CITY OF FERNAN LAKE VILLAGE
SPECIAL CITY COUNCIL MEETING MINUTES
February 12th, 2024

Mayor Watkins called the meeting to order at 5:00p.m. There was a quorum present of Council members Dircksen, Quinn, Goodsen and Meyers.

Agenda - The Council reviewed the agenda. There was a motion made by Council member Myers to approve the agenda noting the date correction for the next meeting and was seconded by Council member Quinn. Motion was carried by Dircksen, Meyers, Goodsen and Quinn.

Fernan Lake Management Planning - The Mayor gave a summary of the meeting agenda.

Ryan Van Goethem with EutroPHIX provided a presentation on the goals and background of the project including preliminary lakebed sediment sample results. A copy of the presentation is attached and will be added to the City's web site.

The public engaged in questions and comments with council and EutroPHIX representatives.

Public Guests

Susan Hooks	Cecil Kelly	Kevin Collins
Bob Moate	Sharon Bosley	Bonnie Douglas
Sam Granier	Jim Lien	Jay Gridley
Cindy Williams	Lynn Alexander	Helen Elder
Randy Nichols	Robert West	Matt Castro
Rose Miller	Steve Palmer	Tom Yount
Brian White	Wanda Quinn	Joan Crawford
Monica Noce	Heidi Acuff	Janet Stevens
Aaron Davis	Bob Steed	Doug Webster
Keith Baugher	Robert Lindquist	Art Collins
Zac Swank	Bradley Roth	Rick Gerwin
Glen Douglas	Zane Blattstein	Martin Stacey
Rob Rutherford	Mary Sanderson	Neil Nemec

Richard & Jill Jurvelin	Bill & Dana Miller
Jeff & Mary Curry	Diego & Rebecca Olivier
Jim & Michele Unsworth	Josh & Sarah Thompson
Larry & Carrie Shenfield	

Motion was made by Council member Quinn to adjourn the meeting, seconded by Council member Dircksen. Meeting was adjourned at 6:20 p.m.

Fernan Lake Management Plan
Introduction & Process

Feb 12th, 2024

Presenter: Ryan Van Goethem – EutroPHIX
Partners: AquaTechnex LLC.

EutroPHIX

Fernan Lake, ID

- Wildlife
- Boating
- Fishing
- Sight Seeing

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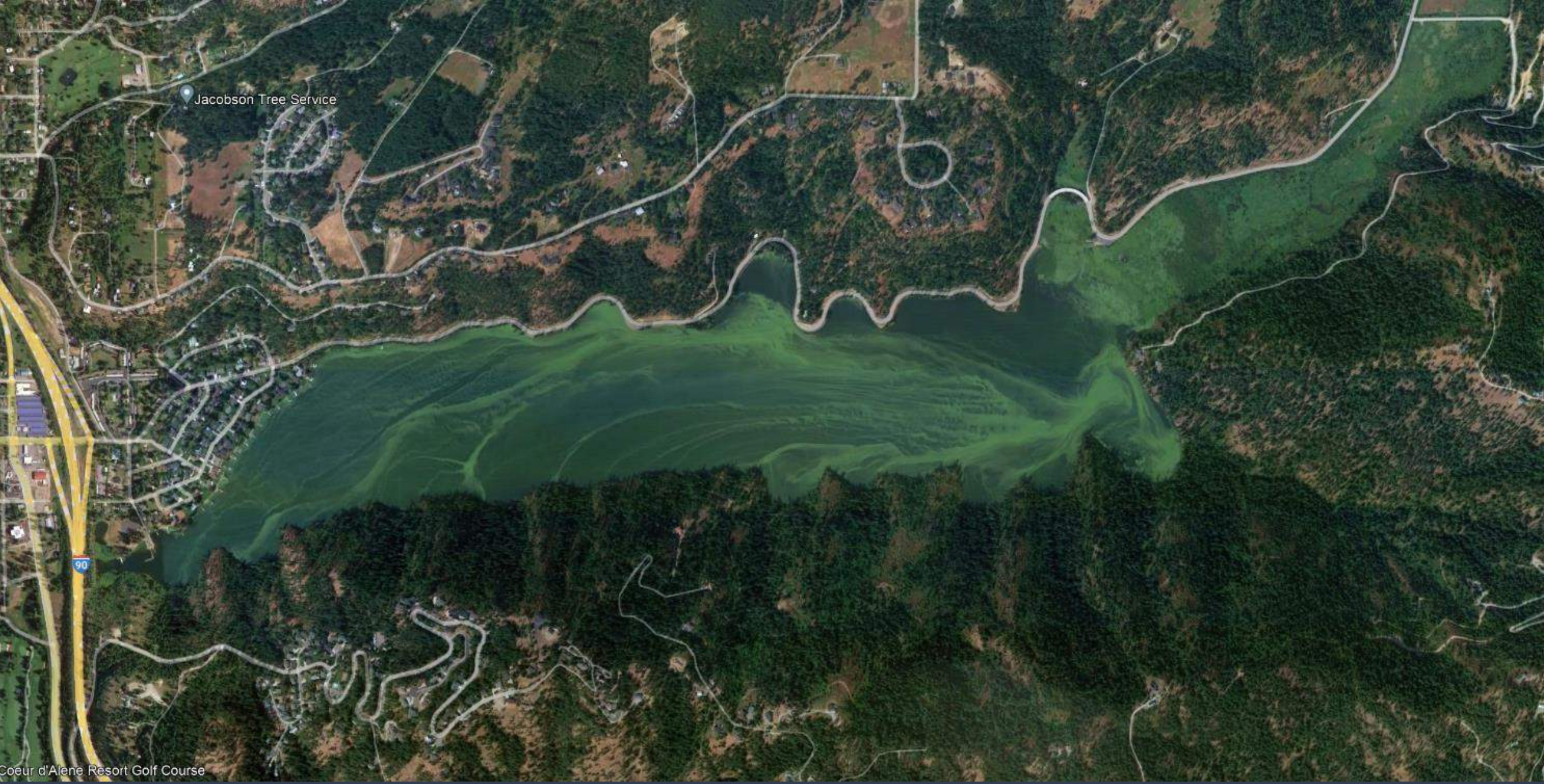

EutroPHIX

Planning Team

- Over 25 years experience managing lakes
- Experts in harmful algae blooms and phosphorus mitigation
- Determining solutions to provide clean, safe, and enjoyable water

Ryan Van Goethem
Western WQ Specialist

Byran Fuhrmann, Ph.D.
Aquatic Technology Development Scientist (Biogeochemist)

Scott Shuler
Director of Technology & Operations

Terrence McNabb, CLM
Manager
AquaTechnex LLC

Bradley Roth
Aquatic Biologist
AquaTechnex LLC

Ben Casscles
Aquatic & Fisheries Biologist
AquaTechnex LLC

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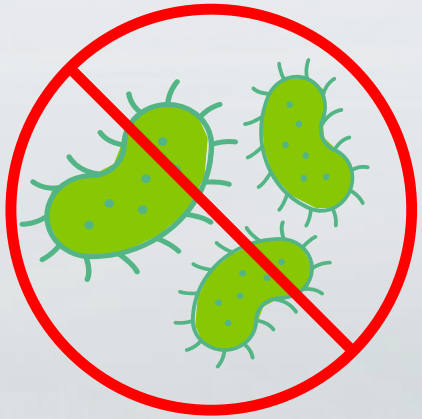
Lake Management Plan Goals

Short and long-term solutions to meet water quality standards

Reduce the extent and severity of HABs



Accelerate water quality restoration

Lake Management Plan Process

- November 2023
- Results back

- In Process

- Mid-March 2024
- Present at Public Meeting

- May 2024
- Present at Public Meeting

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Stay Informed + Involved

- City of Fernan Village will notify residents of meetings
- Use QR to leave feedback – received by EutroPHIX + City of Fernan Village
- Information page on City Website (coming soon!)

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Questions?

Next to Sediment Assessment

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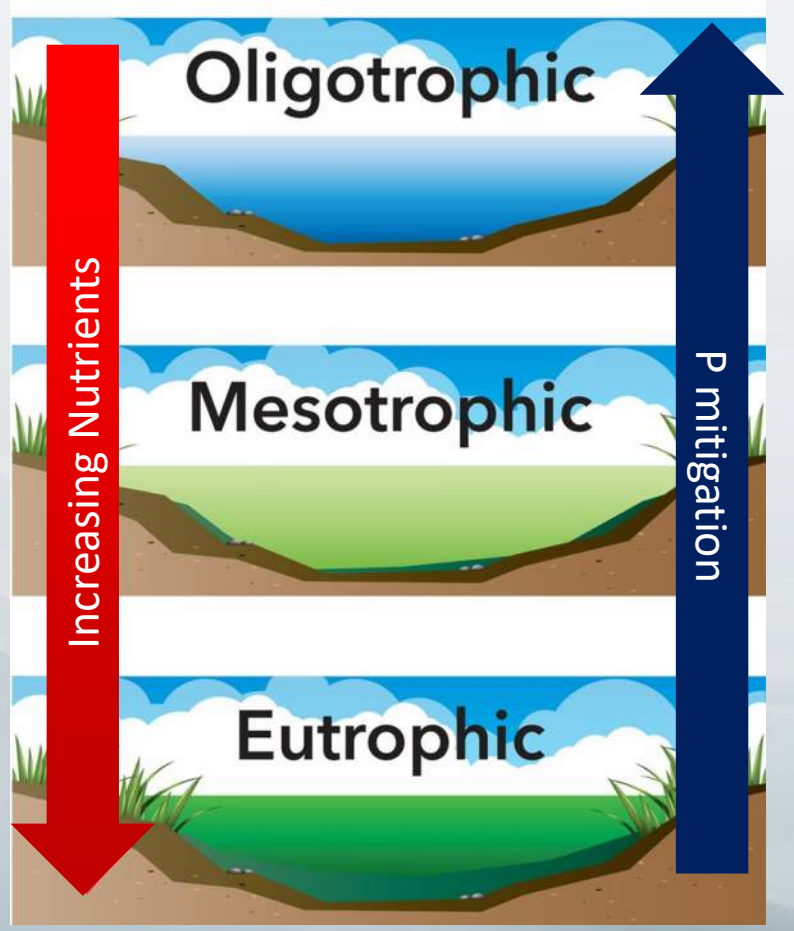
Phosphorus has strong impact on water quality and productivity



- Phosphorus often limiting/co-limiting in freshwater systems
- Increased trophic state and productivity
- Toxin producing cyanobacteria can dominate when phosphorus is more available
- Mitigating phosphorus in waterbodies often improves water quality

Fernan Lake flushes annually winter-spring, but little flow occurs in summer. Internal process likely determine summer water quality

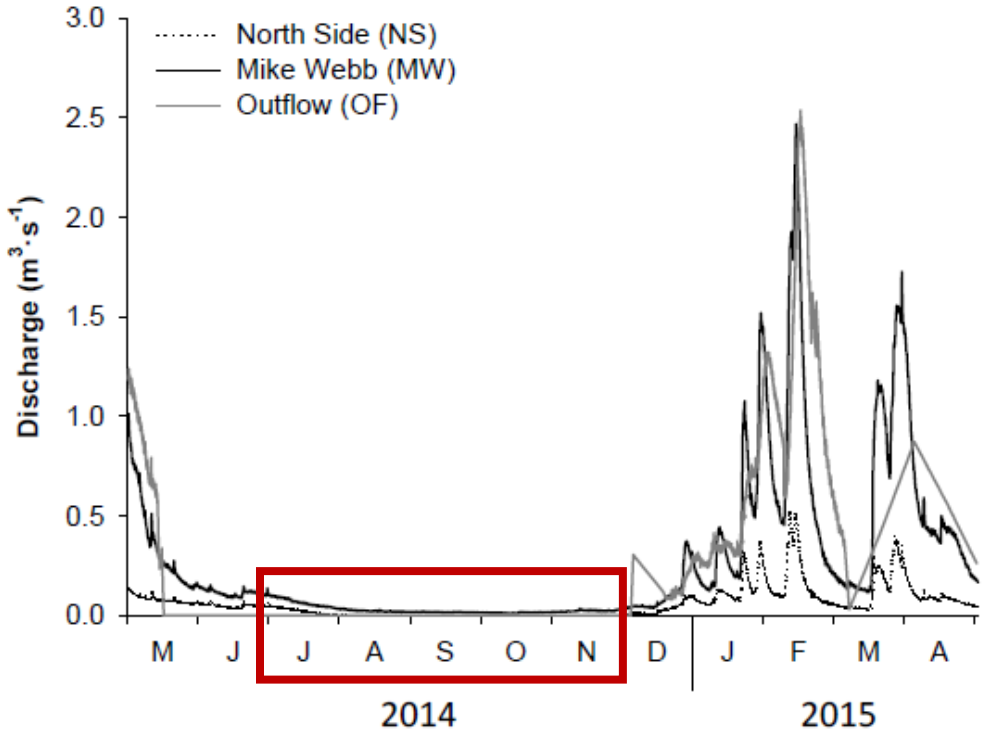


Figure 2.4: Hydrograph of discharge for the North Side (NS), Mike Webb (MW) and Outflow (OF) sampling sites during the 2014-2015 sampling period.

Table 2.7: Annual water budget for Fernan Lake, ID during the 2014-2015 study period.

Annual water budget			
Inputs	$m^3 \cdot y^{-1}$	Depth ($m \cdot y^{-1}$)	Source
Fernan Creek	$8.3 \cdot 10^6$	5.05	This study
Precipitation	$1.3 \cdot 10^6$	0.77	This study
Culverts	$1.8 \cdot 10^4$	0.01	This study
Gain from groundwater	$3.4 \cdot 10^6$	2.05	This study
Outputs			
Fernan Dam	$8.8 \cdot 10^6$	5.38	This study
Evaporation	$1.7 \cdot 10^6$	1.03	Regional averages (see Appendix G)
Loss to Aquifer	$2.0 \cdot 10^6$	1.23	This study

LaCroix Thesis (2015)

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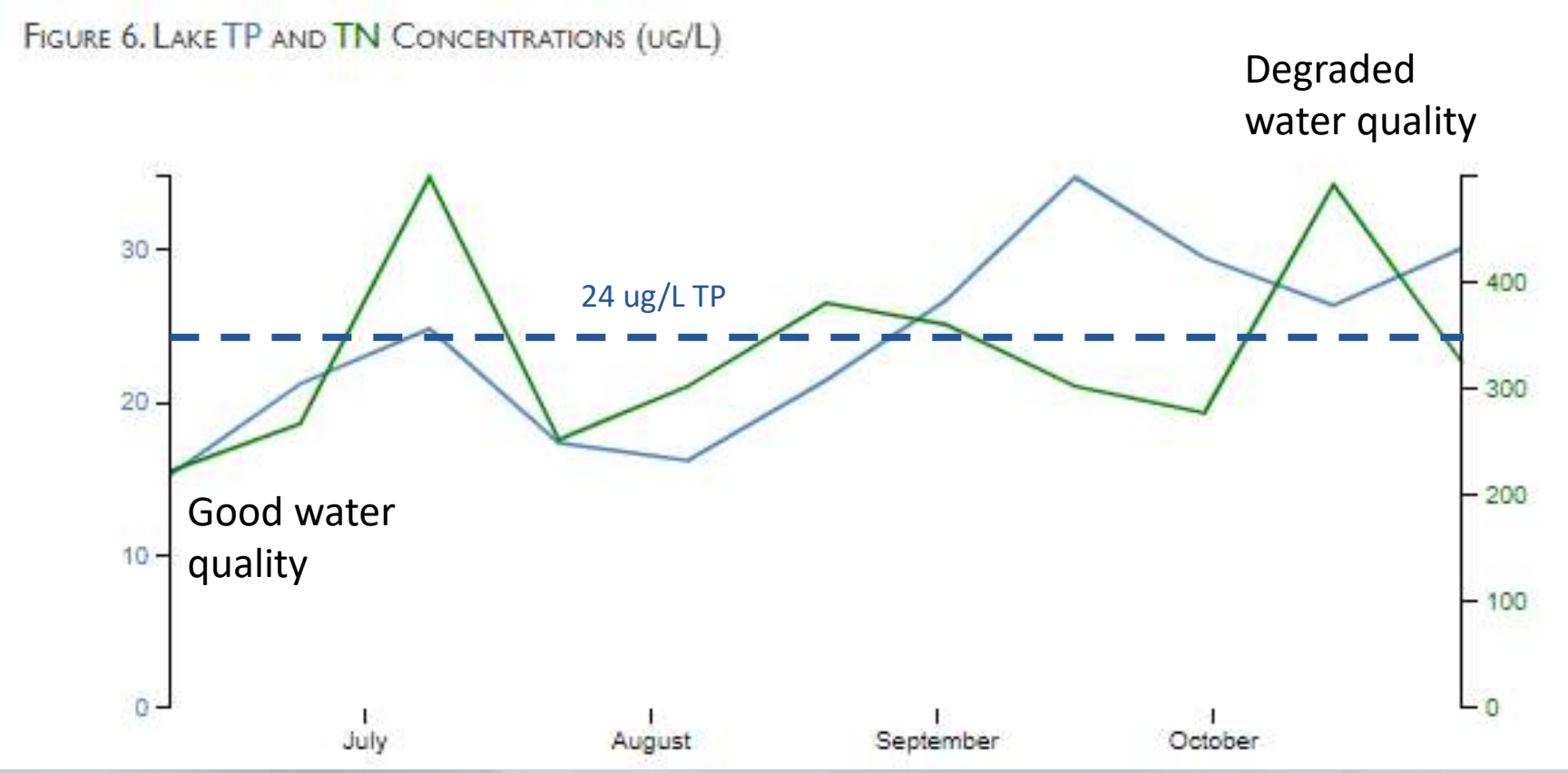
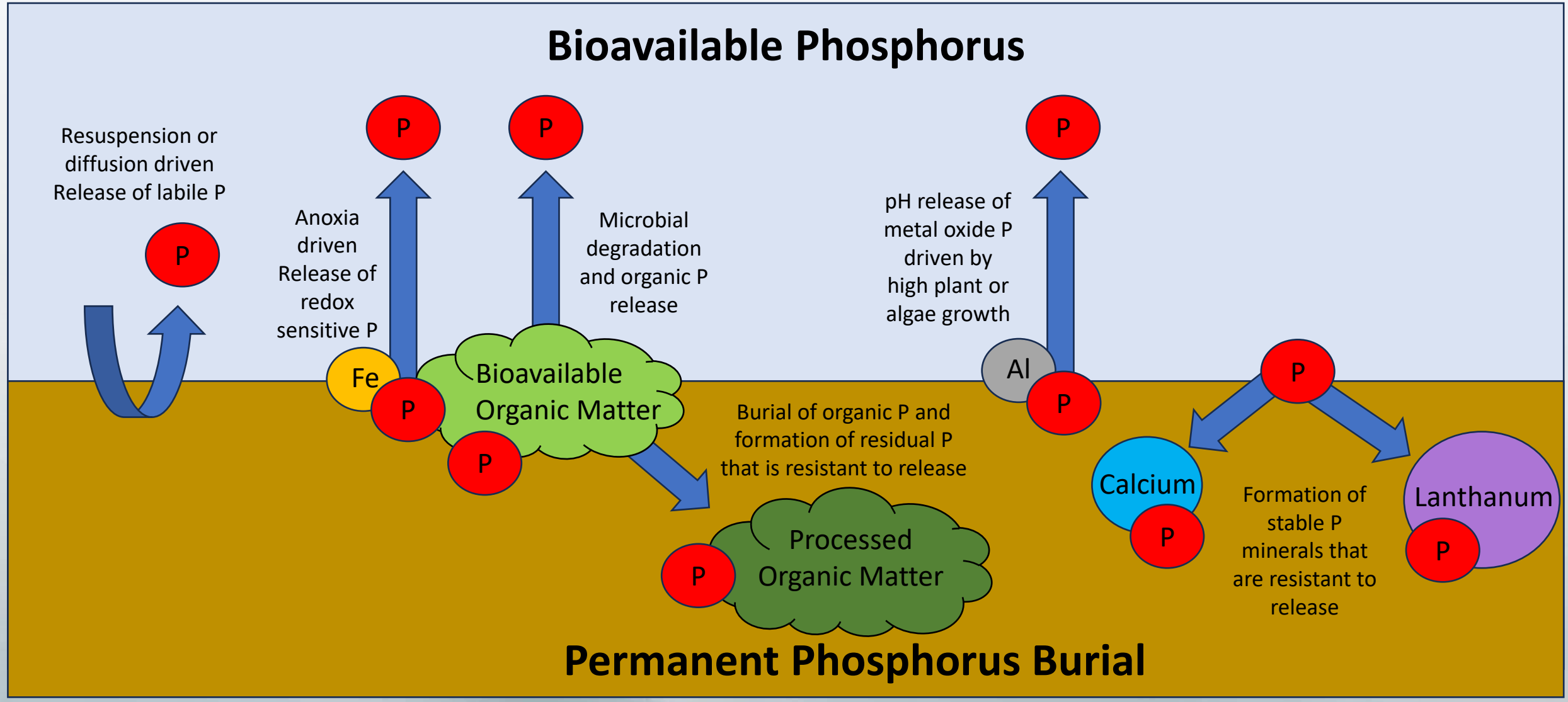
Nitrogen & Phosphorus increases during the summer, favorable for cyanobacteria growth



Modified from: https://webpages.uidaho.edu/vtl/Projects/Miles/fernan/

Lake sediments can help understand phosphorus dynamics



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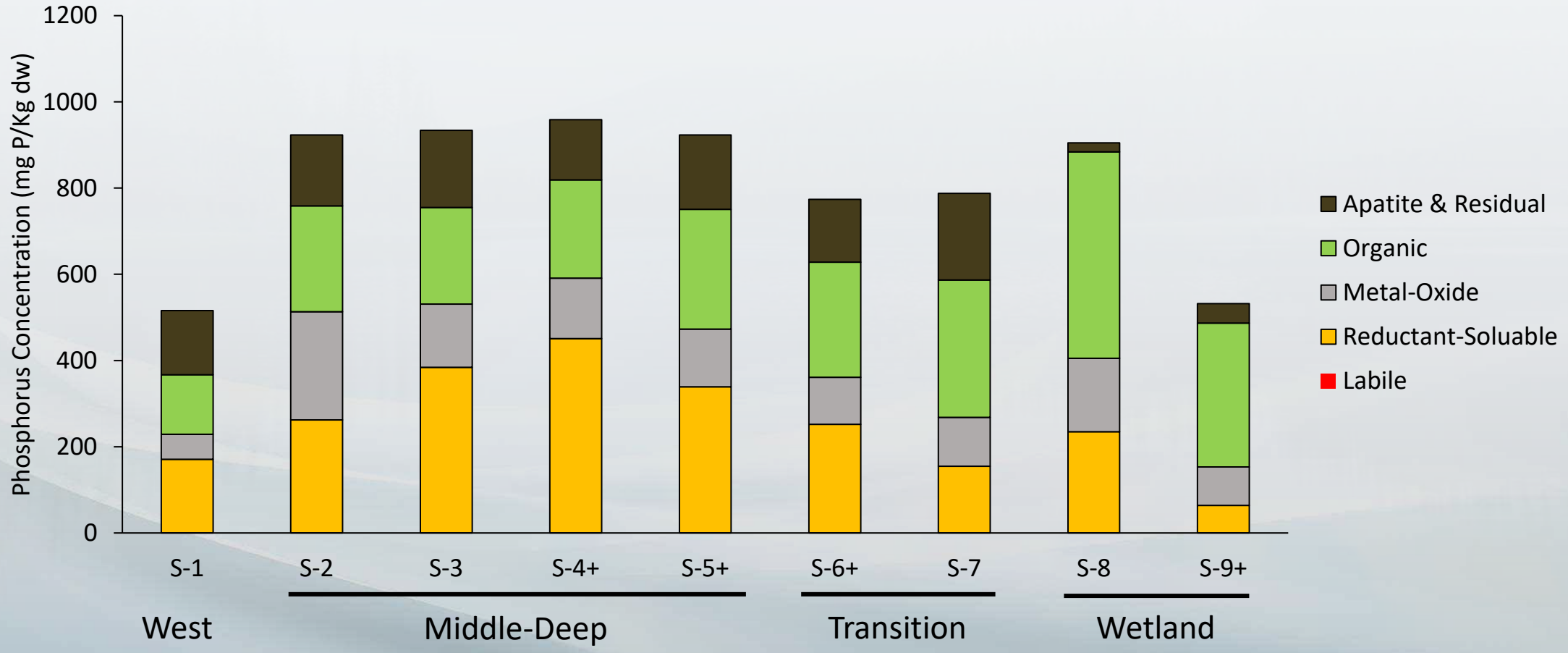
Sediment Sampling Nov 2023

- 9 sediment samples, 4 water samples
- Wetland to deep holes
- P fractionation analysis
- Sediment characteristics
- “+” P binding properties + indexes

Phosphorus Fractionation Interpretation

Parameter	Release Potential	Component(s)
% Solids	N/A	High % solids = mineral rich sediment
		Low % solids = “muck” – organic matter rich sediment
Labile P	Very high	Soluble phosphorus trapped within the sediment porewater
Redox Sensitive P	Very high in deep lakes	Iron-bound phosphorus
	Moderate in shallow lakes	
	Low in aerated lakes	
Metal Oxide P	Moderate in shallow lakes	Mostly Aluminum-bound phosphorus
	Low in deep lakes	Some highly stable iron-bound phosphorus
Organic P	Moderate	Phospholipids and polyphosphates
		Phosphorus contained within partially degraded organic matter
Apatite & Residual P	Generally negligible	Calcium phosphate minerals
		Lanthanum-bound phosphorus (rhabdophane)
		Organic matter resistant to degradation

P Fractionation reveals variation across the lake related to depth



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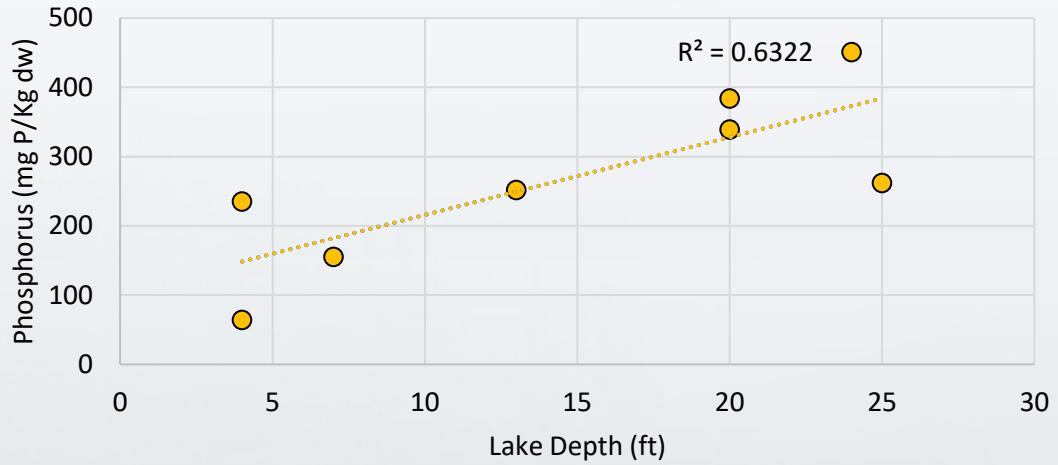
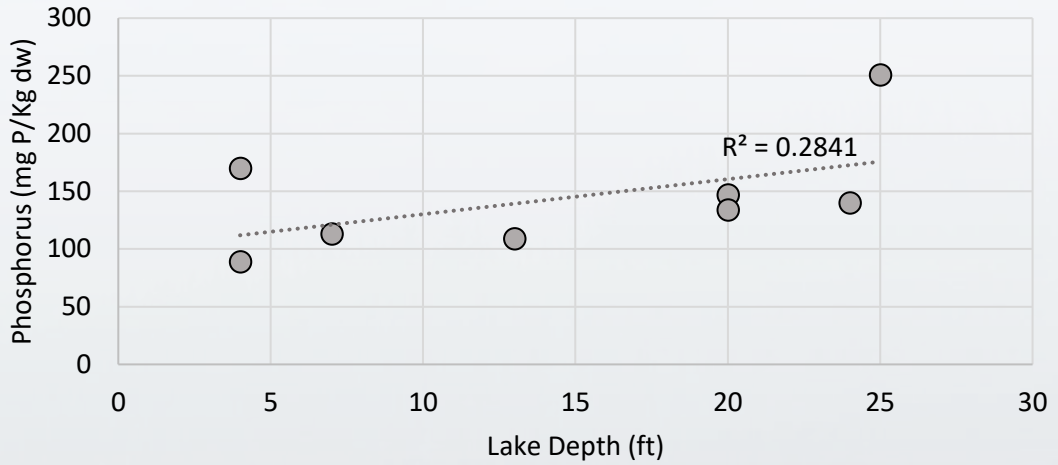
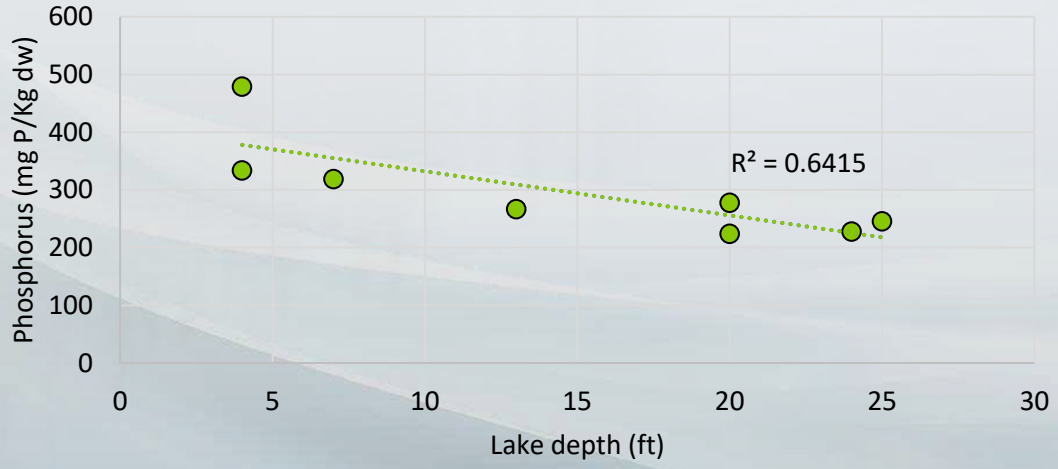
Reductant-Soluble



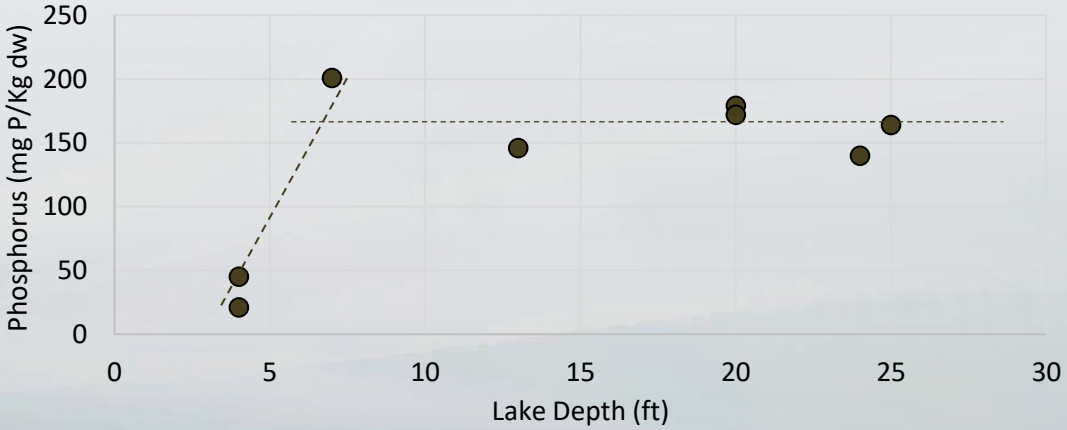
Metal-Oxide



Organic P



Apatite & Residual



Note: data excludes S-1 due to being an outlier with different sediment type

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Sediments have properties that allow for a high diffusion rate of P to water column

Diffusion Related Parameters									
Sample Name	% Solids	Total Organic Matter Content	Wet Bulk Density (g/cm^3)	Dry Bulk Density (g/cm^3)	Particle Density (g/cm^3)	Porosity	Sediment Expansion Coefficient	Site Specific Osgood Index	Diffusion Index
S-4+	10%	12%	1.00	0.67	1.48	55%	85%	5.6	7.0
S-5+	10%	12%	1.00	0.60	1.34	56%	84%	4.7	7.3
S-6+	9%	12%	1.00	0.39	1.58	75%	76%	3.0	8.7
S-9+	8%	20%	1.00	0.36	0.90	60%	78%	0.9	8.0

Wetland (S-9+)

- lowest % solids
- highest Total Organic Matter and Diffusion Index

1= low
10 = high

Sediments are sensitive to low oxygen & anoxic conditions

Iron Related Insight									
Sample Name	Redox P Release Parameters				Iron Stability and Stripping Potential				
	% Soluble Manganese	Bioavailable Organic Matter Content	Redox Sensitive Fe to P Molar Ratio	Redox Release Index	% Dissolved Iron	% Redox Sensitive Iron	% Metal Oxide Iron	Total Relevant Fe to P Molar Ratio	Iron-Stripping Potential
S-4+	58%	6%	17	9.5	2%	94%	5%	24	Moderate
S-5+	75%	5%	17	7	10%	83%	7%	26	High
S-6+	97%	6%	11	8	21%	69%	10%	16	Moderate
S-9+	40%	16%	14	8	27%	46%	28%	8	Low

- All samples have soluble manganese indicating sediments are going anoxic in summer
- High Fe-P ratios present allowing released P to rebind to Iron in oxic conditions in the lake
- Less Iron in Wetland sites indicating iron released and accumulating in lake, low potential to rebind released P

Sediments have abundant organic phosphorus and metal oxide P is mobile

Sample Name	Site Depth (ft)	Organic P Relase Parameters				pH Release Parameters			
		% Bioavailable Organic Matter	% Bioavailable Organic Phosphorus	Carbon to Phosphorus Ratio	Organic P Release Index	Sediment pH	Metal Oxide to P Molar Ratio	% Metal Oxide Aluminum	pH release index
S-4+	24	49%	100%	114	8.0	5.8	28	90%	2.0
S-5+	20	47%	88%	83	7.7	5.6	33	89%	2.7
S-6+	13	50%	84%	86	8.0	6.1	39	90%	3.7
S-9+	4	81%	100%	134	10.0	5.6	82	93%	7.3

Wetland (S-9+)

- High bioavailable organic matter indicating source of P during degredation
- Indicates high sediment oxygen demand
- Metal oxide P is released here, Al-P is a very inefficient bond

Lake

- medium bioavailable organic matter indicating organic P partially degraded,
- medium sediment oxygen demand expected
- Metal oxide P is stable here, Al-P is an inefficient bond

Sediments have abundant organic phosphorus and metal oxide P is mobile

Phosphorus Burial Insight									
Sample Name	Organic P Burial Parameters				Stable Mineral Formation				Overall Phosphorus Burial Potential
	% Refractory Organic Matter	% Refractory Organic Phosphorus	Carbon to Phosphorus Ratio	Organic Matter Burial Potential	% Stable Mineral P out of Total P	Acid Soluble Calcium Content (g/kg)	Lanthanum Content (mg/kg)	Stable P Mineral Formation Potential	
S-4+	51%	0%	114	Low	15%	0.6	0	Low	Low
S-5+	53%	12%	83	Low	14%	0.5	0	Low	Moderate
S-6+	50%	16%	86	Low	12%	0.4	0	Low	Moderate
S-9+	19%	0%	134	Low	8%	0.4	0	Low	Low

Wetland (S-9+)

- Low refractory organic matter, major source of organic P
- Low Ca-P in sediment
- Low burial potential of P to non-mobile forms

Lake

- medium refractory organic matter indicating organic P partially degraded,
- Low Ca-P in sediment
- Low burial potential of P to non-mobile forms

Water Chemistry Nov 2023

Total Phosphorus: 64 µg/L in wetland, 30-50 µg/L in lake

Free Reactive Phosphorus: 6 µg/L in wetland, < 5 µg/L in lake,

- P bound in algae biomass and particulates, macrophyte decay

Alkalinity: 13-23 mg/L $CaCO_3$

Total Hardness: <10 mg/L $CaCO_3$

pH: ~7

- Water is very soft allowing for large shifts in pH
- Algae blooms and wetland likely jump pH >9

*Need careful consideration if using algaecides or P sequestration agents

Sediment Assessment Summary

- P is cycling from wetland through the lake
- P is maintained in available forms, low proportion is bound to stable minerals and permanently buried
- Wetland is major P source, deep lake sediments likely a moderate P source
- Unique biogeochemistry will inform solutions for Lake Management Plan

Questions?

Fernan Lake Management Plan
Public Feedback

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