Lakes Management Plan Update

Special City Council Workshop

September 28, 2023

City of Camas WASHINGTON

Agenda

- Brief Overview (Reference July 3, 2023 Workshop Update)
  - **Phase 1 (2021)** – Background; Confirm public Need Statement; Strategy to develop Lakes Management Plan
  - **Phase 2 (Late 2021 to date)** – QAPP; Water quality sampling; Lakes Management Plan Development

- **Today's Update:**
  - Recommended Strategies

City of Camas

Lacamas Lake Management Plan

City gears up to fight algae blooms

Lacamas Lake is a key recreation spot in the Camas area

Lacamas, Round and Fallen Leaf lakes contribute to our overall quality of life, the local economy and civic pride in Camas. Camas residents and visitors have enjoyed going to these lakes for decades to fish, swim, boat, and recreate. Not only are the lakes a good place for people to recreate, they also serve as important habitat for wildlife.

Lacamas Lake had two reported algae blooms in 2018, three or four in 2019, and near-continual blooms in 2020 from April through October. Nearby Round Lake also had increases in blooms and Fallen Leaf Lake had its first known bloom in 2020.

Early analysis suggests water quality in all three lakes is changing, which will continue to lead to algae blooms unless we act.

We're gearing up to develop a plan to address algae blooms

The City has begun a process to develop a Lake Management Plan that will outline actions to improve water quality in Lacamas, Fallen Leaf and Round lakes. The project will address algae blooms, along with other water quality concerns that City Council has identified as a top priority.

So far the City has:

- **Secured two state grants totaling $210,000 to help fund the project.**
- **Convened a Citizen Advisory Committee.**
- **Hired technical and public involvement experts that will help make sure the plan has both sound science and broad public engagement.**

What is a Lake Management Plan?

A Lake Management Plan is a document that identifies the goals and actions for the purpose of improving and protecting desired conditions in a lake.

Objectives of the plan: Develop strategies to improve and protect the lakes so that people can continue using them for fishing, swimming, boating and other recreation.

We will work towards these objectives by:

- Characterizing the lakes' water quality
- Identifying and quantifying the nutrient sources that are affecting the lakes
- Evaluating potential management measures based on these findings

Learn more by going to the project page at www.engagecamas.com

July 3, 2023 Slides - Reference

Project Overview & History

2019

Water quality & citizen concerns

Nov 2020

Resolution 20-016

Need to take action!

2021

Phase 1 Background and Strategy

2021-2023

Phase 2

Lakes Management Plan Development

2023 – Future

Implementation

Lakes Management Plan

- Purpose:
  - Collect field data and base plan on scientific evidence
  - Complete extensive public outreach
  - Collaborate with Partner Agencies to align work with other efforts
  - Outline short- and long-term strategies to improve water quality in Lacamas, Fallen Leaf, and Round lakes.
  - Address algae blooms and other water quality concerns that City Council has identified as top priorities.
  - Identify resources to implement recommended strategies
  - Continue partnerships with Agencies and find collaborative opportunities to implement

Lakes Management Plan

- Department of Ecology – “Lake Cyanobacteria Management Plan” (LMP) Template
  - Grant Funding Requirement
- Need to submit LMP to Ecology for review/approval
  - Set us up for future funding opportunities!

DEPARTMENT OF ECOLOGY
State of Washington

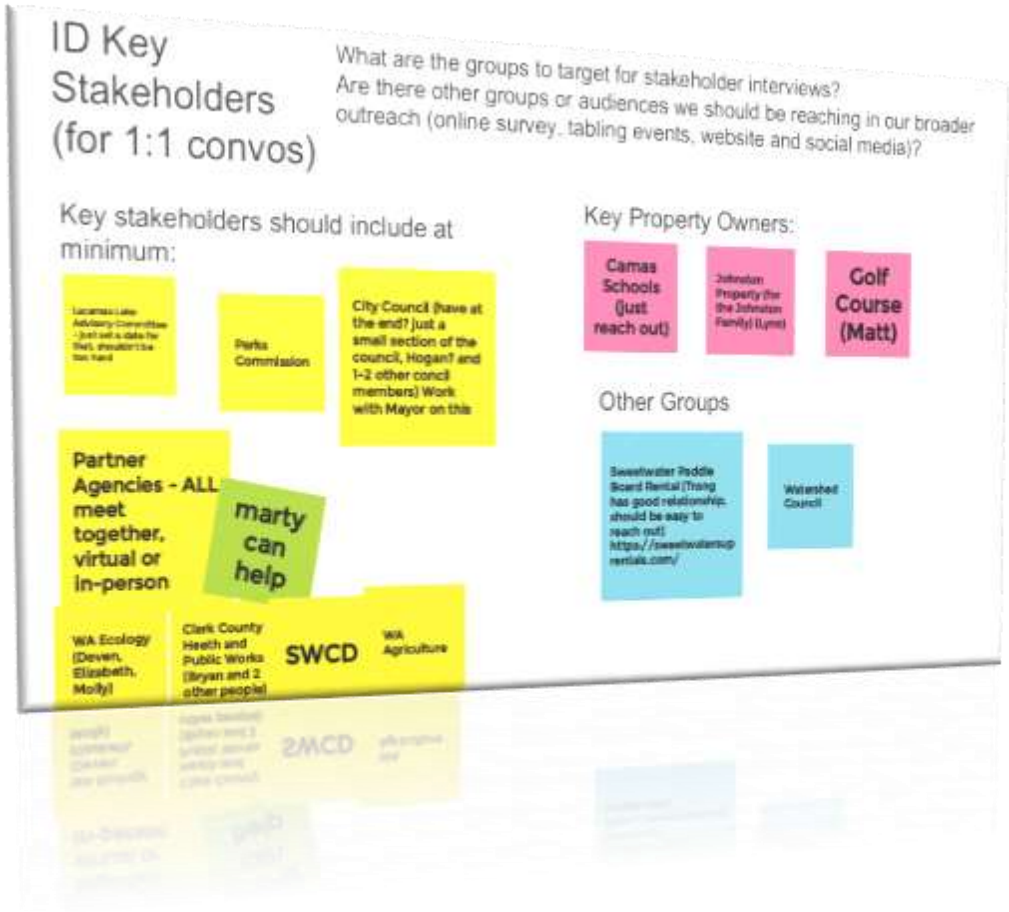
Freshwater Algae Control Program

Lake Cyanobacteria Management Plan Template Guidance

Fiscal Year 2020 Guidance

Overview of Public Outreach

- Engage Camas
- Open houses (3)
- Online Surveys (4)
- Tabling Events (4)
- Several meetings and workshops with Stakeholders
- Large property owner and small business meetings



Stakeholders – Thank You!

Key Stakeholders:

- Clark County Public Works
- Clark County Public Health
- Dept of Ecology (multiple departments)
- Dept of Fish & Wildlife
- Dept of Agriculture
- Clark Conservation District
- Lacamas Watershed Council
- Watershed Alliance of Southwest Washington
- Camas Parks Commission

Public Outreach - What We Heard

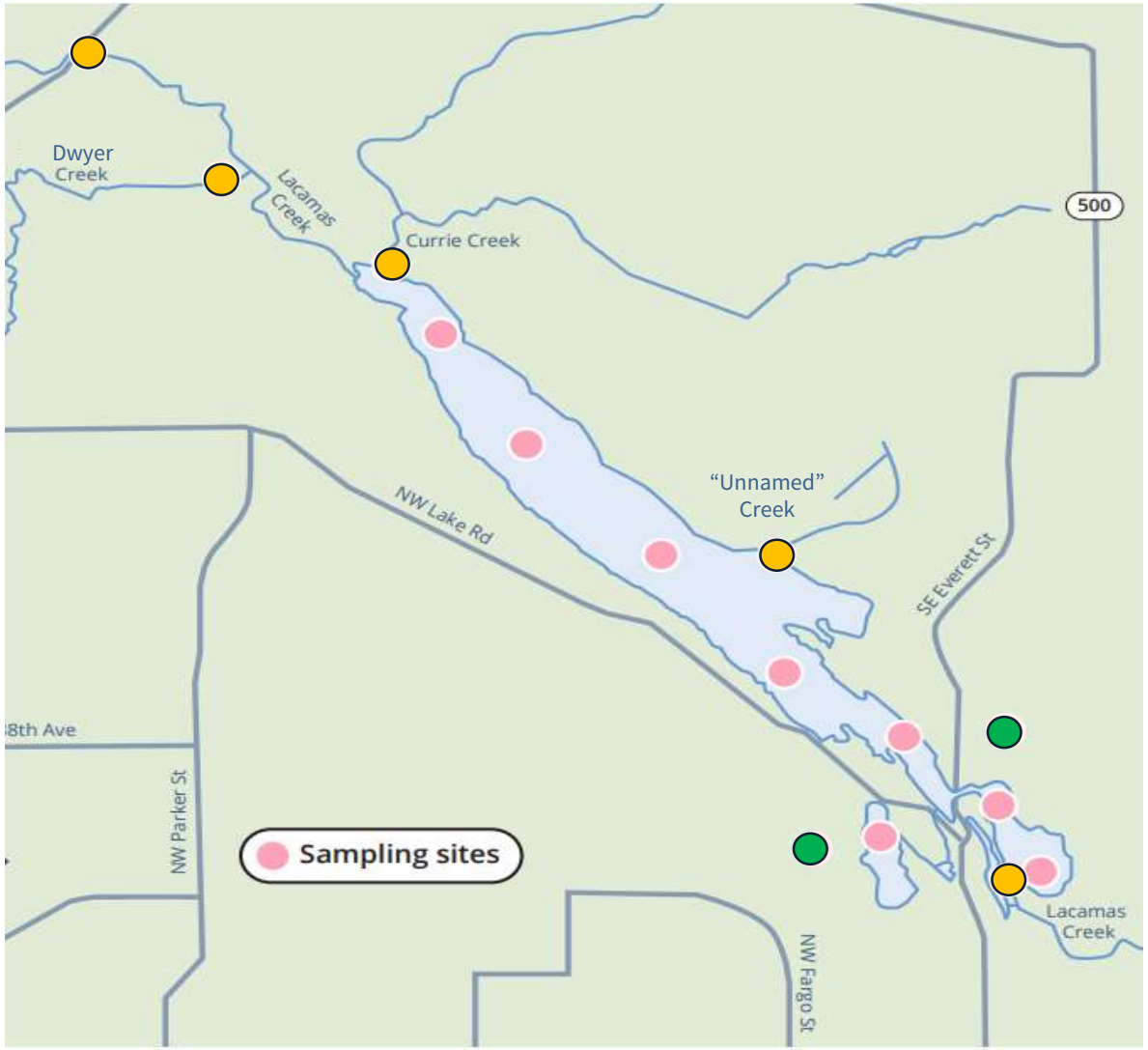
Community members want:

- Primary – Recreation
  - Swimming, fishing and general recreation
  - Safe for children and pets
  - Secondary – Habitat and general water quality (environment)
- Strategies and recommendations backed by science
- Consideration and balancing of all wants/needs

No quantitative goals set within plan or recommendations…

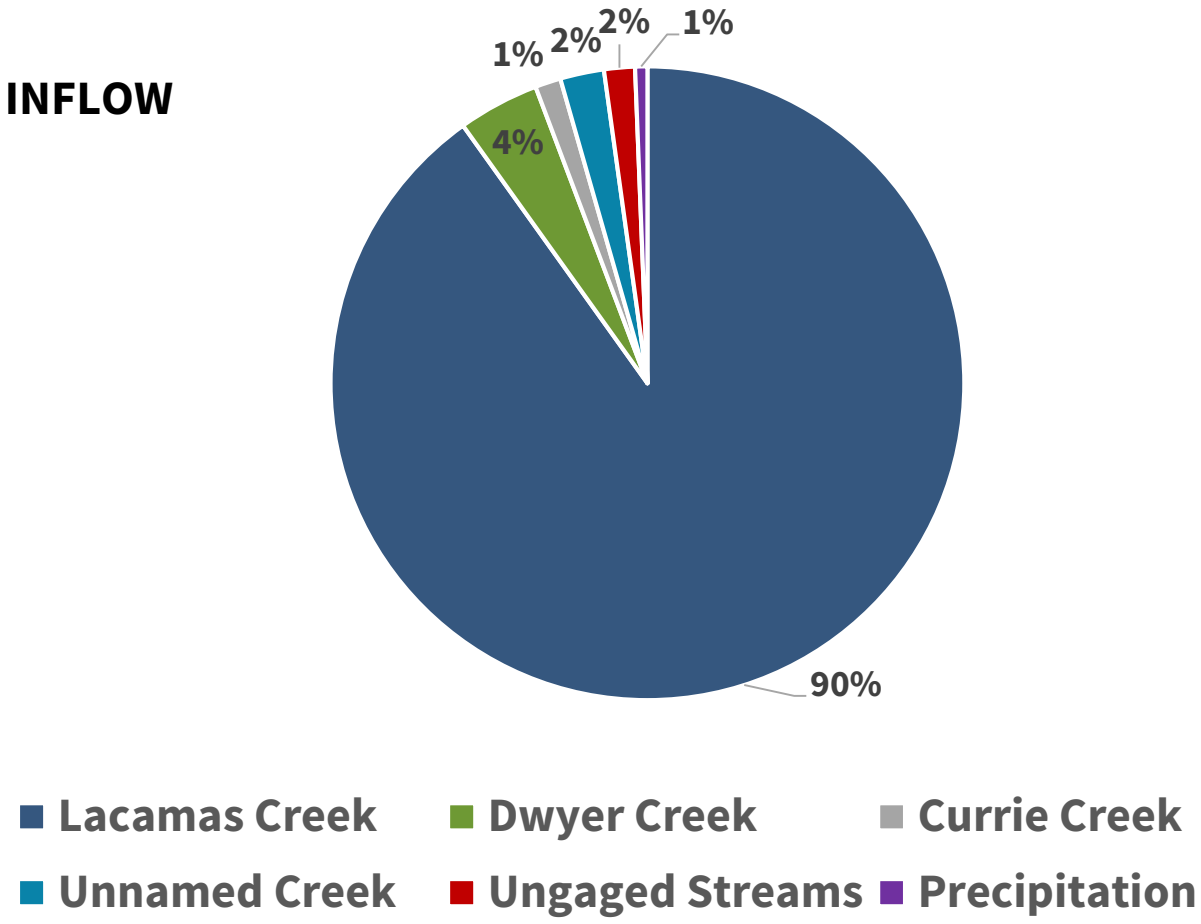
Overview of Sampling Activities

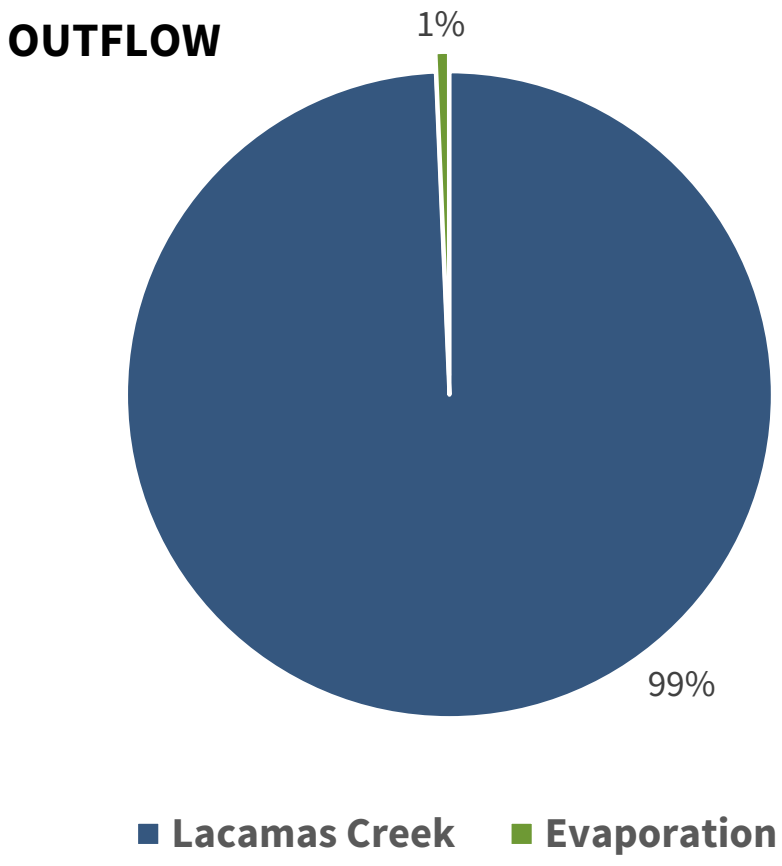
- Creeks
  - Lacamas (2)
  - Dwyer
  - Currie
  - “Unnamed”
- Lakes at different depths
- Sediment in lakes
- Representative stormwater sites
- Aquatic vegetation



Results - Flow Budget

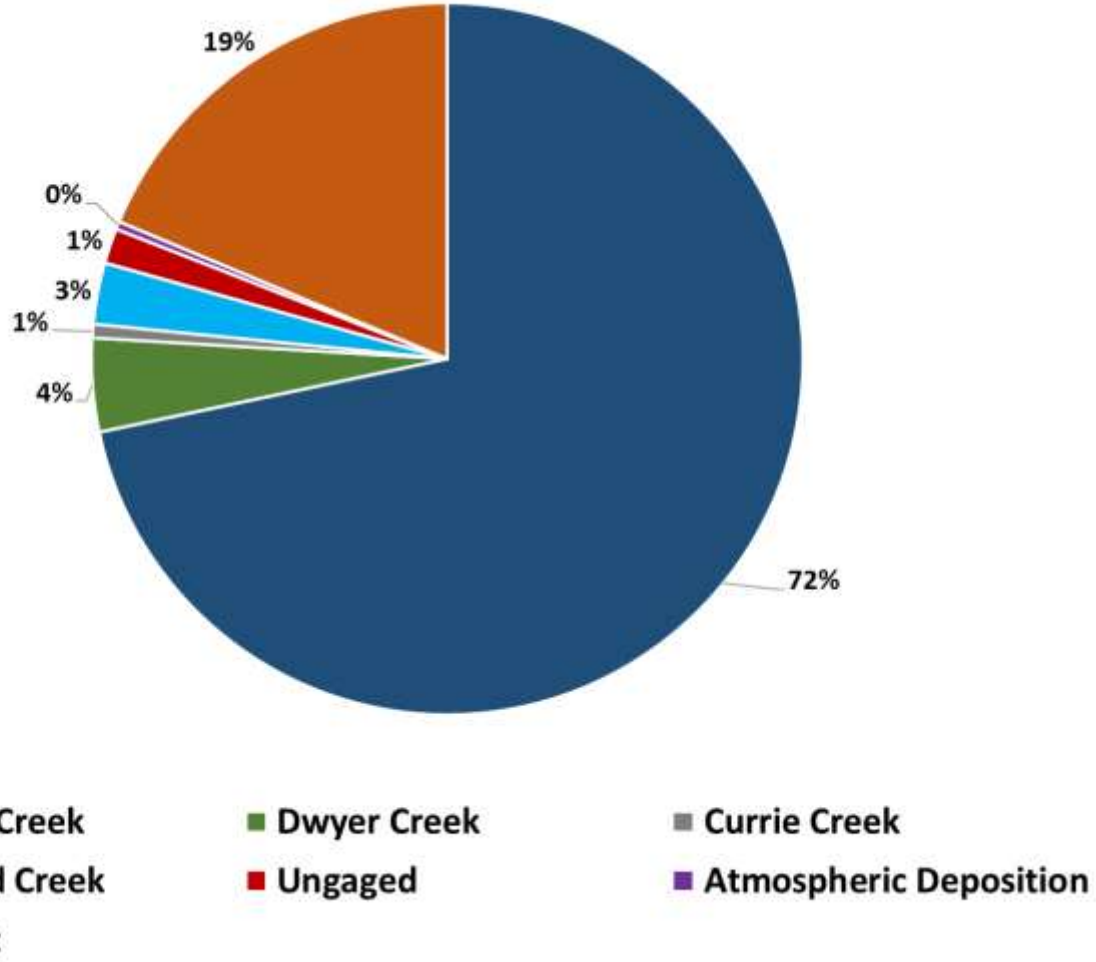
- Total Inflow: ~157,000 acre-feet (~21 x lake storage), May 2022-April 2023
  -





Results - Total Phosphorus Budget

- Data Collected May 2022-April 2023
- Note on Sediment: Concentrations of phosphorous in the sediment and deeper waters were higher in Round and Lacamas Lakes than in the past years (1980s-90s).



Related Work – Clark County

- Collection of nutrient data in Watershed in 2022
    - Lacamas Creek, China Ditch, Upper Fifth Plain Creek, Lower 5th Plain Creek, Shanghai Creek, Matney Creek, Upper Lacamas Creek
  - China Ditch and Lower 5th Plain Creek had consistently the highest TP
  - Stream Health Report: Clark County Watersheds
- Stormwater Management Plan Implementation
  - Inspect and maintain facilities; Capital projects; Public education; etc.
- Agricultural Management
  - Clark Conservation District support; Pollution identification and correction; etc.
- On-Site Septic Inspection Program
  - Poop Smart Clark

Related Work – Ecology

- “Source Assessment” nearly complete on Lacamas Watershed
- Ecology to develop Alternative Restoration Plan
  - Significant public and stakeholder outreach
  - Opportunity to include LMP findings
  - County and City likely to play a big part in implementation
- Source Assessment focused on bacteria, temperature, and nutrients.
- Alternative Restoration Plan to identify recommended strategies to improve water quality within Watershed.

Recommended Strategies

Key Data-Based Conclusions

- Lacamas, Round, and Fallen Leaf Lakes are eutrophic - Potential for continued algal blooms
- In summer 2022, most of the algae in Fallen Leaf Lake was not species associated with toxins, meaning there is a smaller chance of Harmful Algal Blooms
- From May 2022-April 2023, Lacamas Creek accounted for ~72% of Phosphorus loading to Lacamas and Round Lakes (Creeks overall accounted for ~81%)
- While loading from sediments in the Lakes accounts for less of the Phosphorus loading (~20%), may still need to be reduced to achieve desired reduction in algae blooms

Case Studies - Other Pacific Northwest Lakes

- In-Lake Phosphorus Inactivation
  - Heart Lake (Skagit County), alum
  - Lake Loma (Snohomish County), alum
  - Lake Ketchum (Snohomish County), alum
  - Long Lake (Kitsap County), alum
  - Kitsap Lake (Kitsap County), Phoslock and Eutrosorb G
  - Long Lake (Thurston County), alum and Phoslock
  - Newman Lake (Spokane County), alum
  - Lake Lorene (King County), Phoslock
  - Green Lake (King County), alum
  - Oswego Lake (Clackamas County, OR), alum
- Aeration/Oxygenation
  - Newman Lake (Spokane County), oxygenation
  - Twin Lakes (Ferry County), oxygenation
  - Oswego Lake (Clackamas County, OR), aeration
  - Willow Creek Lake (Morrow County, OR), aeration
- Other
  - Green Lake (King County), floating islands
  - Hicklin Lake (King County), floating islands
  - Blue Lake (Multnomah County, OR), solar mixers

3-Part Recommended Management Strategy

1. Annual removal of phosphorus from the **water column** using chemical treatment - beginning Spring 2024

2. Inactivation of phosphorus in the **sediments** using chemical treatment over 5-10 years - beginning Spring 2024

3. Reduction of phosphorus loading from the **watershed**, through continued partnerships with Clark County and other regional and state organizations - Ongoing

Recommended Approach Part 1: Water Column Phosphorus Removal

- Annual removal of phosphorus from water column using aluminum sulfate (alum) or Eutrosorb WC
  - Alum has been applied to numerous lakes in Washington
    - Depending on the required dose, buffering to maintain a pH range that will prevent formation of compounds toxic to aquatic life
  - Eutrosorb WC is a more recent product (2022) and is believed to have a lower risk to aquatic organisms
  - Recommend initially focusing on Lacamas Lake for treatment

Recommended Approach Part 1: Water Column Phosphorus Removal

Option	Planning Level Annual Cost
Water column stripping using alum or Eutrosorb WC	**$70,000 - $190,000 for Lacamas Lake** $90,000 - $225,000 for Lacamas and Round Lakes

- First dosage Spring 2024. Some benefit expected in 2024 but may take a few years to optimize dosage and timing. Potential to reduce dosage in future years.
- Will not affect ability to swim/fish in lakes beyond the days on which application occurs.
- Alum is permitted under Ecology Aquatic Plant and Algae Management General Permit. Eutrosorb WC will require experimental permit.

Recommended Approach Part 2: Sediment Phosphorus Inactivation

- Inactivation of Phosphorus in the sediments in the deepest portions of Lacamas and Round Lakes, using alum or Eutrosorb G, over 5-10 years
  - The deepest portions of the lake are most likely to release phosphorus from the sediments
  - Target areas where water depths exceed 30 feet for treatment (**88 acres in Lacamas Lake** and 11 acres in Round Lake)
  - To control dosage, reduce potential adverse impacts, allow for adaptive management, and reduce costs, inactivation of these sediments can be done over 5-10 years
  - Timing of potential future sediment treatment (10 to 50-year time frame) depends on inflow rate of solids from watershed and effectiveness of watershed-based solutions.

Recommended Approach Part 2: Sediment Phosphorus Inactivation

Option	Planning Level Annual Cost
Sediment inactivation using alum (buffered with sodium aluminate) or Eutrosorb G	**$260,000 - $340,000 for Lacamas Lake** $260,000 - $390,000 for Lacamas and Round Lakes

- Treatment would occur 2024-2028 with monitoring before and after treatments.
- Assumes sediment phosphorus inactivation would occur over a period of 5 years. Future treatment dependent on results and monitoring
- Assumes treatment focuses on deepest portions of Lacamas Lake (greater than 30 feet depth).

Recommended Approach Part 3: Watershed Management Options

Option	Notes
Stormwater program optimization **(City and County)**	**Examples:** Upgrade bioretention facilities Optimize detention ponds Cartridge unit replacement Upgrade media Street Sweeping Asset management
Agricultural BMPs **(City and Partners)**	**Examples:** Conservation Buffers Streamside Management Areas Detention or Retention Basins Media Filtration Reduced use of fertilizer or pesticides Planting vegetation associated with reduced Phosphorus export
Septic system management **(County and Partners)**	Measures to increase compliance
Stream restoration **(City and Partners)**	A stream condition inventory could be conducted to identify erosional locations to identify high priority sites
Constructed wetlands **(City, Partners, and Land Owners)**	Wetland treatment system could be located on public or private lands
Public education **(City and Partners)**	Support groups and efforts conducting work in the Watershed such as Poop Smart Clark. Encourage less fertilizer use, agricultural BMPs, etc.

Watershed Management
City Considerations

- Stormwater Management Program
  - Ongoing NPDES Permit work and Operations and Maintenance
    - Inspection of public and private facilities; Treatment cartridge replacement; Street sweeping; Capital Projects and upgrades
  - Prioritize stormwater facilities draining to Fallen Leaf Lake for inspection, monitoring, and retrofits.
    - Stormwater facilities draining to Lacamas and Round Lakes - effects may be more limited due to proportion of inflow.
  - Investigate sources of nutrients to “Unnamed Creek” and identify strategies for reducing load
  - Work with landowners adjacent to lake on ways to reduce nutrient loading
- Look for creative ways to help fund County, Clark Conservation District, and other efforts
  - Investigation into agricultural-based loadings; Restoration and plantings, etc.

Watershed Management
Collaboration with Partners Key!

- Continued collaboration with Clark County, Ecology, Clark Conservation District, Department of Agriculture, and non-profit partners necessary to be successful.
- Alternative Restoration Plan from Ecology ultimately key - will document where and how resources should be allocated.
  - Will need funding
  - Will take time to make real progress
- City-County Interlocal Agreement discussions
  - Continue Partnership
  - Significant work already being done - find ways to support and enhance
  - Joint funding opportunities

Additional Recommendations

- Continued lake monitoring (~$50,000/year)
  - Additional monitoring to ensure dosages are safe for aquatic life, and to track improvements in water quality (pH, phosphorus, DO)
  - Consider continuous data collection
  - Consider more formal partnership with Lacamas Watershed Council

- Consider pilot floating wetland project (~$40,000 for 1,000 sq ft project)
  - Unlikely to result in significant decrease in total phosphorus concentrations due to size ratio between wetland and lake volume
  - Will allow for some nutrient removal, public education and engagement.

- Public Education - Ongoing
  - Clean-up events
  - Pet-waste and fertilizer use education events
  - Specific outreach to lake shore property and creek side property owners

Summary - Budgetary Level 10-Year Costs

Recommendation	Year	Annual Cost	10-Year Cost	Notes
Water Column Phosphorus Stripping	1-10	$180,000	$1.8 Million	Annual treatments required; initial dosage determined from jar testing future applications influenced by loading from watershed.
Sediment Phosphorus Inactivation	1-5	$260,000	$1.3 Million	Need for additional sediment phosphorous inactivation determined by measured conditions, accumulation of additional phosphorous and sediment from the watershed.
Monitoring	1-10	$50,000	$500,000	Monitoring is needed to refine appropriate dosage of treatments, evaluate effectiveness.
Public Outreach	1-10	$50,000	$500,000	Reduction in nutrient loading from watershed will reduce in-lake treatment costs over time.
	Total	**~$540,000 (Years 1-5)** **~$280,000 (Years 6-10)**	**~$4.1 Million**	

Available Funding - $515,000 thru Direct Grant in 2023-2025 State Capital Budget

Other Options Evaluated - Not Recommended at this time…

Phosphorus Removal at Inflow

Option	Planning Level Initial Cost	Planning Level Annual Cost	Notes	Reason for not recommending this option
Alum dosing at Lacamas Creek	$500,000	$650,000	Initial costs construction, permitting, and design costs are very approximate due to absence of local examples.	High initial costs, and time required to design, permit, construct, and implement system.
Eutrosorb WC dosing at Lacamas Creek	$500,000	$220,000	Initial costs construction, permitting, and design costs are very approximate due to absence of local examples.	High initial costs, and time required to design, permit, construct, and implement system.

Other Options Evaluated - Not Recommended at this time…

Types of Aeration

Option	Planning Level Initial Cost	Planning Level Annual Cost	Notes	Reason for not recommending this option
Hypolimnetic aeration or oxygenation	$690,000	$55,000	Costs based on systems at similarly sized lakes; Assumed $20,000 for annual Operation and Maintenance, and replacement after 20 years ($690,000 annualized)	**Not expected to reduce HABs by itself** - only helps with sediment P (~20% load). Does not address the creek loading. Substantial initial costs; time required to design, construct and implement the system.
Nanobubbler	$800,000	$50,000	Costs assume 10 of the largest units available from Moleaer.	**Not expected to reduce HABs by itself** - only helps with sediment P (~20% load). High initial costs, Need for property for device placement.

Other Non-Recommended Options

Option	Description	Reason for not conducting detailed costing
Algaecide	Risk of toxicity to fish and vegetation; short term solution, requires monitoring	Not at this time; however, new products continue to be developed with lower potential for toxicity to fish and benthic organisms. Maintain for future consideration.
Carp removal	Carp are known to stir up Phosphorus in bottom sediments; reducing Carp population may reduce internal loading.	Consider communications encouraging carp fishing; maintain consideration of commercial removal of carp. However, Further discussions with WDFW needed.
Limiting of motor use in shallow areas of lake	In some areas of Lacamas Lake, motors can stir up sediments from the bottom of the lake, potentially resulting in Phosphorus transfer to the water column.	There is not enough evidence to demonstrate that this would meaningfully reduce internal loading. Maintain for future consideration. *Policy decision*
Dredging	Remove Phosphorus-containing sediments from the bottom of the lakes.	Not at this time due to high costs and need to determine where dredged sediments would be placed.
Ultrasound	Ultrasonic waves create a barrier preventing algae from moving up and down the water column to access nutrients and light needed for growth.	Relatively few examples; not found to be effective at Lake Ketchum
Full Water Column Mixing	Mixing the like using solar-powered mixers or mechanical mixing	Risk of moving high concentrations of nutrients in water near the bottom of the lake to the surface, leading to greater algae growth.

Next Steps

- October/November 2023
  - Complete DRAFT Lakes Management Plan, incorporating Council comments
  - Submit DRAFT Lakes Management Plan to Ecology for review
  - Simultaneously provide opportunity for Stakeholder feedback and comments, including Watershed Symposium
- Winter 2023
  - Incorporate Ecology and Stakeholder feedback
  - Complete Final Lakes Management Plan
- Spring 2024
  - Implementation of In-Lake Treatment Strategies using available funding
- Ongoing
  - Continued implementation of Management Strategies w/ Partners

Questions and Discussion