Lake Lawrence Cyanobacteria Management Plan
Mid-Year Monitoring Update

May 5, 2025; 6:30-7:30 pm

THURSTON COUNTY
WASHINGTON
SINCE 1852

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Agenda

1. Refresher
2. Monitoring Updates
3. LCMP Schedule
4. Questions and Discussion

Project Goals and Objectives

Project Goal

Develop a comprehensive, science-based plan to guide public and private investment for the benefit of human recreation and environmental health in Lake Lawrence.

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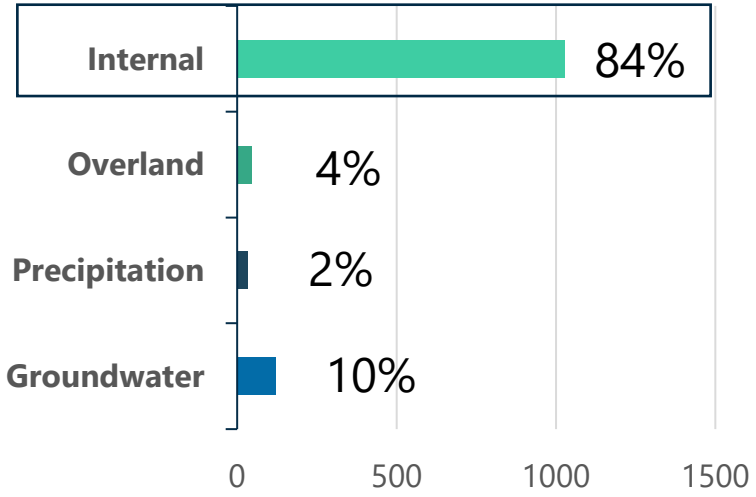
Water Quality Monitoring Goals

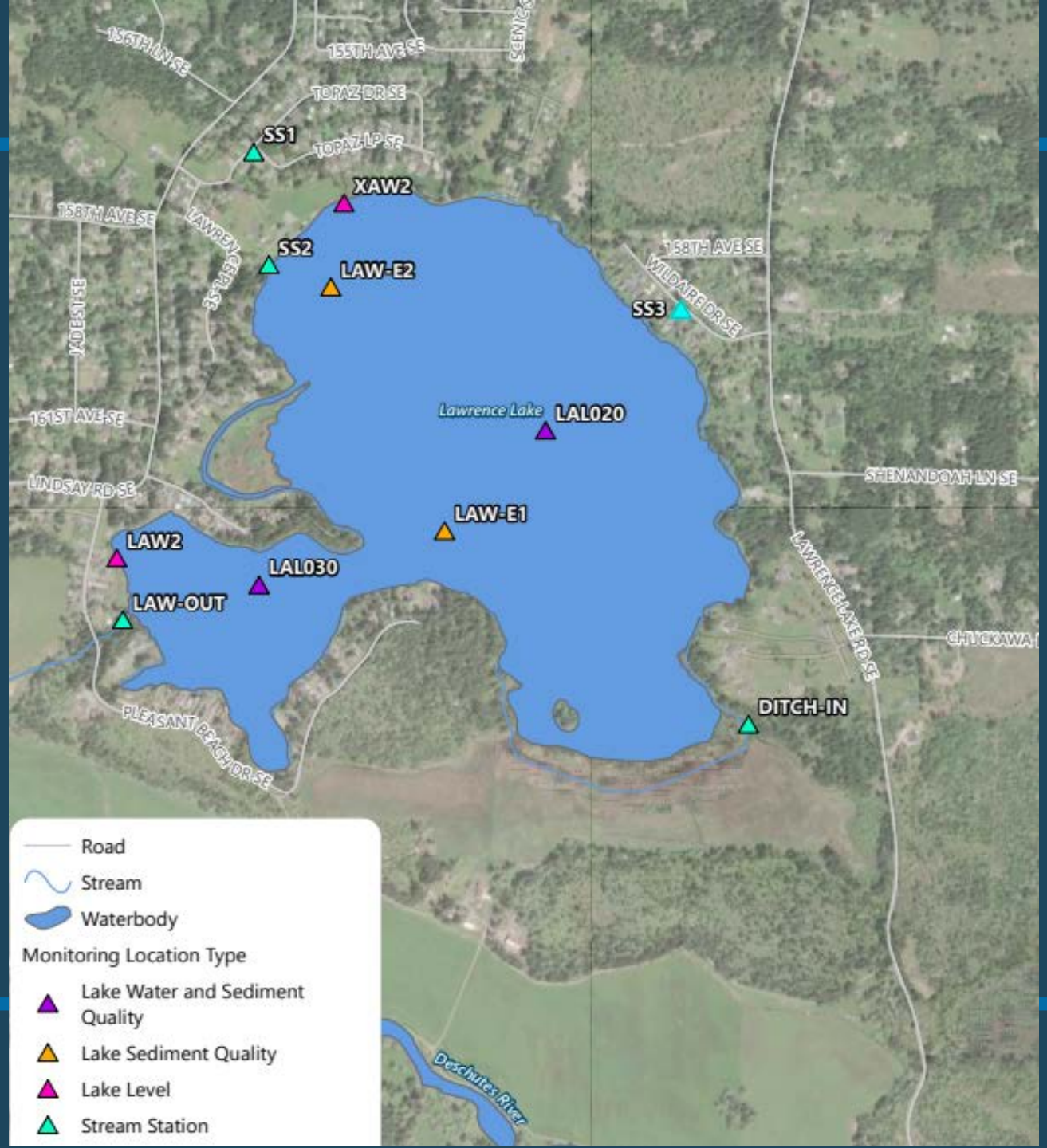


1. ***What are the current water quality conditions and plankton dynamics in Lake Lawrence?***

2. ***Have the water and phosphorus budgets changed since 1990? (particularly sediment release)***

Water Quality Monitoring Strategy

1. ***Revisit KCM (1991) Monitoring Sites***
2. ***Lake water quality monitoring, in both basins, October 2024-October 2025***
    - *Profiles (temperature, dissolved oxygen, pH, conductivity)*
    - *Total and dissolved Phosphorus and Nitrogen at lake surface and bottom*
    - *Chlorophyll-a at lake surface*
    - *Algae ID at lake surface*
    - *Lake use observations (swimmers, anglers, waterfowl)*
3. ***Lake level monitoring***
4. ***Lake inlet + outlet monitoring Oct 2024-Oct 2025***
    - *Total Phosphorus*
    - *Discharge*
5. ***Lake sediment sampling Sept 2024***
    - *Phosphorus fractions, iron, solids*


156TH LN SE
155TH AVE SE
TOPAZ DR SE
TOPAZ LP SE
SS1
XAW2
158TH AVE SE
LAWRENCE PL SE
SS2
LAW-E2
158TH AVE SE
WILDAIRE DR SE
SS3
XDEE ST SE
161ST AVE SE
Lawrence Lake
LAL020
LINDSAY RD SE
SHENANDOAH LN SE
LAW-E1
LAW2
LAL030
LAW-OUT
LAWRENCE LAKE RD SE
CHICKAWA
DITCH-IN
PLEASANT BEACH DR SE
Deschutes River
Road
Stream
Waterbody
Monitoring Location Type
Lake Water and Sediment Quality
Lake Sediment Quality
Lake Level
Stream Station

Preliminary Monitoring Results

Lake Quality & Algae Blooms

~Two-thirds through the lake sampling study.

Thurston County staff have been collecting samples monthly.

No December samples collected due to extreme algae bloom.

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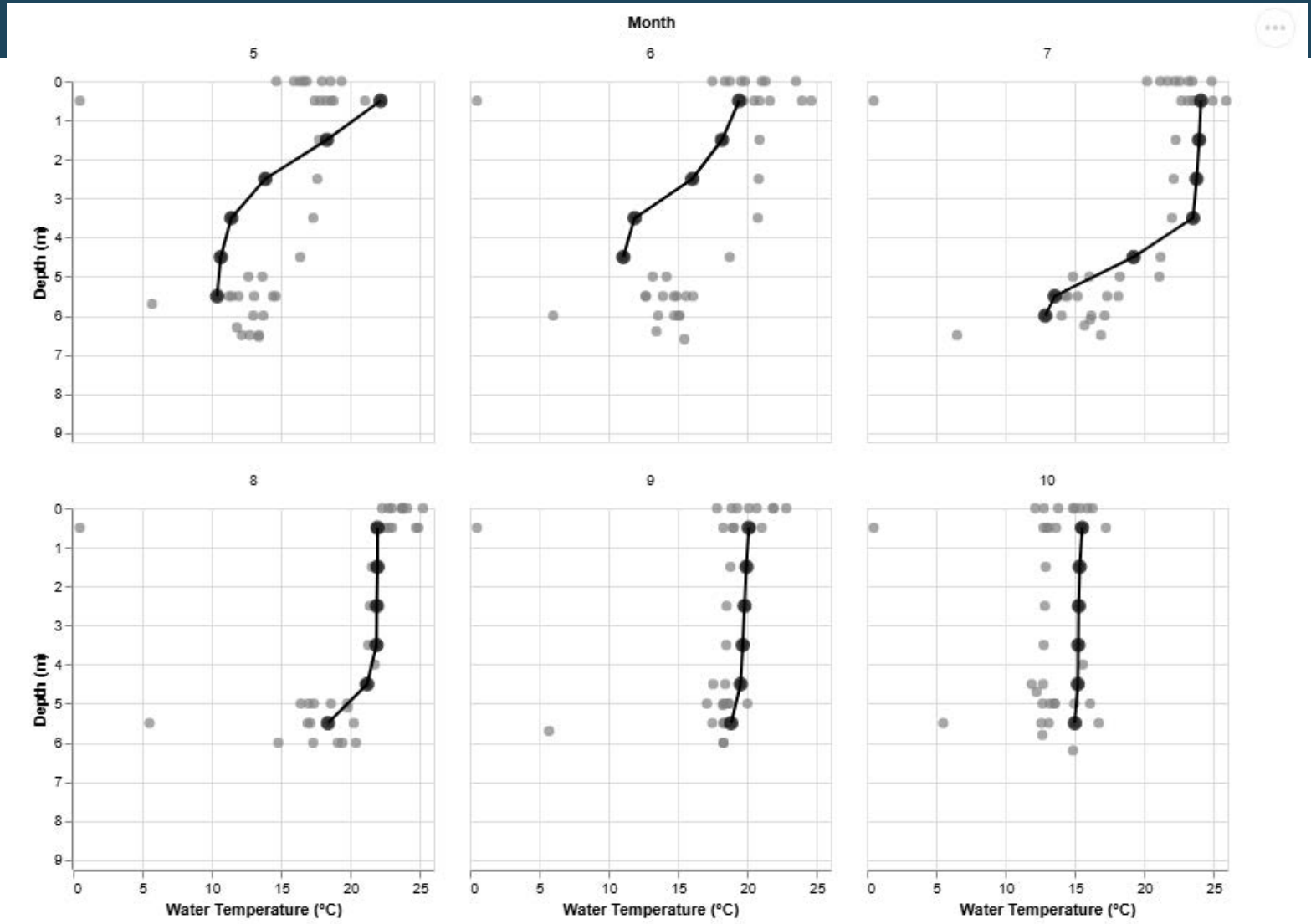
Anatoxin-a
Cylindrospermopsin
Microcystin
Saxitoxin
Count
0
5
10
15
2010
2015
2020
2025
Year
ExceedCriteria
Above
Below

Lake Lawrence thermally stratifies



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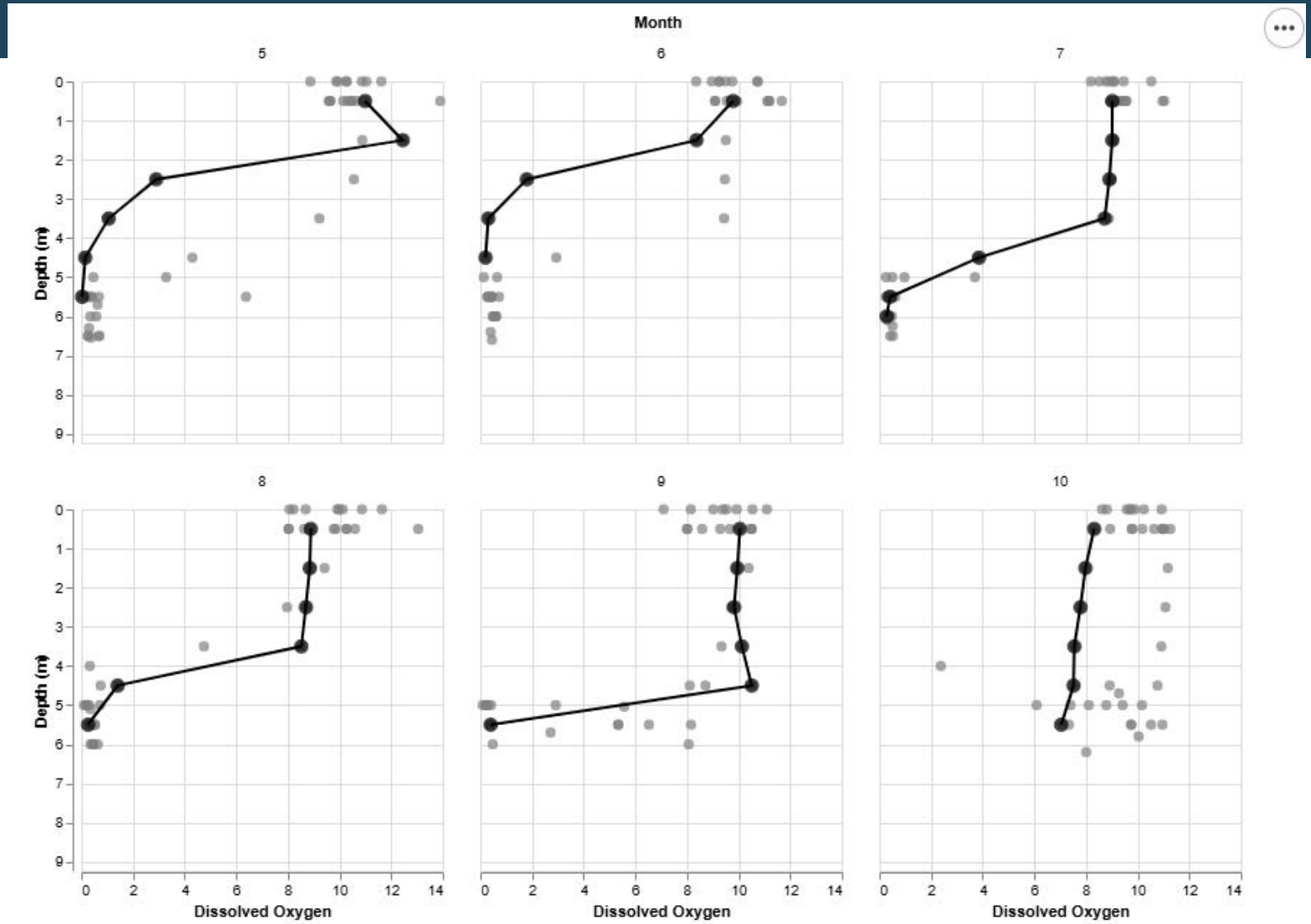
Lake Lawrence goes anoxic at depth



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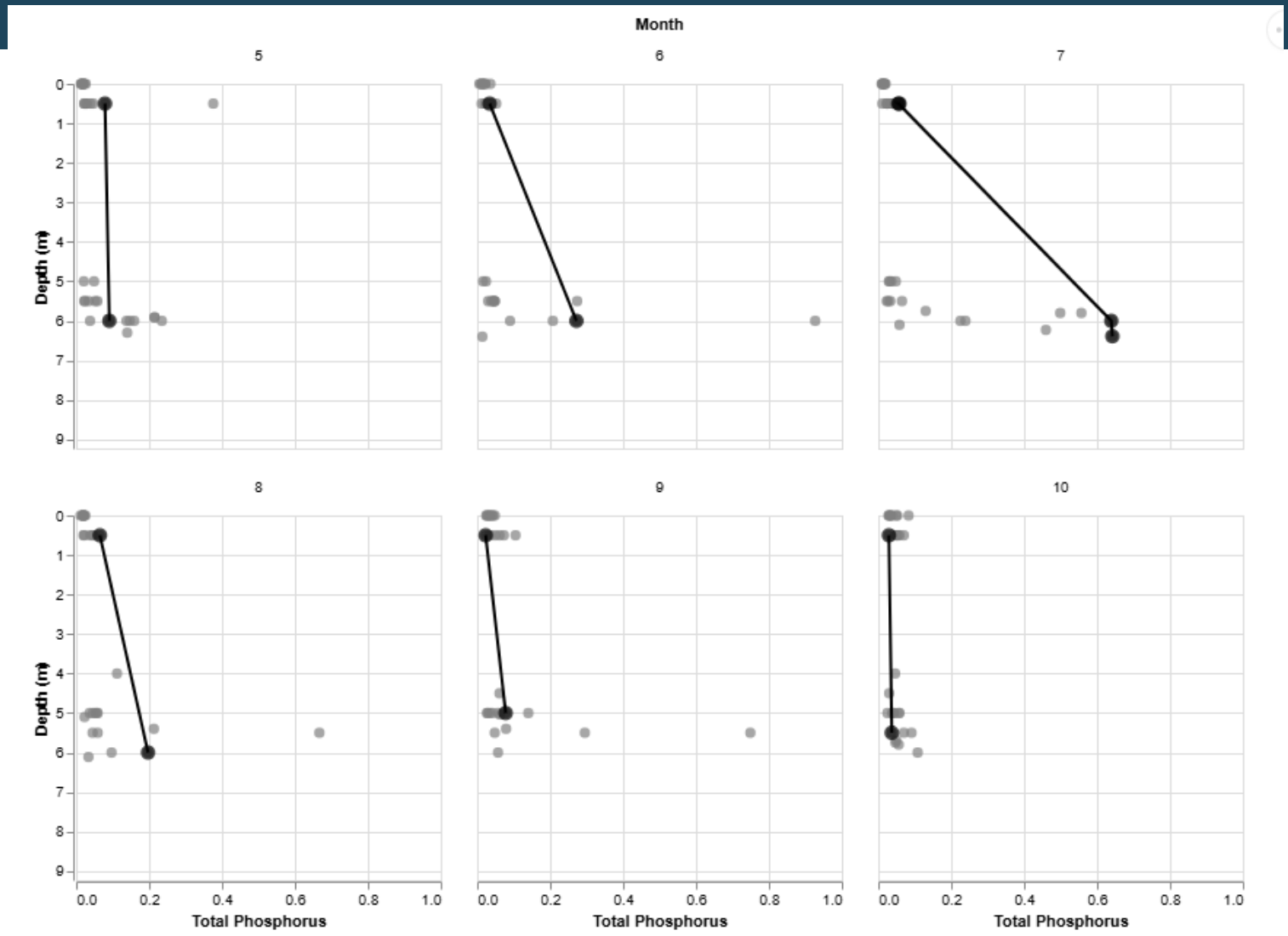
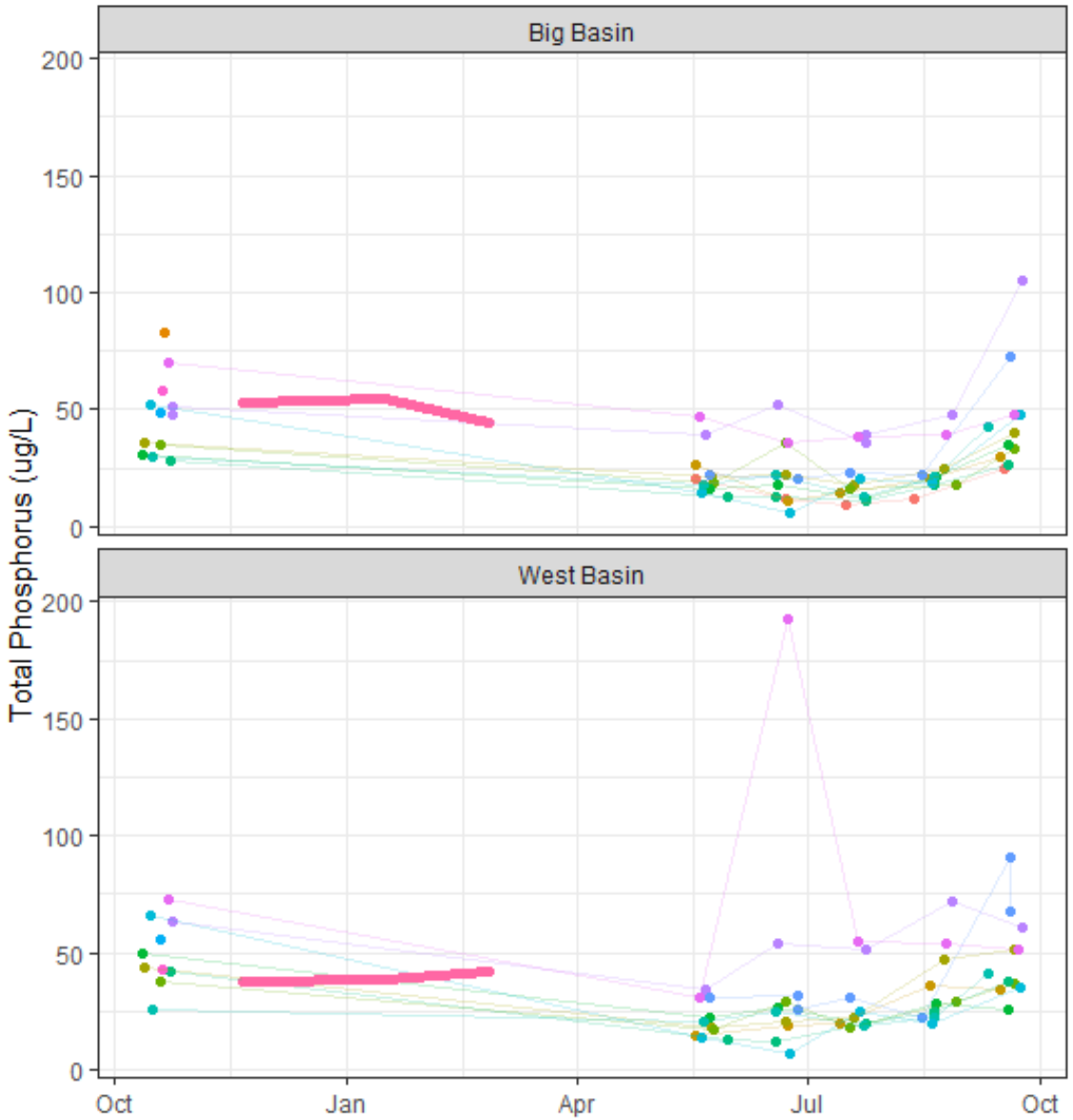
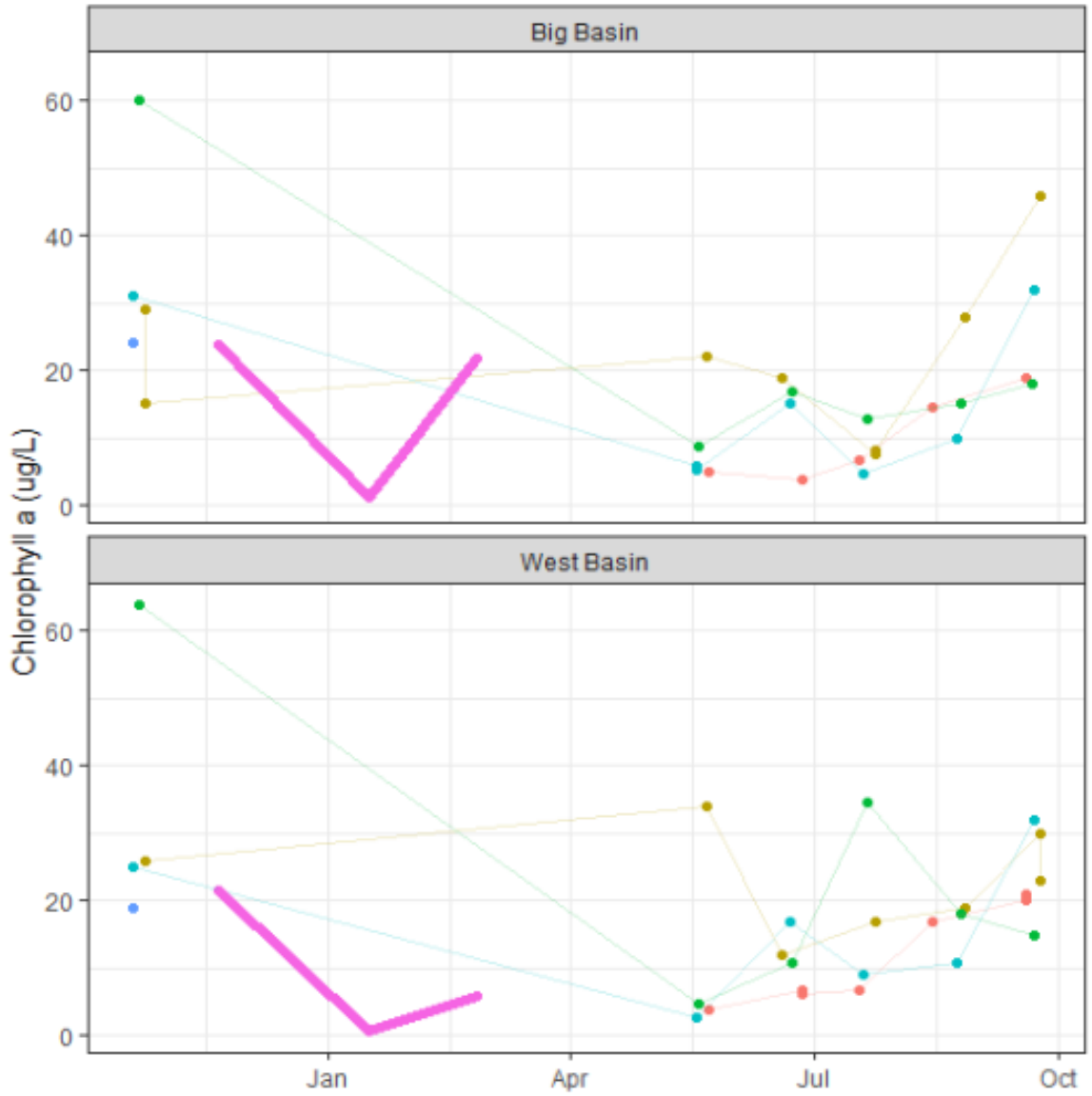
Phosphorus is released under anoxic conditions



Total Phosphorus (ug/L)

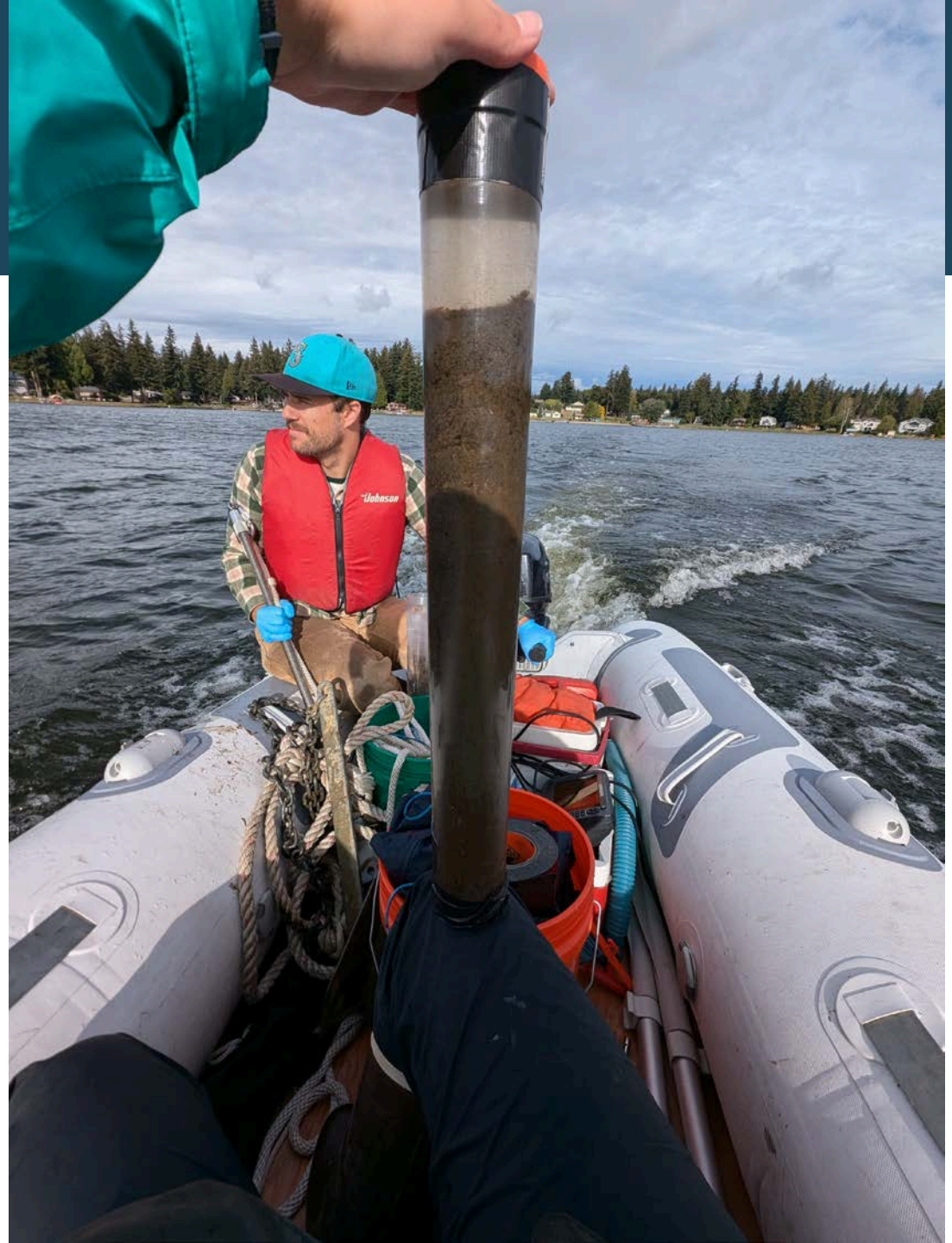


Chlorophyll a (ug/L)



Sediment Quality

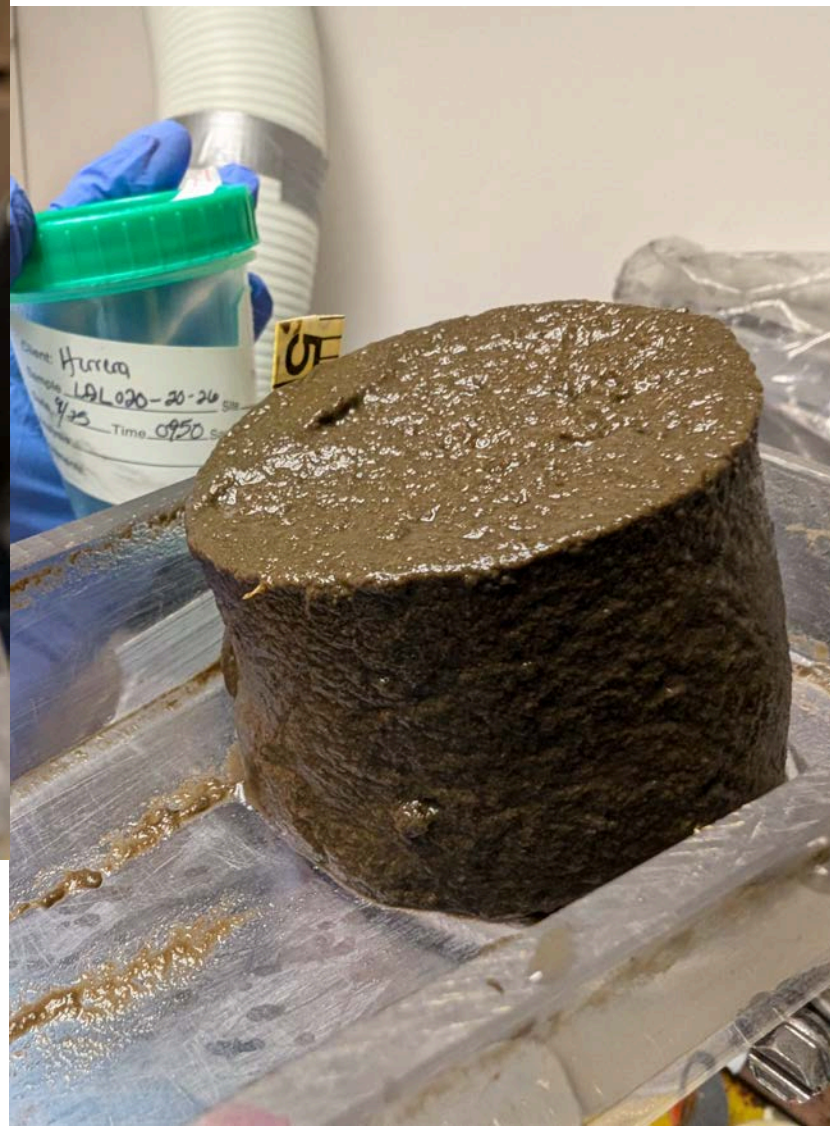
Status: *Completed*



Near surface

12-16 cm beneath

20-26 cm beneath



Sediment Phosphorus Results

Core	Depth Interval (cm)	Mobile P (mg/kg)	Biogenic P (mg/kg)	Active P (mg/kg)	Total P (mg/kg)	% Active P
Big Basin (Deep)	0-10	483	122	605	1491	41%
	12-26	126	200	326	945	34%
Big Basin E1	0-10	26	822	848	1422	60%
	12-26	35	279	314	655	48%
Big Basin E2	0-10	24	165	189	514	37%
	12-26	3	80	84	322	26%
Average	**0-10**	**178**	**369**	**547**	**1142**	**46%**
West Basin	0-10	134	13	147	724	20%
	12-26	84	49	133	600	22%

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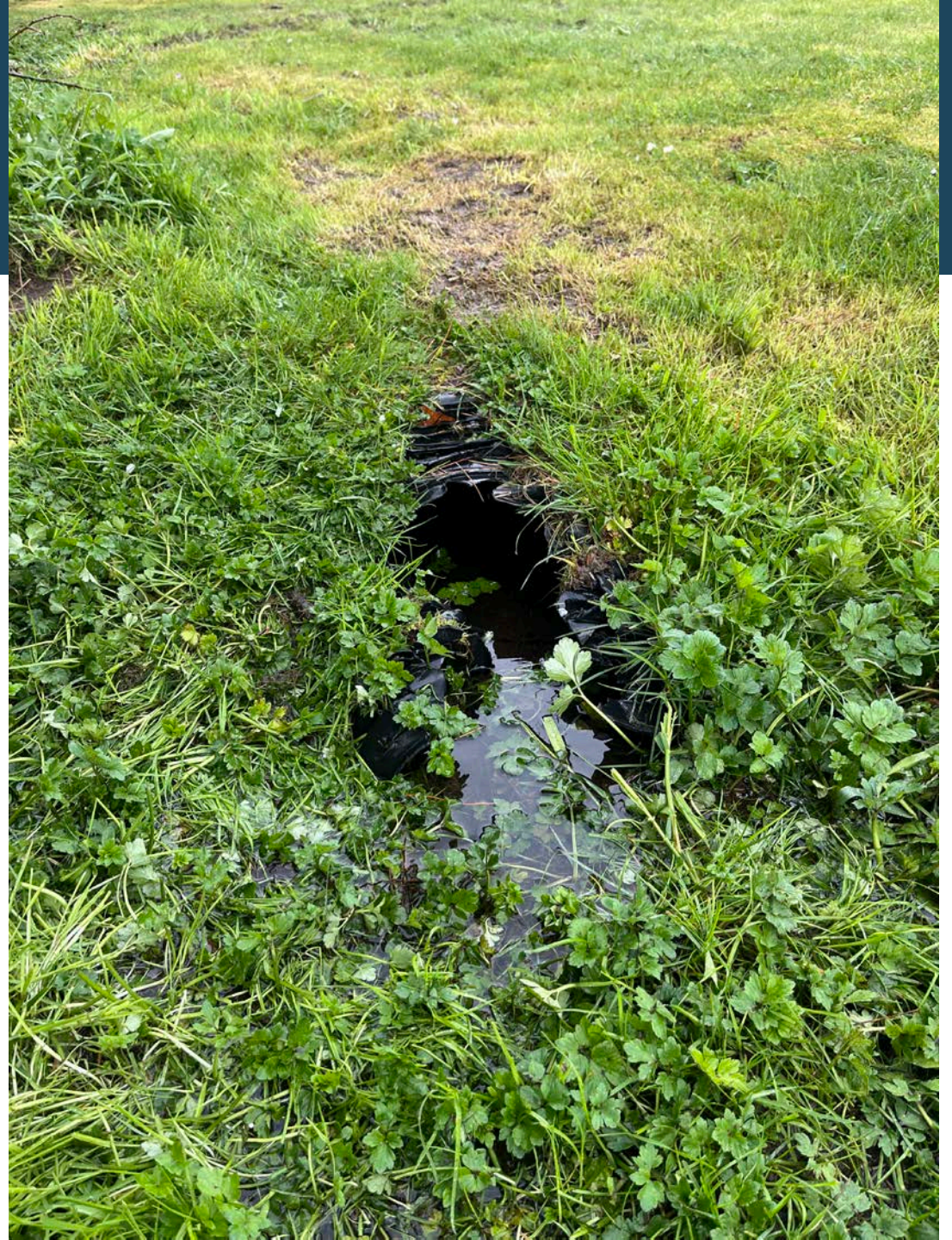
Watershed Monitoring

Status: *Two storms of four collected*

Barry has been integral in providing go/no-go information for whether there are sufficient flows



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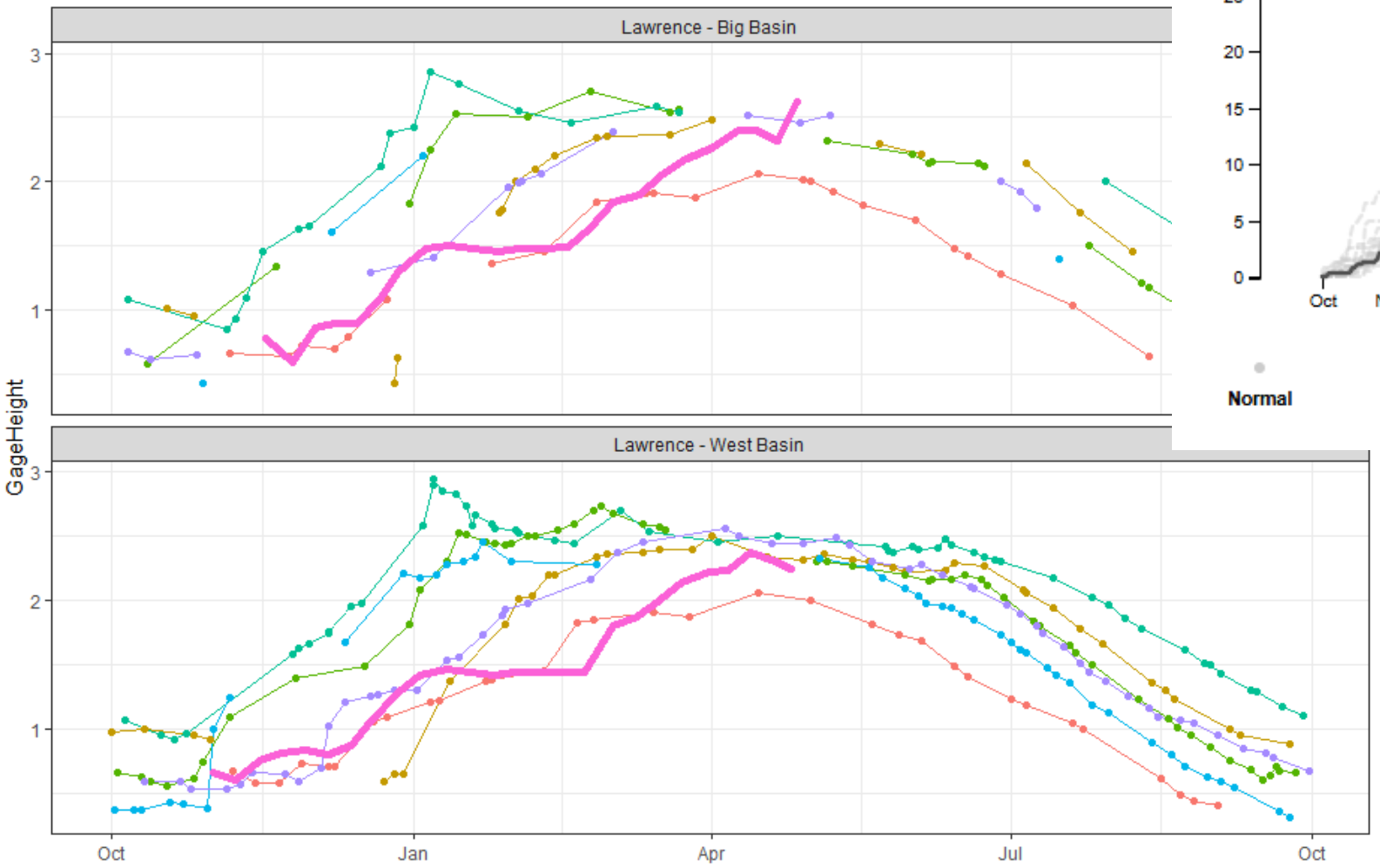
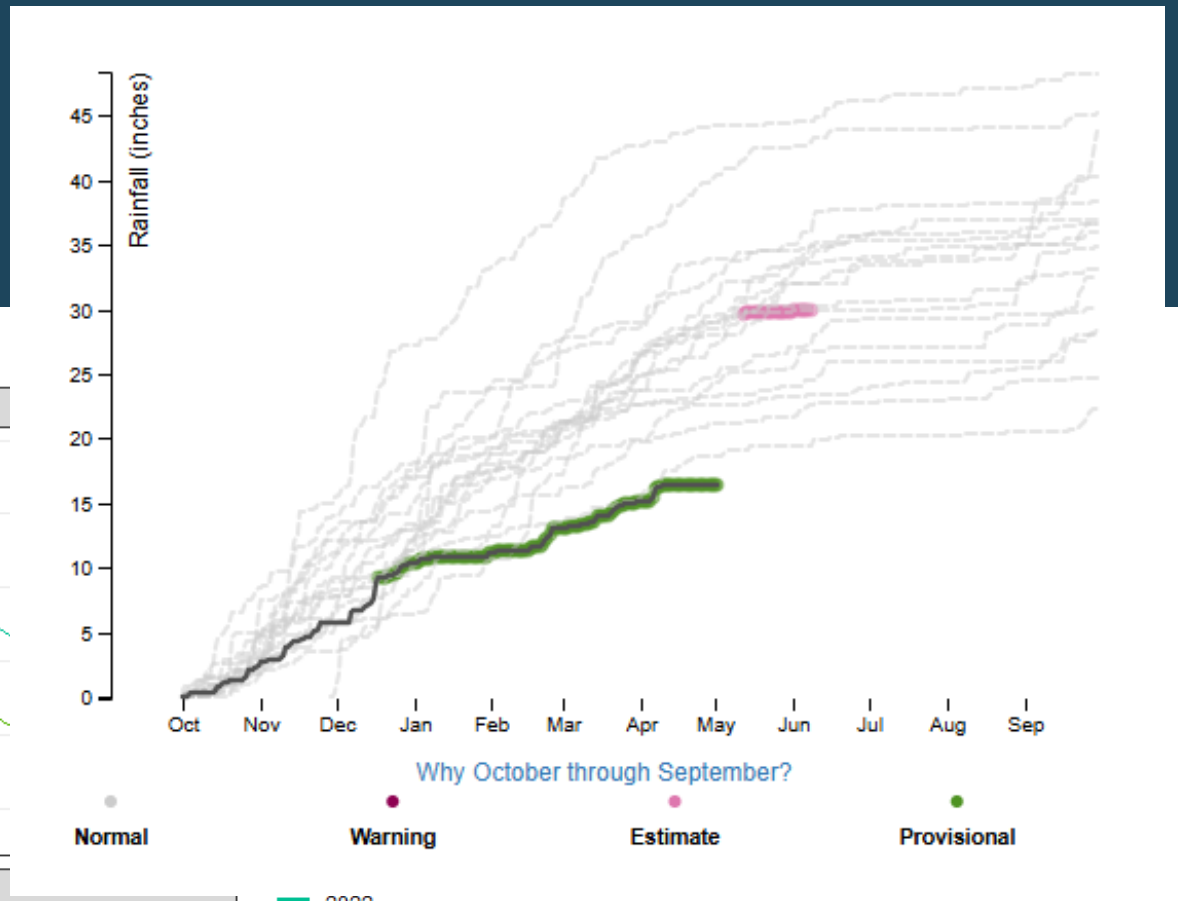
It was a dry winter!





Wet-weather Phosphorus Results

Site	2025-02-25	2025-04-08
SS1	549 ug/L	No flow
SS2	155 ug/L	102 ug/L
SS3	147 ug/L	235 ug/L
DITCH-IN (appears to represent lake)	19 ug/L	44 ug/L
KCM 1991		
Groundwater	63 ug/L	
Overland	Forested: 25 ug/L Residential/Agriculture: 324 ug/L **Volume-weighted: 192 ug/L** (literature values)	

What's Next?

1. Complete Lake And Watershed Monitoring (through October 2025)

2. Develop Update Water and Phosphorus Budgets

3. Evaluate Causes and Drivers for Algae Blooms

4. Develop Lake Cyanobacteria Management Plan

Lake Cyanobacteria Management Plan

Near- and long-term actions to manage water quality in line with identified goals and objectives.

Lake Cyanobacteria Management Plan

The Plan focuses on Surface Water Quality
The Plan does not focus on…

- Fisheries
- Aquatic Plants
- Drinking/Ground Water Quality
- Flooding

We will consider co-benefits/consequences of surface water quality management strategies for those endpoints.

1. Background Information
   - Lake Lawrence and Watershed History
   - Current Management Actions
   - Current Water Quality Conditions
2. LCMP Goals, Objectives, and Success Measures
3. Monitoring Study Findings
4. Water and Phosphorus Load Models
5. Recommended Management Actions and Sequencing (including costs)
6. Adaptive Management Framework
7. Appendices

Project Schedule

Project Step	Action	Period
Lake and Watershed Monitoring	*Published Monitoring Plan (QAPP)*	*October 2024*
	***Public Meeting 1**: Project Overview and Plan*	*July 2024*
	Lake and Watershed Monitoring	Oct 2024 to Oct 2025
	LMDSC/TC Meeting: Monitoring Update	Today!
Lake Cyanobacteria Management Plan	**LMDSC/TC Meeting:** P Budget Results, Potential Management Actions	December 2025
	Pre-Draft Plan for County & LMDSC review	March 2026
	Public Meeting: Present Draft Plan	April 2026
	Draft Plan for Ecology & Public review	April 2026
	Final Meeting: Present Final Plan	June 2026
	Deliver Final Plan	June 2026

Thank you!

Questions?

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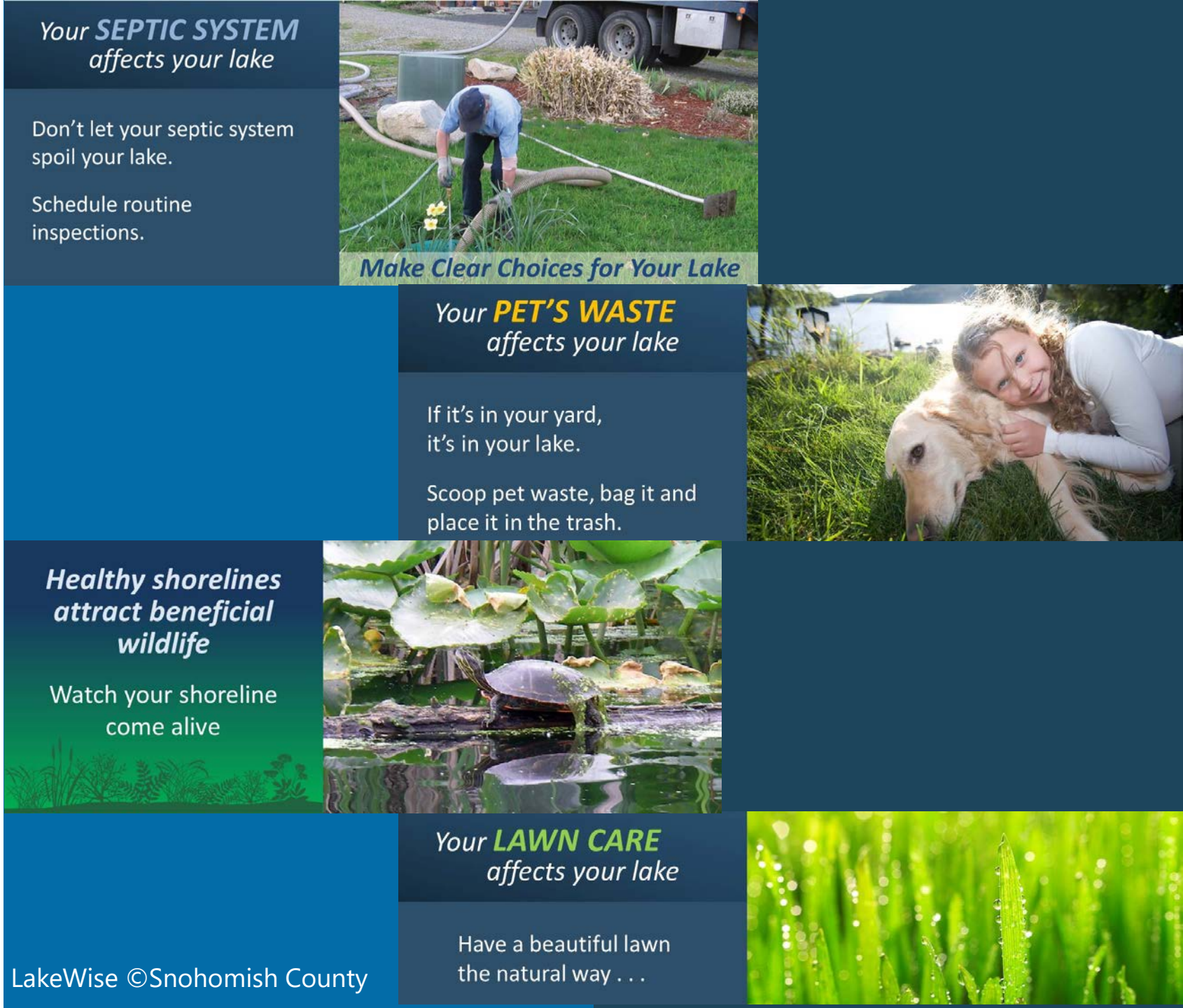
Watershed Management Strategies

1. OSS Inspections, repair, replacement
2. Pollution reduction (e.g., pet waste, fertilizers)
3. Agricultural and forestry BMPs (erosion control)



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Healthy Shore

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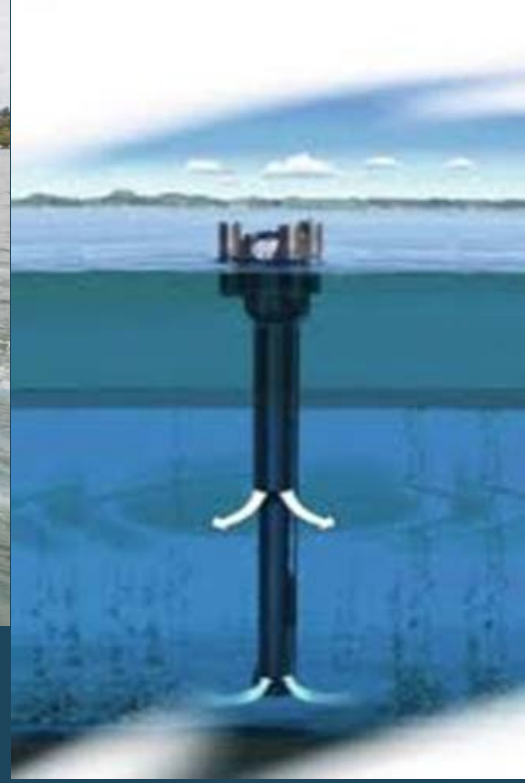
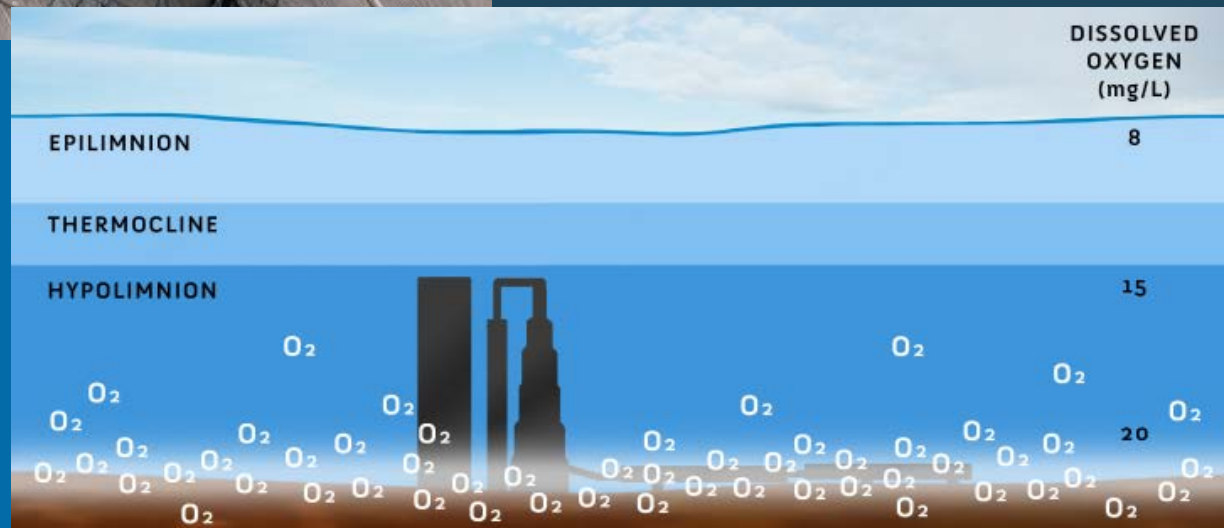
In-lake Management Strategies

1. Phosphorus Inactivation
   - Alum
   - Lanthanum
2. Hypolimnetic oxygenation
3. Biomanipulation
   - Fish removal
4. Lake Circulation
   - Surface or whole
   - Aeration





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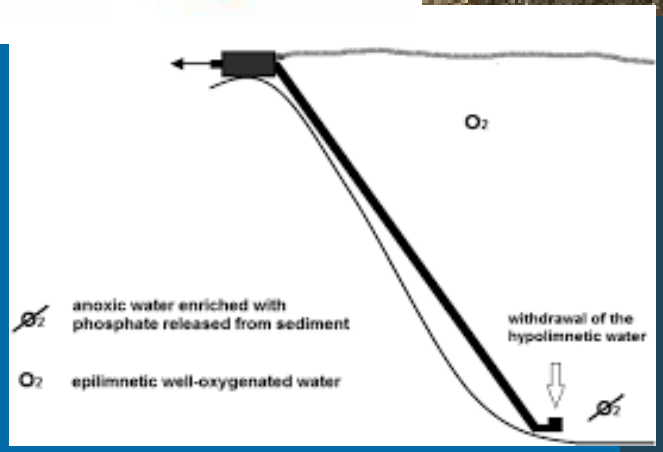
In-lake Management Strategies

5. Dilution/Flushing
6. Hypolimnetic withdrawal
7. Drawdown
8. Dredging
9. Algaecides
10. Other Experimental Approaches:
    - Microbes/Enzymes
    - Barley Straw
    - Dye
    - Nanobubbler



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Lake Lawrence – A History

Pre-Colonization

- Inhabited by Cowlitz, Nisqually, and Cayuse, Umatilla, & Walla Walla peoples

1873

- First survey of the lake
- 25-30 settlers
- "Kandel Lake"

1880s-1890s

- Renamed to "Lake Lawrence"
- Two small sawmills along the lakeshore
- Sawdust and wood waste discarded in lake

1908-1928

- Lake used as a reservoir for Tumwater Power Plant
- Deschutes River diverted into lake
- Lake outlet dammed; lake level raised

1920s-1940s

- Edwards Resort popular for recreation
- Lake became fishing destination

1951

- WDFW started rotenone treatments lake to remove bass, perch, etc.
- WDFW started rainbow trout stocking

1960s-1970s

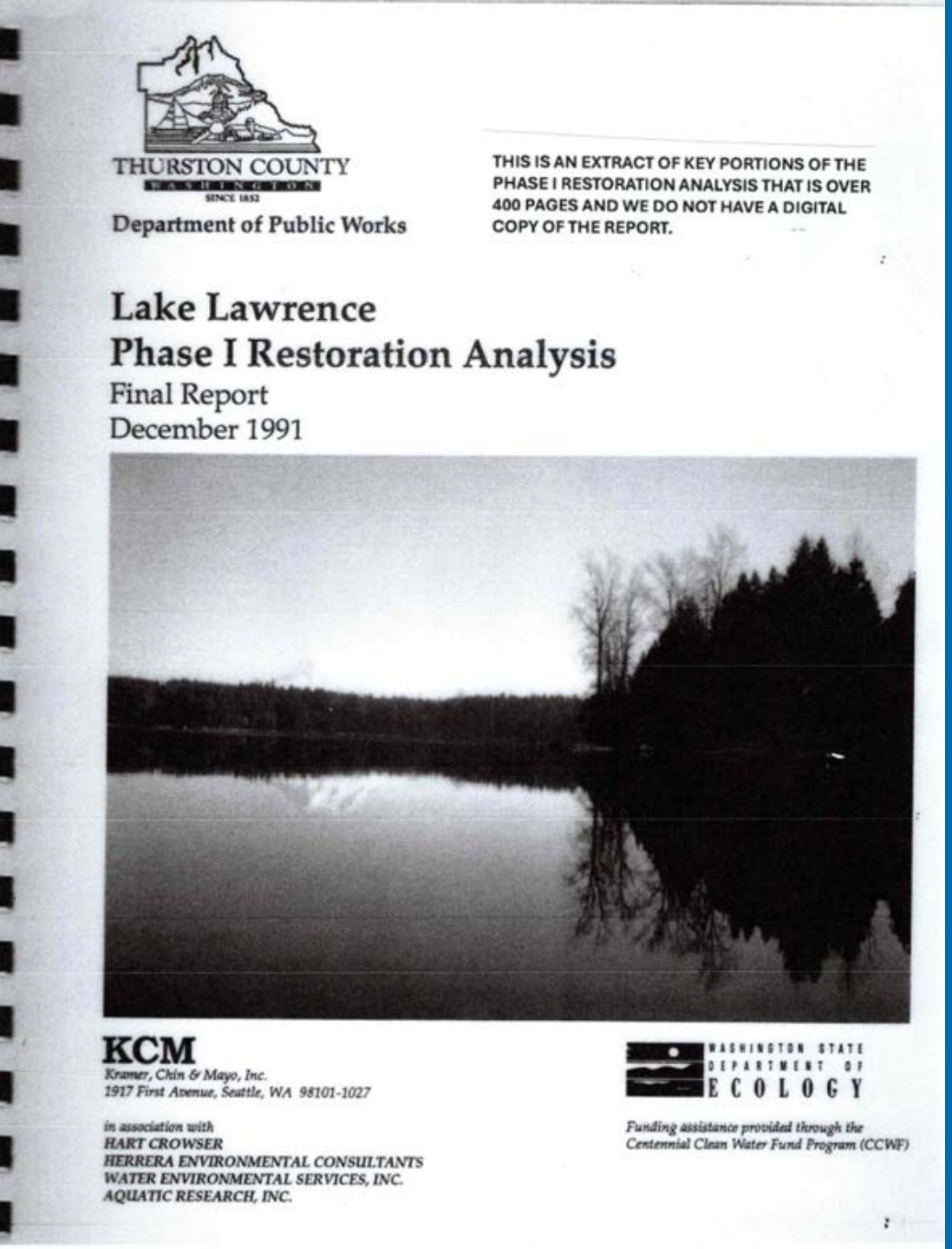
- 1960's- Shoreline and watershed was subdivided and became residential
- Lee Edwards dug canal around 5-acre lot to form "Goat Island"
- Edwards Resort closed in 1973, property divided to private homes and LL Community Club

1980s

- WDFW stopped removing bass
- LMD formed in 1986!

1990s-2000s

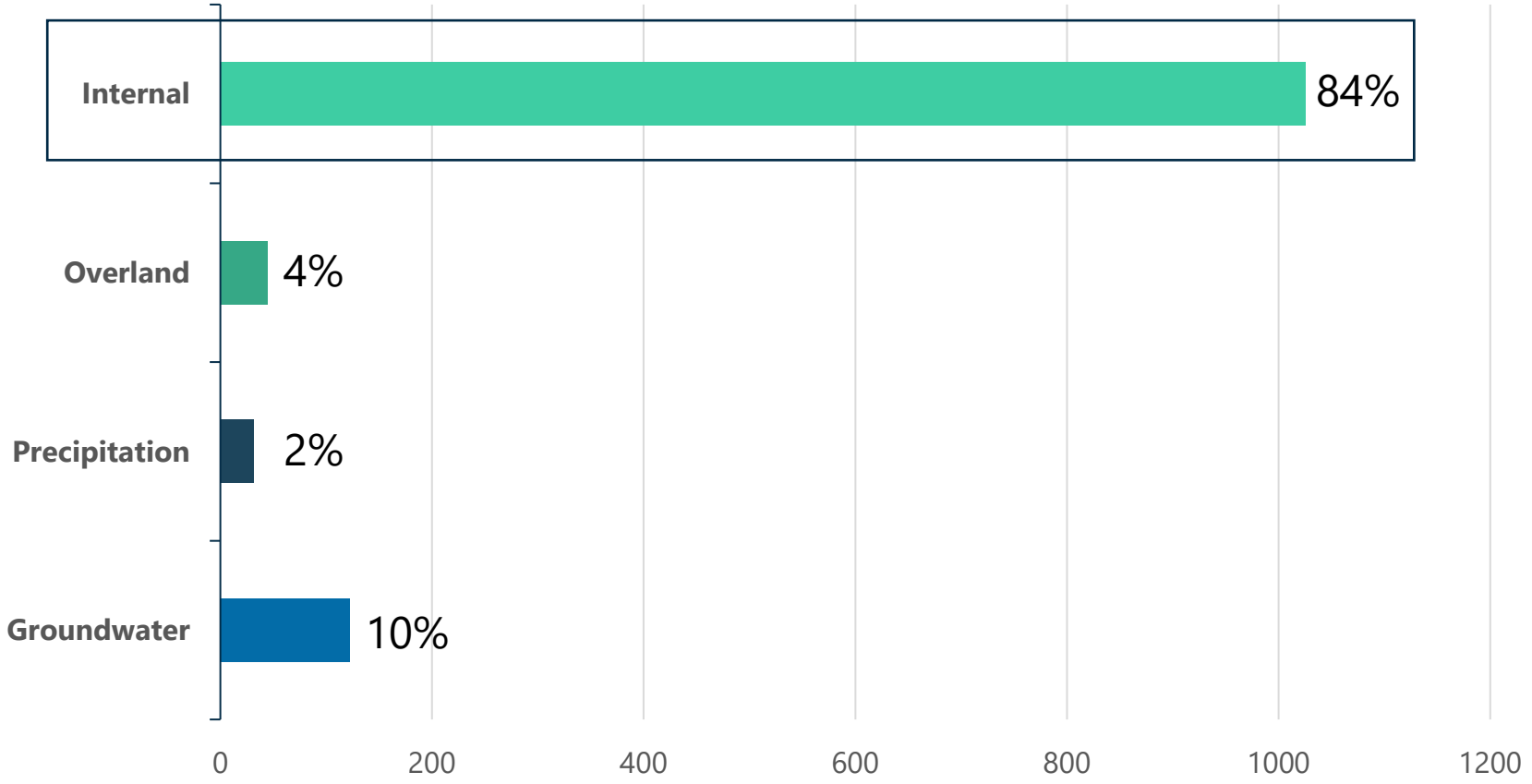
- KCM study 1990-1991
- Dredge & design report, 1995
- IAVMP, 2004
- LLCC + WDFW raised rainbows in net pens



KCM Findings

1. Lake Lawrence is eutrophic, and algae is dominated by cyanobacteria
2. Water enters the lake via groundwater and precipitation. There are no perennial tributaries.
3. Lake Lawrence is stratified from April through October and is hypoxic near the bottom.
4. Phosphorus comes from lake sediment release (84%) and naturally enriched groundwater (10%). Release is more pronounced in the east basin.
5. Algae are limited primarily by phosphorus, especially in the west basin.

Phosphorus Load (kg) (KCM 1991)



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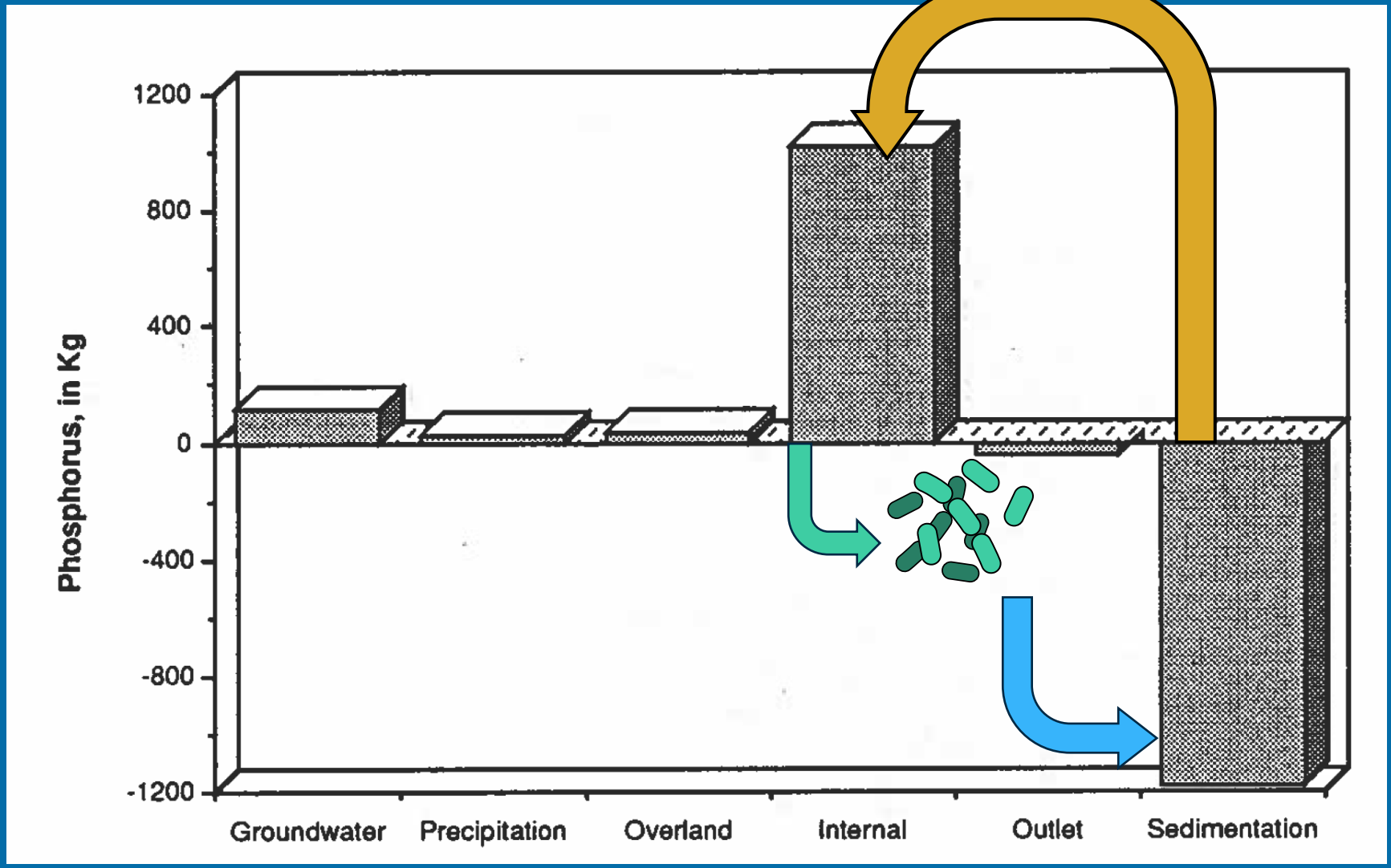
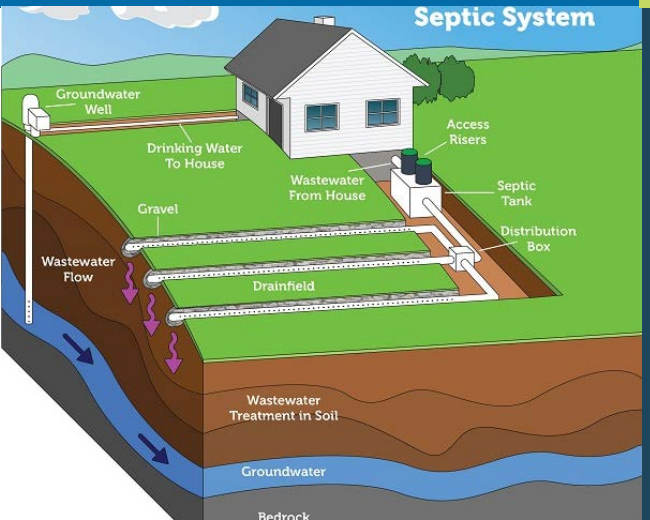


Figure 7-3
PHOSPHORUS LOADING AND LOSSES BY CATEGORY DURING 1990

Potential Phosphorus Sources (KCM 1991)

On-Site Septic Systems

>80% on highly permeable soils

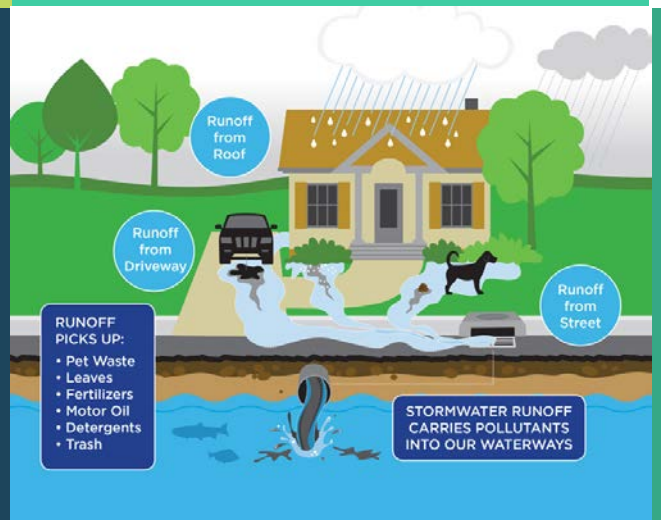


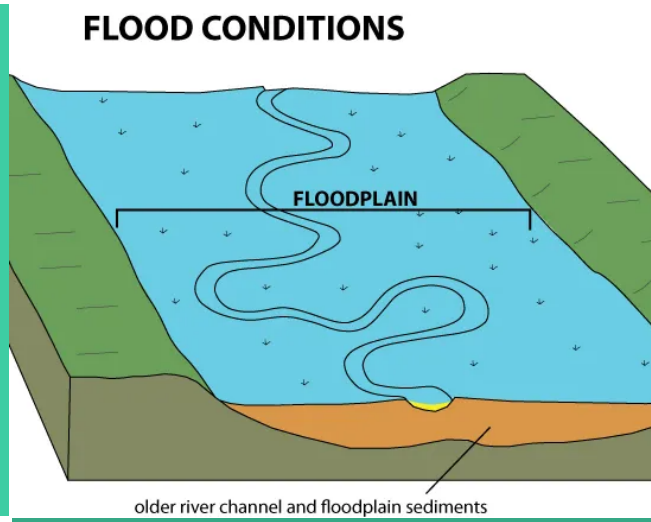
Legacy Farming & Logging

Historical inputs from dairy farms, chicken farms, logging/milling (slabs & sawdust)

Shoreline Runoff

Fertilizers, pesticides, etc. from residences and recreational facilities

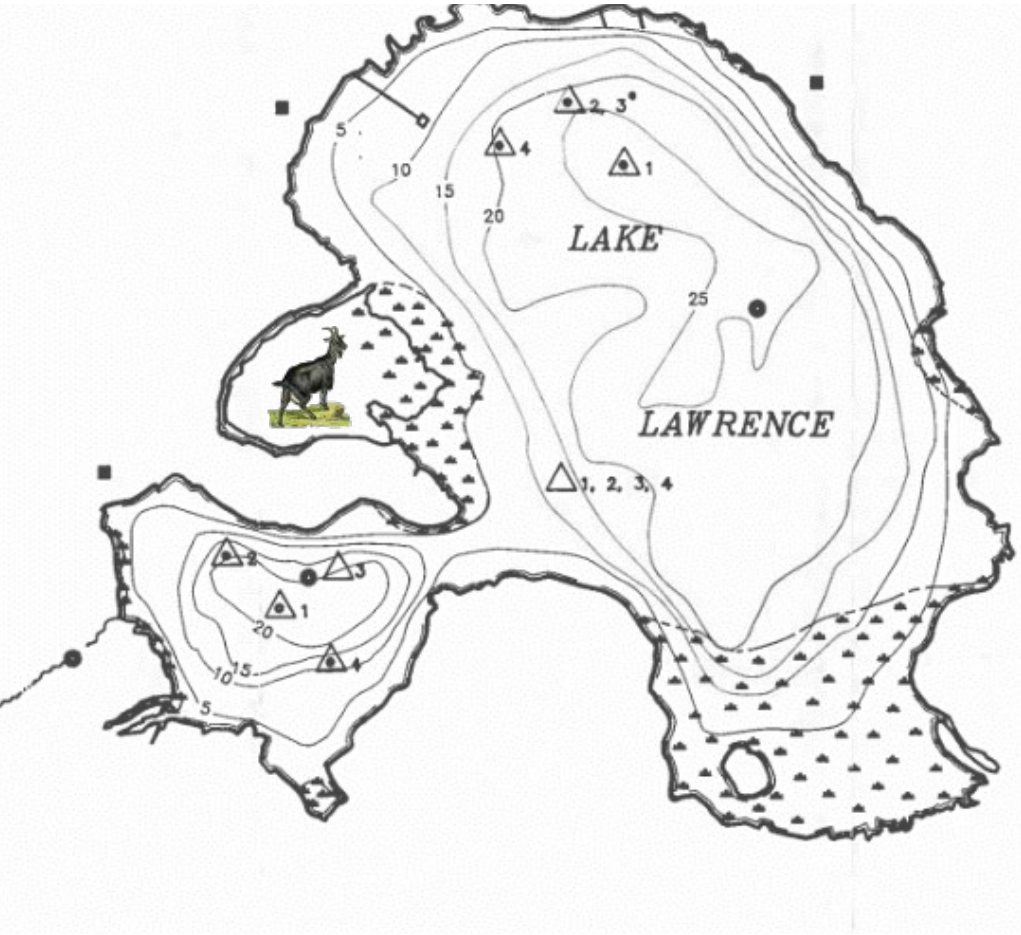




Deschutes River Flooding & Sedimentation

Diversion dam allowed river sediment to settle in the lake & lake levels to rise (inundate shores) for >20 years

Inputs from historical river flooding into lake



KCM Recommendations

1. Dredging in both basins*
   - Prohibitively high cost ($250M in 2022 USD)
2. Harvesting of aquatic plants
3. Sediment covers & grass carp for additional aquatic plant control, as desired
4. Watershed pollution control (education, treatment, BMPs)

*Other measures (e.g., alum treatment) were estimated to be less effective at meeting lake use goals and would not last as long.