City Council Workshop Agenda
Monday, May 02, 2022, 4:30 PM
Council Chambers, 616 NE 4th Avenue

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

To Participate Remotely:
OPTION 1 – Video & Audio (*able to public comment*)
Use Zoom app and Meeting ID – 922 7765 4360; or click https://zoom.us/j/92277654360

OPTION 2 – Audio-only (*able to public comment*)
By phone: 877-853-5257, Meeting ID – 922 7765 4360

OPTION 3 – Observe video & audio (*no public comment*)
Go to www.cityofcamas.us/meetings and click "Watch Livestream" (left on page)

For Public Comment:
1. On Zoom app – click Raise Hand icon
2. On phone – hit *9 to "raise hand"
3. Or, email publiccomments@cityofcamas.us (400 word limit); routes to Council

If you have difficulty accessing the meeting, please call 360-817-7900 for assistance.

CALL TO ORDER

ROLL CALL

PUBLIC COMMENTS

WORKSHOP TOPICS

1. Clark County Commission on Aging
   Presenter: Jenna Kay and Susan Ellinger, Clark County Community Planning and Cass Freedland, Commission on Aging Member
   Time Estimate: 10 minutes

2. Local Government Approach to Public Art
   Presenter: Connie Urquhart, Library Director
   Time Estimate: 15 minutes

3. NE 2nd Avenue Street Improvements and NE Dallas Water Improvements Bids
   Presenter: James Carothers, Engineering Manager
   Time Estimate: 5 minutes

4. 2022 ADA Improvement Project Bids
   Presenter: James Carothers, Engineering Manager
   Time Estimate: 5 minutes

5. Prune Hill Pump Station Professional Services Agreement with Gray and Osborne, Inc.
   Presenter: Steve Wall, Public Works Director
   Estimated Time: 5 minutes

6. Lake Management Plan Water Quality Sampling Professional Services Agreement
   Presenter: Steve Wall, Public Works Director
   Time Estimate: 10 minutes

7. Parking Fine Discussion
   Presenter: Mitch Lackey, Chief of Police
   Time Estimate: 15 minutes

8. Staff Miscellaneous Updates
   Presenter: Jeff Swanson, Interim City Administrator
   Time Estimate: 10 minutes

COUNCIL COMMENTS AND REPORTS

PUBLIC COMMENTS

ADJOURNMENT

Staff Report

May 2, 2022 Council Regular Meeting

Clark County Commission on Aging
Presenter: Jenna Kay and Susan Ellinger, Clark County Community Planning and Cass Freedland, Commission on Aging Member
Time Estimate: 10 minutes

Phone	Email
360.817.7237	msutherland@cityofcamas.us

BACKGROUND: The Clark County Commission on Aging will present its annual report.

SUMMARY: The Clark County Commission on Aging is tasked with leading and managing the implementation of the Aging Readiness Plan and fostering community-wide awareness. The Annual Report summarizes the year 2021.

EQUITY CONSIDERATIONS:

What are the desired results and outcomes for this agenda item? Informational

What's the data? What does the data tell us? n/a

How have communities been engaged? Are there opportunities to expand engagement? n/a

Who will benefit from, or be burdened by this agenda item? n/a

What are the strategies to mitigate any unintended consequences? n/a

Does this agenda item have a differential impact on underserved populations, people living with disabilities, and/or communities of color? Please provide available data to illustrate this impact. n/a

Will this agenda item improve ADA accessibilities for people with disabilities? n/a

What potential hurdles exists in implementing this proposal (include both operational and political)? n/a

How will you ensure accountabilities, communicate, and evaluate results? n/a

How does this item support a comprehensive plan goal, policy or other adopted resolution? The item provides information on aging in the community which aligns with the City's Comprehensive Plan.

BUDGET IMPACT: Informational presentation will not have a direct impact on the budget.

RECOMMENDATION: Information only.

CLARK COUNTY
COMMISSION on AGING

2021 ANNUAL REPORT

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FROM THE CHAIR

DEAR COMMUNITY MEMBERS, Thank you for helping make this year's focus on the road to recovery from COVID-19 a success. Your attendance, questions and comments at our public meetings were invaluable. Your passion and commitment to finding solutions that make Clark County more age-friendly have been crucial elements of our process.

We took what we learned from you and our speakers during our virtual "fireside chats" and developed the findings and recommendations in this report and will present it to the Clark County Council, city councils and the community at large. We hope these recommendations will help our community leaders within Clark County make informed, aging-friendly decisions about creating and maintaining more prepared and resilient communities.

Our report details our year-long focus on the road to recovery from COVID-19. We thank our speakers and look forward to continuing our partnerships.

Looking ahead, we remain steadfast in our charge to educate, raise awareness and advocate through focus areas outlined in the Aging Readiness Plan: community engagement, supportive services, healthy communities, housing and transportation. Surveys across the country show that more than 85 percent of older adults prefer to remain in their home or community as they age, and these focus areas are crucial to ensure that desire is within reach for each of us.

Next year's focus will be on innovation through connection, which ties to the community engagement chapter in the Aging Readiness Plan. Our goal for 2022 is to identify opportunities for creative solutions to address gaps in connecting with one another and to resources. We will also be embarking on the first update to the Aging Readiness Plan since its adoption ten years ago, including the addition of an Emergency Preparedness chapter in light of the COVID-19 pandemic.

We are grateful to Clark County for creating the Commission on Aging in 2012 as a forum to address important issues. Our goal then and now is to achieve an "all-age friendly, livable community." We continue to count on you to reach that goal.

Thank you,

Chuck Green, Chair
Commission on Aging

WHO WE ARE

AGING READINESS PLAN

In 2010, knowing more than 10,000 people nationwide turn 65 each day, the then-Board of County Commissioners appointed a 24-member panel to assess the county's capacity to serve its older residents. The Aging Readiness Task Force developed the Aging Readiness Plan, which identified five focus areas: housing, transportation, supportive services, healthy communities and community engagement. The plan includes perspectives about how to effectively cultivate and protect what residents say they want most – the ability to age in the home and community where they live.

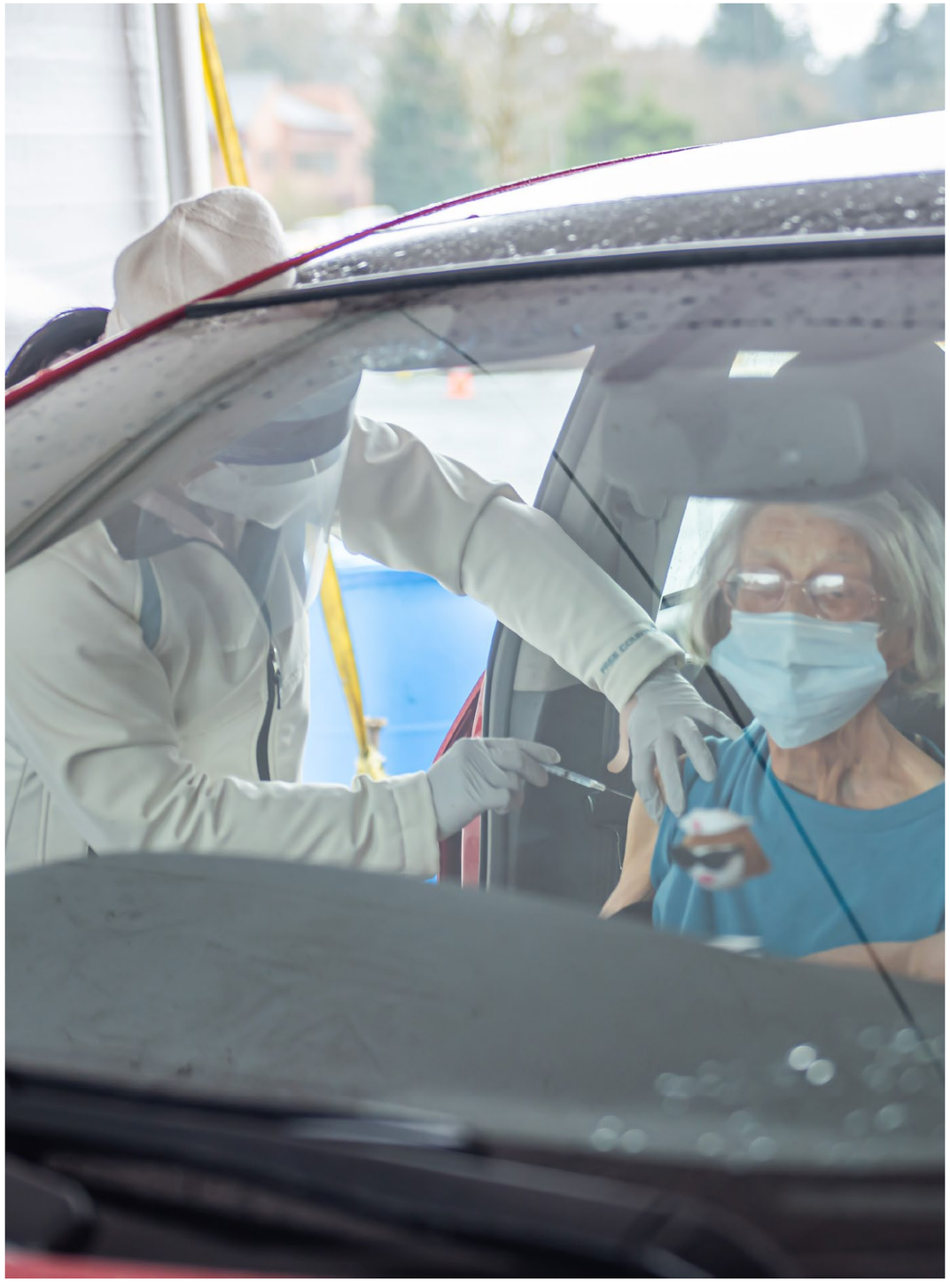
COMMISSION ON AGING

The Commission on Aging was established on May 20, 2012, and is tasked with leading and managing the implementation of the Aging Readiness Plan and fostering county-wide awareness, dialogue and insight into challenges and opportunities for residents of all ages, incomes and abilities. The commission is supported by volunteer members appointed by the Clark County Council. Commission members provide leadership, education, advocacy and community awareness and serve as community ambassadors.

2021 Members

Nancy Dong
Cass Freedland
Chuck Green, Chair
Amy Gross
Franklin Johnson, Vice-Chair
Meghan McCarthy
Linda O'Leary
Larry Smith
Tanya Stewart
Pamela Wheeler

Commission on Aging Mission As community ambassadors, the Commission on Aging provides leadership, advocacy, community awareness and partnerships to initiate change toward an all-age-friendly, livable community.



2021 FOCUS ON ROAD TO RECOVERY FROM COVID-19

The Commission on Aging dedicated its ninth year to the topic of the road to recovery from COVID-19. At each meeting, experts provided insights on a specific aspect of what we can learn from the COVID-19 pandemic, especially related to older adults, to better cope with the current situation and to make sure our community is better prepared for a future large-scale or global emergency. These discussions were targeted to:

- educate commission members and the public;
- direct questions to the expert to gain further information;
- seek comments and questions from the public;
- share information and highlight community resources; and
- identify ways to shape policy or advocate for change.

The commission will conclude its 2021 focus on the road to recovery from COVID-19 by holding a joint meeting with the Clark County Council on Wednesday, Feb. 16, 2022, and sharing its major findings and recommendations.

SPEAKER HIGHLIGHTS

Guest speakers conversed with commission members and the public in virtual "fireside chats." This section provides excerpts from those conversations.

We hope these selections provide a glimpse into what the commission heard and learned during 2021. These conversations were critical to informing the commission's major findings and recommendations, presented later in the report.

ROAD TO RECOVERY KICK-OFF

PRESENTERS
Dr. Melissa Cannon
Western Oregon University

Neil Degerstedt
Long Term Care Ombudsman Program
Area Agency on Aging and Disabilities of Southwest Washington

The social aspect needs to be addressed; the sooner the better. This goes for long-term care residents and seniors in general. We need to try and have safe distancing and making certain that people coming in have been vaccinated. We need to do it in a safe way. People seem to be responding to at least keeping their distance and, if they have a cough or sniffle, to wear a mask. That will be a part of our life for short- and long-term; people will wear masks to a greater extent, especially during outbreaks of the flu, etc. Would love to see people back together, able to give hugs, but has to be done in a safe way.

We will be dealing with a lot of traumatized [long-term care] residents. How can we best serve them and best connect them with the best support systems? Hoping once visitation is allowed again and resident rights are restored to the level prior to the pandemic, that's when the work really begins for us. I know this past year [2020] involved a lot of grief, sorrow, and pain. Next year [2021], I'm looking at it as a year of healing and looking forward to helping people. – Neil Degerstedt

Recovery is going to look different for everyone. Some people never felt that affected and already feel like we're recovered. Others are not going to see a return to normal for a really long time. – Dr. Melissa Cannon

We have a lot of work to do. We really need to stop the spread of misinformation, depoliticize these issues, and invest in science. There are lots of good lessons learned to carry forward and do better next time. – Dr. Melissa Cannon

The Red Cross responds to approximately eight calls per month for families displaced by a fire. In nine out of ten cases, the family doesn't have a preparedness kit ready.
– Victor Magana

FIRST AND EARLY RESPONDERS

PRESENTERS
MaryJane Rose and Victor Magana
American Red Cross, Cascades Region

Chief Robert Milano
Emergency Medical Services
City of Vancouver

On calls, we run into seniors who may no longer be able to care for themselves. The only option the fire department currently has is protective services through the state. There can be a range in time in how quickly the state is able to respond. When people are in crisis, the last thing they need to do is wait for help. The fire department is looking at a way to build out some sort of live portal to point seniors to other levels of services in the county. They could then share that information with people while they are in crisis.

We are working on a fall and slip program. This is the most common type of call we receive. We want to advocate for ways to alleviate some of those risks.

Q: What is on your wish list?
A: *An employee position who could do the follow-up with our high-risk communities who use 911 a lot. This person could find different avenues for these customers other than 911. This person could also help with different community involvement opportunities too.* – Chief Robert Milano

For older adults, there is a huge need in making sure people know who their point of contact is for medical devices, equipment…and how long they can sustain certain items when not at home, and a plan to work within those needs. In an emergency, it may take a while to get those services. This was a huge challenge with us with COVID-19 and displacement from fires. – Victor Magana

Being prepared in advance and having things like a list of medications, physicians, a go-bag ready to go…with copies of medical cards, phone numbers of physicians... It's very helpful to a first responder and to the Red Cross in the event of opening a shelter…With the fires this past year, we could have saved a lot of time in tracking down that information with individuals. We advocate for a two-week ready kit and to have all of that information in the kit. – MaryJane Rose

RESOURCES

Community Emergency Response Teams (CERT)
www.certclarkcountywa.com/

MapMyNeighborhood
mil.wa.gov/map-your-neighborhood

Ready kit checklist
www.redcross.org/content/dam/redcross/get-help/pdfs/brcr_checklist/EN_Be-Red-Cross-Ready-Factsheet.pdf

We need to recognize the importance of support for individuals providing the care. There's a saying 'whole persons caring for whole persons,' meaning, full care for patients and those providing the care. – Dr. Gregg VandeKieft

hush-naidoo-jade

SERIOUS ILLNESS AND CAREGIVER SUPPORT

PRESENTERS

Peggy Maguire
Cambia Health Foundation

Gregg VandeKieft, M.D.
Providence Institute of Human Caring and
Providence St. Peter Hospital

Palliative care is specialized medical care for people living with serious illness. This type of care is focused on providing relief from the symptoms and stress of the illness. The goal is to improve quality of life for both the patient and the family. (https://www.capc.org/)

The biggest lesson for me was the exposure of many disparities, gaps and inequities that existed prior to COVID-19 in our health system. We're not all in the same boat. For the underserved populations, people traditionally on the outside of our health system, multiple studies showed communities of color were disproportionately impacted by the pandemic and were more at risk of getting infected and dying from the disease. Exposure and access to care were impacted. Underlying conditions put people at higher risk. COVID-19 has really taught us how the social determinants of health impact lives.

Some hospitals were overwhelmed during the winter surge. Palliative care doctors were unprepared for this, and these are specialists who are used to talking about serious illness and dying. Caregiver (in this instance, healthcare workers) burnout is profound. This applies to family caregivers too.

One of the silver linings of the pandemic is the increased access to telehealth service. In serious illness care, think about people wanting to be at home and how hard it can be to get into an office setting for a check-in. It can be more convenient if you can check-in with your palliative care team by video conference. Expansion of telehealth during the pandemic is really good for consumers and the healthcare system. We think it's here to stay–hope it's here to stay. Telehealth won't replace a face-to-face visit, but it can be part of the whole recipe. – Dr. Gregg VandeKieft

One area funded through the Cambia Foundation was development of a series of communication tools that helped clinicians engage in conversations that are typically palliative care specialist specific training. Some tools and techniques from the palliative care field were made accessible to a broader swath of the workforce, such as talking maps to help people address and screen serious illness and COVID-19.

Make it easy to engage in difficult and important conversations about what matters to people in shaping their healthcare. For example, make it easy to: name a healthcare proxy, identify what matters to you, and have what matters to you honored and respected in the healthcare system. -Peggy Maguire

RESOURCES

Center to Advance Palliative Care (CAPC)
https://www.capc.org

End-of-Life Nursing Education Consortium
www.aacnnursing.org/ELNEC

Project ECHO
hsc.unm.edu/echo

ARCHANGELS – LOOK, LOVE, LIFT
we-are-archangels.squarespace.com/look-love-lift

Moms Meals
www.momsmeals.com

Papa Pals
www.papa.com

Isolation creates even bigger problems. We can provide the most nutritious food and if people are isolated in their homes, they are not going to thrive. We are trying to combine good nutrition and human connection to enable them to deal with their changes and stay healthy as long as possible. That has been really important during the pandemic. -Suzanne Washington

FOOD AS MEDICINE

PRESENTERS

Neil Barnard, M.D.
Physicians Committee for Responsible Medicine

Suzanne Washington
Meals on Wheels People

I would shift our dietary input away from animal products and towards plants. If we did that well, our health would revolutionize to a great extent. -Dr. Neil Barnard

For the people we are serving, many, if not most, are down the path of having mobility changes, physical changes, mental health changes, losing friends, etc. For us, providing nutritious food is important for people who already have chronic conditions or who don't have money or the ability to cook food.

Isolation creates even bigger problems. We can provide the most nutritious food and if people are isolated in their homes, they are not going to thrive. We are trying to combine good nutrition and human connection to enable them to deal with their changes and stay healthy as long as possible. That has been really important during the pandemic.

As we age, how we taste things changes. Our body tricks us into thinking we're full when we're not or that we can eat sugar because we are going to die anyway. We need to eat healthier, even if we don't feel like it, all along the way. -Suzanne Washington

Currently, procedures pay better than guidance. In our clinic, we would get paid more if we amputated diabetics' feet than guiding them on lifestyle changes. Surgeons nowadays make $500,000 to $1 million a year. Primary care doctors make a fraction of that and practices that employ them lose money and are getting swallowed up by huge hospital conglomerates. We need to stop paying so much for procedures and pay more for dietetic care. We need people to understand the key things that effect our health, i.e., heart disease and diabetes can be treated and are reversible, medical schools need to teach this information, and hospitals need to model it, like what happened with smoking. We need to help people get over their natural nervousness of quitting eating unhealthy foods. -Dr. Neil Barnard

We are constantly working with our federal partners to understand how important nutrition is. We need more funding just for nutrition. We also need more funding for medically tailored meals. We are working with local hospitals on programs for prevention and transition out of the hospital, to provide people with healthy food before they enter or come out of the hospital. We are in a research project with Kaiser where they are tracking the benefits on the financial side as well as the savings if you feed someone for 90-days after leaving the hospital, will it reduce the likelihood of being readmitted? The Food as Medicine coalition is doing research across the country on things like this and advocates for more money up front for fewer procedures later. -Suzanne Washington

They [patients] come in not because they want to change, but because they want their diabetes, for instance, to get better. I take about two minutes to describe how foods play a role in diabetes.... In the case of diabetes for example, I'll take an 8.5 x 11 piece of paper and draw an oval on the piece of paper. I explain: 'This is a muscle cell in your body and it's driven by glucose. In your body the glucose isn't getting into your cells, that's called insulin resistance. Why is that? You can't see this, but if I looked inside your cells with a magnetic resonance scanner, I would find that you are filled with fat particles. Where did those come from? The salmon, chicken, cheese, etc. that you ate. If I stop eating those things, will my diabetes get better? Well, let's see.' Then they and their reluctant spouse spend one-hour with a dietician. You don't have to confront their skepticism. They should be skeptical. The dietician draws up a menu, very soon they get results and feel better. It's important to explain how the foods work in their body and then just try it. You have to make a powerful diet so they will get better fast. That's what can make people believers. – Dr. Neil Barnard

RESOURCES

Food is Medicine Coalition
fimcoalition.org

Physicians Committee for Responsible Medicine
PCRM.org

The pathway I see is three parts: 1) we need a screening protocol to collect info and ask questions; 2) we need a resource directory; 3) we need a way the clinics or social service organizations can create a pathway to use the resource and close the loop with people to get the services. The above may sound easy, but it's not.

– Judy Zerzan-Thul

SOCIAL DETERMINANTS OF HEALTH

PRESENTERS
Judy Zerzan-Thul
Washington State Health Care Authority

Gillian Feldmeth
NowPow

The Commission's guests explained that social determinants of health are the conditions in which people are born, grow, work and age. The terminology is currently changing from "social determinants of health" to "health-related social needs." Homelessness, employment, food, transportation, and criminal justice are all examples. You could also include race/ethnicity, income level or, whether you have a car, high school diploma, etc. Health-related social needs change over time depending on life stage.

They further explained that there is often an assumption that a social determinant of health (SDH) is a negative thing, but there can be positive SDH as well. Having a job can lead to improved health outcomes. Oftentimes in the communities they work with, taking the asset-based approach can be helpful when working with individual community members. In terms of life ages and stages, the idea that, and COVID exposed this, any of us at any point in time could enter a scenario where something that wasn't an issue before could become an issue. It's important to understand that as we age and circumstances change, the SDH are quite dynamic.

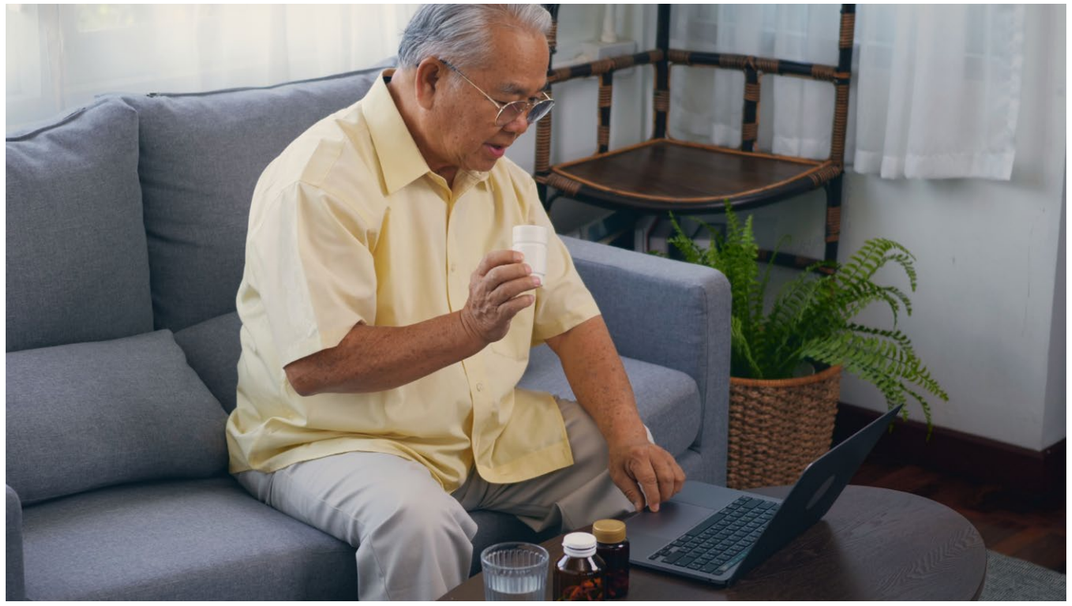
NowPow is a health technology company. *We provide people with the knowledge of resources in their community that may help address identified needs. Many of our partners, which involve health systems, community-based organizations, health departments, etc. use our tech to systematically assess need at the individual level by asking the individual if they are experiencing any challenges. The questions may differ depending on who we are working with. We put a large emphasis on engaging the individual on understanding what their priorities are. Community partners are asking their clients questions and then asking if they want support with that need. Putting the patient first can lead to improved outcomes. – Gillian Feldmeth*

The magic starts to happen when you connect the person in front of you and some of these tools to help figure that out. If we ask things in aligned ways, as we move across communities and organizations, we will all know what we're asking and can better connect people. For example, at the Health Care Authority (HCA), we have five different ways to ask about race and ethnicity. You can't connect the categories because we are asking slightly different questions. The data isn't as helpful when it isn't aligned. We need to figure out on a community level how do we make sure we're asking the same question, so people don't feel like they're getting asked the same question repeatedly, and how we can translate the information across providers. We can't share data if things don't match.

We have been thinking about social risk adjustment. Many times, in healthcare systems, things are risk adjusted and identify where there are people at higher risk for higher utilization. There is interesting work that some algorithms might have some racial bias and further disadvantage people. Social risk adjustment is about: how do you make sure you are not putting bias into your equation? North Carolina has a nice model where they pay more for primary care providers in high poverty areas. Providers ask questions and connect patients to resources and adequately reimburse people with enough money in system to connect people to resources.

The rural healthcare system was set up in the '60s and is hospital focused. It's not set up for in-home support or primary care. There isn't always internet structure for in-home communication. How can we do better with things like telemedicine in rural areas? – Judy Zerzan-Thul

Regarding social isolation, at NowPow we often get individuals asking us to add certain types of resources to the directory. In the pandemic, we saw requests around social connection. We saw hotlines or community-based organizations add calling clients to their service offerings to address this need. It was interesting to see in our data, where frontline social workers and community health workers were explicitly asking or sensing need to further support folks feeling isolated. That's always an interesting space for us to be in. The community organizations are doing this work. Tech can complement it and a community-based organization should use the best available tech and shouldn't have to rely on outdated methods to track things. This is like how health systems are investing in digital technology." – Gillian Feldmeth



RESOURCES

Social Intervention Research and Evaluation Network (SIREN)
sirenetwork.ucsf.edu

Accountable Community of Health for Southwest Washington (SWACH)
southwestach.org

Healthier Washington
wsha.org/our-members/projects/healthier-washington

NowPow
www.nowpow.com

The biggest barrier is the disconnect between incomes and cost of housing. The delta keeps growing.

– Andy Silver

HOUSING AND HOMELESSNESS

PRESENTERS
Andy Silver
Vancouver Housing Authority

Tim Zaricznyj
Providence Supportive Housing

Jonathan Kumar
Samaritan

People have worked and saved, but a fixed income doesn't keep up with escalated costs of housing. They downsize and it's still not enough. – Tim Zaricznyj

People with fixed incomes may include older adults and people with disabilities. It also includes people who work in sectors like the service industry or retail that are not paying wages for people to afford housing.

With older adults, the demand for affordable housing has skyrocketed as the cost of housing has separated from what most peoples' fixed incomes are. – Andy Silver

Anyone on a fixed income living in a community with increased cost of living is at risk for homelessness and experiencing housing insecurity. Someone is considered housing insecure if they are paying more than 50% of their income to housing.

Samaritan is a support platform for people experiencing homelessness. Human service providers and health systems use Samaritan to engage with Samaritan members to address vital needs. The first Samaritan member spent three years living

on the street, uses a wheelchair and was not accessing social services on a consistent basis because there were a lot of barriers. A nonprofit reached out to him and gave him a Samaritan membership. He got a beacon to store critical documents. He set goals. Samaritan and the supporting nonprofit surrounded him with a team of supporters and community volunteers who could send words of encouragement and could send cash. He was able to get some basic needs met, i.e., food and clothing. Samaritan provides bonuses for achieving action steps toward your goals. He connected with a housing navigator on a monthly basis, and, within six or seven months moved into an apartment. After getting housing, he got a lot healthier.

There are a lot of invisible barriers that were keeping this person from housing.

I think we would all wish that every single person had a stable home. I think we can get there. It's a matter of building the right type of affordable homes and providing a social home to people. In terms of causes of homelessness, people often don't have a friend or family network to keep them afloat when a tragedy or decision happens. Even with the pervasiveness of homelessness, the numbers are in our favor. If we all do small acts of kindness, commit to being a neighbor and not a stranger, take ownership and treat people who are homeless as if they were one of our family members, then this problem goes away. – Jonathan Kumar

RESOURCES

Providence Supportive Housing:
www.providence.org/supportive-housing

Vancouver Housing Authority (VHA)
vhausa.org

Council for the Homeless
www.councilforthehomeless.org

Samaritan
www.samaritan.city

PERSONAL ECONOMICS/ FINANCIAL RECOVERY

PRESENTERS

Scott Bailey
Washington State Employment Security Department

Gary Beagle
Intrustment Northwest

A Pew Research Center study of adults' financial situation in January 2021 compared to one-year prior showed that 30% of adults surveyed said they were better off financially than the year before, 21% said they were worse, and the rest said they were the same.

There were budget changes for households, such as a decrease in spending on entertainment, food, etc., which created an increase in savings. – Gary Beagle

The biggest economic issue is the eviction issue. We've seen a steady increase in houselessness in the country and locally. Even before the recession, almost half of rental households were characterized as income distressed. It doesn't take much to nudge folks off the edge in those situations when something happens that requires money (i.e., a medical procedure, etc.)

Good news in Clark County is that we have been recovering faster than the state/nation. As of August, we were only .6% employment below where we were in Feb. 2020 when COVID kicked in. We are looking ahead to see what extent remote work continues. We are seeing an interesting push/pull on employers wanting employees back and employees not wanting to come back. In addition, it will be interesting to see how the great refusal of not wanting to go back to a job that was not fulfilling and how that will impact working conditions going forward. Some employers are offering hiring bonuses or bigger wages, which helps some, but not all of it. Supply constraints is another issue. The immediate cause was COVID, but if you peel back the immediate cause, you see more issues. Supply chains are very fragile, and one break in the link can cause serious problems. – Scott Bailey

We need to figure out how to support people in the lower income groups going forward because stimulus funding was helpful to meet their needs, such as Medicaid clients receiving funding through CARES Act to get medical supplies/needs taken care of (dental/vision/hearing aids). Medicare does not cover much dental/vision.

We need to work with state legislators to get more money for individuals in supportive services to meet basic needs.

We have seen households spending down their savings to become eligible for Medicaid. We have seen some long-term care facilities cost $8,000/month. This new program [WA long term care program] will save the state money under Medicaid dollars because it means households may not need to shift over to Medicaid and use up their savings, it allows younger individuals to talk about savings, it provides alternative options to long-term care facilities (i.e., money could be spent on home care). It will have a lot of benefits. – Gary Beagle

RESOURCES

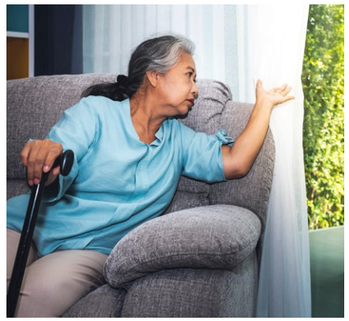
Statewide Health Insurance Benefits Advisors (SHIBA)
www.insurance.wa.gov about-shiba-services

Consumer Financial Protection Bureau
www.consumerfinance.gov/coronavirus

The FDIC's Money Smart for Older Adults
www.fdic.gov/resources/consumers/money-smart/teach-money-smart/money-smart-for-older-adults

Administration for Community Living
acl.gov/

Washington Long-term Care Program
wacaresfund.wa.gov



COMMISSION FINDINGS AND RECOMMENDATIONS

Recovery from the COVID-19 pandemic is going to look different for everyone. Our future will never be the same. For some people, they never felt affected by the virus and already feel like our community has recovered. For others, they may not feel a "return to normal" for a very long time. It is likely that many changes due to the pandemic will continue and that "normal" may look different moving forward. In our focus this year, we listened for findings and recommendations on what a more resilient Clark County might look like for older adults and other vulnerable community members, to aid in recovery from the current pandemic and to better prepare our community for a future emergency.

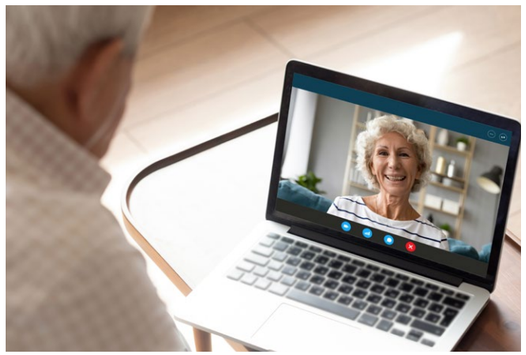
We all know Clark County has resilient people. Our findings and recommendations this year highlight ways to build on that resiliency, to create a more connected, prepared, and healthy community.

Community engagement

Findings

From the closure of senior centers to the inability of families to visit loved ones in long-term care facilities, phone and video calls helped those who can use the technology, but could not replace in-person human connection, social contact and interaction. Prior to the pandemic, research showed one of the strongest indicators of someone's ability to cope and be resilient is their social contacts. (Clark County Commission on Aging, March 17, 2021). Local organizations created new programs because the need for personal connection was so apparent. For example, Meals on Wheels People created a Friendly Chat program where 600 of their clients opted into the program and 300 volunteers made calls to have a chat with an older adult. Meals on Wheels People also had trained volunteers to conduct Wellness Check calls, focused on identifying anything their clients might need and offering to connect them to resources.

Healthcare and social service providers have found that texting technology has been helpful to reach some people who do not have a computer but may have a cell phone. (Clark County Commission on Aging, August 18, 2021). Written communication became increasingly important without in-person options. In Polk County, Ore. for example, the community health faculty at Western Oregon University developed a monthly newsletter tailored for the older population. When an emergency occurs in the future, methods such as this, which don't rely on phones or computers, may be used to communicate with older adults. (Clark County Commission on Aging presentation, March 17, 2021).



Another challenge during the pandemic has been the drop-off in the number of volunteers for many organizations and the challenge of not having enough volunteers to help provide community services. Many community volunteers are older adults who stopped volunteering due to safety concerns during the pandemic. (Clark County Commission on Aging presentation, March 17, 2021).

Recommendations

- The Commission on Aging, Area Agency on Aging & Disabilities of Southwest Washington (AAADSW), Clark County businesses, and community service providers who work with older adults should incor porate lessons learned from communities that have done a good job reaching older adults during the pandemic. The Commission on Aging would like to team with AAADSW to share and distribute these best practices.
- Local service providers should continue their outreach efforts to establish connections and build relationships with older adults. New or expanded older adult connection programs, that reach community members who are still isolated, are also needed.
- Local Clark County service providers should continue to be creative in the ways they recruit volunteers and ensure the use of volunteers' skills in ways that are safe.

Supportive services

Findings

Caregivers. Caregiving has a significant impact on the health of the caregiver as well as the patient with the original diagnosis. A 2020 report showed 83% of caregivers surveyed were under increased stress since the start of the pandemic (Rosalynn Carter Institute for Caregiving, 2020). Forty-two percent of caregivers surveyed said the support they normally received from their community had declined. A Centers for Disease Control and Prevention report in 2020 notes many caregivers have contemplated suicide and experienced an increase in other chronic behavioral health conditions (Czeisler MÉ, Lane RI, Petrosky E, et al., 2020). Hospitals and long-term care facilities are also experiencing a high rate of staff turnover. The healthcare profession is expecting to be challenged to maintain its workforce moving forward, and, at the same time, is anticipating a surge in nursing and medical school interest from young people. (American

Nursing Association, 2021; U.S. Bureau of Labor Statistics, 2021; Berlin, G., Lapointe M., and Murphy M., 2021).

Connections to resources. The pandemic highlighted gaps in being able to connect people to the resources they need. There is a need to ask questions to collect information and identify needs. Having good resource directories, pathways to use the resources and connecting people with services is critical. Efforts to connect organizations and individuals to local resources are underway both locally and nationally. However, there are still many gaps in Clark County between service providers and community members who need services. The following are a few examples of efforts that are underway.

- Southwest Washington Accountable Communities for Health (SWACH) is the regional organization that convenes community leaders to prioritize and solve regional health issues. SWACH includes bidirectional interconnection of care: mental and physical health needs; community-based care coordination; opioid use; chronic disease prevention and control. They convene tribes, hospitals and providers, community, and social service organizations. They have been working since 2016 to address issues such as connecting people to services to improve health outcomes.
- A closed-loop referral platform is a tool that supports social service or healthcare professionals in sending client or patient information to a community-based organization to help address a patient's needs outside of a clinical setting. Closed loop referral platforms that enhance social and medical care coordination are growing and helping connect people to services. Tech companies such as NowPow and Samaritan, while very different in mission, are both trying to connect people with resources. One organization is focused on connecting healthcare providers and patients with community resources and the other is connecting social service providers and people who are experiencing houselessness with resources.
- Valuable community resource centers already exist in our communities, such as school family resource centers, churches, etc. The commission heard stories of resources being provided through these existing community nodes, such as a grandparent getting needed resources through the family resource center at their grandchild's school.

- Approximately 75-80% of local fire and rescue calls are for medical emergencies. Local emergency response providers are looking for alternative models to better support high system utilizers who call 911 frequently, some of which are older adults who can no longer care for themselves. Clark County Fire and Rescue (CCFR) is participating in a pilot program funded by SWACH. The program is called Community Assistance Referral Education Services (CARES). The CCFR CARES program is an innovative mobile integrated healthcare response to improve population health and enhance the patient experience and life situation. Participants are identified by CCFR crews and health system/hospital partners. Program staff provide connection to services, education, effective use of resources, and advocacy and follow-up services for patients and health system/hospital partners. A CCFR social worker and paramedic make up the CCFR CARES team and SWACH serves as the regional hub of community care coordination infrastructure and closed loop referral system. So far, one and a half years into the pilot program, there is approximately an 80% reduction in 911 usage of the people who participated in the program.

Recommendations

- More than ever before it is critically important to support our caregivers. We all need to practice acts of kindness and support to family and professional caregivers. Employers should review their Human Resource policies and identify ways to better support caregivers. This applies to the healthcare sector with professional caregivers as well as all sectors of family caregiving. Examples of recommendations are provided in the Sept. 22, 2021, Recognize, Assist, Include, Support, & Engage (RAISE) Family Caregivers Act Initial Report to Congress.
- Local fire and rescue departments and health service providers should evaluate and learn from the Clark County Fire & Rescue – SWACH pilot program, fall and environmental risk reduction program, and other creative innovative care response models, to develop a long-term sustainably funded model.
- The Commission on Aging should learn more about the Clark County Fire & Rescue CARES program in 2022.
- Local healthcare and service providers can research projects in other communities where closed-loop referral networks are already being used, such as the recent partnership between Long Beach, Calif. and UniteUs. Service providers can learn from these examples.

- Healthcare providers in Clark County can use closed-loop referral platforms for enhanced social and medical care coordination, assisting staff to connect their patients with local services. Community organizations can provide their information to these platforms, so that their services are listed and easy to find.

Healthy communities

Findings

For our older population, various chronic diseases and medications increased their risk of COVID-19 complications. The current healthcare system incentivizes, by paying more for, procedures like surgery, than for doctors to provide diet and lifestyle care to their patients. However, if we eat healthy food and maintain an active lifestyle, we are less likely to experience severe chronic conditions as we age and may be more resilient to certain types of health pandemics complicated by existing conditions. (Clark County Commission on Aging presentation, July 21, 2021).

For every issue the Commission discussed and heard about this year, available data shows that by race, African Americans, Latinos, Native Americans, and Pacific Islanders are more negatively impacted. This is characterized by reduced resources, information distribution and health outcomes. (Clark County Commission on Aging presentation, October 2021; U.S. Government Accountability Office, 2021; Lopez et al., 2021; Centers for Disease Control and Prevention, 2021).

The Commission also found that community members who are donating food or funds to help address local food insecurity challenges could be worsening existing health challenges. There can be a disconnect, for example, with those who donate food and their fellow community members who are in need of food, where the foods that are donated are not healthy, further exacerbating health disparities. (Clark County Commission on Aging presentation, July 21, 2021; Cooksey Stowers et al., 2020).

Recommendations

- Clark County and its cities need to build relationships and trust with community members who have traditionally been underserved and are most vulnerable to health impacts, such as communities of color. County and city officials need to have conversations to listen and learn from these community-members, and then act to address community needs.
- Clark County schools and workplaces can promote healthy eating and lifestyle options for students and employees, respectively. Increased funding for school meals would be essential to support change in schools. Workplaces offering flexible schedules to promote work/life balance would also complement any healthy eating and lifestyle initiatives.
- Local hospitals should implement and elevate the American Medical Association (AMA) healthy hospital food guidelines in their food service.
- Explore opportunities to dialogue with people who donate food about health equity and its relationship to what is donated.
- Current programs that provide healthy foods to those in need should continue to be supported. In addition, the opportunity to support the creation of new partnerships in these efforts should be explored.

Housing

Findings

The pandemic had a significant effect on housing across the county. Even before the pandemic, almost half of rental households were characterized as cost burdened and nearly 30 percent were severely cost burdened (Harvard Joint Center for Housing Studies, 2021). The U.S. Department of Housing and Urban Development (HUD) defines cost-burdened families as those "who pay more than 30 percent of their income for housing" and "may have difficulty affording necessities such as food, clothing, transportation, and medical care." Severe rent burden is defined as paying more than 50 percent of one's income on rent. (U.S. Department of Housing and Urban Development, 2021). In the Clark County area, 12 to 15 percent of renters were estimated to be behind on their rental payments mid-year 2021, (Harvard Joint Center for Housing Studies, 2021). When you do not have a home, it creates barriers to dealing with anything else. The biggest challenge is the disconnect between incomes and cost of housing, with the Portland-Clark County area having the fifteenth highest home price-to-income ratio in the country. (Jones, 2021). This impacts people with fixed incomes such as some older adults and people with disabilities. (Vancouver Housing Authority, 2021). It also includes people who work in sectors like the service industry or retail that are not paying wages for people to afford housing. (National Low Income Housing Coalition, 2021).

Recommendations

- For healthcare systems that build housing to address the linkages between housing and health, focus on high utilizers of the healthcare system, such as older adults with multiple conditions. Explore creative housing models that combine independent living options with healthcare needs. (Example: Providence Supportive Housing has tested multiple models.)

- County and city councils can continue to create policy and adopt development code to remove barriers for non-profits, housing authorities and mission-driven housing developers to build housing that is affordable to people who are priced out of market-rate housing. One example of a barrier that could be removed is to allow regulated affordable housing and housing with permanent supportive services to be built in commercial zones in urban areas.

Emergency preparedness

Findings

We have been challenged to think about essentials during this public health pandemic. In emergency situations, it may be several days or more until needed help is available. Being prepared in advance includes having things like a list of medications, list of physicians, a go-bag ready with copies of medical cards, phone numbers and other critical information. The American Red Cross advocates for every person/household to have a two-week ready kit. American Red Cross staff estimate that 9 out of 10 families who they assist do not have a preparedness kit ready.

Recommendations

- Neighborhood Associations should contact CRESA for emergency preparedness presentations. The form to request a presentation is available at cresa911.org/contact.
- Community members should learn more about emergency preparedness to be able to better take care of themselves and their fellow community members during an emergency. There are several existing volunteer neighbor-helping-neighbor-type programs, that can help when professional disaster response may not be available yet. Community Emergency Response Teams (CERT) trainings, Search and Rescue Teams, Map My Neighborhood/Be 2-weeks Ready programs, etc. are just a few examples of existing programs or resources available to community members. Learn more at cresa911.org.
- The Clark County Council approved the Commission on Aging's request to add an Emergency Preparedness chapter to the Aging Readiness Plan. The Commission should begin this work in 2022.

SILVER CITIZEN AWARD

CAROL STARBUCK

Clark County recognizes that older adults are valuable contributors to the vitality of this community. To encourage and support older adults for their contributions to their communities, the Clark County Commission on Aging established the Silver Citizen Award program to recognize older adults who go above and beyond in service.
The recipient of the commission's second annual Silver Citizen Award is Carol Starbuck. Ms. Starbuck is 77 years old, is a resident of Camas, and has served as a volunteer with the Trauma Intervention Program Northwest, also known as TIP. TIP volunteers are called to emergency scenes and homes to provide immediate emotional and practical support to victims and their families when something bad or traumatic has happened. Carol has been a volunteer with TIP for 25 years.

Carol is a vibrant, funny, and level-headed person who is unafraid to march into tragedy, help those who have suffered a great loss, and assist them in finding their balance. As a TIP volunteer, Carol may be requested 24/7 and 365 days a year to serve the Clark County community in emergencies when immediate, practical, and emotional support to loved ones is needed in the midst of a crisis, usually when a death has occurred. Since 2007, Carol has responded to more than 241 scenes of tragedy, has spent over 360 hours directly with bereaved citizens and has served 902 clients in the Clark County area. Carol has a humble approach that makes a huge impact. She quietly but confidently supports her fellow community members on the worst days of their lives, one call at a time.

It's just icing on the cake to be recognized for what you love to do. - Carol Starbuck

The award recognizes the valuable contributions older adults make to the vitality of the community and is open to any county resident 65 years or older who has enhanced the community through their life's work, engagement of others, volunteerism and/or other impactful acts of service to the community for any age group. Service in any field of endeavor will be considered (e.g., education, radio, television, business, healthcare, art, music, journalism, faith-based, athletics, politics, volunteer service). A couple may receive the award jointly when both have been involved in service and various community endeavors.

IMPLEMENTING THE AGING READINESS PLAN

UPDATE

The Commission on Aging has developed several programs to implement the Aging Readiness Plan, including advocacy of Universal Design for homes and raising awareness of issues important to our aging population. In 2016, the commission began to revisit the primary focus areas outlined in the plan (Housing, Supportive Services, Transportation and Healthy Communities).

HEALTHY COMMUNITIES

In 2019, the commission focused on healthy communities to educate and raise awareness about resources and needs in Clark County to build a healthier community, especially for older adults. Recommendations emphasize community adaptations, business, and design ideas for how our communities can better support our physical, mental, and emotional health as we age.

Fresh food options

In their 2019 Annual Report, the commission recommended promotion of mobile fresh food trucks that could park and serve areas that do not have easy access to fresh food and recommended improving access to farmers markets. Several area fresh food delivery services continued to expand offerings in 2021. Some local farmers markets also continued offering no-contact

pick-up options. Some of these efforts were in response to COVID-19, others have been in process for many years.

Business practices

The commission recommended age-friendly business practices and initiatives in their 2019 Annual Report. In response to COVID-19, many area grocery stores continued to offer special shopping times reserved for older adults and no-contact grocery pick-up options. These offerings are consistent with the type of age-friendly business practices the commission has advocated for in its recommendations.

TRANSPORTATION

In 2018, the commission focused on transportation to educate and raise awareness about transportation resources and needs in Clark County to improve transportation options if driving is no longer an option for an older adult. The commission's recommendations centered on thoughtful development design and regulations to promote transit and pedestrian access options in urban areas and community transportation options for rural areas.

North County Shuttle Service

Community in Motion is now providing North County Shuttle Service, or round-trip transportation from an individual's home in north Clark County to/from Battle Ground. This program follows a pilot program that began in 2020. The service provides access to multiple destinations within Battle Ground including medical appointments, shopping, meal sites, community services and socialization opportunities. The program is open to seniors, persons with disabilities and those who are homebound due to a lack of transportation resources.

Clark County Transportation System Plan

The 2012 Aging Readiness Plan and 2018 Commission on Aging annual report explore alternatives to driving as a method for ensuring mobility equals independence. Clark County is working to create a Transportation System Plan (TSP) that provides direct guidance on how to build, operate and maintain Clark County's major roadway network. The TSP will also address complementary elements of the larger transportation system including transit connectivity, multi-use trails development, state highway coordination and freight railroad safety – maintained by other entities. The TSP addresses a diversity of transportation needs while integrating social, economic, environmental and livability aspirations. It will bridge goals and policies in the Comprehensive Plan with implementation of new and improved infrastructure. A TSP will help implement the 2012 Aging Readiness Plan to provide a sense of independence and mobility for people of all ages using Clark County's transportation network.

SUPPORTIVE SERVICES

In 2017, the commission focused on supportive services to educate and raise awareness about services that exist, or may need to exist, to help Clark County's older adults age in their own home and familiar neighborhoods as long as possible. The commission's recommendations centered on advocacy and promotion of existing services provided in the county; increasing the number of memory care facilities and smaller assisted living communities; supporting resources for caregivers; and assigning a Clark County Sheriff's deputy to the Elder Justice Center team. The deputy was assigned to the team in 2018.

In 2021, supportive service providers in Clark County continued to heroically adapt to challenges from the COVID-19 pandemic and creatively figured out ways to support older adults in the community. The speaker series section of this report highlights some examples of these efforts.

HOUSING

In 2016, the Commission on Aging focused on housing and centered its recommendations on encouraging the construction and remodeling of homes and neighborhoods to be places everyone could visit regardless of ability. Since the Commission on Aging's 2016 focus and recommendations on housing, several jurisdictions have been working on ways to encourage development of age-friendly housing, such as encouraging more single-story, barrier-free homes through incentive programs (City of Ridgefield) and land use policy (City of Camas).

Housing projects

Multiple jurisdictions in the county worked on housing projects in 2021 to encourage a wider variety of housing options and price points. They include Battle Ground, Camas, Ridgefield, Vancouver, and Clark County. Battle Ground and Camas adopted housing action plans. Vancouver continues to work on several code updates, one of

which would, if adopted, incentivize visitable housing to be built in the city. Ridgefield adopted new housing code amendments including incentives for building ADUs, smaller single-family homes, and a diversity of housing types. Clark County had a Commission on Aging member and a representative from the Area Agency on Aging and Disabilities of SW Washington participate in the county's housing project advisory group; a group that is helping steer the county's housing action plan. The county's draft housing action plan includes a recommendation to incentivize visitable housing to be built in the unincorporated Vancouver urban growth area. The commission plans to continue engaging with housing initiatives to advocate for aging-in-place opportunities.

EDUCATION, AWARENESS, AND ADVOCACY

Throughout the year, the commission worked to provide education, community awareness and advocacy to move toward an all-age-friendly community. Below are some events and actions the commission members participated with to provide information or advocate on topics related to aging in Clark County.

- City councils. Commission members presented the 2020 Commission on Aging Annual Report and key takeaways to the city councils in Clark County, to keep them updated on the commission's progress and discuss any local issues related to older adults.
- Silver Citizen Award. To encourage and support older adults for their contributions to their communities, the Clark County Commission on Aging presented its second annual Silver Citizen Award program to recognize older adults who go above and beyond in service.
- Community member survey. Commission members created a community member survey to find out how older adults like to connect with other people and to resources. The survey was distributed countywide in print and online formats, in collaboration with several community partners, and will help inform the commission's work in 2022.
- Proclamations. The commission successfully advocated for the county council to proclaim May as Older Americans Month and supported local organizations who advocated the county council to proclaim county residents learn more about dementia and become a dementia friend.

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For other formats
Contact the Clark County ADA Office
Voice 564.397.2322
Relay 711 or 800.833.6388
ada@clark.wa.gov

www.clark.wa.gov/aging

COMMUNITY PLANNING
1300 Franklin Street • PO Box 9810
Vancouver, WA 98666-9810
564.397.2280 / comm-aging@clark.wa.gov

CLARK COUNTY COMMISSION on AGING

2021 ANNUAL REPORT

Commission on Aging

- Provide leadership in addressing the special needs of the aging population
- Manage and assist with implementation of the Aging Readiness Plan

Focus Areas

Housing 2016

Supportive Services 2017

Transportation 2018

Healthy Communities 2019

COVID-19 Impacts 2020

Road to Recovery from COVID-19 2021

Road to Recovery from COVID-19

- Kick-off
- First and early responders
- Serious illness and caregiver support
- Food as medicine
- Social determinants of health
- Housing and homelessness
- Personal economics/financial recovery

Findings & Recommendations: Community Engagement

- Finding
  - Phone and video calls helped but could not replace in-person connection
  - Many examples of innovation
- Recommendation
  - Share best practices for communicating with older adults

Findings & Recommendations: Supportive Services

- Finding
  - Significant impacts to professional and family caregivers
- Recommendation
  - Employers can better support caregivers through review and revision of HR policies
  - Examples provided in Recognize, Assist, Include, Support, & Engage (RAISE) Family Caregivers Act Initial Report to Congress (https://acl.gov/RAISE/report)

Findings & Recommendations: Healthy Communities

- Finding
  - Healthy food and lifestyles could increase resiliency in future health pandemics
  - Racial disparities in health outcomes
- Recommendations
  - Build relationships and trust with underserved community members
  - Schools, workplaces, and hospitals can promote healthy eating and lifestyle options

Findings & Recommendations: Housing

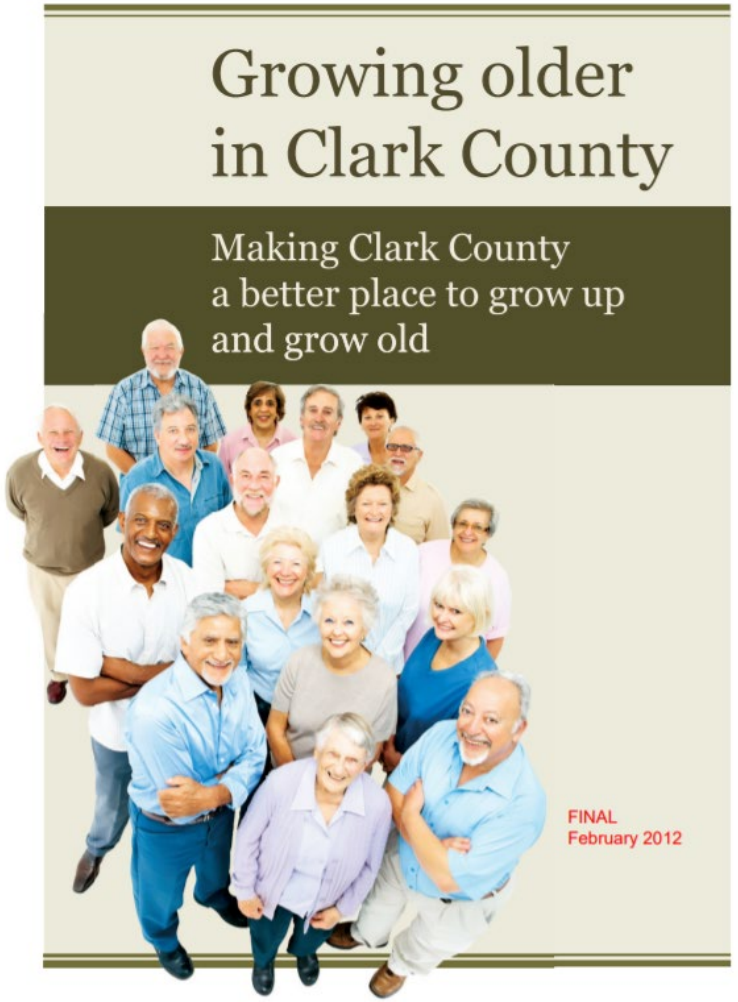
- Finding
  - Housing challenges existed before the pandemic and the pandemic has exacerbated housing challenges for some families
- Recommendation
  - Create policy and adopt development code to remove barriers for non-profits, housing authorities and mission-driven housing developers to build housing affordable to people priced out of market-rate housing

Findings & Recommendations: Emergency Preparedness

- Finding
  - Being prepared for a wide range of emergencies can help during a crisis
- Recommendations
  - Emergency Preparedness presentations and trainings from CRESA
  - Add Emergency Preparedness chapter to the Aging Readiness Plan in 2022

2022 Work Plan

- Innovation through Connection
  - Fireside chats
  - Program of the month
- Aging Readiness Plan Update



Thank you!

Comments and questions

Clark County Public Service Center

1300 Franklin Street • PO Box 5000

Vancouver, WA 98666-5000

Staff Report

May 2, 2022 Council Workshop Meeting

Local Government Approach to Public Art
Presenter: Connie Urquhart, Library Director
Time Estimate: 15 minutes

Phone	Email
360.817.7201	curquhart@cityofcamas.us

BACKGROUND: Events in recent years have led Council to request Staff research and report back on options for addressing public art.

SUMMARY: The City has received several requests from artists and organizations to share in public spaces art pieces of varying formats, which range from permanent installations to temporary exhibits. The City does not have a guiding document to help administration equitably address these requests.

EQUITY CONSIDERATIONS:

Staff will present Council with research findings and answer questions. The most consistent and equitable way to address public art requests is by way of a documented process; the process itself varies city to city. In many cases, cities utilize multiple tools mentioned below.

In a study of 24 comparable cities:

- 18 cities have boards or commissions dedicated to art.
- 15 cities refer to the stewardship of public art in their municipal code.
- 7 cities have official documents or a section about public art as part of a greater comprehensive plan.
- 4 cities have partnerships with local non-profit organizations to help with the stewardship of public art.

BUDGET IMPACT: Currently none.

RECOMMENDATION: Staff recommends the creation of a public art policy.

Staff Report

May 2, 2022 Workshop Meeting

NE 2nd Avenue Street Improvements and NE Dallas Water Improvements Bids
Presenter: James Carothers, Engineering Manager
Time Estimate: 5 minutes

Phone	Email
360.817.7230	jcarothers@cityofcamas.us

BACKGROUND: In March 2021 staff was notified that the Camas Community Development Block Grant "CDBG" grant application to fund street and other improvements on NE 2nd Avenue was recommended for funding by Clark County. The grant, in the amount of $170,000, will partially fund street, sidewalk, curb ramp, and water system improvements in NE 2nd Avenue from NE Everett Street to NE Garfield Street. At the time that the grant was awarded the project was limited to street and water system improvements within NE 2nd Avenue. However, staff had also completed design of the nearby Dallas Street Water Improvements project and combined the Dallas project with the NE 2nd Avenue project due to its close proximity and the potential to receive better bids.

SUMMARY: At the April 20, 2022 bid opening for the project the City received four bids. The low bidder was Advanced Excavating Specialists, LLC in the amount of $413,985.66. Bid Tabulations are attached for reference.

The following table provides a breakdown of construction costs:

Bid Contract	$413,985
10% Change Order Reserve	$41,398
Administrative Costs	$5,000
Water Utility Fund Contribution	($108,937)
CDBG Grant Contribution	($170,000)
Balance (to be paid from General Fund and/or Pavement Preservation Funds)	$181,446

EQUITY CONSIDERATIONS:

What are the desired results and outcomes for this agenda item?

Formal bid award from Council.

How have communities been engaged? Are there opportunities to expand engagement?

Coordination with affected residents has already begun and will continue through the duration of the project.

Who will benefit from, or be burdened by this agenda item?

Residents on NE 2nd Avenue and NE Dallas Street, as well as the adjacent neighborhoods will be the primary beneficiaries. Drivers and pedestrians will experience temporary delays caused by traffic restrictions during construction.

What are the strategies to mitigate any unintended consequences?

Daily inspections of construction activities and regular coordination between the contractor, City, and neighborhood residents.

Does this agenda item have a differential impact on underserved populations, people living with disabilities, and/or communities of color? Please provide available data to illustrate this impact.

CDBG Grants provide capital improvements to lower income areas as defined by HUD. This project will improve NE 2nd Avenue in a CDBG eligible neighborhood.

Will this agenda item improve ADA accessibilities for people with disabilities?

Yes. Non-compliant ADA curb ramps and sidewalks will be replaced.

What potential hurdles exists in implementing this proposal (include both operational and political)?

The low bid received was higher than the engineer's estimate for the project and higher than available budgeted funds. As such, additional funds will need to be obligated by Council to complete the project.

How will you ensure accountabilities, communicate, and evaluate results?

Daily inspections of construction activities and regular coordination between the contractor, City, and neighborhood residents.

How does this item support a comprehensive plan goal, policy or other adopted resolution?

The project preserves affordable housing stocks by updating infrastructure in older neighborhoods consistent with the goals listed in the Camas Comprehensive Plan.

BUDGET IMPACT: As discussed above, the low bid for the project was higher than the engineer's estimate. As such, should Council elect to award this project to the low bidder, staff will propose the use of Pavement Preservation Funds and/or General Fund revenues during the Fall Omnibus (in coordination with the Finance Department).

RECOMMENDATION: Staff has also placed this bid award item on the May 2, 2022 Consent Agenda for Council's Consideration.

City of Camas WASHINGTON

I, James E. Carothers, Engineering Manager, hereby certify that these bid tabulations are correct.

James E. Carothers, PE Date 4/21/22

PROJECT NO. T1034 & W1019 DESCRIPTION:NE 2nd Avenue Street Improvements & NE Dallas Water Improvements DATE OF BID OPENING: April 20, 2022 at 10:00am			Ent. By PAF	Engineer's Estimate: $365,364.44		Advanced Excavating Specialists 1200 Hazel Street Kelso, WA 98626 chris@advexc.us (360) 232-8854		Dirtmasters PO Box 484 Washougal, WA 98671 team@dirtmastersinc.com (541) 400-1136		McDonald Excavating 4120 S Lincoln St Washougal, WA 98671 ryan@mcdonaldexcavatinginc.com (360) 835-8794		Clark and Sons Excavating Inc. 7601 NE 289th Street Battle Ground, WA 98604 josh.clarkandsons@gmail.com (360) 946-8474	
ITEM NO	DESCRIPTION	UNIT	QTY	UNIT PRICE	ENGRG TOTAL	UNIT PRICE	CONTRACT TOTAL	UNIT PRICE	CONTRACT TOTAL	UNIT PRICE	CONTRACT TOTAL	UNIT PRICE	CONTRACT TOTAL
Schedule A - NE 2nd Ave Street Improvements													
1	Mobilization	LS	1.00	$10,000.00	$10,000.00	$28,000.00	$28,000.00	$15,600.00	$15,600.00	$38,500.00	$38,500.00	$40,000.00	$40,000.00
2	Project Temporary Traffic Control	LS	1.00	$5,000.00	$5,000.00	$17,000.00	$17,000.00	$5,500.00	$5,500.00	$12,500.00	$12,500.00	$10,000.00	$10,000.00
3	Clearing & Grubbing	LS	1.00	$1,000.00	$1,000.00	$2,000.00	$2,000.00	$5,000.00	$5,000.00	$2,500.00	$2,500.00	$2,000.00	$2,000.00
4	Remvoval of Structures and Obstructions	LS	1.00	$5,000.00	$5,000.00	$22,000.00	$22,000.00	$2,500.00	$2,500.00	$8,500.00	$8,500.00	$26,000.00	$26,000.00
5	Removal of Additional Cement Concrete	SY	10.00	$10.00	$100.00	$100.00	$1,000.00	$130.00	$1,300.00	$29.00	$290.00	$50.00	$500.00
6	Removal of Additional Cement Concrete Curb	LF	20.00	$10.00	$200.00	$50.00	$1,000.00	$65.00	$1,300.00	$28.50	$570.00	$8.00	$160.00
7	Roadway Excavation, Inc. Haul	CY	225.00	$40.00	$9,000.00	$50.00	$11,250.00	$65.00	$14,625.00	$50.00	$11,250.00	$29.00	$6,525.00
8	In-Place Cement Amended Base (CAB)	SY	2,680.00	$5.00	$13,400.00	$6.00	$16,080.00	$1.96	$5,252.80	$5.00	$13,400.00	$7.00	$18,760.00
9	Cement for CAB (8% @ 10 inch)	TON	85.00	$175.00	$14,875.00	$178.00	$15,130.00	$182.00	$15,470.00	$220.00	$18,700.00	$208.00	$17,680.00
10	Removal and Replacement of Unsuitable Material (Road Base)	CY	10.00	$40.00	$400.00	$175.00	$1,750.00	$130.00	$1,300.00	$118.00	$1,180.00	$92.00	$920.00
11	HMA Class 1/2" PG 64-22 (3 inch depth)	TON	440.00	$120.00	$52,800.00	$120.00	$52,800.00	$112.00	$49,280.00	$140.00	$61,600.00	$126.00	$55,440.00
12	HMA Class 1/2" PG 64-22 (4" depth patch)	TON	17.00	$200.00	$3,400.00	$120.00	$2,040.00	$112.00	$1,904.00	$247.00	$4,199.00	$350.00	$5,950.00
13	Catch Basin Type 1	EA	2.00	$2,000.00	$4,000.00	$2,800.00	$5,600.00	$990.00	$1,980.00	$3,500.00	$7,000.00	$4,000.00	$8,000.00
14	Adjust Manhole	EA	4.00	$400.00	$1,600.00	$750.00	$3,000.00	$475.00	$1,900.00	$750.00	$3,000.00	$700.00	$2,800.00
15	Corrugated Polyethylene Storm Sewer Pipe 8"	LF	46.00	$100.00	$4,600.00	$140.00	$6,440.00	$63.52	$2,921.92	$152.00	$6,992.00	$113.00	$5,198.00
16	Replace Valve Box	EA	5.00	$100.00	$500.00	$250.00	$1,250.00	$250.00	$1,250.00	$500.00	$2,500.00	$700.00	$3,500.00
17	Erosion Control and Water Pollution Control	LS	1.00	$1,500.00	$1,500.00	$3,000.00	$3,000.00	$2,500.00	$2,500.00	$5,000.00	$5,000.00	$1,000.00	$1,000.00
18	Cement Concrete Traffic Curb	LF	399.00	$45.00	$17,955.00	$26.00	$10,374.00	$10.00	$3,990.00	$35.00	$13,965.00	$46.00	$18,354.00
19	Cement Concrete Curb and Gutter	LF	173.00	$55.00	$9,515.00	$34.00	$5,882.00	$27.00	$4,671.00	$44.00	$7,612.00	$57.00	$9,861.00
20	Cement Concrete Pedestrian Curb	LF	251.00	$30.00	$7,530.00	$32.00	$8,032.00	$10.00	$2,510.00	$42.00	$10,542.00	$42.00	$10,542.00
21	Cement Conncrete Driveway Entrance	SY	15.00	$150.00	$2,250.00	$140.00	$2,100.00	$145.00	$2,175.00	$172.00	$2,580.00	$185.00	$2,775.00
22	Cement Concrete Sidewalk	SY	411.00	$90.00	$36,990.00	$94.00	$38,634.00	$155.00	$63,705.00	$123.00	$50,553.00	$82.00	$33,702.00
23	Cement Concrete Curb Ramp	SY	81.00	$90.00	$7,290.00	$297.00	$24,057.00	$175.00	$14,175.00	$369.00	$29,889.00	$434.00	$35,154.00
24	Detectable Warning Surgace	SF	120.00	$90.00	$10,800.00	$26.00	$3,120.00	$78.15	$9,378.00	$32.00	$3,840.00	$80.00	$9,600.00
25	Permanent Signing	LS	1.00	$500.00	$500.00	$500.00	$500.00	$600.00	$600.00	$3,000.00	$3,000.00	$1,000.00	$1,000.00
26	Paint Line	LF	450.00	$6.00	$2,700.00	$4.50	$2,025.00	$3.45	$1,552.50	$5.00	$2,250.00	$5.18	$2,331.00
27	Plastic Stop Line	LF	46.00	$15.00	$690.00	$36.00	$1,656.00	$27.56	$1,267.76	$44.00	$2,024.00	$17.00	$782.00
28	Plastic Crosswalk Line	SF	128.00	$15.00	$1,920.00	$26.00	$3,328.00	$30.00	$3,840.00	$31.00	$3,968.00	$22.00	$2,816.00
29	Roadside Restoration	LS	1.00	$1,500.00	$1,500.00	$1,000.00	$1,000.00	$5,000.00	$5,000.00	$3,000.00	$3,000.00	$4,000.00	$4,000.00
30	Minor Change (minimum bid $5,000)	LS	1.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00
31	Construction Documentation (minimum bid	LS	1.00	$10,000.00	$10,000.00	$10,000.00	$10,000.00	$10,000.00	$10,000.00	$10,000.00	$10,000.00	$10,000.00	$10,000.00
Subtotal Schedule A - NE 2nd Ave. Street Improvements					**$242,015.00**		**$305,048.00**		**$257,447.98**		**$345,904.00**		**$350,350.00**
Washington State Sales Tax (8.4%)					**N/A**		**N/A**		**N/A**		**N/A**		**N/A**
Total Schedule A - NE 2nd Ave. Street Improvements					**$242,015.00**		**$305,048.00**		**$257,447.98**		**$345,904.00**		**$350,350.00**
Schedule B - NE 2nd Avenue Water Improvements													
32	Trench Safety System (Min. $1.00/LF)	LF	46.00	$1.00	$46.00	$1.00	$46.00	$1.00	$46.00	$1.00	$46.00	$1.00	$46.00
33	Removal and Replacement of Unsuitable Material (Pipe Trench)	CY	5.00	$40.00	$200.00	$185.00	$925.00	$130.00	$650.00	$100.00	$500.00	$250.00	$1,250.00
34	Solid Rock Excavation	CY	5.00	$150.00	$750.00	$200.00	$1,000.00	$275.00	$1,375.00	$240.00	$1,200.00	$450.00	$2,250.00
35	Testing and Flushing Water System	LS	1.00	$1,000.00	$1,000.00	$1,000.00	$1,000.00	$2,500.00	$2,500.00	$500.00	$500.00	$2,300.00	$2,300.00
36	Removal and Abandonment of Existing 6 inch Fire Service	LS	1.00	$2,000.00	$2,000.00	$1,000.00	$1,000.00	$7,500.00	$7,500.00	$2,500.00	$2,500.00	$1,162.00	$1,162.00
37	Service Connection, 1 inch Diam (Short Side)	EA	9.00	$1,500.00	$13,500.00	$1,350.00	$12,150.00	$3,800.00	$34,200.00	$2,588.00	$23,292.00	$2,190.00	$19,710.00
38	Service Connection, 1 inch Diam (Long Side)	EA	1.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$3,800.00	$3,800.00	$3,711.00	$3,711.00	$2,700.00	$2,700.00
39	Service Connection, 2 inch Diam	EA	1.00	$5,000.00	$5,000.00	$2,800.00	$2,800.00	$3,800.00	$3,800.00	$4,900.00	$4,900.00	$7,000.00	$7,000.00
40	Remove and Plug Existing Water Service	EA	11.00	$500.00	$5,500.00	$300.00	$3,300.00	$900.00	$9,900.00	$790.00	$8,690.00	$700.00	$7,700.00
41	Minor Changes (minimum bid $5,000)	LS	1.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00
Subtotal Schedule B - NE 2nd Avenue Water Improvement					**$34,996.00**		**$29,221.00**		**$68,771.00**		**$50,339.00**		**$49,118.00**
Washington State Sales Tax (8.4%)					**$2,939.66**		**$2,454.56**		**$5,776.76**		**$4,228.48**		**$4,125.91**
Total Schedule B - NE 2nd Avenue Water Improvement					**$37,935.66**		**$31,675.56**		**$74,547.76**		**$54,567.48**		**$53,243.91**
Schedule C - NE Dallas Water Improvements													
42	Mobilization	LS	1.00	$10,000.00	$10,000.00	$5,000.00	$5,000.00	$4,400.00	$4,400.00	$500.00	$500.00	$10,000.00	$10,000.00
43	Project Temporary Traffic Control	LS	1.00	$1,000.00	$1,000.00	$3,000.00	$3,000.00	$4,500.00	$4,500.00	$4,200.00	$4,200.00	$6,000.00	$6,000.00
44	Clearing & Grubbing	LS	1.00	$1,000.00	$1,000.00	$800.00	$800.00	$3,500.00	$3,500.00	$500.00	$500.00	$2,000.00	$2,000.00
45	Removal of Structures and Obstructions	LS	1.00	$1,000.00	$1,000.00	$1,000.00	$1,000.00	$2,750.00	$2,750.00	$500.00	$500.00	$5,000.00	$5,000.00
46	Removal of Additional Cement Concrete	SY	5.00	$10.00	$50.00	$100.00	$500.00	$130.00	$650.00	$29.00	$145.00	$11.00	$55.00
47	Removal of Additional Cement Concrete Curb	LF	10.00	$10.00	$100.00	$50.00	$500.00	$65.00	$650.00	$28.50	$285.00	$8.00	$80.00
48	Roadway Excavation, Inc. Haul	CY	85.00	$40.00	$3,400.00	$55.00	$4,675.00	$65.00	$5,525.00	$48.00	$4,080.00	$47.00	$3,995.00
49	Roadway and Replacement of Unsuitable Material (Road Base)	CY	10.00	$40.00	$400.00	$175.00	$1,750.00	$130.00	$1,300.00	$118.00	$1,180.00	$90.00	$900.00
50	HMA Class 1/2" PG 64-22 (3 inch depth)	TON	65.00	$120.00	$7,800.00	$120.00	$7,800.00	$112.00	$7,280.00	$163.00	$10,595.00	$126.00	$8,190.00
51	Crushed Surfacing Base Course (6" depth)	TON	95.00	$120.00	$11,400.00	$38.00	$3,610.00	$55.00	$5,225.00	$82.00	$7,790.00	$58.00	$5,510.00
52	Solid Rock Excavation	CY	10.00	$150.00	$1,500.00	$200.00	$2,000.00	$275.00	$2,750.00	$240.00	$2,400.00	$450.00	$4,500.00
53	Trench Safety System (Min. $1.00/LF)	LF	220.00	$1.00	$220.00	$1.00	$220.00	$1.00	$220.00	$1.00	$220.00	$1.00	$220.00
54	Removal and Replacement of Unsuitable Material (Pipe Trench)	CY	10.00	$40.00	$400.00	$185.00	$1,850.00	$130.00	$1,300.00	$100.00	$1,000.00	$95.00	$950.00
55	Ductile Iron Pipe for Water Main, 8 inch Diam.	LF	220.00	$100.00	$22,000.00	$103.00	$22,660.00	$84.44	$18,576.80	$135.00	$29,700.00	$123.00	$27,060.00
56	Testing and Flushing Water System	LS	1.00	$2,000.00	$2,000.00	$500.00	$500.00	$2,500.00	$2,500.00	$1,000.00	$1,000.00	$2,000.00	$2,000.00
57	Gate Valve (6 inch MJ)	EA	1.00	$1,000.00	$1,000.00	$1,250.00	$1,250.00	$3,205.00	$3,205.00	$2,150.00	$2,150.00	$1,759.00	$1,759.00
58	Gate Valve (6 inch FL x MJ)	EA	1.00	$1,000.00	$1,000.00	$1,250.00	$1,250.00	$6,740.00	$6,740.00	$2,150.00	$2,150.00	$1,759.00	$1,759.00
59	Ductile Iron Fitting (6 inch MJ Sleeve)	EA	2.00	$400.00	$800.00	$400.00	$800.00	$4,400.00	$8,800.00	$1,055.00	$2,110.00	$450.00	$900.00
60	Ductile Iron Fitting (6 inch spool)	EA	1.00	$400.00	$400.00	$620.00	$620.00	$1,620.36	$1,620.36	$1,335.00	$1,335.00	$949.00	$949.00
61	Ductile Iron Fitting (8 inch spool)	EA	1.00	$400.00	$400.00	$680.00	$680.00	$1,644.91	$1,644.91	$800.00	$800.00	$1,189.00	$1,189.00
62	Ductile Iron Fitting (6 inch x 8 inch MJ Reducer)	EA	2.00	$800.00	$1,600.00	$410.00	$820.00	$2,335.22	$4,670.44	$1,200.00	$2,400.00	$688.00	$1,376.00
63	Ductile Iron Fitting, 8 inch 22.5 Degree Bend	EA	2.00	$800.00	$1,600.00	$460.00	$920.00	$747.84	$1,495.68	$1,125.00	$2,250.00	$746.00	$1,492.00
64	Additional 6 inch or 8 inch Ductile Iron Fitting	EA	1.00	$800.00	$800.00	$700.00	$700.00	$750.00	$750.00	$1,400.00	$1,400.00	$960.00	$960.00
65	Replace Value Box	EA	2.00	$100.00	$200.00	$240.00	$480.00	$250.00	$500.00	$500.00	$1,000.00	$1,000.00	$2,000.00
66	Service Connection, 1 inch Diam.	EA	1.00	$1,500.00	$1,500.00	$1,350.00	$1,350.00	$3,800.00	$3,800.00	$2,660.00	$2,660.00	$500.00	$500.00
67	Erosion Control and Water Pollution Control	LS	1.00	$1,000.00	$1,000.00	$500.00	$500.00	$2,500.00	$2,500.00	$5,000.00	$5,000.00	$500.00	$500.00
68	Roadside Restoration	LS	1.00	$1,000.00	$1,000.00	$500.00	$500.00	$5,000.00	$5,000.00	$1,500.00	$1,500.00	$2,000.00	$2,000.00
69	Plastic Stop Line	LF	15.00	$15.00	$225.00	$36.00	$540.00	$25.47	$382.00	$44.00	$660.00	$20.00	$300.00
70	Minor Changes (minimum bid $5, 000)	LS	1.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00
Subtotal Schedule C - NE Dallas Water Improvements					**$78,795.00**		**$71,275.00**		**$107,235.19**		**$94,510.00**		**$97,144.00**
Washington State Sales Tax (8.4%)					**$6,618.78**		**$5,987.10**		**$9,007.76**		**$7,938.84**		**$8,160.10**
Total Schedule C - NE Dallas Water Improvements					**$85,413.78**		**$77,262.10**		**$116,242.95**		**$102,448.84**		**$105,304.10**

Schdedule A, B, and C and the Contract Total of this bid proposal must be submitted in order for the bid to be considered complete.

Total Schedule A - NE 2nd Ave. Street Improvements	**$242,015.00**	**$305,048.00**	**$257,447.98**	**$345,904.00**	**$350,350.00**
Total Schedule B - NE 2nd Avenue Water Improvement	**$37,935.66**	**$31,675.56**	**$74,547.76**	**$54,567.48**	**$53,243.91**
Total Schedule C - NE Dallas Water Improvements	**$85,413.78**	**$77,262.10**	**$116,242.95**	**$102,448.84**	**$105,304.10**
CONTRACT TOTAL (BASIS OF AWARD - SCHEDULES A+B+C)	**$365,364.44**	**$413,985.66**	**$448,238.69**	**$502,920.32**	**$508,898.01**
		Calculation errors	**Did not submit E-Verify MOU**	**Calculation errors**	

Staff Report

May 2, 2022 Council Workshop Meeting

2022 ADA Improvement Project Bids
Presenter: James Carothers, Engineering Manager
Time Estimate: 5 Minutes

Phone	Email
360.817.7230	jcarothers@cityofcamas.us

BACKGROUND: Camas budgets $50,000 annually for Americans with Disabilities Act (ADA) related projects. Based on multiple complaints from the elderly and those with mobility impairments, the ADA project for 2022 replaces those exposed aggregate panels that are the subject of complaints in the Downtown core. The scope of the work will be limited to the replacement of sidewalk panels that have "large" exposed aggregate stone as seen in the photos below. These panels tend to present a tripping hazard and are known to be slippery during wet conditions.

SUMMARY: Three construction bids were submitted at the April 20, 2022 bid opening. The low bidder was Clark & Sons, Inc. in the amount of $61,112.00. Staff finds that the low bid is reasonable given the volatile bidding climate. However, staff has also concluded since opening bids that there was, in essence, a scrivener's error in one of the bid items and if all concrete panels that have the large exposed aggregate are to be removed and replaced, the total construction cost will be closer to $85,000. It is staff's recommendation to complete the removal and replacement of all the subject panels with this project.

Exposed Aggregate Sidewalk Panels Downtown

EQUITY CONSIDERATIONS:

What are the desired results and outcomes for this agenda item?

Formal Bid Award by Council.

What's the data? What does the data tell us?

The described concrete panels should be removed based on citizen complaints and physical inspection due to safety concerns.

How have communities been engaged? Are there opportunities to expand engagement?

Camas DCA (Downtown Camas Association) and affected businesses have been consulted and are supportive of the project.

Who will benefit from, or be burdened by this agenda item?

Downtown business owners, residents, and patrons will be the primary beneficiaries. Construction of the project may cause minor traffic delays and temporary closure of some sidewalks during work hours.

What are the strategies to mitigate any unintended consequences?

Daily inspections of construction activities and regular coordination between the contractor, staff, and businesses.

Does this agenda item have a differential impact on underserved populations, people living with disabilities, and/or communities of color? Please provide available data to illustrate this impact.

Replaced sidewalks will improve accessibility for all users.

Will this agenda item improve ADA accessibilities for people with disabilities?

Yes. The intent of the project is to remove physical barriers for those with mobility limitations.

What potential hurdles exist in implementing this proposal (include both operational and political)?

None.

How will you ensure accountabilities, communicate, and evaluate results?

Daily inspections of construction activities and regular coordination between the contractor, staff, and businesses.

How does this item support a comprehensive plan goal, policy or other adopted resolution?

The project is consistent with the goals of the Camas ADA Transition Plan.

BUDGET IMPACT: The current 2022 Budget allocates $50,000 for the project. The cost to remove and replace all the larger exposed aggregate panels will be closer to $85,000. Staff proposes to include additional expenditures in the Fall Omnibus.

RECOMMENDATION: Staff has also placed this bid award item on the May 2, 2022 Consent Agenda for Council's consideration.

City of Camas WASHINGTON

I, James E. Carothers, Engineering Manager, hereby certify that these bid tabulations are correct.

James E. Carothers, PE 4/21/22 Date

PROJECT NO. T1042 DESCRIPTION: 2022 ADA Improvements DATE OF BID OPENING: April 20, 2022 11:00am Ent. By PAF				Engineer's Estimate: $40,100 revised (sales tax not applicable)		Clark and Sons Excavating Inc. 7601 NE 289th St. Battle Ground, WA 98604 360-946-8474		T3 TransBlue 199616 Old Owen Rd. #252 Monroe, WA 98272 800-658-7601		Schmid and Sons Inc PO Box 799 Camas, WA 98607 360-835-3376	
ITEM NO	DESCRIPTION	UNIT	QTY	UNIT PRICE	ENGRG TOTAL	UNIT PRICE	CONTRACT TOTAL	UNIT PRICE	CONTRACT TOTAL	UNIT PRICE	CONTRACT TOTAL
	Schedule 'A' Street										
1	Mobilization	LS	1.00	$5,000.00	$5,000.00	$6,000.00	$6,000.00	$5,000.00	$5,000.00	$5,600.00	$5,600.00
2	Project Temporary Traffic Control	LS	1.00	$5,000.00	$5,000.00	$16,000.00	$16,000.00	$10,000.00	$10,000.00	$16,400.00	$16,400.00
3	Roadway Excavation (includes sawcutting)	CY	48.00	$150.00	$7,200.00	$210.00	$10,080.00	$27.50	$1,320.00	$880.00	$42,240.00
4	Erosion Control and Water Pollution Control	LS	1.00	$500.00	$500.00	$2,500.00	$2,500.00	$10,000.00	$10,000.00	$2,100.00	$2,100.00
5	Roadside Restoration	LS	1.00	$500.00	$500.00	$5,400.00	$5,400.00	$10,000.00	$10,000.00	$3,175.00	$3,175.00
6	Cement Concrete Sidewalk	SY	96.00	$150.00	$14,400.00	$142.00	$13,632.00	$250.00	$24,000.00	$106.56	$10,229.76
7	Minor Changes (minimum bid $5,000)	LS	1.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$10,000.00	$10,000.00	$5,000.00	$5,000.00
8	Construction Documentation (minimum bid $2,500)	LS	1.00	$2,500.00	$2,500.00	$2,500.00	$2,500.00	$5,000.00	$5,000.00	$2,500.00	$2,500.00
	Subtotal (Schedule 'A')				**$40,100.00**		**$61,112.00**		**$75,320.00**		**$87,244.76**
	Washington State Sales Tax (8.4%)				**N/A**		**N/A**		**N/A**		**N/A**
	TOTAL CONSTRUCTION COST (Schedule 'A')				**$40,100.00**		**$61,112.00**		**$75,320.00**		**$87,244.76**
	Basis of Award										

Staff Report

May 2, 2022 Council Workshop

Prune Hill Pump Station Professional Services Agreement with Gray and Osborne, Inc.
Presenter: Steve Wall, Public Works Director
Estimated Time: 5 minutes

Phone	Email
360.817.7899	swall@cityofcamas.us

BACKGROUND: The existing Prune Hill Park Pump Station located at 3403 NW Sierra Drive was originally built in 1994. The City completed an assessment of the pump station in 2017 and identified several deficiencies that should be corrected. The primary issues involve the age and condition of the pump station components. To improve the reliability and capacity of the station replacement of the existing pumps, control panel and equipment, including the emergency generator, is necessary.

SUMMARY: Because of the significant number of sewer pump stations that require upgrading, the City went through a Request for Qualification process in late 2021 to select three separate "on-call" consultants to complete sewer collection system and pump station work for the City over a three year period. Staff is rotating through consultants as projects receive funding and get started. Gray & Osborne, Inc. is one of three consultant engineering companies that were selected to be on the City's On-Call Engineering and Professional Services for Camas Sewer Services. The other two firms are currently working on other sewer projects for the City and Gray and Osborne, Inc. was next in-line for a project.

EQUITY CONSIDERATIONS:

What are the desired results and outcomes for this agenda item?

> Inform Council of the need to complete design upgrades to the Prune Hill Park Pump Station and provide the scope of work and costs for design services.

What's the data? What does the data tell us?

> N/A

How have communities been engaged? Are there opportunities to expand engagement?

> Staff will provide information regarding the project prior to and during construction to adjacent homeowners.

Who will benefit from, or be burdened by this agenda item?

This item will benefit the City by providing much needed professional engineering services to complete the design.

What are the strategies to mitigate any unintended consequences?

N/A

Does this agenda item have a differential impact on underserved populations, people living with disabilities, and/or communities of color? Please provide available data to illustrate this impact.

N/A

Will this agenda item improve ADA accessibilities for people with disabilities?

No

What potential hurdles exists in implementing this proposal (include both operational and political)?

The City already owns the pump station site and has operational control over all components. As such, staff does not foresee any potential hurdles in implementing this project.

How will you ensure accountabilities, communicate, and evaluate results?

Staff will monitor the consultant's invoices and get weekly updates from them during design.

How does this item support a comprehensive plan goal, policy or other adopted resolution?

This item supports the 2017 Wastewater Condition Assessment that identified this sewer lift station as needing upgrades.

BUDGET IMPACT: This professional services agreement for design services is for $164,750. The Sewer Fund has budget available in the professional services line item and under Repair and Replacement to pay for these services.

RECOMMENDATION: This item is for Council information only. Staff recommends this item be placed on the May 16, 2022 Consent Agenda for Council consideration.

CITY OF CAMAS
PROFESSIONAL SERVICES AGREEMENT
Task Order No. 1

616 NE 4th Avenue
Camas, WA 98607

Project No. S1033

ON-CALL PROFESSIONAL SERVICES FOR SEWER COLLECTION SYSTEM 2022-2024

PRUNE HILL PARK PUMP STATION UPGRADE PROJECT

THIS AMENDMENT ("Amendment") to Professional Services Agreement is made as of the 8th day of April, 2022, and between the **City of Camas**, a municipal corporation, hereinafter referred to as "the City", and **Gray & Osborne, Inc.**. hereinafter referred to as the "Consultant", in consideration of the mutual benefits, terms, and conditions hereinafter specified. The City and Consultant may herinafter be refered to collectively as the "Parties."

The Parties entered into an Original Agreement dated January 5, 2022, by which Consultant provides professional services in support of the Project identified above. Except as amended herein, the Origianl Agreement shall remain in full force and effect.

1. Scope of Services. Consultant agrees to perform services as identified in the attached Exhibit (Scope of Services) attached hereto, including the provision of all labor, materials, equipment, supplies and expenses, for an amount not-to-exceed $164,750.

    a. ☐ Unchanged from Original/Previous Contract

2. Time for Performance. Consultant shall perform all services and provide all work product required pursuant to this Amendment by:

    a. ☐ Extended to XXX, 20XX.

    b. ☒ Unchanged from Original/Previous Contract date of December 31, 2024

    Unless an additional extension of such time is granted in writing by the City, or the Agreement is terminated by the City in accordance with Section 18 of the Original Agreement.

3. Payment. Based on the Scope of Services and assumptions noted in attached exhibit. Consultant proposes to be compensated on a time and material basis per attached exhibit (Costs for Scope of Services) with a total estimated not to exceed fee of:

    a. Previous Total of all approved Task Orders: $0.00

    b. Task Order No. 1 $164,750

    c. Total of all approved Task Orders: $164,750

    d. Consultant billing rates:

    ☒ Modification to Consultant Billing Rates attached herein

    ☐ Unchanged from Original Contract

4. Counterparts. Each individual executing this Agreement on behalf of the City and Consultant represents and warrants that such individual is duly authorized to execute and deliver this Agreement. This Agreement may be executed in any number of counter-parts, which counterparts shall collectively constitute the entire Agreement.

DATED this _____ day of _____, 20___.

CITY OF CAMAS:

By:_____

Print Name: Steven C. Hogan

Title: Mayor

GRAY & OSBORNE, INC.:
Authorized Representative

DocuSigned by:
By: Michael B. Johnson, P.E.
6A3341D51D254BF...

Print Name: Michael B. Johnson, P.E.

Title: President

Date: 4/8/2022

EXHIBIT
SCOPE OF SERVICES AND RELATED COSTS

TASK ORDER #1

EXHIBIT A

SCOPE OF WORK

CITY OF CAMAS
PRUNE HILL PARK PUMP STATION UPGRADE PROJECT

PROJECT OVERVIEW

The existing Prune Hill Park pump station was constructed in 1994 and is approximately 28 years old. It is a duplex, 7.5-hp submersible pump station with Paco pumps and a Warrick controller. Its capacity is rated at 350 gpm at a TDH of 53 feet and discharges into a 6-inch force main that connects to the City's STEP system. The City of Camas (City) completed an assessment of the pump station in 2015 and identified several deficiencies that should be corrected. The primary issues involve the age and condition of the pump station components. The City would like to complete a detailed evaluation of the existing pump station and develop an upgrade plan. The City would also like assistance sizing replacement pumps at an early stage of this evaluation so that replacement pumps can be ordered. Once the evaluation has been completed and a preferred alternative has been selected, the City would like to have plans and specifications prepared for the work and then would like assistance with bidding the project. We understand that the following key issues should be considered in the evaluation and design:

- Current and projected 20-year and build-out wastewater flows to the pump station and system pressures and early selection of replacement pumps.
- Replacement of the existing generator, electrical and control components.
- Installation of new telemetry to the City's SCADA.
- Replacement of pumps, motors, level control devices and valving.
- Rehabilitation of the existing wet well including replacement of wet well piping, coating, pump boots and guide rails.
- Installation of a new bypass pumping port, flow meter and pressure gauge.
- Odor control.
- Securing required project permits.

- Pump station upgrades to be in accordance with the City's current pump station design standards, with some modifications based on the smaller size of the pump station.

SCOPE OF WORK

Gray & Osborne has prepared the following scope of work for this project.

Task 1 –Predesign Services

1. Provide Project Management

   Provide comprehensive project management of the Predesign phase of the project. This task will include coordinating and managing the schedule and budget for the consultant team, including subconsultants. A project schedule will be developed and the City will be provided with monthly progress updates. This task will also include coordination with other project stakeholders and regulatory agencies, as required.

2. Review Background Information

   Review previous reports, pump station operating data, and record drawings. This task will also include contacting utility providers and obtaining record information for utilities in the area.

   Review the findings of any odor/corrosion evaluations (including hydrogen sulfide monitoring data) for incorporation into the design. (It is recommended that the City install one of their Odalog H_2S monitors at the pump station during the predesign period.)

3. Provide Pump Sizing Analysis and Select Replacement Pumps

   Complete an analysis of the existing pump station and forcemain pumping conditions. Size and select pumps so that they can be pre-purchased. Gray & Osborne will provide the following services to support completion of this task.

   a. Confirm Tributary Flow to the Pump Station

      Review run data from the existing pump station and land use and population projections for the tributary basin, and estimate flows to the Prune Hill Park Pump Station.

b. Hydraulic Analysis

Conduct a hydraulic analysis of the proposed pump station piping and existing force main and affected STEP system. A system head curve will be developed, to be used to size pumps.

c. Pump Selection

Pumps will be sized to accommodate the design flows determined from the basin analysis. Pump and motor selection will be based on available Flygt submersible pumps per the City standards.

d. Prepare a Technical Memorandum

Prepare a Technical Memorandum for the pump selection. Incorporate relevant design information including flow projections and pump curves. Prepare a draft technical memorandum for City review. Address review comments and prepare a final Technical Memorandum.

4. Provide Preliminary Design Analysis

Complete an analysis of the existing pump station and prepare a predesign report. Gray & Osborne will provide the following services to support completion of this task.

a. Evaluate the Existing Prune Hill Park Pump Station.

Assess the condition of the existing pump station, including:

- Overall site and security elements
- Electrical canopy and roof
- Wet well, protective coating, and interior elements
- Pumping, piping and valving systems
- Power distribution and electrical systems
- Instrumentation and controls
- Odor control and corrosion control needs

b. Topographic Survey

Complete a topographic survey of the pump station site. Coordinate utility locates with City staff and the one-call service prior to field survey. Establish survey control to correspond to the City's survey datum. Identify right-of-way and property lines. Prepare a project base map.

c. Preliminary Site Plan Development

Prepare preliminary site plans. The site plan layouts will include locations for the power transformers, electrical and control canopy structure, wet well, valve vault, and generator.

d. Prepare a Predesign Report

Prepare a Predesign Report for the project. Incorporate the results of the various alternatives evaluations. Develop preliminary design criteria for the project. Incorporate preliminary site and facility layouts. Prepare a draft of the report for City review. Meet with City and staff to review the report. Address any review comments and prepare a final Predesign Report. No work on design will proceed until the Predesign Report is approved by the City.

4. Complete QA/QC Review

Conduct Quality Assurance/Quality Control reviews of the Pre-Design Report.

5. Attend Meetings and Site Visits

Attend meetings with City staff during the Predesign phase. Complete site visits to review existing conditions, field verify utility locations and record drawings (if available), and coordinate work with regulatory agencies. The following meetings are anticipated:

- Project Kick-off Meeting
- Site Visit to Review Existing Facilities
- Predesign Report Review Meeting

It is assumed that the kick-off and pre-design report review meetings will be remote (Zoom) meetings.

Task 2 – Design Engineering Services

1. Provide Project Management

Provide comprehensive project management of the Design phase of the project. This task will include coordinating and managing the schedule and budget for the project team, including subconsultants. The project schedule will be updated, and the City will be provided with monthly progress updates. This task will also include coordination with other project stakeholders and regulatory agencies, as required.

2. Complete Pump Station Design

Complete civil, mechanical, and electrical engineering design of the project. This task includes completing the engineering analysis and calculations necessary to complete the design. This task also includes preparation of detailed plans, specifications, and cost estimates to adequately describe the work for a public works contractor. Gray & Osborne will provide the following services to complete this task.

a. Prepare 60 Percent Plans, Specifications, and Cost Estimate

Prepare 60 percent plans, specifications, and construction cost estimates for the project. Specifications will be prepared in CSI format with applicable City of Camas General Conditions and contract forms. 60 percent plans, specifications, and cost estimates will be submitted to the City for review and comment. Meet with City staff to complete a facilitated review of the plans and specifications.

b. Prepare 90 Percent Plans, Specifications, and Cost Estimate

Prepare 90 percent plans, specifications, and construction cost estimates for the project. 90 percent plans, specifications, and cost estimates will be submitted to the City for review and comment. Meet with City staff to review any comments.

c. Prepare Final Plans, Specifications, and Cost Estimate

Prepare final plans, specifications, and construction cost estimates for the project. Plans and specifications will be suitable for public works bid. Final plans, specifications, and cost estimates will be submitted to the City for regulatory approval and distribution to contractors.

d. Provide Permitting Assistance

Assist the City with applying for and obtaining the required permits for the project. It is anticipated that the following permit applications will be required:

(1) SEPA Checklist
(2) City of Camas Civil Engineering Permit
(3) City of Camas Electrical Permit
(4) Critical Aquifer Recharge Areas (CARA) Permit for new generator
(5) Southwest Washington Clean Air Authority for new generator

A Level 1 Hydrogeological Assessment prepared by a licensed hydrogeologist and a narrative with best management practices for spill prevention will be provided for the CARA permit. The assessment will include:

a. Summary of available geologic and hydrogeologic characteristics of the site, including the surface location of all critical aquifer recharge areas located on site or immediately adjacent to the site, and approximate permeability of the unsaturated zone;

b. Approximate groundwater depth, flow direction, and gradient;

c. Location of wells and springs located within 1,300 feet of the site;

d. Location of other critical areas, including surface waters, within 1,300 feet of the site;

e. Available historic water quality data for the area to be affected by the proposed activity;

f. Results of ground-level reconnaissance of the site and the surrounding area to evaluate the presence of underground storage tanks, aboveground storage tanks, hazardous materials, hazardous waste, solid waste, pits, sumps, staining, odors, or distressed vegetation which may be indicative of adverse environmental conditions; and

g. Identification of appropriate Best Management Practices (BMPs) used to prevent degradation of groundwater.

Permit application and review fees have not been included in this scope of work. It has been assumed that these will be paid directly by the City.

3. Complete QA/QC Review

Conduct Quality Assurance/Quality Control reviews of the 60 percent, 90 percent, and final submittals for the project.

4. Attend Meetings and Site Visits

Attend meetings with City staff during development of the plans and specifications to discuss project issues and review draft deliverables. Prepare meeting notes and provide review comment summary sheets noting how each comment has been addressed. Complete site visits and meet with regulatory agencies as necessary to coordinate the work (up to two site visits).

- 60 Percent Design Review Meeting
- 90 Percent Design Review Meeting

It is assumed that one of these meetings will be a virtual (Zoom) meeting.

Task 3 – Provide Bid and Award Services

Assist the City with the bid and award process for the project. Participate in a pre-bid walkthrough. Respond to bidder inquiries. Prepare addenda as necessary. Review bid results and bidder qualifications. Prepare an award recommendation for the City.

Assumptions

The following assumptions have been made in developing this scope of work.

1. Meetings will be a virtual (Zoom) meetings.
2. Preliminary engineering and alternatives analyses will be completed during preliminary design that will further define the improvements to be constructed.
3. As-builts for the existing pump station are not available.
4. The existing generator will be replaced. It is an older model for which replacement parts are no longer available.
5. The existing canopy does not need to be replaced.
6. No environmental permitting, stormwater or grading permitting is required.
7. No geotechnical investigation or recommendations are required.
8. Construction support services will be contracted under a future amendment.
9. Less than 1 acre of ground disturbance will occur and a Stormwater General Construction Permit (NPDES) is not required.

BUDGET

Based on the Scope of Work described above, the total estimated cost for engineering services is as shown in the attached Exhibit B.

DELIVERABLES

Deliverables will be provided in the following format:

- Reports –electronic pdf files.
- Plans and Specifications – electronic pdf files and 5 paper copies of final plans and specifications

PROJECT SCHEDULE

The anticipated project schedule is as follows:

Notice to Proceed..... April 2022
Replacement Pump Selection.....April 2022 – May 2022
Complete Engineering Design.....April 2022 – January 2023
Construct Project .....April 2023 – December 2023

EXHIBIT "B"

ENGINEERING SERVICES
SCOPE AND ESTIMATED COST

CITY OF CAMAS - PRUNE HILL PARK PUMP STATION UPGRADE

Tasks	Principal Hours	Project Engineer Hours	Structural Eng. Hours	Environmental Tech./ Specialist Hours	Engineer-In-Training Hours	AutoCAD/ GIS Tech Hours	Professional Land Surveyor Hours	Field Survey (2 person) Hours
Task 1 - Predesign Services								
1 Provide Project Management	4							
2 Review Background Information	2	4			8			
3 Prepare Pump Sizing Analysis								
a. Confirm Tributary Flow	1	4			4	4		
b. Hydraulic Analysis	1	4			4			
c. Pump Selection	1	4			4			
d. Prepare Technical Memo	2	16			4	2		
4 Provide Preliminary Design Analysis								
a. Evalaute the Existing Lift Station	4	8						
b. Topographic Survey	1	2				4	8	24
c. Develop Preliminary Site Plan	1	8			4	8		
d. Prepare Pre-Design Report	4	24	2	2	16	8		
5 Complete QA/QC Review	4	2			2			
6 Attend Meetings and Site Visits	8	8						
Task 2 - Design Engineering Services								
1 Provide Project Management	8							
2 Complete Pump Station Design								
a. Prepare 60 Percent Design Submittal	8	64	8		32	96		
b. Prepare 90 Percent Design Submittal	8	48	4		24	64		
c. Prepare Final Design Submittal	4	24	4		12	24		
d. Provide Permit Assistance	2	4		16	8	4		
3 Complete QA/QC Review	16	8	2		8			
4 Conduct Meetings and Site Visits	8	8						
Task 3 - Bid Services								
1 Provide Bid and Award Services	2	8	2		4	4		
Hour Estimate:	89	248	22	18	134	218	8	24
Fully Burdened Billing Rate Range:*	$145 to $215	$125 to $160	$110 to $190	$83 to $151	$92 to $155	$50 to $150	$125 to $175	$180 to $270
Estimated Fully Burdened Billing Rate:*	$200	$150	$170	$130	$115	$110	$170	$240
Fully Burdened Labor Cost:	$17,800	$37,200	$3,740	$2,340	$15,410	$23,980	$1,360	$5,760

Total Fully Burdened Labor Cost:	$	107,590
Direct Non-Salary Cost:		
Mileage & Expenses (Mileage @ current IRS rate)	$	1,440
Printing	$	500
Subconsultant:		
Shell Engineering	$	14,700
Subconsultant Overhead (10%)	$	1,470
Conncticx	$	32,000
Subconsultant Overhead (10%)	$	3,200
GRI	$	3,500
Subconsultant Overhead (10%)	$	350
TOTAL ESTIMATED COST:	**$**	**164,750**

* Actual labor cost will be based on each employee's actual rate. Estimated rates are for determining total estimated cost only. Fully burdened billing rates include direct salary cost, overhead, and profit.

Staff Report

Month Day, Year Council Workshop Meeting

Lake Management Plan Water Quality Sampling Professional Services Agreement
Presenter: Steve Wall, Public Works Director
Time Estimate: 10 min

Phone	Email
360.817.7899	swall@cityofcamas.us

BACKGROUND: The City hired Geosyntec Consultants, Inc. in 2021 to assist the City with completion of a Lake Management Plan to analyze the current water quality conditions and develop a plan to identify management strategies to improve the water quality in Lacamas, Round and Fallen Leaf lakes (the "Lakes"). Subsequent to the original scope of work for Phase 1, the City has also signed two separate contract amendments with Geosyntec in late 2021. The first amendment was to complete the Quality Assurance Project Plan (QAPP), which is required prior to starting water quality sampling. The second amendment included development and implementation of a public involvement plan, identification and progress on short-term wins and development of potential funding opportunities and a funding strategy for future work. Additionally, it is worth noting the QAPP (attached for reference) received approval from the Department of Ecology in early April 2022.

SUMMARY: Based on the attached Ecology reviewed and approved QAPP, Geosyntec Consultants has submitted the attached Scope of Work and contract amendment to complete the water quality monitoring, sampling and associated field work. The work includes approximately 12 months of sampling in various locations in the Lakes, surrounding streams, and at two different stormwater outfall locations. Additionally, lake bottom sediment sampling, vegetation surveys and lake use surveys will be completed among other field work.

City staff worked with Ecology and Geosyntec to develop the QAPP to find a balance between collecting enough data to support development of a Lake Management Plan, while trying to minimize costs to the extent possible. The estimated cost based on the attached Scope of Work is $294,800. This work is identified as "Phase 2B, Part 1" in the overall Lake Management Plan Project as identified in the cost summary below.

EQUITY CONSIDERATIONS:

What are the desired results and outcomes for this agenda item?

> Inform the Council of the scope of work and estimated cost to complete the water quality sampling and monitoring as established in the approved QAPP.

What's the data? What does the data tell us?

Based on research completed in Phase 1 of the Lake Management Plan project, the last time data was collected on Lacamas and Round lakes was more than a decade ago. Much has changed since then and the information collected needs to be updated. The City contracted with the County to complete water quality sampling on Fallen Leaf Lake in 2019; however, additional data is also necessary to support strategies for that lake and is included in this contract amendment.

How have communities been engaged? Are there opportunities to expand engagement?

The City's Lake Management Plan project team has developed a full public outreach and engagement plan. Engagement occurred during Phase 1, and Phase 2 includes additional open houses and outreach efforts. Additionally, the City team has made multiple presentations to the City Council and Parks Commission.

Who will benefit from, or be burdened by this agenda item?

The citizens of Camas and users of the Lakes will benefit from collection of this data, completion of a Lake Management Plan, and implementation of lake management strategies.

What are the strategies to mitigate any unintended consequences?

The scope of work is based on the approved QAPP. The QAPP has been developed by the City's team and reviewed and discussed with the Department of Ecology.

Does this agenda item have a differential impact on underserved populations, people living with disabilities, and/or communities of color? Please provide available data to illustrate this impact.

N/A

Will this agenda item improve ADA accessibilities for people with disabilities?

N/A

What potential hurdles exists in implementing this proposal (include both operational and political)?

The City has funding to support some of the work; however, additional funds will be needed to fully complete the Lake Management Plan, and to ultimately implement the chosen strategies.

How will you ensure accountabilities, communicate, and evaluate results?

The information collected and analyzed will be made available to the public and the City Council will be updated on the work as it progresses.

How does this item support a comprehensive plan goal, policy or other adopted resolution?

This work supports Resolution No. 20-016 and the City Council's desire to investigate potential sources of contaminants causing poor water quality in the Lakes and developing management strategies to improve water quality.

BUDGET IMPACT: Following is a general summary of the costs to date for development of the Lake Management Plan and available funding sources to support the work.

Expenses:

- Phase 1 (Background Research and Ph. 2 Scope Development) $106,400
- Phase 2A (QAPP Development) $22,700
- **Phase 2B, Part 1 (Water Quality Sampling/Field Work) $294,800**
- Phase 2B, Part 2 (Public Outreach, Short-Term Wins, Funding) $127,500
- Phase 2b, Part 3 (Data Analysis and Plan Development) $ TBD

Total Work Contracted To Date: $551,498

Available Budget:

- City Stormwater Funds $300,000
- Freshwater Algae Control Program Grant $66,666
- 2021 State Budget Appropriation $155,000

Total Available Budget: $521,666

Funding Gap: ($29,832)

Should Council direct staff to move forward with the planned work, the 2022 Fall Omnibus will need to include an additional $30,000 to fully fund the work included.

RECOMMENDATION: This agenda item is for City Council's information only. Staff proposes placing the Professional Services Agreement Amendment with Geosyntec Consultants on the May 16, 2022 Regular Meeting Consent Agenda for Council consideration.

Geosyntec consultants

920 SW Sixth Ave, Suite 600
Portland, OR 97204
PH 503.222.9518
FAX 971.271.5884
www.geosyntec.com

18 April 2022

Mr. Steve Wall, P.E.
Public Works Director
City of Camas
616 NE 4th Avenue
Camas, WA 98607

Subject: Proposal for Execution of Field Work for the Cyanobacterial Lake Management QAPP for Lacamas, Round, and Fallen Leaf Lakes

Dear Mr. Wall,

On behalf of Geosyntec Consultants, Inc. (Geosyntec), we are pleased to present the City of Camas (City) with our scope of work for execution of the previously completed and Washington Department of Ecology (Ecology)-approved Lacamas, Round, and Fallen Leaf Lakes Quality Assurance Project Plan (QAPP).

This proposal outlines the tasks needed to complete field work to collect data in support of a Cyanobacterial Lake Management Plan, as outlined in the QAPP. The intent of this scope of work is to collect the water quality and hydraulic data needed to understand the algal blooms that have become common within the lakes. This data will also inform the strategies that can be developed with the intention of decreasing the frequency and duration of the algal blooms.

This proposal is divided into three main phases, each containing multiple tasks, which are summarized as follows:

- Phase 1: Administration and Coordination
- Phase 2: Field Work Execution
- Phase 3: Data Management

The scope of services for each phase and accompanying tasks are presented below.

PHASE 1: ADMINISTRATION AND COORDINATION

Objective

The objective of this task is to effectively manage the project schedule and budget, prepare for and coordinate sampling events, and provide timely progress updates.

Activities

- Project set up and monthly invoicing
- Internal progress meetings within Geosyntec and with our subcontractors
- Progress meetings with the City
- Subcontract and invoice management for field supplies and other purchases

Deliverables

- Monthly invoices
- Summary slides for progress meetings with the City

Assumptions

- Project management and invoicing tasks will last up to 18 months
- One 30 minute virtual meeting per month for 12 months is assumed for internal meetings
- One 1-hour virtual meeting per quarter for 5 quarters is assumed for City progress meetings

PHASE 2: FIELD WORK EXECUTION

Task 2.1: Field Preparation

Objective

Set the project up for success by ensuring sampling events are safe and well-coordinated.

Activities

- Create a health and safety plan; health and safety coordinators, staff members and subcontractors to review
- Review Ecology SOPs as specified in the QAPP
- Coordinate sampling schedule and personnel
- Develop field templates (e.g. daily field reports, data specific sample logs, etc.), as necessary

Deliverables

- Log of SOPs reviewed

Assumptions

- No major health and safety issues that prevent work from occurring, or require a significant change to the scope or budget, will be discovered prior to sampling
- No SOPs beyond those listed in the QAPP will need to be reviewed or developed

Task 2.2: Flow Gage Installation and Data Downloads

Objective

Obtain continuous flow data from Lacamas Creek at Goodwin Road for up to 12 months.

Activities

- Research, select, and procure equipment
- Install equipment
- Interface with data collection equipment
- Apply existing rating curve
- Manage data and troubleshoot equipment or data issues that may arise

Deliverables

- Continuous flow record for Lacamas Creek at Goodwin Road

Assumptions

- Installation of the flow gage can be completed using two field personnel in one field visit, and one follow up visit to verify the equipment is functioning properly.
- Flow data do not need to be available remotely
- Flow data do not to be provided in a specific file format
- Flow data will not need to be uploaded to Ecology's Environmental Information Management (EIM) database
- A new rating curve will not be developed – the existing rating curves from previous flow monitoring efforts at this location will be sufficient
- Flow data will only be downloaded/recovered during creek sampling events (approximately monthly)
- Flow data will be collected for up to 12 months; after that time equipment will be removed unless the City requests that it remain. If it remains, it will become the City's responsibility unless an alternate agreement is made.

Task 2.3: Thermistor Installation and Data Downloads

Objective

Obtain continuous temperature data from Lacamas and Round Lakes.

Activities

- Research, select, and procure materials
- Install equipment
- Interface with data collection equipment
- Download data during lake sampling visits

Deliverables

- Continuous temperature record for Lacamas and Round Lakes

Assumptions

- Installation of both thermistors can be completed using two field personnel in one field visit

- A contingency for replacement parts is included in case a small number of sensors stop functioning or become dislodged. Costs for full replacement of thermistor chains in case of a major event, such as theft, vandalism, or destruction by flood debris, is not included.
- Data do not need to be available remotely
- Data do not need to be provided in a specific file format
- Data will not need to be uploaded to Ecology's EIM database
- Thermistors will be installed only in the locations specified in the QAPP
- Data will only be retrieved during lake sampling events, or as necessary to prevent data that has not yet been downloaded from being overwritten (approximately 8 times)
- Boats needed to access thermistors for data recovery will be provided by a subcontractor.
- Thermistor data will be collected for up to 12 months; after that time equipment will be removed unless the City requests that it remain. If it remains, it will become the City's responsibility unless an alternate agreement is made.

Task 2.4: Surface Water Sampling

Objective

Obtain surface water samples from creeks and lakes, and vertical lake water quality profiles in accordance with the QAPP.

Activities

- Prepare and/or rent field equipment
- Obtain laboratory containers for sample collection
- Conduct surface water sampling or water quality profiling
- Upload notes and data to secure server after event completion

Deliverables

- Field notes from sampling events
- Invoices for rented equipment submitted with monthly invoices

Assumptions

- Data will not be formally summarized in a written document in advance of the draft Lake Management Plan, which is being prepared under a separate scope of work

- Surface water sampling refers to only lake (Lacamas, Round, and Fallen Leaf) and creek (five locations specified in the QAPP) water sampling
- A City technician will be available to assist with at least 75% of surface water sampling events
- Sampling will consist only of the parameters specified in the QAPP, at the frequency and locations specified in the QAPP

Task 2.5: Sediment Sampling

Objective

Obtain sediment samples from each of the three lakes as specified in the QAPP.

Activities

- Prepare and/or rent field equipment
- Obtain laboratory containers for sediment samples
- Conduct sediment sampling
- Upload notes and data to secure server after event completion

Deliverables

- Field notes from sampling events

Assumptions

- Data will not be formally summarized in a written document in advance of the draft Lake Management Plan, which is being prepared under a separate scope of work
- Sampling will consist only of the parameters specified in the QAPP, at the frequency specified in the QAPP
- Sampling will preferably occur prior to lake stratification, which typically occurs in early summer
- Sediment sampling will be performed by a subcontractor under the supervision of Geosyntec

Task 2.6: Stormwater Sampling

The City has expressed a preference to conduct stormwater sampling internally, using City technicians. As such, this task consists of up to eight hours of coordination between Geosyntec's project manager and the City to ensure samples are collected in accordance with the QAPP.

Assumptions

- Geosyntec will not participate in stormwater sampling events in the field
- Geosyntec will not submit samples to the lab, and will not prepare any data summaries in advance of the draft Lake Management Plan, which is being prepared under a separate scope of work

Task 2.7: Aquatic Vegetation Survey

Objective

Identify aquatic vegetation species present in Round and Lacamas Lakes following the methods and requirements described in the QAPP.

Activities

- Prepare maps and select sample points
- Conduct survey
- Upload notes and data to secure server after event completion

Deliverables

- Summary of results as part of the lake management plan (funded separately)

Assumptions

- The survey size and scope will follow what is specified in the QAPP
- Vegetation can be obtained using waders/kayak/rowboat and hand tools
- Vegetation surveys and identification will be completed by a subcontractor
- Geosyntec will not provide field assistance during the vegetation survey

Task 2.8: Lake Use Survey Coordination

Objective

Estimate the number of people using the lakes and the types of activities conducted.

Activities

- Create survey form
- Work with the City to coordinate a volunteer event to execute survey
- Review and digitize completed forms

Deliverables

- Summary of results as part of the lake management plan (funded separately)

Assumptions

- The survey size and scope will follow what is specified in the QAPP
- The survey will be conducted by volunteers and/or City staff
- Up to 4 hours of coordination for two Geosyntec personnel is assumed and does not include field visits

Task 2.9: Laboratory Fees

Objective

Obtain water quality data for surface water samples and lake sediment samples.

Activities

- Conduct one preparation and coordination meeting with the analytical laboratory before sampling begins
- Analyze surface water samples for water quality, as specified in the QAPP
- Analyze sediment samples for sediment quality, as specified in the QAPP
- Extract phosphorus (P) species from sediment and analyze for total P

Deliverables

- Analytical laboratory reports and electronic data deliverables (EDDs)

- Laboratory invoices will be submitted with monthly invoices

Assumptions

- Only the number and type of analyses specified in the QAPP will be required
- Laboratory costs for stormwater samples, which will be obtained by the City (see Phase 2, Task 2.6) are not included
- The laboratory will be able to meet the detection/quantitation limits as specified in the QAPP
- The laboratory will be able to provide an EDD in an EIM format.
- Third party data validation will not be necessary

PHASE 3: DATA MANAGEMENT

Task 3.1: Sample Event Peer Review

Objective

Ensure sample events are completed as scoped, notes are legible and complete, and issues are identified and remedied, if possible.

Activities

- Review field notes and forms
- Discuss potential issues with field staff and City

Deliverables

- Documentation of peer review

Assumptions

- Peer review will occur within three weeks of sampling event completion

Task 3.2: Sample Event Tracking and Data Organization

Objective

Ensure scope of work is completed as proposed and documentation is saved to a secure folder in a logical file structure.

Activities

- Create a field event tracking form with necessary tasks listed
- Organize continuous data and laboratory data as completed or downloaded
- At the completion of the field events, compile EDDs into one file containing water quality data and one file containing sediment data for the sampling program

Deliverables

- Updated tracking form to be delivered prior to or during each City update meeting
- Compiled water quality data for discrete sample data

Assumptions

- Tracking form will be updated monthly or as field tasks are scheduled, whichever is first
- Compiled water quality data files will contain only data associated with this scope of work

Task 3.3: Upload Data to Ecology's EIM Database

Objective

Ensure water quality data are available to Ecology and the public.

Activities

- Set up EIM account
- Prepare data for submission to EIM
- Upload data to EIM

Deliverables

- Water quality data in EIM

- Sediment data in EIM

Assumptions

- Continuous data will not be uploaded to EIM
- Laboratory EDDs will be provided in an EIM format

SCHEDULE

Work will begin as soon as authorized, preferably in late April 2022. The timeline will adhere to the QAPP, which assumes:

- Lake surface water sampling and vertical profiling on Lacamas and Round Lakes will occur monthly from April through October, and once in December or January
- Lake surface water sampling and vertical profiling on Fallen Leaf Lake will occur three times between May and October
- Creek sampling will occur monthly
- Sediment sampling will occur once, preferably in spring
- The aquatic vegetation survey will be completed between April and October

BUDGET

Geosyntec is pleased to provide you this proposal on a time and materials basis of $294,800. This budget estimate includes a 3% communications fee on Geosyntec labor only and a 10% markup on subconsultant labor and any expenses. This is based on the Geosyntec standard rate schedule as provided. Table 1 provides a budget summary for the phases and tasks outlined above.

Table 1: Costs for Proposed Scope of Work.

Phase/Task	Professional Services	Expenses
Phase 1 - Administration and Coordination		
Task 1 - Administration and Coordination	$30,900	$0
Phase 2 - Field Work Execution		
Task 1 - Field Preparation	$16,200	$0
Task 2 - Flow Gage Installation and Data Downloads	$11,300	$3,100
Task 3 - Thermistor Installation and Data Downloads	$10,100	$10,700
Task 4 - Surface Water Sampling	$72,600	$28,500
Task 5 - Sediment Sampling	$9,000	$15,800
Task 6 - Stormwater Sampling	$1,700	$0
Task 7 - Aquatic Vegetation Survey	$0	$12,100
Task 8 - Lake Use Survey Coordination	$4,900	$0
Task 9 - Laboratory Fees	$900	$42,900
Phase 3 - Data Management		
Task 1 - Sample Event Peer Review	$12,500	$0
Task 2 - Sample Event Tracking and Data Organization	$7,500	$0
Task 3 - Upload Data to EIM	$4,100	$0
SUBTOTAL	***$181,700***	***$113,100***
TOTAL	**$294,800**	

CLOSURE

If you have any questions regarding this draft scope of work, please feel free to contact me at (971) 271-5906/(503) 936-0115, or by email at RAnnear@geosyntec.com.

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Thank you for the opportunity to submit this scope of work for your consideration.

Sincerely,

Robert Annear, Ph.D., P.E.(OR, WA, ID, FL, NC)
Senior Principal Engineer
971.271.5906
RAnnear@geosyntec.com
Geosyntec Consultants

Bob Anderson, LHG, CWRE
Senior Principal
206.496.1454
BAnderson@Geosyntec.com
Geosyntec Consultants

Lacamas, Round, and Fallen Leaf Lakes Cyanobacterial Lake Management Plan

Quality Assurance Project Plan

FINAL

Prepared by Geosyntec Consultants
on behalf of the City of Camas

Quality Assurance Project Plan

Lacamas, Round, and Fallen Leaf Lakes Cyanobacterial Lake Management Plan

March 2022

Approved by: **Date:**

Steve Wall, City of Camas, Public Works Director

Ariel Mosbrucker, Geosyntec Consultants

Jacob Krall, Ph.D., P.E. (OR and CA), Geosyntec Consultants

Robert Annear, Ph.D., P.E. (OR, WA, ID, FL, NC), Geosyntec Consultants

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2 ABSTRACT

The Lacamas, Round and Fallen Leaf Lakes Cyanobacteria Management Plan (LCMP) is designed to characterize the major drivers of cyanobacteria blooms within Lacamas, Round, and Fallen Leaf Lakes. The blooms are becoming increasingly common and longer in duration, which is thought to be a result of excess nutrient loading. These cyanobacteria blooms can result in harmful toxins in the lake waters which result in health issues for the recreating community.

Additional understanding of the causes behind the increase in blooms is needed. While there is a large historical data set pertaining to nutrients in Lacamas Lake, a full nutrient budget has not been completed for this lake in over three decades. Round and Fallen Leaf Lakes have even more limited data sets. As such, before mitigation and prevention measures to curtail blooms can be developed and enacted, a full understanding of current nutrient cycling within the lake must be developed, and the influence of external loading sources must be determined.

Data in the three lakes will be collected over the course of a year, to include water quality sampling of lake water, influent and effluent creek water, and storm water, as well as sediment chemistry. The goal of this data collection is to develop hydrologic and nutrient budgets for Lacamas and Round Lakes, and to obtain a better understanding of the rarely studied Fallen Leaf Lake. The hydrologic and nutrient budgets for Fallen Leaf Lake may have large errors as the lake is small and both its inlets and outlets are ephemeral and storm dependent.

After field data is collected and processed, the LCMP will be developed. The intent of the LCMP is to use science-based information to achieve a more complete understanding of lake nutrient dynamics and to guide management decisions for the lakes. Continued data collection as well as use of the hydrologic and nutrient budgets will inform future management decisions while meeting the requirements and quality controls laid out in this Quality Assurance Project Plan (QAPP) approved by the State of Washington Department of Ecology (Ecology).

3 BACKGROUND

3.1 Introduction and Problem Statement

Lacamas, Round, and Fallen Leaf Lakes are located in Clark County in southwest Washington State. These lakes are classified as eutrophic based on the most recent available data measurements. Clark County found eutrophic conditions in Lacamas Lake based on chlorophyll a, phosphorus, and Secchi depth measurements during monitoring in 2005, 2006, and 2007. Less data exists for Round Lake, but it was assessed to be eutrophic to hypereutrophic by Beak and SRI (Beak and SRI, 1985). Fallen Leaf Lake was assessed in 2020 by Clark County and was also found to be eutrophic based on chlorophyll-a-based trophic state index (TSI; Carlson, 1977) in 5 out of 6 measurements (with one sample consistent with oligotrophic conditions), near the border between eutrophic and mesotrophic based on Secchi disk TSI, and between eutrophic and hypereutrophic based on phosphorus TSI (Carlson, 1977).

Each lake has experienced algae blooms in recent years, with the blooms of most concern being Harmful Algal Blooms (HABs), which result in the presence of cyanotoxins. Following several years of sporadic HABs (two noted in 2018, and 3-4 in 2019), Lacamas Lake experienced near-continuous HABs from April-October 2020. Round Lake has also seen increases in HABs in recent years; one sample tested above toxicity levels for Microcystin in April 2019, compared to six such samples in 2020. A HAB was reported on July 28, 2021, for both Lacamas and Round Lakes, with the advisory level reduced to a warning on September 30, 2021, despite the blooms remaining present, and warnings lifted in November 2021. Fallen Leaf Lake had its first recorded bloom in 2020.

This QAPP document outlines the process that will lead to the development of an Ecology-approved Lake Cyanobacteria Management Plan (LCMP), which will include management strategies for reducing HABs.

3.2 Study Area and Surroundings

The Lacamas, Round, and Fallen Leaf Lake watershed, as delineated by USGS StreamStats, is shown in Figure 1. The watershed is 59.7 square miles (38,184 acres) and includes agricultural, residential, commercial, and industrial land uses. The watershed extends from Hockinson, WA in the northern part of the watershed to the City of Camas in the southern part of the Watershed. Lacamas Creek flows 18 miles from forested areas through both agricultural and residential areas prior to discharging into Lacamas Lake. There are five major tributaries to Lacamas Creek: Matney Creek, Shanghai Creek, Fifth Plain Creek, China Ditch, and Dwyer Creek (Figure 1).

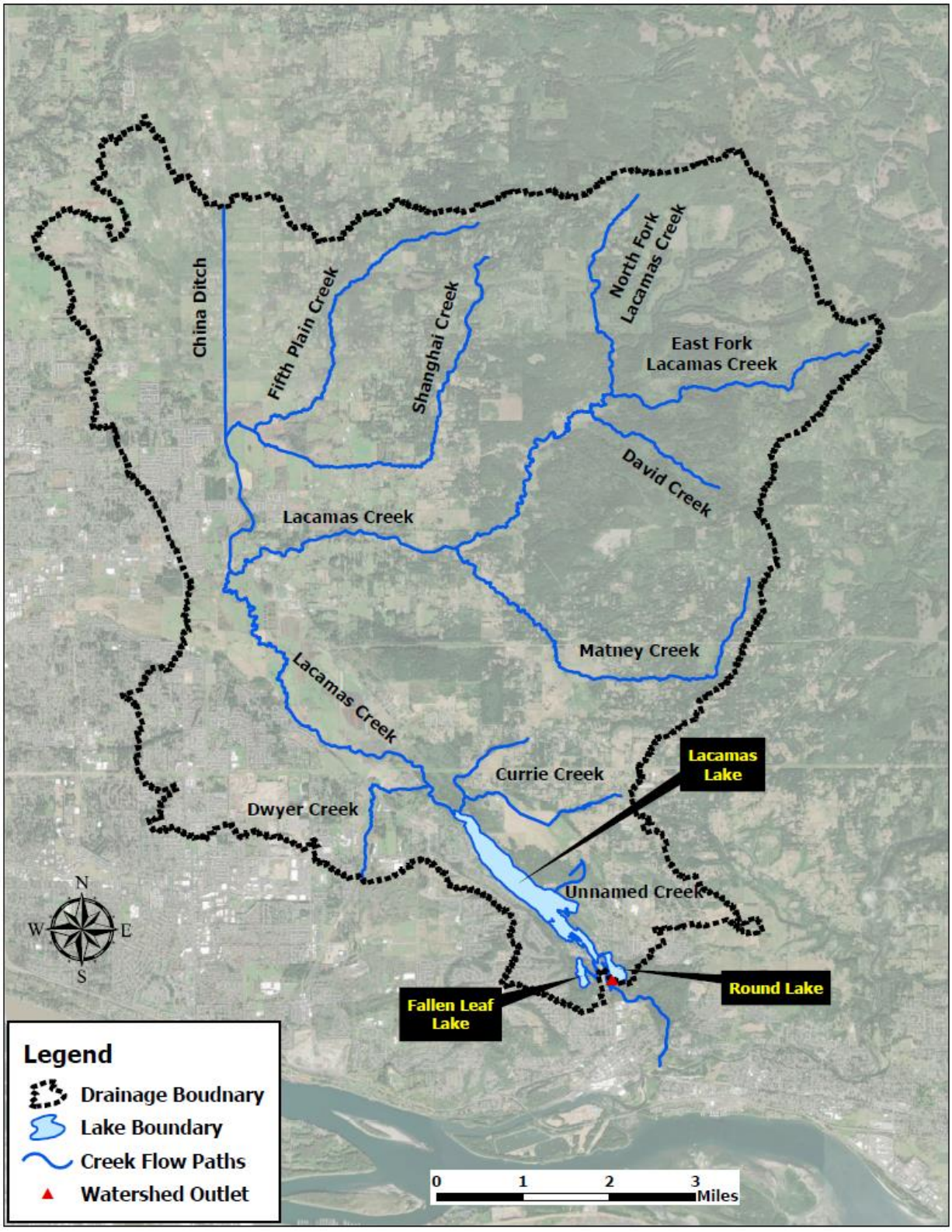

Figure 1. Lacamas/Round Lake watershed as delineated by USGS StreamStats

The largest of the three lakes, Lacamas Lake, is approximately 330 acres in size with a maximum depth of approximately 60 feet. Lacamas Lake is long and narrow in shape, with a length of approximately 2.5 miles, and a maximum width of approximately 0.3 miles. The vast majority of inflow to Lacamas Lake is from Lacamas Creek—the historically gauged flow measured at Lacamas Creek at Goodwin Road accounted for approximately 95% of the flow to the lake as estimated by Beak and SRI (Beak and SRI, 1985). Dwyer Creek enters Lacamas Creek below this gauge location, and there is additional limited inflow from Currie Creek, a small tributary to Lacamas Lake at its northeast end, and an unnamed creek at its southeast end (Figure 1). There are also some direct inflows from stormwater, and likely from groundwater. However, groundwater is not believed to be a major source of nutrients to the lakes (Beak and SRI, 1985).

Round Lake is the most downstream lake in the chain examined for this study. The channel connecting Lacamas and Round Lakes is the dominant inflow to Round Lake. Round Lake is much smaller in size, approximately 26 acres, and is also relatively deep, with a maximum depth of 55 feet. Water exits Round Lake either through the upper dam, where it discharges into lower Lacamas Creek, or through Mill Pond and the lower dam, where it discharges to a short, approximately 100 ft side stream that then discharges into lower Lacamas Creek.

Both Lacamas and Round Lakes are natural but were enlarged after the construction of two dams on Lacamas Creek downstream of Round Lake during the 1880s (Beak and SRI, 1985). Historically, the dams were used to control discharge to the Mill Ditch, which provided flow to a paper mill now operated by Georgia Pacific, and to Lacamas Creek downstream of the Lakes, which flows into the Washougal River. The dams were gifted to the City of Camas by Georgia Pacific in 2018 (Green, 2018). The Mill Ditch is no longer used, and flow below the dams is now directed only into Lacamas Creek (personnel communication, Steve Wall, city of Camas).

Fallen Leaf Lake is located just west of the downstream end of Lacamas Lake. Fallen Leaf Lake is a natural lake, approximately 21 acres in size, and has a maximum depth of approximately 28 feet. Fallen Leaf Lake is higher in elevation and its outlet flows into Lacamas Lake near Lacamas Lake Lodge during periods of high water. During periods of low water, the flows from Fallen Leaf to Lacamas Lake are negligible (Clark County, 2021). Fallen Leaf Lake has three small tributary streams, with a direct drainage area of approximately 0.55 square miles in size (350 acres), which is largely residential (Figure 2).

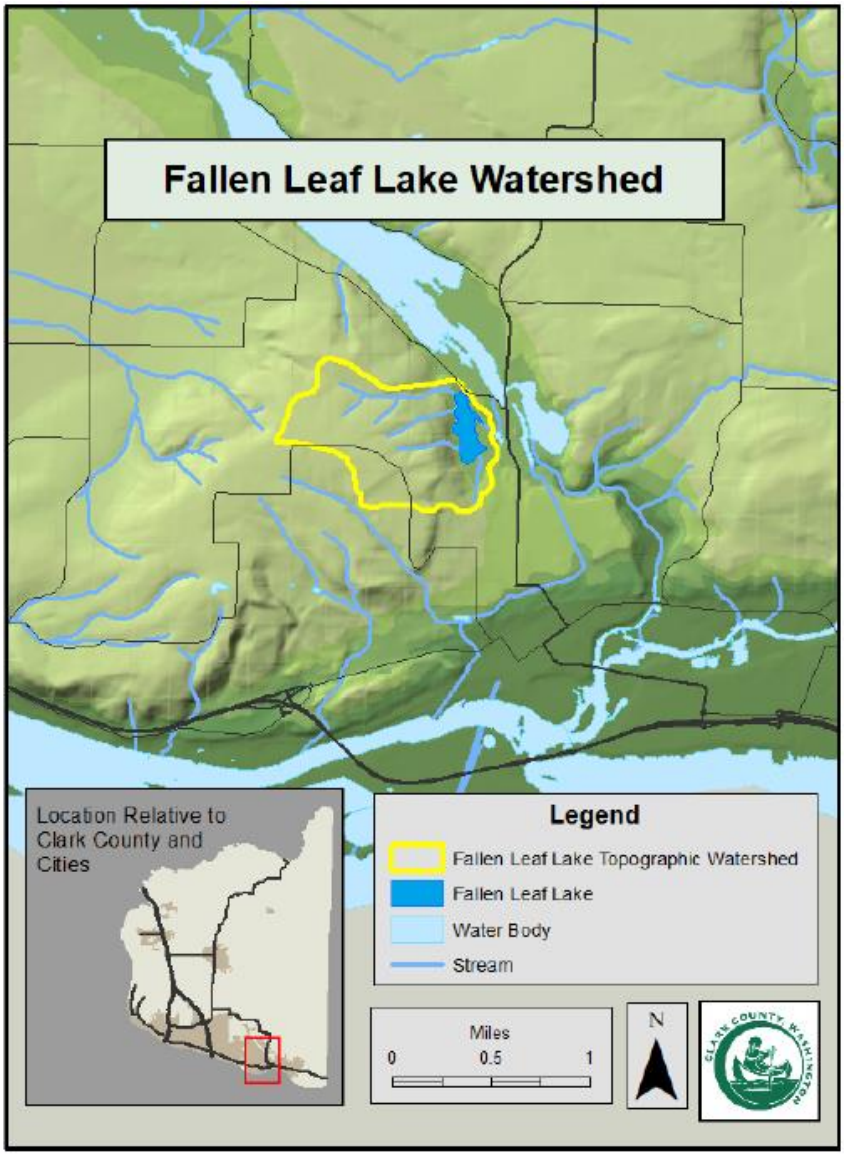

Figure 2. Fallen Leaf Lake watershed (Clark County, 2021)

3.2.1 History of study area

Development within the Lacamas/Round Lake watershed largely began in the 1880s. In 1883 La Camas Colony Company was created and the town of La Camas, later changed to Camas, was formed (Beak and SRI, 1985). Also in 1883, work began on the dams used to provide water for the newly constructed paper mill. During this time significant population growth in the area occurred and farms were formed. Beginning in the 1890s, drainage channels were built to drain the wetlands for farmland and to increase the flow of water delivered to the Camas paper mill; These channels led to altered watershed hydrology, which caused erosion of stream banks and increased flooding (Gleason and McCarthy, 2021). The current concrete buttress dams were

constructed in 1936 to replace the log dams constructed in the 1880s. The mill discontinued use of lake water for paper manufacturing in 2015 (Georgia-Pacific, 2018).

From 1900 to 1960, dairy cattle operations increased in the pasture areas of the watershed, in part due to improved roadways allowing for easier transportation of milk products to Vancouver, Washington and Portland, Oregon (Beak and SRI, 1985). Subsequently, the land was divided into smaller plots as the size of farms decreased and some became no longer feasible economically. As a result, the watershed includes both large farms and small 5-acre parcels of residential land (Beak and SRI, 1985).

In recent years, the population of Clark County has increased substantially, from approximately 425,400 people in 2010 to 503,300 in 2021, the second highest population growth rate in Washington (Macuk, 2021). The increased population growth has led to both increased development in the watershed and increased use of the lakes for recreation.

3.2.2 Summary of previous studies and existing data

Table 1 provides a summary of previous studies regarding water quality in Lacamas, Round, and Fallen Leaf Lakes. Table 2 provides a summary of the relevant available data from those studies.

Table 1. Previous studies pertaining to water quality at Lacamas, Round, and Fallen Leaf Lakes

Year	Author(s)	Title
1985	Beak Consultants, Inc. and Scientific Resources, Inc.	Lacamas - Round Lake Diagnostic and Restoration Analysis
1989-1999	Washington State Department of Ecology	Summer Water Quality Monitoring
1990	Washington State Department of Ecology	Lake Water Quality Assessment Project
1991	Connin, S. for EPA Region 10	Characteristics of Successful Riparian Restoration Projects in the Pacific Northwest
1996	Eilers, J. M., Raymond, R. B., Vache, K. B., Sweet, J. W., Gubala, C. P., Sweets, P. R.	Lacamas Lake Watershed 1995 Water Quality Monitoring Program
1997	Raymond, R.B., Eilers, J. M., Vache, K. B., Sweet, J. W.,Sweets, P. R., Gubula, C.P.	Lacamas Lake Watershed 1996 Water Quality Monitoring Program
1998	Raymond, R.	Dye Tracer Mixing Study at Lacamas Lake, 1996 and 1997
1998	Raymond, R.B., Eilers, J.M., Bernert, J.A., Vache, K.B.	Lacamas Lake Watershed Restoration Project Program Review
1999	Mueller, K.W., Downen, M.R.	1997 Lacamas Lake Survey: The Warmwater Fish Community of a Highly Eutrophic Lowland Lake
1999	Parsons, J.	Lacamas Lake aquatic plant summary
2002	Schnabel, J.D.	Lacamas Lake Restoration Program: WY2000 and WY2001 Water Quality Monitoring.
2004	Schnabel, J.D.	Lacamas Lake Nutrient Loading and In-Lake Conditions
2006	Schnabel, J.D.	Monitoring Report - Lacamas Lake Annual Data Summary for 2006

Year	Author(s)	Title
2007	Schnabel, J.D.	Monitoring Report - Lacamas Lake Annual Data Summary for 2007
2011	Deemer, B,R., Harrison, J.A, Whitling, E.W.	Microbial dinitrogen and nitrous oxide production in a small eutrophic reservoir: An in,situ approach to quantifying hypolimnetic process rates
2012	Henderson, S. M., Deemer, B. R.	Vertical propagation of lake wide internal waves
2015	Deemer, B. R., Henderson, S. M., Harrison, J. A.	Chemical mixing in the bottom boundary layer of a eutrophic reservoir: The effects of internal seiching on nitrogen dynamics.
2017	Perkins, K..R.	Influence of environmental factors on the vertical distribution of phytoplankton in Lacamas Lake, WA
2017	Harrison, J. A., Deemer, B. R., Birchfield, M. K., O'Malley, M. T.	Reservoir water-level drawdowns accelerate and amplify methane emission
2019	Nolan, S., Bollens, S. M., & Rollwagen-Bollens, G.	Diverse taxa of zooplankton inhabit hypoxic waters during both day and night in a temperate eutrophic lake.
2019	Perkins, K. R., Rollwagen-Bollens, G., Bollens, S. M., Harrison, J. A	Variability in the vertical distribution of chlorophyll in a spill-managed temperate reservoir
2021	Rose, V., Rollwagen-Bollens, G., Bollens, S. M., Zimmerman, J.	Effects of Grazing and Nutrients on Phytoplankton Blooms and Microplankton Assemblage Structure in Four Temperate Lakes Spanning a Eutrophication Gradient
2021	Clark County Public Works, Clean Water Division	Fallen Leaf Lake Baseline Monitoring Report

Table 2. Summary of existing water and sediment quality data for Lacamas, Round, and Fallen Leaf Lakes

Sample Type	Years Sampled	Locations	Measured Parameters
Lacamas Lake			
Water Quality	Various, 1984 - 2017	Deepest location; SR500 bridge; field profiles throughout lake	Temperature, DO, conductivity, pH, turbidity, Secchi, alkalinity, total P, ortho-P, TSS, TKN, nitrate, nitrite, ammonia, chlorophyll a, phytoplankton
Sediment	1984, 1995, 1996	Deepest location; 3 other locations	Total P, available P, total iron, total aluminum, TKN, ammonia, Paleolimnological parameters (1995)
Sediment Flux[1]	1984, 1996	Deepest location, 3 other locations	Temperature, DO, conductivity, pH, total P, soluble reactive P, dissolved P, TKN, ammonia, dissolved iron, metals, DDT, DDE
Stormwater	1985	Lacamas Creek at Goodwin Road, during storm	Temperature, DO, conductivity, pH, turbidity, total P, TSS, TKN, nitrate, nitrite, ammonia, fecal coliform
Inflow (Lacamas Creek at Goodwin Road)	1995, 1996, 2003	Goodwin Road	Temperature, DO, conductivity, pH, turbidity, total P, TSS, TKN, nitrate, nitrite, ammonia, fecal coliform
Round Lake			
Water Quality	1984-1985	Deepest location	Temperature, DO, conductivity, pH, turbidity, Secchi, alkalinity, total P, soluble reactive P, TSS, TKN, nitrate, nitrite, ammonia, chlorophyll a, phytoplankton
Water Quality	1990	Deepest Location	Secchi, Temperature, DO, total P, total N
Sediment	1984	Deepest location; near inlet	Total P, available P, total iron, total aluminum, TKN, ammonia
Sediment Flux	1984	Deepest location; near inlet	Temperature, DO, conductivity, pH, total P, soluble reactive P, dissolved P, TKN, ammonia, dissolved iron, metals, DDT, DDE

[1] Beak and SRI (1985) conducted elutriate testing to understand potential impacts of dredging and/or wind disturbance. Beak and SRI (1985) also used Dissolved Oxygen data and literature to estimate Phosphorus release under anoxic conditions. Raymond et. al (1998) discussed an evaluation of a 1996 sediment core and found that Phosphorus release was small relative to watershed loading.

Sample Type	Years Sampled	Locations	Measured Parameters
Stormwater	*None*	*none*	*none*
Outflow (Lacamas Creek downstream of dams)	*none*	*none*	*none*
Fallen Leaf Lake			
Water Quality	2020	Deepest location	Temperature, DO, conductivity, pH, Secchi, total P, TKN, nitrate, chlorophyll a, E. coli
Sediment	*none*	*none*	*none*
Sediment Flux	*none*	*none*	*none*
Stormwater	2020	Tributaries (storm-dominated)	Temperature, DO, conductivity, pH, turbidity, total P, TSS, E. coli

3.2.3 Water quality parameters of interest and potential sources

This QAPP describes the data collection necessary for the creation of hydrologic and nutrient (phosphorus and nitrogen) budgets for Lacamas and Round Lakes. These budgets will be a powerful tool in identifying the key sources of nutrients that lead to cyanobacterial blooms. In addition, data will be collected at Fallen Leaf Lake to gain a better understanding of hydrologic and nutrient inputs, though budgets for Fallen Leaf Lake may have a large error between inputs and outputs due to its small size and ephemeral nature. The field and laboratory activities to accomplish this are described in Section 7.

The sampling plan described in this QAPP is not intended to measure iron, sulfur, or other micronutrients that are important for cyanobacterial and algal growth. Based on extensive algal blooms that have occurred in the lakes, this document assumes that macronutrients (i.e., phosphorus and nitrogen) limit cyanobacteria and algae growth, not micronutrients.

Nutrients are suspected to enter Lacamas Lake primarily via four sources (Beak and SRI, 1985):

1. External loading via Lacamas Creek. Lacamas Creek has 5 primary tributaries, which contribute nutrients to this primary pathway to Lacamas Lake:
    - *i.* Fifth Plain Creek
    - *ii.* China Ditch
    - *iii.* Shanghai Creek
    - *iv.* Matney Creek
    - v. Dwyer Creek
2. Direct stormwater runoff
3. Direct agricultural runoff
4. Internal loading

Nutrients and water enter Round Lake primarily through its connection with Lacamas Lake, but also through runoff and internal loading. Nutrients and water enter Fallen Leaf Lake through the same processes; however, the primary sources consist of three unnamed tributaries, of which the northwestern most tributary is estimated to be highest in discharge volume (Clark County, 2021).

Direct runoff is a combination of point sources (i.e., municipal stormwater outfalls) and direct discharge to the lake. Agricultural runoff may occur as direct discharge from fields near the lake or through drainage ditches that act as point sources. Groundwater discharge and internal loading vary spatially. Groundwater is not believed to be a major source of nutrients to the lakes (Beak and SRI, 1985).

3.2.4 Regulatory criteria or standards

Lacamas and Round Lake's designated uses include core summer salmonid habitat; primary contact recreation; domestic, industrial, agricultural, stock and wildlife habitat water supply; harvesting; commerce and navigation; boating; and aesthetics. Fallen Leaf Lake is separately

designated and has the same designated uses. Algal blooms impair each of these uses. Regulatory criteria (Table 3) apply for conventional pollutants as defined in WAC 173-201A-600 (1)(a)(ii).

Table 3. Lacamas, Round, and Fallen Leaf Lakes regulatory criteria

Criterion	Value	Units
Temperature	16[1]	°C
Dissolved Oxygen (DO)	9.5[2]	mg/L
Total Dissolved Gas	≤ 110	%
pH	6.5 – 8.5[3]	-
Turbidity	5 over background when background < 50 10% increase when background > 50	NTU
E. coli	100[4] No more than 10% < 320	CFU or MPN per 100 mL

[1] Applies as 7-day average of the daily maximum temperature (7DADMax)

[2]Applies as daily minimum

[3]Human-caused variation must be less than 0.2 units

[4]Applies to geometric mean of at least 3 samples

3.3 Water Quality Impairment Studies

In accordance with the Clean Water Act, Ecology conducts a water quality assessment of Washington state waters every two years. The result of these assessments is a database of categorical rankings for each applicable standard in each assessment unit. Those assessment units classified as Category 5 make up the 303(d) list of impaired water bodies of the state. Lacamas Lake is currently listed as impaired for phosphorus in the water column, while Round Lake is impaired for pH and DO in the water column. Fallen Leaf Lake has not been assessed by the state for water quality impairment. Lacamas Creek, which feeds Lacamas Lake, is impaired for DO, bacteria, and temperature in the water within the assessment unit just upstream of Lacamas Lake.

Table 4. Impaired water quality parameters in Lacamas, Round, and Fallen Leaf Lake, as well as nearby tributaries

Waterbody	Parameter	Listing ID[1]
Lacamas Lake	Total Phosphorus	6346
Round Lake	DO	7936
	pH	**7935**
Fallen Leaf Lake	*not assessed*	
Lacamas Creek	Bacteria - Fecal coliform	7913
	DO	7912, 7915
	pH	7916
	Temperature	7914, 7917
Dwyer Creek	DO	7894
Currie Creek	*not assessed*	

[1] Bolded Listing IDs are listings that appear in the 2014 WQA (approved by EPA on July 22, 2016) but are not brought forth in the draft 2018 WQA (submitted to EPA, but not yet approved).

3.4 Effectiveness Monitoring Studies

Not applicable – this is not an effectiveness monitoring study.

4 PROJECT DESCRIPTION

4.1 Project Goals

The goal of this sampling project is to collect data of sufficient quality and quantity to support development of a LCMP for Lacamas, Round, and Fallen Leaf Lakes by following Ecology's Lake Cyanobacteria Management Plan template and guidance. Specifically, the data will be used to:

- Track changes in the water quality characteristics of Lacamas, Round, and Fallen Leaf Lakes throughout a year
- Quantify the nutrient loading of different sources and inputs of nutrients to Lacamas, Round, and Fallen Leaf Lakes
- Develop hydrologic and nutrient budgets for Lacamas and Round Lakes

4.2 Project Objectives

The objectives of this project are to:

- Collect 8 sets of monthly surface water quality data from Lacamas and Round Lakes
- Collect 3 sets of monthly surface water quality data from Fallen Leaf Lake
- Collect 12 sets of monthly water quality data from the major contributing creeks
- Collect continuous temperature data of the water column in Lacamas and Round Lakes
- Collect continuous flow data from Lacamas Creek at Goodwin Road
- Characterize the labile phosphorus in sediment in the three lakes
- Determine the contribution of nutrients in stormwater to Round and Fallen Leaf Lakes
- Obtain a rough picture of lake macroecology through collection of data related to aquatic vegetation and human use

4.3 Information Needed and Sources

Information and data available from previous studies is summarized in Section 3.2.2 and Table 1. Additional information, such as GIS layers, will be obtained from the City of Camas or Clark County.

4.4 Tasks Required

To complete this project the following tasks will be required:

- Conduct field work
    - Create a health and safety plan
    - Create a sampling schedule
    - Gather water quality sampling and monitoring equipment
    - Re-establish flow monitoring gauge at Lacamas Creek at Goodwin Road
    - Verify surface water sampling locations
    - Calibrate instruments (Section 7.2.3)
    - Install thermistor chains (Section 7.2.3)
    - Collect monthly surface water samples at multiple depths (Section 7.2.3)
    - Track storms (Section 7.2.9)
    - Collect stormwater samples, spread throughout the rainy season (Section 7.2.9)

  - Collect sediment samples (Section 7.2.7)
  - Conduct aquatic vegetation surveys (Section 7.2.5)
  - Conduct lake use surveys (Section 7.2.6)
- Analyze results of field work by measuring completed work against Quality Objectives (Section 6)
- Develop and perform QA/QC on hydrologic and nutrient budgets
- Identify management methods for cyanobacteria control and lake restoration planning
- Determine funding strategy and implementation
- Complete LCMP

4.5 Systematic Planning Process

The preparation of this QAPP is sufficient systematic planning for this project.

5 ORGANIZATION AND SCHEDULE

5.1 Key Individuals and Their Responsibilities

Table 5 shows the responsibilities of those who will be involved in this project.

Table 5. Organization of project staff and responsibilities

Staff	Title	Responsibilities
Steve Wall City of Camas Public Works Director Phone: 360-834-6864	Client	Clarifies scope of the project. Provides internal review of the QAPP and approves the final QAPP. City of Camas may also provide staff to support field work.
Ariel Mosbrucker Professional Geosyntec Consultants Phone: 971.271.5902	QAPP and Field Work Project Manager	Reviews the project scope and budget, tracks progress. Oversees development of the QAPP. Oversees field sampling and transportation of samples to the laboratory. Ensures QA review of data is performed appropriately. Ensures data is input into Ecology's Environmental Information Management System (EIM).
Dr. Jacob Krall Project Professional Geosyntec Consultants Phone: 971.271.5902	Modeling and Lake Management Plan Project Manager	Reviews the project scope and budget, tracks progress. Oversees analysis and interpretation of data. Develops nutrient budgets and leads development of the subsequent LCMP. Ensures QA review of data, analysis and interpretation of data are performed appropriately.
Dr. Rob Annear Senior Principal Geosyntec Consultants Phone: 971.271.5906	Principal Investigator	Provides internal review of the QAPP, approves the budget, and approves the final QAPP. Ensures QA review of data, analysis and interpretation of data are performed appropriately.
Ryon Foster-Edwards Stormwater Analyst MacKay Sposito Phone: 541-401-9626	Field Assistant	Helps collect samples and records field information.
Dr. Toni Pennington Senior Aquatic Biologist Environmental Science Associates Phone: 971-295-5016	Aquatic Plants Lead	Plans and leads aquatic plants surveys.
Analytical Laboratory (TBD)	N/A	Reviews draft QAPP, coordinates with Geosyntec's QA team.
Department of Ecology	Environmental Assessment Program	Reviews and approves the draft QAPP and the final QAPP.

5.2 Special Training and Certifications

At least one member of the field team for each data collection event will have previous experience with the equipment being used. Field staff must read the QAPP prior to conducting data collection activities, and all staff must be familiar with the project's health and safety plan. As water quality and sediment sampling will be conducted by boat, at least one member of each sampling team must have experience operating a boat. If a motorboat of greater than 15 horsepower is used for sampling the operator must complete a boating safety course and carry a Washington State Boater Education Card. All persons on a watercraft must wear an approved personal flotation device in the state of Washington.

5.3 Organization Chart

Figure 3 shows the relationship between organizations responsible for reviewing, approving, or executing this QAPP document and the work it outlines.

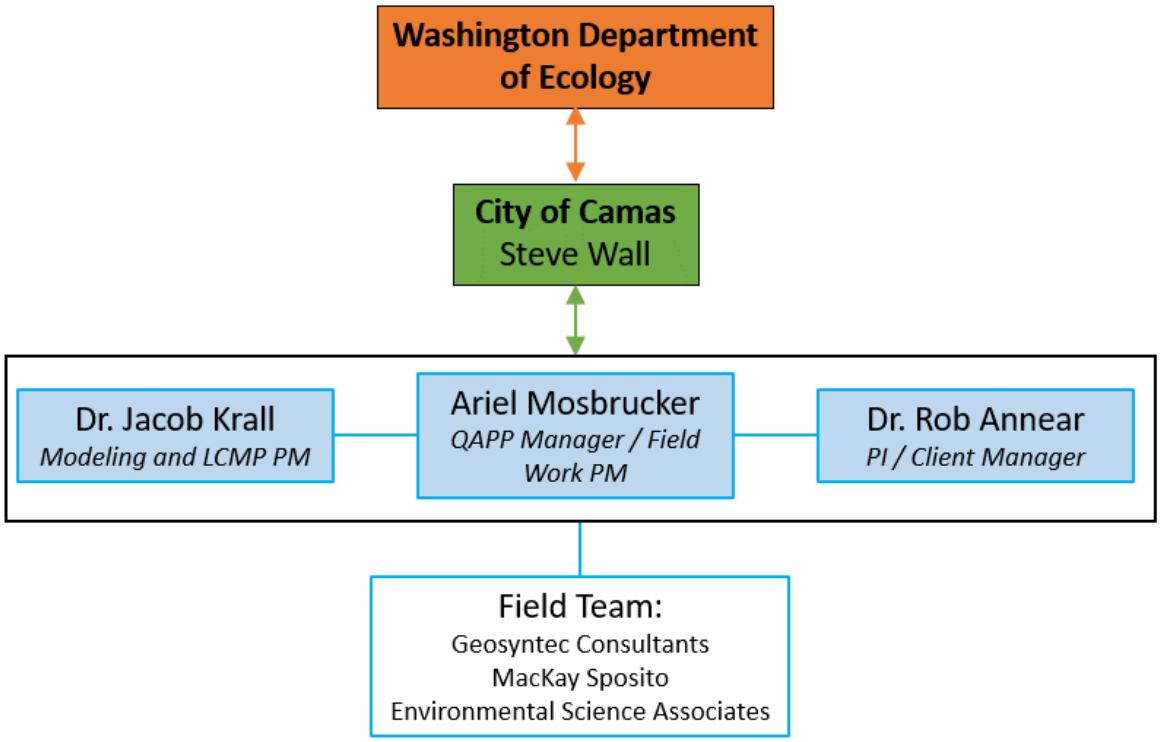

Figure 3. Organizational chart

5.4 Proposed Project Schedule

Table 6 through Table 8 list key activities, anticipated completion dates, and lead staff for this project. It should be noted that dates are subject to change based on Ecology approval, contract approval, weather conditions, and other field conditions that might impact the accessibility of the lakes.

Table 6. Schedule for completing field and laboratory work

Task	Due date	Lead staff
Field work	May 31, 2023	Ariel Mosbrucker
Laboratory analyses	July 31, 2023	Analytical Lab

Table 7. Schedule for data entry

Task	Due date	Lead staff
EIM data loaded	December 31, 2023	Ariel Mosbrucker

EIM: Environmental Information Management database

Table 8. Schedule for final lake cyanobacteria management plan report

Task	Due date	Lead staff
Draft to Ecology	December 31, 2023	Jacob Krall

5.5 Budget and Funding

This work will be funded through a combination of City of Camas stormwater funds, Washington state capital budget allocations, and Ecology's Freshwater Algae Control Program Grant. Available funding to date is provided in Table 9.

Table 9. Project budget and funding

Funding Source	Amount
City of Camas Stormwater Funds	$ 300,000
State Capital Budget Allocation	$ 155,000
Freshwater Algae Control Program Grant	$ 66,666
	Total: $ 521,666

Table 10. Laboratory budget details for water quality samples

Parameter	Method	Approx. Number of Samples	Number of QA Samples	Total Number of Samples	Cost Per Sample ($)	Lab Subtotal ($)
TSS	SM 2540 D-97	141	23	164	18	3,240
Ammonia	SM 4500-NH_3 G	141	23	164	25	4,500
TKN	ASTM D1426-08B	141	23	164	45	8,100
Nitrate + Nitrite	EPA 353.2	141	23	164	25	4,500
Total P	EPA 365.3	141	23	164	30	5,550
Soluble Reactive P	EPA 365.3	141	23	164	23	4,140
Hardness	SM 2340C	141	23	164	18	3,240
Chlorophyll-*a*	SM 10200 H	57	6	63	45	3,600
Phytoplankton Species	N/A	3	0	3	1200	3,600

Table 11. Laboratory budget details for sediment samples

Parameter	Method	Approx. Number of Samples	Number of QA Samples	Total Number of Samples	Cost Per Sample ($)	Lab Subtotal ($)
Total P	EPA 365.3M	4	1	5	35	175
Organic Content	ASTM D2974 – 07a	4	1	5	35	175
Moisture Content	ASTM D2216	4	1	5	20	100
P-fractionation extraction	Chang and Jackson, 1956,	4	0	4	1,500	6,000
Saloid-bound P	Chang and Jackson, 1956, and EPA 365.3M	4	0	4	35	140
Iron-bound P	Chang and Jackson, 1956, and EPA 365.3M	4	0	4	35	140

6 QUALITY OBJECTIVES

6.1 Data Quality Objectives (DQOs)

The main data quality objective (DQO) for this project is to collect water quality and sediment samples outlined in Section 7 which are representative of the Lacamas, Round, and Fallen Leaf Lakes, and to have them analyzed to support development of hydrologic and nutrient budgets. The

analysis will use standard methods to obtain concentration data that meet the measurement quality objectives (MQOs) described below and that are comparable to previous and future study results.

6.2 Measurement Quality Objectives (MQOs)

Measurement quality objectives (MQOs) are to obtain data of sufficient quality to meet the study objectives. MQOs include targets for precision, bias, sensitivity, representativeness, comparability, and completeness.

6.2.1 Targets for Precision, Bias, and Sensitivity

The MQOs for project results, expressed in terms of acceptable precision, bias, and sensitivity, are described in this section and summarized in Table 12 through

Table 14. MQOs will be verified based on the specific brand and model of field instruments, and analytical laboratory selected for this work. Minor adjustment to these MQOs may be made prior to the start of data collection if necessary.

Table 12. Measurement quality objectives for field measurement equipment

Parameter	Accuracy	Sensitivity
Temperature	± 0.4 degrees C	± 0.2 degrees C
Conductivity	± 2%	± 1 µohm/cm
ORP	± 20 mV	± 0.1 mV
DO	± 10%	± 0.1 mg/L
pH	± 0.2 S.U.	± 0.1 S.U.

Table 13. Measurement quality objectives for laboratory analyses of water samples

Parameter	Method	Lab Duplicate (RPD)	Field Duplicate (RPD)	Matrix Spike Duplicate (RPD)	Matrix Spike (% Recovery)	Control standard/ surrogate (% Recovery)	Method Reporting Limit Target
		Bias and Precision	Precision	Bias and Precision	Bias and Accuracy	Bias and Accuracy	Sensitivity
TSS	SM 2540 D-97	≤5%	≤30%	N/A	N/A	85 - 115	5 mg/L
Ammonia	SM 4500-NH_3 G	≤20%	≤30%	≤20%	90 - 110	90 - 110	0.02 mg/L
TKN	ASTM D1426-15B	≤20%	≤30%	≤20%	72 - 129	72 - 129	0.04 mg-N/L
Nitrate + Nitrite	EPA 353.2	≤20%	≤30%	≤20%	90 - 110	90 - 110	0.02 mg-N/L
Total P	EPA 365.3	≤20%	≤30%	≤20%	85 - 115	85 - 115	0.005 mg-P/L
Ortho-P	EPA 365.3	≤20%	≤30%	≤20%	85 - 115	85 - 115	0.009 mg-P/L
Hardness	SM 2340C	≤20%	≤30%	≤20%	90 - 116	90 - 116	0.8 mg-$CaCO_3$/L
Chlorophyll-*a*	SM 10200 H	≤20%	≤30%	≤20%	70 - 130	88 - 113	0.3 mg/m^3
Phytoplankton Species	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 14. Measurement quality objectives for laboratory analyses of sediment samples

Parameter	Method	Laboratory Duplicate (RPD)	Field Duplicate (RPD)	Matrix Spike Duplicate (RPD)	Matrix Spike (% Recovery)	Control standard/ surrogate (% Recovery)	Method Reporting Limit Target
		Bias and Precision	Precision	Bias and Precision	Bias and Accuracy	Bias and Accuracy	Sensitivity
Total P	EPA 365.3M	≤20%	≤30%	≤20%	75 - 135	75 - 135	1 mg-P/kg
Organic Content	ASTM D2974-07a	N/A	N/A	N/A	N/A	N/A	N/A
Moisture Content	ASTM D2216	N/A	N/A	N/A	N/A	N/A	N/A
Saloid-bound P	Modified Chang-Jackson method (Chang and Jackson 1956), followed by EPA 365.3 (water)	Same as Total P in water, above					
Iron-bound P	Modified Chang-Jackson method (Chang and Jackson 1956), followed by EPA 365.3 (eater)	Same as Total P in water, above					

6.2.1.1 Precision

Precision is a measure of variability between results of replicate measurements due to random error. It will be assessed using duplicate field measurements and laboratory analysis of duplicate samples. For water samples and surface sediment samples, if the sample container is of sufficient size, two sets of bottles will be filled from the same grab sample. If the sample does not contain sufficient volume for two sets of sample bottles to be filled, a second grab sample will be obtained from the same location within 15 minutes of the first sample for use as a field duplicate. Sediment core duplicates will be obtained by collecting multiple sediment cores within 25 ft of each other.

6.2.1.2 Bias

Bias is the difference between the sample mean and the true value. Bias will be addressed by calibrating field and laboratory instruments, and by analyzing lab control samples, matrix spikes, and/or standard reference materials.

6.2.1.3 Sensitivity

Sensitivity is a measure of the capability of a method to detect a substance. For the purposes of this QAPP it is described as the Method Reporting Limit (MRL; Table 13 and

Table 14).

6.2.2 Targets for comparability, representativeness, and completeness

6.2.2.1 Comparability

Comparability will be ensured by following the Standard Operating Procedures (SOPs) specified in Section 8.2. Field staff will be required to review SOPs prior to conducting field sampling to ensure their familiarity with required procedures. Copies of the SOPs will be carried into the field during sampling execution.

6.2.2.2 Representativeness

Representativeness will be ensured by following consistent, documented procedures, including this QAPP. Measurements will be taken as close as practical to the same locations throughout the project, with sample locations recorded via GPS coordinates. Sample coordinates may be adjusted during the first sampling event due to field conditions, but any deviation from the specified sampling location will be documented in the field forms. Following the first sampling event, if sample locations deviate from the target sample location by more than 50 feet, the associated data will be flagged, and the actual sample location will be documented in the field forms. Monthly samples will be taken at least 2 weeks apart to ensure samples are not biased towards a certain set of environmental conditions, with a preference for 3 or more weeks apart. Samples are intended to represent variable flow, seasonality, and weather conditions.

6.2.2.3 Completeness

This study has a goal of 95% completeness as related to collection of specified samples. If safety concerns, access, weather, or other factors prevent the collection of a full suite of data during a

given month, a second attempt will be made to collect the data within the same month. If the second attempt is unsuccessful, the project team will assess the criticality of the missing data and whether it can be estimated based on other available information. The reason for any missed sampling events will be recorded in the LCMP, which will contain a data summary for the collected data.

If data is deemed incomplete due to laboratory error, a request will be made to for the lab to re-analyze samples, if holding times allow.

6.3 Acceptance Criteria for Quality of Existing Data

Available data will be assessed based on its data quality level as listed in Ecology's EIM database (Ecology, 2021). Only data with a Level 3 or higher QA Assessment Level designation will be used in the LCMP. Additional data not included in EIM may be used if an associated QAPP is available.

6.4 Model Quality Objectives

The models created for this project will be simple spreadsheet-based mass balance models. These nutrient and hydrologic budgets will be considered acceptable if calculated inflows and the sum of outflows plus change in storage is within ±20% of each other.

7 STUDY DESIGN

This section describes the collection of samples for field or laboratory analysis to support the LCMP for Lacamas, Round, and Fallen Leaf Lakes.

7.1 Study Boundaries

The study boundaries for this project consist of the watersheds for Lacamas, Round, and Fallen Leaf Lakes. This consists of the lakes themselves as well as surrounding streams and stormwater conveyance systems in the vicinity of the lakes where they discharge to, or originate from, one of the three lakes. Selected sample points, by sample type, are shown in Figure 4 and described in their respective subsections of Section 7.2. Selected sample points are approximate and include lake sampling points, which were selected based on lake bathymetry and historical sampling locations; creek sampling points, which were selected based on historical sampling locations and locations where bridges or walkways enable easy access for sampling; and stormwater sampling locations, which were selected based on accessibility as determined during a field visit.

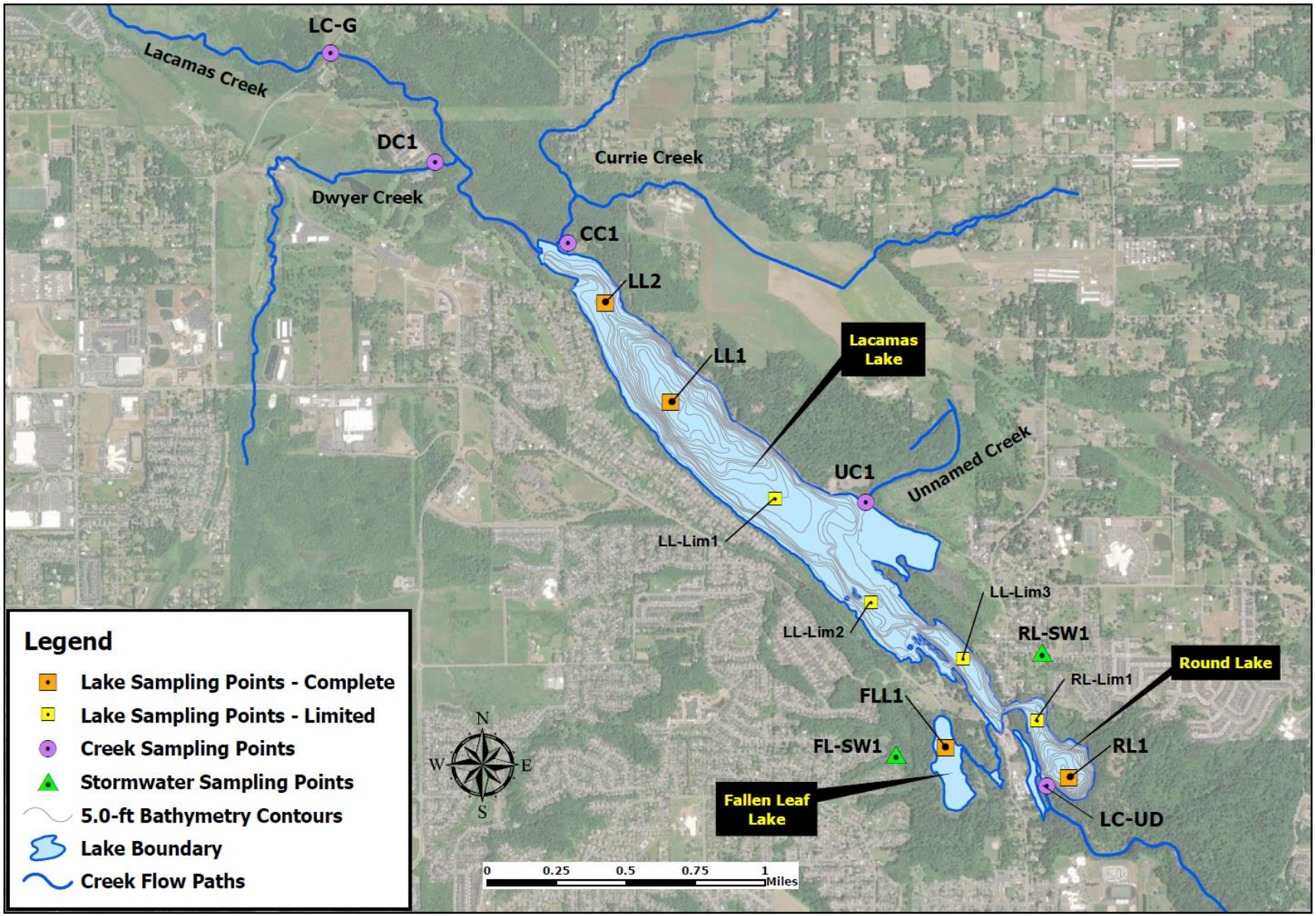

Figure 4. Proposed sampling locations for Lacamas, Round, and Fallen Leaf Lakes

7.2 Field Data Collection

7.2.1 Hydrology

7.2.1.1 Flow Monitoring

Flow monitoring will occur for Lacamas Creek at Goodwin Road (LC-G, Figure 4). A gauge has existed here in the past but was decommissioned some time ago. The gauge will be re-established as part of this work.

Outflow from the three lakes will be calculated based on changes in lake storage, calculated via depth measurements, and dimensions of hydraulic structures passing water through each of the upper and lower dams.

7.2.1.2 Meteorological information.

Multiple sources of data will be used for any meteorological analysis. The sources include Washington State Department of Transportation (WSDOT), Clark County, National Centers for Environmental Information (NCEI), and Automated Surface Observing Systems (ASOS). The open web source Weather Underground will be used for tracking storm forecasts for sampling purposes but will preferentially not be used for data analysis due to a lack of data review protocols with this source (Table 15).

Table 15. Summary of Nearby Meteorological Stations

Source	Station ID	Latitude	Longitude	Approx. Elevation (ft)	Frequency
WSDOT	DW4130	45.62	-122.44	250	15-min
WSDOT	DW0646	45.61	-122.43	400	15-min
Clark County	Lacamas	45.634	-122.460	215	15-min
NCEI	Portland-Troutdale Airport (72698524242)	45.551	-122.410	20	hourly
ASOS	Portland-Troutdale (TTD)	45.551	-122.410	20	5-min
Weather Underground	KWACAMAS12	45.619	-122.436	250	5-min
Weather Underground	KWACAMAS161	45.606	-122.419	282	5-min

7.2.1.3 Other Monitoring

An observational assessment of whether there is an active surface flow connection between Fallen Leaf Lake and Lacamas Lake will be made during each surface water sampling visit and documented on the field form (Section 7.2.3).

7.2.2 Evaporation

7.2.2.1 Locations

Lake evaporation will be calculated using local meteorological data, and thus there are no evaporation field measurements proposed.

7.2.2.2 Monitoring Methods

Lake evaporation will be calculated using the U.S. Weather Bureau method presented by Harwell (2012). This requires dewpoint temperature, daily average air temperature, daily average wind speed, and cloud cover from the meteorological data archives.

7.2.3 Surface Water

Creek sampling will occur once per month for 12 months from the outset of the project in early 2022. Lake water quality sampling for Lacamas and Round Lakes will occur once per month during the months of April through October, and once in either December or January. Sampling for Fallen Leaf Lake will be limited due to its recent characterization (Clark County Public Works, 2021). However, three sampling events will occur in this lake between the months of May and October to provide a concurrent reference with data from the other two lakes. Sampling events at each location will be at least 2 weeks apart, and preferentially at least 3 weeks apart.

Surface water sampling locations have been identified to characterize water quality in each of Lacamas, Round, and Fallen Leaf Lakes as well as their tributaries (Figure 4). Two types of lake sample locations are identified – complete and limited. All specified field and laboratory data will be collected during all sampling events at complete sampling locations, while only field parameters will be collected at limited sampling locations when certain conditions are present (Table 16).

Table 16. Complete versus Limited Lake Sample Locations

Complete Lake Sample Locations	Limited Lake Sample Locations
• Field parameters collected during every lake sampling event • Samples for laboratory analysis collected during every lake sampling event	• Field parameters collected when an oxycline is present at at least one of the complete lake sampling locations in the same lake • No samples for laboratory analysis will be collected

Surface water sampling locations are described in Table 17 and Table 18. Locations are intentionally approximate to allow for minor adjustments based on field conditions when initial sampling occurs. In addition, a sampling point may be moved to better align with sample points historically used by Clark County. During initial sampling, geographical coordinates will be

recorded, and future sampling will occur as close as reasonably possible to the established coordinates. If a sampling location must be moved, this will be recorded in field logs and the project team will decide whether the moved location will be maintained into the future or whether future sampling will occur at the original location.

Table 17. Lake Sampling Locations

Site ID	Type	Description	Approx. Location[1]	Estimated max lake depth (m)	Max # depths sampled[2]	Thermistor chain?
LL1	Lake, Complete	Deepest point in Lacamas Lake	45.6205, -122.4318	20	2-3	Y
LL2	Lake, Complete	Inlet to Lacamas Lake	45.6257, -122.4366	4.6	2	N
LL-Lim1	Lake, Limited	Center of lake SE of LL1	45.6037, -122.4047	8.5	-	N
LL-Lim2	Lake, Limited	Center of lake SE of LL-Lim1	45.6100, -122.4170	6.7	-	N
LL-Lim3	Lake, Limited	Center of Lake near Heritage Park	45.6070, -122.4102	4.6	-	N
RL1	Lake, Complete	Deepest point in Round Lake	45.6008, -122.4024	18	2-3	Y
RL-Lim1	Lake, Limited	Round Lake near inlet	45.6141, -122.423	4.6	-	N
FLL1	Lake, Complete	Deepest point in Fallen Leaf Lake	45.6024, -122.4115	8.8	2-3	N

[1] Official sampling location coordinates will be established during the first round of sampling based on field conditions. Estimated coordinates are provided to guide field crew members to the approximate desired sampling location during the first sampling event.

[2] This column refers to sample collection for laboratory analysis. Field parameters will be measured every 1.0 m.

Table 18. Creek Sampling Locations

Site ID	Type	Description	Approx. Location[1]	Estimated max lake depth (m)	Max # depths sampled	Thermistor chain?
LC-G	Creek	Lacamas Creek at Goodwin Road	45.638786, -122.456912	N/A	N/A	N/A
LC-UD	Creek	Lacamas Creek at outlet from Round Lake Upper Dam	45.600331, -122.404017	N/A	N/A	N/A
DC1	Creek	Dwyer Creek at Lacamas Heritage Trail crossing	45.633073, -122.449174	N/A	N/A	N/A
CC1	Creek	Currie Creek near outlet across from Camp Currie	45.628801, -122.439341	N/A	N/A	N/A
UC1	Creek	Unnamed Creek at SE Leadbetter Road	45.615173, -122.417336	N/A	N/A	N/A

[1] Official sampling location coordinates will be established during the first round of sampling based on field conditions. Estimated coordinates are provided to guide field crew members to the approximate desired sampling location during the first sampling event.

7.2.3.1 Sampling methods: lake samples

Field parameters (Table 19) will be collected continuously by lowering a water quality sonde from the surface to the bottom of the water column while the sonde records measurements continuously. The sonde's descent will be paused every 1.0 m until readings stabilize. Temperature (T), specific conductance (SC), pH, DO, oxidation-reduction potential (ORP), and turbidity will be measured.

In addition, thermistor chains will be installed at the deepest location in each of the three lakes (LL1, RL1, and FLL1). These will measure temperature continuously (e.g., every 15 minutes) at a depth interval of approximately 0.75 m, starting 0.5 m from the bottom of the water column and extending through the entire water column of each lake. Data will be downloaded concurrent with lake sampling events.

For collection of samples for laboratory analysis, sampling depths will be selected to produce the best possible estimates of internal loading at the time of sampling. Internal loading of phosphorus into the water column of each lake is likely dependent on vertical mixing. When wind is calm, biological activity reduces DO concentrations in the bottom of the water column. This can lead to bottom-water anoxia, which allows iron-bound phosphorus to move from the sediment bed to the

water column. Then, when wind increases, this released phosphorus is mixed through the water column.

The depths at which water samples for laboratory analysis will be collected will vary between locations (Table 17) to A) minimize analytical costs and sampling effort and B) characterize the nutrient chemistry of the water column below the oxycline (i.e., the portion of the water column where DO concentrations change from oxic to anoxic), should it exist. The following steps will be used to determine the depths of samples collected during each sampling excursion:

1. Every collection of water samples should be preceded by measurement of the water column with a multiparameter sonde (field measurements). If the lake water column shows a decrease in DO concentration over depth, often in combination with thermal stratification, a clear change in DO concentration will be important. The depth at which this change occurs represents the oxycline.
2. Two samples should be collected at shallower lake sampling locations, and during times when an oxycline is not present at deeper lake sampling locations (Table 17). In these circumstances, the two samples should be collected 0.5 m below the surface and 0.5 m from the apparent bottom. If bottom sediment is unconsolidated and the depth that is 0.5 m from the bottom is ambiguous, the sample should be collected as deep as possible without collecting unconsolidated fluffy sediment. The turbidity of the sample should be representative of the water column, not the loose floc layer overlying the sediment.
3. Three samples should be collected at deeper lake sampling locations when an oxycline is present (Table 17). When 3 samples are collected, they should be collected at the depths described above for the collection of 2 samples plus also a third depth located 0.5-1.0 m below the oxycline.

To collect samples, a 4- to 6-L vertical Kemmerer bottle or similarly sized Van Dorn sampler will be used at depths greater than 0.5 m. Sampling will occur from the front half of the field vessel to minimize potential for contamination related to the boat engine. Gradations of 0.5 m will be marked on the rope used to suspend the sample collection vessel, and this will determine the precision of the depth at which samples are collected. The sampling vessel will be anchored prior to deployment. When the sampling vessel has been retrieved, it will be used to fill individual sample bottles.

Sample bottles will be handled only with gloved hands, and they will be stored in resealable plastic bags in coolers on ice before and after sampling. Sample bottles will be supplied by the analytical laboratory and thus will not need cleaning; the sampling vessel will be rinsed 3-5 times with distilled water prior to each sampling day and will be flushed with surface water from each location prior to sampling from that location.

7.2.3.2 Sampling methods: creek samples

Creek samples should be collected on a dry day. Specifically, an antecedent dry period of > 6 h with < 0.04 in of rain is required, with an antecedent dry period of > 24 h with < 0.10 in of rain preferred when possible.

Samples should be collected from within the flowing portion of the stream, as close to the thalweg as possible. Samples will be collected as grab samples using a sampling pole or bucket on a string. Sampling vessels will be decontaminated prior to each sampling event using a phosphate-free lab-grade detergent, such as Citranox® or Liquinox®, and will be rinsed with distilled water before sampling at each location.

7.2.3.3 Laboratory analytes and field parameters

Laboratory analytes and field parameters planned for this sampling regime are shown in Table 19. For field measurements at creek sampling locations, a handheld water quality meter or a water quality sonde should be used to measure T, SC, pH, turbidity, ORP, and DO. At lake sampling locations, a water quality sonde should be used to measure these field parameters, and Secchi disk depths should also be recorded. With respect to water quality sonde measurements, a DO optode will be the preferred type of DO sensor due to its speed and ease of use. All sensors will be calibrated according to equipment manufacturer recommendations. For laboratory analytes, laboratory-provided bottles will be obtained and filled with sample, and samples will be stored on ice in a cooler until delivery to the lab.

Table 19. Field and lab measurement parameters for surface water samples

Parameter	Sample Type	Field Filtered?	Lab or Field Measurement?	Analytical Method
Temperature	Lake, Creek	N	Field	Multi-parameter sonde
Specific Conductance	Lake, Creek	N	Field	Multi-parameter sonde
Dissolved Oxygen	Lake, Creek	N	Field	Multi-parameter sonde
Oxidation-Reduction Potential	Lake	N	Field	Multi-parameter sonde
pH	Lake, Creek	N	Field	Multi-parameter sonde
Secchi depth	Lake	N	Field	Secchi disk
Suspended Solids	Complete Lake, Creek	N	Lab	SM 2540 D-97

Parameter	Sample Type	Field Filtered?	Lab or Field Measurement?	Analytical Method
Ammonia	Complete Lake, Creek	N	Lab	SM 4500-NH_3 G
TKN	Complete Lake, Creek	N	Lab	ASTM D1426-15B
Nitrate + Nitrite	Complete Lake, Creek	N	Lab	EPA 353.2
Total P	Complete Lake, Creek	N	Lab	EPA 365.3
Ortho-P	Complete Lake, Creek	Y	Lab	EPA 365.3
Hardness	Complete Lake, Creek	N	Lab	SM 2340C
Chlorophyll-*a*[1]	Complete Lake	N	Lab	SM 10200 H
Phytoplankton Species[2]	Complete Lake	N	Lab	N/A

[1] Chlorophyll-a samples will only be taken at depths less than approximately 10 meters, as previous research has shown little to no chlorophyll at deeper depths (Perkins et al., 2019).

[2] Only one phytoplankton species sample from each lake is planned for analysis. This sample will be obtained in late summer or early fall.

7.2.4 Waterfowl

Waterfowl are not believed to be a major contributor to nutrients in Lacamas, Round, or Fallen Leaf Lakes. As such, waterfowl surveys will not be conducted.

7.2.5 Aquatic Vegetation Survey

The objective of aquatic vegetation surveys are to quantify the plant populations in each lake and better understand the pervasiveness of native and invasive plant species at a high level. These aquatic vegetation surveys are not meant to be an exhaustive study but rather focused on gaining a baseline understanding of the current populations. If this initial survey indicates that additional data are needed, a more detailed survey may be undertaken as part of future studies.

Watercraft-based aquatic vegetation surveys will be conducted for each of Lacamas and Round Lakes. Fallen Leaf Lake will not be surveyed as it was surveyed recently by Clark County (Clark County, 2021). Protocols will follow the point-intercept method specified in Ecology's Aquatic Plant Sampling Protocols guidance document (Parsons, 2001) and detailed in Madsen, 1999. Briefly, the littoral zone of each lake will be divided into 50 x 50 m grids, approximately 30 to 50 of the grid points will be selected as sample points, and presence/absence data for vegetation species will be recorded at each sample point. The littoral zone will be defined by a qualified

individual and surveys will not surpass areas with an overlying water depth of greater than 35 ft (10.5 m). Plant species will be identified to species by a qualified aquatic plant botanist.

7.2.6 Lake Use Survey

Lake use surveys will be conducted four times: one for each of a weekday and weekend day in each of spring and summer. Surveys will be conducted for up to two hours at each of Heritage Park, Lacamas Park, Fallen Leaf Lake Park, the Leadbetter Road boat launch, and the Lacamas Shores boat launch, between 8 am and 4 pm. Observers will use clicker counters or alternative devices, and will record the following information:

- Site name
- Date, start and end time
- Weather, including temperature, visibility, approximate cloud cover, approximate wind speed
- Observer name
- Number of vehicles with and without boat trailers
- Number and type of watercraft entering the water (motorized, non-motorized)
- Number of swimmers and fishermen not associated with boats
- Number of hikers/walkers/picnic goers
- Number of dogs or other pets

7.2.7 Sediment Sampling

Sediment samples will be collected at each of the four complete lake sampling locations (LL1, LL2, RL1, and FLL; Figure 4) once during the sampling year, in spring. Sediment sampling will occur prior to seasonal lake stratification if possible.

7.2.7.1 Sampling methods

Where possible, samples will be collected as 1-m cores in 3- or 4-inch diameter core liners. Samples will be capped, taped, and stored vertically on ice in the field at or below *in situ* temperature until processing or analysis.

Sediment cores will be collected in the following manner:

- Samples will be obtained by vibracoring where practicable, and by power grab when vibracoring is not practicable.
- A position check will be conducted either pre- or post-sampling to confirm DGPS accuracy and recorded in the field logbook.
- The vessel will maneuver to the proposed sample location and the water depth will be measured and recorded.
- The coring apparatus will be suspended from the vessel to the vertical position and then lowered until the core cutter meets the sediment.
- A core catcher cap will be placed on the bottom of the core tube as soon as the core tube breaks the water surface.
- Core penetration and recovery depth will be recorded, and the core will be inspected for acceptability using the following criteria:
    - Core tube is not overfilled.
    - Overlying water is present (indicates minimal leakage).

  - Estimated recovery is greater than 75%.
  - Core tube appears intact without obstructions or blocking.
  - The desired penetration depth of about 1 m is achieved.
- While the core tube is on deck, the overlying water will be siphoned off, if necessary, using plastic tubing or similar siphoning device. The core tube will be capped, and the exterior of the core tube will be scribed with the sample ID and recovery information.
- The core tube may be temporarily stored on the vessel and then transported to shore for processing, or may be processed on the vessel

The percent recovery will be estimated by measuring the total core length minus the void space within the core; the percent recovery is the sample length divided by the penetration depth. Percent recovery and total drive depth are used to determine the *in-situ* depth of subsamples. The core catcher will be inspected for signs of sediment loss during retrieval. The following data will be recorded on the sediment core log:

- Sampling location, time, and water depth
- Mudline elevation
- Core tube penetration depth and sample recovery
- Physical description of core tube (e.g., intact, bent, full core catcher)

If sample acceptance criteria are not achieved, the core may be set aside, and additional core drives will be advanced. If necessary, the best of three core drives will be accepted (deepest drive depth, highest % recovery), even if core recoveries are less than 75%. Sampling crews may increase the sampling area to a radius of 50 ft or more from the proposed location to try and improve sample recovery.

For processing, core tubes will be split open longitudinally (with or without a liner) and sediment will be visually logged using ASTM International Visual-Soil Classification Methods (D-2488). The core processing logs will include:

- Sediment type, density/consistency, including sediment particle size estimates
- Debris (wood, large rocks etc.) or vegetation
- Actual sample length and “representative” length before compaction during core collection
- Visual stratification and lenses
- Biological activity (e.g., shells, tubes, presence of organisms)
- Other distinguishing characteristics or features

After logging, samples will be photographed prior to sectioning the top 5 cm of each core. Sediment will be scooped out of the core tube using stainless-steel spoons; sediment in direct contact with the sidewalls of the tube will be avoided. Stainless-steel spoons, small spatulas, photographs, and a tape measure will be used in the logging process. Samples will be stored in laboratory provided containers and placed in a cooler with ice. The 0-5 cm section, representing the readily available in-lake nutrient load, will be submitted for analysis.

If coring is not possible due to logistical constraints (see Section 7.5.1) sediment grab samples may be collected in lieu of cores.

7.2.7.2 Analysis of Sediment Samples

Sediment samples will be analyzed for the parameters specified in Table 20. Saloid-bound P and iron-bound P will be determined by extracting the iron-bound P fraction using the modified Chang-Jackson method (Chang and Jackson, 1956). Saloid-bound P is representative of the stored P that is releasable under aerobic conditions, and iron-bound P is representative of the stored P that is releasable under anaerobic conditions. The remaining sediment P is considered stable. The fractionations and extraction will be performed by SiREM lab in Knoxville, TN, and the P fractions will be subsequently determined by the selected Ecology-certified laboratory by analyzing the appropriate extracts for total P content using the method listed in Table 20.

Measurement of nitrogen species in sediment is excluded for several reasons. Foremost, algal blooms in all three lakes have historically occurred when the lake is stratified and the bottom water is anoxic. Under these conditions, the potential for release of phosphorus from lake sediments is at its greatest, and the nitrogen to phosphorus ratio in Lacamas Lake has tended to decrease over the summer (e.g., Schnabel, 2007), indicating the potential for release of phosphorus from lake sediments is of greater significance than release of nitrogen from lake sediments. Furthermore, nitrogen concentrations are difficult to manage and control, as some algal species can fix nitrogen from the atmosphere when nitrogen is limited. For these reasons, analysis of sediment in the lake will focus on phosphorus species.

Table 20. Analytical measurement parameters for sediment samples

Parameter	**Method**
Total P	EPA 365.3 M
Organic content	ASTM D2974 – 07a
Moisture content	ASTM D2216
Saloid-bound P	Modified Chang-Jackson method (Chang and Jackson, 1956), followed by EPA 365.3
Iron-bound P	Modified Chang-Jackson method (Chang and Jackson, 1956), followed by EPA 365.3

7.2.8 Groundwater

Previous investigations have determined that most groundwater contributions likely enter the lakes along their southwestern edge (E&S Environmental Chemistry, Inc. 1997). However, it is unlikely that the groundwater in this area carries high nutrient loads, as the overlying area is a residential development which is connected to the sanitary system and contains little agriculture. As such groundwater is not likely to be a significant source of nutrients to any of the three lakes and will therefore not be monitored as part of this effort.

As part of the LCMP, research will be performed to determine if any additional information on groundwater movement in the area has been published since the 1997 study. If any new and relevant information is found it will be referenced in the LCMP and estimates of groundwater inflow to the lakes will be updated as necessary.

7.2.9 Overland \ Stormwater Flow

7.2.9.1 Sampling Locations

Stormwater sampling sites were selected using the following general guidance (USGS, 2009; Center for Watershed Protection, 2008):

- Sites should be readily accessible for field crews, preferentially at public locations or in public right of way.
- Sites should be safe locations to conduct sampling activities.
- Site proximity should be considered to ensure efficient sampling of multiple sites during storm events.
- Site locations should avoid stagnant or tailwater conditions and those with steep slopes.

Fifteen locations were identified from GIS desktop analysis and were visited in person to determine viability for sampling based on the general guidance above. Two sites were selected for stormwater sampling: one which discharges to Round Lake and one which discharges to Fallen Leaf Lake (Table 21). Sites discharging to Lacamas Lake were not included due to the inclusion of sampling for small creeks tributary to Lacamas Lake (Section 7.2.3.2), which will capture some stormwater, and due to the size of Lacamas Lake, which is less likely to be affected by inputs from direct stormwater inflows.

Table 21. Stormwater Sampling Locations

Site	Lake Drainage	Approx. Location
RL-SW1	Round Lake	45.607249, -122.404298
FL-SW1	Fallen Leaf Lake	45.602022, -122.415203

7.2.9.2 Sample Collection Methods

Stormwater sampling will occur during the spring and fall seasons. These are time periods during which direct stormwater contribution from the surrounding areas to the three lakes is highest in proportion to inflow from other sources. Two samples are targeted for each season from each location.

To the maximal extent possible, the storms sampled will adhere to the following criteria:

- Antecedent dry period: > 6 h with < 0.04 in of rain (USGS, 2014)
- Predicted storm duration: > 6 h (USGS, 2014)
- Predicted storm depth: > 0.15 in (City of Portland BES, 2015)

All samples will be grab samples collected in accordance with Ecology stormwater sampling manuals (Ecology, 2015). Sampling vessels will be decontaminated prior to each sampling event

using a phosphate-free lab-grade detergent, such as Citranox® or Liquinox®, and will be rinsed at least three times with native water before sampling at each location. Two types of measurements will be collected from each site: field and analytical laboratory (Table 22).

Table 22. Field and lab measurement parameters for stormwater samples

Parameter	Field Filtered?	Lab or Field Measurement?	Analytical Method
Temperature	N	Field	Multi-parameter sonde
Specific Conductance	N	Field	Multi-parameter sonde
Dissolved Oxygen	N	Field	Multi-parameter sonde
pH	N	Field	Multi-parameter sonde
Suspended Solids	N	Lab	SM 2540 D-97
Ammonia	N	Lab	SM 4500-NH_3 G
TKN	N	Lab	ASTM D1426-15B
Nitrate + Nitrite	N	Lab	EPA 353.2
Total P	N	Lab	EPA 365.3
Ortho-P	Y	Lab	EPA 365.3
Hardness	N	Lab	SM 2340C

7.3 Modeling and Analysis Design

A full numerical model is not planned for this project. An analytical phosphorus model, such as the Vollenweider mass-balance model, will be developed. This model predicts the lake phosphorus concentration based on the phosphorus loading, mean hydraulic residence time, and a first-order loss coefficient (which represents processes such as sedimentation), which will be a calibration parameter. This will be performed as a simple spreadsheet model.

The data collected as part of this study is expected to be sufficient to complete the hydrologic and nutrient budgets for Lacamas and Round Lakes. Due to its size and lack of continuous direct connection with the other two lakes, budgets for Fallen Leaf Lake may have a large error.

7.3.1 Hydrologic Budget

The hydrologic budget of the connected Lacamas and Round Lakes will be defined as described in Equation 1:

$$P + Q_{LC\text{-}G} + Q_{DC} + Q_{CC} + Q_{DC} + Q_{SR} + GW = Q_{LC\text{-}UD} + Q_{LC\text{-}LD} + EVAP + \Delta S \qquad (1)$$

where

P is the volume of precipitation falling directly on the lake

$Q_{LC\text{-}G}$ is inflow via Lacamas Creek at Goodwin Road
Q_{CC} is inflow via Currie Creek
Q_{DC} is inflow via Dwyer Creek
Q_{SR} is inflow via surface runoff
GW is groundwater inflow volume
$Q_{LC\text{-}UD}$ is flow at Lacamas Creek originating from the Upper Dam
$Q_{LC\text{-}LD}$ is flow at Lacamas Creek originating from the Lower Dam
$EVAP$ is evaporation from the lake surface
ΔS is the change in lake storage

Of these variables only $Q_{LC\text{-}G}$ will be directly measured. Q_{CC}, Q_{DC}, and Q_{SR} will be estimated from drainage area characteristics. $Q_{LC\text{-}UD}$ and $Q_{LC\text{-}LD}$ will be estimated based on lake level and dam operations, and P and EVAP will be calculated from meteorological data. GW and S will be unknowns whose values will be checked against estimates from previous studies, and lake level changes, respectively.

7.3.2 Nitrogen Budget

The budgets for total nitrogen in the water column of the connected Lacamas and Round Lakes will be defined as described in Equation 2:

$$L_{LC\text{-}G\text{-}N} + L_{DC\text{-}N} + L_{CC\text{-}N} + L_{SR\text{-}N} + GW_N + L_{INT\text{-}L\text{-}N} + L_{INT\text{-}R\text{-}N} + L_{ATM\text{-}N} = E_{UD\text{-}N} + E_{LD\text{-}N} + \Delta S_N + D \quad (2)$$

where

$L_{LC\text{-}G\text{-}N}$ is the load of nitrogen entering via Lacamas Creek at Goodwin Road
$L_{CC\text{-}N}$ is the load of nitrogen entering via Currie Creek
$L_{DC\text{-}N}$ is the load of nitrogen entering via Dwyer Creek
$L_{SR\text{-}N}$ is the load of nitrogen entering via surface runoff
GW_N is the load of nitrogen entering via groundwater
$L_{INT\text{-}L\text{-}N}$ is the internal load of nitrogen entering the water column from the sediment bed in Lacamas Lake
$L_{INT\text{-}R\text{-}N}$ is the internal load of nitrogen entering the water column from the sediment bed in Round Lake
$L_{ATM\text{-}N}$ is loading via atmospheric deposition
$E_{UD\text{-}N}$ is the export of nitrogen via flow out of the lake from the upper dam
$E_{LD\text{-}N}$ is the export of nitrogen via flow out of the lake from the lower dam
S_N is the change in nitrogen stored in the lake
D is the loss of nitrogen to the atmosphere via denitrification.

Of these variables, $L_{LC\text{-}G\text{-}N}$ will be calculated from measured flow and measured nitrogen concentrations. $L_{CC\text{-}N}$, $L_{DC\text{-}N}$, $L_{SR\text{-}N}$, and $E_{UD\text{-}N}$ will be calculated from estimated flow and measured nitrogen concentrations. $E_{LD\text{-}N}$ will be calculated from estimated flows and the nitrogen concentration exiting the upper dam. $L_{INT\text{-}N}$ will be calculated from measured sediment and sediment flux concentrations. GW_N, $L_{ATM\text{-}N}$, D, and S_N will be unknowns that may be estimated via literature values.

7.3.3 Phosphorus Budget

The budgets for total phosphorus in the water column of the connected Lacamas and Round Lakes will be defined as described in Equation 3:

$$L_{LC\text{-}G\text{-}P} + L_{DC\text{-}P} + L_{CC\text{-}P} + L_{SR\text{-}P} + GW_P + L_{INT\text{-}L\text{-}P} + L_{INT\text{-}R\text{-}P} + L_{ATM\text{-}P} = E_{LD\text{-}P} + E_{UD\text{-}P} + \Delta S_P \quad (3)$$

where

$L_{LC\text{-}G\text{-}P}$ is the load of phosphorus entering via Lacamas Creek at Goodwin Road
$L_{DC\text{-}P}$ is the load of phosphorus entering via Dwyer Creek
$L_{CC\text{-}P}$ is the load of phosphorus entering via Currie Creek
$L_{SR\text{-}P}$ is the load of phosphorus entering via surface runoff
GW_P is the load of phosphorus entering via groundwater
$L_{INT\text{-}L\text{-}P}$ is the internal load of phosphorus entering the water column from the sediment bed in Lacamas Lake
$L_{INT\text{-}R\text{-}P}$ is the internal load of phosphorus entering the water column from the sediment bed in Lacamas Lake
$L_{ATM\text{-}P}$ is loading via atmospheric deposition
$E_{UD\text{-}P}$ is the export of phosphorus via flow out of the lake from the upper dam
$E_{LD\text{-}P}$ is the export of phosphorus via flow out of the lake from the lower dam
ΔS_P is the change in phosphorus stored in the lake.

Of these variables, $L_{LC\text{-}G\text{-}P}$ will be calculated from measured flow and measured nitrogen concentrations. $L_{CC\text{-}P}$, $L_{DC\text{-}P}$, $L_{SR\text{-}P}$, and $E_{UD\text{-}P}$ will be calculated from estimated flow and measured phosphorus concentrations. $E_{LD\text{-}P}$ will be calculated from estimated flows and the phosphorus concentration exiting the upper dam. $L_{INT\text{-}P}$ will be calculated from measured sediment and sediment flux concentrations. GW_P, $L_{ATM\text{-}P,}$ and S_P will be unknowns that may be estimated via literature values.

7.4 Assumptions of Study Design

Assumptions underlying this study design appear in Table 23.

Table 23. Assumptions underlying study design

Task	Assumptions
Hydrology	• Efforts to reestablish continuous flow gauging on Lacamas Creek at Goodwin Road will be successful. • Equations presented by Harwell (2012) for the U.S. Weather Bureau method of estimating evaporation render pan evaporation measurements unnecessary. • Stormwater drainage areas are sufficiently defined to allow for reasonable estimation of runoff. • Water level data near the Round Lake dams will be available for the duration of the field study.

Task	Assumptions
Surface Water Sampling	• A set of surface water measurements and samples can be accomplished in 1-2 workdays, allowing preparation and follow-up activities to occur within one week. • Stratification will be sufficiently stable when it occurs for field measurements to characterize it and anoxic bottom water to be sampled. • Staff will be available to keep to a consistent field sampling schedule and to process samples and organize data in between sampling trips. • Ecology's EIM database will be sufficient for storage of field analytical results and corresponding metadata.
Stormwater Sampling	• Stormwater sampling points will have flow during qualifying events when samplers go to the field to obtain samples
Hydrologic Budget	• Groundwater flows are not significant. • Sufficient data will be available to estimate flows exiting the lakes into lower Lacamas Creek. Hydrologic mass balance will be conducted quarterly to assess sufficiency of data.
Nutrient Budgets	• Internal loading estimates will be reasonable when based on a limited number of bottom water and sediment samples.

7.5 Possible Challenges and Contingencies

7.5.1 Logistical problems

Sampling locations will be visited during trial field sampling runs prior to the collection of data. Logistical and/or health and safety issues encountered during these dry runs will receive careful consideration.

Of the three lakes, only Lacamas Lake contains a true boat launch. Round Lake has a dirt ramp for launching small watercraft while Fallen Leaf Lake does not have any type of ramp. Travel from Lacamas to Round and Fallen Leaf Lakes is not possible for a typical sampling vessel due to clearance between the lake water surface and the SR500 bridge. Furthermore, motorized vessels are not permitted on Round or Fallen Leaf Lakes, though the field staff may request an exemption from the City of Camas, if possible. As such, multiple types of vessels will be needed to conduct sampling, and boats will need to be launched and loaded at each lake.

Sediment sampling may prove difficult if it must occur from a small, non-motorized watercraft. In this case, the team will need to explore the possibility of alternate options, such as installation of a temporary floating dock above the sample points in Round and Fallen Leaf Lakes, or the use of small pontoon boats or rowboats. If necessary, sediment samples in Round and Fallen Leaf Lakes may need to be surface grab samples rather than core samples or may need to be collected by hand using SCUBA gear.

Logistical problems for surface water and sediment sampling may include the ability to sample all locations in close temporal proximity, as watercraft will need to be launched and reloaded at each of the three lakes, safe access to each of the creek sampling locations, and timely availability of rental equipment and contractors. Furthermore, access to Currie Creek is through Camp Currie, whose gate is locked for portions of the year. Samplers will need to work with the City of Camas to obtain access to this location during the off season.

Logistical problems for overland flow sampling could include timing of rain, ability to safely reach sampling points during low-light conditions, and ability to reach and sample all locations during the same storm.

Finally, the lakes experience heavy use during summer months. Issues such as vandalism or theft of thermistors may arise.

7.5.2 Practical constraints

Most sampling will need to be done with at least two people present for safety reasons. Sampling will require at least 2 days per month for surface water samples, along with an additional day for each of equipment preparation and post-sampling equipment maintenance. Back-up staff will need to be identified to accommodate work absences (e.g., vacation, sick time) so that these events do not lead to missed sampling excursions.

7.5.3 Schedule limitations

Logistical issues may lead to sampling events that are not evenly spaced between months, or even missed sampling events. Sample events are most critical during the likely period of stratification (May through October), so it is essential that the QAPP be reviewed and approved in time for sampling to start, preferably by April 2022, but no later than May 2022, to ensure at least one sampling collection event occurs before the critical time period is reached.

8 FIELD PROCEDURES

8.1 Invasive Species Evaluation

Environmental ethics and Washington law prohibit the transportation of aquatic plants, animals, and many noxious weeds. The procedures explained in this section describe the field procedures that will be used to prevent the transport of aquatic invasive species (AIS) into Lacamas, Round, and Fallen Leaf Lakes while conducting field work.

In general, equipment used in the field must be easy to inspect and clean. If feasible, each piece of equipment should be used in a singular water body. Non-felt soles and boot-foot waders will be used during fieldwork in sediment or waterways since the spread of New Zealand mud snails and other AIS has been associated with felt-soled wading gear. Since sampling from Lacamas, Round, and Fallen Leaf Lakes will not take place in an area of extreme concern for AIS in Washington, additional decontamination steps for other equipment are not necessary.

Throughout field activities, it is essential to minimize the contact between equipment and potential sources of invasive species. For instance:

i. Sample collection should be prioritized from the least to most impacted areas.

ii. Activities that involve contact with sediment (i.e., wading) or disturbance of sediment (i.e., running boats in very shallow water)should be avoided.

iii. A catch pan will be used underneath the sediment coring apparatus when it is retrieved to avoid getting plants, sediment, fish, or other AIS on the boat deck and bilges.

iv. Driving and walking through muddy areas with high weed growth should be avoided.

Field gear used for sampling will be used only after drying from its previous use. For example, boots and waders should be stored on a drying rack until dry, not left in a gear bag.

After completion of fieldwork, equipment and gear will be inspected and cleaned, preferably before leaving the sampling site. Visible vertebrates, invertebrates, plants, algae, or sediment on equipment will be removed manually or with a scrub brush. Bilges, samplers, or any other equipment will be drained since they could hold water from the site. Areas that are difficult to clean manually will be flushed until the rinse water is clean. More detailed information on how to clean boats and motors can be found in Attachment B of EAP070 (linked in Table 24).

Procedures described in this SOP must be followed except when the fieldwork includes:

i. Moving short distances by foot within the same watershed

ii. Transiting by boat to different sites within a waterbody

If procedures in this SOP are not workable for a particular part of the project, exceptions will be documented prior to commencement of work.

8.2 Measurement and Sampling Procedures

Prior to sampling, field staff will review relevant SOPs to ensure samples and field measurements are collected properly (Table 24).

Table 24. Standard operating procedures

Activity	SOP	Year	Title and Link
All field work	EAP070	3/2018	Minimize the Spread of Invasive Species
Measurement of field parameters	EAP011	1/2019	Instantaneous Measurements of Temperature in Water
	EAP031	1/2018	Collection and Analysis of pH Samples
	EAP032	7/2017	Collection and Analysis of Conductivity Samples
	EAP108	2/2019	Collecting In Situ Water Quality Data
Continuous T measurements	EAP080	4/2018	Continuous Temperature Monitoring of Freshwater in Rivers and Streams
Collection of water quality samples	EAP034	7/2017	Collection, Processing, and Analysis of Stream Samples
Collection of sediment samples	EAP110	11/2018	Sampling Sediment for Chemistry
Collection of stormwater samples	18-10-026	7/2018	Calculating Pollutant Loads for Stormwater Discharges
	18-10-023	7/2018	Collecting Grab Samples from Stormwater Discharges

8.3 Containers, Preservation Methods, Holding Times

Hold times, sample size requirements, and containers required for sampling efforts are presented in Table 25 and Table 26.

Table 25. Containers and hold times for water quality parameters

Parameter	**Method**	**Min. Volume (mL)**	**Hold Time (d)**	**Container Type[1]**	**Preservative[2]**
Suspended Solids	SM 2540 D-97	1000	7	HDPE	a
Ammonia	SM 4500-NH_3 G	500	28	HDPE	a, b
TKN	ASTM D1426-15B	500	28	HDPE	a, b
Nitrate + Nitrite	EPA 353.2	500	28	HDPE	a, b
Total P	EPA 365.3	500	28	HDPE	a, b

Parameter	Method	Min. Volume (mL)	Hold Time (d)	Container Type[1]	Preservative[2]
Ortho- P	EPA 365.3	500	2	HDPE	a
Hardness	SM 2340C	500	182	HDPE	c
Chlorophyll-*a*	SM 10200 H	1000	2[3]	AG	a
Phytoplankton Species	SM 10200 E	500	-[4]	HDPE	a, d

[1]HDPE = high-density polyethylene, AG = amber glass

[2] a = cool 0-6°C, b = pH<2 with H_2SO_4, c = pH<2 with HNO_3, d = ethanol or isopropyl alcohol (contact lab) or Lugol's solution

[3]Requirement is to filter within 48 hours.

[4]Hold time not specified for preserved samples. If not field-preserved, samples must be shipped to lab overnight on ice.

Table 26. Containers and hold times for sediment parameters

Parameter	Analytical Method	Minimum Mass (g)	Hold Time (d)	Container
Total P	EPA365.3M	20	28	glass jar
Organic Content	ASTM D2974 - 2031	20	10	glass jar
Moisture Content	ASTM D2216	20	10	glass jar
Saloid-bound P	Modified Chang-Jackson method (Chang and Jackson, 1956), followed by EPA 365.3	25	28	glass jar
Iron-bound P	Modified Chang-Jackson method (Chang and Jackson, 1956), followed by EPA 365.3	25	28	glass jar

8.4 Equipment Decontamination

Field staff may encounter cyanotoxins while sampling in support of this project. No other exposure of equipment to toxic chemicals is anticipated as part of the planned sampling described here.

Equipment will be decontaminated between sampling locations to prevent the spread of invasive species, for sample quality assurance/quality control, and to keep the equipment in good working order. Decontamination of equipment will consist of thorough rinsing with native water at sampling locations and with distilled water at the end of each sampling day.

8.5 Sample ID

A self-adhesive, non-removable label will be affixed to each sample container and completed with an indelible marker prior to sample collection. Sample labels will contain the following information:

- Site name
- Project number
- A unique sample identification number (see below for correct sample designation nomenclature for quality control samples)
- Initials of sample collector(s)
- Time and date collected
- Analysis required
- Sample preservative (if applicable)

Locations where field quality control (QC) samples are collected will be documented in field records. The following standard abbreviations will be used:

- d.1 – start of the sample depth interval in feet to closest tenth of a foot
- d.2 – end of sample depth interval in feet to closest tenth of a foot
- yymmdd – date of sample collection
- field duplicate samples will use "FD" followed by sequential numbering (i.e., FD1, FD2, etc.) so that the laboratory cannot identify where the sample came from. Field notes will record what sample is represented by each field duplicate.
- Equipment blank sample IDs will use QCEB-#

8.6 Chain-of-Custody

Chain-of-custody forms will be used to trace the possession and handling of samples, from the time of their collection, through analysis, until their final disposition. These forms will document the names of the relinquishing and receiving parties and the time and date of the transfer of custody. Field personnel will complete the following information on each chain of custody form:

- Project number
- Client or project name
- Project location
- Sample identification number
- Date and time of sample collection
- Sample matrix

- Sample preservative
- Analyses requested
- Sampler's signature
- Signature of person relinquishing sample custody to the laboratory courier or FedEx
- Date and time relinquished
- Sampler remarks

One chain-of-custody form will accompany each set of coolers sent to the laboratory. The chain of custody form will be placed in a sealed plastic bag inside the cooler. A custody seal will be placed on each cooler after packing and prior to shipment. For multiple cooler shipments, the cooler number designation (e.g., cooler 1 of 2, cooler 2 of 2) will be written on the custody seal. Shipping of samples to the laboratory will be accomplished by FedEx or equivalent overnight service. Samples will remain in the custody of the sampling team until custody is relinquished to FedEx or a laboratory courier. Each sample shipment will be tracked via the FedEx tracking number to ensure that prompt delivery of the shipment to the laboratory has occurred. A copy of the chain-of-custody form will then be transmitted to the project manager and uploaded to the project file folder.

8.7 Field Log Requirements

Field activities will be documented meticulously using permanent waterproof ink on field worksheets that are organized in a field sampling log. All entries will be initialed and dated accordingly. When changes are necessary, personnel will draw a single line through the error, write the corrections adjacent to it, and initial it. Documented field procedures should be detailed enough to allow the data user to easily understand the procedures. All field procedures must include a list of the required field log entries such as:

- Project Name
- Project location
- Field personnel information
- Sequence of events
- Any changes or deviations from the QAPP
- Environmental conditions (e.g., air and water temperature, wind, cloud cover, etc.)
- Date, time, location, ID, and description of each sample
- Instrument calibration procedures, if needed.
- Field equipment decontamination procedures
- Field measurement results
- Identity of QC samples collected
- Unusual circumstances that might affect interpretation of results

8.8 Other Activities

The laboratory will be alerted at least three business days in advance of anticipated lake, surface water, and sediment sampling, so they are prepared to receive samples. The lab may not be alerted in advance of stormwater sampling due to the uncertain timing inherent to stormwater sampling.

A tailgate safety meeting will occur at the beginning of each field workday. Safety meetings will include a brief review of the health and safety plan, a more detailed discussion of activities being performed for the first time or changes to previously executed activities, and any special considerations, such as expected weather.

9 LABORATORY PROCEDURES

9.1 Lab Procedures Table

Samples will be sent to an Ecology-accredited analytical laboratory for analyses of water quality parameters (Table 27) and sediment parameters (

Table 28) when practicable. If an Ecology-accredited laboratory that accepts outside samples is not available for a specific parameter, or if Ecology-accredited laboratories have prohibitive turnaround times or costs, laboratories with other certifications will be considered.

Containers will be provided by analytical laboratories with preservative already in them, so field sampling personnel will not be responsible for adding preservative. Phytoplankton concentration will be quantified, and species will be identified according to standard methods.

Filtered samples will be filtered in the field through 0.45 µm polytetrafluoroethylene (PTFE) or polyethersulfone (PES) syringe-tip filters attached to polypropylene (PP) syringes, or through 0.45 µm PES high-capacity cartridge filters.

Table 27. Analytical methods for water quality samples

Parameter	Matrix	Sample Type[1]	Approx. # Samples	Target MDL	Analytical Method
Suspended Solids	W	L, C, S	164	5 mg/L	SM 2540 D-97
Ammonia	W	L, C, S	164	0.02 mg/L	SM 4500-NH_3 G
TKN	W	L, C, S	164	0.04 mg-N/L	ASTM D1426-15B
Nitrate + Nitrite	W	L, C, S	164	0.02 mg-N/L	EPA 353.2
Total P	W	L, C, S	164	0.005 mg-P/L	EPA 365.3
Ortho-P	W	L, C, S	164	0.009 mg-P/L	EPA 365.3
Hardness	W	L, C, S	164	0.8 mg-$CaCO_3$/L	SM 2340C
Chlorophyll-*a*	W	L	63	0.3 mg/m^3	SM 10200 H
Phytoplankton Species	W	L	3	N/A	N/A

[1]L = lake samples, C = creek samples, S = storm samples (Figure 4)

Table 28. Analytical methods for sediment samples

Parameter	Matrix	# Samples	Target MDL	Analytical Method
Total P	S	5	0.2 mg-P/kg	EPA 365.3M
Organic Content	S	5	-	ASTM D2974 – 07a
Moisture Content	S	5	-	ASTM D2216
Saloid-bound P	S	4	*Same as Total P in water*	Modified Chang-Jackson (Chang and Jackson, 1956), followed by EPA 365.3M
Iron-bound P	S	4	*Same as Total P in water*	Modified Chang-Jackson (Chang and Jackson, 1956), followed by EPA 365.3M

9.2 Special Method Requirements

For biological analyses (e.g., concentrations and species counts of phytoplankton), a ≥24 h notice is required before sending samples to the analytical laboratory because analyses must begin within 12 h of receiving samples.

9.3 Laboratories Accredited for Methods

Samples collected will be analyzed by an Ecology-accredited analytical laboratory where practicable, which will be selected at a later date. If an Ecology-accredited laboratory is not available for a specific parameter due to prohibitive turnaround time or costs, laboratories with other accreditations may be considered.

10 QUALITY CONTROL PROCEDURES

Field quality control (QC) will be accomplished through calibration and validation of equipment, as well as the measurement of field duplicates. Laboratory QC will be assessed through the internal laboratory QC performed, including method blanks, laboratory control sample (LCS) recoveries, surrogate recoveries, laboratory duplicates, and matrix spike/matrix spike duplicate recoveries as applicable to the analytical method.

10.1 Instrument Calibration

Laboratory instruments will be calibrated according to the specified analytical methodology and manufacturer's instructions. Calibration of instruments is required to ensure the analytical system is operating correctly and functioning at the proper sensitivity to meet established reporting limits. Each instrument will be calibrated with standard solutions appropriate to the type of instrument and the calibration range established for the given analytical method. The frequency of calibration and calibration verification and the concentration of calibration standards are determined by the manufacturer's guidelines and the analytical method.

10.2 Field Quality Control

QC samples will be obtained in the field and analyzed in the lab to allow for assessment of MQOs. The selected analytical laboratory will use its standard, established procedures and the requirements of each method to analyze a sufficient number of blanks, spikes, and surrogates. For field samples, duplicates will be obtained at a minimum rate of 1 in every 10 sample sets for each type of matrix. Here, a sample set is defined as the full suite of analytical parameters intended to be collected at a given location and depth. Specifically:

- 1 duplicate sediment core section from a random location will be obtained and analyzed.
- 1 duplicate set of lake water samples will be obtained from a random depth and location for every 10 sample sets.
- 1 duplicate set of creek water samples will be obtained from a random location for every 10 sample sets.
- 1 duplicate set of stormwater samples will be obtained from a random location.
- Field equipment blanks will be collected at a rate of one sample per every third sampling events for both creek and storm sample locations. This represents a field blank rate of at least 10 percent. Equipment blanks will not be collected for lake samples as Kemmerer or Van Dorn samplers will be cleaned only by rinsing with native water at each location since the sample bottle must pass through the water column to obtain samples anyway.

Trip blanks are not necessary as no volatile parameters are being analyzed as part of this QAPP.

10.3 Corrective Action Process

Field activities will be reviewed as soon as practicable following each sampling event, including calibration frequency, decontamination method, and sample collection locations. If activities are found to be inconsistent with this QAPP, field staff will be asked to review relevant SOPs, and

additional sampling may be conducted to replace inadequate data if time allows. For laboratory analyses, the lab may be asked to re-analyze samples that do not meet MQOs if holding times allow.

11 DATA MANAGEMENT PROCEDURES

11.1 Data Recording and Reporting Requirements

Final laboratory data and electronic data deliverables (EDDs) will be stored on Geosyntec's server in the, "Data," folder within the project folder (PNW0463). Field data will be carefully recorded using field template forms or well-kept notes, which will be uploaded to the same folder the first business day after work is completed. For work completed by subcontractors, subcontractors will email the project manager all field data and notes within three business days of returning from the field. The project manager will then save this data to the same folder.

Hand-recorded data will be manually digitized as necessary, with all digitized data undergoing peer review for accuracy.

11.2 Laboratory Data Package Requirements

The Ecology-certified analytical laboratory will essentially generate EPA Level II documentation during this investigation. This level of documentation is generally considered legally defensible and consists of the following:

- Holding times
- Laboratory method blank data
- Sample data
- Matrix/surrogate spike data
- Duplicate sample data

Completed, final data reports will be provided in pdf format.

11.3 Electronic Transfer Requirements

All laboratory results, including QC sample results, will also be provided as an EDD in excel format.

11.4 Data Upload Procedures

Compiled data will be input into Ecology's Environmental Information Management (EIM) data system following completion of the Lake Cyanobacterial Management Plan. A project named, "Lacamas, Round, and Fallen Leaf LCMP 2022," or similar, will be created in EIM to hold the data. Inputs will be peer reviewed and corrected if necessary.

11.5 Model Information Management

A full numerical model is not planned for this project. An analytical phosphorus model, such as the Vollenweider mass-balance model, will be developed. This model predicts the lake phosphorus concentration based on the phosphorus loading, mean hydraulic residence time, and a first-order loss coefficient (which represents processes such as sedimentation), which will be a calibration parameter. This will be a simple spreadsheet. The final version of the spreadsheet will be clearly labeled as final with the date of completion. Graphs will be included in the same spreadsheet as

the calculations. Because only an analytical mass-balance is proposed, there are no substantial input and output data storage needs.

12 AUDITS AND REPORTS

12.1 Field, Laboratory, and other Audits

When practicable, this work will use only Ecology-accredited laboratories, which undergo audits from Ecology's Laboratory Accreditation Unit (LAU) every 3 years. If an Ecology-certified laboratory that accepts outside samples is not available for a specific parameter, or if Ecology-certified laboratories have prohibitive turnaround times or costs, laboratories with other certifications will be considered. In these cases, associated certification information will be documented in the LCMP.

No other audits are planned. Depending on who is conducting the field work Geosyntec may send out field staff to periodically participate in field sampling conducted by subconsultants.

12.2 Responsible Personnel

Ecology's LAU is responsible for auditing analytical laboratories. Laboratory audits include an examination of documents and procedures, examination of equipment, review of quality assurance procedures, and discussion with laboratory staff.

12.3 Frequency and Distribution of Reports

The data collected as part of QAPP execution will result in a single report: the LCMP. The final report will be conveyed to Ecology via email, and will follow Ecology's Freshwater Algae Control Program Lake Cyanobacteria Management Plan template:

https://www.ezview.wa.gov/Portals/_1962/Documents/LacamasCleanWater/Ecology_CyanobacteriaManagementTemplateGuidance.pdf

12.4 Responsibility for Reports

The final LCMP will be completed by Geosyntec Consultants and its subcontractors on behalf of the City of Camas.

13 DATA VERIFICATION

13.1 Field Data Verification, Requirements, and Responsibilities

Field data will be hand-digitized from notes as necessary. Data will then be peer reviewed both for accuracy and reasonableness. Reasonableness will include identifying any data that are noticeably different from nearby samples or previous samples at the same location. Any questionable data points will be relayed to the project manager, who will discuss the questionable data with field staff. A decision will then be made on whether to keep, flag, or discard the data in question. The project manager or a designated staff member will periodically (i.e., at minimum once per quarter) review field data for completeness and legibility.

13.2 Lab Data Verification

The Ecology-certified analytical laboratory will perform internal data verification before releasing data to the project manager. The lab will report to the project manager if holding times are exceeded or if preservation temperatures exceed method requirements. In these cases, the project manager will decide whether samples should be analyzed. If the samples are analyzed, a data flag will be applied.

13.3 Validation Requirements

Formal data validation is defined as, “an analyte-specific and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set,” (EPA, 2002). This requires a qualified, independent individual to review raw field or instrument records and bench sheets. Data validation is not necessary for this project as individual water quality results are not tied to legal water quality limits or requirements. If data obtained during this study suggest that any of the sampling locations have a previously unknown water quality impairment for any of the measured parameters, data validation may become necessary.

13.4 Model Quality Assessment

The models created for this project will be simple spreadsheet-based mass balance models. These nutrient and hydrologic budgets will be evaluated by comparing inflows, retained mass and volume, and outflows. If the budget is accounted for within the range specified by the Model Quality Objectives (Section 6.4), the model will be considered of sufficient quality. If the difference does not meet the objectives, data, such as estimated flows, may be reexamined, or additional data may need to be collected.

14 DATA QUALITY (USABILITY) ASSESSMENT

14.1 Process for Determining Project Objectives Were Met

After data verification is complete, the project manager or designee will compare the overall data package to MQOs and DQOs as specified in Section 6. Data may be rejected for the following reasons:

- The method used was inappropriate for the analyte, or prevents comparison to other samples collected as part of this project
- It is determined that significant contamination may be present in a sample
- A sample was taken from an incorrect location
- A sample was insufficiently preserved, based on pH or a gross exceedance of temperature
- Incompatible equipment, such as incorrect bottle type, was used
- A sample's hold time was grossly exceeded
- Field duplicate or lab duplicate samples exceed their RPD specified in Table 13 and
- Table 14 by more than a factor of 2

The reason for any rejected data will be documented. After any rejected data is removed from the data set, data completeness and representativeness will be evaluated. If data completeness goals have not been met, additional measurements may be taken, or the lab may be asked to reanalyze samples, as possible and necessary.

14.2 Treatment of Non-Detects

The treatment of non-detect data will vary based on frequency of occurrence:

- If all samples for a parameter are non-detect, that parameter will be assumed to be absent at the sample location.
- If less than ten percent of samples for a given parameter at a given location are non-detect, if data is not determined to be critical to understanding lake chemistry, or if the data set is too small to implement regression on order statics (ROS), statistical analyses will use half of the detection limit in place of results.
- If greater than ten percent of samples for a given parameter at a given location are non-detect, or if the parameter in question is of critical importance for lake management, ROS statistics will be used to fill in non-detect values where possible.

14.3 Data Analysis and Presentation Methods

Data analysis will seek to use collected data to A) build on the existing conceptual understanding of the limnology of Lacamas, Round, and Fallen Leaf Lakes as it pertains to nutrient dynamics and algae growth and B) constrain water and nutrient fluxes to facilitate the creation of quantitative nutrient budgets. This discussion describes analyses to be completed after data sets for individual variables have been verified and summarized.

"Flow-through" figures will simplify in-lake dynamics and focus only on the inflows into and outflows from the lake. These maps will be created both for data collected during individual

sampling excursions and for average fluxes measured over the year. As visual representations of the nutrient budget equations presented in Section 7.3, they will show relative magnitudes of different terms in Equations 1-3.

The understanding gained from this exercise will be summarized in a narrative form, thus enhancing the conceptual understanding of nutrient limnology and algal dynamics in the lake.

14.4 Sampling Design Evaluation

This sampling plan is expected to yield enough statistical power to develop a useful spreadsheet-based model of lake nutrients.

14.5 Documentation of Assessment

Final lab reports, including data qualifiers, will be provided in an Appendix to the LCMP. A comparison of data completeness to goals will also be provided.

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16 APPENDICES

Appendix A: Glossaries, Acronyms and Abbreviations

Glossary of General Terms

Ambient: Background or away from point sources of contamination. Surrounding environmental condition.

Anthropogenic: Human-caused.

Baseflow: The component of total streamflow that originates from direct groundwater discharges to a stream.

Conductivity: A measure of water's ability to conduct an electrical current. Conductivity is related to the concentration and charge of dissolved ions in water.

Critical condition: When the physical, chemical, and biological characteristics of the receiving water environment interact with the effluent to produce the greatest potential adverse impact on aquatic biota and existing or designated water uses. For steady-state discharges to riverine systems, the critical condition may be assumed to be equal to the 7Q10 flow event unless determined otherwise by the department.

Designated uses: Those uses specified in Chapter 173-201A WAC (Water Quality Standards for Surface Waters of the State of Washington) for each water body or segment, regardless of whether or not the uses are currently attained.

Dissolved oxygen (DO): A measure of the amount of oxygen dissolved in water.

Effluent: An outflowing of water from a natural body of water or from a human-made structure. For example, the treated outflow from a wastewater treatment plant.

Eutrophic: Nutrient rich and high in productivity resulting from human activities such as fertilizer runoff and leaky septic systems.

Existing uses: Those uses actually attained in fresh and marine waters on or after November 28, 1975, whether or not they are designated uses. Introduced species that are not native to Washington, and put-and-take fisheries comprised of non-self-replicating introduced native species, do not need to receive full support as an existing use.

Municipal separate storm sewer systems (MS4): A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains): (1) owned or operated by a state, city, town, borough, county, parish, district, association, or other public body having jurisdiction over disposal of wastes,

stormwater, or other wastes and (2) designed or used for collecting or conveying stormwater; (3) which is not a combined sewer; and (4) which is not part of a Publicly Owned Treatment Works (POTW) as defined in the Code of Federal Regulations at 40 CFR 122.2.

National Pollutant Discharge Elimination System (NPDES): National program for issuing, modifying, revoking and reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements under the Clean Water Act. The NPDES program regulates discharges from wastewater treatment plants, large factories, and other facilities that use, process, and discharge water back into lakes, streams, rivers, bays, and oceans.

Nonpoint source: Pollution that enters any waters of the state from any dispersed land-based or water-based activities, including but not limited to atmospheric deposition, surface-water runoff from agricultural lands, urban areas, or forest lands, subsurface or underground sources, or discharges from boats or marine vessels not otherwise regulated under the NPDES program. Generally, any unconfined and diffuse source of contamination. Legally, any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act.

Nutrient: Substance such as carbon, nitrogen, and phosphorus used by organisms to live and grow. Too many nutrients in the water can promote algal blooms and rob the water of oxygen vital to aquatic organisms.

pH: A measure of the acidity or alkalinity of water. A low pH value (0 to 7) indicates that an acidic condition is present, while a high pH (7 to 14) indicates a basic or alkaline condition. A pH of 7 is considered to be neutral. Since the pH scale is logarithmic, a water sample with a pH of 8 is ten times more basic than one with a pH of 7.

Point source: Source of pollution that discharges at a specific location from pipes, outfalls, and conveyance channels to a surface water. Examples of point source discharges include municipal wastewater treatment plants, municipal stormwater systems, industrial waste treatment facilities, and construction sites where more than 5 acres of land have been cleared.

Pollution: Contamination or other alteration of the physical, chemical, or biological properties of any waters of the state. This includes change in temperature, taste, color, turbidity, or odor of the waters. It also includes discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state. This definition assumes that these changes will, or are likely to, create a nuisance or render such waters harmful, detrimental, or injurious to (1) public health, safety, or welfare, or (2) domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or (3) livestock, wild animals, birds, fish, or other aquatic life.

Primary contact recreation: Activities where a person would have direct contact with water to the point of complete submergence including, but not limited to, skin diving, swimming, and water skiing.

Reach: A specific portion or segment of a stream.

Riparian: Relating to the banks along a natural course of water.

Sediment: Soil and organic matter that is covered with water (for example, river or lake bottom).

Stormwater: The portion of precipitation that does not naturally percolate into the ground or evaporate but instead runs off roads, pavement, and roofs during rainfall or snow melt. Stormwater can also come from hard or saturated grass surfaces such as lawns, pastures, playfields, and from gravel roads and parking lots.

Streamflow: Discharge of water in a surface stream (river or creek).

Surface waters of the state: Lakes, rivers, ponds, streams, inland waters, salt waters, wetlands and all other surface waters and water courses within the jurisdiction of Washington State.

Thalweg: The deepest and fastest moving portion of a stream.

Total suspended solids (TSS): Portion of solids retained by a filter.

Turbidity: A measure of water clarity. High levels of turbidity can have a negative impact on aquatic life.

Watershed: A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

303(d) list: Section 303(d) of the federal Clean Water Act, requiring Washington State to periodically prepare a list of all surface waters in the state for which beneficial uses of the water – such as for drinking, recreation, aquatic habitat, and industrial use – are impaired by pollutants. These are water quality-limited estuaries, lakes, and streams that fall short of state surface water quality standards and are not expected to improve within the next two years.

Acronyms and Abbreviations

AIS	Aquatic invasive species
ASOS	Automated Surface Observing Systems
DO	Dissolved Oxygen (see Glossary above)
DQI	Data quality indicators
DQO	Data Quality Objective
e.g.	For example
Ecology	Washington State Department of Ecology
EDD	Electronic Data Deliverable
EIM	Environmental Information Management database
EPA	U.S. Environmental Protection Agency
et al.	And others
GPS	Global Positioning System
HAB	Harmful algal bloom
i.e.	In other words
LAU	Ecology's Laboratory Accreditation Unit
LCMP	Lake Cyanobacteria Management Plan for Lacamas, Round, and Fallen Leaf Lakes
LCS	Laboratory control sample
MQO	Measurement quality objective
NPDES	National Pollutant Discharge Elimination System (See Glossary above)
NCEI	National Centers for Environmental Information
ORP	Oxidation-reduction potential
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
SC	Specific conductance
SOP	Standard operating procedures
T	Temperature
TKN	Total Kjeldahl Nitrogen
TN	Total nitrogen
TP	Total phosphorus
TSS	Total Suspended Solids (See Glossary above)
USGS	United States Geological Survey
WAC	Washington Administrative Code

WQA	Water Quality Assessment

Units of Measure

°C	degrees centigrade
cfs	cubic feet per second
cfu	colony forming units
cms	cubic meters per second, a unit of flow
dw	dry weight
ft	feet
g	gram, a unit of mass
kg	kilograms, a unit of mass equal to 1,000 grams
m	meter
mg	milligram
mg/Kg	milligrams per kilogram (parts per million)
mg/L	milligrams per liter (parts per million)
mL	milliliter
NTU	nephelometric turbidity units
s.u.	standard units
µg/g	micrograms per gram (parts per million)
µg/Kg	micrograms per kilogram (parts per billion)
µg/L	micrograms per liter (parts per billion)
µmhos/cm	micromhos per centimeter
µS/cm	microsiemens per centimeter, a unit of conductivity
ww	wet weight

Quality Assurance Glossary

Accreditation: A certification process for laboratories, designed to evaluate and document a lab's ability to perform analytical methods and produce acceptable data. For Ecology, it is "Formal recognition by (Ecology)…that an environmental laboratory is capable of producing accurate analytical data." [WAC 173-50-040] (Kammin, 2010)

Accuracy: The degree to which a measured value agrees with the true value of the measured property. USEPA recommends that this term not be used, and that the terms *precision* and *bias* be used to convey the information associated with the term *accuracy* (USGS, 1998).

Analyte: An element, ion, compound, or chemical moiety (pH, alkalinity) which is to be determined. The definition can be expanded to include organisms, e.g., fecal coliform, Klebsiella (Kammin, 2010).

Bias: The difference between the sample mean and the true value. Bias usually describes a systematic difference reproducible over time and is characteristic of both the measurement system and the analyte(s) being measured. Bias is a commonly used data quality indicator (DQI) (Kammin, 2010; Ecology, 2004).

Blank: A synthetic sample, free of the analyte(s) of interest. For example, in water analysis, pure water is used for the blank. In chemical analysis, a blank is used to estimate the analytical response to all factors other than the analyte in the sample. In general, blanks are used to assess possible contamination or inadvertent introduction of analyte during various stages of the sampling and analytical process (USGS, 1998).

Calibration: The process of establishing the relationship between the response of a measurement system and the concentration of the parameter being measured (Ecology, 2004).

Check standard: A substance or reference material obtained from a source independent from the source of the calibration standard; used to assess bias for an analytical method. This is an obsolete term, and its use is highly discouraged. See Calibration Verification Standards, Lab Control Samples (LCS), Certified Reference Materials (CRM), and/or spiked blanks. These are all check standards but should be referred to by their actual designator, e.g., CRM, LCS (Kammin, 2010; Ecology, 2004).

Comparability: The degree to which different methods, data sets and/or decisions agree or can be represented as similar; a data quality indicator (USEPA, 1997).

Completeness: The amount of valid data obtained from a project compared to the planned amount. Usually expressed as a percentage. A data quality indicator (USEPA, 1997).

Continuing Calibration Verification Standard (CCV): A quality control (QC) sample analyzed with samples to check for acceptable bias in the measurement system. The CCV is usually a midpoint calibration standard that is re-run at an established frequency during the course of an analytical run (Kammin, 2010).

Control chart: A graphical representation of quality control results demonstrating the performance of an aspect of a measurement system (Kammin, 2010; Ecology 2004).

Control limits: Statistical warning and action limits calculated based on control charts. Warning limits are generally set at +/- 2 standard deviations from the mean, action limits at +/- 3 standard deviations from the mean (Kammin, 2010).

Data integrity: A qualitative DQI that evaluates the extent to which a data set contains data that is misrepresented, falsified, or deliberately misleading (Kammin, 2010).

Data quality indicators (DQI): Commonly used measures of acceptability for environmental data. The principal DQIs are precision, bias, representativeness, comparability, completeness, sensitivity, and integrity (USEPA, 2006).

Data quality objectives (DQO): Qualitative and quantitative statements derived from systematic planning processes that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions (USEPA, 2006).

Data set: A grouping of samples organized by date, time, analyte, etc. (Kammin, 2010).

Data validation: An analyte-specific and sample-specific process that extends the evaluation of data beyond data verification to determine the usability of a specific data set. It involves a detailed examination of the data package, using both professional judgment and objective criteria, to determine whether the MQOs for precision, bias, and sensitivity have been met. It may also include an assessment of completeness, representativeness, comparability, and integrity, as these criteria relate to the usability of the data set. Ecology considers four key criteria to determine if data validation has actually occurred. These are:

- Use of raw or instrument data for evaluation.
- Use of third-party assessors.
- Data set is complex.
- Use of EPA Functional Guidelines or equivalent for review.

Examples of data types commonly validated would be:

- Gas Chromatography (GC).
- Gas Chromatography-Mass Spectrometry (GC-MS).
- Inductively Coupled Plasma (ICP).

The end result of a formal validation process is a determination of usability that assigns qualifiers to indicate usability status for every measurement result. These qualifiers include:

- No qualifier – data are usable for intended purposes.
- J (or a J variant) – data are estimated, may be usable, may be biased high or low.
- REJ – data are rejected, cannot be used for intended purposes. (Kammin, 2010; Ecology, 2004).

Data verification: Examination of a data set for errors or omissions, and assessment of the Data Quality Indicators related to that data set for compliance with acceptance criteria (MQOs). Verification is a detailed quality review of a data set (Ecology, 2004).

Detection limit (limit of detection)**:** The concentration or amount of an analyte which can be determined to a specified level of certainty to be greater than zero (Ecology, 2004).

Duplicate samples: Two samples taken from and representative of the same population, and carried through and steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variability of all method activities including sampling and analysis (USEPA, 1997).

Field blank: A blank used to obtain information on contamination introduced during sample collection, storage, and transport (Ecology, 2004).

Initial Calibration Verification Standard (ICV): A QC sample prepared independently of calibration standards and analyzed along with the samples to check for acceptable bias in the measurement system. The ICV is analyzed prior to the analysis of any samples (Kammin, 2010).

Laboratory Control Sample (LCS): A sample of known composition prepared using contaminant-free water or an inert solid that is spiked with analytes of interest at the midpoint of the calibration curve or at the level of concern. It is prepared and analyzed in the same batch of regular samples using the same sample preparation method, reagents, and analytical methods employed for regular samples (USEPA, 1997).

Matrix spike: A QC sample prepared by adding a known amount of the target analyte(s) to an aliquot of a sample to check for bias due to interference or matrix effects (Ecology, 2004).

Measurement Quality Objectives (MQOs)**:** Performance or acceptance criteria for individual data quality indicators, usually including precision, bias, sensitivity, completeness, comparability, and representativeness (USEPA, 2006).

Measurement result: A value obtained by performing the procedure described in a method (Ecology, 2004).

Method: A formalized group of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, data analysis), systematically presented in the order in which they are to be executed (EPA, 1997).

Method blank: A blank prepared to represent the sample matrix, prepared and analyzed with a batch of samples. A method blank will contain all reagents used in the preparation of a sample, and the same preparation process is used for the method blank and samples (Ecology, 2004; Kammin, 2010).

Method Detection Limit (MDL): This definition for detection was first formally advanced in 40CFR 136, October 26, 1984 edition. MDL is defined there as the minimum concentration of an analyte that, in a given matrix and with a specific method, has a 99% probability of being identified, and reported to be greater than zero (Federal Register, October 26, 1984).

Percent Relative Standard Deviation (%RSD): A statistic used to evaluate precision in environmental analysis. It is determined in the following manner:

$$\%RSD = (100 * s)/x$$

where s is the sample standard deviation and x is the mean of results from more than two replicate samples (Kammin, 2010).

Parameter: A specified characteristic of a population or sample. Also, an analyte or grouping of analytes. Benzene and nitrate + nitrite are all parameters (Kammin, 2010; Ecology, 2004).

Population: The hypothetical set of all possible observations of the type being investigated (Ecology, 2004).

Precision: The extent of random variability among replicate measurements of the same property; a data quality indicator (USGS, 1998).

Quality assurance (QA): A set of activities designed to establish and document the reliability and usability of measurement data (Kammin, 2010).

Quality Assurance Project Plan (QAPP): A document that describes the objectives of a project, and the processes and activities necessary to develop data that will support those objectives (Kammin, 2010; Ecology, 2004).

Quality control (QC): The routine application of measurement and statistical procedures to assess the accuracy of measurement data (Ecology, 2004).

Relative Percent Difference (RPD): RPD is commonly used to evaluate precision. The following formula is used:

[Abs(a-b)/((a + b)/2)] * 100

where "Abs()" is absolute value and a and b are results for the two replicate samples. RPD can be used only with 2 values. Percent Relative Standard Deviation is (%RSD) is used if there are results for more than 2 replicate samples (Ecology, 2004).

Replicate samples: Two or more samples taken from the environment at the same time and place, using the same protocols. Replicates are used to estimate the random variability of the material sampled (USGS, 1998).

Representativeness: The degree to which a sample reflects the population from which it is taken; a data quality indicator (USGS, 1998).

Sample (field): A portion of a population (environmental entity) that is measured and assumed to represent the entire population (USGS, 1998).

Sample (statistical): A finite part or subset of a statistical population (USEPA, 1997).

Sensitivity: In general, denotes the rate at which the analytical response (e.g., absorbance, volume, meter reading) varies with the concentration of the parameter being determined. In a specialized sense, it has the same meaning as the detection limit (Ecology, 2004).

Spiked blank: A specified amount of reagent blank fortified with a known mass of the target analyte(s); usually used to assess the recovery efficiency of the method (USEPA, 1997).

Spiked sample: A sample prepared by adding a known mass of target analyte(s) to a specified amount of matrix sample for which an independent estimate of target analyte(s) concentration is available. Spiked samples can be used to determine the effect of the matrix on a method's recovery efficiency (USEPA, 1997).

Split sample: A discrete sample subdivided into portions, usually duplicates (Kammin, 2010).

Standard Operating Procedure (SOP): A document which describes in detail a reproducible and repeatable organized activity (Kammin, 2010).

Surrogate: For environmental chemistry, a surrogate is a substance with properties similar to those of the target analyte(s). Surrogates are unlikely to be native to environmental samples. They are added to environmental samples for quality control purposes, to track extraction efficiency and/or measure analyte recovery. Deuterated organic compounds are examples of surrogates commonly used in organic compound analysis (Kammin, 2010).

Systematic planning: A step-wise process which develops a clear description of the goals and objectives of a project, and produces decisions on the type, quantity, and quality of data that will be needed to meet those goals and objectives. The DQO process is a specialized type of systematic planning (USEPA, 2006).

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