yes	No	Yes
Comment: Camas Municipal Code (CMC) Chapter 15.04.010; adopts the most current State Building Code as amended.			
Zoning Code	Yes	No	Yes
Comment: CMC Title 18 Zoning: Ord. 2515 § 1 (Exh.A (part)), 2008; Ord. 2443 § 3 (Exh. A (part)), 2006)			
Subdivisions	Yes	No	Yes
Comment: CMC Chapter 17.11 Subdivisions; Ord. 21-005 2021, Ord. 19-001 2019, Ord. 18-014 2018, Ord. 2612 2011, Ord. 2483, 2007			
Stormwater Management	Yes	Yes	Yes
Comment: CMC Chapter 14.02 Stormwater Control: Ord. 2582, § I, 2-1-2010- adopts the 2005 Ecology Stormwater Manual and Camas Stormwater Design Standards Manual Res. 1193 adopted July 2010.			
Post-Disaster Recovery	No	No	No
Comment: None at this time.			
Real Estate Disclosure	No	Yes	Yes
Comment: WA State Disclosure Law- RCW 64.06			
Growth Management	Yes	No	Yes
Comment: The City is in compliance and good standing with the Washington Growth Management Act of 1990 with its land-use policies identified in its comprehensive plan (June 2016 update) and municipal code.			
Site Plan Review	Yes	No	No

	Local Authority	Other Jurisdiction Authority	State Mandated
Comment: CMC Chapter 18.18 Site Plan Review: Ord. 21-005 2021, Ord. 2612 2011, Ord. 2515 2008, Ord. 2481, 2007, Ord. 2443, 2006			
Environmental Protection	Yes	No	Yes
Comment: CMC Chapter 16.51 Critical Areas: Ord. 18-014 2018, Ord. 17-002 2017, Ord. 2691 2014, Ord. 2517 2008; 2008; Shoreline Master Program adopted 2021			
Flood Damage Prevention	Yes	Yes	Yes
Comment: CMC Chapter 16.57 Frequently Flooded Areas: Ord. 21-006 2021, Ord. 2691 2014, Ord. 2647 2012, Ord. 2517 2008			
Emergency Management	Yes	No	Yes
Comment: 2016 Draft Comprehensive Emergency Management Plan			
Climate Change	No	No	No
Comment: None at this time.			
Other	No	No	No
Comment: None at this time.			
General or Comprehensive Plan	Yes	No	Yes
Is the plan equipped to provide linkage to this mitigation plan? No			
Comment: 2035 City of Camas Comprehensive adopted in June 2016			
Capital Improvement Plan	Yes	No	Yes
What types of capital facilities does the plan address? Roads, water and sewer			
How often is the plan updated? 6 year CIP, Reviewed and updated annually.			
Comment:			
Floodplain or Watershed Plan	No	No	No
Comment: None at this time.			
Stormwater Plan	Yes	No	No
Comment: Comprehensive Stormwater Drainage Plan April 2013			
Habitat Conservation Plan	No	No	No
Comment: None at this time.			
Shoreline Management Plan	Yes	No	Yes
Comment: Ord. 21-003 Feb. 2021			
Community Wildfire Protection Plan	No	No	No
Comment: None at this time.			
Forest Management Plan	No	No	No
Comment: None at this time.			
Climate Action Plan	No	No	No
Comment: None at this time.			
Housing Action Plan	Yes	No	No
Comment: Res. 21-006 July 2021			
Comprehensive Emergency Management Plan	Yes	No	Yes
Comment: Adopted/approved 2006, currently being revised.			
Threat & Hazard Identification & Risk Assessment	No	No	No
Comment: None at this time.			
Post-Disaster Recovery Plan	No	No	No
Comment: None at this time.			
Continuity of Operations Plan	No	No	No
Comment: None at this time.			
Public Health Plan	No	Yes	No
Comment: Region IV Public Health Emergency Response Plan Dec. 2013			

Table 3-2. Fiscal Capability

Financial Resources	Accessible or Eligible to Use?
Community Development Block Grants	Yes
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	Yes (water, sewer, stormwater)
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	No
Withhold Public Expenditures in Hazard-Prone Areas	No
State-Sponsored Grant Programs	No
Development Impact Fees for Homebuyers or Developers	Yes
Other	No

Table 3-3. Administrative and Technical Capability

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Community Department – 1 Community Development Director, 1 Planning Manager, 2 Senior Planners, 1 Planner, 1 Project Manager
Engineers or professionals trained in building or infrastructure construction practices	Yes	Community Development- 1 Building Official, 2 Building Inspectors. Utilities Department (21 water/sewer/storm water employees).
Planners or engineers with an understanding of natural hazards	Yes	Community Development- 1 Senior Planner; Engineering- 1 Engineer; could contract with others for expertise in this field
Staff with training in benefit/cost analysis	Yes and No	Community Development- 1 Senior Planner (could use a refresher course)
Surveyors	No	No licensed surveyors on City staff.
Staff capable of making substantial damage estimates	Yes	Community Development- 1 Building Official, 1 Senior Planner
Personnel skilled or trained in GIS applications	Yes and No	Community Development- Senior Planners, City can and has requested GIS assistance from Clark County GIS staff.
Scientist familiar with natural hazards in local area	Yes	No scientist or biologist on staff. The City has contracted for this level of expertise in the past.
Emergency manager	Yes	Fire Department- Fire Chief
Grant writers	Yes	City staff writes grants.

Table 3-4. National Flood Insurance Program Compliance

Criteria	Response
When did the community enter the NFIP?	02/18/81
When did the Flood Insurance Rate maps become effective?	09/05/2012
What local department is responsible for floodplain management?	Community Development
Who is your floodplain administrator? (department/position)	Community Development/Senior Planner
Is this a primary or auxiliary role?	N/A
Are any certified floodplain managers on staff in your jurisdiction?	No
What is the date of adoption of your flood damage prevention ordinance?	3-15-2021
Does your floodplain management program meet or exceed minimum requirements?	Meets
If so, in what ways?	N/A

Criteria	Response
When was the most recent Community Assistance Visit or Community Assistance Contact?	5-20-2020
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed? If so, please state what they are.	No N/A
Do your flood hazard maps adequately address the flood risk within your jurisdiction? If no, please state why.	Yes N/A
Does your floodplain management staff need any assistance or training to support its floodplain management program? If so, what type of assistance/training is needed?	Not at this time.
Does your jurisdiction participate in the Community Rating System (CRS)? If so, is your jurisdiction seeking to improve its CRS Classification? If not, is your jurisdiction interested in joining the CRS program?	No No
How many Flood Insurance policies are in force in your jurisdiction?[a] What is the insurance in force?[a] What is the premium in force?[a]	59 $18,212,900 $42,184
How many total loss claims have been filed in your jurisdiction?[a] How many claims were closed without payment/are still open?[a] What were the total payments for losses?[a]	6 Unknown $13,710.27

a. According to FEMA records as of 11/30/15.

Table 3-5. Community Classifications

	Participating?	Classification	Date Classified
Community Rating System	No	N/A	N/A
Building Code Effectiveness Grading Schedule	Yes	2	2001
Public Protection	No	N/A	N/A
Storm Ready	No	N/A	N/A
Firewise	No	N/A	N/A

Table 3-6. Education and Outreach

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes
Do you have personnel skilled or trained in website development?	Yes. IT department.
Do you have hazard mitigation information available on your website? If yes, please briefly describe.	No N/A
Do you utilize social media for hazard mitigation education and outreach? If yes, please briefly describe.	No N/A
Do you have any citizen boards or commissions that address issues related to hazard mitigation? If yes, please briefly specify.	No N/A
Do you have any other programs already in place that could be used to communicate hazard-related information? If yes, please briefly describe.	Yes city website, water bill news media, social media
Do you have any established warning systems for hazard events? If yes, please briefly describe.	No N/A

Table 3-6. Education and Outreach

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes – We have a dedicated Public Information Officer.
Do you have personnel skilled or trained in website development?	Yes
Do you have hazard mitigation information available on your website? If yes, please briefly describe.	No

Criteria	Response
Do you utilize social media for hazard mitigation education and outreach? If yes, please briefly describe.	Yes City Website, Facebook, CRESA
Do you have any citizen boards or commissions that address issues related to hazard mitigation? If yes, please briefly specify.	No
Do you have any other programs already in place that could be used to communicate hazard-related information? If yes, please briefly describe.	No
Do you have any established warning systems for hazard events? If yes, please briefly describe.	Yes Everbridge through CRESA

3.4 INTEGRATION WITH OTHER PLANNING INITIATIVES

The following describe the jurisdiction's process for integrating the hazard mitigation plan into local planning mechanisms.

3.4.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan:

- The Comprehensive Plan- The Plan addresses Critical Areas including Frequently Flooded Areas and Geologically Hazardous Areas.
- Stormwater Design Manual- geotechnical analysis report is required for stormwater detention facilities located within 200 feet top of a Landslide Hazard area.
- Critical Areas Ordinance (CAO)- the first goal of the Camas CAO is to protect members of the public and public resources and facilities from injury, loss of life, or property damage due to landslides and steep slope failures, erosion, seismic events, or flooding.
- Shoreline Master Program (SMP)- the goal for flood hazards in the SMP is to promote public health, safety, and general welfare, and minimize public and private losses due to flood conditions in specific areas.

3.4.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan, but provide an opportunity for future integration:

- Comprehensive Plan- The Hazard Mitigation plan could be adopted by reference
- Stormwater Drainage Plan- some of the identified capital improvements could be included as hazard mitigation initiatives in the Hazard Mitigation action plan.
- Capital Improvement Plan- some of the hazard mitigation initiatives could be incorporated from the Capital Improvement Plan.

3.5 JURISDICTION-SPECIFIC NATURAL HAZARD EVENT HISTORY

Table 3-7 lists all past occurrences of natural hazards within the jurisdiction.

Table 3-7. Natural Hazard Events

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Severe Storm(s)	4253	2/2/16	Approx. 1 mill.
Severe Storm(s)	1825	3/2/2009	N/A

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Severe Storm(s)	1682	2/14/2007	N/A
Severe Storm(s)	1671	12/12/2006	N/A
Earthquake	1361	3/1/2001	N/A
Severe Storm(s)	1159	3/1/2001	N/A
Flood	1100	2/9/1996	N/A
Severe Storm(s)	1079	1/3/1996	N/A
Volcano	623	5/21/1980	N/A
Flood	545	12/10/1977	N/A
Flood	185	12/29/1964	N/A
Flood	146	3/2/1963	N/A
Severe Storm(s)	137	10/20/1962	N/A
Flood	70	3/6/1957	N/A
Flood	50	2/25/1956	N/A

3.6 JURISDICTION-SPECIFIC VULNERABILITIES

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 0
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 0
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0

Other noted vulnerabilities include:

- Aging water and sewer lines are vulnerable to the earthquake hazard.
- Aging city hall building. Constructed before seismic codes were in place- susceptible to earthquake damage.
- Public Works Operations Center building- constructed prior to seismic codes in place and thus vulnerable to the earthquake hazard.
- Dam at Lacamas lake- could be impacted to flooding or earthquake.
- Potential chemical spill from the paper mill
- High pressure natural gas line could be vulnerable to the earthquake hazard.
- High tension power lines may be vulnerable severe storms (i.e. wind and ice).
- Homes along the Washougal River may be susceptible to flooding.

3.7 HAZARD RISK RANKING

Table 3-8 presents the ranking of the hazards of concern.

Table 3-8. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Earthquake	48	High
2	Severe Weather	51	High
3	Landslide	18	Medium
4	Flood	18	Medium
5	Wildfire	22	Medium
6	Dam Failure	11	Low
6	Volcano	8	Low
7	Drought	3	Low

3.8 STATUS OF PREVIOUS PLAN INITIATIVES

Table 3-9 summarizes the initiatives that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared. It should be noted, that the actions identified in the following table were developed in 2016. Due to COVID and staff turnover that has occurred since their identification, the status of some actions may be unknown. Additionally, some actions identified in the 2016 plan may have had implementation agencies other than the City of Camas.

Table 3-9. Previous Planning Initiatives

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
CM-1 – Where appropriate, support retro-fitting, purchase or relocation of structures located in high hazard areas and prioritize those structures that have experienced repetitive losses. Comment:		X	
CM-2 – Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions within the community. Comment:		X	
CM-3- Develop and implement a program to capture perishable data after significant events (e.g. high water marks, preliminary damage estimates, damage photos) to support future mitigation efforts including the implementation and maintenance of the hazard mitigation plan. Comment:		X	
CM-4- Support the County-wide hazard mitigation initiatives identified in Volume I of the hazard mitigation plan. Comment:		X	
CM-5- Actively participate in the plan maintenance protocols outlined in Volume I of the hazard mitigation plan. Comment:		X	
CM-6- Continue to maintain good standing and compliance under the National Flood Insurance Program (NFIP). This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP: Enforcement of the flood damage prevention ordinance Participate in floodplain identification and mapping updates Provide public assistance/information on floodplain requirements and impacts Comment:		X	
CM-7- Work with building officials to identify ways to improve the jurisdiction's BCEGS classification. Comment:		X	
CM-8- Develop a post-disaster recovery plan and a debris management plan. Comment:		X	
CM-9- Participate in programs such as Firewise, StormReady and the Great Shakeout. Comment:		X	
CM-10- Support voluntary structural retrofitting of older homes on vulnerable soils. Comment:		X	
CM-11- Ensure critical facilities have back-up power generation facilities. Comment:		X	

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
CM-12- Encourage non-structural retrofitting for critical facilities, schools, hospitals and businesses by anchoring, base isolating, relocating vulnerable nonstructural building elements such as hazardous materials containment. Comment:		X	
CM-13- Support the retrofit of at-risk homes to wildland fire. Comment:		X	
CM-14- Work with CRESA to ensure that the public is informed of the necessity of maintaining self-sufficient supplies for 10-14 days. Comment:		X	
CM-15- Ensure that residents understand the benefits of defensible space to minimize and reduce the impacts of fires. Comment:		X	
CM-16- Develop an automated method to notify the public of events during a disaster. Comment:		X	
CM-17- Conduct pre-earthquake assessments for critical and essential facilities and develop a risk-reduction strategy. Comment:		X	
CM-18- Determine critical government functions and establish redundancy for these functions. Comment:		X	
CM-19- Develop integrated County stormwater basin-wide plans Comment:		X	
CM-20- Institute Low Impact Development Practices Comment:		X	
CM-21- Continue and/or enhance where feasible, the city's ongoing drainage system maintenance program to reduce or minimize the impact from stormwater flooding within the City. Comment:		X	
CM-22- Address stormwater flooding problems due to lack of drainage conveyance systems at the following locations: intersection of NW Julia Street and NW 26th Avenue along NW Maryland Street southern end of NW Iris Court, north of Columbia Summit Drive along NW 10th Ave at NW Ivy Drive and NW Drake Street Comment:		X	
CM-23- Identify and mitigate drainage issues resulting in nuisance flooding such as replacing undersized culverts where needed. Comment:		X	
CM-24- Monitor/review accumulated effects from piecemeal development on steep slopes. Comment:		X	
CM-25- Identify a funding mechanism for a local match to Federal funds that can fund private mitigation practices. Comment:		X	
CM-26- Develop a drought contingency plan. Comment:		X	
CM-27- Update the City's Emergency Plan notebook. Comment:		X	
CM-28- Partner with the Cascade Volcano Observatory in public education and awareness campaigns. Comment:		X	

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
CM-29- Use zoning and/or special wildfire overlay district to designate high-risk areas and specify the conditions for the use and development of specific areas. Comment:		X	
CM-30- Seek out partnerships for the use of a boat during a flood disaster. Comment:		X	
CM-31- Develop an inventory of public and commercial buildings that may be particularly vulnerable to earthquake damage. Comment:.		X	

3.9 HAZARD MITIGATION ACTION PLAN AND EVALUATION OF RECOMMENDED ACTIONS

Table 3-10 lists the actions that make up the City of Camas hazard mitigation action plan. Table 3-11 identifies the priority for each action. Table 3-12 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Table 3-10. Hazard Mitigation Action Plan Matrix 2023-2028

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
CM-1 – Where appropriate, support retro-fitting, purchase or relocation of structures located in high hazard areas and prioritize those structures that have experienced repetitive losses.						
Existing	All Hazards	4, 5, 7, 9, 10	Planning	High	HMGP, PDM, FMA, CDBG-DR	Short-term
CM-2 – Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions within the community.						
New and Existing	All Hazards	2,4	Planning	Low	Staff Time, General Funds	On-going
CM-3- Develop and implement a program to capture perishable data after significant events (e.g. high water marks, preliminary damage estimates, damage photos) to support future mitigation efforts including the implementation and maintenance of the hazard mitigation plan.						
Existing	All Hazards	1, 2, 4, 12	Fire/Emergency Management and Building Department	Medium	Staff Time, General Funds	Short-term
CM-4- Support the County-wide hazard mitigation initiatives identified in Volume I of the hazard mitigation plan.						
New and Existing	All Hazards	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	Lead Contact Department for Plan	Low	Staff Time, General Funds	Short-term
CM-5- Actively participate in the plan maintenance protocols outlined in Volume I of the hazard mitigation plan.						
New and Existing	All Hazards	1,4	Lead Contact Department for Plan	Low	Staff Time, General Funds	Short-term
CM-6- Continue to maintain good standing and compliance under the National Flood Insurance Program (NFIP). This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP: Enforcement of the flood damage prevention ordinance Participate in floodplain identification and mapping updates Provide public assistance/information on floodplain requirements and impacts						

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
New and Existing	Flood	1, 4, 5, 9	Community Development and Public Works	Low	Staff Time, General Funds	On-going
CM-7- Work with building officials to identify ways to improve the jurisdiction's BCEGS classification.						
New	Earthquake, Flood, Landslide, Severe Weather, Volcano, Wildfire	5, 6, 7, 10, 12	Building and Development Services	Low	Staff Time, General Funds	Short-term
CM-8- Develop a post-disaster recovery plan and a debris management plan.						
Existing	All Hazards	1, 2, 4, 9	Fire/Emergency Management and Public Works	Medium	EMPG	On-going
CM-9- Participate in programs such as Firewise, StormReady and the Great Shakeout.						
New and Existing	Dam Failure, Flood, Severe Weather, Wildfire	1,7	Fire/Emergency Management and Public Works	Low	Staff Time, General Funds	On-going
CM-10- Support voluntary structural retrofitting of older homes on vulnerable soils.						
Existing	Earthquake	1, 2, 7, 9	Building	Low	Property Owner, FEMA Hazard Mitigation Grant Funding	On-going
CM-11- Ensure critical facilities have back-up power generation facilities.						
New	All Hazards	2, 5, 8, 9, 10	Public Works	High	FEMA Hazard Mitigation Grant Programs	Long-term
CM-12- Encourage non-structural retrofitting for critical facilities, schools, hospitals and businesses by anchoring, base isolating, relocating vulnerable nonstructural building elements such as hazardous materials containment.						
New and Existing	Earthquake	1, 2, 5, 9, 10	Building	Low	Property owner, Staff Time, General Funds, FEMA funding	On-going
CM-13- Support the retrofit of at-risk homes to wildland fire.						
New and Existing	Wildfire	2, 4, 5, 7, 9, 12	Fire and Building	Medium	Property owner, FEMA Hazard Mitigation Grant Programs	On-going
CM-14- Work with CRESA to ensure that the public is informed of the necessity of maintaining self-sufficient supplies for the appropriate number of days.						
Existing	All Hazards	1, 2, 3, 4	Fire/Emergency Management	Low	Staff Time, General Funds	On-going
CM-15- Ensure that residents understand the benefits of defensible space to minimize and reduce the impacts of fires.						
New	Wildfire	1, 2, 5, 11	Fire	Low	Staff Time, General Funds	On-going
CM-16- Develop an automated method to notify the public of events during a disaster.						
New	All Hazards	1, 2, 3, 4, 12	Fire/Emergency Management	Medium	FEMA funds	Short-term
CM-17- Conduct pre-earthquake assessments for critical and essential facilities and develop a risk-reduction strategy.						
New	Earthquake	1, 5, 9, 10, 12	Building and Public Works	Medium	Staff time, General Funds, FEMA Hazard Mitigation Grant Programs	Long-term

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
CM-18- Determine critical government functions and establish redundancy for these functions.						
New	Earthquake	4, 6, 8, 10	Public Works, Police, Fire	Medium	Staff Time, General Funds	Long-term
CM-19- Develop integrated County stormwater basin-wide plans						
New	Flood, Severe Weather	1, 5, 9, 10, 11, 12	Public Works	Medium	FEMA Hazard Mitigation Funding	Long-term
CM-20- Institute Low Impact Development Practices						
New	Flood, Severe Weather	1, 5, 6, 7, 11, 12	Public Works, Community Development	Low	Staff Time, General Funds	On-going
CM-21- Continue and/or enhance where feasible, the city's ongoing drainage system maintenance program to reduce or minimize the impact from stormwater flooding within the City.						
New and Existing	Flood and Severe Weather	2, 5, 10, 11, 12	Public Works	Low	Stormwater Utility, CIP	On-going
CM-22- Address stormwater flooding problems due to lack of drainage conveyance systems at the following locations: along NW Maryland Street southern end of NW Iris Court, north of Columbia Summit Drive						
New and Existing	Flood and Severe Weather	2, 5, 10, 11, 12	Public Works	Medium	CIP, FEMA Hazard Mitigation Grant Programs	Long-term
CM-23- Identify and mitigate drainage issues resulting in nuisance flooding such as replacing undersized culverts where needed.						
New and Existing	Flood and Severe Weather	1, 2, 5, 11, 12	Public Works	Low	Staff Time, General Funds	On-going
CM-24- Monitor/review accumulated effects from piecemeal development on steep slopes.						
New	Landslide	11,12	Community Development	Low	Staff Time, General Funds	On-going
CM-25- Identify a funding mechanism for a local match to Federal funds that can fund private mitigation practices.						
New	All Hazards	1	Community Development	Low	Staff Time, General Funds	Short-term
CM-26- Develop a drought contingency plan.						
New	Drought	1,2, 3, 4, 5, 6, 11	Public Works	Medium	Staff Time, General Funds, FEMA Hazard Mitigation Grant Programs	Short-term
CM-27- Update the City's Emergency Plan notebook.						
Existing	All Hazards	1, 3, 12	Fire/Emergency Management	Low	Staff Time, General Funds	On-going
CM-28- Partner with the Cascade Volcano Observatory in public education and awareness campaigns.						
Existing	Volcano	1, 2, 3, 4	Fire/Emergency Management	Low	Staff Time, General Funds	On-going
CM-29- Use zoning and/or special wildfire overlay district to designate high-risk areas and specify the conditions for the use and development of specific areas.						
New	Wildfire	1, 2, 4, 5, 7, 11	Fire	Low	Staff Time, General Funds	Short-term
CM-30- Seek out partnerships for the use of a boat during a flood disaster.						
New	Flood	2, 5	Fire/Emergency Management	Low	Staff Time, General Funds	Short-term
CM-31- Develop an inventory of public and commercial buildings that may be particularly vulnerable to earthquake damage.						

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
New	Earthquake	1, 5, 9, 10	Building/Public Works	Low	Staff Time, General Funds	Short-term

Table 3-11. Mitigation Strategy Priority Schedule

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
CM-1	5	High	High	Yes	Yes	No	Medium	High
CM-2	2	Medium	Low	Yes	No	Yes	High	Low
CM-3	4	Low	Medium	No	No	Maybe	Low	Low
CM-4	12	Low	Low	Yes	No	Yes	High	Low
CM-5	2	Low	Low	Yes	No	Yes	High	Low
CM-6	4	Medium	Low	Yes	No	Yes	High	Low
CM-7	5	Medium	Low	Yes	No	Yes	High	Low
CM-8	4	Medium	Medium	Yes	Yes	No	Medium	High
CM-9	2	Medium	Low	Yes	No	Yes	High	Low
CM-10	4	High	Low	Yes	Yes	No	Medium	High
CM-11	5	High	High	Yes	Yes	Yes	Medium	High
CM-12	5	High	Low	Yes	Yes	No	Medium	High
CM-13	6	High	Medium	Yes	Yes	No	Medium	High
CM-14	4	Medium	Low	Yes	No	Yes	Medium	Low
CM-15	4	Medium	Low	Yes	No	Yes	Medium	Low
CM-16	5	Medium	Medium	Yes	No	Yes	Medium	Low
CM-17	5	Medium	Medium	Yes	Maybe	No	Medium	Medium
CM-18	4	High	Medium	Yes	No	Yes	Medium	Low
CM-19	6	High	Medium	Yes	Yes	No	High	High
CM-20	6	Medium	Low	Yes	Maybe	Yes	Medium	Low
CM-21	5	Medium	Low	Yes	No	Yes	Medium	Low
CM-22	5	High	Medium	Yes	No	No	High	High
CM-23	5	Medium	Low	Yes	No	Yes	Medium	Low
CM-24	2	Low	Low	Yes	No	Yes	Low	Low
CM-25	1	Medium	Low	Yes	No	Yes	Medium	Low

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
CM-26	7	Medium	Medium	Yes	Yes	Yes	Medium	Medium
CM-27	3	Medium	Low	Yes	No	Yes	Medium	Low
CM-28	4	Medium	Low	Yes	No	Yes	Medium	Low
CM-29	6	Medium	Low	Yes	No	Yes	Medium	Low
CM-30	2	Medium	Low	Yes	No	Yes	Medium	Low
CM-31	4	Medium	Low	Yes	No	Yes	Medium	Low

a. See the introduction to this volume for explanation of priorities.

Table 3-12. Analysis of Mitigation Actions

Hazard Type	Action Addressing Hazard, by Mitigation Type[a] 1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Dam Failure	CM-2, CM-3, CM-4, CM-5, CM-6, CM-8, CM-25, CM-27	CM-1, CM-6	CM-4, CM-6, CM-14, CM-16		CM-8, CM-11	
Drought	CM-2, CM-3, CM-4, CM-5, CM-8, CM-25, CM-26, CM-27	CM-1, CM-26	CM-4, CM-14, CM-16, CM-26	CM-26	CM-8, CM-11	
Earthquake	CM-2, CM-3, CM-4, CM-5, CM-7, CM-8, CM-17, CM-25, CM-27, CM-31	CM-1, CM-7, CM-10, CM-11, CM-12, CM-17, CM-31	CM-4, CM-14, CM-16		CM-8, CM-11, CM-18	CM-17, CM-31
Flood	CM-2, CM-3, CM-4, CM-5, CM-6, CM-7, CM-8, CM-19, CM-21, CM-23, CM-25, CM-27	CM-1, CM-6, CM-7	CM-4, CM-6, CM-14, CM-16	CM-9, CM-19, CM-20, CM-21	CM-8, CM-11	CM-22
Landslide	CM-2, CM-3, CM-4, CM-5, CM-7, CM-8, CM-24, CM-25, CM-27	CM-1, CM-7	CM-4, CM-14, CM-16		CM-8, CM-11	

Hazard Type	Action Addressing Hazard, by Mitigation Type[a] 1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Severe weather	CM-2, CM-3, CM-4, CM-5, CM-7, CM-8, CM-19, CM-21, CM-23, CM-25, CM-27	CM-1, CM-7, CM-9	CM-4, CM-14, CM-16	CM-19, CM-20, CM-21	CM-8, CM-11	CM-22
Volcano	CM-2, CM-3, CM-4, CM-5, CM-7, CM-8, CM-25, CM-27	CM-1, CM-7	CM-4, CM-14, CM-16, CM-28		CM-8, CM-9, CM-11	
Wildfire	CM-2, CM-3, CM-4, CM-5, CM-7, CM-15, CM-25, CM-27	CM-1, CM-7, CM-9, CM-13, CM-15	CM-4, CM-9, CM-14, CM-15, CM-20	CM-15	CM-9, CM-11	

a. See the introduction to this volume for explanation of mitigation types.

4. CITY OF LA CENTER

4.1 HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact

Greg Thornton, Mayor
210 E 4th St.
La Center, WA 98629
Telephone: 360-263-5123
e-mail Address: gthornton@ci.lacenter.wa.us

Alternate Point of Contact

Bryan Kast, Public Works Director
210 E 4th St.
La Center, WA 98629
Telephone: 360-263-7661
e-mail Address: bkast@ci.lacenter.wa.us

4.2 JURISDICTION PROFILE

The following is a summary of key information about the jurisdiction and its history:

- Date of Incorporation—1909
- Current Population—3950 as of July, 2021 (Office of Financial Management Projections)
- Population Growth—The City of La Center's growth rate suffered during the recession. From 1994 through 2015 the city's population increased four-fold. Between 2004 and 2014 the Washington Office of Financial Management reported that La Center witnessed annual growth rates as low as 1% and as high as 10%. The average growth rate over the 10 year period was 4.3%. Under the current growth projections, by 2036 La Center will have a total of 7,914.
- Location and Description—The City of La Center is a small, but growing community in southwest Washington located approximately 16 miles north of the Vancouver/Portland metropolitan area and approximately two miles east of Interstate 5. Although La Center is only 20 minutes from the employment centers, attractions, and services of the major metropolitan area, it enjoys the feel of a small-town community. NOPE
- Brief History— On December 7, 1875, John H. Timmen donated land to plat the original site of the town, which would eventually be known as La Center. Early settlers called the area "Timmen's Landing" in reference to his boat landing along the East Fork of the Lewis River. The direct access to the river promoted our rich history of steamboats, sternwheelers, logging, mills and apples and prune agriculture. Thirty four years later on August 23, 1909, Clark County Commissioners recognized the Town of La Center as a municipality.
- Climate— La Center's weather is typical of the Pacific Northwest. We have wet but mild springs averaging 63 degrees. Summers are typically low in humidity and average 80 degrees. Fall typically averages 75 degrees. Winters are generally mild with a few days of snow with an average temperature of 48 degrees. Despite the Northwest's reputation of raining for nine months out of the year, the annual average precipitation is only 45.7 inches.
- Governing Body Format— The City of La Center is a strong Mayor form of government with a five-member City Council. There are three main departments within the City structure; administrative/finance, police and public works. The administrative branch assumes responsibility for the adoption of this plan; the public works department will oversee its implementation.

- Development Trends— Like many communities, La Center's growth was stalled during the recession. Although major growth was stalled due to the economic down turn, the City continued planning for the future. In 2010 the City annexed 583 acres of land leading to the corridor of commerce (Interstate 5) for employment lands. In addition over 350 single family residential lots are in various stages of development. The City is development friendly with standards established to shape the community for generations to come. The Cowlitz casino project is expected to be complete by mid-2017. A new interchange at La Center Road and Interstate 5 along with the addition of new water, sewer and stormwater facilities will increase opportunities for Industrial and Commercial growth in La Center. Various mixes of housing types are being planned within the city to accommodate normal growth as well as the addition of 800 – 1200 new jobs being created at the I-5 junction.

4.3 CAPABILITY ASSESSMENT

An assessment of legal and regulatory capabilities is presented in Table 4-1. An assessment of fiscal capabilities is presented in Table 4-2. An assessment of administrative and technical capabilities is presented in Table 4-3. Information on National Flood Insurance Program (NFIP) compliance is presented in Table 4-4. Classifications under various community mitigation programs are presented in Table 4-5. An assessment of education and outreach capabilities is presented in Table 4-6.

Table 4-1. Legal and Regulatory Capability

	Local Authority	Other Jurisdiction Authority	State Mandated
Building Code	Yes	No	Yes
Comment: Title 15: La Center Building Code and Specialty Code; last amended by Ord. 2022-01			
Zoning Code	Yes	No	Yes
Comment: Title 18: Development Code: Division 2. Zoning; Last amended by Ord. 2017-09			
Subdivisions	Yes	No	Yes
Comment: Title 18: Division 3; Section 18.210: Subdivision Provisions; Last by Ord. 2010-09			
Stormwater Management	Yes	No	Yes
Comment: Title 18: Division 4; Chapter 18.320: Stormwater and Erosion Control; Last amended by Ord. 2010-05			
Post-Disaster Recovery	No	No	No
Comment: N/A			
Real Estate Disclosure	No	No	No
Comment: N/A			
Growth Management	Yes	Yes	Yes
Comment: Title 18: Division 2: Chapter 18.120 Plan Amendments and Zone Changes; Last by Ord 2007-09			
Site Plan Review	Yes	No	Yes
Comment: Title 18: Division 3; Section 18.215: Site Plan Review; Last amended by Ord. 2010-05			
Environmental Protection	Yes	No	Yes
Comment: Title 18: Division 4; Chapter 18.310: Environmental Policy; Last amended by Ord. 2006-17			
Flood Damage Prevention	Yes	No	Yes
Comment: Frequently Flooded Areas addressed in Title 18: Division 4: Chapter 18.300: Critical Areas; Last amended by Ord. 2021-08			
Emergency Management	Yes	Yes	Yes
Comment: La Center is covered by the Emergency Operations Plan for Clark County prepared by CRESA in 2013.			
Climate Change	No	No	No
Comment: N/A			
Other	No	No	No
Comment: N/A			
General or Comprehensive Plan	Yes	Yes	Yes
Is the plan equipped to provide linkage to this mitigation plan? No			

	Local Authority	Other Jurisdiction Authority	State Mandated
Comment: La Center Comprehensive Plan 2016-2035; Adopted 13 October, 2021; Ordinance #2021-12			
Capital Improvement Plan What types of capital facilities does the plan address? Transportation How often is the plan updated? Updated every 5 -7 years Comment: Update to be approved 2016			Yes
Floodplain or Watershed Plan Comment: N/A	No	No	No
Stormwater Plan Comment: No Capital Improvement Plan for Stormwater			Yes
Habitat Conservation Plan Comment: N/A	No	No	Yes
Economic Development Plan Comment: element of the Comprehensive Plan	Yes	No	Yes – dependent on funding
Shoreline Management Plan Comment: element of the Comprehensive Plan	Yes	No	Yes
Community Wildfire Protection Plan Comment: N/A	No	No	No
Forest Management Plan Comment: N/A	No	No	No
Climate Action Plan Comment: N/A	No	No	No
Other Comment: N/A	No	No	No
Comprehensive Emergency Management Plan Comment: Regional Comprehensive Emergency Management Plan; 2013; CRESA	Yes	Yes	Yes
Threat & Hazard Identification & Risk Assessment Comment: N/A	No	No	No
Post-Disaster Recovery Plan Comment: N/A	No	No	No
Continuity of Operations Plan Comment: N/A	No	No	No
Public Health Plan Comment: N/A	No	No	No

Table 4-2. Fiscal Capability

Financial Resources	Accessible or Eligible to Use?
Community Development Block Grants	No
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	Yes, Sewer
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	No
Withhold Public Expenditures in Hazard-Prone Areas	No
State-Sponsored Grant Programs	No
Development Impact Fees for Homebuyers or Developers	Yes
Other	REET, Grants

Table 4-3. Administrative and Technical Capability

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Public Works, City Engineer
Engineers or professionals trained in building or infrastructure construction practices	Yes	Public Works, Building Official
Planners or engineers with an understanding of natural hazards	Yes	Public Works, Planner Consultant
Staff with training in benefit/cost analysis	Yes	Public Works, Director
Surveyors	Yes	Professional Consultant(s)
Staff capable of making substantial damage estimates	Yes	Public Works, City Engineer
Personnel skilled or trained in GIS applications	Yes	Public Works , City Engineer, City Planner, Tech.
Scientist familiar with natural hazards in local area	Yes	Professional Consultant(s)
Emergency manager	Yes	CRESA/City Supported
Grant writers	Yes	Public Works, Planning, City Engineer, Planner Tech., Professional Consultant(s)

Table 4-4. National Flood Insurance Program Compliance

Criteria	Response
When did the community enter the NFIP?	N/A
When did the Flood Insurance Rate maps become effective?	09/05/2012
What local department is responsible for floodplain management?	Public Works Planning
Who is your floodplain administrator? (department/position)	Public Works, City Building Official
Is this a primary or auxiliary role?	Auxiliary
Are any certified floodplain managers on staff in your jurisdiction?	No
What is the date of adoption of your flood damage prevention ordinance?	2012
Does your floodplain management program meet or exceed minimum requirements? If so, in what ways?	La Center Floodplain Management Program is not currently recognized by FEMA
When was the most recent Community Assistance Visit or Community Assistance Contact?	Unknown
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed?	Yes
If so, please state what they are.	La Center is currently suspended from the NFIP
Do your flood hazard maps adequately address the flood risk within your jurisdiction?	Unknown
If no, please state why.	Insert appropriate information
Does your floodplain management staff need any assistance or training to support its floodplain management program? If so, what type of assistance/training is needed?	No
Does your jurisdiction participate in the Community Rating System (CRS)?	No
If so, is your jurisdiction seeking to improve its CRS Classification?	N/A
If not, is your jurisdiction interested in joining the CRS program?	No
How many Flood Insurance policies are in force in your jurisdiction?[a]	0
What is the insurance in force? [a]	$0
What is the premium in force? [a]	$0
How many total loss claims have been filed in your jurisdiction? [a]	Unknown
How many claims were closed without payment/are still open? [a]	Unknown
What were the total payments for losses? [a]	Unknown

a. According to FEMA records as of 11/30/2015

Table 4-5. Community Classifications

	Participating?	Classification	Date Classified
Community Rating System	No	N/A	N/A
Building Code Effectiveness Grading Schedule	No	____N/A___	Date
Public Protection	No	___N/A____	Date
Storm Ready	No	N/A	N/A
Firewise	No	N/A	N/A

Table 4-6. Education and Outreach

Criteria	Response
Do you have a Public Information Officer or Communications Office?	No
Do you have personnel skilled or trained in website development?	Yes, Public Works Adm.
Do you have hazard mitigation information available on your website? If yes, please briefly describe.	Yes 2016 Update/Survey
Do you utilize social media for hazard mitigation education and outreach? If yes, please briefly describe.	No
Do you have any citizen boards or commissions that address issues related to hazard mitigation? If yes, please briefly specify.	No
Do you have any other programs already in place that could be used to communicate hazard-related information? If yes, please briefly describe.	Yes Quarterly Newsletters
Do you have any established warning systems for hazard events? If yes, please briefly describe.	No

4.4 INTEGRATION WITH OTHER PLANNING INITIATIVES

The following describe the jurisdiction's process for integrating the hazard mitigation plan into local planning mechanisms.

4.4.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan:

- None at this time.

4.4.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan, but provide an opportunity for future integration:

- Comprehensive Plan – Implement city wide policies related to zoning, geologic hazards and slopes.
- Shorelines Program - — Implement restrictions or mitigation on construction, re-construction or building activity within hazard areas or flood plains.
- Critical Areas - Implement possible mitigation for construction, re-construction or building activity within critical areas and buffers.
- Standards for Construction - Implement mitigation for construction impacts, restrict or implement conditions for storm, water, sanitary sewer and road construction.

4.5 JURISDICTION-SPECIFIC NATURAL HAZARD EVENT HISTORY

Table 4-7 lists all past occurrences of natural hazards within the jurisdiction.

Table 4-7. Natural Hazard Events

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Severe Winter Storm, Straight Line Winds, Flooding, Landslides, Mudslides and a Tornado	4253	12/1/2015	Unknown
Severe Winter Storm And Record And Near Record Snow	1825	12/12/2008	Unknown
Severe Winter Storm, Landslides, And Mudslides	1682	12/14/2006	Unknown
Severe Storms, Flooding, Landslides, And Mudslides	1671	11/2/2006	Unknown
Earthquake	1361	2/28/2001	Unknown
Severe Winter Storms, Land & Mudslides, Flooding	1159	12/26/1996	Unknown
High Winds, Severe Storms And Flooding	1100	1/26/1996	Unknown
Severe Storms, High Wind, And Flooding	1079	11/7/1995	Unknown
Volcanic Eruption, Mt. St. Helens	623	5/21/1980	Unknown
Severe Storms, Mudslides, & Flooding	545	12/10/1977	Unknown
Heavy Rains & Flooding	185	12/29/1964	Unknown
Severe Storms	137	10/20/1962	Unknown

4.6 JURISDICTION-SPECIFIC VULNERABILITIES

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 0
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 0
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0

Other noted vulnerabilities include:

- Isolation, only one bridge leading in and out of the community
- Vulnerable creek crossing (Brezee Creek) between emergency services, public works operations and schools

4.7 HAZARD RISK RANKING

Table 4-8 presents the ranking of the hazards of concern.

Table 4-8. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Severe weather	33	High
2	Earthquake	32	High
3	Flood	18	Medium
3	Landslide	18	Medium
4	Dam failure	8	Low
5	Drought	1	Low
5	Volcano	1	Low
5	Wildfire	1	Low

4.8 STATUS OF PREVIOUS PLAN INITIATIVES

Table 4-9 summarizes the initiatives that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared. It should be noted, that the actions identified in the following table were developed in 2016. Due to the significant amount of time and staff turnover that has occurred since their identification, the status of some actions may be unknown. Additionally, the implementation of many action items was assigned to agencies aside from the City of La Center.

Table 4-9 Status of Previous Planning Initiatives

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
Where appropriate, support retro-fitting, purchase or relocation of structures located in high hazard areas and prioritize those structures that have experienced repetitive losses. Comment: Focus within City jurisdiction, carry over as action item LC-1		X	
Join the CRS program Comment: Become compliant with NFIP			x
Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions with the community. Comment: Continue annual inspections and retro as feasible, carry over as action item LC-2		X	
Ensure that the public is informed of the necessity of maintaining a 3 day supply of food and water Comment: On-Going preparedness messaging, carry over as action items LC-3		X	
Develop public information packets ready to deploy following a disaster event Comment: Carry over as action item LC-4		X	
Ensure severe weather warning system and public education for tornadoes in place. Comment: Carry over as action item LC-5		X	
Expand the public awareness program about hazard materials Comment: Carry over as action item LC-6		X	
Cultivate an awareness program for landslide hazards Comment: Carry over as action item LC-7		X	
Develop an automated method to notify the public of events during a disaster. Comment: County Wide Notification System in Place	x		
Expand weather radio systems to include all of Clark County Comment: La Center area covered	x		
Conduct pre-earthquake assessments for critical and essential facilities and develop a risk-reduction strategy Comment: Carry over as action item LC-8		x	
Determine critical government functions and establish redundancy for these functions. Comment: Carry over as action item LC-9		x	
Target development and preparedness efforts of Tier II hazardous material facilities Comment: No tier II sites known within City boundaries			x
Provide opportunities for strategic relations between emergency managers and social service providers. Comment: More of a County wide action item			x
Develop a contingency/Business resumption organization Comment: Carry over as action item LC-11		x	
Require the construction of earthquake-resilient structures	x		

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
Comment: Comply with current building codes			
Develop integrated County stormwater basin-wide plans Comment: County directive			x
Promote development off of the floodplain Comment: Currently one structure within City boundaries in flood plain, LC-13		x	
Consider adoption of a zero-rise floodway Comment: Comply with NFIP LC-14		x	
Expand the County Clean Water Program Comment: County Directive			x
Seek compliance with the National Flood Insurance Program (NFIP) to maintain good standing and compliance under the NFIP. This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP. Enforcement Participate in floodplain identification and mapping updates Provide public assistance/information on the floodplain requirements and impacts. Comment: Carry over as action item LC-10		x	
Support the use of LIDAR mapping technology to refine landslide hazard maps Comment: Tied in with assessment of landslide areas as described above			x
Ensure state certification of licensing for professionals performing geotechnical evaluations to a higher standard. Comment: Only licensed geo-engineers used	x		
Institute Low Impact Development Practices Comment: Updated with comprehensive plans LC-16		x	
Initiate a vegetation management program Comment: Continue to refine and develop LC-17		x	
Ensure emergency vehicle access to all residents to allow effective response and recovery from disaster events. Comment: Carry over as an action item LC-19		x	
Develop priority routes throughout the county and improve these routes Comment: Carry over as action item LC-19		x	
Ensure that electricity is available to populations requiring priority for electricity. Comment: Clark County Public Utility role			x
Ensure appropriate equipment is available during events. Comment: Carry over as action item LC-19		x	

4.9 HAZARD MITIGATION ACTION PLAN AND EVALUATION OF RECOMMENDED ACTIONS

Table 4-10 lists the actions that make up the City of La Center hazard mitigation action plan. Table 4-11 identifies the priority for each action. Table 4-12 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Table 4-10. Hazard Mitigation Action Plan Matrix 2023-2028

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
LC-1—Seek to establish and maintain, where appropriate, support retro-fitting, purchase or relocation of structures located in high hazard areas and prioritize those structures that have experienced repetitive losses.								
Existing	All Hazards	1,2,4,5,8,9, 10,12		Planning	High	City, Owners, HMGP, PDM, FMA	Ongoing	
LC-2—Seek to integrate and maintain the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions with the community.								
Existing	EQ, LS, Hazmat	1,2,4,5,8,9, 10,12		City	Low	City, Owners, HMGP, PDM, FMA	Ongoing	
LC-3—Ensure that the public is informed of the necessity of maintaining a 3 day supply of food and water								
Existing	All Hazards	1,2		CRESA/City Supported	Low	General Fund/Staff Time	Ongoing	
LC-4—Develop public information packets ready to deploy following a disaster								
Existing	All Hazards	1,2		CRESA/City Supported	Low	General Fund/Staff Time	Ongoing	
LC-5—Ensure severe weather warning system and public education for tornadoes in place.								
Existing	SW	1,2,3		CRESA/City Supported	Low	General Fund/Staff Time	Ongoing	
LC-6—Expand the public awareness program about hazard materials								
Existing	Hazmat	1,2,		CRESA/City Supported	Low	General Fund/Staff Time	Ongoing	
LC-7—Cultivate an awareness program for landslide hazards								
Existing	LS	1,2,		CRESA/City Supported	Low	General Fund/Staff Time	Ongoing	
LC-8—Conduct pre-earthquake assessments for critical and essential facilities and develop a risk-reduction strategy								
Existing	EQ	4,5,8,9,10		City Building Dept.	Medium	General Fund/Staff Time	Ongoing	
LC-9—Determine critical government functions and establish redundancy for these functions.								
Existing	All Hazards	8,10		CRESA/City Supported	Medium	General Fund/Staff Time	Short-term 1-3 Years	
LC-10—Seek compliance with the National Flood Insurance Program (NFIP) to maintain good standing and compliance under the NFIP. This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP. Enforcement Participate in floodplain identification and mapping updates Provide public assistance/information on the floodplain requirements and impacts.								
New	Flood	5,6,7,11,12		Planning Dept.	Low	General Fund/Staff Time	Short-term 0-1 Year	
LC-11—Develop a contingency/Business resumption organization								
New	All Hazard	10		CRESA/City Supported/Chamber of Commerce	Medium	General Fund/Staff Time	Short-term 0-5 Years	
LC-12—Require the construction of earthquake-resilient structures								
Existing	EQ	10		City Building Department	Low	General Fund/Staff Time	Short-term 0-1 Year	
LC-13—Promote development off of the floodplain								

Existing	Flood	10,11,12	City Building Department	Medium	General Fund/Staff Time	Short-term 0-5 Years
LC-14—Consider adoption of a zero-rise floodway						
Existing	Flood	10,11,12	City Building Department	Low	General Fund/Staff Time	Short-term 0-1 Year
LC-15—Develop a method of assessing and documenting landslide hazard areas.						
Existing	LS	1,2,4,5,6,7, 8,10,12	City Building Department	Medium	General Fund, Grant, Staff Time	Short-term 0-5 Years
LC-16—Support the use of LIDAR mapping technology to refine landslide hazard maps						
Existing	LS	1,2,4,5,6,7, 8,10,12	City Building Department	Medium	General Fund, Grant, Staff Time	Short-term
LC-17—Institute Low Impact Development Practices						
Existing	EQ, Flood, LS,	2,4,5,6,7,10 ,11,12	City Building Department	Low	General Fund, Staff Time	Short-term 0-1 Year
LC-18—Initiate a vegetation management program						
Existing	WF	1,11,12	City Public Works Department	Low	General Fund, Staff Time	Short-term 0-1 Year
LC-19—Ensure emergency vehicle access to all residents to allow effective response and recovery from disaster events.						
Existing	All Hazards	1,2,3,4,5,6, 8,9,10,12	CRESA, City Public Works Department	High	FEMA Grants, General Fund, Bonds, Staff Time	Short-term 0-5 Years

Table 4-11. Mitigation Strategy Priority Schedule

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
LC-1	9	High	Low	Yes	Yes	Yes	High	Medium
LC-2	8	High	Low	Yes	Yes	Yes	High	Medium
LC-3	2	Medium	Medium	Yes	No	Yes	Medium	Low
LC-4	2	High	Low	Yes	No	Yes	High	Low
LC-5	3	High	Low	Yes	No	Yes	High	Low
LC-6	2	Low	Low	Yes	No	Yes	Medium	Low
LC-7	2	High	Low	Yes	No	Yes	High	Low
LC-8	5	High	High	Yes	No	No	Low	Low
LC-9	2	High	Low	Yes	No	Yes	High	Low
LC-10	5	High	Low	Yes	No	Yes	High	Low
LC-11	1	High	High	Yes	No	No	Medium	Low
LC-12	1	High	Low	Yes	No	Yes	High	Low
LC-13	3	Low	Low	Yes	No	Yes	High	Low
LC-14	3	High	Low	Yes	No	Yes	High	Low
LC-15	9	High	Medium	Yes	No	No	Medium	Low
LC-16	9	High	Low	Yes	No	Yes	High	Low
LC-17	8	High	Low	Yes	No	Yes	Medium	Low

LC-18	3	Medium	Low	Yes	No	Yes	Medium	Low
LC-19	10	High	High	Yes	Yes	No	Low	High

a. See the introduction to this volume for explanation of priorities.

Table 4-12. Analysis of Mitigation Actions

Hazard Type	Action Addressing Hazard, by Mitigation Type[a] 1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Dam Failure	LC-1, LC-9, LC-11	LC-6	LC-3, LC-4, LC-11		LC-9, LC-19	
Drought	LC-1, LC-9, LC-11	LC-6	LC-3, LC-4, LC-11		LC-9, LC-19	
Earthquake	LC-1, LC-2, LC-9, LC-11, LC-12, LC-17	LC-6	LC-3, LC-4, LC-8, LC-11		LC-9, LC 19	
Flood	LC-9, LC 10, LC-11, LC-12, LC-13, LC-14, LC-17	LC 10	LC-3, LC-4, LC 10		LC-9, LC-19	LC-19
Landslide	LC-9, LC-11, LC-15		LC-4, LC-11		LC-19	LC-19
Severe Weather	LC-1, LC-9, LC-11	LC-6	LC-3, LC-4, LC-11		LC-9	
Volcano	LC-1, LC 9, LC-11		LC-3, LC-4, LC-11		LC-9	
Wildfire	LC-18, LC 9, LC-11		LC-3, LC-4, LC-11		LC-9,	

a. See the introduction to this volume for explanation of mitigation types.

5. CITY OF RIDGEFIELD

5.1 NATURAL HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact
Lee Knottnerus, Deputy City Manager
230 Pioneer Street
Ridgefield, WA 98642
Telephone: (360) 887-3557
e-mail: Lee.Knottnerus@ridgefieldwa.us

Alternate Point of Contact
Claire Lust, Community Development Director
510-B Pioneer St, Ridgefield, WA 98642
Telephone: (360) 887-3908
e-mail: Claire.lust@ridgefieldwa.us

5.2 JURISDICTION PROFILE

The following is a summary of key information about the jurisdiction and its history:

- **Date of Incorporation**— Founded in 1865 and Incorporated in 1909.
- **Current Population**— According to the US Census Bureau, the population for 2022 was 13,640.
- **Population Growth**— Based on data gathered from the US Census Bureau, Ridgefield continues to experienced steady growth. With a population of 6,123 in 2014, the City has more than doubled in size. In recent years, Ridgefield continues to be one of the fastest growing communities in Washington, and is anticipated to grow from its current 13,640 to 25,494 people by 2035.
- **Location and Description**— Ridgefield is located 10 miles north of Vancouver, Washington and 20 miles north of Portland, Oregon on the I-5 Discovery Corridor with easy access to metropolitan amenities yet enough distance to maintain a small-town atmosphere. According to the United States Census Bureau, the city has a total area of approximately 7.18 square miles (18.60 km^2), of which, 7.08 square miles is land and 0.10 square miles is water. The City is bordered by Clark County.

  The city is a pastoral, rolling-hills countryside and slopes up a gentle incline from the riverbank of Lake River to elevated highlands on the east. The Ridgefield National Wildlife Refuge Complex lies between the downtown area and the Columbia River three miles to the west. The area is marked with numerous fields bordered by canyons, with ridges along them overlooking the canyons in places. The canyons have been and continue to be carved from the land primarily by water erosion.

  State Route 501, also known as Pioneer Street, acts as the primary transportation corridor connecting downtown and the I-5 Junction. Land uses along this corridor reflect the spectrum of development types with a combination of industrial, residential and commercial development. Main Avenue and Hillhurst Road are north-south connectors that are near or traverse downtown. These areas reflect over 100 years of settlement, with a mix of old historic residential structures interspersed with modern subdivisions and a diverse array of historic buildings in the downtown area.

- **Brief History**— Ridgefield's origins can be traced back more than 1,000 years to early Native American settlements that prospered in the area near Lake River now designated as the Ridgefield National Wildlife Refuge. The Lewis and Clark Expedition visited the area twice and the City of Ridgefield grew up on the banks of the River. This navigable water starts in Vancouver Lake and flows north into the Columbia River. After the Civil War, the area grew rapidly through the second half of the nineteenth century.

The railroad arrived in 1903 and in 1916, the steamship City of Ridgefield was launched. Served by both river and rail, Ridgefield was seen as a 'transfer center to inland towns.' In 1920, Ridgefield was known for its immensely fertile agricultural lands producing potatoes, prunes, and livestock. The area also enjoyed a rich manufacturing base, including a large lumber mill, a shingle mill, a creamery, a cheese factory and a boat building business. The Pacific Wood Treating Company opened in 1963, providing the city with several hundred jobs until it filed for bankruptcy and closed its doors in 1993.

The completion of Interstate 5 in the 1960s made Ridgefield more accessible which led to growth in the industrial and shipping sectors. The creation of the Ridgefield National Wildlife Refuge in 1965 drew an increasing numbers of tourists. Beginning in 2000, the population of Ridgefield exploded and a growing number of companies have chosen the location for a variety of reasons, including land availability, proximity to Portland, ocean/air/rail freight facilities, good schools, and livable communities.

- **Climate**— Ridgefield enjoys a mild climate, thanks to its proximity to the Pacific Ocean to the west and the Cascade mountains to the east. The warmest month of the year is August with an average maximum temperature of 82 degrees. The coldest month of the year is January with an average minimum temperature of 34 degrees. Temperature variations between night and day tend to be moderate during summer with a difference of about 27 degrees Fahrenheit, and fairly limited during winter with an average difference of 15 degrees Fahrenheit.

  The annual average precipitation in Ridgefield is 45.70 inches. Winter months tend to be wetter than summer months. The wettest month of the year is December with an average rainfall of 7.08 inches. On average, there are 145 sunny days per year in Ridgefield.

- **Governing Body Format**— Ridgefield's original incorporation called for a strong-mayor form of government with a volunteer mayor. In 1999 the voters approved a ballot measure that changed city government to the council-manager form, in which the elected council hires a city manager and appoints a volunteer mayor from its own ranks. Ridgefield is classified as a "non-charter code city" under state law. The City Council assumes responsibility for the adoption of this plan; the City Manager will oversee its implementation.
- **Development Trends**—While housing in Ridgefield has developed less densely than some other Clark County cities to date, future growth is anticipated to alter that pattern. To accommodate this growth and shape a quality future, Ridgefield is developing a strong, shared vision. The City is focusing planning efforts on community priorities, including detailed plans for downtown design, multi-modal transportation, downtown and waterfront integration (in 2015 the Washington legislature approved funding for a railroad overpass that will connect the downtown and waterfront areas), and development of an outdoor recreation complex. Additional planning efforts target environmental resource protection.

  The cornerstone of the city's long-range planning efforts is the Comprehensive Plan. The plan details policies for land use, housing, economic development, capital facilities, environmental resources, and more, supported by capital facilities plans for public utilities including water, sanitary sewer, transportation, and parks. The City of Ridgefield is in the process of updating its Comprehensive Plan, with anticipated completion in December 2025, to plan for the next 20 years of development. The community vision identified in the current plan emphasizes:

  - A regional employment center for Clark County and Southwest Washington rather than a bedroom community, with opportunities for family-wage jobs.

- Quality neighborhoods, including maintaining existing neighborhoods, and creating new neighborhoods that incorporate pedestrian elements, access to schools and parks, and high quality design.
- Protection of critical environment resource areas to ensure the city's natural amenities remain central to the community identity, aesthetics, and environmental well-being.
- Careful management of growth to ensure orderly, cost effective provision of public facilities and utilities as the city continues to grow.

5.3 CAPABILITY ASSESSMENT

An assessment of legal and regulatory capabilities is presented in Table 5-1. An assessment of fiscal capabilities is presented in Table 5-2. An assessment of administrative and technical capabilities is presented in Table 5-3. Information on National Flood Insurance Program (NFIP) compliance is presented in Table 5-4. Classifications under various community mitigation programs are presented in Table 5-5. An assessment of education and outreach capabilities is presented in Table 5-6.

In addition to the capabilities listed below, the City of Ridgefield is a member of the Discovery Clean Water Alliance, which was legally formed on January 4, 2013 under the Joint Municipal Utility Services Act (RCW 39.106). The Alliance serves four Member agencies – the City of Battle Ground, Clark County, Clark Regional Wastewater District and the City of Ridgefield. The Alliance Members jointly own and jointly manage regional wastewater assets under Alliance ownership. The Alliance seeks to optimize the long-term framework for delivery of regional wastewater transmission and treatment services to the urban growth areas in the central portion of Clark County, Washington.

Table 5-1. **Legal and Regulatory Capability**

	Local Authority	Other Jurisdiction Authority	State Mandated
Building Code	Yes	Yes	Yes
Comment: Ridgefield Municipal Code (RMC), Title 14, Buildings and Construction (Construction Administrative Code) Adopted pursuant to RCW 19.27.031 and State Building Code Council of the State of Washington 14.030.010 states "All building and building-related codes as currently adopted or as may be adopted in future enactments by the state of Washington pursuant to RCW 19.27.031, together with all amendments that may be adopted by the State Building Code Council of the state of Washington are hereby adopted as the building codes for the city of Ridgefield." The provisions of the code apply to the administration of the technical and nontechnical codes – International Building Code, International Residential Code, International Existing Building Code, International Fuel Gas Code, International Mechanical Code, Uniform Plumbing Code, International Property Maintenance Code, Uniform Housing Code, International Fire Code, International Energy Conservation Code, ADA Standards for Accessible Design, National Green Building Standard.			
Zoning Code	Yes	No	Yes
Comment: RMC 18.200 – Establishment of Zoning Districts and Maps			
Subdivisions	Yes	No	Yes
Comment: RMC 18.620 – Procedure for Subdivisions			
Stormwater Management	Yes	No	Yes
Comment: RMC 13.75 – Stormwater Utility			
Post-Disaster Recovery	No	No	No
Comment: N/A			
Real Estate Disclosure	No	No	No
Comment: N/A			
Growth Management	Yes	Yes	Yes
Comment: RMC Title 18 – Ridgefield Development Code (1995) adopted pursuant to RCW 36.70A.120			
Site Plan Review	Yes	No	No
Comment: RMC 18.500- Site Plan Review			

	Local Authority	Other Jurisdiction Authority	State Mandated
Environmental Protection	Yes	Yes	Yes
Comment: RMC 18.810 – Environmental Standards pursuant to SEPA, RCW 43.21C.120, WAC 197-904, 197-11			
Flood Damage Prevention	Yes	No	Yes
Comment: RMC 18.750- Flood Control, 2007			
Emergency Management	Yes	Yes	Yes
Comment: RMC 2.44- Emergency Management, 2005, pursuant to RCW 38.52; Article 11, Section 11 of the Washington State Constitution			
Climate Change	No	No	No
Comment: N/A			
Other	No	No	No
Comment:			
General or Comprehensive Plan	Yes	No	Yes
Is the plan equipped to provide linkage to this mitigation plan? Yes Comment: Ridgefield Urban Area Comprehensive Plan (2016-2035); approved 2/25/2016			
Capital Improvement Plan	Yes	No	Yes
What types of capital facilities does the plan address? General Facilities, Water, Sewer, Stormwater, Parks, Transportation, Schools How often is the plan updated? Annually Comment: Capital Facilities Plan, incorporated by reference into the Comprehensive Plan			
Floodplain or Watershed Plan	No	No	No
Comment: N/A			
Stormwater Plan	Yes	No	Yes
Comment: Capital Facilities Plan, incorporated by reference into the Comprehensive Plan			
Habitat Conservation Plan	No	No	No
Comment:			
Economic Development Plan	Yes	No	Yes (dependent on funding)
Comment: An element of the comprehensive plan			
Shoreline Management Plan	Yes	No	Yes
Comment: Shoreline Management Program, 12/31/2021			
Community Wildfire Protection Plan	No	No	No
Comment: N/A			
Forest Management Plan	No	No	No
Comment: N/A			
Climate Action Plan	No	No	No
Comment: N/A			
Other	No	No	No
Comment: N/A			
Comprehensive Emergency Management Plan	Yes	Yes	Yes
Comment: Emergency Management Plan (update in progress); CRESA			
Threat & Hazard Identification & Risk Assessment	In Progress	No	No
Comment: Completion in 2022			
Post-Disaster Recovery Plan	No	No	No
Comment: N/A			
Continuity of Operations Plan	No	No	No
Comment: N/A			
Public Health Plan	No	No	No
Comment: N/A			

Table 5-2. **Fiscal Capability**

Financial Resources	Accessible or Eligible to Use?
Community Development Block Grants	Yes
Capital Improvements Project Funding – Revenue bonds are used to finance construction or improvements in facilities of enterprise systems operated by the City in accordance with the Capital Improvement Program and are generally payable from the enterprise. Revenue bonds are not subject to the City's statutory debt limitation and voter approval is not required.	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service – Ridgefield only provides water service, and has the authority to establish user fees and development charges for water connections	Yes
Incur Debt through General Obligation Bonds – Assessment bonds are considered in place of general obligation bonds where possible to assure the greatest degree of public equity. Limited Tax General Obligation Bonds can be issued with the approval of the City Council under specific circumstances. Unlimited General Obligation Bonds are payable from excess tax levies and subject to voter approval by 60% of the voters.	Yes
Incur Debt through Special Tax Bonds	No
Incur Debt through Private Activity Bonds	No
Withhold Public Expenditures in Hazard-Prone Areas	No
State-Sponsored Grant Programs - Department of Ecology, Department of Commerce	Yes
Development Impact Fees for Homebuyers or Developers - RMC 18.070 - The city has authorized the use of impact fees for allowable public purposes by adoption of the RUACP and CFP. The CFP identifies each of the city's major capital facilities and services; establishes levels of service (LOS) standards for each capital facility; and identifies specific capital facilities construction or enhancement projects for which impact fees may be used.	Yes
Other – Public Works Trust Fund Loans, the Local Option Capital Asset Lending Program	No

Table 5-3. **Administrative and Technical Capability**

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Public Works, Community Development
Engineers or professionals trained in building or infrastructure construction practices	Yes for Infrastructure	Building Official Public Works
Planners or engineers with an understanding of natural hazards	Yes	Community Development Public Works
Staff with training in benefit/cost analysis	Yes	Community Development Public Works
Surveyors	No	
Staff capable of making substantial damage estimates	Yes	Building Official
Personnel skilled or trained in GIS applications	No	
Scientist familiar with natural hazards in local area	No	
Emergency manager	Yes	Police Chief; CRESA
Grant writers	No	

Table 5-4. **National Flood Insurance Program Compliance**

Criteria	Response
When did the community enter the NFIP?	05/19/81
When did the Flood Insurance Rate maps become effective?	09/15/2012
What local department is responsible for floodplain management?	Community Development
Who is your floodplain administrator? (department/position) • Is this a primary or auxiliary role?	Community Development Director Auxiliary

Criteria	Response
Are any certified floodplain managers on staff in your jurisdiction?	No
What is the date of adoption of your flood damage prevention ordinance? • Does your floodplain management program meet or exceed minimum requirements? • If so, in what ways?	2007 Meet
When was the most recent Community Assistance Visit or Community Assistance Contact?	Unknown
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed? • If so, please state what they are.	No
Do your flood hazard maps adequately address the flood risk within your jurisdiction? • If no, please state why.	Yes
Does your floodplain management staff need any assistance or training to support its floodplain management program? • If so, what type of assistance/training is needed?	Yes Update regulations
Does your jurisdiction participate in the Community Rating System (CRS)? • If so, is your jurisdiction seeking to improve its CRS Classification? • If not, is your jurisdiction interested in joining the CRS program?	No No
• How many Flood Insurance policies are in force in your jurisdiction? [a] • What is the insurance in force? [a] • What is the premium in force? [a]	1 $350,000 $412
• How many total loss claims have been filed in your jurisdiction? [a] • How many claims were closed without payment/are still open? [a] • What were the total payments for losses? [a]	0 0 $0

a. According to FEMA records as of 11/30/2015

Table 5-5. **Community Classifications**

	Participating?	Classification	Date Classified
Community Rating System	No	N/A	N/A
Building Code Effectiveness Grading Schedule	Unknown	Unknown	Unknown
Public Protection	Unknown	Unknown	Unknown
Storm Ready	No	N/A	N/A
Firewise	No	N/A	N/A

Table 5-6. **Education and Outreach**

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes
Do you have personnel skilled or trained in website development?	Yes
Do you have hazard mitigation information available on your website? • If yes, please briefly describe.	No, direct questions to CRESA
Do you utilize social media for hazard mitigation education and outreach? • If yes, please briefly describe.	Yes Facebook, Twitter– articles & notices
Do you have any citizen boards or commissions that address issues related to hazard mitigation? • If yes, please briefly specify.	Planning Commission
Do you have any other programs already in place that could be used to communicate hazard-related information? • If yes, please briefly describe.	Yes Website, Next Door
Do you have any established warning systems for hazard events?	Yes, CRESA Public Alerts

Criteria	Response
• If yes, please briefly describe.	

5.4 INTEGRATION WITH OTHER PLANNING INITIATIVES

The following describe the jurisdiction's process for integrating the natural hazard mitigation plan into local planning mechanisms.

5.4.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the natural hazard mitigation plan:

- Mitigation assessments are included in the Ridgefield Development Code, the Construction Administrative Code, land use plans and site plan review. Goals and risk assessments are also included in the process for review/adoption of the Urban Area Comprehensive Plan and the Capital Improvement Plan.

5.4.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the natural hazard mitigation plan, but provide an opportunity for future integration:

- Integrate plan goals with community objectives
- Create a stand-alone resiliency plan as an appendix to the Comprehensive Plan. Incorporate the Shoreline Management Program into the Comprehensive Plan

5.5 JURISDICTION-SPECIFIC NATURAL HAZARD EVENT HISTORY

Table 5-7 lists all past occurrences of natural hazards within the jurisdiction.

Table 5-7. **Natural Hazard Events**

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Severe Rain, Landslide	N/A	2016	Unknown
Severe Rain, Landslide	N/A	2012	Unknown
Earthquake	1361	2001	Unknown
Severe Winter Storm	1159	1997	Unknown
Severe Storm, Flooding	N/A	11/1995	10 houseboats damaged
Volcanic Eruption	623	5/21/1980	Unknown
Tornado	N/A	8/26/1953	Unknown

5.6 JURISDICTION-SPECIFIC VULNERABILITIES

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 0
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 0
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0

Other noted vulnerabilities include:

- An urban drainage issue downtown that results in localized flooding every time it rains – This issue is being addressed through the recently adopted Stormwater Management Comprehensive Plan.
- All neighborhoods and the downtown area have the potential to have ingress and egress cut off as the result of a hazard event, such as a flood or earthquake, on Pioneer Street.
- Substantial number of buildings in downtown area are unreinforced masonry.
- Port of Ridgefield, 348+ residential, 3 commercial, and 2 industrial structures on D, E or F soils.
- The Port of Ridgefield, 97+ residential and 5 commercial lots developed in the floodplain.
- 224+ landslide susceptible parcels, including Union Ridge Elementary School and Ridgefield High School.
- Existing buildings, the floodplain and the location of the downtown area cannot be modified. However, the City can create an education and awareness program for residents who live in these areas regarding the vulnerabilities, possibility of insurance coverage, retrofitting, etc.

5.7 HAZARD RISK RANKING

Table 5-8 presents the ranking of the hazards of concern.

Table 5-8. **Hazard Risk Ranking**

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Earthquake	39	High
1	Severe Weather	39	High
2	Flood	21	Medium
3	Landslide	18	Medium
4	Wildfire	8	Low
5	Dam Failure	7	Low
6	Drought	2	Low
6	Volcano	2	Low

5.8 STATUS OF PREVIOUS PLAN INITIATIVES

Table 5-9 summarizes the initiatives that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared. It should be noted, that the actions identified in the following table were developed in 2016. Due to COVID and staff turnover that has occurred since their identification, the status of some actions may be unknown. Additionally, some actions identified in the 2016 plan may have had implementation agencies other than the City of Ridgefield .

Table 5-9. **Status of Previous Plan Initiatives**

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
RF-1 –Where appropriate, support retro-fitting, purchase or relocation of structures located in high hazard areas and prioritize those structures that have experienced repetitive losses; encourage non-structural retrofitting of hazardous materials containment. *Comment;* *Ongoing*		X	
RF-2 – Integrate the natural hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions within the community. *Comment Will be part of 2025 plan*		X	
RF-3 – Develop and implement a program to capture perishable data after significant events (e.g., high water marks, preliminary damage estimates,			X

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
damage photos) to support future mitigation efforts including the implementation and maintenance of the natural hazard mitigation plan. *Comment: Staffing changes have made this a project that will not be completed during this plan period*			
RF-4 – Support the County-wide initiatives identified in Volume 1 of the natural hazard mitigation plan. *Comment Ongoing efforts*		X	
RF-5 – Actively participate in the plan maintenance protocols outlined in Volume 1 of the natural hazard mitigation plan. *Comment. Ongoing*		X	
RF-6 – Continue to maintain good standing and compliance under the National Flood Insurance Program (NFIP). This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP: *Comment Ongoing*		X	
RF-7 – Work with building officials to identify ways to participate in the BCEGS classification program *Comment: Staffing changes have made this a project that will not be completed during this plan period*			X
RF-8 –Support mitigation measures that enhance other phases of emergency management such as the development of a post-disaster recovery plan and a debris management plan; the development of public information packets to deploy following a disaster event; ensure emergency vehicle access to all residents to allow effective response and recovery; develop a contingency/business resumption organization *Comment: Participated in county debris plan and in fuels management plan, other efforts are on going*		X	
RF-9 – Participate or encourage participation in programs such as Firewise, StormReady. *Comment Efforts are ongoing buy have been hampered due to staffing changes*		X	
RF-10 – Conduct a citywide resiliency study – critical and hazardous infrastructure *Comment Efforts are ongoing buy have been hampered due to staffing changes*		X	
RF-11 – Continue to pursue best available data and use this data to inform policies and regulations. This would include projects such as mapping and assessing vulnerability to erosion; stabilize erosion hazard areas, manage development in erosion hazard areas; Promoting development off of the floodplain, consider adoption of a zero-rise floodway, Support the use of LIDAR mapping technology to refine landslide hazard maps *Comment*		X	
RF-12 – Conduct pre-earthquake and flood assessments for critical and essential facilities and develop a risk reduction strategy, e.g., relocate and/or retrofit facilities. *Comment; Staffing and funding changes have caused this to be reprioritized .*		X	
RF-13 – Determine critical government functions and establish redundancy for those functions *Comment Completed as part of COOP and EOC planning with CRESA in 2022*	X		
RF-14 – Target development and preparedness efforts of Tier II hazardous material facilities. *Comment: Completed in partnership with CCFR and CRESA*	X		
RF-15– Initiate a vegetation management program. *Comment: Phased in noxious and invasive plant abatement program during this plan period*	X		

5.9 HAZARD MITIGATION ACTION PLAN AND EVALUATION OF RECOMMENDED ACTIONS

Table 5-10 lists the actions that make up the City of Ridgefield hazard mitigation action plan. Table 5-11 identifies the priority for each action. Table 5-12 summarizes the mitigation actions by hazard of concern and the six mitigation types.

5.10 FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

- Climate Change – Water levels at the waterfront/Port property
- Citywide Resiliency Study – critical and hazardous infrastructure

Table 5-10. **Hazard Mitigation Action Plan Matrix 2023-2028**

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
RF-1 –Where appropriate, support retro-fitting, purchase or relocation of structures located in high hazard areas and prioritize those structures that have experienced repetitive losses; encourage non-structural retrofitting of hazardous materials containment.						
Existing	All Hazards	4, 5, 7, 9, 10	Planning	High	HMGP, PDS, FMA, CDBG-DR	Short-term
RF-2 – Integrate the natural hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions within the community.						
New and Existing	All Hazards	2, 4	Planning	Low	Staff time, General Fund	On-going
RF-3 – Support the County-wide initiatives identified in Volume 1 of the natural hazard mitigation plan.						
New and existing	All Hazards	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	Community Development Dept.	Low	Staff Time, General Funds	Long Term
RF-4 – Actively participate in the plan maintenance protocols outlined in Volume 1 of the natural hazard mitigation plan.						
New and Existing	All Hazards	1, 4	Community Development Dept.	Low	Staff Time, General Funds	On-going
RF-5 – Continue to maintain good standing and compliance under the National Flood Insurance Program (NFIP). This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP: • Enforcement of the flood damage prevention ordinance. • Participate in floodplain identification and mapping updates. • Provide public assistance/information on floodplain requirements and impacts. • Improve stormwater management; improve stormwater drainage system capacity.						
New and Existing	Flood	1, 4, 5, 9	Public Works	Low	Staff Time, General Funds	On-going
RF-6 –Support mitigation measures that enhance other phases of emergency management such as the development of a post-disaster recovery plan and a debris management plan; the development of public information packets to deploy following a disaster event; ensure emergency vehicle access to all residents to allow effective response and recovery; develop a contingency/business resumption organization.						
Existing	All Hazards	1, 2, 4, 9	Emergency Management	Medium	EMPG	On-going
RF-7 – Participate or encourage participation in programs such as Firewise, StormReady.						
New and Existing	Dam Failure, Flood, Severe Weather, Wildfire	1, 7	Emergency Management and Public Works	Low	Staff Time, General Funds	On-going
RF-8 – Conduct a citywide resiliency study – critical and hazardous infrastructure.						
New and Existing	Earthquake, Severe Weather	1, 4, 5, 9	Public Works	Medium	Staff Time, Grants may be available	On-going

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
RF-9 – Continue to pursue best available data and use this data to inform policies and regulations. This would include projects such as mapping and assessing vulnerability to erosion; stabilize erosion hazard areas, manage development in erosion hazard areas; Promoting development off of the floodplain, consider adoption of a zero-rise floodway, Support the use of LIDAR mapping technology to refine landslide hazard maps.						
New and Existing	Flood, Landslide, Severe Weather	1, 4, 5, 9	Public Works	Medium	Staff Time, Grants may be available	On-going
RF-10 – Conduct pre-earthquake and flood assessments for critical and essential facilities and develop a risk reduction strategy, e.g., relocate and/or retrofit facilities.						
New and Existing	Earthquake, Flood, Severe Weather	5, 8, 9, 10, 12	Public Works	Medium	Staff Time, General Funds	Long Term

Table 5-11. **Mitigation Strategy Priority Schedule**

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
RF-1	5	High	High	Yes	Yes	No	Medium	High
RF-2	2	Medium	Low	Yes	No	Yes	Medium	Low
RF-3	12	Low	Low	Yes	No	Yes	Medium	Low
RF-4	2	Low	Low	Yes	No	Yes	Medium	Low
RF-5	4	Medium	Low	Yes	No	Yes	Medium	Low
RF-6	4	Medium	Medium	Yes	Yes	No	Medium	High
RF-7	2	Medium	Low	Yes	No	Yes	Medium	Low
RF-8	4	High	High	Yes	Maybe	No	Medium	High
RF-9	4	High	Medium	Yes	Maybe	Partial	Medium	Medium
RF-10	5	Medium	Medium	Yes	No	No	Medium	Low

a. See the introduction to this volume for explanation of priorities.

Table 5-12. **Analysis of Mitigation Actions**

Hazard Type	Action Addressing Hazard, by Mitigation Type[a]					
	1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Dam Failure	RF-1, , RF-3, RF-4, RF-5, RF-6,	RF-1, RF-5, RF-9	RF-3, RF-5, RF-6		RF-6	
Drought	RF-2, , RF-3, RF-4, RF-6,	RF-1	RF-3, RF-6		RF-6	
Earthquake	RF.2, RF.3, RF.4, RF.5, RF.7, RF.8, RF.10, RF.11, RF-10,	RF.1, RF.7, RF-10	RF-3, RF-6	RF-8	RF.8	RF-10
Flood	RF-2, , RF-3, RF-4, RF-5, , RF-6, RF-9, RF-10, ,	RF-1, RF-5, , RF-8, RF-9, RF-10,	RF-3, RF-5, RF-6	RF-7,	RF-6	RF-10
Landslide	RF-2, , RF-3, RF-4, , RF-6,	RF-1, , RF-9,	RF-3, RF-6	RF-8, RF-9,	RF-6	

Hazard Type	Action Addressing Hazard, by Mitigation Type[a] 1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
	RF-9, RF-10, ,					
Severe Weather	RF-2, , RF-3, RF-4, , RF-6, RF-9, RF-10,	RF-1, , RF-7, RF-9, RF-10,	RF-3, RF-6	RF-7, RF-8, RF-9	RF-6, RF-7	RF-10
Volcano	RF-2, , RF-3, RF-4, , RF-6,	RF-1,	RF-3, RF-6		RF-6	
Wildfire	RF-2, , RF-3, RF-4, , ,	RF-1, , RF-7	RF-3, RF-6, RF-7	RF-7,		

a. See the introduction to this volume for explanation of mitigation types.

6. TOWN OF YACOLT

6.1 HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact
Stephanie Fields, Clerk/Treasurer
PO Box 160
Yacolt, WA. 98675
360.686.3922
e-mail:
clerk@townofyacolt.com

Alternate Point of Contact
Katelyn Listk, Mayor
PO Box 160
Yacolt, WA. 98675
360.686.3922
e-mail: mayorlistek@townofyacolt.com

6.2 JURISDICTION PROFILE

The following is a summary of key information about the jurisdiction and its history:

- Date of Incorporation—1908
- Current Population—1,686 as of 2020 according to the US Decennial Census estimates.
- Population Growth—Between 2010 and 2020 there has been a 6.5% population increase according to the U.S. Census.
- Location and Description—The small town of Yacolt is nestled in the foothills of the Cascade Mountains in the shadow of Mt. St. Helens. It is on the Scenic Route in North Clark County. Yacolt boasts country living with easy access to the luxuries of the city. Both Vancouver and Portland, Oregon are just a short drive away. Yacolt schools are in the Battle Ground School District and it is home to North Clark Little League. The local library is Fort Vancouver Regional Library. Yacolt is in located in the 18th Legislative District in Clark County.
- Brief History—Yacolt was originally named Garner, named for the family who homesteaded 160 acres in 1887. The post office was officially established in 1895 with two locations, one named Garner and the other named Yacolt. Over time, the Yacolt name won out. Yacolt translates to “valley of the demons” or “haunted place.” It was named for a Native American legend about several children camping in Yacolt, many years ago, who wandered away from camp never to be seen again. It was believed that evil spirits had taken them. In September 1902, Yacolt experienced the largest fire in the state history. The fire is now infamously known as the Yacolt Burn. At the time of the fires, the town consisted of 15 buildings and was almost completely destroyed by the fire. The fire’s origin is still unknown; however, there was speculation that it was an accident resulting from local loggers working. The fire burned over 370 square miles and resulted in 38 fatalities. Despite this massive disaster, Yacolt was officially incorporated on July 31, 1908. In 2008, the town celebrated its 100th anniversary.
- Climate—Seasonal weather includes temperatures in the summer of over 80 and lows of 51, winter ranges from high 47 to lows of 23. The average rain fall in summer is 1.6 inches, and 6.4 inches in the winter.

- Governing Body Format—Mayor-Council Forum is made up of 5 Council Members who are elected and assumes responsibility for the adoption of this plan; the Mayor and Administration will oversee its implementation. The council members are responsible for budget creation and general governance of the Town. The Mayor is responsible for overseeing the budget expenditures and administration.
- Development Trends—The Town of Yacolt continues to research the development of a sewer system, there is very little development opportunities due to the lack of such a system. A small housing development is planned for2023.. Future plans include some beautification centrally to help entice potential business and industry to the area.

6.3 CAPABILITY ASSESSMENT

An assessment of legal and regulatory capabilities is presented in Table 6-1. An assessment of fiscal capabilities is presented in Table 6-2. An assessment of administrative and technical capabilities is presented in Table 6-3. Information on National Flood Insurance Program (NFIP) compliance is presented in Table 6-4. Classifications under various community mitigation programs are presented in Table 6-5. An assessment of education and outreach capabilities is presented in Table 6-6.

Table 6-1. Legal and Regulatory Capability

	Local Authority	Other Jurisdiction Authority	State Mandated
Building Code	Yes	No	Yes
Comment: Yacolt adopted revised international building codes 2012 edition by Ordinance #527- #530 in February 2015.			
Zoning Code	Yes	No	Yes
Comment: Current Zoning is regulated by Ordinance 371 which was adopted on February 3, 1997 There have been several amendments to this ordinance and it is projected to be re-written in 2017.			
Subdivisions	Yes	No	Yes
Comment: Zoning Ordinance # 371 and International Revised Building Codes as adopted by Ordinance # 527 regulate subdivisions			
Stormwater Management	Yes	No	Yes
Comment: Stormwater Protection Management Plan was adopted in June of 1999 by Ordinance # 385			
Post-Disaster Recovery	No	No	No
Comment: N/A			
Real Estate Disclosure	No	No	No
Comment: N/A			
Growth Management	Yes	Yes	Yes
Comment: Yacolt adopted the Growth Management Plan on August 19, 2013 by Resolution # 497			
Site Plan Review	Yes	No	No
Comment All Site Plan reviews are completed by the Town of Yacolt building inspector and engineer of record at the time of submittal and regulated by Ordinance # 371 adopted in 1997 and the revised building codes 2012 edition as adopted by Ordinance \# 527			
Environmental Protection	Yes	No	Yes
Comment: Ordinance # 440 was adopted for the protection of public health, safety, welfare, resource land and critical land areas, on April 17, 2006			
Flood Damage Prevention	Yes	No	Yes
Comment: Ordinance # 502 was adopted on August 6, 2012 establishing Region X flood plain damage prevention			
Emergency Management	Yes	Yes	Yes

	Local Authority	Other Jurisdiction Authority	State Mandated
Comment: The Town of Yacolt currently has Interlocal agreements or MOU's for emergency services with the following local jurisdictions Clark County Fire District 13, Cowlitz Fire and Rescue, Clark County Sheriff's Office, CRESA, GETS, GEM, M RSC and Southwest Regional Transportation.			
Climate Change	No	No	No
Comment: N/A			
Other	N/A	N/A	N/A
Comment: N/A			
General or Comprehensive Plan	Yes	No	Yes
Is the plan equipped to provide linkage to this mitigation plan?			
Comment: Sections 2,3 and 5 of Yacolt Comprehensive Plan			
Capital Improvement Plan	Yes	No	Yes
Yacolt's Capital Improvement plan addresses the following Capital Facilities: Stormwater, Streets, Utilities, Parks/Open spaces, Schools, Law Enforcement, and Electrical to name a few. This plan was updated and adopted in 2013 and will be updated again in 2023.			
How often is the plan updated? Every 7-10 years			
Comment:			
Floodplain or Watershed Plan	No	No	No
Comment: N/A			
Stormwater Plan	Yes	No	No
Comment: Ordinance # 385 Stormwater Facility Maintenance			
Habitat Conservation Plan	No	No	No
Comment: N/A			
Economic Development Plan	No	No	Yes – dependent on funding
Comment: N/A			
Shoreline Management Plan	No	No	No
Comment: N/A			
Community Wildfire Protection Plan	No	No	No
Comment: N/A			
Forest Management Plan	No	No	No
Comment: N/A			
Climate Action Plan	No	No	No
Comment N/A			
Other	N/A	N/A	N/A
Comment: N/A			
Comprehensive Emergency Management Plan	No	Yes	Yes
Comment: Yacolt adopted Resolution # 316 a Model for Regional Emergency Management Work plan and Intergovernmental Agreement for Regional Emergency Management in 1997. That plan is currently under review and is being updated for adoption by the end of 2016.			
Threat & Hazard Identification & Risk Assessment	Yes	No	No

	Local Authority	Other Jurisdiction Authority	State Mandated
Comment: Yacolt adopted Resolution # 510 in 2014 to be insured by Association of WA. Cities Risk Management Service Agency.			
Post-Disaster Recovery Plan	No	No	No
Comment: N/A			
Continuity of Operations Plan	No	No	No
Comment: N/A			
Public Health Plan	No	No	No
Comment: N/A			

Table 6-2. Fiscal Capability

Financial Resources	Accessible or Eligible to Use?
General Operating Funds	Yes
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	No
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	No
Withhold Public Expenditures in Hazard-Prone Areas	Unknown
State-Sponsored Grant Programs (TIB and Dept of Ecology)	Yes
Development Impact Fees for Homebuyers or Developers - Park Impact Fee, Transportation Impact Fee, Stormwater fee	Yes
Other	No

Table 6-3. Administrative and Technical Capability

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Contract Support
Engineers or professionals trained in building or infrastructure construction practices	Yes	Contract Support
Planners or engineers with an understanding of natural hazards	Yes	Contract Support
Staff with training in benefit/cost analysis	Yes	Contract Support
Surveyors	Yes	Contract Support
Staff capable of making substantial damage estimates	No	
Personnel skilled or trained in GIS applications	No	
Scientist familiar with natural hazards in local area	No	
Emergency manager	Yes	All Departments
Grant writers	Yes	Administration

Table 6-4. National Flood Insurance Program Compliance

Criteria	Response
When did the community enter the NFIP?	1995

Criteria	Response
When did the Flood Insurance Rate maps become effective?	8/16/2012
What local department is responsible for floodplain management?	Public Works Director
Who is your floodplain administrator? (department/position)	Public Works Director
Is this a primary or auxiliary role?	Auxiliary
Are any certified floodplain managers on staff in your jurisdiction?	No
What is the date of adoption of your flood damage prevention ordinance?	8/10/2012
Does your floodplain management program meet or exceed minimum requirements?	Exceed
If so, in what ways?	Region X 100 year flood plain Maps base flood elevations even though our designation does not require
When was the most recent Community Assistance Visit or Community Assistance Contact?	Unknown
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed? If so, please state what they are.	No No
Do your flood hazard maps adequately address the flood risk within your jurisdiction? If no, please state why.	Yes
Does your floodplain management staff need any assistance or training to support its floodplain management program? If so, what type of assistance/training is needed?	Yes Subdivision Training
Does your jurisdiction participate in the Community Rating System (CRS)? If so, is your jurisdiction seeking to improve its CRS Classification? If not, is your jurisdiction interested in joining the CRS program?	No No No
How many Flood Insurance policies are in force in your jurisdiction? [A] What is the insurance in force? [a] What is the premium in force? [a]	4 $683,200 $7,719
How many total loss claims have been filed in your jurisdiction? [a] How many claims were closed without payment/are still open? [a] What were the total payments for losses? [a]	0 0 $0

a. According to FEMA records as of 11/30/2015

Table 6-5. Community Classifications

	Participating?	Classification	Date Classified
Community Rating System	No	N/A	Date
Building Code Effectiveness Grading Schedule	No	N/A	Date
Public Protection	No	N/A	Date
Storm Ready	No	N/A	Date
Fire wise	No	N/A	Date

Table 6-6. Education and Outreach

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes, Mayor and Clerk
Do you have personnel skilled or trained in website development?	Yes, Mayor
Do you have hazard mitigation information available on your website?	No
If yes, please briefly describe.	

Criteria	Response
Do you utilize social media for hazard mitigation education and outreach?	No
If yes, please briefly describe.	
Do you have any citizen boards or commissions that address issues related to hazard mitigation?	No
If yes, please briefly specify.	
Do you have any other programs already in place that could be used to communicate hazard-related information?	No
If yes, please briefly describe.	
Do you have any established warning systems for hazard events?	No
If yes, please briefly describe.	

6.4 INTEGRATION WITH OTHER PLANNING INITIATIVES

The following describe the jurisdiction’s process for integrating the hazard mitigation plan into local planning mechanisms.

6.4.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan:

- Ordinance 440 Critical Area , it provides setbacks for structures from flood plains
- We have adopted all of the international building codes of Washington including geographical hazards and seismic activity.

6.4.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan, but provide an opportunity for future integration:

- Comprehensive Plan—Add future capital facilities funding for wildfire and include by reference.
- Zoning Ordinance 371 updated to be inclusive of all future emergency plans
- Ordinance #443 Emergency Management Plan, in order to be prepared for emergency
- Capital Improvement Plan – Review and add future improvements to support all areas of hazard plan.

6.5 JURISDICTION-SPECIFIC NATURAL HAZARD EVENT HISTORY

Table 6-7 lists all past occurrences of natural hazards within the jurisdiction.

Table 6-7. Natural Hazard Events

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Severe Storm	N/A	4/21/2016	unknown
Severe Storm	1825	12/12/2008	unknown
Severe Storm	1682	12/14/2006	unknown
Severe Storm	1671	12/02/2006	unknown
Severe Storm	N/A	6/27/2001	unknown
Earthquake	1361	2/28/2001	unknown

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Severe Storm	1159	12/26/1996	unknown
Severe Storm	1079	11/7/1996	unknown
Flood	1100	1/26/1996	unknown
Flood	N/A	8/22/1989	unknown
Volcano	623	5/18/1980	unknown
Flood	545	12/10/1977	unknown
Flood	185	12/29/1964	unknown

6.6 JURISDICTION-SPECIFIC VULNERABILITIES

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 0
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 0
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0

Other noted vulnerabilities include:

- Wildfire residential and commercial lots as developed are vulnerable including necessary services : Yacolt Town Hall, North County Fire District 13, Yacolt Primary School.

6.7 HAZARD RISK RANKING

Table 6-8 presents the ranking of the hazards of concern.

Table 6-8. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Severe weather	48	High
2	Wildfire	36	High
3	Earthquake	32	High
4	Landslide	27	Medium
5	Flood	18	Medium
6	Drought	1	Low
6	Volcano	1	Low
7	Dam failure	0	None

6.8 STATUS OF PREVIOUS PLAN INITIATIVES

Because of the significant amount of time that has passed since the development of the original hazard mitigation plan, the status of previously identified actions are unknown. Many actions were to be implemented by other agencies and were not within the capabilities of the Town of Yacolt. The previously identified actions were reviewed as part of the plan development process to determine if any should be carried over to the 2016 hazard mitigation plan. Actions that were deemed appropriate and within the capabilities of the Town of Yacolt are included in the following tables.

Table 6-9.Status of Previous Plan Initiatives

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
Conduct pre-earthquake assessments for critical and essential facilities and develop a risk reduction strategy		X	
Comment:			
Develop a system for public awareness on a semiannual basis for emergency preparedness using meetings, social media and automation and other electronic methods.		X	
Comment:			
Collectively work with local agencies to encourage partnerships to advise the public of no burn policies as preventative measures.		X	
Comment:			
Identify and participate in opportunities for strategic relations between emergency management and social service providers		X	
Comment:			
Work collectively with local, state and federal agencies to update crucial planning and development plans for the long term by incorporating the recommendations of risk assessment in the hazard mitigation plan as part of planning and development.		X	
Comment:			
Develop a business resumption model or Continuity of Operations Plan		X	
Comment:			
Develop priority routes in and out of town ensuring access for emergency vehicles and all residents for effective response and recovery from disaster events.		X	
Comment:			
Promote development off of the floodplain, supporting the use of mapping technology and ensuring all professionals are state certified and licensed in geographical elevations		X	
Comment:			
Promote Clean Water Programs and develop storm water basin plans		X	
Comment:			
Where appropriate, support retro-fitting, relocation or acquisition from willing property owners of structures located in hazard prone areas to protect structures from future damage, with repetitive and severe repetitive loss as a priority.		X	
Comment:			
Integrate the hazard mitigation plan into other plans, programs, ordinances , codes and databases that dictate land use decisions, unified development, comprehensive planning, critical areas ordinances, stormwater etc. within the community.		X	
Comment:			
Continue to maintain good standing and compliance under the National Flood Insurance Program (NFIP). This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP: • Enforcement of the flood damage prevention ordinance. • Participate in floodplain identification and mapping updates. • Provide public assistance/information on floodplain requirements and impacts.		X	

6.9 Hazard Mitigation Action Plan and Evaluation of Recommended Actions

Table 6-10 lists the actions that make up the town of Yacolt hazard mitigation action plan. Table 6-11 identifies the priority for each action. Table 6-12 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Table 6-10. Hazard Mitigation Action Plan Matrix 2023-2028

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
YA-1—Conduct pre-earthquake assessments for critical and essential facilities and develop a risk reduction strategy.						
Existing	Earthquake	4,10,12	Public Works	Medium	Staff time, general fund, HMGP and PDM for implementation	Short term
YA-2—Develop a system for public awareness on a semiannual basis for emergency preparedness using meetings, social media and automation and other electronic methods.						
New and Existing	All Hazards	1,2,3,5,6,10, 12	Town Staff, CRESA,	High	Staff time, general fund	Long term
YA-3—Collectively work with local agencies to encourage partnerships to advise the public of no burn policies as preventative measures.						
New and Existing	Wildfire	1,2,4,9,12	Fire District 13, Town Staff, Fire Marshall,	Medium	General funds, staff time	Long term
YA-4—Identify and participate in opportunities for strategic relations between emergency management and social service providers						
N/A	All hazards	2,5,6,9,10	CRESA, Red Cross	Low	Operating Budget	Short term
YA-5—Work collectively with local, state and federal agencies to update crucial planning and development plans for the long term by incorporating the recommendations of risk assessment in the hazard mitigation plan as part of planning and development.						
New and Existing	All Hazards	1,4,5,6,12	Public Works, Community Development, Clark County, Dept. of Ecology,	High	Operating Budget	Long Term
YA -6—Develop a business resumption model or Continuity of Operations Plan						
New and Existing	All Hazards	3,4,5,10	Town Staff, Local Business Owners, CRESA, Community Development	Medium	Operating Budget, Possibly UASI	Short Term
YA-7—Develop priority routes in and out of town ensuring access for emergency vehicles and all residents for effective response and recovery from disaster events.						
New and Existing	All Hazards	4,5,6,9,11,	Fire District 13, Fire Marshall, Clark County, Yacolt Public Works	High	Operating Budget, State and federal agencies, Possibly FP&S grants	Short term
YA-8—Promote development off of the floodplain, supporting the use of mapping technology and ensuring all professionals are state certified and licensed in geographical elevations						

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
New and Existing	Landslides Floods	1,5,6,7,9,101 2	Community Development, GIS, Planning and Development, Public Works	Medium	Operating Budget	
YA-9—Promote Clean Water Programs and develop storm water basin plans						
Existing	Floods	1,2,5,6,7,8,9, 12	Public Works, Community Development, Planning	Medium	Operating Budget, state and federal resources, Possibly EPA Grants	Short term
YA-10—Where appropriate, support retro-fitting, relocation or acquisition from willing property owners of structures located in hazard prone areas to protect structures from future damage, with repetitive and severe repetitive loss as a priority.						
Existing	All Hazards	4, 5, 7, 9, 10	Community Development, Planning	High	HMGP, PDM, FMA, CDBG-DR	Long-term
YA-11—Integrate the hazard mitigation plan into other plans, programs, ordinances , codes and databases that dictate land use decisions, unified development, comprehensive planning, critical areas ordinances, stormwater etc. within the community.						
New and Existing	All Hazards	2, 4	Community Development, Planning, Public Works	Low	Staff Time, General Funds	On-going
YA-12—Continue to maintain good standing and compliance under the National Flood Insurance Program (NFIP). This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP: Enforcement of the flood damage prevention ordinance. Participate in floodplain identification and mapping updates. Provide public assistance/information on floodplain requirements and impacts.						
New and Existing	Flood	1, 4, 5, 9	Public Works	Low	Staff Time, General Funds	On-going

Table 6-11. Mitigation Strategy Priority Schedule

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
YA-1	3	High	Medium	Yes	No	No	Medium	High
YA-2	12	High	High	Yes	Yes	Maybe	High	High
YA-3	5	High	Medium	Yes	Yes	Yes	High	High
YA-4	5	High	Low	Yes	Yes	Yes	High	low
YA-5	5	High	High	Yes	Yes	No	Medium	High
YA-6	4	High	High	Yes	Maybe	No	Medium	High
YA-7	5	High	High	Yes	Yes	No	High	High

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
YA-8	7	Medium	Medium	Yes	Yes	No	Medium	High
YA-9	8	Medium	High	Yes	Maybe	Yes	High	High
YA-10	5	High	High	Yes	Yes	No	Medium	High
YA-11	2	Medium	Low	Yes	No	Yes	High	Low
YA-12	Medium	Low	Yes	No	Yes	High	Low	Medium

a. See the introduction to this volume for explanation of priorities.

Table 6-12. Analysis of Mitigation Actions

Hazard Type	Action Addressing Hazard, by Mitigation Type[a]					
	1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Wildfire	YA-2,3,4,5,6,7,8, 11	YA- 1,3,5,6,8,10	YA-2,3,4	YA-1,2,3,	YA-2,3,5,7,	YA-1,2,4,5,,8
Drought	YA-2,3,5, 11	YA-10	YA-2,3,4	YA-4,5		
Volcano	YA-1,2,4, 11	YA-4,5,10	YA-2,4	YA-5	YA-2,4,5	YA_1,5
Earthquake	YA-11	YA-10				
Severe Storm	YA-11	YA-10	YA-2,4,5,7		YA-2,4,5,7	
Flood	YA2,4,8, 11, 12	YA-10, 12	YA-2,4,5, 12		YA_2,4,577	
Dam Failure	YA-11, 12	YA-10, 12	YA- 2,4,5, 12		YA-7	
Landslide	YA-2,4,5, 11	YA-5, 10	YA-2,4,5	YA-8	YA-2,4,5,7	

a. See the introduction to this volume for explanation of mitigation types.

6.10 FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

Yacolt needs to update its emergency plans to better address the issues of wildfires. We also need utilize state and federal funding to make necessary and vital changes to how we address the concerns of hazards

7. CITY OF VANCOUVER

7.1 HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact
Gene Juve, Emergency Manager
PO Box 1995
Vancouver, WA 98668-1995
Telephone: 360-487-8603
e-mail Address: gene.juve@cityofvancouver.us

Alternate Point of Contact
Geraldene Moyle, General Services Director
PO Box 1995
Vancouver, WA 98668-1995
Telephone: 360-487-8633
e-mail Address:
geraldene.moyle@cityofvancouver.us

7.2 JURISDICTION PROFILE

The following is a summary of key information about the jurisdiction and its history:

- Date of Incorporation—January 23, 1857
- 2021 Population—190,915
- Population Growth—Future growth through 2035 for Clark County as a whole is projected by OFM to most likely average approximately 1.3 percent per year. The City of Vancouver has proportionately less buildable land than Clark County and is anticipated to grow at a slightly slower annual pace on average, although future annexation may result in higher growth.
- Location and Description—The City of Vancouver is located on the Columbia River, the largest river in the Pacific Northwest. Located 106 miles upriver from the Pacific Ocean on the Columbia River, Vancouver is on the North shore across the river from Portland, OR. Vancouver is the largest city in southwest Washington and the gateway to the Columbia River Gorge National Scenic area. Vancouver has a robust port, thriving waterfront and community connection with the river through waterfront redevelopment, better public access and trails as well as parks and educational facilities that tie our past with our future and the Columbia River. Most properties adjacent to the border of Vancouver are within unincorporated Clark County; however, Vancouver shares much of its easternmost boundary with the City of Camas.
- Brief History—In 1825, Vancouver became headquarters for the Hudson's Bay Company. For many years, Vancouver was the center of all fur trading in the Pacific Northwest due to its vital location on the Columbia River. Over the century, Vancouver steadily developed. In 1908, the first rail line reached Vancouver. During World War I, Vancouver was home to the world's largest spruce cut-up mill. The mill made lumber for airplanes that helped win the war in Europe. During World War II, Vancouver's Kaiser Shipyard built a variety of crafts that contributed greatly to America's war effort.
- Climate—Vancouver enjoys mild weather with less average annual rainfall than Boston, Washington D.C. or Atlanta. Seasons are distinct. Summer temperatures generally climb into the low 80s. Winter nights rarely fall below 30 degrees Fahrenheit. Average annual rainfall is 42 inches and average annual snowfall is 3 inches.

- Governing Body Format—The City of Vancouver is managed by a Council/Manager form of government. The council has seven members including a mayor. The City Council has responsibility for adopting this plan; the City Manager oversees its implementation.
- Development Trends—Recent development in the City of Vancouver has consisted primarily of new multifamily housing, which is encouraged by a state development incentive that provides a reduction in property tax for both affordable and market rate housing. Office space development has picked up and the city has initiated several major development projects, including The Heights neighborhood center and the Fourth Plain international project. The city's premier development site of 32 acres of waterfront development is complete. Overall development is guided by the city's Comprehensive Plan, which provides the long-term vision and policy direction for managing the built and natural environment in Vancouver and providing necessary public facilities. The Land Use and Development Code contains use and development standards. The Plan and Code contain zoning maps which designate the general categories of uses (e.g. commercial, industrial, residential) that are allowed on individual properties citywide.

7.3 CAPABILITY ASSESSMENT

An assessment of legal and regulatory capabilities is presented in Table 7-1. An assessment of fiscal capabilities is presented in Table 7-2. An assessment of administrative and technical capabilities is presented in Table 7-3. Information on National Flood Insurance Program (NFIP) compliance is presented in Table 7-4. Classifications under various community mitigation programs are presented in Table 7-5. An assessment of education and outreach capabilities is presented in Table 7-6.

Table 7-1. Legal and Regulatory Capabilities

	Local Authority	Other Jurisdiction Authority	State Mandated
Building Code	Yes	No	Yes
***Comment**: The City's Building Codes are based on International Building Codes that are adopted by the state. City Building Code is codified at Vancouver Municipal Code (VMC), Title 17; The requirements and standards of this code are implemented and enforced by the Community Development Department. Following is the link to City adopted Building Codes: http://www.cityofvancouver.us/vmc?tid=331&throbber=1*			
Zoning Code	Yes	No	Yes
***Comment**: The City controls land use and many development standards through its zoning code. This is codified at VMC Title 20 and is referred to as the City's Land Use and Development Code. The requirements and standards of this code are implemented and enforced by the Community Development Department. See http://www.cityofvancouver.us/vmc?tid=334&throbber=1*			
Subdivisions	Yes	No	Yes
***Comment**: The City has approval authority over land divisions of property (short plats, subdivisions, binding site plans.)The procedures and standards that pertain to land divisions are located in VMC 20.320, in the City's Land Use and Development Code. See http://www.cityofvancouver.us/vmc?tid=334&throbber=1*			
Stormwater Management	Yes	No	Yes
***Comment**: The City has approval authority over storm water management facilities. Under Clean Water Act regulations, local governments in Washington State and those subject to the federal National Pollutant Discharge Elimination System (NPDES) Storm Water Program are required to have stormwater management programs. As authorized by the Clean Water Act, the U.S. Environmental Protection Agency's NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. The City's Storm Water regulations and standards are codified at VMC Title 14.*			

	Local Authority	Other Jurisdiction Authority	State Mandated
Post-Disaster Recovery	Yes	No	No
***Comment**: The City participated as a primary stakeholder in the development of the Regional Recovery Framework (RDPO 2019) which includes city planning checklists and a framework outline focused on the seven Recovery Support Functions (RSF). Regional Recovery Framework_FullPlan.pdf - Google Drive*			
Real Estate Disclosure	Yes	No	Yes
***Comment**: There are several ordinances in Vancouver that require disclosure to a renter or buyer of property, including: VMC Title 8 (Public Peace and Safety): 1) residential rental agreement requirements; 2) rental agreement that waives tenant's remedies is prohibited; 3) additional affirmative defense created for renters; and VMC Title 20 (Land Use and Development): a) notice on title required for residential projects located in a Noise Impact Combining District; b) Plat note required for nearby surface mining operations; c) City may require applicant to complete SEPA public notice requirements. See http://www.cityofvancouver.us/vmc?tid=334&throbber=1*			
Growth Management	Yes	No	Yes
***Comment**: The City's Comprehensive Plan and associated ordinances are in compliance with state GMA law Policy EN-11 states that the City will "(manage development in geologically hazardous areas and floodplains to protect public safety."*			
Site Plan Review	Yes	No	No
***Comment**: The City requires site plan review approval of most commercial, industrial and multi-family projects prior to issuance of a building permit, per VMC 20.270. The procedural requirements and development standards that are applied to site plan reviews are implemented and enforced by the Community Development Department. See http://www.cityofvancouver.us/vmc?tid=334&throbber=1*			
Environmental Protection	Yes	No	Yes
***Comment**: The City has authority to review environmental impacts under the State Environmental Policy Act (SEPA) of any development project not otherwise exempted from SEPA review. The City has adopted the maximum thresholds in state law for triggering SEPA review, which are codified at VMC 20.790. The following ordinances protect the natural environment: Shoreline Management Ordinance, VMC 20.760; Critical Areas Ordinance, VMC 20.740 (includes wetlands, critical habitat, floodplains, and geo-hazard areas); and Tree Conservation Ordinance, VMC 20.770. These laws are implemented and enforced by the Community Development Department. See http://www.cityofvancouver.us/vmc?tid=334&throbber=1. Additionally, the Water Resources Protection Ordinance (VMC 14.26) sets minimum standards that help protect critical aquifers underlying the entire city, establishes greater standards of compliance for businesses and industries that manage hazardous materials, and creates Special Protection Areas around the City's water stations as an additional safeguard.*			
Flood Damage Prevention	Yes	No	Yes
***Comment**: The City reviews developments in the flood plain under its local floodplain ordinance. which is a part of the Critical Areas Ordinance, VMC 20.740. This ordinance is implemented and enforced by the Community Development Department. See http://www.cityofvancouver.us/vmc?tid=334&throbber=1*			
Emergency Management	Yes	No	Yes
***Comment**: The City of Vancouver has an Emergency Manager and is a participant in the 2018 Clark County Comprehensive Emergency Management Plan http://cresa911.org/emergency-management/response-plans/*			
Climate Change	No	No	No
***Comment**: The City is currently developing a comprehensive Climate Action Plan with aggressive policies and benchmarks designed to achieve zero carbon emissions by 2040. Target date for adoption is 4th Quarter 2022. The Natural Hazard Mitigation Plan is concurrently going through a revision process to ensure climate change impact is appropriately reflected in the Hazard Identification and Risk assessment process.*			
General or Comprehensive Plan	Yes	No	Yes
Is the plan equipped to provide linkage to this mitigation plan?			
***Comment**: The City's Comprehensive Plan is undergoing a major revision/update which will include linkage with the Climate Action Plan and Natural Hazard Mitigation Plan. The Comprehensive Plan includes the following elements: land use, housing, capital facilities, utilities, and transportation.*			

	Local Authority	Other Jurisdiction Authority	State Mandated
Capital Improvement Plan	Yes	No	Yes
What types of capital facilities does the plan address? Streets, water, sewer, storm water, parks			
How often is the plan updated? Every six years. Current CIP runs through 2026			
***Comment**: The City has detailed adopted capital improvement plans for all public facilities.*			
Floodplain or Watershed Plan	Yes	Yes	No
***Comment**:*			
Stormwater Plan	Yes	Yes	Yes
***Comment**: Vancouver's Surface Water Management Program is the core administration for coordinating activities required by the federal Clean Water Act and the City's Phase II National Pollution Discharge Elimination System (NPDES) Permit for Western Washington, issued by the WA Department of Ecology. The City's stormwater ordinances and related codes comply with the City's NPDES permit. The City's general permit requirements supplement and clarify the Western Washington Stormwater Manual to provide guidance for local conditions. The City's 2021 Stormwater Management Plan is at www.cityofvancouver.us/sites/default/files/fileattachments/public_works/page/1125/vancouver_-_2021_swmp_final.pdf*			
Habitat Conservation Plan	Yes	No	No
***Comment**: The City has wetland and habitat ordinances in place which protect critical areas from development, and regulations that protect endangered species from development in its Fish and Wildlife Conservation Area ordinance, at VMC 20.740.110 http://www.cityofvancouver.us/vmc/7380/20740110-fish-and-wildlife-habitat-conservation-areas?throbber=1*			
Economic Development Plan	Yes	No	Yes – dependent on funding
***Comment**: The City has adopted the County's Economic Development Plan, dated September 2011, the current edition of the plan.) http://static1.squarespace.com/static/53fcd546e4b09b99036a0e5f/t/54b31812e4b034ff307c51fb/1421023250596/FINAL_Clark+County+ED+Plan+9_2011.pdf*			
Shoreline Management Plan	Yes	No	Yes
***Comment**: The City has a locally-adopted Shoreline Management Plan and ordinance (VMC 20.760) which regulates uses in the shoreline environment. The Shoreline Management Plan, adopted in 1975 and updated in 2012, is implemented and enforced by the Community Development Department.*			
Community Wildfire Protection Plan	YES	No	No
***Comment**: The Fire Department has developed and published a Wildfire Action Plan instructing residents on establishing Defensive Space Zones, planning specific actions as the wildfire threat approaches, and evacuation/survival tips and tools.*			
Forest Management Plan	No	No	No
***Comment**: The City has an Urban Forest Management Plan (2007),as well as a tree conservation ordinance that contains regulations and best practices regarding the protection of trees and criteria for removal of trees. This ordinance is codified at VMC 20.770 and is implemented and enforced by the Urban Forester (Public Works Department) and the Community Development Department. Urban Forest Management Plan is at http://www.cityofvancouver.us/sites/default/files/fileattachments/public works/page/1389/ufmp fina-web.pdf*			
Climate Action Plan	Yes	No	No
***Comment**: The City has a DRAFT Climate Action Plan projected for Council approval in 4th Quarter, 2022.*			
Other	Yes	N/A	N/A
***Comment:** The Regional Disaster Debris Management Plan was completed in December 2018 after a year of planning and close coordination among regional partners. The City of Vancouver Annex outlines a strategy for managing disaster debris operations and assigns critical response roles and responsibilities. It also provides a timeline of activities based on normal, pre-event, response, and recovery time periods; and includes extensive pre-event messaging and implementing documents. Potential Debris Collection Sites have been identified and surveyed.*			

	Local Authority	Other Jurisdiction Authority	State Mandated
Comprehensive Emergency Management Plan	Yes	Yes	Yes
Comment*: Vancouver is a participant in the 2018 Clark County Comprehensive Emergency Management Plan. http://cresa911.org/emergency-management/response-plans/*			
Threat & Hazard Identification & Risk Assessment	Yes	Yes	No
Comment*: Clark County Hazards Identification Vulnerability Analysis- 2011; Document is maintained by CRESA*			
Post-Disaster Recovery Plan	Yes	No	No
Comment*: The City participated as a primary stakeholder in the development of the Regional Recovery Framework (RDPO 2019) which includes city planning checklists and a framework outline focused on the seven Recovery Support Functions (RSF). Regional Recovery Framework_FullPlan.pdf - Google Drive*			
Continuity of Operations Plan	Yes	No	No
Comment*: The City has a citywide COOP which is scheduled for update in 4th Quarter, 2022*			
Public Health Plan	No	Yes	No
Comment*: Region IV Public Health Emergency Response Plan – December 2013. Clark County Public Health is the lead agency and the plan is being revised to incorporate lessons-learned during the COVID-19 pandemic.*			

Table 7-2. Fiscal Capability

Financial Resources	Accessible or Eligible to Use?
Community Development Block Grants	Yes, in qualifying Census Tracts
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	City charges fees for water and sewer service; and such funds would be restricted to utility-related purposes
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	Unlikely
Withhold Public Expenditures in Hazard-Prone Areas	Yes, we could if City Council adopts this policy
State-Sponsored Grant Programs	Unknown
Development Impact Fees for Homebuyers or Developers	Yes: May only be used for specific purpose (e.g. Parks, Transportation, Schools, etc.)
City General Fund	Yes, upon specific budget approval by City Council
City Building Fund	Yes, but may only be used for building code/safety – related studies

Table 7-3. Administrative and Technical Capability

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Community Development/Public Works/Planning Official/City Engineer
Engineers or professionals trained in building or infrastructure construction practices	Yes	Community Development/Public Works/ Building Official/City Engineer

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with an understanding of natural hazards	Yes	Community Development/Planning Official
Staff with training in benefit/cost analysis	Yes	Finance Department/Budget Manager
Surveyors	Yes	Public Works/City Surveyor
Staff capable of making substantial damage estimates	No	Not available on-staff
Personnel skilled or trained in GIS applications	Yes	Public Works/Engineering Tech
Scientist familiar with natural hazards in local area	No	No on-staff scientists
Emergency manager	Yes	City Manager's Office
Grant writers	Yes	Public Works/CD/Transportation Planner or Surface Water Analyst

Table 7-4. National Flood Insurance Program Compliance

Criteria	Response
When did the community enter the NFIP?	08/17/81
When did the Flood Insurance Rate maps become effective?	09/05/2012
What local department is responsible for floodplain management?	Community Development
Who is your floodplain administrator? (department/position)	Community Development/Land Use Official
• Is this a primary or auxiliary role?	Primary
Are any certified floodplain managers on staff in your jurisdiction?	No
What is the date of adoption of your flood damage prevention ordinance?	8/20/2012
• Does your floodplain management program meet or exceed minimum requirements?	Meet
• If so, in what ways?	N/A
When was the most recent Community Assistance Visit or Community Assistance Contact?	6/20/2020
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed? • If so, please state what they are.	Yes Case No: 19-10-0377A: Structure built with lowest floor below the based flood elevation; In process of resolution
Do your flood hazard maps adequately address the flood risk within your jurisdiction? • If no, please state why.	Yes
Does your floodplain management staff need any assistance or training to support its floodplain management program? • If so, what type of assistance/training is needed?	Yes Refresher course on any new changes to flood plain management best practices is needed
Does your jurisdiction participate in the Community Rating System (CRS)? • If so, is your jurisdiction seeking to improve its CRS Classification? • If not, is your jurisdiction interested in joining the CRS program?	No Yes
How many Flood Insurance policies are in force in your jurisdiction? • What is the insurance in force? • What is the premium in force?	401 $120,901,200 $332,621
How many total loss claims have been filed in your jurisdiction?	12

Criteria	Response
• How many claims were closed without payment/are still open?	6
• What were the total payments for losses?	$113,938

Table 7-5. Community Classifications

	Participating?	Classification	Date Classified
Community Rating System	No	N/A	N/A
Building Code Effectiveness Grading Schedule	Yes	3	2019
Public Protection	No	___N/A____	Date
Storm Ready	No	N/A	N/A
Firewise	No	N/A	N/A

Table 7-6. Education and Outreach

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes, Laura Shepard (City Communications Director)
Do you have personnel skilled or trained in website development?	Yes, Brian Bates (Web Manager)
Do you have hazard mitigation information available on your website?	No; website currently undergoing revision
• If yes, please briefly describe.	
Do you utilize social media for hazard mitigation education and outreach?	Yes
• If yes, please briefly describe.	Vancouver uses Twitter and Facebook as well as the regional Clark Regional Emergency Alert system to alert the public to potential hazard risks.
Do you have any citizen boards or commissions that address issues related to hazard mitigation?	No
• If yes, please briefly specify.	
Do you have any other programs already in place that could be used to communicate hazard-related information?	Yes
• If yes, please briefly describe.	Neighborhood Association/Liaison program, local cable TV, city website, public information app
Do you have any established warning systems for hazard events?	
• If yes, please briefly describe.	Reverse 911 and "FlashNews" and we have the ability to push out messages using email (EMMA) distribution lists for various departments. Clark Regional Emergency Alert system. The new MyVancouver app also has the potential to allow push messages for those who have signed up, as does the Solid Waste RecycleRight app. Vancouver also participates in the Regional Disaster Preparedness Organization (http://www.portlandoregon.gov/rdpo/) for Portland UASI Region.

7.4 INTEGRATION WITH OTHER PLANNING INITIATIVES

The following describe the jurisdiction's process for integrating the hazard mitigation plan into local planning mechanisms.

7.4.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan:

- City Strategic Plan (2016-2021) at http://www.cityofvancouver.us/sites/default/files/2016StrategicPlan/index.html which includes Objective 1.2 (infrastructure), Objective 2.1 (Police, Fire, Emergency – seismic upgrades), and Objective 2.2 (emergency management). (2022 version drafted/pending City Council adoption.)
- City Critical Areas Ordinance (includes regulations for Fish and Habitat Conservation Areas, Frequently Flooded Areas and Geologic Hazard Areas) codified at VMC 20.740
- City Shoreline Management Plan and Ordinance, codified by reference at VMC 20.760. http://www.cityofvancouver.us/vmc/7384/20760010-purpose?throbber=1
- City Water System Comprehensive Plan
- City Transportation Improvement Plan
- City General Sewer Plan

7.4.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan, but provide an opportunity for future integration:

- City Strategic Plan (2022-2027) http://www.cityofvancouver.us/sites/default/files/2016StrategicPlan/index.html
- City Comprehensive Plan could provide more specific references to the Hazard Mitigation Plan goals, risk assessment and recommendations
- County Regional Disaster Recovery Plan
- City Climate Action Plan (currently in the final stages of development/adoption)

7.5 JURISDICTION-SPECIFIC NATURAL HAZARD EVENT HISTORY

Table 7-7 lists all past occurrences of natural hazards within the jurisdiction.

Table 7-7. Natural Hazard Event History

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Severe Heat Wave	N/A	6/26-28 2021	N/A
Windstorm	N/A	12/11/2014	N/A
Severe Winter Storm	1825	3/2/2009	N/A
Snow Event	N/A	12/19-26/2008	N/A
Severe Winter Storm	1682	2/14/2007	N/A
Severe Storm, Flooding	1671	12/12/2006	N/A
Severe Winter Storm	N/A	1/6-9/2004	$160,000 in public sector debris management
Hail, Severe Storm	N/A	6/27/2001	N/A
Earthquake (Nisqually Quake Magnitude 6.8)	1361	2/28/2001	N/A
Severe Winter Storm, Flooding	1159	1/17/1991	N/A

Flood	1100	2/9/1996	$29M; Damage to 120 businesses and 82 residences
Severe Storm(s)	1079	1/3/1996	N/A
Earthquake (Spring Break Quake Magnitude 5.6)	N/A	3/25/1993	N/A
Wind	N/A	1/10/1988	N/A
Wind	N/A	12/24/1983	N/A
Volcanic Eruption	623	5/21/1980	N/A
Flood	545	12/10/1977	N/A
Hail, Wind	N/A	5/1/1976	N/A
Tornado	N/A	4/5/1972	$28.3M

7.6 JURISDICTION-SPECIFIC VULNERABILITIES

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 0
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 0
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0

Other noted vulnerabilities include:

- City-Owned Facilities – The resilience of city facilities has been significantly enhanced. The city recently passed a special fire levy that will continue to upgrade our response resiliency. $60 million will be invested in replacement of Fire Station 3 and Fire Station 6, and fund seismic improvements for Stations 4,5 and 8. Fire Station 11 is in the design phase and will be built to meet seismic facility standards. The new Police Headquarters on Chkalov Drive is undergoing renovation to meet seismic standards for emergency facilities. The city has identified the site of our new Public Works Operations Center with seismic resiliency as a focal point of facility design and operation. When completed, the Center will house our Emergency Operations Center. City Hall, less than 15 years old, is seismic sturdy, with recent expansion of emergency generator capability and upgrades to the air filtration system. A few city buildings are located in the flood plain or in areas susceptible to liquefaction.
- Water System -- Eighty percent of the city's water distribution system consists of ductile iron pipe, which reduces water losses, and is more resilient to failure in an earthquake, the greatest natural hazard we face. Both the distribution and production systems of the City's water supply, including treatment and storage facilities, are being made less susceptible to damage from a major earthquake impact. The city recently completed major upgrades to seismic resiliency at Station #1 with new twin reservoirs plus a tower reservoir. Site security improvements included moving communication lines underground and advanced cybersecurity measures. Our Water System Comprehensive Plan continues to guide our capital improvement efforts (i.e. the city recently broke ground at Water Station #5 to replace an existing seismically deficient reservoir with two new storage reservoirs) to increase the resiliency of our water system to natural hazards. The City is also in the design stage to replace an existing reservoir and elevated tank at Water Station #3.
- On-Site Septic Systems – The City still has a number of homes in areas of the community that are still utilizing septic systems. Most have public sanitary sewer directly available to the property. These systems may be more susceptible to failure as the result of an earthquake, liquefaction, or landslides.

- Sewer System – The system which includes sewer lines, interceptors, lift stations and treatment plants as well as a sludge incinerator are potentially vulnerable to impacts of earthquakes and liquefaction, landslides and floods. Power disruption resulting from these events or hazards also has the potential to disrupt normal functions.
- Transportation System - The City has a number of structures, including bridges and retaining walls that might be damaged or compromised by earthquakes, landslides, flooding or heavy volcanic ash fall. In many cases responsibility for inspecting the soundness of these assets falls on partners or contractors (county, state, consultants) who might be involved in work for others during a major event. Some areas of the community experience occasional shallow flooding which limits the flow of traffic and/or may temporarily isolate access to some areas of the community during periods of localized or Columbia River flooding. Similarly, travel may be impacted or routes need to be closed as a result of snow, storm debris or other weather events; landslides; or hazardous material spills. During short-term or ongoing power grid outages the City's signal lights and streetlights will not function and this will likely limit traffic flow.
- Surface Water System -- There are a number of areas in the community that experience seasonal, shallow urban flooding during prolonged periods of high precipitation. This can impact mobility as well as threaten life and property. Drainage and/or infiltration structures and pipes may become blocked by excess water, debris, sediment, landslides, or volcanic ash. Hazardous material spills may move off-site and contaminate downstream locations if not property managed.
- Disaster Debris Planning – The Regional Disaster Debris Management Plan was completed in December 2018 after a year of planning and close coordination among regional partners. The City of Vancouver Annex outlines a strategy for managing disaster debris operations and assigns critical response roles and responsibilities. It also provides a timeline of activities based on normal, pre-event, response, and recovery time periods; and includes extensive pre-event messaging and implementing documents. Potential Debris Collection Sites have been identified and surveyed.

7.7 HAZARD RISK RANKING

Table 7-8 presents the ranking of the hazards of concern.

Table 7-8. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Severe Weather	33	High
2	Earthquake	32	High
3	Flood	9	Low
4	Wildfire	6	Low
5	Landslide	4	Low
6	Volcano	3	Low
7	Dam Failure	3	Low
8	Drought	0	Low

7.8 STATUS OF PREVIOUS PLAN INITIATIVES

Table 7-9 summarizes the initiatives that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this revision was prepared.

Table 7-9. Status of Previous Plan Initiatives

Action Item	Completed	Carry Over to Plan Update	Removed
Join FEMA's Community Rating System (CRS)			X
Comment: *Vancouver is not a participant in the CRS program.*			
Create Four PSA Videos to educate the public about disaster preparedness.	X		
Comment: *CVTV created four video spots that played on our cable stations and were shared on social media. Titles, date created, and links:* *1) Great Shake Out 10-9-2020 https://youtu.be/3blCWNu9v0c;* *2) STOP, DROP & (rock)'n ROLL! 1-14-2020 https://youtu.be/OSH6BJ1r_C4;* *3) Flood Insurance 4-29-2019 https://youtu.be/9HlVy51jKgU; and* *4) Defensible Space 2-15-19 https://youtu.be/HYgOpu0ReQw*			
Join WASafe, a state program through the Department of Health that provides expert assistance through its team of Safety Assessment Facility Evaluators which can be deployed to evaluate structural safety of buildings	X		
Comment: *Vancouver's Assistant Building Official represents the City in WASafe.*			
Implement Low Impact Development Standards for Buildings, Streets, Parking Lots, Storm Water Management Facilities, etc.		X	
Comment: *This is an ongoing process* ***Action Item VC-1 in Table 1-9***			
Replace Fire Station #2	X		
Replace Fire Station #1	X		
Implement Seismic Retrofit Recommendations of Water Storage Seismic Evaluation		X	
Comment: *As distribution pipes are replaced, zinc coated ductile iron is used as a standard throughout the water system. All newly installed pipes located in areas designated as highly liquefiable soils and all water mains 12-inches and greater in size are fully restrained. The City recently replaced three seismically deficient water storage tanks and completed seismic upgrades to three additional water storage tanks. A current construction project will replace an additional tank with two new resilient water storage tanks. A capital improvement plan has been developed that includes strategies for replacing two additional inadequate tanks. The City has been installing emergency generators at multiple sites and currently has the capacity to provide the average day demand water use on back-up power. The City has completed a vulnerability assessment, a water shortage response plan, and an emergency response plan for the water system. Additionally, the system has built in redundancy and capabilities within the distribution system to direct water where it is needed if one part of the system is compromised.* ***Action Item VC-2 in Table 1-9***			
Continue Incentive Program for Eliminating Private Septic Systems.		X	
Comment: *For the areas that are currently un-sewered, the City has an ongoing capital improvement plan that will continue to install public sanitary sewer collection services in areas where that has not been available. As part of the Capital program the City offers an incentive to connect and financing to encourage residents to connect and decommission existing septic systems.* ***Action Item VC-3 in Table 1-9***			
Implement Recommended Priority Improvements from Citywide Sewer System Study.		X	

Comment**: A completed Engineering study included an evaluation of condition and vulnerabilities of large diameter pipes in the sewer system (interceptors). The study provided a prioritization of upgrades and repairs to extend the life of pipes and reduce risks of adverse events. The evaluations included consideration of sensitive locations (waterways, soils, population areas, etc.). The City is working through this list of capital projects to address the required upgrades. In another project, the City and its consultant are preparing design plans to upgrade the mothballed sewage pump station, Burnt Bridge Creek Pump Station, to provide flexibility in directing sewage to Vancouver's two wastewater treatment plants, and to alleviate flow through the Burnt Bridge Creek Interceptor, especially during heavy rain events, which currently places the interceptor at risk for sewage overflows. Lastly, in 2018 the City constructed a bypass mitigation system for sewage entering the headworks of Westside Wastewater Treatment Plant. The operations contract for the treatment plants incorporates emergency planning and response activities and preparedness for those assets. Backup power is provided for the treatment plants as well as key lift stations. **Action Item VC-4 in Table 1-9			
Address Areas of Localized Street Flooding and Ensure Bridges are Inspected by Partner Agencies.	X		
***Comment**: The City has a Transportation Improvement Plan and newly authorized dedicated funding that supports our capability to maintain and upgrade the entire transportation and this will address some of the noted vulnerabilities. We work with partners to provide annual bridge inspections and the City's Operations Center and Surface Water Engineering teams coordinate to address known areas of seasonal urban flooding. Operations Center crews are fully prepared to respond to non-catastrophic levels of nature caused hazard events and emergency access priority clearance arterials (for example to access hospitals and schools, etc.) have been pre-identified to be prioritized in response efforts.*			
Prioritize Surface Water System Improvements that Decrease Vulnerabilities.		X	
Comment Public Works provides ongoing maintenance of the City's surface water infrastructure and Engineering uses a Capital Improvements Program to prioritize and undertake projects that improve system function. ***Action Item VC-5 in Table 1-9***			
Finalize and Adopt Regional Debris Management Plan.	X		
***Comment**: The Regional Disaster Debris Management Plan was completed in December 2018 after a year of planning and close coordination among regional partners. The City of Vancouver Annex outlines a strategy for managing disaster debris operations and assigns critical response roles and responsibilities. It also provides a timeline of activities based on normal, pre-event, response, and recovery time periods; and includes extensive pre-event messaging and implementing documents. Potential Debris Collection Sites have been identified and surveyed.*			
Replace City Operations Center located at 4711 NE Fourth Plain Blvd.		X	
Comment**: The City has acquired property on NE 94th Avenue, north of Padden Parkway, and will begin design of a replacement Operations Center (to occur within 5-6 years) to meet current codes and seismic standards. The existing operations center will either be repurposed or demolished. **Action Item VC-6 in Table 1-9			
Consolidate Vancouver Police Headquarters (currently located at 605 E Evergreen Blvd) from aging, vulnerable building to newer, seismic compliant Chkalov Building, located at 521 SE Chkalov Drive. Repurpose current Headquarters building for non-emergency related use.		X	
Comment**: This is a destination/location change to a more suitable and resilient alternate facility. **Action Item VC-7 in Table 1-9			
Evaluate and Prioritize Properties in Extreme Hazard Areas for Future Buy-out		X	
Comment**: This is an ongoing process. **Action Item VC-8 in Table 1-9			

Develop a Plan and Agreement to Increase Elevation of Units within Lakeside Mobile Estates. Work with property owner on a plan and schedule for raising or removing mobile homes that are located in the 100-year floodplain, and identification of possible grant funding that can assist in the costs of such enhancements.		X	
Comment**: This is an ongoing process pending a funding source. **Action Item VC-9 in Table 1-9			
Require the retrofitting of older, vulnerable or critical structures located on NEHRP 'E' and 'F' soils. This would only apply when substantial alterations or additions are proposed to such structures and will be applied at the time a building permit is reviewed.		X	
Comment**: This is an ongoing process. **Action Item VC-10 in Table 1-9			
Encourage non-structural retrofitting where appropriate in the City, given scope of project and intended use of building.		X	
Comment**: This is an ongoing process. **Action Item VC-11 in Table 1-9			
Retrofit hazardous material containment areas.	X		
***Comment**: The HAZMAT containment areas have been retrofitted.*			
Encourage non-structural retrofitting of hazardous materials containment through the establishment of a program to encourage structural retro-fitting of hazardous materials containment during City of Vancouver Fire Marshal operational permit inspections.		X	
Comment**: This is an ongoing process. **Action Item VC-12 in Table 1-9			
Develop an automated method to notify the public of events during a disaster.	X		
***Comment**: CRESA has developed, tested and implemented the Clark Regional Emergency Alert system... available to all jurisdictions.*			
Determine critical government functions and establish redundancy for these functions *Action Item VC-13 in Table 1-9*		X	
***Comment**: The City's Continuity of Operations (COOP) Plan is scheduled for revision in the 4th Quarter of 2022.*			
Continue to maintain good standing and compliance under the National Flood Insurance Program (NFIP). This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP: - Enforcement of the flood damage prevention ordinance - Participate in floodplain identification and mapping updates - Provide public assistance/information on floodplain requirements and impacts.		X	
Comment**: This is an ongoing process. **Action Item VC-14 in Table 1-9			

Tailor and Adopt a Model Post-Disaster Recovery Ordinance for Vancouver	X		
Comment*: The City participated in development of the Regional Recovery Framework Plan which is focused on the six FEMA Recovery Support Functions (RSFs) and used to tailor our disaster-specific recovery process.*			
Require the construction of earthquake-resilient structures through application of Building Codes as applicable	X		
Comment*: Incorporated into standard review/permitting procedures*			
Support development of integrated County storm water basin-wide plans	X		
Comment*: The City supports the county effort through annual coordination and collaboration.*			
Promote development outside of the floodplain.		X	
Comment*:* This includes responding to any directive from a recent court case that will make development in floodplains much more restrictive due to ESA-related concerns. Puget Sound is under this order currently (Phase 1) and the rest of the state including Vancouver is under Phase 2, which is not yet in effect but anticipated in the next several years. *This is an ongoing process.* ***Action Item VC-15 in Table 1-9***			
Conduct pre-earthquake assessments for critical and essential facilities and develop a risk-reduction strategy		X	
Comment*: This is an ongoing process.* ***Action Item VC-16 in Table 1-9***			
Integrate the hazard mitigation plan into other plans, programs, ordinances , codes and databases that dictate land use decisions, unified development, comprehensive planning, critical areas ordinances, stormwater etc. within the community.		X	
Comment*: This is an ongoing process.* ***Action Item VC-17 in Table 1-9***			
Ensure emergency vehicle access to all residents to allow effective response and recovery from disaster events.	X		
Comment*: Fire, Police and Public Works have recently completed a review and update of Emergency Transportation Routes (ETRs), as well as alternative routing options to avoid known hazard-vulnerable streets.*			
Develop priority routes throughout the City and improve these routes to a higher standard.	X		
Comment: *In addition to the ETRs mentioned above, Public Works reviews and updates street conditions during their annual Transportation Improvement Plan review and project prioritization.*			
Ensure appropriate equipment is available during events.	X		
Comment*: Fire, Police and Public Works annually review their equipment capabilities and take appropriate action to ensure sufficient resources are available for anticipated needs.*			

Where appropriate, support retro-fitting, relocation or acquisition from willing property owners of structures located in hazard prone areas to protect structures from future damage, with repetitive and severe repetitive loss as a priority. Seek opportunities to leverage partnerships within the planning area in these pursuits.		X	
Comment*: This is an ongoing process.* ***Action Item VC-18 in Table 1-9***			
Target development and preparedness efforts of Tier II hazardous material facilities.		X	
Comment: *This is an ongoing process.* ***Action Item VC-19 in Table 1-9***			

7.9 HAZARD MITIGATION ACTION PLAN AND EVALUATION OF RECOMMENDED ACTIONS

Table 7-10 lists the actions that make up the City of Vancouver hazard mitigation action plan. Table 7-11 identifies the priority for each action. Table 7-12 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Key to Acronyms:
CDD Community Development Department
CMO City Manager's Office
EPH Economic Prosperity and Housing Department
FEMA Federal Emergency Management Agency
VPD Vancouver Police Department

Table 7-10. Hazard Mitigation Action Plan Matrix

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
VC-1— ***Implement Low Impact Development Standards for Buildings, Streets, Parking Lots, Storm Water Management Facilities, etc.***						
New	Flood, Severe Storms	2, 4, 6, 7, 11, 12	CDD/Public Works*	Medium	Staff Time, General Fund	Short-term
VC-2— ***Implement Seismic Retrofit Recommendations of Water Storage Seismic Evaluation.***						
Existing	All Hazards	2, 4	CDD	None	Capital Budget	Short-term
VC-3— ***Continue Incentive Program for Eliminating Private Septic Systems.***						
Existing	Earthquake, Flood, Landslide	5, 7, 11	Public Works	Medium	Capital Budget	On-going
VC-4— ***Implement Recommended Priority Improvements from Citywide Sewer System Study.***						
New	Earthquake	2, 5, 9, 10, 12	Public Works	High	Budget Surplus	Short-term
VC-5— ***Prioritize Surface Water System Improvements that Decrease Vulnerabilities.***						
Existing/New	Flood, Landslide	5, 8, 10, 12	Public Works	Medium	Capital Budget	Short-term

VC-6— ***Replace City Operations Center located at 4711 NE Fourth Plain Blvd.***						
New	Earthquake	5, 9, 10	Public Works	High	Capital Budget	Long-term
VC-7— ***Consolidate Vancouver Police Headquarters***						
Existing	Earthquake	5, 9, 10	VPD*/Public Works	High	Capital Budget	Long-term
VC-8— ***Evaluate and Prioritize Properties in Extreme Hazard Areas for Future Buy-out***						
Existing	Flood, Landslide	2, 9, 12	CDD	Medium	General Fund, HMGP, PDM, FMA	Short-term
VC-9— ***Develop a Plan and Agreement to Increase Elevation of Units within Lakeside Mobile Estates. Work with property owner on a plan and schedule for raising or removing mobile homes that are located in the 100-year floodplain, and identification of possible grant funding that can assist in the costs of such enhancements.***						
Existing	Flood	2, 9, 12	CDD	Medium	Staff Time, General Fund	Short-term
VC-10— ***Require the retrofitting of older, vulnerable or critical structures located on NEHRP 'E' and 'F' soils. This would only apply when substantial alterations or additions are proposed to such structures and will be applied at the time a building permit is reviewed.***						
Existing	Earthquake	2, 4, 5	CDD	Low (cost to City)	Staff Time, Building Fund	On-going
VC-11— ***Encourage non-structural retrofitting where appropriate in the City, given scope of project and intended use of building.***						
Existing	Earthquake	2, 4, 5	CDD	Low (cost to City)	Staff Time, Building Fund	On-going
VC-12— ***Encourage non-structural retrofitting of hazardous materials containment through the establishment of a program to encourage structural retro-fitting of hazardous materials containment during City of Vancouver Fire Marshal operational permit inspections.***						
Existing	Fire, Flood	2, 4, 5	Fire	Low	Operating	On-going
VC-13— *Determine critical government functions and establish redundancy for these functions.*						
Existing	All Hazards	1, 4, 8	CMO/Emergency Management	Low	Staff Time, General Fund	Short-term
VC-14—*Continue to maintain good standing and compliance under the National Flood Insurance Program (NFIP). This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP*						
New/Existing	Flood	1, 4, 5, 9	CDD*/Public Works	Low	Staff Time	On-going
VC-15— ***Promote development outside of the floodplain. This includes responding to any directive from a recent court case that will make development in floodplains much more restrictive due to ESA-related concerns. Puget Sound is under this order currently (Phase 1) and the rest of the state including Vancouver is under Phase 2, which is not yet in effect but anticipated in the next several years.***						
New	Flood	2, 4, 5, 7, 10, 11	CDD	Low	Staff Time, General Fund	On-going

VC-16— ***Conduct pre-earthquake assessments for critical and essential facilities and develop a risk-reduction strategy***						
Existing	Earthquake	4, 5, 10, 12	CDD	High	Building Fund	Long-term
VC-17— ***Integrate the hazard mitigation plan into other plans, programs, ordinances , codes and databases that reflect land use decisions, unified development, comprehensive planning, critical areas ordinances, stormwater etc. within the community.***						
New and Existing	All Hazards	1, 2, 4, 6	CDD	Low	Staff Time, General Funds	Long-term
VC-18— ***Where appropriate, support retro-fitting, relocation or acquisition from willing property owners of structures located in hazard prone areas to protect structures from future damage, with repetitive and severe repetitive loss as a priority. Seek opportunities to leverage partnerships within the planning area in these pursuits.***						
Existing	All Hazards	4, 5, 7, 9, 10	CDD	High	HMGP, PDM, FMA, CDBG-DR	Short-term
VC-19—***Build/relocate Fire Stations #3 and #6 to be better positioned to respond to emergencies and also to meet current seismic codes.***						
Existing	All Hazards	4,5,8,9,10, 12	Fire*/Public Works/CDD	High	Special Levy	Short-term
VC-20—***Upgrade Fire Stations #4, #5, and #8 to meet earthquake resilience standards.***						
Existing	Earthquake	4,5,8,9,10, 12	Fire*/Public Works/CDD	High	Budgeted Capital Improvements	Short-term
VC-21—***Complete construction of new Fire Station #11 in order to be better positioned to respond to emergencies and also to meet current seismic codes.***						
Existing	All Hazards	4,5,8,9,10, 12	Fire*/Public Works/CDD	High	Special Levy	Short-term
VC-22—***Incorporate Climate Action Plan natural hazard mitigation actions into the NHMP.***						
Existing	All Hazards	4,5,8,9,10, 12	CMO/EPH	Low	Staff Time	Short-term

Table 7-11. Mitigation Strategy Priority Schedule

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
VC-1	6	High	Medium	Yes	Maybe	No	High	Medium
VC-2	5	High	High	Yes	No	Yes	Medium	Low
VC-3	3	High	Medium	Yes	No	Yes	High	Low
VC-4	5	High	High	Yes	No	Yes	Medium	Low
VC-5	4	Medium	Medium	Yes	Maybe	No	Medium	Medium
VC-6	3	High	High	Yes	No	No	Medium	Low

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
VC-7	3	High	High	Yes	No	Yes	Medium	Low
VC-8	3	Medium	Medium	Yes	Maybe	No	Medium	Medium
VC-9	3	Low	Medium	Yes	Maybe	No	Low	Medium
VC-10	3	High	Low	Yes	No	Yes	High	Low
VC-11	3	High	Low	Yes	No	Yes	High	Low
VC-12	3	Medium	Low	Yes	Maybe	Yes	High	Medium
VC-13	3	High	Medium	Yes	No	No	Medium	Low
VC-14	4	Medium	Low	Yes	No	Yes	High	Low
VC-15	5	High	Low	Yes	No	Yes	High	Low
VC-16	4	High	High	Yes	Maybe	No	Medium	Medium
VC-17	4	High	Medium	Yes	No	No	High	Low
VC-18	5	High	High	Yes	Yes	Maybe	Medium	High
VC-19	6	High	High	Yes	No	No	High	Low
VC-20	6	High	High	Yes	No	Yes	High	Low
VC-21	6	High	Low	Yes	No	No	High	Low
VC-22	6	Medium	Low	Yes	Maybe	Yes	High	Medium

Table 7-12. Analysis of Mitigation Actions

Hazard Type	Action Addressing Hazard, by Mitigation Type[a]					
	1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Dam Failure	VC-15, VC-18	VC-15, VC-18, VC-19, VC-20, VC-21	VC-17	VC-22	VC-13	
Drought	VC-2			VC-22		
Earthquake	VC-16, VC-14	VC-3, VC-10, VC-11, VC-16, VC-17, VC-18, VC-19, VC-20, VC-21	VC-16, VC-17		VC-7,VC-13, VC-19, VC-20, VC-21	VC-2, VC-6, VC-10, VC-16, VC-19, VC-20, VC-21
Flood	VC-1, VC-5, VC-12, VC-15, VC-14, VC-18	VC-3, VC-5, VC-8, VC-9, VC-12 VC-15, VC-17, VC-18	VC-9, VC-17	VC-4, VC-12, VC-15, VC-22	VC-13	VC-2
Landslide	VC-1, VC-3, VC-5, VC-17, VC-18	VC-3, VC-5, VC-8, VC-17, VC-18	VC-17	VC-22	VC-13	VC-2
Severe Weather	VC-14	VC-17, VC-19, VC-20, VC-21		VC-4, VC-22	VC-13	VC-2, VC-4, VC-19, VC-20, VC-21
Volcano	VC-14	VC-17			VC-13	

Hazard Type	Action Addressing Hazard, by Mitigation Type[a]					
	1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Wildfire	VC-14	VC-17		VC-19, VC-20, VC-21, VC-22	VC-13	VC-19, VC-20, VC-21

8. CITY OF WASHOUGAL

8.1 NATURAL HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact
Mitch Kneipp, Community Development Director
1701 C Street
Washougal, WA 98671
360-835-8501 x604
mitch.kneipp@cityofwashougal.us

Alternate Point of Contact
Trevor Evers, Public Works Director
1701 C Street
Washougal, WA 98671
360-835-8501 x202
trevor.evers@cityofwashougal.us

8.2 JURISDICTION PROFILE

The following is a summary of key information about the jurisdiction and its history:

- Date of Incorporation—1908
- Current Population—17,390 as of April 1, 20122(2022 OFM estimate)
- Population Growth—Based on OFM data the City of Washougal has seen relatively steady growth with a population increase of over 54% from 7975 in the year 2002 to 17,390 in 2022.
- Location and Description—The City is located in Clark County, in southwest Washington along the Columbia River on the Oregon/Washington border. The City lies approximately 23 miles northeast from Portland, Oregon, 18 miles east of Vancouver, Washington and approximately 180 miles south of the City of Seattle. State Route 14 bisects the City as it heads east into the Columbia River Gorge National Scenic Area which defines the City's easternmost boundary and Washougal is immediately east of the City of Camas. Washougal currently occupies a total of approximately 5.7 square miles.
- Brief History—Joseph Durgan and Lewis Love purchased 20-acres from Richard Ough's Donation Land Claim and mapped the town of Washougal and platted it on May 6, 1880. The area was known for its fertile lowlands and supported dairy cattle, farming and logging. When the railroad came to town in 1908 it opened up Washougal to the transcontinental railroad lines and with that growth the City incorporated. The town steadily grew and in 1912 Pendleton Woolen Mills was established and has been the largest employer in the City and a thriving business here ever since. The City continues to thrive and has undertaken an effort to revitalize its downtown which has taken off and that, coupled with a successful Port offering a Marina and Industrial Park, the City is poised for growth.
- Climate—Washougal has a mild climate with an average of 50 inches of rain each year with about five days each winter where snow (usually unmeasurable) or icy conditions exist. The high temperature is the summer is around 82ºF and the low temperature in winter is around 34ºF.
- Governing Body Format—The City of Washougal operates under the laws of the State of Washington applicable to a Code City with a Mayor-Council form of government. Council members are elected by the citizens of the City and serve four-year terms as part-time elected officials acting in a legislative capacity. The Council holds regular meetings twice a month on second and fourth Mondays and special meetings as

needed. All meetings are open to the public as provided by law and agenda items are prepared in advance. The City Council of the City of Washougal assumes responsibility for the adoption of this plan; the City of Washougal Administration will oversee its implementation.

- Development Trends—Washougal has historically been a bedroom community and residential development continues to do well. The City has invested in its downtown with 6.5-million dollars of street improvements and private investment has followed. The Port of Camas/Washougal entered into a development agreement with the City for development of their 120-acre industrial park known as Steigerwald Commerce Center and the first phase of the development is nearly complete. Another development agreement between the Port, a private developer and the City will facilitate the redevelopment of a former lumber yard along the Columbia River into a mixed use development including parks, commercial and residential uses.

8.3 CAPABILITY ASSESSMENT

An assessment of legal and regulatory capabilities is presented in Table 8-1. An assessment of fiscal capabilities is presented in Table 8-2. An assessment of administrative and technical capabilities is presented in Table 8-3. Information on National Flood Insurance Program (NFIP) compliance is presented in Table 8-4. Classifications under various community mitigation programs are presented in Table 8-5. An assessment of education and outreach capabilities is presented in Table 8-6.

Table 8-1. **Legal and Regulatory Capability**

	Local Authority	Other Jurisdiction Authority	State Mandated
Building Code Comment: Washougal Municipal Code 15.04	Yes	No	Yes
Zoning Code Comment: Washougal Municipal Code Title 18	Yes	No	Yes
Subdivisions Comment: Washougal Municipal Code Title 17	Yes	No	Yes
Stormwater Management Comment: Washougal Municipal Code 14.28 and Washougal Engineering Standards Chapter 4	Yes	No	Yes
Post-Disaster Recovery Comment: N/A	No	No	No
Real Estate Disclosure Comment: N/A	No	No	No
Growth Management Comment: RCW 36.70A / City of Washougal Comprehensive Plan	Yes	Yes	Yes
Site Plan Review Comment: Washougal Municipal Code 18.88	Yes	No	No
Environmental Protection Comment: Washougal Municipal Code Title 16	Yes	No	Yes
Flood Damage Prevention Comment: Washougal Municipal Code 16.28	Yes	No	Yes
Emergency Management Comment: Washougal Municipal Code 2.48	Yes	No	Yes
Climate Change Comment: N/A	No	No	No
Other Comment: N/A	No	No	No
General or Comprehensive Plan Is the plan equipped to provide linkage to this mitigation plan?	Yes	Yes	Yes

	Local Authority	Other Jurisdiction Authority	State Mandated
Comment: Washougal Municipal Code 2.48 can be revised to provide linkage, as well as the Comprehensive Plan			
Capital Improvement Plan	Yes	No	Yes
What types of capital facilities does the plan address? How often is the plan updated? Comment: Transportation, Parks, Sewer, Water, Fire. As often as needed but usually amended annually.			
Floodplain or Watershed Plan	No	No	No
Comment: N/A			
Stormwater Plan	Yes	No	Yes
Comment: 2014 Stormwater Management Program (SWMP for the City of Washougal)			
Habitat Conservation Plan	No	No	No
Comment: N/A			
Economic Development Plan	Yes	Yes	Yes – dependent on funding
Comment: The City is partners with the City of Camas and the Port of Camas/Washougal in our own economic development agency known as the Camas/Washougal Economic Development Association (CWEDA) and the City also contributes to the regional economic development agency known as the Columbia River Economic Development Council (CREDC).			
Shoreline Management Plan	Yes	No	Yes
Comment: The City's SMP is still being developed and reviewed with completion anticipated in 2016.			
Community Wildfire Protection Plan	No	No	No
Comment: N/A			
Forest Management Plan	No	No	No
Comment: N/A			
Climate Action Plan	No	No	No
Comment: N/A			
Other	No	No	No
Comment: N/A			
Comprehensive Emergency Management Plan	Yes	No	Yes
Comment: Washougal Municipal Code 2.48- Emergency Management adopted February 21, 2006.			
Threat & Hazard Identification & Risk Assessment	No	No	No
Comment: N/A			
Post-Disaster Recovery Plan	No	No	No
Comment: N/A			
Continuity of Operations Plan	No	No	No
Comment: N/A			
Public Health Plan	No	No	No
Comment: N/A			

Table 8-2. **Fiscal Capability**

Financial Resources	Accessible or Eligible to Use?
Community Development Block Grants	Yes
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	Yes (Water, Sewer and Stormwater)
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	Yes (Local Improvement District) (LID)
Withhold Public Expenditures in Hazard-Prone Areas	No

Financial Resources	Accessible or Eligible to Use?
State-Sponsored Grant Programs	Yes (Department of Transportation (TIB); Washington Association of Sheriffs and Police Chiefs (WASPC); Department of Health; Recreation and Conservation Office; Department of Ecology; and Utilities & Transportation Commission)
Development Impact Fees for Homebuyers or Developers	Yes
Other	No

Table 8-3. **Administrative and Technical Capability**

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Community Development – Community Development Director and Planner
Engineers or professionals trained in building or infrastructure construction practices	Yes	Community Development – Building Official and Building Inspector Public Works – City Engineer and Engineering Inspector
Planners or engineers with an understanding of natural hazards	No	We would contract this out.
Staff with training in benefit/cost analysis	No	We would contract this out.
Surveyors	Yes	Contract support
Staff capable of making substantial damage estimates	No	We would contract this out.
Personnel skilled or trained in GIS applications	Yes	Community Development – Community Development Director and Planner
Scientist familiar with natural hazards in local area	No	We would contract this out.
Emergency manager	Yes	Camas / Washougal Fire Department and CRESA
Grant writers	Yes	Public Works – Senior Analyst and Parks Manager

Table 8-4. **National Flood Insurance Program Compliance**

Criteria	Response
When did the community enter the NFIP?	03/02/81
When did the Flood Insurance Rate maps become effective?	09/15/2012
What local department is responsible for floodplain management?	Community Development
Who is your floodplain administrator? (department/position) • Is this a primary or auxiliary role?	Community Development – Community Development Director (Mayor's designee) Auxiliary
Are any certified floodplain managers on staff in your jurisdiction?	No
What is the date of adoption of your flood damage prevention ordinance? • Does your floodplain management program meet or exceed minimum requirements? • If so, in what ways?	October 1, 2012 Meet
When was the most recent Community Assistance Visit or Community Assistance Contact?	2012
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed? • If so, please state what they are.	No
Do your flood hazard maps adequately address the flood risk within your jurisdiction? • If no, please state why.	Yes

Criteria	Response
Does your floodplain management staff need any assistance or training to support its floodplain management program? • If so, what type of assistance/training is needed?	No, staff has utilized on-line training N/A
Does your jurisdiction participate in the Community Rating System (CRS)? • If so, is your jurisdiction seeking to improve its CRS Classification? • If not, is your jurisdiction interested in joining the CRS program?	No N/A Possibly
• How many Flood Insurance policies are in force in your jurisdiction? [a] • What is the insurance in force? [a] • What is the premium in force? [a]	47 $14,465,000 $37,692
• How many total loss claims have been filed in your jurisdiction? [a]	10
• How many claims were closed without payment/are still open? [a]	2
• What were the total payments for losses? [a]	$71,369.59

a. According to FEMA records as of 11/30/2015.

Table 8-5. **Community Classifications**

	Participating?	Classification	Date Classified
Community Rating System	No	N/A	N/A
Building Code Effectiveness Grading Schedule	Yes	Dwelling – 2; Commercial – 2	8/2012
Public Protection	Yes	Dwelling – 5; Commercial – 5	7/2012
Storm Ready	No	N/A	N/A
Firewise	Yes (West End)	Firewise	2009

Table 8-6. **Education and Outreach**

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes – Daniel Layer, Finance Director
Do you have personnel skilled or trained in website development?	Yes – IT Manager, PC\Network Specialist and Social Media Specialist
Do you have hazard mitigation information available on your website? • If yes, please briefly describe.	No, but we could
Do you utilize social media for hazard mitigation education and outreach? • If yes, please briefly describe.	Yes We have recently utilized our website, Twitter feed and Facebook page to publicize this update to the Natural Hazard Mitigation Plan.
Do you have any citizen boards or commissions that address issues related to hazard mitigation? • If yes, please briefly specify.	No N/A
Do you have any other programs already in place that could be used to communicate hazard-related information? • If yes, please briefly describe.	Yes Website, Twitter feed and Facebook page as well as a City maintained email list for subscribers.
Do you have any established warning systems for hazard events? • If yes, please briefly describe.	Yes We utilize our website, social media accounts and email subscribers list to notify the public of inclement weather or other possible hazards.

8.4 INTEGRATION WITH OTHER PLANNING INITIATIVES

The following describe the jurisdiction's process for integrating the natural hazard mitigation plan into local planning mechanisms.

8.4.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the natural hazard mitigation plan:

- City of Washougal Strategic Plan – "Public Safety" and "Emergency Preparedness" are identified within the "Core Services" pillar of the City's Strategic Plan.
- Comprehensive Plan – The Plan addressed Critical Areas including Frequently Flooded Areas, Geologically Hazardous Areas, Wetlands, Habitat Conservation Areas and Critical Aquifer Recharge Areas. Development regulations for all of these critical areas have been adopted consistent with the Comprehensive Plan. These regulations incorporate the Best Available Science to protect these areas and if there are impacts then appropriate mitigation is required.

8.4.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the natural hazard mitigation plan, but provide an opportunity for future integration:

- City of Washougal Strategic Plan – Public Safety is identified within the "Core Services" pillar of the City's Strategic Plan. Within that pillar Public Safety has been identified and an indicator to monitor improvements in Public Safety is "Emergency Preparedness." The Strategic Plan could be updated to reference the natural hazard mitigation plan and the natural hazard mitigation plan can be identified as a project showing progress towards Public Safety and adherence to the Strategic Plan.
- Comprehensive Plan – As part of an update reference to the natural hazard mitigation plan could be incorporated.
- Shoreline Management Plan – With the current update to Washougal's SMP the goals, risk assessment and/or recommendations of the natural hazard mitigation plan could be incorporated.

8.5 JURISDICTION-SPECIFIC NATURAL HAZARD EVENT HISTORY

Table 8-7 lists all past occurrences of natural hazards within the jurisdiction.

Table 8-7. **Natural Hazard Events**

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Flood	N/A	Oct. 2015	$75-100K
Blizzard	1825	Dec. 2008	Undetermined
Severe Storm	1682	Dec. 2006	Undetermined
Severe Storm	1671	Nov. 2006	Undetermined
Earthquake	1361	Feb. 2001	Undetermined
Severe Storm	1159	Dec. 1996	Undetermined
Severe Storm	1079	Nov. 1995	Undetermined
Volcanic Eruption	623	May 1980	Undetermined
Severe Storm	137	Oct. 1962	Undetermined

8.6 JURISDICTION-SPECIFIC VULNERABILITIES

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 0
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 0
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0

Other noted vulnerabilities include:

- Approximately 7.8 percent of structures in Washougal are located in dam inundation areas. Residents and property owners may not be aware of the risk because of the distance from the source of failure.
- Significant portions of the City are located in moderate to high liquefaction potential areas.
- Approximately 13 percent of structures in Washougal are located in Mt. Hood Distal hazard areas. Residents and property owners may not be aware that they are located in a volcano hazard area.
- There are 3 facilities reporting hazardous materials in the 100-year floodplain.
- There is an isolated area along the Washougal River located across from Hathaway Park that is known for flooding during heavy rain events. The City provides sand and sandbags for residents to help fortify their property.
- The City of Washougal only has one bridge crossing the Washougal River serving the residences to the north of town. There is an additional bridge on the west end of town but it is located in Camas.
- This City of Washougal has seven (7) at-grade railroad crossings and only one (1) railroad overpass over the Burlington Northern Railroad tracks. These tracks bisect the city and if they are congested or blocked there is only one way to evacuate the northern portion of the city (highest population area) and if the overpass is also compromised there is no way to evacuate this area to the south or for the area to the south to be evacuated to the north.

8.7 HAZARD RISK RANKING

Table 8-8 presents the ranking of the hazards of concern.

Table 8-8. **Hazard Risk Ranking**

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Severe weather	33	High
2	Earthquake	32	High
3	Flood	18	Medium
3	Landslide	18	Medium
4	Volcano	15	Medium
5	Dam failure	8	Low
6	Wildfire	6	Low
7	Drought	1	Low

8.8 STATUS OF PREVIOUS PLAN INITIATIVES

Table 8-9 summarizes the initiatives that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this revision was prepared.

Table 8-9 Status of Previous Plan Initiatives

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
WS-1—Require the retrofitting of older, vulnerable or critical structures located on NEHRP ‘E’ and ‘F’ soils Comment: Staffing issue, lack of staff and funding		X	
WS-2—Through education and outreach support the retrofit of at-risk homes in subdivisions to prevent fire Comment: Staff merger and ongoing effort		X	
WS-3—Encourage the retrofit hazardous material containment areas. Comment: Lack of Staffing and a reduction in staffing		X	

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
WS-4—Encourage non-structural retrofitting of hazardous materials containment. Comment: Lack of staffing		X	
WS-5—Educate residents as to the benefits of defensible space to minimize and reduce the impacts of fires Comment: Staff merger limited full implementation		X	
WS-6—Provide fast, accurate spatial incident information for emergency services response Comment: City uses County GIS service, cannot support local service level in this area			X
WS-7—Conduct pre-earthquake assessments for critical and essential facilities and develop a risk-reduction strategy Comment lack of staff		X	
WS-8—Determine critical government communication functions and establish redundancy for these functions Comment: Police Department has completed this function, working with CRESA for 2023-2024 completion	X		
WS-9—Identify Tier II hazardous material facilities within Washougal and assess spill contingency plans and ensure adequate emergency services and response capabilities Comment: CRESA maintains Tier 2 reporting and MOU with VFD Hazmat provide adequate response	X		
WS-10—Continue to encourage partnerships among agencies to promote uniformity among no-burn policies Comment: Framework established to sustain efforts in the area.	X		
WS-11 Promote development off of the floodplain Comment: Framework established to sustain efforts in the area.	X		
WS-12—Consider adoption of a zero-rise floodway Comment: adopted no net rise policy in 2020	X		
WS-13—Institute low impact development practices Comment: Fully instituted in 2017-2018	X		
WS-14—Initiate a vegetation management program Comment: Noxious weed component added to property management plan in 2019	X		
WS-15—Ensure emergency vehicle access to all residents to allow effective response and recovery from disaster events. Comment: Ongoing effort. Required for new developments working into retrofit for older property		X	
WS-16—Continue to improve the priority routes throughout the city to a higher standard Comment: Ongoing effort. Required for new developments working into retrofit for older property		X	
WS-17—Ensure appropriate communication equipment is available during events Comment: Completed in PD, working the issue in joint service FD		X	
WS-18—Condition development in areas without adequate fire suppression to provide greater access. Comment: Updated fire codes, to include sprinklers, in all new developments	X		
WS-19—Seek opportunities to provide early warning of hazard events Comment: Ongoing		X	
WS-20—Where appropriate, support retro-fitting, purchasing or relocating structures located in high hazard areas and prioritize those structures that have experienced repetitive losses Comments: Lack of sustainable local funding, reduction in finance staffing, in addition to no significant repetitive losses is why this is no longer feasible.			X
WS-21—Integrate the natural hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions within the community	X		

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
Comments: Completed in last comprehensive plan update in 2016/2017			
WS-22—Continue to maintain good standing and compliance under the National Flood Insurance Program (NFIP). This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP: Comments: Ongoing effort		X	

8.9 HAZARD MITIGATION ACTION PLAN AND EVALUATION OF RECOMMENDED ACTIONS

Table 8-10 lists the actions that make up the City of Washougal hazard mitigation action plan. Table 8-11 identifies the priority for each action. Table 8-12 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Table 8-10. **Hazard Mitigation Action Plan Matrix**

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
WS-1—Require the retrofitting of older, vulnerable or critical structures located on NEHRP ‘E’ and ‘F’ soils						
Existing	Earthquakes	1, 2, 4, 7, 9, 12	Community Development	High	HMGP, PDM, FMA, Owner’s Expense	Long-term
WS-2—Through education and outreach support the retrofit of at-risk homes in subdivisions to prevent fire						
Existing	Wildland Fires	1, 2, 4, 7, 9, 12	Community Development / C-W Fire	High	HMGP, PDM, Owner’s Expense	Ongoing
WS-3—Encourage the retrofit hazardous material containment areas.						
Existing	Earthquakes	1, 2, 4, 5, 12	Community Development / C-W Fire	High	HMGP, Owner’s Expense	Ongoing
WS-4—Encourage non-structural retrofitting of hazardous materials containment.						
Existing	Earthquakes	1, 2, 4, 5, 7, 12	Community Development / C-W Fire	Medium	HMGP, PDM, Owner’s Expense	Ongoing
WS-5—Educate residents as to the benefits of defensible space to minimize and reduce the impacts of fires.						
New and Existing	Wildland Fires	1, 2, 4, 7, 9, 12	C-W Fire	Medium	HMGP, PDM, General Fund	Ongoing
WS-6—Conduct pre-earthquake assessments for critical and essential facilities and develop a risk-reduction strategy						
New and Existing	New and Existing	New and Existing	New and Existing	New and Existing	New and Existing	New and Existing
WS-7—Ensure emergency vehicle access to all residents to allow effective response and recovery from disaster events.						
New and Existing	All Hazards	1, 2, 3, 4, 8, 12	Community Development / Public Works / Washougal PD / C-W Fire	High	General Fund	Ongoing
WS-8—Continue to improve the priority routes throughout the city to a higher standard.						
New and Existing	All Hazards	2, 3, 4, 5, 8, 10, 12	Community Development / Public Works / Washougal PD / C-W Fire	High	HMGP, PDM, State Grants, General Fund	Long-term

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
WS-9—Ensure appropriate communication equipment is available during events.						
New and Existing	All Hazards	1, 2, 4, 6, 8, 12	Community Development / Public Works / Washougal PD / C-W Fire	High	General Fund	Ongoing
WS-10—Seek opportunities to provide early warning of hazard events						
New	All Hazards	1, 2, 3, 4, 12	Community Development / Public Works / Washougal PD / C-W Fire	Medium	Possibly HMGP, General Fund	Ongoing
WS-11—Continue to maintain good standing and compliance under the National Flood Insurance Program (NFIP). This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP: • Enforcement of the frequently flooded areas ordinance • Participate in floodplain identification and mapping updates • Provide public assistance/information on floodplain requirements and impacts.						
New and Existing	Flood	1, 2, 4, 5, 6, 9, 11, 12	Community Development	Low	General Fund	Ongoing

Table 8-11. **Mitigation Strategy Priority Schedule**

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
WS-1	6	High	High	Yes	Yes	No	Medium	High
WS-2	6	Medium	High	No	Yes	No	Low	Medium
WS-3	5	Medium	High	No	Yes	No	Low	Medium
WS-4	6	Low	Medium	No	Yes	No	Low	Medium
WS-5	6	Low	Medium	No	Yes	No	High	Medium
WS-6	4	Medium	Medium	Yes	Yes	No	Medium	Medium
WS-7	6	High	High	Yes	No	No	Low	Low
WS-8	7	Medium	High	No	Yes	No	Low	Medium
WS-9	6	Medium	High	No	No	No	Low	Low
WS-10	5	High	Medium	Yes	Maybe	No	Medium	Medium
WS-11	8	High	Low	Yes	No	Yes	Medium	Low

a. See the introduction to this volume for explanation of priorities.

Table 8-12. **Analysis of Mitigation Actions**

Hazard Type	Action Addressing Hazard, by Mitigation Type[a]					
	1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Dam Failure	WS-7, WS-10	WS-7, WS-10	WS-10		WS-7, WS-10	WS-15
Earthquake	WS-1, WS-3, WS-4; WS-6,	WS-1, WS-3, WS-4, WS-6,	WS-1, WS-3, WS-4, WS-10		WS-6, WS-7, WS-8, WS-9, WS-10	WS-1, WS-3,

Hazard Type	Action Addressing Hazard, by Mitigation Type[a]					
	1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
	WS-7, WS-8, WS-10	WS-7, WS-8, WS-9, WS-10				
Landslide	WS-7, WS-7, WS-8, WS-10,	WS-7, WS-7, WS-8, WS-9, WS-10	WS-10	WS-7	WS-7, WS-8, WS-9, WS-10	
Flood	WS-7, WS-8, WS-10, WS-11	WS-7, WS-8, WS-9, WS-10, WS-11	WS-10, WS-11	WS-10	WS-7, WS-8, WS-9, WS-10	
Severe Weather	WS-7, WS-8, WS-10	WS-7, WS-8, WS-9, WS-10	WS-10,		WS-7, WS-8, WS-9, WS-10	
Volcano	WS-7, WS-8, WS-10,	WS-7, WS-8, WS-9, WS-10,	WS-10,		WS-7, WS-8, WS-9, WS-10	WS-15
Wildland Fire	WS-2, WS-5, WS-7, WS-8, WS-10	WS-2, WS-5, WS-7, WS-8, WS-9, WS-10	WS-2, WS-5, ,WS-10,	WS-5,	WS-7, WS-8, WS-9, WS-10	WS-2,

a. See the introduction to this volume for explanation of mitigation types.

9. BATTLE GROUND PUBLIC SCHOOLS

9.1 HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact
Tom Adams, Director of Student Services
PO Box 200
Battle Ground, WA 98604
Telephone: 360-885-5415
e-mail Address: adams.tom@battlegroundps.org

Alternate Point of Contact
Cheri Dailey, Director of Risk Management and Business Operations
PO Box 200
Battle Ground, WA 98604
Telephone: 360-885-5381
e-mail Address: dailey.cheri@battlegroundps.org

9.2 JURISDICTION PROFILE

9.2.1 Overview

Battle Ground Public Schools is a public K-12 school district in northeast Clark County, Washington, and has 18 schools spread over 273 square miles. It stretches from the lowlands of suburban Vancouver on the west, near the confluence of Interstate 5 and Interstate 205, to the Cascade Mountains at the Clark-Skamania county line on the east. Mount St. Helens is just 10 miles outside of the district's northeast boundary. The district serves populations within portions of Clark County, the City of Battle Ground and the City of Vancouver. A five member elected board of directors governs the district. Battle Ground Public Schools Board of Directors assumes responsibility for the adoption of this plan; the Director of Student Services and the Executive Director of Facilities will oversee its implementation.

The district was established in 1909 and serves approximately 12,000 students and employs 1,602 staff. The school district is funded by the state as well as local levies.

9.2.2 Service Area and Trends

Approximately 78,081 people reside within the district's service area. The district serves a population of 12,000 students. Its service area covers an area of 273 square miles, which has a total replacement value of $814,705,640 for district assets and $13.7 billion for overall structure value.

The district has been reviewing building needs to accommodate increases in population but no decisions have been made at this time as to location. We have seen a great deal of new housing starts and apartment construction in the south of our district and expect increases in enrollment.

9.2.3 Assets

Table 9-1 summarizes the critical assets of the district and their value.

Table 9-1. Special Purpose District Assets

Asset	Value
Property	
563 acres	$32.4 million
Critical Facilities	
Amboy Middle School (6 facilities)	$40,602,000
Battle Ground High School (22 facilities)	$150,518,500
Captain Strong Elementary School (7 facilities)	$39,270,200
Center For Ag Science & Environ. Ed (10 facilities)	$23,436,540
Chief Middle School	$38,815,000
Daybreak Campus (5 facilities)	$62,570,000
Dodge House	$877,000
Glenwood Heights Primary (9 facilities)	$31,706,420
Homelink-CAM	$10,500,000
Laurin Middle (9 facilities)	$31,334,280
Lewisville Non School (6 facilities)	$26,078,320
Maple Grove Primary (3 facilities)	$31,865,120
River Home Link (8 facilities)	$34,130,160
Pleasant Valley Campus (8 facilities)	$51,423,860
Prairie High School (20 facilities)	$105,728,240
Tukes Valley Campus (5 facilities)	$62,570,000
Yacolt Primary (10 facilities)	$40,880,000
Total:	**$814,705,640**

9.3 Planning and regulatory Capabilities

The following existing codes, ordinances, policies or plans are applicable to this hazard mitigation plan:

- BGPS Board of Directors Policies
  Long Range Facility Plan
  Board of Directors Strategic Plan
  Capital Facilities Plan
- Clark County Codes
- City of Battle Ground Codes
- City of Vancouver Codes
- City of Yacolt Codes.

9.4 Fiscal, ADMINISTRATIVE and TECHNICAL Capabilities

An assessment of fiscal capabilities is presented in Table 9-2. An assessment of administrative and technical capabilities is presented in Table 9-3.

Table 9-2. Fiscal Capability

Financial Resources	Accessible or Eligible to Use?
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	NA
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	No
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	Yes - Impact Fees
Other	NA

Table 9-3. Administrative and Technical Capability

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Operations Department
Engineers or professionals trained in building or infrastructure construction practices	Yes	Operations Department
Planners or engineers with an understanding of natural hazards	Yes	Operations Department
Staff with training in benefit/cost analysis	Yes	Business Services
Surveyors	No	NA
Personnel skilled or trained in GIS applications	Yes	Facilities Department
Scientist familiar with natural hazards in local area	No	NA
Emergency manager	Yes	Business Services/HR
Grant writers	No	NA
Other	No	NA

9.5 EDUCATION AND OUTREACH CAPABILITIES

An assessment of education and outreach capabilities is presented in Table 1-4.

Table 9-4. Education and Outreach

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes
Do you have personnel skilled or trained in website development?	Yes
Do you have hazard mitigation information available on your website? • If yes, please briefly describe.	No
Do you utilize social media for hazard mitigation education and outreach? • If yes, please briefly describe.	No

Criteria	Response
Do you have any citizen boards or commissions that address issues related to hazard mitigation? • If yes, please briefly specify.	No
Do you have any other programs already in place that could be used to communicate hazard-related information? • If yes, please briefly describe.	Yes Blackboard Connect, FlashAlert, District information line
Do you have any established warning systems for hazard events? • If yes, please briefly describe.	Yes Blackboard Connect, FlashAlert, District information line

9.6 Integration with Other Planning Initiatives

The following describe the jurisdiction's process for integrating the hazard mitigation plan into existing plans and programs.

9.6.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan:

- None identified at this time.

9.6.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan, but provide an opportunity for future integration:

- Long Range Facility Plan
- Board of Directors Strategic Plan
- Capital Facilities Plan

9.7 Jurisdiction-Specific Natural Hazard Event History

Table 9-5 lists all past occurrences of natural hazards within the jurisdiction.

Table 9-5. Natural Hazard Events

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Washington Covid-19 Pandemic	DR-4481	March 22, 2020	NA
Severe Winter Storm, Straight Line Winds, Flooding, Landslides, Mudslides and a Tornado	DR-4253	December 1, 2015	NA
Severe Winter Storm and Record and Near Record Snow	DR-1825	December 12, 2008	NA

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Severe Winter Storm, Landslides, and Mudslides	DR-1682	December 14, 2006	NA
Severe Winter Storms, Flooding	DR-1159	December 26, 1996	NA
Volcanic Eruption, Mount St. Helens	DR-623	May 21, 1980	NA
Dole Valley Fire	NA	1929	NA
Yacolt Burn	NA	1903	$13,000,000

9.8 Jurisdiction-Specific Vulnerabilities

Noted vulnerabilities the jurisdiction include:

- Older facilities may not have been built to modern seismic standards.

9.9 Hazard Risk Ranking

Table 9-6 presents the ranking of the hazards of concern.

Table 9-6. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Severe Weather	18	Medium
2	Earthquake	16	Medium
3	Landslide	15	Medium
4	Wildfire	7	Low
5	Volcano	3	Low
6	Flood	2	Low
7	Dam Failure	0	None
7	Dan Failure	0	None

9.10 Status of Previous Plan Initiatives

Table 9-7 summarizes the initiatives that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared. The actions identified in the following table were developed in 2016.

Table 9-7. Status of Previous Plan Initiatives

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
Follow all federal, state, local, Office of Superintendent of Public Instruction (OSPI) applicable building standards		x	
Comment:			
Review OSPI Hazard Mitigation Plan goals and objectives	x		
Comment:			
Actively participate in plan maintenance outlined in volume 1 of the hazard mitigation plan		x	
Comment:			

Review potential risk for natural disasters on land purchases	x		
Comment:			
Share the hazard mitigation plan with the school board in a public meeting		x	
Comment:			
Work with local agencies (ESD112, CRESA, Local Fire and Law Enforcement) on reunification site	x		
Comment: Emergency Operations Plan Revised August 2021			
Complete state OSPI School Facilities Study and Survey for facilities review. Study addresses overall analysis of the school districts' facilities, educational programs and plans, student population projections, capital finance and operating capabilities and identification of needs for new construction, modernization or replacement of facilities.	x		
Comment:			
Ensure emergency communication systems functioning (Automated calling, district network and phone systems, e911 identification, district radio systems)	x		
Comment:			
Integrate the hazard mitigation plan into other plans and programs that support infrastructure investments choices, such as the capital improvement program.		x	
Comment: Currently updating Capital Facilities Plan			
Store emergency supplies and emergency water supply for students and staff at school for at least one day	x		
Comment: Each site is responsible for storing emergency supplies			
Where possible, support construction and retrofitting of vulnerable facilities			x
Comment: Per Executive Director of Facilities - retrofitting is too expensive, we try to replace building instead.			
Designate snow routes with transportation contractor to ensure student safety	x		
Comment:			
Install and maintain surge protection on critical electronic equipment	x		
Comment:			

9.11 Hazard Mitigation Action Plan and Evaluation of Recommended Actions

Table 9-7 lists the actions that make up the battle ground public schools hazard mitigation action plan. Table 9-8 identifies the priority for each action. Table 9-9 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Table 9-8. Hazard Mitigation Action Plan Matrix

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
BGPS-1—Follow all federal, state, local, Office of Superintendent of Public Instruction (OSPI) applicable building standards						
New	All hazards	4, 5, 10, 11, 12	BGPS Facilities	Low	General Fund, Levy	Ongoing
BGPS-2—Review OSPI Hazard Mitigation Plan goals and objectives						
NA	All hazards	4, 5, 10, 11, 12	BGPS Facilities	Low	General Fund, Levy	Short-term
BGPS-3—Actively participate in plan maintenance outlined in volume 1 of the hazard mitigation plan						
New and existing	All hazards	1, 4	BGPS Facilities	Low	General Fund, Levy	Ongoing
BGPS-4—Review potential risk for natural disasters on land purchases						
New	All hazards	4, 5, 10, 11, 12	BGPS	Low	General Fund, Levy	Short-term
BGPS-5—Share the hazard mitigation plan with the school board in a public meeting						
NA	All hazards	1, 4	BGPS	Low	General Fund, Levy	Ongoing
BGPS-6—Work with local agencies (ESD112, CRESA, Local Fire and Law Enforcement) on reunification site						
New and existing	All hazards	2, 4	BGPS	Low	General Fund, Levy	Short-term
BGPS-7—Complete state OSPI School Facilities Study and Survey for facilities review. Study addresses overall analysis of the school districts' facilities, educational programs and plans, student population projections, capital finance and operating capabilities and identification of needs for new construction, modernization or replacement of facilities.						
New and existing	All hazards	4, 5, 10, 11, 12	BGPS	Low	General Fund, Levy	Short-term
BGPS-8—Ensure emergency communication systems functioning (Automated calling, district network and phone systems, e911 identification, district radio systems)						
New and existing	All hazards	3	BGPS	Low	General Fund, Levy	Short-term
BGPS-9—Integrate the hazard mitigation plan into other plans and programs that support infrastructure investment choices, such as the capital improvement program.						
New and existing	All hazards	5, 6	BGPS	Low	General Fund, Levy	Short-term
BGPS-10—Store emergency supplies and emergency water supply for students and staff at school for at least one day						
New and existing	All hazards	2, 5	BGPS	Low	General Fund, Levy	Short-term
BGPS-11—Where possible, support construction and retrofitting of vulnerable facilities						
Existing	Earthquake	4, 5, 10, 11, 12	BGPS	High	General Fund, Levy, HMGP, PDM	Long-term
BGPS-12—Designate snow routes with transportation contractor to ensure student safety						
NA	Severe weather	4, 5, 6, 8, 12	BGPS	Low	General Fund, Levy	Short-term
BGPS-13—Install and maintain surge protection on critical electronic equipment						
New and existing	Severe weather	5, 8, 10	BGPS	Low	General Fund, Levy	Short-term

Table 9-9. Mitigation Strategy Priority Schedule

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
BGPS-13	3	Medium	Low	Yes	No	Yes	High	Low

a. See the introduction to this volume for explanation of priorities.

Table 9-10. Analysis of Mitigation Actions

Hazard Type	Action Addressing Hazard, by Mitigation Type[a] 1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Dam Failure	BGPS-2, BGPS-3, BGPS-4, BGPS-9	BGPS-1, BGPS-4, BGPS-7	BGPS-5		BGPS-6, BGPS-8, BGPS-10	
Drought	BGPS-2, BGPS-3, BGPS-4, BGPS-9	BGPS-1, BGPS-4, BGPS-7	BGPS-5		BGPS-6, BGPS-8, BGPS-10	
Earthquake	BGPS-2, BGPS-3, BGPS-4, BGPS-9	BGPS-1, BGPS-4, BGPS-7, BGPS-11	BGPS-5		BGPS-6, BGPS-8, BGPS-10	
Flood	BGPS-2, BGPS-3, BGPS-4, BGPS-9	BGPS-1, BGPS-4, BGPS-7	BGPS-5		BGPS-6, BGPS-8, BGPS-10	
Landslide	BGPS-2, BGPS-3, BGPS-4, BGPS-9	BGPS-1, BGPS-4, BGPS-7	BGPS-5		BGPS-6, BGPS-8, BGPS-10	
Severe weather	BGPS-2, BGPS-3, BGPS-4, BGPS-9	BGPS-1, BGPS-4, BGPS-7, BGPS-13	BGPS-5		BGPS-6, BGPS-8, BGPS-10, BGPS-12	
Volcano	BGPS-2, BGPS-3, BGPS-4, BGPS-9	BGPS-1, BGPS-4, BGPS-7	BGPS-5		BGPS-6, BGPS-8, BGPS-10	
Wildfire	BGPS-2 BGPS-3, BGPS-9	BGPS-1	BGPS-5		BGPS-6, BGPS-8, BGPS-10	

a. See the introduction to this volume for explanation of mitigation types.

10. CLARK COUNTY PUBLIC UTILITIES DISTRICT #1

10.1 NATURAL HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact
Dan Krebs, Director of Operations
PO Box 8900
Vancouver, WA 98668
Telephone: 360-992-8870
e-mail Address: dkrebs@clarkpud.com

Alternate Point of Contact
Crystal Jones, Emergency and Environmental Coordinator
PO Box 8900
Vancouver, WA 98668
Telephone: 360-992-8894
e-mail Address: cjones@clarkpud.com

10.2 JURISDICTION PROFILE

10.2.1 Overview

Clark Public Utilities (Utility) is a customer-owned utility providing electric and water service in Clark County, Washington. A municipal corporation organized under the laws of the state of Washington, the Utility was formed by a vote of the people in 1938 and currently provides electric service to more than 192,000 customers and water service to more than 31,000 homes and businesses. The Utility currently has 370 employees. A three-member board of commissioners is elected by the citizens of Clark County to set policy for the utility. The Board of Commissioners assumes responsibility for the adoption of this plan. The General Manager/CEO will oversee its implementation.

The Utility electric service area includes all of Clark County which is located in the Southwestern region of Washington State. The Columbia River forms its southern and western borders; it is bounded on the north by the Lewis River and on the east by Skamania County.

The water Utility service area covers about 200 square miles and includes the communities of Hazel Dell, Salmon Creek, Lakeshore, Felida, Mt. Vista, La Center, Brush Prairie, Hockinson, Venersborg, Heisson, Meadow Glade, Dollars Corner, Duluth, Pioneer, Manor, Amboy and Yacolt. In addition, we operate several small "satellite" systems for small groups of homes throughout the county.

The utility is funded by revenues from rates charged for the retail sale of electricity and water. When available we also sell surplus electricity and water that can increase revenue. These rates are set by the three elected Board of Commissioners.

10.2.2 Service Area and Trends

The Utility serves a population of 445,000. Its service area covers an area of 630 square miles. Between 2010 and 2014 the utility has experienced customer growth of approximately 6 percent. The Utility expects continued customer growth at the current rate based on current economic trends. The Utility continues to implement cost reductions that have resulted in stable electric and water rates for several years. The estimated replacement value of structures in the Utility’s electric and water service territory is approximately $91 billion.

10.2.3 Assets

Table 10-1 summarizes the critical assets of the district and their value.

Table 10-1. **Special Purpose District Assets**

Asset	Value
Property	
220 acres of land	$100,000,000
Critical Infrastructure and Equipment	
Electric system transmission, substations and plant	$98,000,000
Electrical system distribution overhead and underground	$643,000,000
Electrical generating system, plant, transmission, distribution and structures	$257,500,000
Water system wells, pumping and treatment	$30,000,000
Water system transmission, distribution and plant	$150,000,000
Total:	$1,178,500,000
Critical Facilities	
Electric Center building_	$9,800,000
Operations Center buildings_	$34,650,000
River Road Generating facility	$163,000,000
Carol Curtis Well field	$5,8700,000
Bridge Substation office	$550,000
Total:	$266,700,000

10.3 CAPABILITY ASSESSMENT

10.3.1 Planning and Regulatory Capabilities

The following existing codes, ordinances, policies or plans are applicable to this natural hazard mitigation plan:

- National Electrical Safety Code
- National Environmental Protection Act
- Federal Endangered Species Act
- Washington State Building Code
- The District must adhere to all applicable codes and regulations enforced by federal, state and local authorities.

10.3.2 Fiscal, Administrative and Technical Capabilities

An assessment of fiscal capabilities is presented in Table 10-2. An assessment of administrative and technical capabilities is presented in Table 10-3.

10.3.3 Education and Outreach Capabilities

An assessment of education and outreach capabilities is presented in Table 10-4.

Table 10-2. **Fiscal Capability**

Financial Resources	Accessible or Eligible to Use?
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	No
User Fees for Water, Sewer, Gas or Electric Service	Yes
Incur Debt through General Obligation Bonds	No
Incur Debt through Special Tax Bonds	No
Incur Debt through Private Activity Bonds	No
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	Yes
Other	No

Table 10-3. **Administrative and Technical Capability**

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	No	
Engineers or professionals trained in building or infrastructure construction practices	Yes	Greg Pagel, Facilities Manager Eric Beck, Engineering Manager Water
Planners or engineers with an understanding of natural hazards	No	
Staff with training in benefit/cost analysis	No	
Surveyors	No	
Personnel skilled or trained in GIS applications	Yes	Mike Pratka, Manager GIS/CAD Services
Scientist familiar with natural hazards in local area	No	
Emergency manager	Yes	Dan Krebs, Director of Operations
Grant writers	No	
Other	No	

Table 10-4. **Education and Outreach**

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes, Erica Erland, Corporate Communications Manager
Do you have personnel skilled or trained in website development?	Yes, but we contract with a private company, Corporate Media
Do you have hazard mitigation information available on your website? • If yes, please briefly describe.	Yes On our Outage Page we have emergency preparedness links to FEMA, Red Cross, etc.
Do you utilize social media for hazard mitigation education and outreach? • If yes, please briefly describe.	Yes As noted in the previous response
Do you have any citizen boards or commissions that address issues related to hazard mitigation? • If yes, please briefly specify.	No
Do you have any other programs already in place that could be used to communicate hazard-related information? • If yes, please briefly describe.	Yes We can include inserts in our customer's utility bills that cover hazard mitigation topics.
Do you have any established warning systems for hazard events? • If yes, please briefly describe.	No

10.4 INTEGRATION WITH OTHER PLANNING INITIATIVES

The following describe the jurisdiction's process for integrating the natural hazard mitigation plan into existing plans and programs.

10.4.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the natural hazard mitigation plan:

- Annual Capital Improvement Budget: When reviewing projects consideration is given during the design process if the project in in a known flood area or landslide area. This risk assessment is used by both the Water and Electric Departments. Over the years some capital projects are budgeted for the following year to improve our electrical system based on a natural disaster that occurred in the previous fiscal budget year.

10.4.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the natural hazard mitigation plan, but provide an opportunity for future integration:

- Develop a strategic plan to identify high impact facilities such as substations and water reservoirs in need of seismic retrofits.

10.5 JURISDICTION-SPECIFIC NATURAL HAZARD EVENT HISTORY

Table 10-5 lists all past occurrences of natural hazards within the jurisdiction.

Table 10-5. **Natural Hazard Events**

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Severe weather	4249	12/8/2015	200,000
Severe weather	NA	12/11/2014	1,200,000
Severe weather	NA	11/11/2014	$425,000
Severe weather	1671	12/12/2006	1,100,000
Severe weather	NA	01/06/2004	1,600,000
Severe weather	NA	12/26/1996	1,400,000
Severe weather	NA	12/12/1995	1,800,000
Severe weather	137	10/20/1962	unknown

10.6 JURISDICTION-SPECIFIC VULNERABILITIES

Noted vulnerabilities of the jurisdiction include the following:

- Substations and switching stations
- Water reservoirs
- River Road generating plant

10.7 HAZARD RISK RANKING

Table 10-6 presents the ranking of the hazards of concern.

Table 10-6. **Hazard Risk Ranking**

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Earthquake	54	High

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
2	Severe Storm	54	High
3	Flood	45	High
4	Volcano	16	Medium
5	Dam Failure	11	Low
6	Landslide	8	Low
7	Wildfire	8	Medium
8	Drought	5	Low

10.8 Status of Previous Plan Initiatives

Table 10-7 summarizes the initiatives that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared. The actions identified in the following table were developed in 2016.

Table 10-7. **Status of Previous Plan Initiatives**

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
Educate customers in outage prone areas by providing informational pamphlets with mailed bills.		x	
Comment:			
Where appropriate, support retrofitting, purchase, or relocation of structures located in hazard areas to protect structures from future damage, with properties with exposure to repetitive losses as a priority.	x		
Comment: *We build to NESC Heavy Loading for distribution and transmission lines even though we are in a Medium Loading*			
Consider, where appropriate, the adoption of higher construction standards for building substations, transmission lines and distribution lines that will result in an increase in resilience for new infrastructure	x		
Comment: *We have high reliability numbers.*			
Consider, purchasing mobile back-up generators to be used to serve critical infrastructure including, water, and sewer treatment and distribution facilities owned by CPU and others.		x	
Comment: *We've added some generator capacity and are determining the requirements for a new mobile generator. I'd probably list this as on-going and continuous as we'll need to keep on top of replacements on a regular basis. We're also looking at developing agreements and relationships with local rental companies to supply generators on an as needed basis.*			
Consider upgrading lines and poles to improve wind/ice loading, undergrounding critical lines, and adding additional interconnection switches to allow alternate feed paths.		x	
Comment: *Ongoing process*			
Actively participate in the plan maintenance protocols outlined in Volume I of the hazard mitigation plan.		x	
Comment: Clark PUD is involved in updating the plan every 5 years.			

Support County wide initiatives identified in Volume I of the hazard mitigation plan.		x	
Comment: *In progress*			

10.9 HAZARD MITIGATION ACTION PLAN AND EVALUATION OF RECOMMENDED ACTIONS

Table 10-8 lists the actions that make up the Clark County Public Utilities District #1 hazard mitigation action plan. Table 10-9 identifies the priority for each action. Table 10-10 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Table 10-8. Hazard Mitigation Action Plan Matrix

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
CPU #1 Educate customers in outage prone areas by providing informational pamphlets with mailed bills.						
New & Existing	New & Existing	New & Existing	New & Existing	New & Existing	New & Existing	New & Existing
CPU #2 Consider, purchasing mobile back-up generators to be used to serve critical infrastructure including, water, and sewer treatment and distribution facilities owned by CPU and others.						
New & Existing	New & Existing	New & Existing	New & Existing	New & Existing	New & Existing	New & Existing
CPU #3 Consider upgrading lines and poles to improve wind/ice loading, undergrounding critical lines, and adding additional interconnection switches to allow alternate feed paths.						
New & Existing	New & Existing	New & Existing	New & Existing	New & Existing	New & Existing	New & Existing
CPU #4 Actively participate in the plan maintenance protocols outlined in Volume I of the hazard mitigation plan.						
New & Existing	New & Existing	New & Existing	New & Existing	New & Existing	New & Existing	New & Existing
CPU #5 Support County wide initiatives identified in Volume I of the hazard mitigation plan.						
New & Existing	New & Existing	New & Existing	New & Existing	New & Existing	New & Existing	New & Existing

Table 10-9 **Mitigation Strategy Priority Schedule**

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
CPU #1	3	Low	Low	Yes	No	Yes	High	NA
CPU #2	4	High	High	Yes	Yes	No	Medium	Medium
CPU #3	3	High	High	Yes	Yes	No	Medium	High
CPU #4	2	Low	Low	Yes	No	Yes	High	Low
CPU #5	8	Low	Low	Yes	No	Yes	High	Low

a. See the introduction to this volume for explanation of priorities.

Table 10-10. Analysis of Mitigation Actions

Earthquake	Ex-1, Ex-2, Ex-3, Ex-4, Ex-5	Ex-1	Ex-2	Ex-3
Severe Storm	Ex-1, Ex-2, Ex-3, Ex-4, Ex-5	Ex-1	Ex-2	Ex-3
Flood	Ex-1, Ex-2, Ex-3, Ex-4, Ex-5	Ex-1	Ex-2	Ex-3
Volcano	Ex-1, Ex-2, Ex-3, Ex-4, Ex-5	Ex-1	Ex-2	Ex-3
Dam Failure	Ex-1, Ex-2, Ex-3, Ex-4, Ex-5	Ex-1	Ex-2	Ex-3
Landslide	Ex-1, Ex-2, Ex-3, Ex-4, Ex-5	Ex-1	Ex-2	Ex-3
Wildfire	Ex-1, Ex-2, Ex-3, Ex-4, Ex-5	Ex-1	Ex-2	Ex-3
Drought	Ex-1, Ex-2, Ex-3, Ex-4, Ex-5	Ex-1	Ex-2	Ex-3

a. See the introduction to this volume for explanation of mitigation types.

10.10 FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

This is the first time the Utility has participated in the updating of the Clark Regional Natural Hazard Mitigation Plan and development of this annex. Staff resources needed to complete this process was limited and gathering the needed information required assistance from many different departments. Future updates would include additional personnel to perform a more comprehensive risk assessment and identification of potential hazard risk mitigation projects.

CPU will develop a utility wide working group to monitor progress of proposed mitigation efforts as well as identifying future projects for hazard mitigation.

11. CLARK REGIONAL WASTEWATER DISTRICT

11.1 HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact
Shawn Moore
Business Services Director
8000 NE 52nd Ct.
Vancouver WA 98685
Telephone: (360) 993-8849
e-mail Address: smoore@crwwd.com

Alternate Point of Contact
Heath Henderson
Engineering Director
8000 NE 52nd Ct.
Vancouver WA 98685
Telephone: (360) 993-8815
e-mail Address: hhenderson@crwwd.com

11.2 Jurisdiction Profile

11.2.1 Overview

The Clark Regional Wastewater District (District) is a special-purpose district organized under Title 57 RCW. It was formed in 1958 to provide urban wastewater services for unincorporated Clark County. The District has more than 80 full-time staff and is governed by a three-member elected Board of Commissioners (Board). The District is funded through rates and connection charges. The District provides service to roughly 100,000 people, mostly residential. In addition to the unincorporated areas of Clark County (City of Vancouver urban growth area), the District's service area includes the City of Ridgefield, portions of the Cities of Battle Ground and Vancouver and the rural centers of Meadow Glade and Hockinson. The Board is responsible for the adoption of the plan which will be implemented under the supervision of the General Manager.

11.2.2 Service Area and Trends

The District serves a population of over 100,000 across a service area that covers more than 50 square miles. The total replacement value of all structures located in the service area is estimated at $20 billion dollars.

The District is expecting an average growth rate of over 3% for the next 20 years. Residential growth rates (sewer access population) in the District over the last 5, 10, and 20 years have averaged 4.5%.

The Clark Regional Wastewater District is a member of the Discovery Clean Water Alliance, which was legally formed on January 4, 2013, under the Joint Municipal Utility Services Act (RCW 39.106). The Alliance serves four Member agencies – the City of Battle Ground, Clark County, Clark Regional Wastewater District and the City of Ridgefield. The Alliance Members jointly own and jointly manage regional wastewater assets under Alliance ownership. The Alliance seeks to optimize the long-term framework for delivery of regional wastewater transmission and treatment services to the urban growth areas in the central portion of Clark County, Washington. The District is the official 'Administrative Lead' agency for the Alliance. Responsibilities include executive, administrative, financial, operations and engineering functions.

11.2.3 Assets

Table 11-1 summarizes the critical assets of the district and their value.

Table 11-1. Special Purpose District Assets

Property	
8.5 acres of land	$2,100,000
28 acres of land[a]	$6,000,000
Critical Infrastructure and Equipment	
730 miles of pipe	$68,000,000
74 pump stations	$30,000,000
877 STEP Systems	$4,000,000
6 portable generators	$150,000
4 portable pumps	$210,000
28 District vehicles	$2,100,000
36th Ave. Pump Station[a]	$11,000,000
117th St. Pump Station[a]	$20,000,000
22 miles of force main and interceptors[a]	$39,000,000
Total:	$282,460,000
Critical Facilities	
District Operations Center	$16,000,000
Salmon Creek Treatment Plant[a]	$175,000,000
Ridgefield Treatment Plant[a]	$8,000,000
Total:	$199,000,000

Discovery Clean Water Alliance assets under management by District.

11.3 Planning and regulatory Capabilities

The following existing codes, ordinances, policies or plans are applicable to this hazard mitigation plan:

- Policy 037 Comprehensive Emergency Response Plan Rev 08/01/19 Adopted
- Comprehensive General Sewer Plan adopted 01/22/2019
- 2022-2027 Capital Improvement Program adopted 12/28/2021
- District Code 2.36 Declaration of Emergency
- District Code 2.28 Contracts for Architectural and Engineering Services
- District Code 2.32 Small Works Roster and Vendor Lists
- District Code 2.34 Purchase of Materials, Supplies and Equipment – Competitive Bidding and Vendor Rosters
- Resolution 1586 – Joint Standards for Management, Operations and Maintenance of Wastewater Collection Systems adopted May 28, 2013

11.4 Fiscal, ADMINISTRATIVE and TECHNICAL Capabilities

An assessment of fiscal capabilities is presented in Table 11-2. An assessment of administrative and technical capabilities is presented in Table 11-3.

Table 11-2. Fiscal Capability

Financial Resources	Accessible or Eligible to Use?
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	No
User Fees for Water, Sewer, Gas or Electric Service	Yes

Financial Resources	Accessible or Eligible to Use?
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	No
Incur Debt through Private Activity Bonds	No
State-Sponsored Grant Programs (Community Economic Revitalization Board)	Yes
Development Impact Fees for Homebuyers or Developers	Yes (SDCs)
Other	No

Table 11-3. Administrative and Technical Capability

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Engineering: District Engineer, Development Program Manager Administration: Business Services Director
Engineers or professionals trained in building or infrastructure construction practices	Yes	Engineering: District Engineer, Principal Engineer, Senior Project Manager Administration: General Manager and Business Services Director Operations: Operations Manager
Planners or engineers with an understanding of natural hazards	No	
Staff with training in benefit/cost analysis	Yes	Engineering: District Engineer, Principal Engineer, Senior Project Manager Finance: Finance Director, Fiscal Manager and Accounting Manager Administration: General Manager and Business Services Director
Surveyors	No	
Personnel skilled or trained in GIS applications	Yes	Engineering: Senior GIS Specialist
Scientist familiar with natural hazards in local area	No	
Emergency manager	No	
Grant writers	No	
Other	Yes	Pretreatment Coordinator

11.5 Education and Outreach Capabilities

An assessment of education and outreach capabilities is presented in Table 1-4.

Table 11-4. Education and Outreach

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes (General Manager and Business Services Director)
Do you have personnel skilled or trained in website development?	No
Do you have hazard mitigation information available on your website? If yes, please briefly describe.	No
Do you utilize social media for hazard mitigation education and outreach? If yes, please briefly describe.	No
Do you have any citizen boards or commissions that address issues related to hazard mitigation? If yes, please briefly specify.	No
Do you have any other programs already in place that could be used to communicate hazard-related information? If yes, please briefly describe.	Yes Website, Monthly Newsletter & IVR System
Do you have any established warning systems for hazard events?	No

Criteria	Response
If yes, please briefly describe.	

11.6 Integration with Other Planning Initiatives

The following describe the jurisdiction's process for integrating the hazard mitigation plan into existing plans and programs.

11.6.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan:

- Comprehensive General Sewer Plan

11.6.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan, but provide an opportunity for future integration:

- Strategic Plan - The District Strategic Plan is updated every 4-5 years of after a significant event. Current and short-term organizational goals are, however, reviewed and updated on an annual basis. Enterprise Resiliency is one of the attributes of the plan framework.
- Comprehensive Emergency Response Plan - The Emergency Response Plan has an annex which outlines the risks associated with Clark County. This annex would be updated along with any more specific risk assessments and mitigation plans.
- Comprehensive General Sewer Plan - The GSP is updated on a six-year basis to include proposed infrastructure requirements by basin. Hazard mapping was incorporated into the Plan with the 2017 update and considered in development of the long-range infrastructure plans therein. Risks and mitigation strategies associated with future infrastructure planning can be further incorporated with future updates.

11.7 Jurisdiction-Specific Natural Hazard Event History

Table 11-5 lists all past occurrences of natural hazards within the jurisdiction.

Table 11-5. Natural Hazard Events

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Severe Winter Storm	4253	2015	$300,000 District mainline pipe next to a small stream was broken by the stream swollen by rain going outside of its stream bed and scouring the land that contained the pipe.
Severe Winter Storm	1825	2009	No impact on infrastructure but did impact the electrical utility requiring portable generators to be sent to pump stations until the electrical grid was restored.
Severe Winter Storm	1682	2007	No impact on infrastructure but did impact the electrical utility requiring portable generators to be sent to pump stations until the electrical grid was restored.

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Severe Winter Storm	1671	2006	No impact on infrastructure but did impact the electrical utility requiring portable generators to be sent to pump stations until the electrical grid was restored.
Earthquake	1361	2001	No impact on infrastructure.
Flood	1100	1996	Impact on key pump station requiring emergency pumping, sandbagging and pump around. County built a flood wall that can withstand a 500 year flood.
Volcano	623	1980	No impact on infrastructure.

11.8 Jurisdiction-Specific Vulnerabilities

Noted vulnerabilities the jurisdiction includes:

- Access to 74 pump stations and two (2) treatment plants when roads are closed due to winter storms, flooding or a potential large earthquake impacting roads and access with fallen trees and power lines.
- Localized large-scale flooding where new pump stations have been added as backbone infrastructure is added to the District.
- Large-scale flooding in the Columbia which can impact the treatment plant's ability to send treated effluent into the Columbia.
- Provision of electricity to District pump stations during widespread power outages and access to emergency fuel supplies for redundant power systems (e.g. generators) at pump stations and treatment plants.

11.9 Hazard Risk Ranking

Table 11-6 presents the ranking of the hazards of concern.

Table 11-6. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Severe weather	45	High
2	Earthquake	36	High
3	Flood	11	Medium
3	Volcano	11	Medium
4	Landslide	8	Low
5	Wildfire	0	None
5	Drought	0	None
5	Dam Failure	0	None

11.10 Status of Previous Plan Initiatives

Table 11-7 summarizes the initiatives that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared. The actions identified in the following table were developed in 2016.

Table 11-7. Status of Previous Plan Initiatives

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
Review all critical assets that show probability of extensive damage for the Cascadia event over 2% and probability of extensive damage over 5% for the 500 year earthquake.		X	
comments:			
Define retrofit requirements, redundancy strategy and costs to meet current code and mitigate probability of extensive damage. Determine policy and capital programing strategy by executives.		X	
comments:			
Define response policy and procedures in the event of a large-scale event and significant impact on the asset(s) for operations staff decisions.		X	
comments:			
Review all infrastructure defined as being impacted by the 500 year flood. Define impact, on system, emergency response strategy, time to bring back on line.		X	
comments:			
Evaluate and establish relocation and protection measures alternatives for infrastructure potentially impacted by the 500 year flood event.		X	
comments:			
Define expected cost estimate to bring system back online after flood event. Define capital costs strategy and requirements for policy decisions and capital improvements planning.		X	
comments:			
Define response policy and procedures in the event of a large-scale event and significant impact on the asset(s) for operations staff decisions.		X	
comments:			
Review all infrastructure that has a single access point and the potential for reduced or eliminated access on roads in a severe weather event.		X	
comments:			
Define alternate strategy cost estimates for capital programing for mitigation of single access to key infrastructure and the placement of redundant energy supply (generator and fuel).		X	
comments:			
Define response policy and procedures in the event of a large-scale event and significant impact to multiple assets.		X	
comments:			

Evaluate District customer communication measures, equipment and capabilities.		X	
comments:			
Where appropriate, acquire system/equipment to communicate hazard mitigation, disaster preparedness, response and recovery information with customers.		X	
comments:			
Evaluate redundant power capabilities and operating procedures.		X	
comments:			
Where appropriate, implement/purchase measures to increase capabilities. Including emergency fuel storage, onsite generators, etc.		X	
comments:			
Evaluate critical facilities and identify failure modes, locations and energy capacity.		X	
comments:			
Review all assets that are listed in landslide potential zones and determine impact to system.		X	
comments:			
Define strategy on short-term emergency response and cost as well as long term mitigation strategy and capital impact including retro fitting where applicable.		X	
Comments:			
Investigate potential impact on treatment plants for conveyance flows to contain additional sediment from a volcano and direct ash flow into uncovered treatment infrastructure.		X	
comments:			
Define strategy for short term response and mitigation to include long term mitigation capital plan.		X	
comments:			
Review District code for all new infrastructure(s) to include hazard review for Earthquake, Flood, Severe Winter Events and Landslide impacts. Require capability investment to mitigate large scale events where feasible including redundancy, additional equipment on site and in inventory. Define average length of time to order equipment and install in the analysis.		X	
comments:			
Integrate current assessment and mitigation strategies into the District's Strategic Plan and Emergency Plan.		X	
comments:			

Develop a post disaster recovery plan and procedures and incorporate into Emergency Plan.		X	
comments:			
Support county-wide initiatives, where appropriate, identified in HMP.		X	
comments:			
Actively, participate in plan maintenance protocols, where appropriate, identified in HMP.		X	
comments:			
Evaluate impacts of climate change on District operations and facilities.		X	
comments:			
Adopt climate change policy and implement, where appropriate, changes in District procedures, planning documents and operations.		X	
comments:			
Define and develop ratepayer education on impact of a natural disaster on District infrastructure. Include what they can do to minimize impact until infrastructure is back on line.		X	
comments:			
Capture data after each hazard event to include impact, cost, and additional effort to support analysis for future mitigation efforts and update the hazard mitigation plan.		X	
comments:			
Evaluate and implement measures to increase emergency capacity for emergency management, operational capability and continuity of business.		X	
comments:			

11.11 Hazard Mitigation Action Plan and Evaluation of Recommended Actions

Table 11-8 lists the actions that make up the Clark Regional Wastewater District hazard mitigation action plan. Table 11-9 identifies the priority for each action. Table 11-10 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Table 11-8. Hazard Mitigation Action Plan Matrix

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
CRWWD-1 - Review all critical assets that show probability of extensive damage for the Cascadia event over 2% and probability of extensive damage over 5% for the 500 year earthquake.						
Existing	Earthquake	5,10,12	Engineering	Low	Staff time	Short term
CRWWD-2 - Define retrofit requirements, redundancy strategy and costs to meet current code and mitigate probability of extensive damage. Determine policy and capital programing strategy by executives.						

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
Existing	Earthquake	2,8,9	Senior Mgt. and BOC	High	Staff time	Long term
CRWWD-3 - Define response policy and procedures in the event of a large-scale event and significant impact on the asset(s) for operations staff decisions.						
Existing	Earthquake	6	Operations	Low	Staff time	On-going
CRWWD-4 - Review all infrastructure defined as being impacted by the 500 year flood. Define impact, on system, emergency response strategy, time to bring back on line.						
Existing	Flood	5,10,12	Operations	Low	Staff time	Short term
CRWWD-5 - Evaluate and establish relocation and protection measures alternatives for infrastructure potentially impacted by the 500 year flood event.						
Existing	Flood	5,9,10	Engineering	Low	Staff time	Short term
CRWWD-6 - Define expected cost estimate to bring system back online after flood event. Define capital costs strategy and requirements for policy decisions and capital improvements planning.						
New and Existing	Flood	2,8,9	Engineering	High	Staff time	Long term
CRWWD-7 - Define response policy and procedures in the event of a large-scale event and significant impact on the asset(s) for operations staff decisions.						
Existing	Flood	6	Operations	Low	Staff time	On-going
CRWWD-8 - Review all infrastructure that has a single access point and the potential for reduced or eliminated access on roads in a severe weather event.						
Existing	Severe Weather	5,10,12	Operations	Low	Staff time	Short term
CRWWD-9 - Define alternate strategy cost estimates for capital programing for mitigation of single access to key infrastructure and the placement of redundant energy supply (generator and fuel).						
Existing	Severe Weather	2,8,9		High	Staff time	Long term
CRWWD-10 -Define response policy and procedures in the event of a large-scale event and significant impact to multiple assets.						
Existing	Severe Weather	6	Operations	Low	Staff time	On-going
CRWWD-11 - Evaluate District customer communication measures, equipment and capabilities.						
Existing	Severe Weather	1,2,3,	Administration	Low	Staff time	Short term
CRWWD-12 - Where appropriate, acquire system/equipment to communicate hazard mitigation, disaster preparedness, response and recovery information with customers.						
New	Severe Weather	1,2,3	Administration	High	Possibly DHS grants	Long term
CRWWD-13 - Evaluate redundant power capabilities and operating procedures.						
Existing	Severe Weather	5,10	Operations	Low	Staff time	Short term
CRWWD-14 - Where appropriate, implement/purchase measures to increase capabilities. Including emergency fuel storage, onsite generators, etc.						
New and Existing	Severe Weather	5,10	Operations	High	General Fund, HMGP, PDM	Long term
CRWWD-15 - Evaluate critical facilities and identify failure modes, locations and energy capacity.						
Existing	Severe Weather	6,8,10	Operations	Low	Staff time	Short term
CRWWD-16 - Review all assets that are listed in landslide potential zones and determine impact to system.						
Existing	Landslide	5,10,12	Engineering	Low	Staff time	Short term
CRWWD-17 - Define strategy on short-term emergency response and cost as well as long term mitigation strategy and capital impact including retro fitting where applicable.						
Existing	Landslide	2,8,9	Engineering	High	Staff time	Long term
CRWWD-18 - Investigate potential impact on treatment plants for conveyance flows to contain additional sediment from a volcano and direct ash flow into uncovered treatment infrastructure.						
Existing	Volcano	5,10,12	Engineering	Low	Staff time	Short term
CRWWD-19 - Define strategy for short term response and mitigation to include long term mitigation capital plan.						
New and Existing	Volcano	2,8,9	Engineering	High	Staff time	Long term

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
CRWWD-20 - Review District code for all new infrastructure(s) to include hazard review for Earthquake, Flood, Severe Winter Events and Landslide impacts. Require capability investment to mitigate large scale events where feasible including redundancy, additional equipment on site and in inventory. Define average length of time to order equipment and install in the analysis.						
Existing	All Hazards	5,10,12,2,6	Engineering	Low	Staff time	Short term
CRWWD-21 - Integrate current assessment and mitigation strategies into the District's Strategic Plan and Emergency Plan.						
Existing	All Hazards	6,5	Administration	Low	Staff time	Short term
CRWWD-22 - Develop a post disaster recovery plan and procedures and incorporate into Emergency Plan.						
New and existing	All Hazards	6,5	Administration	Low	Possibly UASI	Short term
CRWWD-23 - Support county-wide initiatives, where appropriate, identified in HMP.						
New and existing	All Hazards	1,4,12	Administration	Low	Staff time	On-going
CRWWD-24 - Actively, participate in plan maintenance protocols, where appropriate, identified in HMP.						
New and existing	All Hazards	1,4,12	Operations	Low	Staff time	On-going
CRWWD-25 - Evaluate impacts of climate change on District operations and facilities.						
New and existing	All Hazards	2,5,10,11,12	Engineering	High	Possibly EPA	Long term
CRWWD-26 - Adopt climate change policy and implement, where appropriate, changes in District procedures, planning documents and operations.						
New and existing	All Hazards	11,12	Engineering	High	Staff time	On-going
CRWWD-27 - Define and develop ratepayer education on impact of a natural disaster on District infrastructure. Include what they can do to minimize impact until infrastructure is back on line.						
Existing	All Hazards	1,4	Administration	Low	Staff time	Short term
CRWWD-28 - Capture data after each hazard event to include impact, cost, and additional effort to support analysis for future mitigation efforts and update the hazard mitigation plan.						
New and existing	All Hazards	12	Operations	Low	Staff time	On-going
CRWWD-29 - Evaluate and implement measures to increase emergency capacity for emergency management, operational capability and continuity of business.						
New and existing	All Hazards	5,10,8	Administration	High	Staff time, Possible FEMA, DHS, EPA or UASI grants	On-going
CRWWD-30 - Evaluate and implement measures to deploy modern Public Safety (FirstNet) mobile communications at Salmon Creek Treatment Plant for emergency management, operational capability and continuity of business.						
Existing	All Hazards	3,5,8,10	Administration	Medium	Staff time, Possible FEMA or EPA	Short term

Table 11-9. Mitigation Strategy Priority Schedule

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
1	3	Medium	Medium	Yes	No	Yes	Medium	Low
2	3	Medium	High	Yes	No	No	Medium	Low
3	1	Medium	Low	Yes	No	Yes	High	Low
4	3	Medium	Medium	Yes	No	Yes	Medium	Low
5	4	Medium	Low	Yes	No	Yes	High	Low
6	3	Medium	High	Yes	No	No	Medium	Low
7	1	Medium	Low	Yes	No	Yes	High	Low
8	3	Medium	Medium	Yes	No	Yes	Medium	Low
9	3	Medium	High	Yes	No	No	Medium	Low
10	1	Medium	Low	Yes	No	Yes	High	Low
11	3	High	Low	Yes	No	Yes	Medium	Low
12	3	High	High	Yes	No	No	Medium	Low
13	2	Medium	Low	Yes	No	Yes	Medium	Low
14	2	Medium	High	Yes	Yes	No	Medium	High
15	3	Medium	Low	Yes	No	Yes	Medium	Low
16	3	Medium	Medium	Yes	No	Yes	Medium	Low
17	3	Medium	High	Yes	No	No	Medium	Low
18	3	Medium	Medium	Yes	No	No	Medium	Low
19	3	Medium	High	Yes	No	No	Medium	Low
20	5	Medium	Low	Yes	No	No	Medium	Low
21	2	Medium	Low	Yes	No	Yes	High	Low
22	2	High	Low	Yes	Maybe	Yes	High	Medium
23	2	Medium	Low	Yes	No	Yes	High	Low
24	3	High	Low	Yes	No	Yes	High	Low
25	5	Medium	High	Yes	Maybe	No	Low	Medium
26	2	Medium	High	Yes	No	No	Low	Low
27	2	Medium	Low	Yes	No	No	Medium	Low
28	1	Medium	Low	Yes	No	Yes	High	Low
29	3	Medium	High	Yes	Maybe	No	Medium	Medium
30	4	Medium	Medium	Yes	Maybe	Yes	High	Medium

a. See the introduction to this volume for explanation of priorities.

Table 11-10. Analysis of Mitigation Actions

Hazard Type	Action Addressing Hazard, by Mitigation Type[a] 1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Earthquake	CRWWD-1, CRWWD-14, CRWWD-16, CRWWD-20	CRWWD-2	CRWWD-11, CRWWD-12, CRWWD-21, CRWWD-23, CRWWD-24, CRWWD-27	CRWWD-2, CRWWD-25, CRWWD-26	CRWWD-3, CRWWD-12, CRWWD-29, CRWWD-30	CRWWD-2
Flood	CRWWD-4, CRWWD-6, CRWWD-20	CRWWD-5	CRWWD-11, CRWWD-12, CRWWD- 21, CRWWD-23, CRWWD-24, CRWWD-27	CRWWD-5, CRWWD-25, CRWWD-26	CRWWD-7, CRWWD-12, CRWWD-29, CRWWD-30	CRWWD-5
Severe Weather	CRWWD-8, CRWWD-14, CRWWD-20	CRWWD-9, CRWWD-13, CRWWD-15	CRWWD-11, CRWWD-12, CRWWD- 21, CRWWD-23, CRWWD-24, CRWWD- 27	CRWWD-9	CRWWD-10, CRWWD-13, CRWWD-12, CRWWD-29, CRWWD-30	CRWWD-14
Landslide	CRWWD-16, CRWWD-20	CRWWD-17	CRWWD-11, CRWWD-12, CRWWD-21, CRWWD-23, CRWWD-24, CRWWD-27	CRWWD-25, CRWWD-26, CRWWD-17	CRWWD-17, CRWWD- 12, CRWWD-29, CRWWD-30	CRWWD-17
Volcano	CRWWD-18, CRWWD-19, CRWWD-20	CRWWD-19	CRWWD-11, CRWWD-12, CRWWD-21, CRWWD-23, CRWWD-24, CRWWD-27	CRWWD-18, CRWWD-25, CRWWD-26	CRWWD-19, CRWWD-12, CRWWD-29, CRWWD-30	CRWWD-19

- a. See the introduction to this volume for explanation of mitigation types.

12. C-TRAN PUBLIC TRANSIT BENEFIT AREA

12.1 NATURAL HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact
Scott Deutsch, Director of Safety & Risk
10600 NE 51st Circle.
Vancouver, WA 98662
360-906-7333 (Desk)
360-696-4494 (C-TRAN)
scott.deutsch@c-tran.org

Alternate Point of Contact
Bob Medcraft, Security Chief
10600 NE 51st Circle
Vancouver, WA 98662
360-906-7536 (Desk)
360-696-4494 (C-TRAN)
bob.medcraft@c-tran.org

12.2 JURISDICTION PROFILE

12.2.1 Overview

The C-TRAN Public Transportation Benefit Area (PTBA) is an entity founded in 1980 to provide fixed-route, paratransit, on-demand (The Current), and vanpool services to the Vancouver Urban Growth Area as defined in 2005, and the city limits of Camas, Washougal, Ridgefield, Battle Ground, La Center, and Yacolt. C-TRAN operates three transit centers: Vancouver Mall Transit Center, Fisher's Landing Transit Center in east Vancouver, and 99th Street in Hazel Dell, plus other park and ride facilities.

A nine-member elected Board of Directors governs the C-TRAN PTBA. The board assumes responsibility for adopting this plan; C-TRAN's Chief Executive Officer (CEO) oversees its implementation.

As of October 2022, C-TRAN serves 27 fixed-routes across Clark County with Regional and Express service into Portland, Oregon utilizing a staff of 429. Funding primarily comes from local sales tax revenue, fares, and other sources.

12.2.2 Population

The district serves a population of approximately 445,744 (2021 Clark County Census data). C-TRAN's service area covers 143 square miles. Clark County projects continued population growth in the coming years, with most new residents living within the PTBA. As a result, C-TRAN expects the demand for transit service to grow at a similar rate as the new residents access jobs, education, and other transportation needs.

12.2.3 Assets

Table 12-1 summarizes the critical assets of the district and their value.

Table 12-1. Special Purpose District Assets

Asset	Value
Property	
7th Street, 0.23 acres	$222,862
Operations (65th), 12.21 acres	$5,127,373.77
Evergreen Transit Center, 2.31 acres	$154,406
Central County Park-N-Ride, 11.55 acres	$2,295,134
Fisher's Landing Park-N-Ride, 20.39 acres	$6,606,148
99th Street Transit Center, 10.14 acres	$5,239,499
Administration (51st) **Total:**	$1,866,212.64 **$21,511,634.93**
Critical Infrastructure and Equipment	
Revenue Vehicle Coaches (47 Vanpool, 52 Demand Response Buses, 116 Fixed Route Buses	$75,153,398.84
Fixed Route Contingency Fleet Service Vehicles (26 vehicles)	$1,864,755.84 $1,460,999.97
CAD/AVL System	$2,329,663.86
Total:	**$80,808,818.51**
Critical Facilities	
65th Ave Campus (Maint & Operations) Administration (51st)	$17,514.287.86 $6,259,971.92
99th Street	$11,405,899.09
Fisher's Landing	$6,967,635.96
Salmon Creek	$213,368
Evergreen Van Mall Fourth Plain Corridor	$1,897,470 $8,178,78.07 $20,413,590.13
Total:	**$72,851,005.03**

12.3 PLANNING AND REGULATORY CAPABILITIES

The following existing codes, ordinances, policies, or plans apply to this Hazard Mitigation Plan:

- C-TRAN System Security Plan (SSP).
- C-TRAN Public Transit Agency Safety Plan (PTASP)
- C-TRAN Transportation Service Disruption Plan (TSDP)
- C-TRAN Continuity of Operations Plan (COOP)

12.4 FISCAL, ADMINISTRATIVE, AND TECHNICAL CAPABILITIES

Presented in Table 1-2 is an assessment of C-TRAN's fiscal capabilities, and Table 1-3 shows C-TRAN's assessment of administrative and technical capabilities.

Table 12-2. Fiscal Capability

Financial Resources	Accessible or Eligible to Use?
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	No
User Fees for Water, Sewer, Gas or Electric Service	No

Financial Resources	Accessible or Eligible to Use?
Incur Debt through General Obligation Bonds	No
Incur Debt through Special Tax Bonds	No
Incur Debt through Private Activity Bonds	No
State-Sponsored Grant Programs: -Paratransit Special Needs Formula Grant Program -Regional Mobility Grant Program	Yes
Development Impact Fees for Homebuyers or Developers	No
Other:	Yes • Federally Sponsored Grant Programs (Sections 5307, 5337, and 5339 Formula Funds) • Existing Sales Tax Revenues • Fare Revenue • Advertising Revenue

Table 12-3. Administrative and Technical Capability

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	No	N/A
Engineers or professionals trained in building or infrastructure construction practices	No	N/A
Planners or engineers with an understanding of natural hazards	No	N/A
Staff with training in benefit/cost analysis	No	N/A
Surveyors	No	N/A
Personnel skilled or trained in GIS applications	No	N/A
Scientist familiar with natural hazards in local area	No	N/A
Emergency manager	No	N/A
Grant writers	No	N/A
Other	No	N/A

12.5 EDUCATION AND OUTREACH CAPABILITIES

Table 1-4 shows the assessment of education and outreach capabilities.

Table 12-4. Education and Outreach

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes: Eric Florip, Manager of Communications, Marketing, and Customer Experience
Do you have personnel skilled or trained in website development?	Yes, Dean Horn, Planning, Projects, and Design Administrator
Do you have hazard mitigation information available on your website?	No
• If yes, please briefly describe.	N/A
Do you utilize social media for hazard mitigation education and outreach?	Yes
• If yes, please briefly describe.	Weather Detours, Construction-Related Detours

Criteria	Response
Do you have any citizen boards or commissions that address issues related to hazard mitigation?	Yes
• If yes, please briefly specify.	C-TRAN Citizens Advisory Committee (CCAC)
Do you have any other programs already in place that could be used to communicate hazard-related information?	Yes
• If yes, please briefly describe.	Facebook, Twitter, Instagram
Do you have any established warning systems for hazard events?	Yes
• If yes, please briefly describe.	Transportation Service Disruption Plan (TSDP)

12.6 INTEGRATION WITH OTHER PLANNING INITIATIVES

The following describes C-TRAN's process to integrate the Hazard Mitigation Plan into existing plans and programs.

12.6.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment, and recommendations of the hazard mitigation plan:

- C-TRAN Continuity of Operations Plan (COOP)

12.6.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment, or recommendations of the hazard mitigation plan, but provide an opportunity for future integration:

- C-TRAN System Security Plan (SSP) – future integration from the HMP recommendations if applicable.
- C-TRAN Transportation Service Disruption Plan (TSDP) – future integration from HMP recommendations if applicable.
- C-TRAN Public Transit Agency Safety Plan (PTASP).

12.7 JURISDICTION-SPECIFIC NATURAL HAZARD EVENT HISTORY

Table 12-5 lists all past occurrences of natural hazards within the jurisdiction.

Table 12-5. Natural Hazard Events

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Severe Storm	1825	Dec 12, 2008 thru Jan 5, 2009	$107,588.71
Severe Storm	N/A	14 Dec, 2006	Unknown
Severe Storm	N/A	11 Nov, 2006	Unknown
Severe Storm	N/A	10 Feb, 1997	Unknown
Flooding	N/A	23 Feb 1996	Unknown
Severe Storm	N/A	18 Dec 1995	Unknown
Severe Winter Storm	N/A	January 2017	Unknown

12.8 C-TRAN-SPECIFIC VULNERABILITIES

Noted vulnerabilities for C-TRAN include:

- Access to a fuel source (unleaded and diesel) after a natural disaster
- Service impact from severe weather or other natural disaster, including the inability of C-TRAN employees to get to work
- Service impact from power loss at some facilities and transit centers.
- Service impact from loss of radio communication
- See C-TRAN COOP for other specific vulnerabilities

12.9 HAZARD RISK RANKING

Table 12-6 presents the ranking of the hazards of concern.

Table 12-6. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Severe Weather	51	High
1	Earthquake	51	High
2	Wildfire	16	Medium
3	Flood	15	Medium
3	Landslide	15	Medium
4	Dam Failure	8	Low
5	Volcano	7	Low
6	Drought	0	Low

12.10 HAZARD MITIGATION ACTION PLAN AND EVALUATION OF RECOMMENDED ACTIONS

Table 12-7 lists the actions that make up the C-TRAN Public Transit Benefit Area Hazard Mitigation Plan; Table 12-8 identifies the priority for each action; and Table 12-9 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Table 12-7. Hazard Mitigation Action Plan Matrix

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
CTRAN-1—Where appropriate, support retrofitting, purchase, or relocation of structures in high-hazard areas and prioritize structures with the highest risk of loss.						
Existing	All Hazards	4, 5, 7, 9, 10	Board	High	HMGP, PDM, FMA	Short-Term
CTRAN-2—Integrate the hazard mitigation plan into the System Security Plan (SSP), the Public Transit Agency Safety Plan (PTASP), and the Transportation Service Disruption Plan (TSDP) as appropriate in support of infrastructure investment choices, such as capital improvement.						
Existing	All Hazards	1, 2, 3, 4, 5	Executive Staff	Low	Staff Time, General Funds	On-Going
CTRAN-3—Improve existing C-TRAN hazard and maintenance databases to capture perishable data after significant events (e.g., preliminary damage estimates, claims associated with storm damage, damage photos) to support future mitigation efforts, including the implementation and annual maintenance of the Hazard Mitigation Plan, the SSP, the TSDP, and the PTASP.						
New and Existing	All Hazards	5, 6, 8, 10, 12	Executive Staff	Low	Staff Time, General Funds	Complete
CTRAN-4—Incorporate mitigation retrofits for C-TRAN facilities into the bi-annual capital improvements program, following seismic risk assessments to target high-hazard buildings for mitigation opportunities.						
Existing	All Hazards	2, 4, 5, 9, 10	Board	High	HMGP, PDM, FMA	On-Going
C-TRAN 5—Purchase portable generators and install quick-connect emergency generator hook-ups to power critical OEM and Transit Station assets to supplement existing emergency power and provide redundancy for critical functions.						
Existing	All Hazards	5, 8, 9, 10	Board	Medium	HMGP, PDM, General Funds	Complete
CTRAN-6—Perform non-structural assessments and mitigation activities (e.g., anchor bookcases to the wall) and educate C-TRAN employees on the possible impacts of earthquakes and how to deal with them.						
Existing	Earthquake	1, 2, 3, 4, 6, 10	All C-TRAN Employees	Low	Staff Time	Ongoing
CTRAN-7—Communicate earthquake secondary hazards to the public (e.g. landslides, dam failure, fires, damage to transportation infrastructure) via website and social media.						
Existing	Earthquake	1, 2, 3, 4	Public Affairs	Low	Staff Time, General Funds	Ongoing
CTRAN-8—C-TRAN's Continuity of Operations Plan (COOP) identifies the mitigation for contingency fuel sources in case the primary resupply source and onsite dispensing system is unavailable or damaged.						
Existing	Earthquake, Flood, Severe Storm/Weather	5, 6, 8, 10	Operations	Medium	Staff Time, General Funds, Possibly DHS grants	Short-Term
CTRAN-9—Support the county-wide initiatives identified in Volume I of the hazard mitigation plan.						
New and Existing	All Hazards	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	Lead Contact Department for Plan	Low	Staff Time, General Funds	Short-Term

Table 12-8. Mitigation Strategy Priority Schedule

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
CTRAN-1	5	High	High	Yes	Yes	No	Medium	High
CTRAN-2	5	Medium	Low	Yes	No	Yes	High	Low
CTRAN-3	5	Low	Low	Yes	No	Yes	High	Low
CTRAN-4	5	High	High	Yes	Yes	No	Medium	High
CTRAN-5	4	High	Medium	Yes	Yes	No	Medium	High
CTRAN-6	6	Medium	Low	Yes	No	Yes	High	Low
CTRAN-7	4	Low	Low	Yes	No	Yes	High	Low
CTRAN-8	4	High	Medium	Yes	Possibly	No	Medium	Medium
CTRAN-9	12	Low	Low	Yes	No	Yes	High	Low

a. See the introduction to this volume for explanation of priorities.

Table 12-9. Analysis of Mitigation Actions

Hazard Type	Action Addressing Hazard, by Mitigation Type[a]					
	1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Dam Failure	C-TRAN-2 C-TRAN-3 C-TRAN-9	C-TRAN-1 C-TRAN-4			C-TRAN-5	C-TRAN-4
Drought	C-TRAN-2 C-TRAN-3 C-TRAN-9	C-TRAN-1 C-TRAN-4			C-TRAN-5	C-TRAN-4
Earthquake	C-TRAN-2 C-TRAN-3 C-TRAN-9	C-TRAN-1 C-TRAN-4 C-TRAN-8	C-TRAN-6 C-TRAN-7		C-TRAN-5 C-TRAN-8	C-TRAN-4
Flood	C-TRAN-2 C-TRAN-3 C-TRAN-9	C-TRAN-1 C-TRAN-4 C-TRAN-8			C-TRAN-5 C-TRAN-8	C-TRAN-4
Landslide	C-TRAN-2 C-TRAN-3 C-TRAN-9	C-TRAN-1 C-TRAN-4			C-TRAN-5	C-TRAN-4
Severe Weather	C-TRAN-2 C-TRAN-3 C-TRAN-9	C-TRAN-8			C-TRAN-5 C-TRAN-8	C-TRAN-4

	Action Addressing Hazard, by Mitigation Type[a]					
Hazard Type	1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Volcano	C-TRAN-2 C-TRAN-3 C-TRAN-9				C-TRAN-5	C-TRAN-4
Wildfire	C-TRAN-2 C-TRAN-3 C-TRAN-9				C-TRAN-5	C-TRAN-4

a. See the introduction to this volume for explanation of mitigation types.

Item 4.

13. CLARK FIRE PROTECTION DISTRICT #3

13.1 HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact
Jason Mansfield, Captain
17718 NE 159 ST
Brush Prairie, WA 98606
Telephone: 360-892-2331
e-mail Address: jason@fire3.org

Alternate Point of Contact
Fire Chief, Scott Sorenson
17718 NE 159 ST
Brush Prairie, WA 98606
Telephone: 360-892-2331
e-mail Address: scott@fire3.org

13.2 JURISDICTION PROFILE

13.2.1 Overview

Fire District 3 is an all-risk response agency; meaning, that to the best of its ability, it will respond to any emergency-related situation (fires, rescues, medical emergencies, hazardous materials incidents, natural and manmade disasters, etc.). Fire District 3 was legally formed in 1947 as authorized by Washington State statute (RCW 52.02.020). The district is governed under the policy-making direction of a three-member board of Fire Commissioners. The board assumes responsibility for the adoption of this plan; the Fire Chief will oversee its implementation.

Fire District 3 currently has 52 full time employees and maintains a pool of approximately 25 volunteers. Fire District 3 is a Junior Taxing District and receives its funds through property taxes, some special purpose taxes like timber tax, and a service contract with the City of Battle Ground. The district's services span 92 square miles, including the City of Battle Ground and eight major unincorporated areas: (a) Hockinson, (b) Brush Prairie, (c) Venersborg, (d) Rawson Rd, (e) Heisson, (f) Battle Ground Lake, (g) Crawford, and (h) Lucia Falls. As reported by the County's GIS, approximately 44,928 people reside within Fire District 3's response area.

13.2.2 Service Area and Trends

The district serves a population of 44,928. Its service area covers an area of 92 square miles, which has a total replacement value of $7.037,492,013 billion.

Fire District 3 has seen an approximate average of a 10 percent increase in assessed valuation annually. There has been an increase of undeveloped land being converted to light industrial and residential use in our service area. This increase in density of land uses will represent an increase in population and thus a projected increase in call volume. Our five-year response average is 4,338.4 incidents per year with an average 6 percent yearly increase in response. With the proposed rezoning and development of the Urban Land Bank along SR 503, we are projecting the necessity of adding an additional station to meet the service needs of that area as well as increased staffing levels to meet the needs of the entire District. The fire district has existing plans of building a new fire station in the City of Battle Ground to replace Station 35 with a construction date TBA.

13.2.3 Assets

Table 1-1 summarizes the critical assets of the district and their value.

Item 4.

Table 13-1. Special Purpose District Assets

Asset	Value
Property	
21.23 acres of land	$2,414,490
Critical Infrastructure and Equipment	
7 Fire Engines and contents	$4,550,000
1 Ladder Truck	$1,029,686
5 Squads and contents	$664,479
1 Rescues and contents	$50,000
2 Water Tenders and contents	$828, 761
3 Command Vehicles	$227,189
2 Fire Marshall	$25,000
1 Ambulance/Rehab	$10,000
3 utility	$30,000
Total:	$7,415,115
Critical Facilities	
Station 31, Hockinson	$2,363,120
Station 32, Venersborg_	$1,318,238
Station 33, Battle Ground Lake	$1,203,687
Station 34, Rawson Rd	$1,277362
Station 35, Battle Ground	$1,123,989
Personal Property All Stations	$2,216,860
	$7,286,396

13.3 PLANNING AND REGULATORY CAPABILITIES

The following existing codes, ordinances, policies or plans are applicable to this hazard mitigation plan:

- Interim Final Rule 44 CFR part 201.6 – Requires a local jurisdiction have a Local Mitigation Plan in place to be FEMA compliant.
- Washington State Legislature RCW 38.52.070 - Directs local organizations to develop an emergency management plan which becomes a part of the state's comprehensive emergency management plan.
- Clark Regional Comprehensive Regional Emergency Response Plan - Identifies authorities and assigns responsibilities for planning, response, and recovery activities.

13.4 FISCAL, ADMINISTRATIVE AND TECHNICAL CAPABILITIES

The jurisdiction participates in the Public Protection Class Rating System and currently has a rating of 4. This rating was achieved in September, 2014. An assessment of fiscal capabilities is presented in Table 1-2. An assessment of administrative and technical capabilities is presented in Table 1-3.

Table 13-2. Fiscal Capability

Financial Resources	Accessible or Eligible to Use?
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	No
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	No
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	Yes
Other - Private Grants	Yes

Item 4.

Table 13-3. Administrative and Technical Capability

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Fire District 3, Fire Marshall
Engineers or professionals trained in building or infrastructure construction practices	Yes	Fire District 3, Fire Marshall
Planners or engineers with an understanding of natural hazards	No	
Staff with training in benefit/cost analysis	Yes	Scott Sorenson, Fire District 3, Fire Chief; Assistant Chief
Surveyors	No	
Personnel skilled or trained in GIS applications	Yes	Clark County GIS, Contract Support
Scientist familiar with natural hazards in local area	No	
Emergency manager	Yes	Sean Smith, Fire District 3, Emergency Manager
Grant writers	Yes	Scott Sorenson, Fire District 3, Fire Chief, Assistant Chief.
Other	No	

13.5 EDUCATION AND OUTREACH CAPABILITIES

An assessment of education and outreach capabilities is presented in Table 1-4.

Table 13-4. Education and Outreach

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes
Do you have personnel skilled or trained in website development?	Yes
Do you have hazard mitigation information available on your website?	Yes
If yes, please briefly describe.	We periodically put information about wildfires, floods, earthquakes, volcanoes, and tornadoes on our website. We also have links to various sites with useful information.
Do you utilize social media for hazard mitigation education and outreach?	Yes
If yes, please briefly describe.	Much like our website, we periodically put information about hazard mitigation on our Facebook page.
Do you have any citizen boards or commissions that address issues related to hazard mitigation?	No
If yes, please briefly specify.	
Do you have any other programs already in place that could be used to communicate hazard-related information?	Yes
If yes, please briefly describe.	We have a large roadside variable message sign that we can and do place out at strategic locations making people aware of certain conditions.
Do you have any established warning systems for hazard events?	No
If yes, please briefly describe.	

Item 4.

13.6 INTEGRATION WITH OTHER PLANNING INITIATIVES

The following describe the jurisdiction's process for integrating the hazard mitigation plan into existing plans and programs.

13.6.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan:

- Emergency Management Program: The program manager leads the process for creation and implementation of the hazard mitigation plan. Prior to implementation, the plan is reviewed and voted on the adoption of the plan by a Board of Commissioners.

13.6.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan, but provide an opportunity for future integration:

- Fire District 3 utilizes a strategic planning process where a new strategic plan is developed once every five years guiding the district's growth and operations. The district's 2020 strategic plan is in operation until 2025 where a new strategic plan will be developed. The current strategic plan addresses hazard mitigation and risk assessment.
- Fire District 3 Disaster Plan: This plan currently lays out the roles and responsibilities of Fire District 3 personnel in the event of a disaster. Information from the hazard mitigation plan will be incorporated as appropriate.
- Policy 1102 Emergency Power. The purpose of this policy is to establish a process for identifying emergency power needs or relocation plans for critical facilities and/or equipment. The Fire Chief is responsible for creation and implementation of the Emergency Power plan.
- Policy 716 Public Alerts. The purpose of this policy is to provide guidelines for notifying the public of vital fire safety information and/or emergency evacuation instructions. The Fire Chief is responsible for appointing an administrator for the Public Alert system.

13.7 JURISDICTION-SPECIFIC NATURAL HAZARD EVENT HISTORY

Table 1-5 lists all past occurrences of natural hazards within the jurisdiction.

Table 13-5. Natural Hazard Events

Type of Event	FEMA Disaster # (if applicable)		Date	Preliminary Damage Assessment
Tornado			03/21/2013	$15,000
Wind Storm	1682		12/14/2006	$190,000
Wind Storm			12/18/2005	$45,000
Wind Storm			12/12/2004	$50,000
Lightning			6/21/1997	Unknown
Flood			12/12/1996	Unknown
Wind Strom Clark Co			12/21/2015	Unknown
Thunder Storm Clark Co			12/07/2015	Unknown
Severe Winter Storm	4253		12/01/2015	Unknown

Wind Storm Clark Co			11/17/2015	Unknown
Wind Storm Clark Co			10/15/2016	Unknown
Wind Storm Clark Co			12/08/2016	Unknown
Thunder Storm Clark Co			06/07/2018	Unknown
Wind Storm Clark Co			1/05/2019	Unknown
Wind Storm Clark Co			09/07/2020	Unknown
Biological (Covid-19)	4481		3/22/2020	Unknown

13.8 JURISDICTION-SPECIFIC VULNERABILITIES

Noted vulnerabilities in the jurisdiction include:

- Replace Station 35 with a new station in the City of Battle Ground.

13.9 HAZARD RISK RANKING

Table 1-6 presents the ranking of the hazards of concern.

Table 13-6. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Earthquake	54	Medium
2	Severe Weather	42	Medium
3	Wildfire	32	Medium
4	Landslide	6	Low
5	Flood	3	Low
6	Drought	0	None
7	Volcano	3	Low
8	Dam Failure	0	None

13.10 STATUS OF PREVIOUS PLAN INITIATIVES

Table 13-7 summarizes the initiatives that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared. The actions identified in the following table were developed in 2016.

Table 13-7. Status of Previous Plan Initiatives

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
Where appropriate, support retro-fitting, purchase or relocation of structures located in high hazard areas and prioritize those structures that have experienced repetitive losses.		x	
Comment:			
Integrate the hazard mitigation plan into other plans and programs that support infrastructure investments choices, such as the capital improvement program.		x	
Comment:			

Item 4.

Develop and implement a program to capture perishable data after significant events (e.g. high water marks, preliminary damage estimates, damage photos) to support future mitigation efforts including the implementation and maintenance of the hazard mitigation plan.		x	
Comment:			
Support the County-wide initiatives identified in Volume I of the hazard mitigation plan.		x	
Comment:			
Actively participate in the plan maintenance protocols outlined in Volume I of the hazard mitigation plan.		x	
Comment:			
Develop a post-disaster recovery plan and a debris management plan.		x	
Comment:			
Require rapid damage assessment training for all staff.		x	
Comment:			
Identify funding opportunities for the purchase of a backup generator at Station 34.	x		
Comment:			
Assess emergency response routes and determine backup options in case of damage or disruption.		x	
Comment:			
Develop and implement a 10-14 day food and water plan for staff members at critical facilities.		x	
Comment:			
Perform non-structural assessments and mitigation activities (e.g. anchor bookcases to the wall).		x	
Comment:			
Encourage residents to post addresses where they are visible to first responders.		x	
Comment:			
Replace 44 year old water tender with updated apparatus.	x		
Comment:			
Develop evacuation/emergency road plans and prioritize roads for response efforts.		x	
Comment:			
Seek alternative water supplies in urban wildland interface areas.		x	
Comment:			

13.11 HAZARD MITIGATION ACTION PLAN AND EVALUATION OF RECOMMENDED ACTIONS

Table 1-8 lists the actions that make up the Municipal Jurisdiction Name hazard mitigation action plan. Table 1-9 identifies the priority for each action. Table 1-10 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Item 4.

Table 13-8. Hazard Mitigation Action Plan Matrix

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
FD3-1—Where appropriate, support retro-fitting, purchase or relocation of structures located in high hazard areas and prioritize those structures that have experienced repetitive losses.						
Existing	All Hazards	4, 5, 7, 9, 10	Facilities	High	HMGP, PDM,	Short-term
FD3-2—Integrate the hazard mitigation plan into other plans and programs that support infrastructure investments choices, such as the capital improvement program.						
New and Existing	All Hazards	2, 4,	Board	Low	Staff Time, General Funds	On-going
FD3-3—Develop and implement a program to capture perishable data after significant events (e.g. high water marks, preliminary damage estimates, damage photos) to support future mitigation efforts including the implementation and maintenance of the hazard mitigation plan.						
Existing	All Hazards	1, 2, 4, 12	Emergency Management	Medium	Staff Time, General Funds	Short-term
FD3-4—Support the County-wide initiatives identified in Volume I of the hazard mitigation plan.						
New and Existing	All Hazards	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	Lead Contact Department for Plan	Low	Staff Time, General Funds	Short-term
FD3-5—Actively participate in the plan maintenance protocols outlined in Volume I of the hazard mitigation plan.						
New and Existing	All Hazards	1, 4	Lead Contact Department for Plan	Low	Staff Time, General Funds	Short-term
FD3-6—Develop a post-disaster recovery plan and a debris management plan.						
Existing	All Hazards	1, 2, 4, 9	Emergency Management	Medium	EMPG	Long-term
FD3-7—Require rapid damage assessment training for all staff.						
New and Existing	All Hazards	2, 4, 6, 12	Training	Low	Staff Time, General Funds	On-going
FD3-8—Identify funding opportunities for the purchase of a backup generator at Station 34.						
New and Existing	All Hazards	5, 6, 8, 9, 10	Facilities	High	EMPG, HMGP, PDM, Staff Time, General Funds	Short-term
FD3-9—Assess emergency response routes and determine backup options in case of damage or disruption.						
New and Existing	All Hazards	2, 4, 5, 6,	Operations	Low	Staff Time, General Funds	On-going

FD3-10—Develop and implement a 10-14 day food and water plan for staff members at critical facilities.						
New and Existing	All Hazards	4, 5, 6, 10, 12	Emergency Management	Medium	EMPG, Staff Time, General Funds	On-going
FD3-11—Perform non-structural assessments and mitigation activities (e.g. anchor bookcases to the wall).						
Existing	Earthquake, Severe Weather	5, 6, 9, 10	Facilities	Medium	EMPG, Staff Time, General Funds	Short-term
FD3-12—Encourage residents to post addresses where they are visible to first responders.						
Existing	All Hazards	1, 2, 4,	Public Education	Low	Staff Time, General Funds	On-going
FD3-13—Replace 44 year old water tender with updated apparatus.						
Existing	All Hazards	1, 2, 4,	Apparatus	High	AFG, EMPG, Staff Time, General Funds	Short-Term
FD3-14—Develop evacuation/emergency road plans and prioritize roads for response efforts.						
New and Existing	All Hazards	1, 2, 4, 5, 6,	Operations	Low	Staff Time, General Funds	
FD3-15—Seek alternative water supplies in urban wildland interface areas.						
New and Existing	Wildfire	4, 6,11	Operations	Low	Staff Time, General Funds	

Table 13-9. Mitigation Strategy Priority Schedule

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
FD3-1	5	High	High	Yes	Yes	No	Medium	High
FD3-2	2	Medium	Low	Yes	No	Yes	High	Low
FD3-3	4	Low	Medium	Yes	No	No	Low	Low
FD3-4	12	Low	Low	Yes	No	Yes	High	Low
FD3-5	2	Low	Low	Yes	No	Yes	High	Low
FD3-6	4	Medium	Medium	Yes	Yes	No	Medium	High
FD3-7	4	Low	Low	Yes	No	Yes	Medium	Low
FD3-8	5	Medium	High	Yes	Yes	No	Medium	High
FD3-9	4	Medium	Low	Yes	No	Yes	High	Low
FD3-10	5	Medium	Medium	Yes	Yes	Yes	Medium	Low
FD3-11	4	High	Medium	Yes	Yes	Yes	Medium	Low

Item 4.

FD3-12	3	High	Low	Yes	No	Yes	High	Low
FD3-13	3	High	High	Yes	Yes	No	Medium	High
FD3-14	5	Medium	Low	Yes	No	Yes	High	Low
FD3-15	4	Medium	Low	Yes	No	Yes	High	Low

a. See the introduction to this volume for explanation of priorities.

Table 13-10. Analysis of Mitigation Actions

	Action Addressing Hazard, by Mitigation Typea					
Hazard Type	1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Dam Failure	FD3-2, FD3-3, FD3-4, FD3-5, FD3-6,	FD3-1, FD3-8	FD3-4, FD3-12		FD3-6, FD3-7, FD3-9, FD3-10, FD3-12, FD3-13, FD3-14	
Drought	FD3-2, FD3-3, FD3-4, FD3-5, FD3-6,	FD3-1, FD3-8	FD3-4, FD3-12		FD3-6, FD3-7, FD3-9, FD3-10, FD3-12, FD3-13, FD3-14	
Earthquake	FD3-2, FD3-3, FD3-4, FD3-5, FD3-6,	FD3-1, FD3-8, FD3-11	FD3-4, FD3-12		FD3-6, FD3-7, FD3-9, FD3-10, FD3-11, FD3-12, FD3-13, FD3-14	
Flood	FD3-2, FD3-3, FD3-4, FD3-5, FD3-6,	FD3-1, FD3-8	FD3-4, FD3-12		FD3-6, FD3-7, FD3-9, FD3-10, FD3-12, FD3-13, FD3-14	
Landslide	FD3-2, FD3-3, FD3-4, FD3-5, FD3-6,	FD3-1, FD3-8	FD3-4, FD3-12		FD3-6, FD3-7, FD3-9, FD3-10, FD3-12, FD3-13, FD3-14	
Severe Weather	FD3-2, FD3-3, FD3-4, FD3-5, FD3-6,	FD3-1, FD3-8, FD3-11	FD3-4, FD3-12		FD3-6, FD3-7, FD3-9, FD3-10, FD3-11, FD3-12, FD3-13, FD3-14	
Volcano	FD3-2, FD3-3, FD3-4, FD3-5, FD3-6,	FD3-1, FD3-8	FD3-4, FD3-12		FD3-6, FD3-7, FD3-9, FD3-10, FD3-12, FD3-13, FD3-14	
Wildfire	FD3-2, FD3-3, FD3-4, FD3-5, FD3-6,	FD3-1, FD3-8	FD3-4, FD3-12		FD3-6, FD3-7, FD3-9, FD3-10, FD3-12, FD3-13, FD3-14, FD3-15	

a. See the introduction to this volume for explanation of mitigation types.

14. Port of Vancouver USA

14.1 HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact
Scott Ouchi, Safety, Risk, & Emergency Mgr.
3103 NW Lower River Rd
Vancouver, WA 98660
Telephone: 360-823-5340
e-mail Address: souchi@portvanusa.com

Alternate Point of Contact
Todd Krout, Director of Operations
3103 NW Lower River Rd
Vancouver, WA 98660
Telephone: 360-823-5323
e-mail Address: tkrout@portvanusa.com

14.2 JURISDICTION PROFILE

14.2.1 Overview

The Port of Vancouver was created in 1912 by Clark County residents to ensure that prime industrial and marine property on the waterfront was retained for public economic benefit. The port receives income from tenant leases and vessel fees which covers operating costs such as salaries, rents, utilities and business services. The port also invests in capital improvements to build and improve port facilities like rail and docks. These capital improvements are paid partly from income the port generates. But they also are paid by tenants and customers through fees, port district residents through taxes, and state and federal grant programs.

Today, the port is home to more than 50 businesses that employ more than 3,900 employees and indirectly employs another 24,000 people which generates about $3.8 billion in economic activity annually. Combined, the port and its tenants pay more than $132 million annually in state and local taxes. The port is governed by a three-person Board of Commissioners, whose members are elected on six-year staggered terms. The commissioners hire a CEO who is charged with overseeing port operations, carrying out policies and overseeing staff. The Board of Commissioners will assume responsibility for the adoption of this plan and the CEO will oversee its implementation.

14.2.2 Service Area and Trends

The Port District serves a population of roughly 335,569 within 111 square miles that makes up the three taxing districts. Its service area covers an area of 2,100 acres, which has a total replacement value of $51,004,771,581 billion. According to a recent economic study, the economic benefit of the port’s marine and industrial activities increased from $2.9 billion in 2014 to $3.8 billion. Over the next few years, the port will focus on maximizing marine business, including the movement of commodities such as grain, steel, automobiles and energy infrastructure components. Additionally, the port will focus on expanding its industrial properties, including the development of the Terminal 1 project, which will open up access to the waterfront for the enjoyment of the entire community. For industrial business and development, industrial warehouse space continues to be nearly or completely leased, driving the need for new shovel-ready properties. The port has 50 acres of undeveloped property available for light industrial use and 600 acres available for future development.

Item 4.

14.2.3 Assets

Table 14-1 summarizes the critical assets of the district and their value.

Table 14-1. Special Purpose District Assets

Asset	Value
Property	
1,288 acres of land	**$155,250,025 million**
Critical Infrastructure and Equipment	
Buildings and Structures	$120,942,806
Machinery and Equipment	$28,791,049
Total:	**$149,733,855**
Leasehold Improvements	**$268,550,860**
Total:	**$573,534,740**

14.3 PLANNING AND REGULATORY CAPABILITIES

The following existing codes, ordinances, policies or plans are applicable to this hazard mitigation plan:

- 2022 Capital Maintenance Improvement Plan
- 2018 Strategic Plan

14.4 FISCAL, ADMINISTRATIVE AND TECHNICAL CAPABILITIES

An assessment of fiscal capabilities is presented in Table 14-2. An assessment of administrative and technical capabilities is presented in Table 14-3.

Table 14-2. Fiscal Capability

Financial Resources	Accessible or Eligible to Use?
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	Yes
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	Yes
State and Federal Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	No
Other	

Table 14-3. Administrative and Technical Capability

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Engineering & Project Delivery
Engineers or professionals trained in building or infrastructure construction practices	Yes	Engineering & Project Delivery
Planners or engineers with an understanding of natural hazards	Yes	Engineering & Project Delivery
Staff with training in benefit/cost analysis	Yes	Finance & Admin

Staff/Personnel Resources	Available?	Department/Agency/Position
Surveyors	No	
Personnel skilled or trained in GIS applications	No	
Scientist familiar with natural hazards in local area	Yes	Environmental Services
Emergency manager	Yes	Operations
Grant writers	Yes	Finance & Admin
Other		

14.5 EDUCATION AND OUTREACH CAPABILITIES

An assessment of education and outreach capabilities is presented in Table 1-4.

Table 14-4. Education and Outreach

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes, External Affairs
Do you have personnel skilled or trained in website development?	Yes, External Affairs
Do you have hazard mitigation information available on your website?	No
• If yes, please briefly describe.	
Do you utilize social media for hazard mitigation education and outreach?	No
• If yes, please briefly describe.	
Do you have any citizen boards or commissions that address issues related to hazard mitigation?	No
• If yes, please briefly specify.	
Do you have any other programs already in place that could be used to communicate hazard-related information?	Yes
• If yes, please briefly describe.	Radio communications, bi-weekly staff meetings, safety committee meetings and Joint Accident Prevention Committee meetings
Do you have any established warning systems for hazard events?	No
• If yes, please briefly describe.	

14.6 INTEGRATION WITH OTHER PLANNING INITIATIVES

The following describe the jurisdiction's process for integrating the hazard mitigation plan into existing plans and programs.

14.6.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan:

- None at this time.

14.6.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan, but provide an opportunity for future integration:

- Emergency Response Plan—Identifies potential hazards and protocols for dealing with hazards. Information from the hazard mitigation plan will be incorporated at the next update, as appropriate.

- Water System Emergency Response Plan—Identifies potential hazards and protocols for dealing with hazards. Information from the hazard mitigation plan will be incorporated at the next update, as appropriate.

14.7 JURISDICTION-SPECIFIC NATURAL HAZARD EVENT HISTORY

Table 14-5 lists all past occurrences of natural hazards within the jurisdiction.

Table 14-5. Natural Hazard Events

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
High Winds		11/01/2015	$17,585.73
High Winds		11/11/2014	$16,626.39

14.8 JURISDICTION-SPECIFIC VULNERABILITIES

Noted vulnerabilities the jurisdiction include:

- Identified areas of vulnerability include: volcanic ash fall; earthquake liquefaction; flooding and severe weather events.
  - POV has facilities located on liquefiable soil.
  - POV has many structures that are older and may not be built to current seismic codes.

14.9 HAZARD RISK RANKING

Table 14-6 presents the ranking of the hazards of concern.

Table 14-6. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
	Severe weather	48	High
	Flood	42	Medium
	Earthquake	36	High
	Dam failure	18	Medium
	Landslide	3	Low
	Volcano	3	Low
	Drought	0	None
	Wildfire	0	None

14.10 STATUS OF PREVIOUS PLAN INITIATIVES

Table 14-7 summarizes the initiatives that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared. The actions identified in the following table were developed in 2016.

Table 14-7. Previous Plan Initiatives

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
Where appropriate, support retro-fitting, purchase or relocation of structures located in high hazard areas and prioritize those structures that have experienced repetitive losses.		x	
Comments:			

Perform assessments of non-structural items (bookcases/racking, etc.) and ensure secured to fixed structure.		x	
Comments: Identified and secured several non-structural fixtures. This will be on-going as new non-structural fixtures get added over the years.			
Develop a Business Continuity and Disaster Recovery plan, involving key stakeholders.	x		
Comments:			
Assess property elevations to ensure the floodplain is considered in existing and future developments.		x	
Comments: The port is currently working on developing a Fill Permitting Strategy to elevate certain ports parcel above the regulatory base flood (100 year recurrence) elevation. This relates to port parcels 3, 7, and 10; as well as Terminal 5 West. This accounts for approximately 600 acres of land located within the floodplain, that will be filled in the future. In Calendar Year 2022 and 2023, we will begin the process of engineering and permitting for this earthwork. Due to the large quantity of fill required, this process will occur over many years and improvements will be realized in incremental yearly changes			
Develop volcanic emergency action plan; identify resources that may be negatively impacted; and educate employees on impacts and emergency plans.	x		
Comments:			

14.11 HAZARD MITIGATION ACTION PLAN AND EVALUATION OF RECOMMENDED ACTIONS

Table 14-8 lists the actions that make up the Port of Vancouver USA hazard mitigation action plan. Table 14-9 identifies the priority for each action. Table 14-10 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Table 14-8. Hazard Mitigation Action Plan Matrix

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
POV-1: Where appropriate, support retro-fitting, purchase or relocation of structures located in high hazard areas and prioritize those structures that have experienced repetitive losses.						
Existing	All Hazards	4,5,9,10	POV Operations	High	Staff time/Port expense	On-going
POV-2: Perform assessments of non-structural items (bookcases/racking, etc.) and ensure secured to fixed structure.						
Existing	Earthquake	4,5,9,10	POV Operations	Low	Staff time/Port expense	Short term
POV-3: Develop a Business Continuity and Disaster Recovery plan, involving key stakeholders.						
Existing	All Hazards	4,5,8,12	POV Operations	Low	Staff time/Port expense	Short term
POV-4: Assess property elevations to ensure the floodplain is considered in existing and future developments.						
Both	Flood	4,5,6,8,9,10	POV Operations	Low	Staff time/Port expense	On-going
POV-5: Develop volcanic emergency action plan; identify resources that may be negatively impacted; and educate employees on impacts and emergency plans.						
Both	Ash Fall (Volcano)	4,5,6,8,10	POV Operations	Medium	Staff time/Port expense	On-going

Table 14-9. Mitigation Strategy Priority Schedule

Item 4.

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
POV-1	4	Low	High	No	Yes	No	Medium	High
POV-2	4	High	Low	Yes	No	Yes	High	Medium
POV-3	4	Low	Low	Yes	Yes	Yes	High	Low
POV-4	6	Low	Low	Yes	No	Yes	Medium	Low
POV-5	5	Low	Low	Yes	No	Yes	Medium	Low

a. See the introduction to this volume for explanation of priorities.

Table 14-10. Analysis of Mitigation Actions

Hazard Type	Action Addressing Hazard, by Mitigation Type[a]					
	1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Severe Weather	POV-1, POV-2, POV-3, POV-4, POV-5	POV-1, POV-2	POV-3		POV-3	POV-1
Flood	POV-1, POV-3, POV-4	POV-1, POV-4	POV-3	POV-4	POV-3	
Earthquake	POV-1, POV-2, POV-3, POV-4	POV-1, POV-2	POV-3		POV-3	POV-1
Dam failure	POV-1, POV-3	POV-1	POV-3		POV-3	POV-1
Landslide	POV-1, POV-3	POV-1	POV-3		POV-3	POV-1
Volcanic Ash Fall	POV-1, POV-3, POV-5	POV-1, POV-3, POV-4	POV-3, POV-5		POV-3	

a. See the introduction to this volume for explanation of mitigation types.

14.12 FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

- Seismic infrastructure and structural retrofit assessment.

15. VANCOUVER PUBLIC SCHOOLS

15.1 HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact
Nicole Daltoso
Facilities Planning Manager
2901 Falk Rd
Vancouver, WA 98661
Telephone: 360-313-1048
Email address: Nicole.Daltoso@vansd.org

Alternate Point of Contact
AJ Panter
Executive Director, Facility Support Services
2901 Falk Rd
Vancouver, WA 98661
Telephone: 360-313-1040
Email address: AJ.Panter@vansd.org

15.2 JURISDICTION PROFILE

15.2.1 Overview

Formed in 1852, Vancouver Public Schools is a public-school district comprised of 21 elementary schools, six middle schools, five high schools, an arts school, a STEM school, and three additional programs across 58 square miles. The district includes approximately 22,000 students and 3,300 employees. Over the years we've inspired, challenged, urged, supported, and charged into unexplored territory. In concerts with an informed, engaged community, we've developed plans that have produced incredible results. We continue to look ahead.

Members of the Vancouver Public Schools board of directors are elected by the citizens of the community to four-year terms. The board set the district's goals and policies and is the governing body for adoption of school budgets. The Vancouver Public Schools board of directors assume responsibility for the adoption of this plan; Facility Support Services will oversee its implementation.

Vancouver Public Schools is funded through State, Federal, and Local funds.

15.2.2 Service Area and Trends

Approximately 142,905 people reside within the district's service area. The district currently serves a population of 22,000 students. Its service area covers an area of 58 square miles.

15.2.3 Assets

Table 15-1 summarizes the critical assets of the district and their value.

Table 15-1. Special Purpose District Assets

Asset	Value
Property	
Total acreage: 694.75	$11,284,016
Critical Infrastructure and Equipment	
Vehicles	$18,887,859
Maintenance Equipment	$774,000
Total	**$19,661,859**
Critical Facilities	**Building + Contents**
Administration/Other – Warehouse	**$10,859,851**
Administration/Other – Central Office/Pool	**$28,569,520**
Administration/Other – Pool	**$2,475,233**
Administration/Other – Kiggins Bowl Complex	**$2,833,532**
Administration/Other – Maintenance/Grounds	**$4,732,123**
Administration/Other – Transportation	**$10,188,978**
Administration/Other – Rental House	**$25,000**
Administration/Other – Various Storage	**$180,000**
Alki Middle School	**$31,197,240**
Benjamin Franklin Elementary School	**$12,101,082**
Benjamin Franklin Elementary School – Double Portable	**$170,000**
Benjamin Franklin Elementary School – Double Portable	**$170,000**
Benjamin Franklin Elementary School – Double Portable	**$170,000**
Chinook Elementary School	**$20,339,638**
Chinook Elementary School – Double Portable	**$170,000**
Columbia River High School	**$57,448,270**
Discovery Middle School	**$34,885,340**
Dwight D. Eisenhower Elementary School	**$19,486,600**
Eleanor Roosevelt Elementary School	**$23,259,220**
Eleanor Roosevelt Elementary School – Single Portable	**$122,000**
Eleanor Roosevelt Elementary School – Double Portable	**$170,000**
Felida Elementary School	**$20,144,026**
Fort Vancouver High School	**$70,163,670**
Fort Vancouver High School – Double Portable	**$170,000**
Fruit Valley Elementary School	**$11,005,339**
Gaiser Middle School	**$30,770,860**
Gaiser Middle School – Single Portable	**$122,000**
Gaiser Middle School – Single Portable	**$122,000**

Item 4.

Gaiser Middle School – Single Portable	**$122,000**
Gaiser Middle School – Single Portable	**$122,000**
GATE House	**$1,125,960**
Harney Elementary School	**$19,414,360**
Harney Elementary School – Double Portable	**$170,000**
Harney Elementary School – Double Portable	**$170,000**
Harry S Truman Elementary School	**$22,242,950**
Hazel Dell Elementary School	**$15,920,120**
Hazel Dell Elementary School – Double Portable	**$170,000**
Heights Campus	**$15,513,940**
Home Connection/Virtual Academy	**$11,966,750**
Hough Elementary School	**$15,085,517**
Hudson’s Bay High School	**$70,878,544**
iTech Preparatory School	**$30,300,000**
Jason Lee Middle School	**$27,312,725**
Jason Lee Middle School – Single Portable	**$122,000**
Jason Lee Middle School – Single Portable	**$122,000**
Jason Lee Middle School – Single Portable	**$122,000**
Lake Shore Elementary School	**$18,736,280**
Lewis & Clark High School (Flex Academy)	**$3,808,960**
Lincoln Elementary School	**$18,144,000**
Martin Luther King Jr. Elementary School	**$19,251,975**
McLoughlin Middle School & George C. Marshall Elementary School	**$69,000,000**
Minnehaha Elementary School	**$17,436,680**
Peter S. Ogden Elementary School	**$26,000,000**
Peter S. Ogden Elementary School (Old Building)	**$11,186,000**
Ruth Bader Ginsburg Elementary School	**Opening Fall 2023**
Sacajawea Elementary School	**$13,239,800**
Salmon Creek Elementary School	**$18,005,769**
Sarah J. Anderson Elementary School	**$19,599,731**
Sarah J. Anderson Elementary School – Double Portable	**$170,000**
Skyview High School	**$82,248,900**
Thomas Jefferson Middle School	**$35,129,380**
Vancouver Innovation Technology & Arts (VITA)	**Opening Fall 2022**
Vancouver School of Arts & Academics (VSAA)	**$30,464,138**
Walnut Grove Elementary School	**$19,661,867**
Washington Elementary School	**$13,827,980**

Item 4.

Total (Building + Contents)	**$1,038,843,848**
Total (Building/Contents & Vehicles/Equipment)	**$1,058,505,707**

15.3 PLANNING AND REGULATORY CAPABILITIES

The following existing codes, ordinances, policies or plans are applicable to this hazard mitigation plan:

- VPS Board of Directors Policies
- VPS Strategic Plan
- Capital Facilities Plan
- Clark County Codes
- City of Vancouver Codes

15.4 FISCAL, ADMINISTRATIVE AND TECHNICAL CAPABILITIES

An assessment of fiscal capabilities is presented in Table 15-2. An assessment of administrative and technical capabilities is presented in Table 15-3.

Table 15-2. Fiscal Capability

Financial Resources	Accessible or Eligible to Use?
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	No
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	No
Incur Debt through Private Activity Bonds	No
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	Yes - Impact Fees
Other	No

Table 15-3. Administrative and Technical Capability

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Planning Department / External consultants
Engineers or professionals trained in building or infrastructure construction practices	Yes	Facilities Department / External consultants
Planners or engineers with an understanding of natural hazards	Yes	External consultants
Staff with training in benefit/cost analysis	Yes	Business Services
Surveyors	No	NA
Personnel skilled or trained in GIS applications	Yes	Planning Department
Scientist familiar with natural hazards in local area	No	NA
Emergency manager	Yes	Facilities, Safety/Security, Environmental Safety, Building Admin, Superintendent
Grant writers	Yes	Business Services
Other	No	NA

Item 4.

15.5 EDUCATION AND OUTREACH CAPABILITIES

An assessment of education and outreach capabilities is presented in Table 1-4.

Table 15-4. Education and Outreach

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes
Do you have personnel skilled or trained in website development?	Yes
Do you have hazard mitigation information available on your website?	No
• If yes, please briefly describe.	NA
Do you utilize social media for hazard mitigation education and outreach?	Yes
• If yes, please briefly describe.	Employee outreach – internal intranet; social media channels – Facebook, Twitter
Do you have any citizen boards or commissions that address issues related to hazard mitigation?	No
• If yes, please briefly specify.	NA
Do you have any other programs already in place that could be used to communicate hazard-related information?	Yes
• If yes, please briefly describe.	Blackboard mass communication, Blackboard mobile app, FlashAlert, VPS district school closure info line, district website
Do you have any established warning systems for hazard events?	Yes
• If yes, please briefly describe.	Blackboard mass communication, Blackboard mobile app, FlashAlert, VPS district school closure info line, district website

15.6 INTEGRATION WITH OTHER PLANNING INITIATIVES

The following describe the jurisdiction's process for integrating the hazard mitigation plan into existing plans and programs.

15.6.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan:

- None identified at this time.

15.6.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan, but provide an opportunity for future integration:

- VPS Strategic Plan
- Capital Facilities Plan

15.7 JURISDICTION-SPECIFIC NATURAL HAZARD EVENT HISTORY

Table 15-5 lists all past occurrences of natural hazards within the jurisdiction.

Item 4.

Table 15-5. Natural Hazard Events

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Flooding	NA	May 31, 1948	NA
Columbus Day Storm	NA	October 10, 1962	NA
Tornado	NA	April 5, 1972	NA
Volcanic Eruption, Mount St. Helens	DR-623	May 21, 1980	NA
Tornado	NA	January 10, 2008	NA

15.8 JURISDICTION-SPECIFIC VULNERABILITIES

Noted vulnerabilities the jurisdiction include:

- Older facilities may not have been built to modern seismic standards.
- Many facilities have roofs that are at or beyond their life expectancy.

15.9 HAZARD RISK RANKING

Table 15-6 presents the ranking of the hazards of concern.

Table 15-6. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Severe Weather	51	High
1	Earthquake	48	High
2	Flood	18	High
2	Landslide	12	High
4	Wildfire	12	Medium
6	Dam Failure	8	Low
3	Drought	3	Low
5	Volcano	1	Low

15.10 HAZARD MITIGATION ACTION PLAN AND EVALUATION OF RECOMMENDED ACTIONS

Table 15-7 lists the actions that make up the Vancouver Public Schools hazard mitigation action plan. Table 15-8 identifies the priority for each action. Table 15-9 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Table 15-7. Hazard Mitigation Action Plan Matrix

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
VSD-1 – Perform roof replacements on roofs that have met or exceeded their life expectancy						
Existing	Severe Weather, Tornado	9, 10	Vancouver School District - Planning and Maintenance; External Architects	High-Medium	Bond, Levy General Fund, HMGP, PDM	Short-term
VSD-2 – Purchase back-up generators for facilities; central office ITS						
Existing	All hazards	2, 3, 10	Vancouver School District - Information Technology Services; Planning and Maintenance	High	General Fund, HMGP, PDM	Short-term
VSD-3 – All new buildings are to be built to current seismic building code						
New	Earthquake	4, 5, 9, 10	Vancouver School District - Planning; External Architects	High	Bond	Short-term
VSD-4 – Where appropriate, support retro-fitting, purchase or relocation of structures, or removal of hazards, such as trees, susceptible to causing damage that are located in high hazard areas, and prioritize those structures that have experienced repetitive losses.						
Existing	All hazards	4, 5, 7, 9, 10	Vancouver School District - Planning and Maintenance	High	General Fund, HMGP, PDM	Long-term
VSD-5 – Continue efforts to streamline and revise emergency response plans, recovery and continuity plans, and integrate mitigation planning into these processes						
New & Existing	All hazards	1, 2, 3, 4, 6, 10, 11, 12	Vancouver School District - Safety/Security, Environmental Safety, district wide	Low	General Fund, Staff Time, EMPG	Ongoing
VSD-6 – Support the County-wide initiative in Volume 1 of the hazard mitigation plan						
New and existing	All hazards	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	Lead contact Department for Plan	Low	Staff Time, General Funds	Short-term
VSD-7 – Actively participate in the plan maintenance strategy outlined in Volume 1 of the hazard mitigation plan						
New and existing	All hazards	1, 4	Lead contact Department for Plan	Low	Staff Time, General Funds	Short-term

Item 4.

Table 15-8. Mitigation Strategy Priority Schedule

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
VSD-1	2	High	High	No	Yes	No	Low	High
VSD-2	3	Medium	High	No	Yes	No	Low	Medium
VSD-3	4	High	Low	Yes	No	Yes	High	NA
VSD-4	5	High	High	Yes	Yes	No	High	High
VSD-5	8	Low	Low	Yes	Yes	Yes	Medium	Low
VSD-6	12	Low	Low	Yes	No	Yes	Medium	Low
VSD-7	2	Low	Low	Yes	No	Yes	Medium	Low

a. See the introduction to this volume for explanation of priorities.

Table 15-9. Analysis of Mitigation Actions

Hazard Type	Action Addressing Hazard, by Mitigation Type[a]					
	1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Dam Failure	VSD-4, VSD-5, VSD-6, VSD-7	VSD-4	VSD-5, VSD-6		VSD-5	
Drought	VSD-4, VSD-5, VSD-6, VSD-7	VSD-4	VSD-5, VSD-6		VSD-5	
Earthquake	VSD-1, VSD-2, VSD-3, VSD-4, VSD-5, VSD-6, VSD-7	VSD-3, VSD-4	VSD-5, VSD-6		VSD-5	
Flood	VSD-4, VSD-5, VSD-6, VSD-7	VSD-4	VSD-5, VSD-6		VSD-5	
Landslide	VSD-1, VSD-4, VSD-5, VSD-6, VSD-7	VSD-4	VSD-5, VSD-6		VSD-5	
Severe weather	VSD-1, VSD-2, VSD-4, VSD-5, VSD-6, VSD-7	VSD-4	VSD-5, VSD-6		VSD-5	
Volcano	VSD-1, VSD-2, VSD-4, VSD-5, VSD-6, VSD-7	VSD-4	VSD-5, VSD-6		VSD-5	
Wildfire	VSD-1, VSD-4, VSD-5, VSD-6, VSD-7	VSD-4	VSD-5, VSD-6		VSD-5	

a. See the introduction to this volume for explanation of mitigation types.

16. RIDGEFIELD SCHOOL DISTRICT

16.1 HAZARD MITIGATION PLAN POINT OF CONTACT

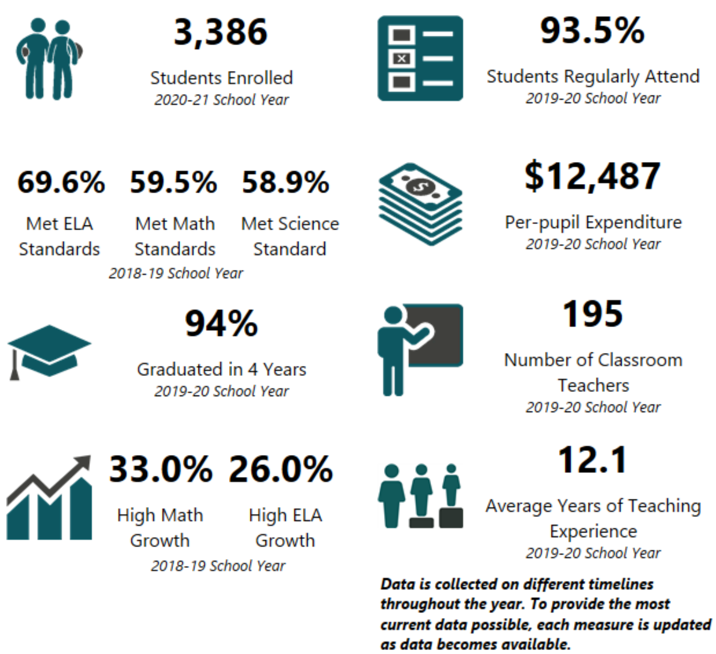
Primary Point of Contact
Chris Griffith, Assistant Superintendent
2724 South Hillhurst Road
Ridgefield, WA 98642
Telephone: 360-619-1304
e-mail Address: chris.griffith@ridgefieldsd.org

Alternate Point of Contact
Nathan McCann, Superintendent
2724 South Hillhurst Road
Ridgefield, WA 98642
Telephone: 360-619-1302
e-mail Address: Nathan.mccann@ridgefieldsd.org

16.2 JURISDICTION PROFILE

16.2.1 Overview

The Ridgefield School District offers an academic program with a proven record of achievement. Ridgefield has a long history as a district with a strong curriculum—a blend of common-sense basic skills instruction and creative strategies that promotes higher-level thinking and reasoning. Ridgefield students typically have performed at or among the highest when compared with students across the region.



Ridgefield School District currently employees nearly 195 certificated teachers, 11 administrators and roughly 100 classified employees to support students and certificated staff.

The district operates on a budget of nearly $52.4 million collected from a variety of sources.

2021-22:

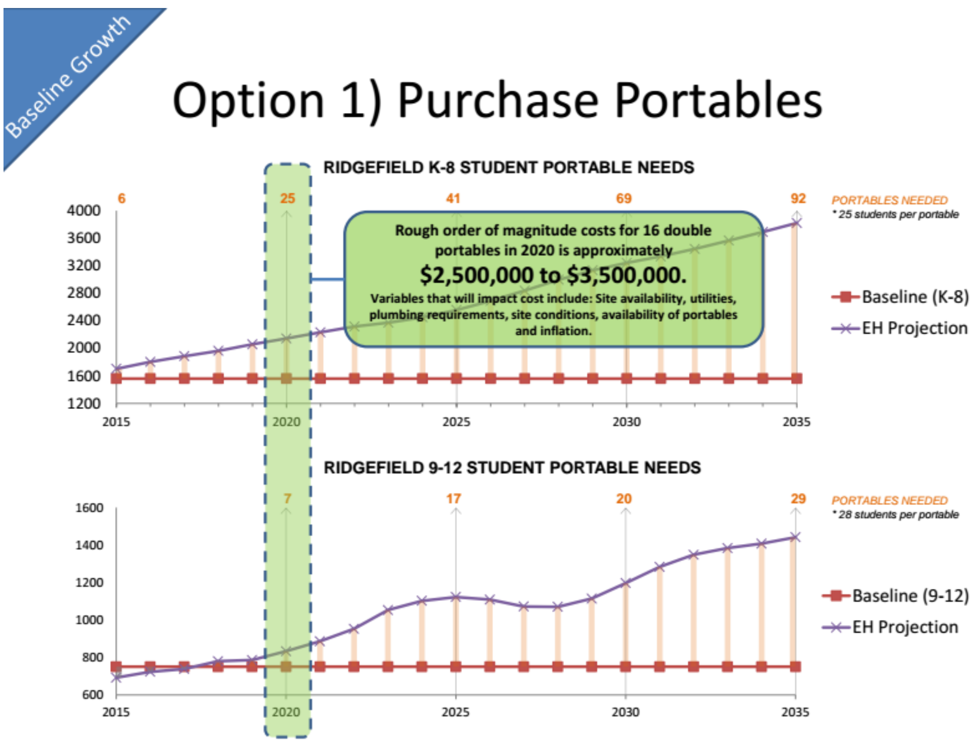
- Local Taxes - 13.3%
- Local Nontax - 3.4%
- State - 75.2%
- Federal - 7.8%
- Other - 0.3%

The Ridgefield School District school board assumes responsibility for the adoption of this plan; the Office of the Superintendent will oversee its implementation.

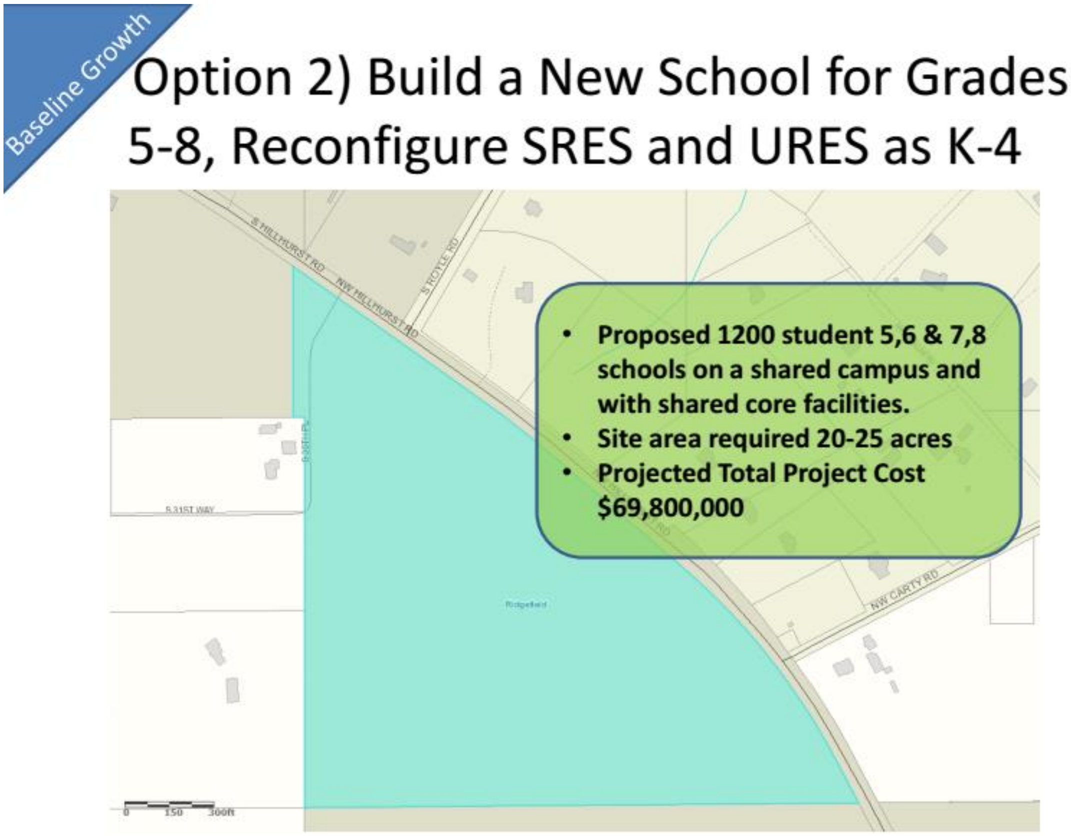
16.2.2 Service Area and Trends

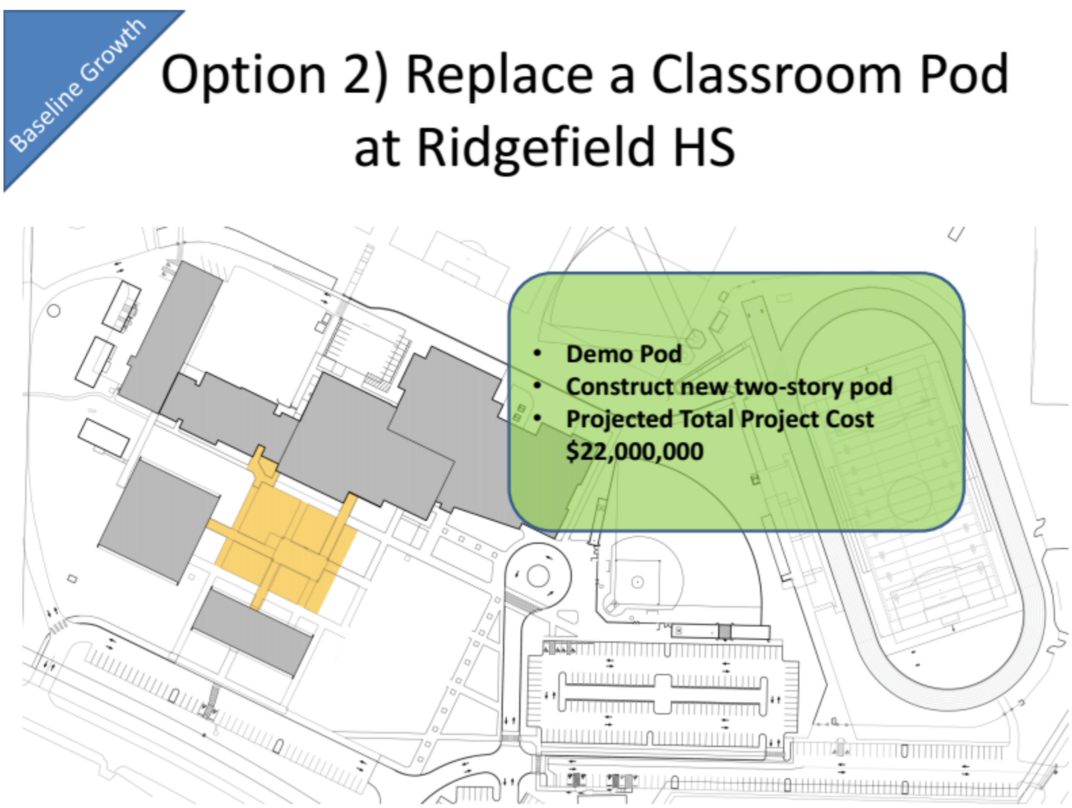
The district serves a population of 3,700 students. Its service area covers an area of 57.3 square miles, which has a total replacement value of $2.7 billion. Approximately, 20,000 people reside within the service area of the district.

Currently the Ridgefield School District is the fastest growing district in Clark County (percent of student population based). This has created a need for additional classrooms. In 2017 the Ridgefield School District successfully passed a $78 million bond that constructed a new joint 5/6 intermediate school and replacement 7/8 middle school (option #2 below). The Ridgefield School District has since asked the voters three times for additional bonding capacity to add classroom space, both of which failed to reach the required 60% supermajority. The failure of those bond measures has necessitated the district purchase additional portables (option #1 below). The district is currently running another bond measure, seeking community support to build a new elementary school (option #3 below).

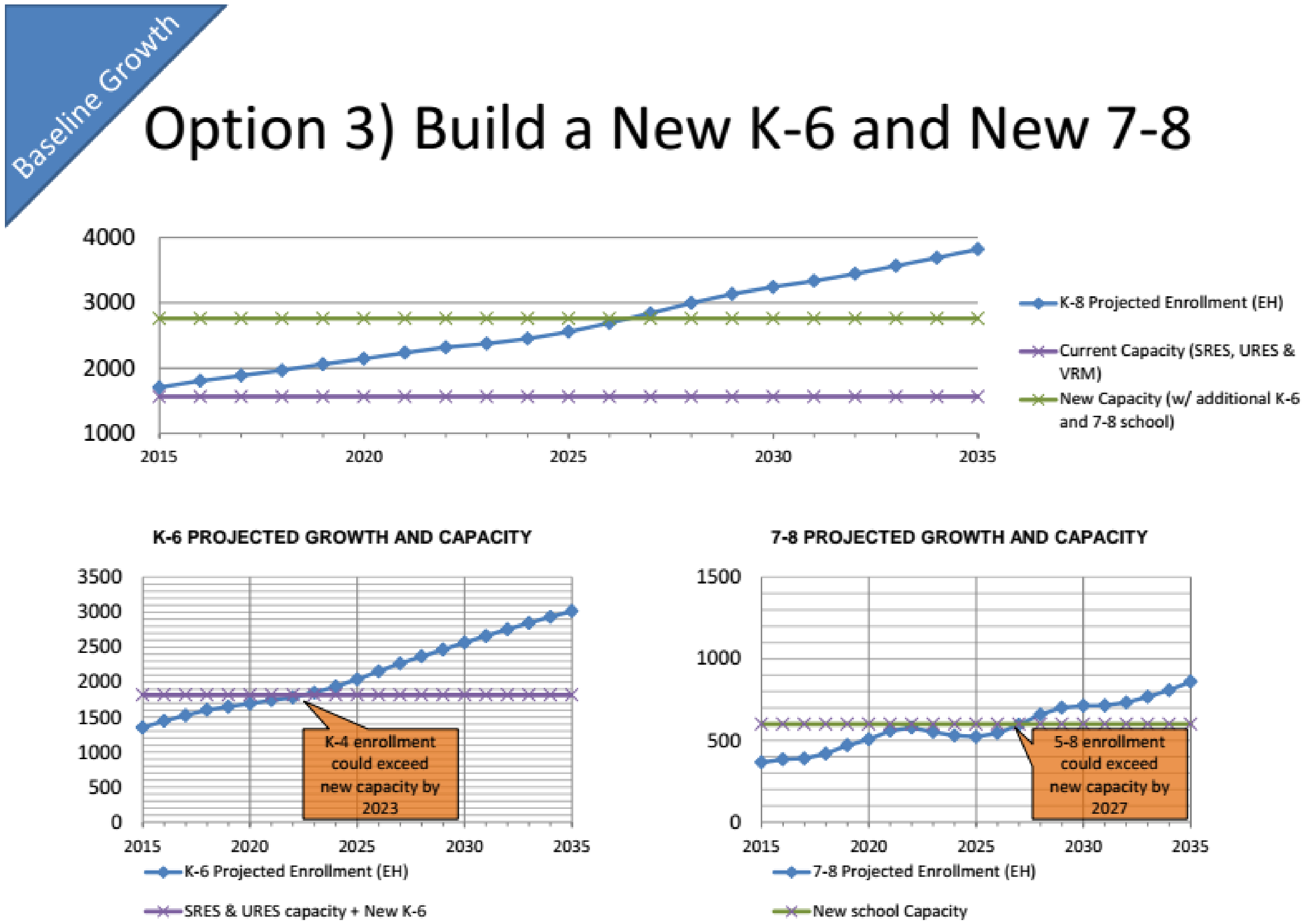


Item 4.


Baseline Growth
Option 2) Build a New School for Grades 5-8, Reconfigure SRES and URES as K-4
• Proposed 1200 student 5,6 & 7,8 schools on a shared campus and with shared core facilities.
• Site area required 20-25 acres
• Projected Total Project Cost $69,800,000
NW HILLHURST RD
NW CARTY RD


Baseline Growth
Option 2) Replace a Classroom Pod at Ridgefield HS
• Demo Pod
• Construct new two-story pod
• Projected Total Project Cost $22,000,000

Item 4.



16.2.3 Assets

Table 16-1 summarizes the critical assets of the district and their value.

Table 16-1. Special Purpose District Assets

Asset	Value
Property	
57.3 square miles	$2.7 billion
Critical Infrastructure and Equipment	
District vehicle (x2)	$10,000 each
Athletic van (x3)	$7,500 each
Maintenance vehicle - van	$12,000
Maintenance vehicle - van	$12,000
Maintenance vehicle - van	$12,000
Maintenance vehicle - truck	$15,000
Total:	**$93,500**
Critical Facilities	
South Ridge Elementary School	$7,061,200

Item 4.

Union Ridge Elementary School	$14,732,875
View Ridge Middle School / Sunset Ridge Intermediate	$31,387,281
Ridgefield High School	$24,241,800
Wisdom Ridge Academy	Leased
District office	$14,729,635
Total[a]	**$92,152,791**

16.3 PLANNING AND REGULATORY CAPABILITIES

The following existing codes, ordinances, policies or plans are applicable to this hazard mitigation plan:

More information on these plans can be found - http://www.ridgefieldsd.org/about-us/board-of-directors/policies-and-procedures
- Capital Facilities Plan (6900)
- Risk Management Program (6500)
- Site Acquisition (6905)

Ridgefield School District Safety Committee

16.4 FISCAL, ADMINISTRATIVE AND TECHNICAL CAPABILITIES

An assessment of fiscal capabilities is presented in Table 16-2. An assessment of administrative and technical capabilities is presented in Table 16-3.

Table 16-2. Fiscal Capability

Financial Resources	Accessible or Eligible to Use?
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	No
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	No
Incur Debt through Private Activity Bonds	No
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers (GMA)	Yes
Other	No

Table 16-3. Administrative and Technical Capability

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Outside consultant(s)
Engineers or professionals trained in building or infrastructure construction practices	Yes	Maintenance director LSW Architects
Planners or engineers with an understanding of natural hazards	Yes	LSW Architects
Staff with training in benefit/cost analysis	Yes	LSW Architects
Surveyors	Yes	Outside consultant(s)
Personnel skilled or trained in GIS applications	Yes	Outside consultant(s)
Scientist familiar with natural hazards in local area	Yes	Outside consultant(s)
Emergency manager	Yes	Maintenance director, principals, superintendent

Item 4.

Staff/Personnel Resources	Available?	Department/Agency/Position
Grant writers	Yes	Federal Programs office
Other	No	

16.5 EDUCATION AND OUTREACH CAPABILITIES

An assessment of education and outreach capabilities is presented in Table 1-4.

Table 16-4. Education and Outreach

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes - Nathan McCann, Superintendent
Do you have personnel skilled or trained in website development?	Yes – Technology Department
Do you have hazard mitigation information available on your website?	No
• If yes, please briefly describe.	
Do you utilize social media for hazard mitigation education and outreach?	Yes
• If yes, please briefly describe.	We posted a link to the initial hazard mitigation plan public survey on the district website and used the district email system to notify parents of our activities.
Do you have any citizen boards or commissions that address issues related to hazard mitigation?	No
• If yes, please briefly specify.	
Do you have any other programs already in place that could be used to communicate hazard-related information?	Yes
• If yes, please briefly describe.	The district has a safety committee that meets four times a year. Information related to the plan could be shared with this group. The group would then take the material back to their buildings to share with all staff members.
Do you have any established warning systems for hazard events?	Yes
• If yes, please briefly describe.	Building intercom and phone systems. Additionally, flash alerts can be sent.

16.6 INTEGRATION WITH OTHER PLANNING INITIATIVES

The following describe the jurisdiction's process for integrating the hazard mitigation plan into existing plans and programs.

16.6.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan:

- Emergency Operations Plan—the District is currently in the process of revising and updating the Emergency Operations Plan. As part of this process the Ridgefield School District has been working with CRESA, the Ridgefield Police Department and Clark County Fire & Rescue. We have planned an RRAT exercise to take place on January 14th. Once completed, the district will take the lessons learned and apply them to our plan. Additionally, we will discuss and include the hazard mitigation plan.

16.6.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan, but provide an opportunity for future integration:

- The Ridgefield School District is working with Clark County school districts regarding an area wide adoption of the Standard Response Protocol and Standard Reunification Plan (http://www.iloveuguys.org/).
- The Ridgefield School District Safety Committee will be kept apprised of the District's progress on the implementation and maintenance of the hazard mitigation plan.

16.7 JURISDICTION-SPECIFIC NATURAL HAZARD EVENT HISTORY

Table 16-5 lists all known, past occurrences of natural hazards within the jurisdiction.

Table 16-5. Natural Hazard Events

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Eruption	623	5/80	$0
Severe Winter Weather	Governor Proclamation 17.01 & 17.02	12/8, 12/9, 12/15, 1/11-1/13, 1/17	$0 - School Closure
Severe Winter Weather	4253	12/15	$0 - School Closure, Interstate 501 lane closure
Severe Winter Weather	N/A	2/7/14 and 2/10/14	$0- School Closure, Interstate 501 lane closure
Severe Winter Weather	N/A	12/10/13 and 12/11/13	$0- School Closure, Interstate 501 lane closure
Severe Winter Weather	N/A	1/18/12	$0- School Closure
Severe Winter Weather	N/A	2/24/11	$0- School Closure
Severe Winter Weather	N/A	11/23/10	$0- School Closure

16.8 JURISDICTION-SPECIFIC VULNERABILITIES

Noted vulnerabilities the jurisdiction include:

- Many of the core district facilities have not been seismically retrofitted.

16.9 HAZARD RISK RANKING

Table 16-6 presents the ranking of the hazards of concern.

Table 16-6. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Severe Weather	51	High
3	Earthquake	36	High
4	Landslide	24	Medium
5	Flood	16	Medium
6	Dam Failure	9	Low
7	Drought	8	Low
8	Volcano (ash fall)	8	Low

Item 4.

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
9	Wildfire	0	None

16.10 HAZARD MITIGATION ACTION PLAN AND EVALUATION OF RECOMMENDED ACTIONS

Table 16-8 lists the actions that make up the Ridgefield School District hazard mitigation action plan. Table 16-9 identifies the priority for each action. Table 16-10 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Table 16-7. Hazard Mitigation Action Plan Matrix

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
RSD-1—Ridgefield School District has many older facilities that were not designed with seismic activity in mind. Perform non-structural retrofits on all facilities.						
Existing	Earthquake	9,10	Ridgefield School District - Maintenance	Medium	General fund - maintenance	Short term
RSD-2—Purchase back-up generators for facilities (Union Ridge, South Ridge, Ridgefield High School).						
Existing	All hazards	2, 3, 10	Ridgefield School District - Maintenance	High	HMGP, PDM	Short term
RSD-3—Retro fit all brick buildings for seismic activity (Union Ridge, South Ridge, Ridgefield High School).						
Existing	Earthquake	9, 10	Ridgefield School District - Maintenance and Contractor	High	HMGP, PDM	Long term
RSD-4—Work with local agencies to identify a standard Reunification Site for use by all schools when evacuation of school facilities is necessary. Currently working with CRESA, Ridgefield Police, Clark County Fire & Rescue, Clark County Sheriff.						
N/A	All hazards	1, 4	Ridgefield School District, Ridgefield Police Department, Clark County Fire & Rescue, Clark County Event Center	Low	General fund	Short term
RSD-5—Share the Hazard Mitigation work with the school board during a public meeting.						
N/A	All hazards	1	Ridgefield School District	Low	Staff time	Short term
RSD-6 Support the County –wide initiative in Volume I of the hazard mitigation plan.						
New and Existing	All hazards	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	Lead contact Department for Plan	Low	Staff Time, General Funds	Short-term
RSD – 7 Actively participate in the plan maintenance strategy outlined in Volume I of the hazard mitigation plan.						
New and Existing	All hazards	1, 4	Lead Contact Department for Plan	Low	Staff Time, General Funds	Short-term

Item 4.

Table 16-8. Mitigation Strategy Priority Schedule

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
1	2	High	Medium	Yes	No	Yes	High	Low
2	3	High	High	Yes	Yes	No	Low	High
3	2	High	High	Yes	Yes	No	Low	High
4	2	High	Low	Yes	No	Yes	High	Low
5	5	Low	Low	Yes	No	Yes	Medium	Low
6	12	Low	Low	Yes	No	Yes	High	Low
7	2	Low	Low	Yes	No	Yes	High	Low

a. See the introduction to this volume for explanation of priorities.

Table 16-9. Analysis of Mitigation Actions

Hazard Type	Action Addressing Hazard, by Mitigation Type[a]					
	1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Severe Weather	RSD-1, RSD-2, RSD-3	RSD-1, RSD-2, RSD-3	RSD-5		RSD-4, RSD-5	RSD-3
Earthquake	RSD-1, RSD-3	RSD-1, RSD-3	RSD-5			RSD-3
Landslide		RSD-2	RSD-8			
Flood		RSD-2	RSD-8			
Dam Failure		RSD-2	RSD-8			
Drought		RSD-2	RSD-8			
Volcano (ash fall)		RSD-2	RSD-8			

a. See the introduction to this volume for explanation of mitigation types.

16.11 FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

The Ridgefield School District will continue to partner with the City of Ridgefield considering long term planning in regards to traffic impact.

16.12 ADDITIONAL COMMENTS

As the Ridgefield School District continues to grow, we will take into consideration potential hazards when designing new construction.

17. EVERGREEN PUBLIC SCHOOLS

17.1 HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact
Shane Gardner, Director of Safety/Security
13413 NE LeRoy Haagen Memorial Drive
Vancouver, WA 98668-8910
Telephone: 360-604-4066
Email address: shane.garder@evergreenps.org

Alternate Point of Contact
Kyle Olsen, Manager of Safety and Security
13413 NE LeRoy Haagen Memorial Drive
Vancouver, WA 98668-8910
Telephone: 360-604-4065
Email address: kyle.olsen@evergreenps.org

17.2 JURISDICTION PROFILE

17.2.1 Overview

The purpose of Evergreen Public Schools Hazard Mitigation Plan is to reduce the impacts of future natural disasters on the district's facilities, students, staff and volunteers. That is, the purpose is to make the Evergreen Public Schools more disaster resistant and disaster resilient, by reducing the vulnerability to disasters and enhancing the capability to respond effectively to, and recover quickly from, future disasters.

Completely eliminating the risk of future disasters in Evergreen Public Schools is neither technologically possible nor economically feasible. However, substantially reducing the negative impacts of future disasters is achievable with the adoption of this pragmatic Hazard Mitigation Plan and ongoing implementation of risk reducing action items. Incorporating risk reduction strategies and action items into the district's existing programs and decision making processes will facilitate moving the Evergreen Public Schools toward a safer and more disaster resistant future.

Evergreen Public Schools Hazard Mitigation Plan is based on a four-step framework that is designed to help focus attention and action on successful mitigation strategies: Mission Statement, Goals, Objectives, and Action Items.

Mission Statement. The Mission Statement states the purpose and defines the primary function of the Evergreen Public Schools Hazard Mitigation Plan. The Mission Statement is an action-oriented summary that answers the question "Why develop a hazard mitigation plan?"

Goals. Goals identify priorities and specify how Evergreen Public Schools intends to work toward reducing the risks from natural and human-caused hazards. The Goals represent the guiding principles toward which the district's efforts are directed. Goals provide focus for the more specific issues, recommendations, and actions addressed in Objectives and Action Items.

Objectives. Each Goal has Objectives which specify the directions, methods, processes, or steps necessary to accomplish the Evergreen Public Schools Hazard Mitigation Plan's Goals. Objectives lead directly to specific Action Items.

Action Items. Action Items are specific, well-defined activities or projects that work to reduce risk. That is, the Action Items represent the specific, implementable steps necessary to achieve the district's Mission Statement, Goals, and Objectives.

The mission statement for Evergreen Public Schools Hazard Mitigation Plan is to:

Proactively facilitate and support district-wide policies, practices, and programs that make Evergreen Public Schools more disaster resistant and disaster resilient.

Making Evergreen Public Schools more disaster resistant and disaster resilient means taking proactive steps and actions to:

- Protect life safety,
- Reduce damage to district facilities,
- Minimize economic losses and disruption, and
- Shorten the recovery period from future disasters.

17.2.2 SERVICE AREA AND TRENDS

Evergreen has expanded and refined its educational programs as the 54 square mile district rapidly developed and added population in recent years. In the spring of 2004, the school board endorsed the use of the name Evergreen Public Schools as an alternative to the official name of Evergreen School District #114. Using the name Evergreen Public Schools reflects the ownership each member of the community has in its school district. It also better captures the cooperative environment that the district nurtures.

Evergreen Public Schools provides the academic, cultural, vocational, and athletic programs needed to help students become responsible, knowledgeable adults.

Evergreen Public Schools currently serves 22,921 students and employs 2,203 employees. Our budget for the school year 2021/2022 is $406,945,000. Student enrollment is as follows in the table below.

17.2.3 ASSETS

Table 17-1 summarizes the critical assets of the district and their value.

Table 17-1. Special Purpose District Assets

Asset				
Critical Facilities	**Description**	**Street Address**	**Value**	**Sq. Ft.**
HeLa High School	**BioScience Academy H.S.**	**9105 NE 9th St**	**$19,800,000.00**	**69,008**
Columbia Valley Elementary School	**Covered play structure**	**17500 SE Sequoia Circle**	**$275,000.00**	**3,200**

Orchards Elementary School	Covered play structure	11405 NE 69th Street	$275,000.00	3,200
York Elementary School	Covered play structure	9301 NE 152nd Ave	$275,000.00	3,200
Emerald Elementary School	Detached Play	4000 NE 164th Ave	$250,000.00	3,200
Image Elementary	Detached Play	5201 NE 131st Ave	$250,000.00	3,200
Marion Elementary School	Elementary Building	10119 NE 14th St	$23,485,000.00	62,000
Quad 205 Storage	Warehouse Storage	10914 NE 39th St, Ste B4	$0.00	4,550
Land	Vacant Land	2224 NE Brendan Circle	$0.00	1
Sifton Elementary	Detached Covered Play Area	7301 NE 137th Ave	$102,080.00	3,200
Emerald Elementary School	School Building	4000 NE 164th Ave	$23,485,000.00	61,000
Fircrest Elementary School	Attached Covered Play Structure	12001 NE 9th Street	$11,000.00	4,500
Illahee Elementary	Portables (3)	19401 SE 1st Street	$517,440.00	4,704
Harmony Elementary	Building	17404 A NE 18th Street	$14,170,475.00	49,519
Hearthwood Elementary	Portables (2)	801 NE Hearthwood Blvd	$689,920.00	3,136
Evergreen High School	Portables (8)	14300 NE 18th ST	$1,512,280.00	13,748
Covington Middle School	Portable Quad 2 Modular	11200 NE Rosewood Road	$1,143,890.00	8,064
Burton Elementary	Attached Covered Play Structure	14015 NE 28th St	$11,000.00	1,500
Endeavour Elementary School	Attached Covered Play Structure	2701 NE Four Seasons Lane	$11,000.00	2,200

Crestline Elementary	2 attached Covered Play Structures	13003 SE 7th St	$22,000.00	3,761
Old Legacy High School	Legacy High School	2205 NE 138th Ave	$3,240,897.00	11,554
49th Street Academy	K-13 Special Needs Students	14619-B 49th Street	$176,000.00	1,568
Harmony Elementary	Attached Covered Play Structure	17404 A NE 18th Street	$11,000.00	4,020
Mckenzie Stadium	Athletic Light Standards	14300 NE 18th St	$132,084.00	0
Vacant Land	Haagen Vacant Land 22.47 acres	136th Ave & N side of Mill Plain	$0.00	0
York Elementary School	Attached Covered Play Structure	9301 NE 152nd Ave	$11,000.00	2,200
Sunset Elementary School	Attached Covered Play Structure	9001 NE 95th St	$11,000.00	4,500
Shahala Middle School	Freestanding Covered Play Area	601 SE 192nd Ave	$11,000.00	3,224
Riverview Elementary	Storage Shed	12601 Se Riveridge Dr	$41,250.00	500
Riverview Elementary	Attached Covered Play Structure	12601 Se Riveridge Dr	$11,000.00	4,500
Pioneer Elementary	Attached Covered Play Structure	7212 NE 166th Ave	$11,000.00	4,020
Orchards Elementary	Attached Covered Play Structure	11405 NE 69th Street	$11,000.00	2,200
Image/Home Choice Academy	Attached Covered Play Structure	4400 Ne 122nd Ave	$11,000.00	4,500
Illahee Elementary	Attached Covered Play Structure	19401 SE 1st Street	$11,000.00	4,016
Hearthwood Elementary	Modular Building (1)	801 NE Hearthwood Blvd	$418,000.00	4,608

Mckenzie Stadium	Athletic Storage	2205 NE 138th Ave	$19,763.00	1
Pacific Middle School	Athletic Storage Shed	2017 NE 172nd Ave	$21,942.00	500
Burnt Bridge Creek Elementary	Building	14619 A NE 49th St	$14,025,000.00	49,414
Illahee Elementary	Elementary School	19401 SE 1st Street	$16,090,800.00	55,699
Silver Star Elementary	Covered Play Area	14300 NE 18th ST	$247,500.00	1,728
Fisher's Landing Elementary	Attached Covered Play Structure	3800 SE Hiddenbrook Drive	$330,000.00	4,010
Fisher's Landing Elementary	Building	3800 SE Hiddenbrook Dr	$14,093,750.00	49,972
Archway Academy	Archway Academy	13500 NE 9th Street	$4,389,825.00	9,535
Legacy High School and New Hollingsworth Academy/49th Street Academy	Legacy High School and New Hollingsworth Academy/49th Street Academy	13300 NE 9th Street and 13400 NE 9th Street	$28,587,075.00	60,655
Image Elementary	Image Elementary School Building	5201 NE 131st Ave	$23,485,000.00	61,000
Cascadia Tech Building Lot	0	2213 NE Brendan Circle	$0.00	1
Old Legacy High School	Portables (2)	2205 NE 138th Ave	$357,500.00	3,144
Old Legacy High School	Modular Building	2205 NE 138th Ave	$440,000.00	5,180
Harmony Elementary	Storage Shed	17404 A NE 18th Street	$55,000.00	500
Hearthwood Elementary School	Attached Covered Play Structure	801 NE Hearthwood Blvd	$11,000.00	4,500
Heritage High School	Field house Storage	7825 NE 130th Ave	$110,000.00	500
Illahee Elementary	Storage Shed	19401 SE 1st Street	$41,250.00	500

Image/Home Choice Academy	Storage Shed	4400 NE 122nd Ave	$41,250.00	500
Frontier Middle School	Storage Shed	7600 NE 166th Ave	$41,250.00	500
Orchards Elementary	2 Portables	11405 NE 69th Street	$495,000.00	3,136
Fisher's Landing Elementary	Storage Shed	3800 SE Hiddenbrook Dr	$41,250.00	500
Sunset Elementary School	Storage Shed	9001 NE 95th St	$41,250.00	500
Union High School	Quad/Modular	6201 NW Friberg	$1,281,280.00	11,648
Orchards Elementary	Modular Building	11405 Ne 69th Street	$554,400.00	5,040
Image Elementary	Building	4400 NE 122nd Ave	$15,578,750.00	54,400
Cascade Middle School	Covered Play Structure	13900 NE 18th Street	$99,000.00	6,570
Cascadia Technical Academy	Cosmetolog y Building 600	12200 NE 28th ST	$2,145,000.00	7,071
Shahala Middle School	Athletic Storage Shed	601 SE 192nd	$59,400.00	720
Frontier Middle School	Portables (11) - Age Varies	7600 NE 166th Ave	$1,897,280.00	17,248
Ellsworth Elementary	Detached Play	512 SE Ellsworth Ave	$250,000.00	3,200
Shahala Middle School	Portables (12) - Age Varies	601 SE 192nd Ave	$2,069,760.00	18,816
Shahala Middle School	Middle School	601 SE 192nd Ave	$29,430,060.00	104,298
Mckenzie Stadium	Portable Stage	2205 NE 138th Ave	$54,053.00	1
Fircrest Elementary School	Building	12001 NE 9th Street	$15,578,750.00	54,400
Pacific Middle School	Portables (19) - Age Varies	2017 NE 172nd Ave	$3,277,120.00	29,792

Burton Elementary	Buildings 100-300	14015 NE 28th St	$11,382,800.00	40,642
Mckenzie Stadium	Restrooms	2205 NE 138th Ave	$36,038.00	1
Evergreen High School	Tennis Court Surface	14300 NE 18th ST	$38,508.00	1
Covington Middle School	5 Portable - See EPS detail for correct ages of portables	11200 NE Rosewood Road	$862,400.00	7,840
Frontier Middle School	Recycle Shed	7600 NE 166th Ave	$27,500.00	300
Riverview Elementary	Portables (2)	13900 NE 18th ST	$344,960.00	3,136
Fisher's Landing Elementary	Portables (6) - Age Varies	3800 Se Hiddenbrook Drive	$1,034,880.00	9,408
Burnt Bridge Creek Elementary	Portables (6)	14619 A NE 49th Street	$990,000.00	9,408
Covington Middle School	Storage Building	11200 NE Rosewood Road	$99,000.00	1,000
Endeavour Elementary School	4 Portables - Age Varies	2701 NE Four Seasons Lane	$703,120.00	6,272
Fircrest Elementary School	Storage Shed	12001 NE 9th Street	$41,250.00	500
Crestline Elementary	School Building	13003 SE 7th St	$18,650,500.00	60,143
Cascade Middle School	Portables (2) portable quad 1	13900 NE 18th Street	$1,254,000.00	11,200
Crestline Elementary	Detached Play Structure	13003 SE 7th St	$115,500.00	3,634
Transportation	Building	13909 NE 28th ST	$1,650,000.00	9,170
Cascade Middle School	Athletic Storage Building	13900 NE 18th ST	$99,000.00	1,000
Burton Elementary	Portables 7	14015 NE 28th St	$1,320,000.00	10,976

Harmony Elementary - Age Varies	Portables (8)	17404 A NE 18th Street	$1,375,000.00	12,544
Maintenance	Building (Including storage)	3004 NE 124th Ave	$1,155,000.00	7,000
Sifton Elementary	Sifton Elementary School	7301 NE 137th Ave	$23,485,000.00	61,600
Maintenance	Storage Buildings (2)	unknown	$742,500.00	6,750
Frontier Middle School	Buildings 100-300	7600 NE 166th Ave	$27,545,100.00	101,046
York Elementary School	York Elementary School	9301 NE 152nd Ave	$15,732,200.00	56,108
Heritage High School	Greenhouse	7825 NE 130th Ave	$85,800.00	1,200
Heritage High School	Portables (15) - Age Varies	7825 NE 130th Ave	$3,449,600.00	23,520
Pioneer Elementary	Building	7212 NE 166th Ave	$14,170,530.00	49,519
Hearthwood Elementary School	Storage Shed	801 NE Hearthwood	$41,250.00	500
Silver Star Elementary	Attached Covered Play Structure	10500 NE 86th St	$115,500.00	3,634
Pacific Middle School	Covered Play Area	2017 NE 172nd Ave	$115,500.00	2,946
Image/Home Choice Academy	Portables (3) - Age Varies	4400 Ne 122nd Ave	$689,920.00	4,704
Silver Star Elementary	Portables (7)	10500 NE 86th St	$1,207,360.00	10,976
Silver Star Elementary	Building/Gym	10500 NE 86th St	$13,591,600.00	41,463
Burton Elementary	Freestanding Covered Play Area	14015 NE 28th St	$115,500.00	3,634
49th Street Academy	Leased Location - Property Coverage Only	14619-B 49th Street	$2,970,000.00	10,799

Phone Switch Station	Building	13905 NE 28th ST	$166,320.00	840
Crestwood Business Park	Leased Classroom Space	11818 SE Mill Pl Blvd Suite 302	$0.00	2,642
Frontier Middle School	Greenhouse	7600 NE 166th Ave	$44,000.00	1,200
Cascadia Technical Academy	Aviation Building 500	12200 NE 28th ST	$4,031,500.00	13,318
Burnt Bridge Creek Elementary	Grounds Shed	14619 A NE 49th Street	$41,250.00	500
Burton Elementary	Storage Shed	14015 NE 28th Street	$27,500.00	200
Pioneer Elementary	Portables (6) - Age Varies	7212 NE 166th Ave	$1,034,880.00	9,408
Fircrest Elementary School	Portables (2) - age varies	12001 NE 9th Street	$344,960.00	3,136
Hearthwood Elementary	Building	801 NE Hearthwood Blvd.	$14,121,250.00	49,100
Sunset Elementary School	Portable (3) - Age Varies	9001 NE 95th ST	$517,440.00	4,704
Sunset Elementary School	Building	9001 NE 95th ST	$15,578,750.00	54,400
Endeavour Elementary School	Elementary School	2701 NE Four Seasons Lane	$16,955,400.00	60,556
Columbia Valley Elementary	Attached Covered Play Structure	17500 SE Sequoia Circle	$181,500.00	2,200
Columbia Valley Elementary	School Building	17500 SE Sequoia Circle	$16,955,400.00	60,556
Administrative	Administrativ e Services Center	13413 NE LeRoy Haagen Memorial Dr.	$33,000,000.00	75,000
Mckenzie Stadium	Artificial Turf	2205 NE 138th Ave	$642,952.00	1
Evergreen High School	Building	14300 NE 18th ST	$78,513,138.00	264,354

Mckenzie Stadium	North Stadium	2205 NE 138th Ave	$873,770.00	2,000
Mckenzie Stadium	South Stadium	2205 NE 138th Ave	$5,305,496.00	27,000
Covington Middle School	Building	11200 NE Rosewood Ave	$33,561,000.00	112,361
Cascadia Technical Academy	Readerboard	12200 NE 28th ST	$7,267.00	1
Mckenzie Stadium	Lighted Reader Board	2205 NE 138th Ave	$7,797.00	1
Mckenzie Stadium	Scoreboard	2205 NE 138th Ave	$23,829.00	1
Cascadia Technical Academy	Light Standards (21)	12200 NE 28th ST	$110,000.00	1
Heritage High School	Building	7825 NE 130th Ave	$72,709,678.00	223,557
Transportation	Covered Bus Ports (4)	13909 NE 28th ST	$2,836,350.00	9,170
Cascadia Technical Academy	Buildings, 100-400 - Building 400 was built in 2004	12200 NE 28th ST	$23,452,000.00	80,315
Riverview Elementary	Building	12601 SE Riverridge Dr	$16,201,900.00	54,400
Cascade Middle School	Building	13900 NE 18th ST	$32,518,200.00	110,315
Mckenzie Stadium	Concessions	2205 NE 138th Ave	$101,134.00	0
Warehouse	Building	2205 NE 138th Ave	$2,750,000.00	25,000
Pacific Middle School	Buildings 100-400	2017 NE 172nd Ave	$27,912,742.00	106,581
Orchards Elementary	School Building	11405 Ne 69th Street	$17,633,616.00	60,556
Union High School	Building	6201 NW Friberg Strunk St	$67,181,400.00	234,900
Ellsworth Elementary	Building	512 SE Ellsworth Ave	$21,350,000.00	61,600

Middle School	Wy'East Middle School	1112 SE 136th Ave	$47,201,000.00	134,860
Mill Plain Elementary - GL Only	Mill Plain Elementary - GL Only	16200 SE 6th St	$0.00	1
Wy'East Middle School	Covered Play Structure	1112 SE 136th Ave	$312,782.00	3,637
Mountain View High School	School Building	1500 SE Blairmont Dr	$125,734,950.00	279,411
Mountain View High School	Covered Play Structure	1500 SE Blairmont Dr	$275,000.00	3,200
Burnt Bridge Creek Elementary	Covered Play Structure	14619 NE 49th St	$148,050.00	4,230
Frontier Middle School	Covered Play Structure	7600 NE 166th Ave	$126,000.00	3,600
Covington Middle School	Covered Play Structure	11200 NE Rosewood Ave	$112,000.00	3,200
Evergreen High School	Evergreen Sports Annex Storage Building 1	14300 NE 18th St	$242,850.00	1,619
Evergreen High School	Evergreen Sports Annex Storage Building 2	14300 NE 18th St	$242,850.00	1,619
Transportation	Portable 1	13909 NE 28th St.	$98,560.00	896
Transportation	Portable 2	13909 NE 28th St.	$172,480.00	1,568

Facility	Site (acres
Heritage	46.35
Old Legacy	6.81
Mountain View	38.23
Union	45.75
CTA	11.91
ASC	5.97

Evergreen HS SPorts Annex	18.03
Maintenance Facility	2.57
McKenzie Stadium	6
Transportation	6.77
Warehouse (Central Receiving)	5.71
HaLa	2.89
Evergreen	27.77
New Legacy	6.6
Cascade MS	16.4
Covington MS	21.45
Frontier MS	40.47
Pacific MS	17.18
Shahala MS	34.2 (Combined with Illahee)
Wy'east MS	25
York Elem	11
Sunset Elem	10.11
Silver Star	11.92
Sifton Elem	10.64
Riverview Elem	10.76
Pioneer Elem	47.24
Orchards Elem	11.81
Mill Plain Elem	8.64
Marrion Elem	16.02
ImageElem	20.94
Temp HCA (Old Image)	15.61
Illahee Elem	Combined with Shahala
Hearthwood Elem	10.97
Harmony Elem	13.7
Fisher's Landing Elem	11.69
Fircrest Elem	11.16
ESD 112 Pre-K	2.71
Endeavor Elem	8.86

Emerald Elem	**9.43**
Ellsworth Elem	**10.14**
Crestline Elem	**10.77**
Columbia Valley Elem	**11.58**
New Burton	**17.4**
Burton Elem	**15.36**
Burnt Bridge Creek Elem	**10.41**

17.3 PLANNING AND REGULATORY CAPABILITIES

The following existing codes, ordinances, policies or plans are applicable to this hazard mitigation plan:

- RCW 28A – Common School Provisions
- WAC Title 392 – Office of Superintendent of Public Instruction
- ABC School District Resources
- School Board
- Superintendent
- Parent Teacher Association
- Teachers Association/Union
- Safety committee
- Office of Superintendent of Public Instruction
- Washington State School Directors' Association - WSSDA
- Washington Association of School Administrators - WASA
- Washington Association of School Business Officials – WASBO
- Washington Association of Maintenance and Operation Administrators – WAMOA
- Rapid Responder System
- Education Service District - 112
- Clark County, including Emergency Management, Public Works and GIS, Planning Department and Building Officials.
- Cities: Vancouver including Emergency Management, Public Works and GIS, Planning Department and Building Officials
- Vancouver Fire Department
- Clark County Sheriff
- Vancouver Police Department
- Safe Schools Task Force
- Evergreen School District Capabilities
- District Website
- School Closure Telephone Plan
- Evacuation Plan
- Lockdown Plan
- Fire Drills
- Earthquake Drills
- Tornado Drills
- Bomb Threat Assessment Guide

- Emergency Response Plan
- Capital Facilities Plan
- Five Year Plan
- Strategic Plan
- Policies and Procedures
- Student Rights and Responsibilities
- District Safety Plan
- Regional Capabilities
- Clark County Hazard Mitigation Plan and Emergency Response Plan

17.4 Fiscal, Administrative and Technical Capabilities

An assessment of fiscal capabilities is presented in Table 1-2. An assessment of administrative and technical capabilities is presented in Table 1-3.

Table 17-2. Fiscal Capability

Financial Resources	Accessible or Eligible to Use?
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	NA
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	No
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	Yes - Impact Fees
Other	NA

Table 17-3. Administrative and Technical Capability

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Operations Department
Engineers or professionals trained in building or infrastructure construction practices	Yes	Operations Department
Planners or engineers with an understanding of natural hazards	Yes	Operations Department
Staff with training in benefit/cost analysis	Yes	Facilities Department / Fiscal Services
Surveyors	No	NA
Personnel skilled or trained in GIS applications	Yes	Facilities Department
Scientist familiar with natural hazards in local area	No	NA
Emergency manager	Yes	Operations Department
Grant writers	No	NA
Other	No	NA

17.5 Education and Outreach Capabilities

An assessment of education and outreach capabilities is presented in Table 1-4.

Table 17-6. Education and Outreach

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes
Do you have personnel skilled or trained in website development?	Yes

Criteria	Response
Do you have hazard mitigation information available on your website?	No
• If yes, please briefly describe.	
Do you utilize social media for hazard mitigation education and outreach?	No
• If yes, please briefly describe.	
Do you have any citizen boards or commissions that address issues related to hazard mitigation?	No
• If yes, please briefly specify.	
Do you have any other programs already in place that could be used to communicate hazard-related information?	Yes
• If yes, please briefly describe.	Flash alert, Social Media, Robo Calls, email, websites
Do you have any established warning systems for hazard events?	Yes
• If yes, please briefly describe.	Easy Alert, Website, Social Media, Robo Call

17.6 Integration with Other Planning Initiatives

The following describe the jurisdiction's process for integrating the hazard mitigation plan into existing plans and programs.

17.6.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan:

17.6.1.1EPS Hazard Mitigation Plan 2022.

17.6.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan, but provide an opportunity for future integration:

17.6.2.1Long Range Facility Plan
17.6.2.2Board of Directors Strategic Plan
17.6.2.3Capital Facilities Plan

17.7 Jurisdiction-Specific Natural Hazard Event History

Table 1-5 lists all past occurrences of natural hazards within the jurisdiction.

Table 17-5. Natural Hazard Events

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment

Severe Winter Storm, Straight Line Winds, Flooding, Landslides, Mudslides and a Tornado	DR-5253	December 1, 2015	NA
Severe Winter Storm and Record and Near Record Snow	DR-1825	December 12, 2008	NA
Severe Winter Storm, Landslides, and Mudslides	DR-1682	December 14, 2006	NA
Severe Winter Storms, Flooding	DR-1159	December 26, 1996	NA
Volcanic Eruption, Mount St. Helens	DR-623	May 21, 1980	NA
Dole Valley Fire	NA	1929	NA
Yacolt Burn	NA	1903	$13,000,000

17.8 Jurisdiction-Specific Vulnerabilities

Noted vulnerabilities the jurisdiction include:

- Older facilities may not have been built to modern seismic standards.
- Snow routes for school buses have not been designated.

17.9 Hazard Risk Ranking

Table 1-6 presents the ranking of the hazards of concern.

Table 17-6. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Severe Weather	18	Medium
2	Earthquake	16	Medium
3	Landslide	15	Medium
4	Wildfire	7	Low
5	Volcano	3	Low
6	Flood	2	Low
7	Dam Failure	0	None
7	Dan Failure	0	None

17.10 Hazard Mitigation Action Plan and Evaluation of Recommended Actions

Table 1-7 lists the actions that make up the battle ground public schools hazard mitigation action plan. Table 1-8 identifies the priority for each action. Table 1-9 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Table 17-7. Hazard Mitigation Action Plan Matrix

Hazard	Action Item	Timeline	Source of funds	Responsible Person	Plan Goals Addressed	
					Life Safety	Protect Facilities
Earthquake Mitigation Action Items						

Short-Term #1	Complete seismic evaluations of the roof truss systems at Image, Sunset and Fircrest elementary schools	1 Year	District funds or grants	Facilities Director	X	X
Short-Term #2	Complete seismic evaluations of the foundations of the District's 172 portables.	1-2 Years	District funds or grants	Facilities Director	X	X
Short-Term #3	Complete ASCE 41-13 Tier 1 evaluations of buildings identified as Pre-Code and/or as Risk Level and Priority for Evaluation of "Moderate" or higher.	1-5 Years	District funds or grants	Facilities Director	X	X
Short-Term #4	Assess the ASCE 41-13 results and select buildings that have the greatest vulnerability for more detailed evaluations.	1-5 Years	District funds or grants	Facilities Director	X	X
Short-Term #5	Evaluate nonstructural seismic vulnerabilities in the District's buildings from building elements and contents that pose significant life safety risk (falling hazards) and mitigate by bracing, anchoring or replacing identified high risk items.	1-5 years	District funds or grants	Facilities Director	X	X
Long-Term #1	Prioritize and implement structural seismic retrofits or replacements based on the results of the seismic evaluations completed under the Short-Term Action Items #1 to #4 listed above, as funding becomes available.	Ongoing	District funds or grants	Facilities Director	X	X
Long-Term #2	Maintain and update building data for seismic risk assessments in the OSPI ICOS PDM database.	Ongoing	District funds or grants	Facilities Director	X	
Long-Term #3	Enhance emergency planning for earthquakes including duck and cover and evacuation drills.	Ongoing	District funds or grants	Facilities Director	X	
Long - Term #4	Post seismic evaluation training of maintenance staff	Ongoing	District funds or grants	Facilities Director	X	

Hazard	Action Item	Timeline	Anticipated funding source	Responsible Person or Department	Plan Goals Addressed			
					Life Safety	Protect Facilities	Enhance Emergency Planning	Enhance Awareness and Education
Multi-Hazard Mitigation Action Items								
Long-Term #1	Integrate the findings and action items in the mitigation plan into ongoing programs and practices for the district.	Ongoing	District	Facilities / Risk Management	X	X	X	X
Long-Term #2	Review emergency and evacuation planning to incorporate hazard and risk information from the mitigation plan.	Ongoing	District	Risk Management	X	X	X	X
Long-Term #3	Consider natural hazards whenever siting new facilities and locate new facilities outside of high hazard areas.	Ongoing	District	Facilities	X	X	X	X
Long-Term #4	Ensure that new facilities are adequately designed to minimize risk from natural hazards.	Ongoing	District/State	Facilities	X	X	X	X
Long-Term #5	Maintain, update and enhance facility data and natural hazards data in the ICOS database.	Ongoing	**District**	Facilities	X	X	X	X
Long-Term #6	Develop and distribute educational materials regarding natural hazards, vulnerability and risk for K-12 facilities.	Ongoing	District	Risk Management	X		X	X
Long-Term #7	Seek FEMA funding for repairs if district facilities suffer damage in a FEMA declared disaster.	Ongoing	District	Facilities / Maintenance/ / Risk Management	X	X		X
Long-Term #8	Pursue pre- and post-disaster mitigation grants from FEMA and other sources.	Ongoing	District	Facilities / Risk Management	X	X		X

Long-Term #9	Post the district's mitigation plan on the website and encourage comments stakeholders for the ongoing review and periodic update of the mitigation plan.	Ongoing	District	Community Relations	X			X

Table 17-8. Mitigation Strategy Priority Schedule

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority	Grant Priority

a. See above table.

Table 17-9. Analysis of Mitigation Actions

	Action Addressing Hazard, by Mitigation Type[a]					
Hazard Type	1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects

a. See the introduction to this volume for explanation of mitigation types.

17.10.1 Prioritization of Mitigation Projects

Prioritization of future mitigation projects within the Evergreen School District requires flexibility because of varying types of projects, district needs, and available funding sources. Prioritized mitigation Action Items developed during the mitigation planning process are summarized in Chapter 4. Additional mitigation Action Items or revisions to the initial Action Items are likely in the future. The Evergreen School District Board will make final decisions about implementation and priorities with inputs from district staff, the mitigation planning team, the public, and other stakeholders.

Evergreen Public School's prioritization of mitigation projects will include the following factors:

- The mission statement and goals in the Evergreen School District Hazard Mitigation Plan including:
  - Goal 1: Reduce Threats to Life Safety,
  - Goal 2: Reduce Damage to District Facilities, Economic Losses, and Disruption of the District's Services,
  - Goal 3: Enhance Emergency Planning, Disaster Response, and Disaster Recovery, and
  - Goal 4: Increase Awareness and Understanding of Natural Hazards and Mitigation
- Benefit-cost analysis to ensure that mitigation projects are cost effective, with benefits exceeding

the costs.

- The STAPLEE process to ensure that mitigation Action Items under consideration for implementation meet the needs and objectives of the District, its communities, and citizens, by considering the social, technical, administrative, political, economic , and environmental aspects of potential projects.

Cost Effectiveness of Mitigation Projects

As Evergreen Public Schools considers whether or not to undertake specific mitigation projects or evaluate how to decide between competing mitigation projects, they must address questions that don't always have obvious answers, such as:

- What is the nature of the hazard problem?
- How frequent and how severe are the hazard events of concern?
- Do we want to undertake mitigation measures?
- What mitigation measures are feasible, appropriate, and affordable?
- How do we prioritize between competing mitigation projects?
- Are our mitigation projects likely to be eligible for FEMA funding?

Evergreen Public Schools recognizes that benefit-cost analysis is a powerful tool that can help provide solid, defensible answers to these difficult socio-political-economic-engineering questions. Benefit-cost analysis is required for all FEMA-funded mitigation projects, under both pre-disaster and post-disaster mitigation programs.

However, regardless of whether or not FEMA funding is involved, benefit-cost analysis provides a sound basis for evaluating and prioritizing possible mitigation projects for any natural hazard. Thus, the district will use

benefit-cost analysis and related economic tools, such as cost-effectiveness evaluation, to the extent practicable in prioritizing and implementing mitigation actions.

17.10.2 STAPLEE PROCESS

Evergreen Public Schools will also use the STAPLEE methodology to evaluate projects based on the Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE) considerations and opportunities for implementing particular mitigation action items in the district. The STAPLEE approach is helpful for doing a quick analysis of the feasibility of proposed mitigation projects.

The following paragraphs outline the district's STAPLEE approach

17.10.3 SOCIAL:

- Is the proposed action socially acceptable to the community?
- Are there equity issues involved that would mean that one segment of the community is treated unfairly?
- Will the action cause social disruption?

17.10.4 TECHNICAL:

- Will the proposed action work?
- Will it create more problems than it solves?
- Does it solve a problem or only a symptom?
- Is it the most useful action in light of other goals?

17.10.5 ADMINISTRATIVE:

- Is the action implementable?
- Is there someone to coordinate and lead the effort?
- Is there sufficient funding, staff, and technical support available?
- Are there ongoing administrative requirements that need to be met?

17.10.6 POLITICAL:

- Is the action politically acceptable?
- Is there public support both to implement and to maintain the project?
- **Legal**: Include legal counsel, land use planners, and risk managers in this discussion.
- Who is authorized to implement the proposed action?
- Is there a clear legal basis or precedent for this activity?
- Will the district be liable for action or lack of action?
- Will the activity be challenged?

17.10.7 ECONOMIC:

- What are the costs and benefits of this action?
- Do the benefits exceed the costs?
- Are initial, maintenance, and administrative costs taken into account?
- Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private)?
- How will this action affect the fiscal capability of the district?
- What burden will this action place on the tax base or economy?
- What are the budget and revenue effects of this activity?

17.10.8 ENVIRONMENTAL:

- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

17.10.9 EVERGREEN SCHOOL DISTRICTS CAPABILITIES

Evergreen Public Schools has the necessary human resources to ensure that Evergreen Public Schools Hazard Mitigation Plan continues to be an actively used planning document. District staff has been active in the

preparation of the Plan, and have gained an understanding of the process and the desire to integrate the Plan into ongoing capital budget planning. Through this linkage, the district's Hazard Mitigation Plan will be kept active and be a working document.

District staff have broad experience with planning and facilitation of community inputs. This broad experience is directly applicable to hazard mitigation planning and to implementation of mitigation projects. If specialized expertise is necessary for a particular project, the district will contract with a consulting firm on an as-needed basis.

Furthermore, recent earthquake and tsunami disasters worldwide serve as a reminder of the need to maintain a high level of interest in evaluating and mitigating risk from natural disasters of all types. These events have kept the interest in hazard mitigation planning and implementation alive among Evergreen Public Schools Board, district staff, and in the communities served by the district.

17.10.10 PLAN MAINTENANCE AND PERIODIC UPDATING

Monitoring Evergreen Public Schools Hazard Mitigation Plan is an ongoing, long-term effort. An important aspect of monitoring is a continual process of ensuring that mitigation Action Items are compatible with the goals, objectives, and priorities established during the development of the district's Mitigation Plan. The district has developed a process for regularly reviewing and updating the Hazard Mitigation Plan. As noted previously, Scott Deutsch, Manager, Risk Management & Safety will have the lead responsibility for implementing Evergreen Public Schools Hazard Mitigation Plan and for periodic monitoring, evaluating, and updating of the Plan. There will be ample opportunities to incorporate mitigation planning into ongoing activities and to seek grant support for specific mitigation projects.

Evergreen Public Schools Hazard Mitigation Plan will be reviewed annually as well as after any significant disaster event affecting the district. These reviews will determine whether there have been any significant changes in the understanding of hazards, vulnerability, and risk or any significant changes in goals, objectives, and Action Items. These reviews will provide opportunities to incorporate new information into the Mitigation Plan, remove outdated items, and document completed Action Items. This will also be the time to recognize the success of the district in implementing Action Items contained in the Plan. Annual reviews will also focus on identifying potential funding sources for the implementation of mitigation Action Items.

The periodic monitoring, evaluation, and updating will assess whether or not, and to what extent, the following questions are applicable:

- Do the plans goals, objectives, and action items still address current and future expected conditions?
- Does the mitigation Action Items accurately reflect the district's current conditions and mitigation priorities?
- Has the technical hazard, vulnerability, and risk data been updated or changed?
- Are current resources adequate for implementing the district's Hazard Mitigation Plan? If not, are there other resources that may be available?
- Are there any problems or impediments to implementation? If so, what are the solutions?
- Have other agencies, partners, and the public participated as anticipated? If no, what measures can be taken to facilitate participation?
- Have there been changes in federal and/or state laws pertaining to hazard mitigation in the district?
- Have the FEMA requirements for the maintenance and updating of hazard mitigation plans changed?
- What can the district learn from declared federal and/or state hazard events in other Washington school districts that share similar characteristics to Evergreen Public Schools, such as vulnerabilities to earthquakes and tsunamis?
- How have previously implemented mitigation measures performed in recent hazard events? This may include assessment of mitigation Action Items similar to those contained in the district's Mitigation Plan, but where hazard events occurred outside of the district.

The District Safety Committee will review the results of these mitigation plan assessments, identify corrective actions, and make recommendations, if necessary, to the Evergreen School Board for actions that may be necessary to bring the Hazard Mitigation Plan back into conformance with the stated goals and objectives. Any major revisions of the Hazard Mitigation Plan will be taken to the Board for formal approval as part of the district's ongoing mitigation plan maintenance and implementation program.

The District Safety Committee will have lead responsibility for the formal updates of the Hazard Mitigation Plan every five years. The formal update process will be initiated at least one year before the five-year anniversary of FEMA approval of Evergreen Public Schools Hazard Mitigation Plan, to allow ample time for robust participation by stakeholders and the public and for updating data, maps, goals, objectives, and Action Items.

Implementation of the mitigation actions identified in the Plan must continue to engage the entire community. Continued public involvement will be an integral part of the ongoing process of incorporating mitigation planning into land use planning, zoning, and capital improvement plans and related activities within the communities served by the district. In addition, the district will expand communications and joint efforts between the district and emergency management activities in the cities of Vancouver and Clark County.

Evergreen Public Schools is committed to involving the public directly in the ongoing review and updating of the Hazard Mitigation Plan. This public involvement process will include public participation in the monitoring, evaluation, and updating processes outlined in the previous section. Public involvement will intensify as the next 5-year update process is begun and completed.

3. CITY OF CAMAS

3.1 HAZARD MITIGATION PLAN POINT OF CONTACT

Primary Point of Contact
Lauren Hollenbeck, Senior Planner
616 NE 4th Avenue
Camas, WA 98607
Telephone: 360-817-1568
e-mail Address: lhollenbeck@cityofcamas.us

Alternate Point of Contact
Steve Wall, Public Works Director
616 NE 4th Avenue
Camas, WA 98607
Telephone: 360-834-6864
e-mail Address: swall@cityofcamas.us

3.2 JURISDICTION PROFILE

The following is a summary of key information about the jurisdiction and its history:

- Date of Incorporation—1906
- Current Population— 26,065 as of April 1, 2020 (2020 Office of Financial Management estimates)
- Population Growth—Based on data tracked by the Office of Financial Management, Camas has experienced a fairly steady growth rate. The overall population has increased approximately 12 percent from 22,843 in 2015 to 26,065 in 2020, an average 2.4 percent per year increase during this time frame.
- Location and Description—The City of Camas is located in Clark County, Washington, west of the Columbia River gorge and approximately 20 miles north of Portland, Oregon. The City is bordered by the Columbia River to the south, the City of Washougal and Woodburn Hill to the east, Lacamas Lake and Lacamas Lake Park to the north, and Grass Valley and the City of Vancouver to the west. It sits north of Highway 14 across the Columbia River from the City of Gresham, Oregon. Camas' downtown and older parts of the City are fairly flat, almost at the same level of the Columbia River, and surrounded by steep slopes.
- Brief History—In the late 1800's, hundreds of Native Americans camped along the Columbia River. The name for the City of Camas comes from the lily-like camas plant, an important part of the Native American diet in the Northwest, and widely found in this area. The first settlers arrived to Camas in the mid 1800's. In 1883, the LaCamas Colony Company of Portland selected this area for their new paper mill, the largest paper mill west of the Rocky Mountains. Mr. Henry L. Pittock, the owner of the Oregonian newspaper needed plenty of water to power paper-making machines for his newspaper and found it in the nearby lakes. Camas was incorporated in 1906 and by 1928 the paper mill was owned and operated by the Crown-Zellerbach Corporation. Today, Crown-Zellerbach is known as Georgia Pacific. From the 1990s through today, Camas experienced significant growth in residential development and in the technology and manufacturing industries due to land annexations.
- Climate—Camas' climate is influenced by the Coast and Cascade mountain ranges. Prevailing winds are from the northeast from April through September, and from the east-southeast for the rest of the year. Occasional high easterly winds occur year-round through the Columbia Gorge. Annual average precipitation is 51 inches. The month of December generally receives the most precipitation, with an

average of 6.5 inches, and July receives the least, with a half-inch. The average mid-winter temperature is 40 degrees, the summer average is 65 degrees, and the annual average temperature is 53 degrees.

- Governing Body Format—Camas uses the "Mayor-Council" form of government which consists of an elected mayor, who serves as the city's chief administrative officer, and a council, which serves as the municipality's legislative body. Additionally, the City has a professional City Administrator to assist the Mayor with administrative and polity related duties. The City consists of nine departments: City Administration, Community Development, Fire, Finance, IT, Library, Parks & Recreation, Police and Public Works. The City has 10 committees, commissions and task forces, which report to the City Council. The City Council assumes responsibility for the adoption of this plan; the City Administrator will oversee its implementation.
- Development Trends—Anticipated development levels for Camas are high, consisting primarily of residential development. In 2015, Camas approved the Green Mountain Planned Residential Development Mixed Use Master Plan to include 1,300-1,400 residential units and commercial uses, the largest mixed use development in the city's recent history. There has also been a focus on affordable housing and a push for more accessory dwelling units, secondary "mother-in-law" units, on properties. Camas adopted its comprehensive plan in 2016, which provides polices and recommendations to direct public and private decisions affecting future growth and development. City actions, such as those relating to growth, land use, transportation, public facilities and services, parks, and open space must be consistent with the plan.

3.3 CAPABILITY ASSESSMENT

An assessment of legal and regulatory capabilities is presented in Table 3-1. An assessment of fiscal capabilities is presented in Table 3-2. An assessment of administrative and technical capabilities is presented in Table 3-3. Information on National Flood Insurance Program (NFIP) compliance is presented in Table 3-4. Classifications under various community mitigation programs are presented in Table 3-5. An assessment of education and outreach capabilities is presented in Table 3-6.

Table 3-1. Legal and Regulatory Capability

	Local Authority	Other Jurisdiction Authority	State Mandated
Building Code	Yes	No	Yes
Comment: Camas Municipal Code (CMC) Chapter 15.04.010; adopts the most current State Building Code as amended.			
Zoning Code	Yes	No	Yes
Comment: CMC Title 18 Zoning: Ord. 2515 § 1 (Exh.A (part)), 2008; Ord. 2443 § 3 (Exh. A (part)), 2006)			
Subdivisions	Yes	No	Yes
Comment: CMC Chapter 17.11 Subdivisions; Ord. 21-005 2021, Ord. 19-001 2019, Ord. 18-014 2018, Ord. 2612 2011, Ord. 2483, 2007			
Stormwater Management	Yes	Yes	Yes
Comment: CMC Chapter 14.02 Stormwater Control: Ord. 2582, § I, 2-1-2010- adopts the 2005 Ecology Stormwater Manual and Camas Stormwater Design Standards Manual Res. 1193 adopted July 2010.			
Post-Disaster Recovery	No	No	No
Comment: None at this time.			
Real Estate Disclosure	No	Yes	Yes
Comment: WA State Disclosure Law- RCW 64.06			
Growth Management	Yes	No	Yes
Comment: The City is in compliance and good standing with the Washington Growth Management Act of 1990 with its land-use policies identified in its comprehensive plan (June 2016 update) and municipal code.			
Site Plan Review	Yes	No	No

	Local Authority	Other Jurisdiction Authority	State Mandated
Comment: CMC Chapter 18.18 Site Plan Review: Ord. 21-005 2021, Ord. 2612 2011, Ord. 2515 2008, Ord. 2481, 2007, Ord. 2443, 2006			
Environmental Protection	Yes	No	Yes
Comment: CMC Chapter 16.51 Critical Areas: Ord. 18-014 2018, Ord. 17-002 2017, Ord. 2691 2014, Ord. 2517 2008; 2008; Shoreline Master Program adopted 2021			
Flood Damage Prevention	Yes	Yes	Yes
Comment: CMC Chapter 16.57 Frequently Flooded Areas: Ord. 21-006 2021, Ord. 2691 2014, Ord. 2647 2012, Ord. 2517 2008			
Emergency Management	Yes	No	Yes
Comment: 2016 Draft Comprehensive Emergency Management Plan			
Climate Change	No	No	No
Comment: None at this time.			
Other	No	No	No
Comment: None at this time.			
General or Comprehensive Plan	Yes	No	Yes
Is the plan equipped to provide linkage to this mitigation plan? No			
Comment: 2035 City of Camas Comprehensive adopted in June 2016			
Capital Improvement Plan	Yes	No	Yes
What types of capital facilities does the plan address? Roads, water and sewer			
How often is the plan updated? 6 year CIP, Reviewed and updated annually.			
Comment:			
Floodplain or Watershed Plan	No	No	No
Comment: None at this time.			
Stormwater Plan	Yes	No	No
Comment: Comprehensive Stormwater Drainage Plan April 2013			
Habitat Conservation Plan	No	No	No
Comment: None at this time.			
Shoreline Management Plan	Yes	No	Yes
Comment: Ord. 21-003 Feb. 2021			
Community Wildfire Protection Plan	No	No	No
Comment: None at this time.			
Forest Management Plan	No	No	No
Comment: None at this time.			
Climate Action Plan	No	No	No
Comment: None at this time.			
Housing Action Plan	Yes	No	No
Comment: Res. 21-006 July 2021			
Comprehensive Emergency Management Plan	Yes	No	Yes
Comment: Adopted/approved 2006, currently being revised.			
Threat & Hazard Identification & Risk Assessment	No	No	No
Comment: None at this time.			
Post-Disaster Recovery Plan	No	No	No
Comment: None at this time.			
Continuity of Operations Plan	No	No	No
Comment: None at this time.			
Public Health Plan	No	Yes	No
Comment: Region IV Public Health Emergency Response Plan Dec. 2013			

Table 3-2. Fiscal Capability

Financial Resources	Accessible or Eligible to Use?
Community Development Block Grants	Yes
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	Yes (water, sewer, stormwater)
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	No
Withhold Public Expenditures in Hazard-Prone Areas	No
State-Sponsored Grant Programs	No
Development Impact Fees for Homebuyers or Developers	Yes
Other	No

Table 3-3. Administrative and Technical Capability

Staff/Personnel Resources	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Community Department – 1 Community Development Director, 1 Planning Manager, 2 Senior Planners, 1 Planner, 1 Project Manager
Engineers or professionals trained in building or infrastructure construction practices	Yes	Community Development- 1 Building Official, 2 Building Inspectors. Utilities Department (21 water/sewer/storm water employees).
Planners or engineers with an understanding of natural hazards	Yes	Community Development- 1 Senior Planner; Engineering- 1 Engineer; could contract with others for expertise in this field
Staff with training in benefit/cost analysis	Yes and No	Community Development- 1 Senior Planner (could use a refresher course)
Surveyors	No	No licensed surveyors on City staff.
Staff capable of making substantial damage estimates	Yes	Community Development- 1 Building Official, 1 Senior Planner
Personnel skilled or trained in GIS applications	Yes and No	Community Development- Senior Planners, City can and has requested GIS assistance from Clark County GIS staff.
Scientist familiar with natural hazards in local area	Yes	No scientist or biologist on staff. The City has contracted for this level of expertise in the past.
Emergency manager	Yes	Fire Department- Fire Chief
Grant writers	Yes	City staff writes grants.

Table 3-4. National Flood Insurance Program Compliance

Criteria	Response
When did the community enter the NFIP?	02/18/81
When did the Flood Insurance Rate maps become effective?	09/05/2012
What local department is responsible for floodplain management?	Community Development
Who is your floodplain administrator? (department/position)	Community Development/Senior Planner
Is this a primary or auxiliary role?	N/A
Are any certified floodplain managers on staff in your jurisdiction?	No
What is the date of adoption of your flood damage prevention ordinance?	3-15-2021
Does your floodplain management program meet or exceed minimum requirements?	Meets
If so, in what ways?	N/A

Criteria	Response
When was the most recent Community Assistance Visit or Community Assistance Contact?	5-20-2020
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed? If so, please state what they are.	No N/A
Do your flood hazard maps adequately address the flood risk within your jurisdiction? If no, please state why.	Yes N/A
Does your floodplain management staff need any assistance or training to support its floodplain management program? If so, what type of assistance/training is needed?	Not at this time.
Does your jurisdiction participate in the Community Rating System (CRS)? If so, is your jurisdiction seeking to improve its CRS Classification? If not, is your jurisdiction interested in joining the CRS program?	No No
How many Flood Insurance policies are in force in your jurisdiction?[a] What is the insurance in force? [a] What is the premium in force? [a]	59 $18,212,900 $42,184
How many total loss claims have been filed in your jurisdiction? [a] How many claims were closed without payment/are still open? [a] What were the total payments for losses? [a]	6 Unknown $13,710.27

a. According to FEMA records as of 11/30/15.

Table 3-5. Community Classifications

	Participating?	Classification	Date Classified
Community Rating System	No	N/A	N/A
Building Code Effectiveness Grading Schedule	Yes	2	2001
Public Protection	No	N/A	N/A
Storm Ready	No	N/A	N/A
Firewise	No	N/A	N/A

Table 3-6. Education and Outreach

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes
Do you have personnel skilled or trained in website development?	Yes. IT department.
Do you have hazard mitigation information available on your website? If yes, please briefly describe.	No N/A
Do you utilize social media for hazard mitigation education and outreach? If yes, please briefly describe.	No N/A
Do you have any citizen boards or commissions that address issues related to hazard mitigation? If yes, please briefly specify.	No N/A
Do you have any other programs already in place that could be used to communicate hazard-related information? If yes, please briefly describe.	Yes city website, water bill news media, social media
Do you have any established warning systems for hazard events? If yes, please briefly describe.	No N/A

Table 3-6. Education and Outreach

Criteria	Response
Do you have a Public Information Officer or Communications Office?	Yes – We have a dedicated Public Information Officer.
Do you have personnel skilled or trained in website development?	Yes
Do you have hazard mitigation information available on your website? If yes, please briefly describe.	No

Criteria	Response
Do you utilize social media for hazard mitigation education and outreach? If yes, please briefly describe.	Yes City Website, Facebook, CRESA
Do you have any citizen boards or commissions that address issues related to hazard mitigation? If yes, please briefly specify.	No
Do you have any other programs already in place that could be used to communicate hazard-related information? If yes, please briefly describe.	No
Do you have any established warning systems for hazard events? If yes, please briefly describe.	Yes Everbridge through CRESA

3.4 INTEGRATION WITH OTHER PLANNING INITIATIVES

The following describe the jurisdiction's process for integrating the hazard mitigation plan into local planning mechanisms.

3.4.1 Existing Integration

The following plans and programs currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan:

- The Comprehensive Plan- The Plan addresses Critical Areas including Frequently Flooded Areas and Geologically Hazardous Areas.
- Stormwater Design Manual- geotechnical analysis report is required for stormwater detention facilities located within 200 feet top of a Landslide Hazard area.
- Critical Areas Ordinance (CAO)- the first goal of the Camas CAO is to protect members of the public and public resources and facilities from injury, loss of life, or property damage due to landslides and steep slope failures, erosion, seismic events, or flooding.
- Shoreline Master Program (SMP)- the goal for flood hazards in the SMP is to promote public health, safety, and general welfare, and minimize public and private losses due to flood conditions in specific areas.

3.4.2 Opportunities for Future Integration

The following plans and programs do not currently integrate the goals, risk assessment and/or recommendations of the hazard mitigation plan, but provide an opportunity for future integration:

- Comprehensive Plan- The Hazard Mitigation plan could be adopted by reference
- Stormwater Drainage Plan- some of the identified capital improvements could be included as hazard mitigation initiatives in the Hazard Mitigation action plan.
- Capital Improvement Plan- some of the hazard mitigation initiatives could be incorporated from the Capital Improvement Plan.

3.5 JURISDICTION-SPECIFIC NATURAL HAZARD EVENT HISTORY

Table 3-7 lists all past occurrences of natural hazards within the jurisdiction.

Table 3-7. Natural Hazard Events

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Severe Storm(s)	4253	2/2/16	Approx. 1 mill.
Severe Storm(s)	1825	3/2/2009	N/A

Type of Event	FEMA Disaster # (if applicable)	Date	Preliminary Damage Assessment
Severe Storm(s)	1682	2/14/2007	N/A
Severe Storm(s)	1671	12/12/2006	N/A
Earthquake	1361	3/1/2001	N/A
Severe Storm(s)	1159	3/1/2001	N/A
Flood	1100	2/9/1996	N/A
Severe Storm(s)	1079	1/3/1996	N/A
Volcano	623	5/21/1980	N/A
Flood	545	12/10/1977	N/A
Flood	185	12/29/1964	N/A
Flood	146	3/2/1963	N/A
Severe Storm(s)	137	10/20/1962	N/A
Flood	70	3/6/1957	N/A
Flood	50	2/25/1956	N/A

3.6 JURISDICTION-SPECIFIC VULNERABILITIES

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 0
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 0
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0

Other noted vulnerabilities include:

- Aging water and sewer lines are vulnerable to the earthquake hazard.
- Aging city hall building. Constructed before seismic codes were in place- susceptible to earthquake damage.
- Public Works Operations Center building- constructed prior to seismic codes in place and thus vulnerable to the earthquake hazard.
- Dam at Lacamas lake- could be impacted to flooding or earthquake.
- Potential chemical spill from the paper mill
- High pressure natural gas line could be vulnerable to the earthquake hazard.
- High tension power lines may be vulnerable severe storms (i.e. wind and ice).
- Homes along the Washougal River may be susceptible to flooding.

3.7 HAZARD RISK RANKING

Table 3-8 presents the ranking of the hazards of concern.

Table 3-8. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Earthquake	48	High
2	Severe Weather	51	High
3	Landslide	18	Medium
4	Flood	18	Medium
5	Wildfire	22	Medium
6	Dam Failure	11	Low
6	Volcano	8	Low
7	Drought	3	Low

3.8 STATUS OF PREVIOUS PLAN INITIATIVES

Table 3-9 summarizes the initiatives that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared. It should be noted, that the actions identified in the following table were developed in 2016. Due to COVID and staff turnover that has occurred since their identification, the status of some actions may be unknown. Additionally, some actions identified in the 2016 plan may have had implementation agencies other than the City of Camas.

Table 3-9. Previous Planning Initiatives

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
CM-1 – Where appropriate, support retro-fitting, purchase or relocation of structures located in high hazard areas and prioritize those structures that have experienced repetitive losses. Comment:		X	
CM-2 – Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions within the community. Comment:		X	
CM-3- Develop and implement a program to capture perishable data after significant events (e.g. high water marks, preliminary damage estimates, damage photos) to support future mitigation efforts including the implementation and maintenance of the hazard mitigation plan. Comment:		X	
CM-4- Support the County-wide hazard mitigation initiatives identified in Volume I of the hazard mitigation plan. Comment:		X	
CM-5- Actively participate in the plan maintenance protocols outlined in Volume I of the hazard mitigation plan. Comment:		X	
CM-6- Continue to maintain good standing and compliance under the National Flood Insurance Program (NFIP). This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP: Enforcement of the flood damage prevention ordinance Participate in floodplain identification and mapping updates Provide public assistance/information on floodplain requirements and impacts Comment:		X	
CM-7- Work with building officials to identify ways to improve the jurisdiction's BCEGS classification. Comment:		X	
CM-8- Develop a post-disaster recovery plan and a debris management plan. Comment:		X	
CM-9- Participate in programs such as Firewise, StormReady and the Great Shakeout. Comment:		X	
CM-10- Support voluntary structural retrofitting of older homes on vulnerable soils. Comment:		X	
CM-11- Ensure critical facilities have back-up power generation facilities. Comment:		X	

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
CM-12- Encourage non-structural retrofitting for critical facilities, schools, hospitals and businesses by anchoring, base isolating, relocating vulnerable nonstructural building elements such as hazardous materials containment. Comment:		X	
CM-13- Support the retrofit of at-risk homes to wildland fire. Comment:		X	
CM-14- Work with CRESA to ensure that the public is informed of the necessity of maintaining self-sufficient supplies for 10-14 days. Comment:		X	
CM-15- Ensure that residents understand the benefits of defensible space to minimize and reduce the impacts of fires. Comment:		X	
CM-16- Develop an automated method to notify the public of events during a disaster. Comment:		X	
CM-17- Conduct pre-earthquake assessments for critical and essential facilities and develop a risk-reduction strategy. Comment:		X	
CM-18- Determine critical government functions and establish redundancy for these functions. Comment:		X	
CM-19- Develop integrated County stormwater basin-wide plans Comment:		X	
CM-20- Institute Low Impact Development Practices Comment:		X	
CM-21- Continue and/or enhance where feasible, the city's ongoing drainage system maintenance program to reduce or minimize the impact from stormwater flooding within the City. Comment:		X	
CM-22- Address stormwater flooding problems due to lack of drainage conveyance systems at the following locations: intersection of NW Julia Street and NW 26th Avenue along NW Maryland Street southern end of NW Iris Court, north of Columbia Summit Drive along NW 10th Ave at NW Ivy Drive and NW Drake Street Comment:		X	
CM-23- Identify and mitigate drainage issues resulting in nuisance flooding such as replacing undersized culverts where needed. Comment:		X	
CM-24- Monitor/review accumulated effects from piecemeal development on steep slopes. Comment:		X	
CM-25- Identify a funding mechanism for a local match to Federal funds that can fund private mitigation practices. Comment:		X	
CM-26- Develop a drought contingency plan. Comment:		X	
CM-27- Update the City's Emergency Plan notebook. Comment:		X	
CM-28- Partner with the Cascade Volcano Observatory in public education and awareness campaigns. Comment:		X	

Action Item	Completed	Carry Over to Plan Update	Removed; No Longer Feasible
CM-29- Use zoning and/or special wildfire overlay district to designate high-risk areas and specify the conditions for the use and development of specific areas. Comment:		X	
CM-30- Seek out partnerships for the use of a boat during a flood disaster. Comment:		X	
CM-31- Develop an inventory of public and commercial buildings that may be particularly vulnerable to earthquake damage. Comment:.		X	

3.9 HAZARD MITIGATION ACTION PLAN AND EVALUATION OF RECOMMENDED ACTIONS

Table 3-10 lists the actions that make up the City of Camas hazard mitigation action plan. Table 3-11 identifies the priority for each action. Table 3-12 summarizes the mitigation actions by hazard of concern and the six mitigation types.

Table 3-10. Hazard Mitigation Action Plan Matrix 2023-2028

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
CM-1 – Where appropriate, support retro-fitting, purchase or relocation of structures located in high hazard areas and prioritize those structures that have experienced repetitive losses.						
Existing	All Hazards	4, 5, 7, 9, 10	Planning	High	HMGP, PDM, FMA, CDBG-DR	Short-term
CM-2 – Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions within the community.						
New and Existing	All Hazards	2,4	Planning	Low	Staff Time, General Funds	On-going
CM-3- Develop and implement a program to capture perishable data after significant events (e.g. high water marks, preliminary damage estimates, damage photos) to support future mitigation efforts including the implementation and maintenance of the hazard mitigation plan.						
Existing	All Hazards	1, 2, 4, 12	Fire/Emergency Management and Building Department	Medium	Staff Time, General Funds	Short-term
CM-4- Support the County-wide hazard mitigation initiatives identified in Volume I of the hazard mitigation plan.						
New and Existing	All Hazards	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	Lead Contact Department for Plan	Low	Staff Time, General Funds	Short-term
CM-5- Actively participate in the plan maintenance protocols outlined in Volume I of the hazard mitigation plan.						
New and Existing	All Hazards	1,4	Lead Contact Department for Plan	Low	Staff Time, General Funds	Short-term
CM-6- Continue to maintain good standing and compliance under the National Flood Insurance Program (NFIP). This will be accomplished through the implementation of floodplain management programs that will, at a minimum, meet the requirements of the NFIP: Enforcement of the flood damage prevention ordinance Participate in floodplain identification and mapping updates Provide public assistance/information on floodplain requirements and impacts						

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
New and Existing	Flood	1, 4, 5, 9	Community Development and Public Works	Low	Staff Time, General Funds	On-going
CM-7- Work with building officials to identify ways to improve the jurisdiction's BCEGS classification.						
New	Earthquake, Flood, Landslide, Severe Weather, Volcano, Wildfire	5, 6, 7, 10, 12	Building and Development Services	Low	Staff Time, General Funds	Short-term
CM-8- Develop a post-disaster recovery plan and a debris management plan.						
Existing	All Hazards	1, 2, 4, 9	Fire/Emergency Management and Public Works	Medium	EMPG	On-going
CM-9- Participate in programs such as Firewise, StormReady and the Great Shakeout.						
New and Existing	Dam Failure, Flood, Severe Weather, Wildfire	1,7	Fire/Emergency Management and Public Works	Low	Staff Time, General Funds	On-going
CM-10- Support voluntary structural retrofitting of older homes on vulnerable soils.						
Existing	Earthquake	1, 2, 7, 9	Building	Low	Property Owner, FEMA Hazard Mitigation Grant Funding	On-going
CM-11- Ensure critical facilities have back-up power generation facilities.						
New	All Hazards	2, 5, 8, 9, 10	Public Works	High	FEMA Hazard Mitigation Grant Programs	Long-term
CM-12- Encourage non-structural retrofitting for critical facilities, schools, hospitals and businesses by anchoring, base isolating, relocating vulnerable nonstructural building elements such as hazardous materials containment.						
New and Existing	Earthquake	1, 2, 5, 9, 10	Building	Low	Property owner, Staff Time, General Funds, FEMA funding	On-going
CM-13- Support the retrofit of at-risk homes to wildland fire.						
New and Existing	Wildfire	2, 4, 5, 7, 9, 12	Fire and Building	Medium	Property owner, FEMA Hazard Mitigation Grant Programs	On-going
CM-14- Work with CRESA to ensure that the public is informed of the necessity of maintaining self-sufficient supplies for the appropriate number of days.						
Existing	All Hazards	1, 2, 3, 4	Fire/Emergency Management	Low	Staff Time, General Funds	On-going
CM-15- Ensure that residents understand the benefits of defensible space to minimize and reduce the impacts of fires.						
New	Wildfire	1, 2, 5, 11	Fire	Low	Staff Time, General Funds	On-going
CM-16- Develop an automated method to notify the public of events during a disaster.						
New	All Hazards	1, 2, 3, 4, 12	Fire/Emergency Management	Medium	FEMA funds	Short-term
CM-17- Conduct pre-earthquake assessments for critical and essential facilities and develop a risk-reduction strategy.						
New	Earthquake	1, 5, 9, 10, 12	Building and Public Works	Medium	Staff time, General Funds, FEMA Hazard Mitigation Grant Programs	Long-term

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
CM-18- Determine critical government functions and establish redundancy for these functions.						
New	Earthquake	4, 6, 8, 10	Public Works, Police, Fire	Medium	Staff Time, General Funds	Long-term
CM-19- Develop integrated County stormwater basin-wide plans						
New	Flood, Severe Weather	1, 5, 9, 10, 11, 12	Public Works	Medium	FEMA Hazard Mitigation Funding	Long-term
CM-20- Institute Low Impact Development Practices						
New	Flood, Severe Weather	1, 5, 6, 7, 11, 12	Public Works, Community Development	Low	Staff Time, General Funds	On-going
CM-21- Continue and/or enhance where feasible, the city's ongoing drainage system maintenance program to reduce or minimize the impact from stormwater flooding within the City.						
New and Existing	Flood and Severe Weather	2, 5, 10, 11, 12	Public Works	Low	Stormwater Utility, CIP	On-going
CM-22- Address stormwater flooding problems due to lack of drainage conveyance systems at the following locations: along NW Maryland Street southern end of NW Iris Court, north of Columbia Summit Drive						
New and Existing	Flood and Severe Weather	2, 5, 10, 11, 12	Public Works	Medium	CIP, FEMA Hazard Mitigation Grant Programs	Long-term
CM-23- Identify and mitigate drainage issues resulting in nuisance flooding such as replacing undersized culverts where needed.						
New and Existing	Flood and Severe Weather	1, 2, 5, 11, 12	Public Works	Low	Staff Time, General Funds	On-going
CM-24- Monitor/review accumulated effects from piecemeal development on steep slopes.						
New	Landslide	11,12	Community Development	Low	Staff Time, General Funds	On-going
CM-25- Identify a funding mechanism for a local match to Federal funds that can fund private mitigation practices.						
New	All Hazards	1	Community Development	Low	Staff Time, General Funds	Short-term
CM-26- Develop a drought contingency plan.						
New	Drought	1,2, 3, 4, 5, 6, 11	Public Works	Medium	Staff Time, General Funds, FEMA Hazard Mitigation Grant Programs	Short-term
CM-27- Update the City's Emergency Plan notebook.						
Existing	All Hazards	1, 3, 12	Fire/Emergency Management	Low	Staff Time, General Funds	On-going
CM-28- Partner with the Cascade Volcano Observatory in public education and awareness campaigns.						
Existing	Volcano	1, 2, 3, 4	Fire/Emergency Management	Low	Staff Time, General Funds	On-going
CM-29- Use zoning and/or special wildfire overlay district to designate high-risk areas and specify the conditions for the use and development of specific areas.						
New	Wildfire	1, 2, 4, 5, 7, 11	Fire	Low	Staff Time, General Funds	Short-term
CM-30- Seek out partnerships for the use of a boat during a flood disaster.						
New	Flood	2, 5	Fire/Emergency Management	Low	Staff Time, General Funds	Short-term
CM-31- Develop an inventory of public and commercial buildings that may be particularly vulnerable to earthquake damage.						

Applies to new or existing assets	Hazards Mitigated	Objectives Met	Lead Agency	Estimated Cost	Sources of Funding	Timeline
New	Earthquake	1, 5, 9, 10	Building/Public Works	Low	Staff Time, General Funds	Short-term

Table 3-11. Mitigation Strategy Priority Schedule

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
CM-1	5	High	High	Yes	Yes	No	Medium	High
CM-2	2	Medium	Low	Yes	No	Yes	High	Low
CM-3	4	Low	Medium	No	No	Maybe	Low	Low
CM-4	12	Low	Low	Yes	No	Yes	High	Low
CM-5	2	Low	Low	Yes	No	Yes	High	Low
CM-6	4	Medium	Low	Yes	No	Yes	High	Low
CM-7	5	Medium	Low	Yes	No	Yes	High	Low
CM-8	4	Medium	Medium	Yes	Yes	No	Medium	High
CM-9	2	Medium	Low	Yes	No	Yes	High	Low
CM-10	4	High	Low	Yes	Yes	No	Medium	High
CM-11	5	High	High	Yes	Yes	Yes	Medium	High
CM-12	5	High	Low	Yes	Yes	No	Medium	High
CM-13	6	High	Medium	Yes	Yes	No	Medium	High
CM-14	4	Medium	Low	Yes	No	Yes	Medium	Low
CM-15	4	Medium	Low	Yes	No	Yes	Medium	Low
CM-16	5	Medium	Medium	Yes	No	Yes	Medium	Low
CM-17	5	Medium	Medium	Yes	Maybe	No	Medium	Medium
CM-18	4	High	Medium	Yes	No	Yes	Medium	Low
CM-19	6	High	Medium	Yes	Yes	No	High	High
CM-20	6	Medium	Low	Yes	Maybe	Yes	Medium	Low
CM-21	5	Medium	Low	Yes	No	Yes	Medium	Low
CM-22	5	High	Medium	Yes	No	No	High	High
CM-23	5	Medium	Low	Yes	No	Yes	Medium	Low
CM-24	2	Low	Low	Yes	No	Yes	Low	Low
CM-25	1	Medium	Low	Yes	No	Yes	Medium	Low

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority[a]	Grant Priority[a]
CM-26	7	Medium	Medium	Yes	Yes	Yes	Medium	Medium
CM-27	3	Medium	Low	Yes	No	Yes	Medium	Low
CM-28	4	Medium	Low	Yes	No	Yes	Medium	Low
CM-29	6	Medium	Low	Yes	No	Yes	Medium	Low
CM-30	2	Medium	Low	Yes	No	Yes	Medium	Low
CM-31	4	Medium	Low	Yes	No	Yes	Medium	Low

a. See the introduction to this volume for explanation of priorities.

Table 3-12. Analysis of Mitigation Actions

	Action Addressing Hazard, by Mitigation Type[a]					
Hazard Type	1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Dam Failure	CM-2, CM-3, CM-4, CM-5, CM-6, CM-8, CM-25, CM-27	CM-1, CM-6	CM-4, CM-6, CM-14, CM-16		CM-8, CM-11	
Drought	CM-2, CM-3, CM-4, CM-5, CM-8, CM-25, CM-26, CM-27	CM-1, CM-26	CM-4, CM-14, CM-16, CM-26	CM-26	CM-8, CM-11	
Earthquake	CM-2, CM-3, CM-4, CM-5, CM-7, CM-8, CM-17, CM-25, CM-27, CM-31	CM-1, CM-7, CM-10, CM-11, CM-12, CM-17, CM-31	CM-4, CM-14, CM-16		CM-8, CM-11, CM-18	CM-17, CM-31
Flood	CM-2, CM-3, CM-4, CM-5, CM-6, CM-7, CM-8, CM-19, CM-21, CM-23, CM-25, CM-27	CM-1, CM-6, CM-7	CM-4, CM-6, CM-14, CM-16	CM-9, CM-19, CM-20, CM-21	CM-8, CM-11	CM-22
Landslide	CM-2, CM-3, CM-4, CM-5, CM-7, CM-8, CM-24, CM-25, CM-27	CM-1, CM-7	CM-4, CM-14, CM-16		CM-8, CM-11	

Hazard Type	Action Addressing Hazard, by Mitigation Type[a] 1. Prevention	2. Property Protection	3. Public Education and Awareness	4. Natural Resource Protection	5. Emergency Services	6. Structural Projects
Severe weather	CM-2, CM-3, CM-4, CM-5, CM-7, CM-8, CM-19, CM-21, CM-23, CM-25, CM-27	CM-1, CM-7, CM-9	CM-4, CM-14, CM-16	CM-19, CM-20, CM-21	CM-8, CM-11	CM-22
Volcano	CM-2, CM-3, CM-4, CM-5, CM-7, CM-8, CM-25, CM-27	CM-1, CM-7	CM-4, CM-14, CM-16, CM-28		CM-8, CM-9, CM-11	
Wildfire	CM-2, CM-3, CM-4, CM-5, CM-7, CM-15, CM-25, CM-27	CM-1, CM-7, CM-9, CM-13, CM-15	CM-4, CM-9, CM-14, CM-15, CM-20	CM-15	CM-9, CM-11	

a. See the introduction to this volume for explanation of mitigation types.

Staff Report

February 20, 2024 Council Workshop Meeting

City and Clark County Lacamas Watershed Management Draft Interlocal Agreement
Presenter: Steve Wall, Public Works Director
Time Estimate: 30 minutes

Phone	Email
360.817.7899	swall@cityofcamas.us

BACKGROUND: The City led an effort between 2020 and 2023 to complete a Lake Cyanobacteria Management Plan ("Lake Management Plan") for Lacamas, Round and Fallen Leaf Lakes. The Draft Plan was presented to the City Council and submitted to the Department of Ecology in Fall 2023 for review. Staff has not received official comments back from Ecology staff; however, verbal discussions with the reviewers indicate no substantive changes will be needed.

SUMMARY: The Lake Management Plan recognizes that it is not just management of the Lakes that is needed to improve water quality. The overall health of the 67 square mile Lacamas Creek Watershed plays a significant role in the long-term health and water quality of Lacamas and Round Lakes. As the majority of the Watershed is located outside of the City of Camas and is within the County's overall jurisdiction, both parties have recognized a need to partner in the ongoing efforts to manage and hopefully improve the water quality conditions within the Lacamas Creek Watershed.

The attached Draft Interlocal Agreement (ILA) has been jointly drafted by Staff at both agencies with the intent that a long-term partnership is formed, in conjunction with other agencies, organizations, and the public, to help manage and improve water quality within the Lacamas Watershed and Lakes. Through this Agreement, ultimately the Parties intend to identify roles and responsibilities, governance, policy, joint and individual work plans and financial expectations, and to clarify regulatory authority(ies) in support of a shared Vision for the Watershed and Lakes. Staff will take the opportunity at the Workshop to review the Draft ILA with the City Council. Additionally, the County Council reviewed the Draft ILA on February 7, and staff will be able to provide the Council with a summary of the County's comments and discussion.

BENEFITS TO THE COMMUNITY: Formation of a long-term partnership with the intent to jointly try and improve water quality will benefit not only the residents of Camas, but the broader community that live within the watershed and/or use the Lakes for recreation and other activities. Improvement to water quality will also provide long-term environmental benefits.

POTENTIAL CHALLENGES: Overall improvement to the water quality within the Watershed and Lakes will take significant efforts by other agencies, property owners, organizations and the public at large. A partnership between the County and City can help highlight the continued importance of improvements overtime; however, signing of an ILA and the partnership itself will not guarantee success.

BUDGET IMPACT: There are no budget impacts with drafting and development of the Interlocal Agreement. However, as discussed with Council previously, both short- and long-term management of the Lakes and Watershed as a whole will include the potential need for significant tracking and expenditures through time. In the near-term, the draft ILA contemplates the City leading and paying for treatment of Lacamas Lake through use of the 2023 State Budget Proviso funds.

RECOMMENDATION: Staff recommends the City Council consider the information presented and provide staff with comments and potential changes to the Draft Interlocal Agreement.

Clark County and City of Camas
Watershed Management
DRAFT Interlocal Agreement

City Council Workshop
February 20, 2024

Give credit where credit is due!

Clark County & Camas
DRAFT Interlocal Agreement

Clark County Council Work Session

February 7, 2024

Work Session Outline

Lacamas Background

County& Camas Work Plan(s)

DRAFT ILA Overview

Next Steps

Work Session Goals

Provide overview of DRAFT ILA.

Receive Council Input on DRAFT

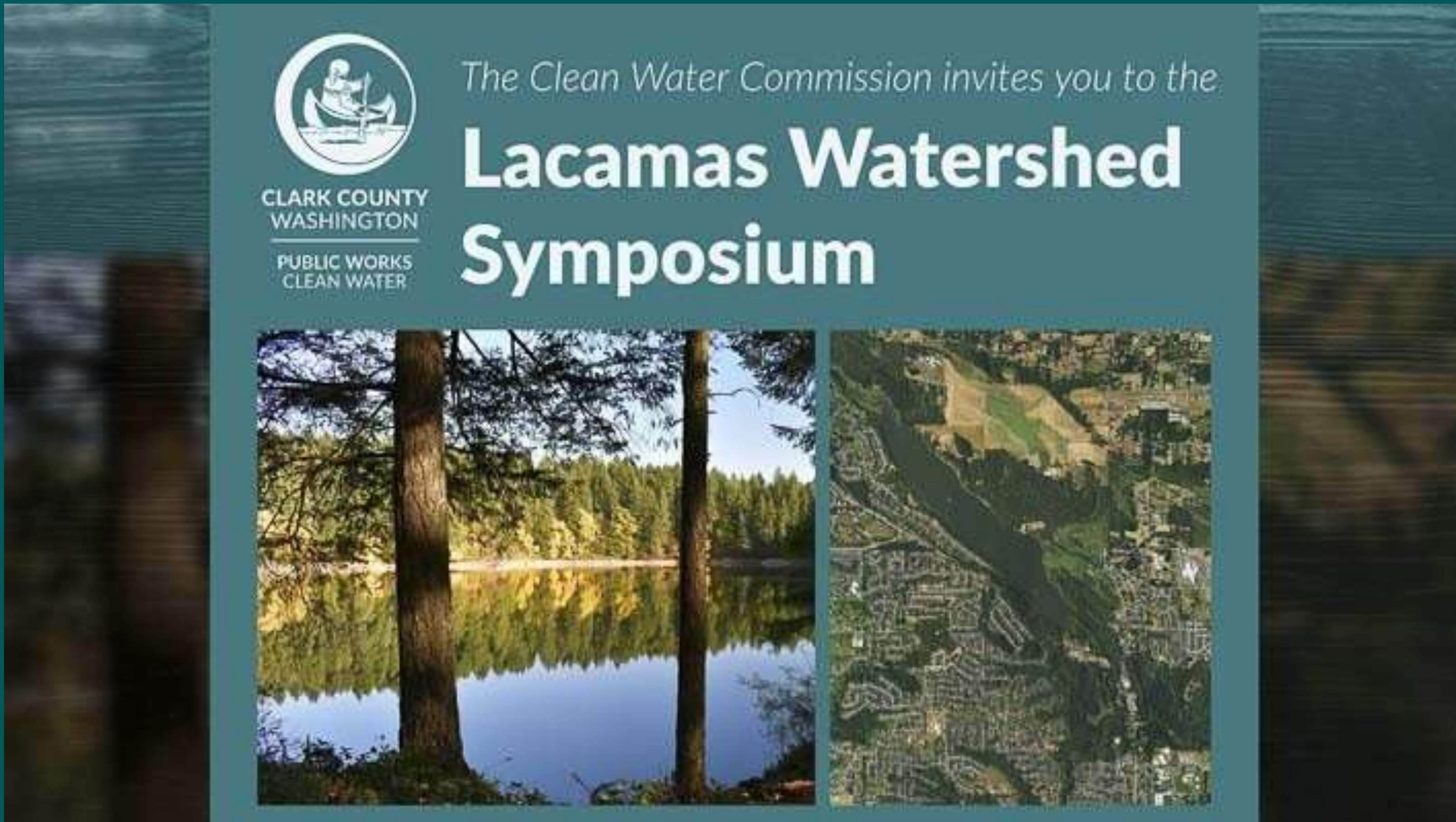
Highlight actions staff can accomplish.

Discuss Next Steps.

Lacamas Background

Lacamas Watershed & Lake Water Quality needs help.


Clark County
Department of Ecology
City of Camas
WARNING
TOXIC ALGAE PRESENT
Lake unsafe for people and pets
Until further notice:
• Do not swim or water ski.
• Do not drink lake water.
• Keep pets and livestock away.
• Clean fish well and discard guts.
• Avoid areas of scum when boating.



Clark County Councilor
Gary Medvigy, District 4

City of Camas Mayor
Steve Hogan

Where are we today?


Need for Interlocal
Agreement

DRAFT ILA Outline

1. **ILA Purpose**
2. **Joint Vision & Charter Development**
3. **Technical Advisory Group Creation**
4. **Joint Public Outreach & Agency Partnerships**
5. **Policy Initiatives**
6. **Work Plans**
   - ❖ Clark County
   - ❖ Camas
   - ❖ Near-term Joint Work Plan
   - ❖ Ongoing Joint Work Plan

ILA Purpose

Long-term Partnership

Governance Structure

Roles & Responsibilities

Shared Vision & Policy Initiatives

Financial Expectations

Regulatory Authority

Mutual Responsibility

Joint Vision & Charter Development

Joint Vision & Charter Development

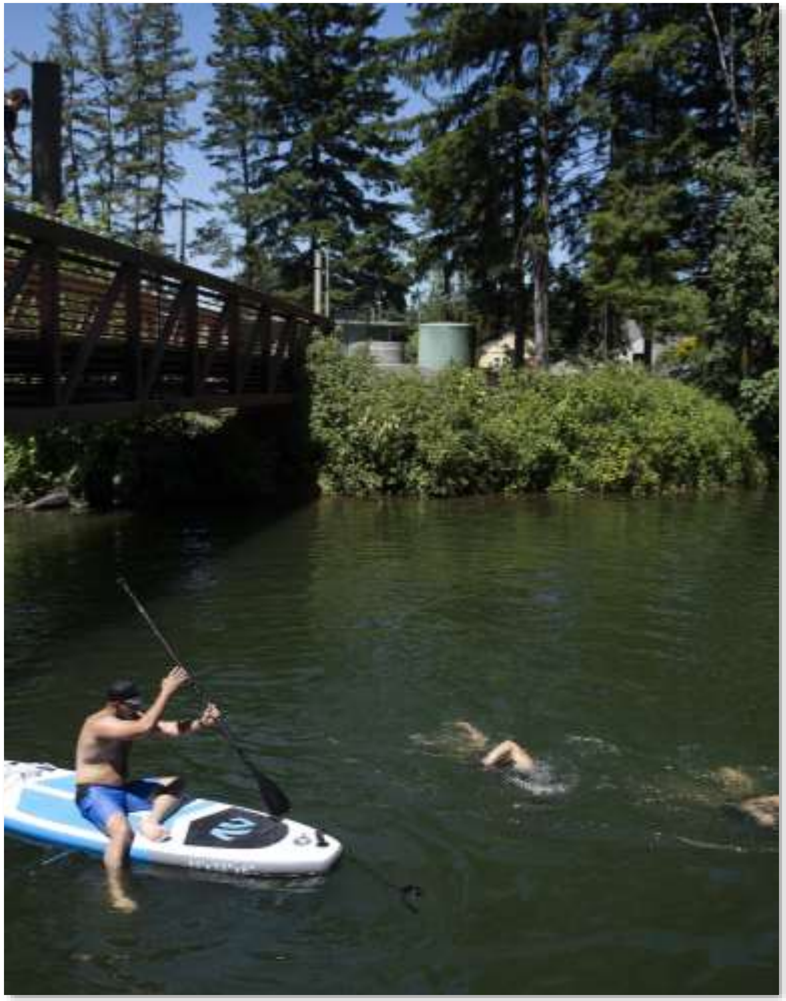
Goals:

- ❖ Establish Charter.
- ❖ Governance Structure.
- ❖ Annual Workplan.
- ❖ Decision-making process.

Technical Advisory Group Creation

Goals:

- ❖Streamline & Formalize Communication.
- ❖Technical overview & guidance.
- ❖Guide implementation.
- ❖Establish funding & policy initiatives.
- ❖Monitor effectiveness of implementation.



Joint Public Outreach

Goals:

- ❖ Public Participation Plan.
- ❖ Identify target audiences & key messages.
- ❖ Timeline for public meetings, events, or open houses.
- ❖ Establish shared webpage.
- ❖ Host water stewardship events.

Joint Public Outreach

Goals:

- ❖ Build resources for private landowners.
- ❖ Joint strategy for pollutant generating facilities.
- ❖ Support site visits, outreach, technical, & financial assistance.

Agency Partnerships

Goal: Participate in Ecology's planning process.

- Priority areas & projects.
- Implementation activities.
- Cost estimates.
- Implementation timeline.
- Effectiveness monitoring.
- Adaptive Management Plan.

Policy Initiatives

Policy Initiatives

- ❖ **Establish legislative priorities.**
- ❖ **Funding Requests.**
- ❖ **Legislative Support for:**
    - ❖ Septic
    - ❖ Sewer
    - ❖ Stormwater
    - ❖ Agriculture.
    - ❖ Riparian restoration
    - ❖ Phosphate fertilizer ban

Policy Initiatives

- ❖Update local codes and ordinances.
- ❖Review local fees & rates.
- ❖Partnership opportunities.
- ❖Long-term management frameworks.

DRAFT Work Plans

Clark County

DNA testing to identify human, livestock, dog, horse, or goose sources of pollution.

Monitoring for Lacamas Watershed.

Stormwater inventory and upgrade of all phosphorous removal cartridges.

Cyanobacteria monitoring and public notification.

Clark County

Poop Smart Clark funding for Lacamas

Behavior change campaign for nutrient reduction

Camas

Investigate Dam Management impacts on lake flushing.

Develop final Lake Treatment Plan for implementation in 2024 (w/ Clark County).

Implement monitoring in lakes.

Gather more information for Lake Management Plan.

Work we will achieve together!

Develop joint Vision and Charter

Create Technical advisory Group.

Public Participation Plan.

Education and Outreach.

Pollutant Generating Facilities.

Establish legislative priorities.

Update local code and ordinances.

Explore funding opportunities.

Develop watershed improvement plan.

Other shared commitments

Revisit ILA biannually (every 2-years)

Work together with partners.

Inventory stormwater facilities for update.

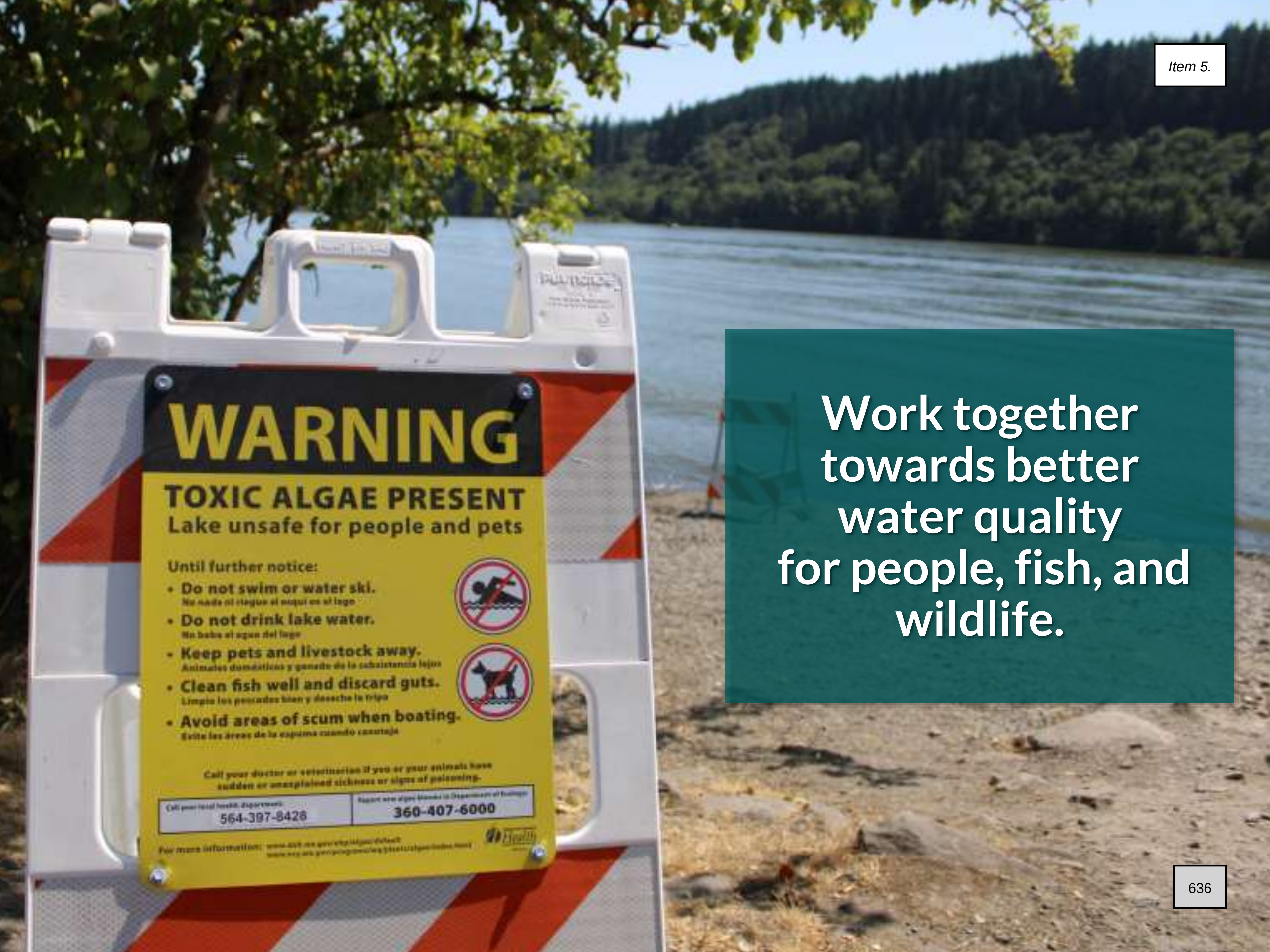
Implement inspections, maintenance, repair of stormwater infrastructure.

Participate in Stormwater Partners for Southwest Washington.

Assess effectiveness of lake treatment.

Investigate Long-term treatment and BMP needs for HABs.

Document implementation annually for Council.



Work together towards better water quality for people, fish, and wildlife.

Questions & Discussion

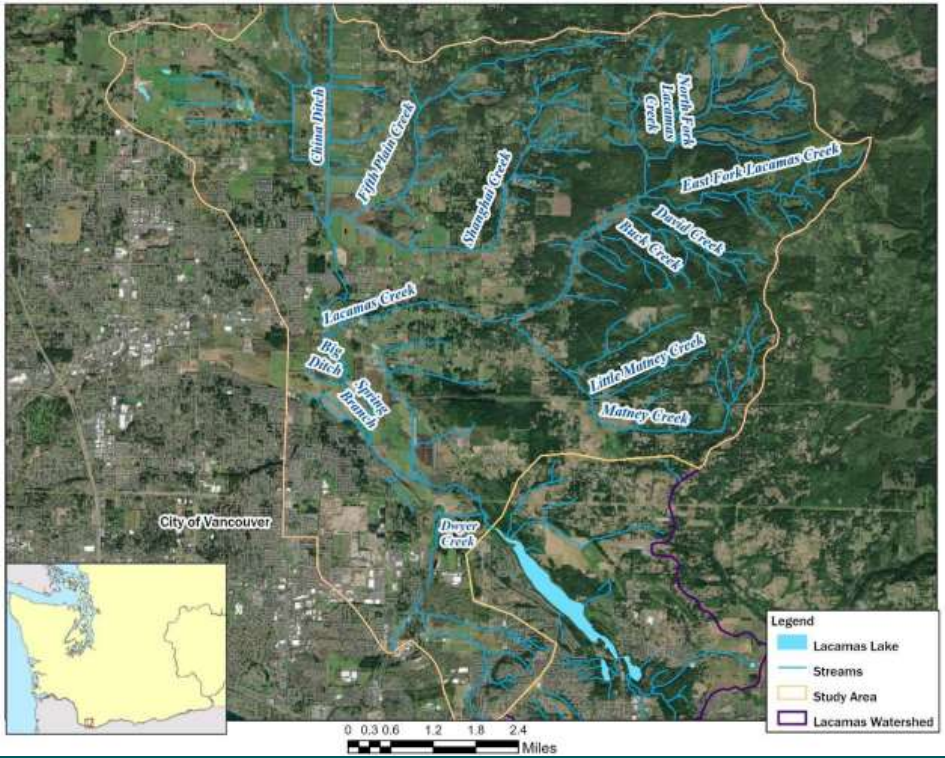
Clark County Council Work Session

February 7, 2024

Appendix Slides

Summary of Priority Areas

- China Ditch: Phosphorus, Nitrogen
- Shanghai Creek: Bacteria
- Fifth Plain Creek: Temperature (upper), Nitrogen (lower)
- Big Ditch: Temperature
- Spring Branch Creek: Phosphorus, Nitrogen
- Lower Lacamas Creek: Nitrogen, Bacteria
- Dwyer Creek: Phosphorus, Temperature, Bacteria



Taken from Ecology's Slide from 10/25/2023.

Camas Lake Management Plan - Timeline

Phase 2: Fall 2023 through Spring 2024 (We are here)

- Present draft Lakes Management Plan, including recommended strategies to City Council.
- Receive feedback from Clark County, Ecology and other agency and non-profit stakeholders.
- Submit draft Lakes Management Plan to Washington State Department of Ecology for review and approval.

Future phases: 2024 and beyond

- Implement in-lake management strategies (spring 2024).
- Continue collaboration with agency partners and identify additional partnerships and opportunities for carrying out and implementing management actions to improve water quality in the 67 square-mile Lacamas Watershed.

CLARK COUNTY, WASHINGTON

Department of Ecology - Timeline

Source Assessment (Water Quality Study)

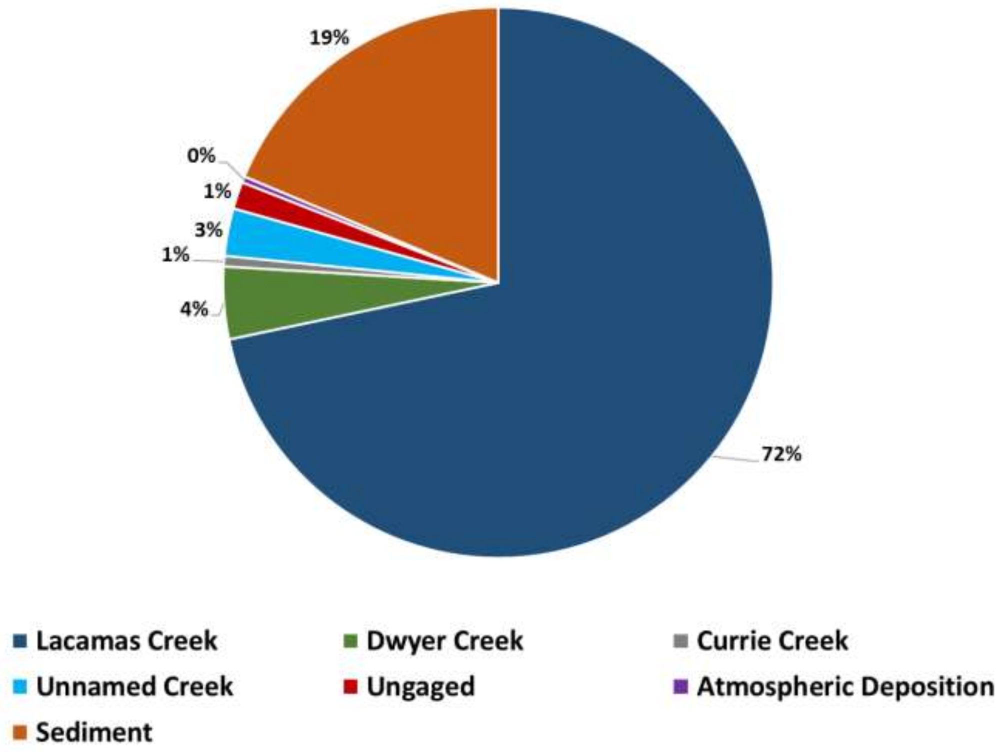
Expected: March 2024

Advanced Restoration Plan (Implementation)

Expected: March 2025

Results - Total Phosphorus Budget

- Data Collected May 2022-April 2023
- Majority of phosphorus enters from Lacamas Creek
- Sediment contributes a sizeable percentage of phosphorus as well
- Creeks contribute minor amounts of phosphorus, mostly due to smaller inflows



3-Part Recommended Management Strategy

1. Annual removal of phosphorus from the **water column** using chemical treatment - beginning Spring 2024

2. Inactivation of phosphorus in the **sediments** using chemical treatment over 5-10 years - beginning Spring 2024

3. Reduction of phosphorus loading from the **watershed**, through continued partnerships with Clark County and other regional and state organizations - Ongoing

Recommended Approach Part 1: Water Column Phosphorus Removal

- Annual removal of phosphorus from water column using aluminum sulfate (alum) or Eutrosorb WC
  - Alum has been applied to numerous lakes in Washington
    - Depending on the required dose, buffering to maintain a pH range that will prevent formation of compounds toxic to aquatic life
  - Eutrosorb WC is a more recent product (2022) and is believed to have a lower risk to aquatic organisms
  - Recommend initially focusing on Lacamas Lake for treatment
  - Estimated Cost = $70,000 to $190,000 per year

Recommended Approach Part 2: Sediment Phosphorus Inactivation

- Inactivation of Phosphorus in the sediments in the deepest portions of Lacamas and Round Lakes, using alum or Eutrosorb G, over 5-10 years
  - The deepest portions of the lake are most likely to release phosphorus from the sediments. Target areas where water depths exceed 30 feet for treatment (**88 acres in Lacamas Lake** and 11 acres in Round Lake)
  - To control dosage, reduce potential adverse impacts, allow for adaptive management, and reduce costs, inactivation of these sediments can be done over 5-10 years
  - Timing of potential future sediment treatment (10 to 50-year time frame) depends on inflow rate of solids from watershed and effectiveness of watershed-based solutions.
  - Estimated Cost = $260,000 to $340,000 per year for 5+/- years

Summary - Budgetary Level 10-Year Costs

Recommendation	Year	Annual Cost	10-Year Cost	Notes
Water Column Phosphorus Stripping	1-10	$180,000	$1.8 Million	Annual treatments required; initial dosage determined from jar testing future applications influenced by loading from watershed.
Sediment Phosphorus Inactivation	1-5	$260,000	$1.3 Million	Need for additional sediment phosphorous inactivation determined by measured conditions, accumulation of additional phosphorous and sediment from the watershed.
Monitoring	1-10	$50,000	$500,000	Monitoring is needed to refine appropriate dosage of treatments, evaluate effectiveness.
Public Outreach	1-10	$50,000	$500,000	Reduction in nutrient loading from watershed will reduce in-lake treatment costs over time.
	Total	**~$540,000 (Years 1-5)** **~$280,000 (Years 6-10)**	**~$4.1 Million**	

Available Funding - $515,000 thru Direct Grant in 2023-2025 State Capital Budget

Taken from Camas' presentation at Lacamas Symposium on 10/25/2023

Other Options Evaluated - Not Recommended at this time…

Phosphorus Removal at Inflow

Option	Planning Level Initial Cost	Planning Level Annual Cost	Notes	Reason for not recommending this option
Alum dosing at Lacamas Creek	$500,000	$650,000	Initial costs construction, permitting, and design costs are very approximate due to absence of local examples.	High initial costs, and time required to design, permit, construct, and implement system.
Eutrosorb WC dosing at Lacamas Creek	$500,000	$220,000	Initial costs construction, permitting, and design costs are very approximate due to absence of local examples.	High initial costs, and time required to design, permit, construct, and implement system.

Other Options Evaluated - Not Recommended at this time…

Types of Aeration

Option	Planning Level Initial Cost	Planning Level Annual Cost	Notes	Reason for not recommending this option
Hypolimnetic aeration or oxygenation	$690,000	$55,000	Costs based on systems at similarly sized lakes; Assumed $20,000 for annual Operation and Maintenance, and replacement after 20 years ($690,000 annualized)	**Not expected to reduce HABs by itself** - only helps with sediment P (~20% load). Does not address the creek loading. Substantial initial costs; time required to design, construct and implement the system.
Nanobubbler	$800,000	$50,000	Costs assume 10 of the largest units available from Moleaer.	**Not expected to reduce HABs by itself** - only helps with sediment P (~20% load). High initial costs, Need for property for device placement.

Other Options Evaluated - Not Recommended at this time…

Option	Description	Reason for not conducting detailed costing
Algaecide	Risk of toxicity to fish and vegetation; short term solution, requires monitoring	Not at this time; however, new products continue to be developed with lower potential for toxicity to fish and benthic organisms. Maintain for future consideration.
Carp removal	Carp are known to stir up Phosphorus in bottom sediments; reducing Carp population may reduce internal loading.	Consider communications encouraging carp fishing; maintain consideration of commercial removal of carp. However, Further discussions with WDFW needed.
Limiting of motor use in shallow areas of lake	In some areas of Lacamas Lake, motors can stir up sediments from the bottom of the lake, potentially resulting in Phosphorus transfer to the water column.	There is not enough evidence to demonstrate that this would meaningfully reduce internal loading. Maintain for future consideration. *Policy decision*
Dredging	Remove Phosphorus-containing sediments from the bottom of the lakes.	Not at this time due to high costs and need to determine where dredged sediments would be placed.
Ultrasound	Ultrasonic waves create a barrier preventing algae from moving up and down the water column to access nutrients and light needed for growth.	Relatively few examples; not found to be effective at Lake Ketchum
Full Water Column Mixing	Mixing the like using solar-powered mixers or mechanical mixing	Risk of moving high concentrations of nutrients in water near the bottom of the lake to the surface, leading to greater algae growth.

Taken from Camas' presentation at Lacamas Symposium on 10/25/2023

INTERLOCAL AGREEMENT
BETWEEN CLARK COUNTY AND THE CITY OF CAMAS
TO DEVELOP A LONG-TERM PARTNERSHIP FOR
MANAGEMENT OF THE LACAMAS WATERSHED AND LACAMAS/ROUND LAKES

Pursuant to Chapter 39.34 RCW and RCW 70A.205.040, this Interlocal Agreement (Agreement) is entered into between Clark County and the City of Camas (the "Parties"), recognizing the continued efforts of the Parties to improve water quality within the Lacamas Watershed, Lacamas Lake and Round Lake, and to develop a long-term partnership to collaborate on future management and implementation strategies.

WHEREAS, the Parties recognize that our community, businesses, public policymakers, and local government staff benefit from cooperative, coordinated, and shared approaches to managing the Lacamas Watershed and Lacamas and Round Lakes (the "Lakes"); and

WHEREAS, both Parties understand the importance of watershed management and the impacts that poor water quality can have on the environment, recreation, and citizens' overall quality of life; and

WHEREAS, there is a mutual benefit to the County and City to continue to protect and improve the Lacamas Watershed for the benefit of current and future generations; and

WHEREAS, Camas citizens, recreational users of the Lakes, and other broader community members have made it abundantly clear through comments and public engagement that improving the water quality within the Lakes and the broader Lacamas Watershed is of paramount importance; and

WHEREAS, in the 1990's and early 2000's the County independently, and through partnering with the Department of Ecology, completed water quality monitoring within Lacamas and Round Lakes, developed strategies to improve water quality, and implemented improvements within the Watershed, primarily targeting agricultural and dairy practices at the time; and

WHEREAS, since the early 2000's there has not been a concerted effort on the part of any agency to specifically monitor water quality within the Lakes and there has been an apparent worsening of water quality or other change in conditions that has brought consistent algal blooms to occur on the Lakes, impacting recreational activities and other environmental resources; and

WHEREAS, the County has completed monitoring of streams within the Lacamas Watershed every five years to track water quality status and trends, with the last effort completed in 2021; and

WHEREAS, in 2021, the City and the County partnered on completion of a water quality assessment of Fallen Leaf Lake (previously known as Dead Lake), which discharges into Lacamas Lake; and

WHEREAS, beginning in 2020 the City secured funding and took the lead in developing a Lake Cyanobacteria Management Plan ("Lake Management Plan") in accordance with the Department of Ecology's guidance documents and in coordination with multiple agency and non-profit stakeholders, including Clark County. A draft of the Lake Management Plan was completed in Fall 2023 and is currently under review by the Department of Ecology; and

WHEREAS, funding for the Lake Management Plan was in part provided by the Department of Ecology Freshwater Algae Control Program and through State Budget appropriations submitted on behalf of the community by the Parties State legislators; and

WHEREAS, the larger streams and the Lakes within the Lacamas Watershed are considered Waters of the State, signifying they are owned by the public and managed through a coordinated effort of state and local agencies, including the County and Camas; and

WHEREAS, the Parties recognize it will take a concerted effort on the part of all agencies having jurisdiction, all non-profit organizations, and the general public to make significant improvements to the water quality within the Lacamas Watershed and Lakes; and

WHEREAS, both parties have existing National Pollutant Discharge Elimination System (NPDES) Stormwater Permits and dedicated stormwater programs that already plan, monitor, inspect and improve water quality within their respective jurisdictional boundaries, including the Lacamas Watershed and Lakes; and

WHEREAS, through the Clark County Cleanwater Commission, a Lacamas Watershed Symposium was held on October 25, 2023, in which multiple agencies and non-profit organizations presented on all of the good work that has been occurring within the Lacamas Watershed and Lakes and where participants discussed potential opportunities for partnering and coordinating on future management and implementation of strategies to improve water quality within the Lacamas Watershed and Lakes; and

WHEREAS, after the Lacamas Watershed Symposium, the City of Camas Council, and the Clark County Council each individually supported the development of an interlocal agreement and partnership between Camas and the County to lead efforts to strengthen and coordinate on management of and improvement to the water quality within the Lacamas Watershed and Lakes.

NOW, THEREFORE, in consideration of the mutual benefits and covenants contained herein, it is hereby agreed:

1. **Purpose of Agreement.** The Parties intend this Agreement to provide for a long-term partnership and creation of a governance structure in support of efforts, in conjunction with other agencies, organizations, and the public, to improve water quality within the Lacamas Watershed and Lakes. Through this Agreement, ultimately the Parties intend to identify roles and responsibilities, governance, policy, joint and individual work plan, and financial expectations, and to clarify regulatory authority(ies) in support of a shared Vision for the Watershed and Lakes.

   1.1. The Parties will revisit this Agreement at least biannually, or as otherwise necessary, to determine if updates are required.

2. **Joint Vision and Charter Development.**

2.1. The Parties will develop a joint Vision and Charter document to confirm and identify a shared vision for the Lacamas Watershed and clarify roles, responsibilities, and expectations for each party as it relates to achieving the Vision and implementing Watershed and Lake Management activities for the Lakes. The Charter may include such things as a governance structure for joint decision-making where necessary, a shared public outreach and information plan, internal communication strategies for keeping the Clark County Council and Camas City Council (the "Councils") informed, annual joint work plan requirements, and other related activities as further identified below.

3. **Technical Advisory Group Creation.**

3.1. The Parties will create a Technical Advisory Group (TAG) to provide for streamlined communication between the Parties; provide technical overview and guidance for activities in the Watershed and Lakes; recommend implementation strategies with forecasted and measurable outcomes to the Councils' to improve water quality within the Lacamas Watershed and Lakes; recommend funding and policy initiatives; and manage, oversee and monitor the effectiveness of this Agreement, implemented projects, public participation and stakeholder engagement.

3.2. The TAG shall meet at least twice annually to review status of individual Party work efforts, assign and coordinate on joint activities, and determine if there are necessary updates for the Councils. Agendas shall be jointly prepared and reviewed by the Parties.

3.3. The TAG shall include members of staff from each Party, and at a minimum will include the Public Works Directors, or their designee, and technical staff members from the County's Cleanwater Division and the City's Stormwater Division. It is envisioned that early meetings of the TAG may have participation from only County and City staff, then expand as the partnership and associated projects evolve.

3.3.1. Each Party may have other staff attend TAG meetings at their own discretion.

3.3.2. Representatives from other agencies or non-profit organizations may be invited to attend TAG meetings upon concurrence of both Parties.

4. **Joint Public Outreach and Agency Partnerships.**

4.1. Public Outreach. The Parties will develop a joint Public Participation Plan for the Lacamas Watershed and Lakes including strategies for keeping the public informed about the status of water quality and implementation strategies and creating a process to gather public input as work efforts and implementation progresses. This Public Participation Plan, at a minimum, will:

4.1.1. Identify target audiences and establish key messages for all stakeholders.

4.1.2. Identify timelines for routine public meetings and/or open houses to share updates on implementation progress in the Watershed and Lakes.

4.1.3. Establish a webpage(s) to provide updates on implementation efforts in the Lacamas Watershed and Lake.

4.1.4. Designate co-sponsored volunteer stewardship activities including, but not limited to, litter cleanups, invasive species removal, community service events, and tree planting activities.

4.1.5. Identify opportunities to provide education and outreach at public events, such as the Camas Farmers Market and Annual Lake Cleanup, and the type of information that should be shared.

4.1.6. Identify and develop specific education and outreach programs through coordination with local organizations that work directly with private landowners to educate property owners on what they can do to improve water quality.

4.1.7. The Parties will work together to develop a specific outreach plan or strategy to work with large pollutant generating facilities in the watershed including Golf Courses and Dairies. This will include requesting partnership support from the Department of Ecology, USDA NRCS, WSDA, or other agencies for joint site visits, outreach, technical, and financial assistance.

4.2. Agency Partnerships.

4.2.1. The Parties will follow the Department of Ecology's Lacamas Creek Source Assessment and Advanced Restoration Plan (ARP) development for the Lacamas Watershed. The Parties will participate, review, or provide comments when deemed necessary to Ecology as allowed or otherwise requested through the Ecology process.

4.2.1.1. The Parties understand the Assessment will serve as the technical foundation for watershed implementation activities and the ARP will identify priority areas and projects for implementation, develop a list of implementation activities, establish cost estimates and a timeline for implementation, and include long-term effectiveness monitoring to adaptively manage the ARP; all for the benefit of the Watershed. It is anticipated that the Parties will be instrumental in carrying out the recommendations of the ARP, likely through their respective Stormwater NPDES permits and, as such, the Parties should endeavor to actively participate in the development of the ARP.

5. Policy Initiatives.

5.1. Operating within their respective established budgetary and policymaking framework, the Parties will attempt to work together to establish legislative priorities and requests for funding for the Lacamas Watershed and Lakes focused on reducing nutrient loading and harmful algal blooms. Examples may include such things as seeking local and/or State legislative support for septic, sewer, and stormwater activities; support for agricultural work; riparian restoration activities; or efforts to regulate the use of phosphate-based fertilizers in the watershed.

5.2. The Parties, through recommendations of the TAG, will work together to identify opportunities to update local codes and ordinances to protect water quality in the Lacamas Watershed and Lakes, which could include new requirements around nutrient application or developing policies for motorized boaters on Lacamas Lake.

5.3. The Parties will work together to identify, support, and pursue funding and partnerships for projects that involve land acquisition, riparian and wetland restoration, or implementation of agricultural best management practices for manure management.

5.4. The Parties will explore opportunities to increase local funding for Watershed and Lakes Management activities. This may include a review of recreational fees, event permits, stormwater rates, use of Clark County's Conservation Futures program, or other potential programs in both jurisdictions. As part of this effort, opportunities to fund other Watershed partners' efforts such as the Clark Conservation District, Lacamas Watershed Council and the Watershed Alliance of Southwest Washington should be explored to the extent possible.

5.5. Long-Term Management. The Parties will assess potential options to, benefits of, or challenges of maintaining a long-term interlocal agreement-based partnership, establishing a different form of joint operated management structure, or the potential for a separate new entity that can serve as a chief steward to support and fund implementation work in the Lacamas Watershed and Lakes. Initial work led by the TAG will focus on determining when an appropriate time would be to assess these potential options as the Parties recognize initial coordination and development of a municipal partnership is the near-term priority.

6. Work Plans.

6.1. **Clark County.**

6.1.1. Dependent upon available funding and staff resources, implement microbial source tracking (MST) monitoring to collect bacteria samples and use DNA technologies to determine whether bacteria pollution is coming from humans, livestock, horses, dogs, or geese. This information will be used to work with Poop Smart Clark to assist landowners with water quality problems on their property, specifically from livestock and septic systems, or to work on other geese deterrent strategies.

6.1.2. Continue to provide monitoring support for the Lacamas Watershed by completing monitoring at least every five years to track water quality status and trends.

6.1.3. Complete stormwater inventory and upgrade all stormwater cartridges to Phosphorb cartridges to increase nutrient treatment in stormwater runoff.

6.1.4. Clark County Public Health will continue to provide cyanobacteria monitoring and education to recreationalists on water quality and beach closures.

6.1.4.1. The Parties will continue coordinating regarding potential improvements to the testing and notification process as it relates to the amount of time required to notify the general public of potential water quality concerns.

6.2. **Camas.**

6.2.1. Continue to provide updates to the TAG and Councils regarding operation of the Lacamas Lake Dams and explore opportunities to integrate dam management activities to improve flushing of Lacamas Lake.

6.2.2. In coordination with the TAG, develop a final Lake Treatment Plan to be implemented in Summer 2024 and more fully develop an adaptive treatment, management, and effectiveness monitoring plan for subsequent years.

6.2.3. In coordination with the TAG, develop and complete monitoring activities in, and downstream of, the Lakes as necessary to continue to establish baseline information and support future Lake treatment efforts.

6.2.4. Gather additional information relative to the findings in the Lake Management Plan, including considerations of things such as dye tracing to determine how creek flows entering the Lakes move through the water bodies, conducting more extensive aquatic vegetation surveys, investigating the sources of the Unnamed Creek on the north side of Lacamas Lake, and additional sediment sampling.

6.3. **<u>Near-Term Joint Work Plan</u>**.

6.3.1. Develop a joint Vision and Charter per Section 2.1.

6.3.2. Create and confirm membership of a Technical Advisory Group (TAG) per Section 3.1.

6.3.3. Develop a joint Public Participation Plan per Section 4.1.

6.3.4. Develop a specific outreach plan and strategies to work with large pollutant generating facilities per Section 4.1.2.

6.3.5. Identify legislative priorities for the next biennium to request support from the Parties local legislators per Section 5.1.

6.3.6. Identify potential opportunities to update local Codes to further strategies that will assist in improving water quality within the Lacamas Watershed and Lakes per Section 5.2.

6.3.7. Explore opportunities to increase local funding for Lacamas Watershed and Lakes activities per Section 5.4.

6.3.8. Develop a conceptual Watershed Improvement Plan with known or suspected “hot spots” (e.g. areas of significant erosion; contributions of contaminants, septic failures, etc.) and potential projects, lead agency, anticipated costs, and probable funding sources to be used by the Parties as a tool to track opportunities not otherwise identified in other planning documents.

6.4. **<u>Ongoing Joint Work Plan</u>**.

6.4.1. Revisit this Agreement at least biannually per Section 1.1.

6.4.2. Continue working with agency and non-profit organizations per Section 4.

6.4.3. The Parties will inventory their respective stormwater facilities to identify which facilities currently have phosphorous removal treatment cartridges. Facilities that are missing, malfunctioning, or needing replacement will be incorporated into the annual capital plan to be upgraded.

6.4.4. Continue to implement each agency’s respective stormwater management programs regulated by the Phase I (County) and Phase II (Camas) NPDES Municipal Stormwater Permits, which includes inspection, maintenance, and repair of municipal stormwater infrastructure. This also includes continuing to identify opportunities for stormwater retrofits; providing routine street sweeping; technical assistance for pollution source control; and providing homeowners with technical assistance for private stormwater facilities.

6.4.5. Both Parties will continue to participate in the Stormwater Partners for Southwest Washington to continue coordinating on stormwater management activities.

6.4.6. The Parties will continue to investigate long-term treatment opportunities and best practices for controlling harmful algal blooms in the Lakes based on treatment effectiveness.

6.4.7. Document annual Watershed and Lakes activities in an annual report to be presented to the Councils and made available to the general public.

7. Limitations.

7.1. Nothing in this agreement shall supersede any authority granted to either the County or the City, or otherwise imply any control by one Party over the other Party.

7.2. Nothing in this agreement shall obligate either Party to provide personnel or assume operation and maintenance responsibilities for the other party's facilities or operations. Nor shall any provision of this agreement change in any manner the rules and restrictions under which either party operates.

7.3. The terms of this Agreement are intended for the exclusive benefit of the Parties hereto and nothing contained herein shall be construed to create any duty or obligation not otherwise mandated by law or create any rights or benefits in or to any third-party.

8. **Dispute resolution.** Any disputes arising under the terms of this agreement shall be resolved through a negotiated effort to reach consensus. The Parties may agree to mediation as part of such effort.

9. **Term.** Commencing on the effective date as outlined below in this Agreement, this Agreement shall continue until terminated as herein provided. Any party hereto may withdraw and terminate its rights and obligations under this Agreement with the understanding that:

9.1. Notice of intent to withdraw shall be provided with 90 days' notice; and

9.2. Termination will not absolve the City or County of responsibility for meeting financial and other obligations outstanding at the time of termination.

10. **Effective date.** This Agreement shall be effective upon its execution by both Parties.

11. **Entire agreement and modification.** This Agreement embodies the entire agreement and understanding between the Parties hereto with respect to its subject matter and supersedes all prior agreements and understandings, whether written or oral, relating to its subject matter. No amendment or modification of this Agreement shall be valid unless made in writing and signed by each of the Parties.

12. **Indemnification / Hold harmless.** To the fullest extent permitted by law, each party shall defend, indemnify, and hold harmless the other party, including their elected and appointed officials, agents, and employees from and against all claims of third parties, and all associated losses arising out of or resulting from each party's own negligent acts or omissions with respect to the performance of this Agreement. Neither party will be required to indemnify, defend, or save harmless the other party if the claim is caused by the sole negligence of the other party. Where such claims result from the concurrent negligence of the parties, their agents, officials, or employees, the indemnity provisions provided herein will be valid and enforceable only to the extent of the negligence of the indemnifying Party, its agents, officials, or

employees. "Claim," as used in this contract, means any financial loss, claim, suit, action, damage, or expense, including but not limited to attorney's fees. Parties waive their immunities under Title 51 RCW to the extent it is required to indemnify, defend, and hold harmless the other party and their elected and appointed officials, agents, or employees. This provisions of this section shall survive after the termination of this Agreement.

13. **Public Records Act.** Notwithstanding the provisions of this Agreement to the contrary, to the extent any record, including any electronic, audio, paper or other media, is required to be kept or indexed as a public record in accordance with the Washington Public Records Act, RCW Chapter 42.56, as may hereafter be amended, each party agrees to maintain all records constituting public records and to produce or assist both parties in producing such records, within the time frames and parameters set forth in state law. Each party further agrees that upon receipt of any written public record request from the public, shall, within two business days, notify the other party of receipt of the request by providing a copy of the request to the other party's Public Records Officer.

14. **Recording or Public Listing.** The Parties agree that this Agreement, after full execution, either will be recorded with the Clark County Auditor or listed by subject on each Party's website or other electronically retrievable public source, as required by RCW 39.34.040.

15. **Severability.** If any provision of this Agreement is held invalid, the remainder would then continue to conform to the terms and requirements of applicable law.

16. **Interlocal Cooperation Act Compliance**. This is an agreement entered into pursuant to Chapter 39.34, RCW. Its purpose is as set forth in Sections 1 and 2. Its duration is as specified in Section 9. Its method of termination is set forth in Section 9. No property shall be acquired pursuant to this Agreement, which will need to be disposed of upon partial or complete termination of this Agreement.

Staff Report

February 20, 2024 Council Workshop Meeting

Resolution 24-001_Draft Creating a Regional Fire Protection Planning Committee
Presenter: Doug Quinn, City Administrator
Time Estimate: 5 minutes

Phone	Email
360.834.6864	*dquinn*@cityofcamas.us

BACKGROUND: The resolution forming the Regional Fire Authority Planning Committee is the next step in the continuation of the shared services model utilized by the Camas Washougal Fire Department (CWFD). The service provides fire protection, emergency medical transport and fire inspection services throughout the cities of Camas and Washougal.

The CWFD currently operates under an inter-local agreement for services between the two cities. Both cities have agreed to discuss the formation of a Regional Fire Protection Authority (RFA) that if voted into existence by a majority of residents within the area of both cities, would reform the current partnership to install the RFA. In order to have that discussion, in accordance with RCW 52.26.030, a Planning Committee must be formed that would evaluate the matters of operation, staffing, and service levels, among other elements. The formation of the committee does not obligate the city to approve the formation of an RFA but is a required step to advance the RFA for future consideration by the Council.

The guiding regulations, RCW 52.26, require that the RFA plan provide guidance for governance, financing, and development of fire protection and emergency services, along with opportunities for public input. It will describe jurisdictional boundaries, organizational structure, operations and services.

The attached Resolution provides for the formation of the RFA Planning Committee, assigning the three existing Joint Policy Advisory Committee (JPAC) members to represent the City's interests in the RFA planning work.

BENEFITS TO THE COMMUNITY: The work of the committee is to develop a plan that creates a long-term structure of future Fire and EMS response teams serving the two cities.

BUDGET IMPACT: Financial impacts, if recommended by the RFA Planning Committee, could be the hiring of contracted services to assist the two cities in developing the RFA planning document. There are sufficient funds in the General Fund to support those services.

RECOMMENDATION: Staff's request is to review the following Resolution for consideration at the next Regular Council Meeting, assigning Bonnie Carter, John Nohr, and Marilyn Boerke to the RFA Planning Committee.

RESOLUTION NO. 24-001

A RESOLUTION of the City Council of the City of Camas, Washington, authorizing the City of Camas to participate in the development of a draft plan for the formation of a Regional Fire Protection Service Authority and appointing members to a Regional Fire Protection Service Authority Planning Committee.

WHEREAS, Washougal and Camas currently provide fire and emergency medical (“EMS”) services pursuant to the terms of an Interlocal Agreement between the Cities of Camas and Washougal for the Formation and Operation of the Camas-Washougal Fire Department dated December 4, 2013, as amended; and

WHEREAS, Washougal and Camas are mutually interested in determining the best option for providing the most effective and efficient delivery of fire and EMS services to the community; and

WHEREAS, to fully explore which service delivery option is best for the community, Camas and Washougal engaged a study by Merina to evaluate various service delivery options; and

WHEREAS, the Merina study recommended a Regional Fire Protection Service Authority (“RFA”) as the preferred service delivery option; and

WHEREAS, to fully explore the option of an RFA, Washougal and Camas must follow the statutory provisions regarding the formation of an RFA, including a Planning Committee established pursuant to RCW 52.26.030; and

WHEREAS, the Planning Committee considers matters identified in RCW 52.26.040 and other related matters, ultimately culminating in preparation of a draft Regional Fire Protection Service Authority Plan to potentially be submitted to the voters; and

WHEREAS, RCW 56.26.030(2) provides that the Council must appoint three elected officials to represent the City on the Planning Committee; and

WHEREAS, since the formation of the Camas Washougal Fire Department, Washougal and Camas have utilized a Joint Policy Advisory Committee (“JPAC”) as a primary advisory body to the respective City Councils, pursuant to the Interlocal Agreement, consisting of three councilmembers from each City; and

WHEREAS, appointment of the current JPAC members to the RFA Planning Committee will provide for continuity in the evaluation process; and

WHEREAS, the establishment of a Planning Committee and the development of a draft Regional Fire Protection Service Authority Plan does not commit the City to any specific action with respect to forming an RFA;

NOW THEREFORE BE IT RESOLVED BY THE CITY COUNCIL OF CAMAS AS FOLLOWS:

SECTION I

That the City Council hereby authorizes the Mayor and elected officials of the City to actively participate with the City of Washougal in a Regional Fire Protection Service Authority Planning Committee for the development of a draft Regional Fire Protection Service Authority Plan to be presented to the Camas and Washougal city councils for possible presentation to the voters of Camas and Washougal.

SECTION II

That the Mayor or designee is authorized to implement such administrative procedures as may be necessary to carry out the provisions of RCW 52.26, and that the following councilmembers be appointed to the Regional Fire Protection Service Authority Planning Committee, in conformance with RCW 52.26.030(2).

1. City Councilmember Bonnie Carter
2. City Councilmember John Nohr
3. City Councilmember Marilyn Boerke

ADOPTED at a regular meeting of the Council of the City of Camas this ________day of ___________________, 2024.

SIGNED:___________________________________

Mayor

ATTEST:___________________________________

Clerk

APPROVED as to form:

____

City Attorney

Staff Report

February 20, 2024 Council Workshop Meeting

Legacy Lands Master Plan – Greenworks PSA
Presenter: Trang Lam, Parks & Recreation Director
Time Estimate: 15 minutes

Phone	Email
360.817.7037	tlam@cityofcamas.us

BACKGROUND: In 2017, the City of Camas completed the "*North Shore Lacamas Lake: A Vision for Conservation and Recreation*" (2017 Vision Plan). The 2017 Vision Plan provides context to all the prior plans that provided the community the foresight to pursuing the acquisition of lands along the Lacamas Lake corridor for conservation and preservation of public access for recreational use. The natural and recreational features within the Lacamas Lake corridor have long shaped the history, growth and character of the City of Camas. The City, through partnerships with Clark County, State of Washington and Columbia Land Trust has preserved land surrounding Lacamas Lake for conservation of riparian zones, wetlands, and forested lands along with preserving public access to recreational opportunities. Along the south side of the lake, Heritage Park, Heritage Trail and Lacamas Lake Lodge provide direct public access to hiking, boating (motorized and non-motorized), fishing, swimming and waterfront event space. Over the last decade, the city has acquired more than 165 acres along the north shore of the lake (Figure 1) to complete its vision In the 2017 Vision Plan.

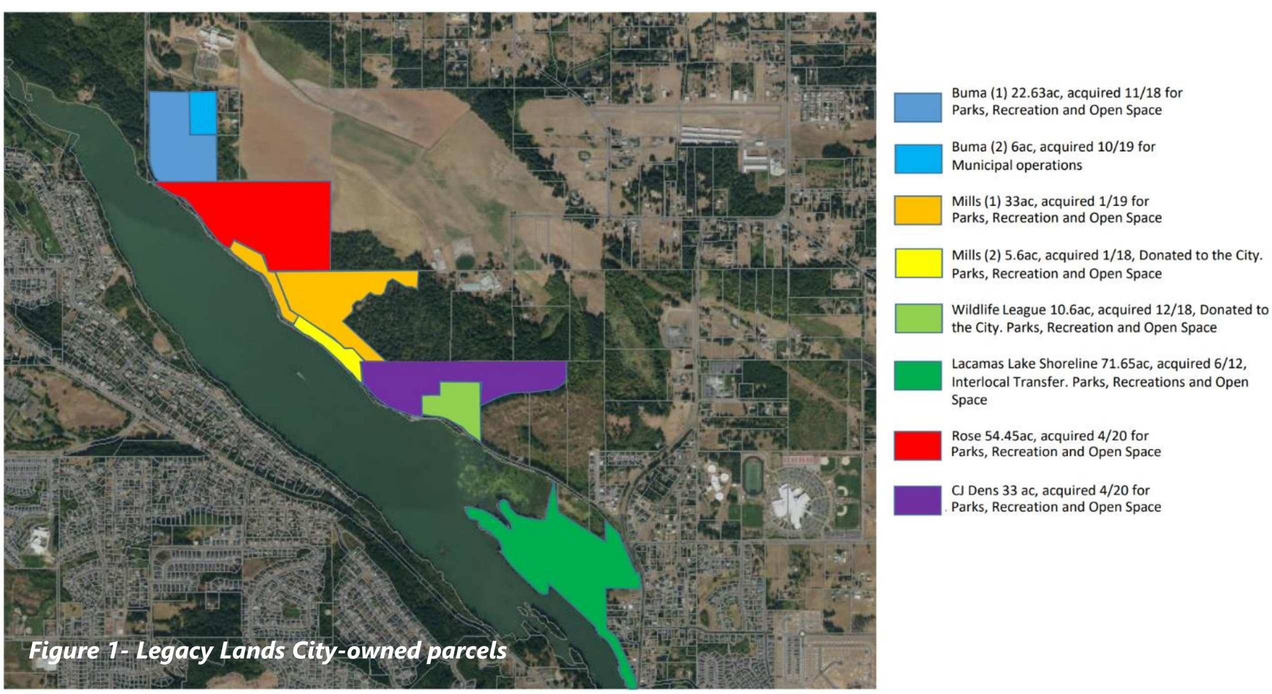


Figure 1- Legacy Lands City-owned parcels

More recently, the City adopted the "*Parks, Recreation and Opens Space (PROS) Plan*" (2022). 97% of the respondents to the PROS Plan community survey, which received nearly 1,400 responses, felt that local parks and recreation opportunities are important or essential to the quality of life in Camas. The PROS Plan's *Chapter 10: Capital Planning and Implementation*, highlights the following key project recommendations that this master planning process will be responsive to –

Trail Connections

Trail connections, including sidewalk and bike lane improvements, are needed to help link destinations across the community. Acquire easements, corridors and parcels to create the comprehensive linkages for Camas' future trail system. Develop larger trails desired by the community, such as North Shores of Lacamas, Mill Ditch, Lewis & Clark. Coordinate with the Transportation System Plan (and subsequent updates), as well as coordinate with local subdivision and site development projects.

Water Access

Improve shoreline and water access for motorized and non-motorized launches, including user conveniences such as restroom facilities and parking.

North Shore Subarea Plan

Maintain strong role in planning for future parks and trails along the North Shore.

In 2019, the City began the process to vision and develop a *North Shores Subarea Plan* (Subarea Plan). During this time, the Parks & Recreation Department (Department) also kicked off a master planning process for Legacy Lands. Due to COVID, both projects were placed on hold in fall 2020. In 2021, phase two of the Subarea Plan development was initiated. Over the next year, the Subarea Plan came to fruition and in November 2022, Camas City Council adopted the Subarea Plan; and in July 2023, Council adopted the Subarea Plan's zoning code amendments and design manual. With a Subarea Plan in place, the Department is reengaging with the community, Parks & Recreation Commission and Council to complete the Legacy Lands Master Plan.

In response to the goals and actions set out in the adopted PROS Plan, staff issued a Request for Qualification process to seek a multidisciplinary consultant team to oversee the delivery and execution of a Legacy Lands Mater Plan (Master Plan).

SUMMARY: The Master Plan will provide a vision for this regional park asset, and a framework for the phasing and partnership opportunities of park development projects on Legacy Lands. The Master Plan process will include:

- Site analysis and programing including urban design, architectural, environmental, economics and civil;
- Design alternatives and final concept design;
- Community engagement; and

- Plan development which includes cost estimates, implementation phasing plan, program priorities, and funding forecast for initial construction phase.

The team of GreenWorks, JLA, First Fourty Feet, Waterleaf Architecture, PBS and ECONorthwest was selected to perform the work.

Staff is seeking Council approval of this Professional Services Agreement (PSA) with GreenWorks, PC in the amount of $166,652 to be dispersed through the end of April 2025 to GreenWorks, PC, as work is completed. The PSA scope of work is attached as Exhibit A. The proposed services and the associated costs are summarized below:

Base Fee	$165,002
Reimbursable Expenses	$1,650
TOTAL FEES (Not to Exceed)	**$166,652**

BENEFITS TO THE COMMUNITY: This Project meets the following City adopted plans:

<u>Camas 2035 Comprehensive Plan</u>
Citywide Land Use, Natural Environment Goal - LU-1.4.4:

- Develop an interconnected network of parks, trails, and open space to support wildlife corridors and natural resources and enhance the quality of life for Camas residents and visitors.

Natural Environment, Environmental Stewardship Goal – NE-1:

- To preserve Camas' natural environment by developing a sustainable urban environment and protecting habitat and vegetation corridors.

Natural Environment, Shoreline Goal – SMP-3.1:

- To guide the future development of shorelines in the City in a positive, effective, and equitable manner consistent with the Shoreline Management Act.

Natural Environment, Landscape Enhancement & Tree Preservation Goal – NE-4:

- To protect Camas' native landscape and mature tree cover.

<u>2022 Parks, Recreation and Open Space (PROS) Plan</u>
STEWARDSHIP OF LAND, PARKS & PROGRAMS:
Goal: Enhance parks and trails amenities.

- Action: Maximize the multiple-use aspects of critical areas, stormwater detention ponds, etc. with addition of public trails or viewing access and education of ecological value of the area.

PLANNING FOR & FILL KNOWN SYSTEM GAPS:
Goal: Enhance outdoor recreation opportunities.

- Action: Develop park master plans that reflect local needs, community input, recreation and conservation goals; with consideration for financial resources and availability of similar amenities/facilities within the city and region.

Goal: Promote water access and safety.

- Action: Evaluate the north shores city-owned Legacy Lands properties to expand trails and water access points around Lacamas Lake.

Goal: Provide equitable access to parks and open space system.

- Evaluate and update design and development standards for parks and recreation amenities within private development to promote and achieve equitable levels of service and provide amenities that are complementary to the city park.

2022 Camas PROS Plan Capital Facilities Plan
Listed as high priority as opportunities arise.

- Legacy Lands – Develop Site Master Plan – Master Plan
- Legacy Lands – Master Plan Phase I Implementation – Development

POTENTIAL CHALLENGES: As noted above, with the completion of the North Shore Subarea Plan, private development, including infrastructure projects, are moving into design and construction. The City would use this Master Plan to inform private development of how they may be able to construct utilities through park land and partner on development of trails and/or other park amenities projects. Without this Master Plan, the City would be reacting to requests from private development instead of informing their design in a proactive manner.

The Master Plan will provide the groundwork for pursuing grant opportunities and public/private partnerships.

BUDGET IMPACT: The Legacy Lands Master Plan PSA with GreenWorks, PC is funded in the FY 2024 adopted budget.

RECOMMENDATION: Staff recommends this item be placed on the March 4, 2024 Consent Agenda for Council's consideration and approval.

EXHIBIT A

GREENWORKS™

January 16, 2024

Trang Lam
Parks and Recreation Director
City of Camas

Re: **Legacy Lands Master Plan**
Landscape Architectural Services Proposal

Dear Trang,

Thank you for the opportunity to continue working with the City of Camas. This project includes Master Planning and Public Engagement for the Legacy Lands, which is approximately 150 acres of public open space along the North shore of Lacamas Lake. We have put the following proposal together based on our knowledge of the project and conversations with you. The following is the consultant team assembled to perform the work:

GreenWorks Consultant Team:

GreenWorks (GW): Prime Consultant and Landscape Architecture

JLA: Public Involvement

First Fourty Feet (FFF): Urban Design

Waterleaf Architecture (WL): Architecture

PBS: Environmental and Civil Engineering Consulting

ECONorthwest (ECO): Economics

We make the following proposal for your consideration and acceptance:

PROPOSED SCOPE OF SERVICES

TASK 1 PROJECT MANAGEMENT

1.1 Project Startup:
Prepare project folder, set up invoice tracking, and prepare subconsultant agreements.

1.2 Kickoff Meeting / Site Visit:
The Design Team shall attend a kickoff meeting in Salem to review the project goals, process, schedule, and public engagement strategy. The meeting will conclude with a site visit.

1.3 Project Manager Meetings (GW–18;)
GW shall meet with the City Staff bi-weekly to review project progress through tasks 1-5.

1.4 Project Management and Coordination
GreenWorks shall facilitate communication between the Design Team and City; Coordinate project deliverables; Prepare Monthly invoices, progress reports, meeting agendas and summaries.

Task 1 Deliverables: project schedule, task matrix, meeting agendas and summaries, monthly invoices

TASK 2 COMMUNITY ENGAGEMENT

2.1 Public Involvement Prep and Assessment Meetings (5 – Virtual)
GW and JLA will meet with the City to review Public Involvement goals and strategy prior to creating a PI Plan (1 meeting) and then prior to and after each open house (4 meetings).

2.2 Public Involvement Plan:
JLA will work with GW and the City to create a Public Involvement Plan which will include the various public outreach efforts planned, the target audiences, format, roles, and the purpose of each outreach effort.

2.3 Open House Preparation:
GW will prepare graphic presentations for each of the two (2) open houses. This would include developing a PowerPoint presentation (GW), large format boards (GW), and talking points (GW and JLA). Graphics will be prepared in other tasks.

2.4 Open Houses (2):
JLA and GW will work with City staff to facilitate two (in-person) public open houses. The general purpose and format of the public meetings will be outlined in the technical memo documenting the overall outreach approach.

2.5 Community Surveys (2):
JLA will take the lead in developing relevant questions for (2) community surveys. The City will manage the posting of the questionnaire and compiling the results.

2.6 Community Engagement Assessment:
JLA will develop a summary of the data collected from open houses, and community surveys.

2.7 Parks Commission Presentation:
GW will attend and present the Concept Plan to the Parks Commission in-person.

Task 2 Deliverables: meeting agendas and summaries, public engagement plan, content for community surveys (2), stakeholder interviews, and open house plans; presentation boards for open houses, public engagement summaries, community survey summaries. PowerPoint and Printouts for Open Houses, and the Parks Commission, Presentations for public meetings shall be printed and delivered in PDF and source format.

TASK 3 SITE ANALYSIS AND PROGRAMMING

3.1 Compile and Review Background Info and Base Maps:
Site: The Design Team shall review the previous Plan and North Shore Frameworks and other relevant documents pertaining to the development of the project. All relevant material shall be provided by the City.

- Urban Design: Collect and review existing site information; review and assessment of North Shore Subarea Plan; Collaborate on the development of the team's existing conditions drawing; Record relevant site influences; opportunities and constraints. Assist GreenWorks with site analysis diagrams and narrative.
- Architecture:

(a) Field Tour and Document Pittock/Leadbetter House, Barn and Supplemental Farm Buildings north of the Leadbetter property. Photo documentation for photo essay of spaces for analysis.

(b) Gather records (plans, permits, reports) from historical archives and other sources.

(c) Develop Conditions list and report. Coordinate with PBS for environmental hazards reports pertaining to the structures.

- Environmental: PBS shall compile relevant environmental data for the design team's use.
- Economics: ECOnorthwest will collect relevant data and previously prepared relevant analyses to conduct an economic assessment of the study area to understand the existing market conditions of the area and seek a data-driven assessment of market potential to inform the demand potential of the Legacy Lands master plan. To the extent that non-parks uses will be desired and considered in relation to the Legacy Lands Master Plan, this collection may include a limited market scan of the area's residential and supportive commercial land uses to inform related programming. *This work may include participation in up to 2 discrete public engagement efforts.*
- Civil: PBS to compile relevant existing site and utility data for the design team's use, using available GIS and City-provided information to determine site constraints tied to utility and grading design.

3.2 Existing Conditions Map:
Prepare a base map with information collected from the city including GIS and LiDar. Identify physical features including topography, tree stands, mapped wetlands, floodplains, roads, buildings, and property lines.

3.3 Analysis:
Site: Prepare an opportunities and constraints diagram that defines the area of development and limitations based on physical and jurisdictional issues. A narrative will accompany the plan describing the development potential and impacts. Items included in the site analysis would be slopes, shade, natural features (collected visually and from GIS), drainage patterns, tree canopy, soils, vegetation, views, adjacent land use, transportation, noise impacts, and general character. Note: we do not have wildlife biologists or arborists or wetlands scientists scoped for this work but can provide a general overview of what we see as landscape architects and provide recommendations for further analysis if warranted by other disciplines. An Illustrative rendering of the Site Analysis will be prepared for public engagement.

- Urban Design: Collect and review existing site information; review and assessment of North Shore Subarea Plan; Collaborate on the development of the team's existing conditions drawing; Record relevant site influences; opportunities and constraints. Review and provide feedback on site analysis diagrams prepared by GreenWorks and narrative (narrative will be for report).
- Architecture:

(a) Provide Architectural site analysis, including building based uses that support exterior features.

(b) Provide building analysis plans and diagrams, outlining opportunities and constraints of existing buildings and interior spaces, including access, utilities, buffers and supports.

(c) Provide high level identification of barriers to accessibility (ADA). Identify key issues to overcome for public access and adaptive reuse.

- Environmental: PBS to compile relevant environmental data for the design team's use. Provide requirements for setback and mitigation to support one preferred site plan. No maps will be generated as part of this task.
- Economics: Using the data collected in Task 3.1, ECOnorthwest will summarize and analyze recent market trends for the relevant land uses. The analysis may include standard metrics including vacancy, rent escalation, deliveries and absorption, and may include a limited survey of comparable rental properties proximate to the study area. ECOnorthwest will utilize that market overview to summarize demand potential for desired uses, which may include existing market trends with a narrative of recent development trends and other demand drivers that will help provide an estimate of demand potential for a resulting land use program. This analysis does not include any financial feasibility or proformas which will be conducted in a future phase.
- Civil: Analysis of existing and possible future utilities through project area to support the preferred site plan. North Shore utility concept to be provided by City.

3.4 Design Team Meeting
The Design Team will meet in-person to report and discuss findings and review the site analysis.

Task 3 Deliverables: Site Analysis Diagram and Narrative. Materials used for public engagement shall be delivered in PDF and source format.

TASK 4 DESIGN ALTERNATIVES

4.1 Preliminary Concept Design Options:
GW will prepare two conceptual design options. The graphics will be plan illustrations to convey ideas visually with the City.

4.2 Conceptual Design Refinement:
GW will refine the conceptual design options based on the City's comments and prepare rendered plans for public engagement.

4.3 Design Team Meeting
The Design Team will meet in-person to review and advance design options in a work-shop format at GreenWorks.

Task 4 Deliverables: draft conceptual design refinements, refined concept design. Materials used for public engagement shall be delivered in PDF and source format.

TASK 5 FINAL CONCEPTUAL DESIGN

5.1 Preferred Concept Design:
GW will prepare a preferred concept based on feedback from the City and public.

- Urban Design: Assist in the development of preliminary conceptual design options. Develop urban design recommendations on how the adjacent urban development can influence the Camas Legacy Lands master plan (and vice versa), including circulation, connections, urban form, wayfinding, placemaking.

5.2 Final Concept Design:
GW will prepare a final concept design based on the City's comments. Illustrative renderings will be prepared for the City's website and City to utilize for presenting to City Council.

- Urban Design: Assist in the development of the final conceptual plan. Collaborate with the team to develop a final design approach that reflects community aspirations and aligns with city goals and objectives. Finalize urban design diagrams, vignettes, and illustratives.

5.3 Design Team Meeting
The Design Team will meet in-person to review and advance the draft Draft Concept Design at GreenWorks.

Task 5 Deliverables: draft and final conceptual design, cost estimate (hard and soft costs), phasing plan. Materials used for public engagement shall be delivered in PDF and source format.

TASK 6 Plan Development

6.1 Cost Estimate:
GW will prepare a draft and final cost estimate based on the elements in the final concept design. The draft will be for City review, and Final will be utilized for phasing strategies and incorporated into the Final Planning Report. Civil and Architectural will assist with providing rough order magnitude costs for infrastructure improvements and renovation improvements.

6.2 Phasing Plan:
GW will prepare a phasing plan based on costs and identified priorities for future construction. A plan and spreadsheet will be prepared to identify areas, elements, and costs for the phases of construction. GW shall prepare a draft phasing plan that will outline constructing phasing scenarios based on public and City program priorities and a funding forecast for an initial construction phase. The draft will be refined based on City feedback and incorporated into the Final Planning Report.

6.3 Draft 1 Planning Report:
GW will prepare a first draft report that includes the results of the master plan evaluation, concept design, and a cost estimate of the proposed improvements. The report will include a discussion of constructing phasing scenarios based on public and City program priorities and a funding forecast for an initial construction phase. The report will be submitted electronically for City review. The following disciplines will contribute written narrative to support their scope of work related to the

- Urban Design: Assist the team in developing the implementation plan and phasing approach. Peer review drafts of the master plan document and provide feedback through the final plan.
- Architecture:
  (a) Waterleaf will provide narrative and concept diagrams for adaptive reuse of the structures within the study area, supportive of the masterplan uses identified.
  (b) Waterleaf will support the work of other consultants in their incorporation of the structures into their disciplines.

- Economics: ECOnorthwest will prepare relevant narrative with supporting tabular and graphic elements to summarize our findings and recommendations conducted in this work plan. *Meetings will be limited to involvement in up to 2 public meetings, up to 8 PM meetings, and up to 2 design meetings.*
- Civil: Provide utility-related input for the report and cost estimate.

6.4 Draft 2 Planning Report:
GW will prepare a second draft of the Planning Report based on City comments.

6.5 Final Planning Report:
GW will update the Planning Report based on comments from City Staff and the Parks Commission.

Task 6 Deliverables: draft(s) and final planning report. Materials used for public engagement shall be delivered in PDF and source format.

Assumptions

1. Site topographic survey is not available for this phase of work. We will utilize Lidar topography, GIS, and aerial photography to conduct our work. If the publicly sourced data is not sufficient to carry out our scope, we can add surveying to our scope of work at an additional fee.
2. Excluded Services include Structural Engineering, Geotechnical Analysis, Wetland Delineations, Habitat Assessments, Archeology, and Arboriculture.
3. GreenWorks, P.C . shall render its services as expeditiously as is consistent with professional skill and care.

TERMS OF AGREEMENT

Fee Schedule
Professional fees for the scope of work are as follows:
Tasks 1 through 6..$166,652

This total fee of $166,652 includes reimbursables and will be billed based on the terms of the Master Agreement between GreenWorks and the City of Camas.

We are excited by this opportunity. If there are any questions or concerns about our scope of work, please do not hesitate to call.

Sincerely,

Ben Johnson, PLA
Principal
GreenWorks, P.C.
503-222-5612 | benj@greenworkspc.com