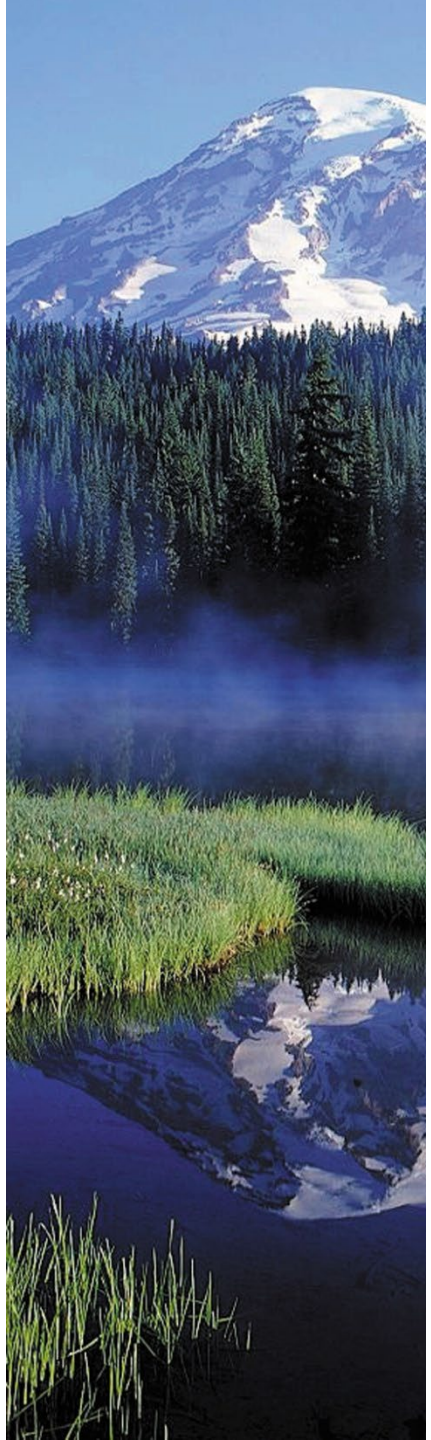


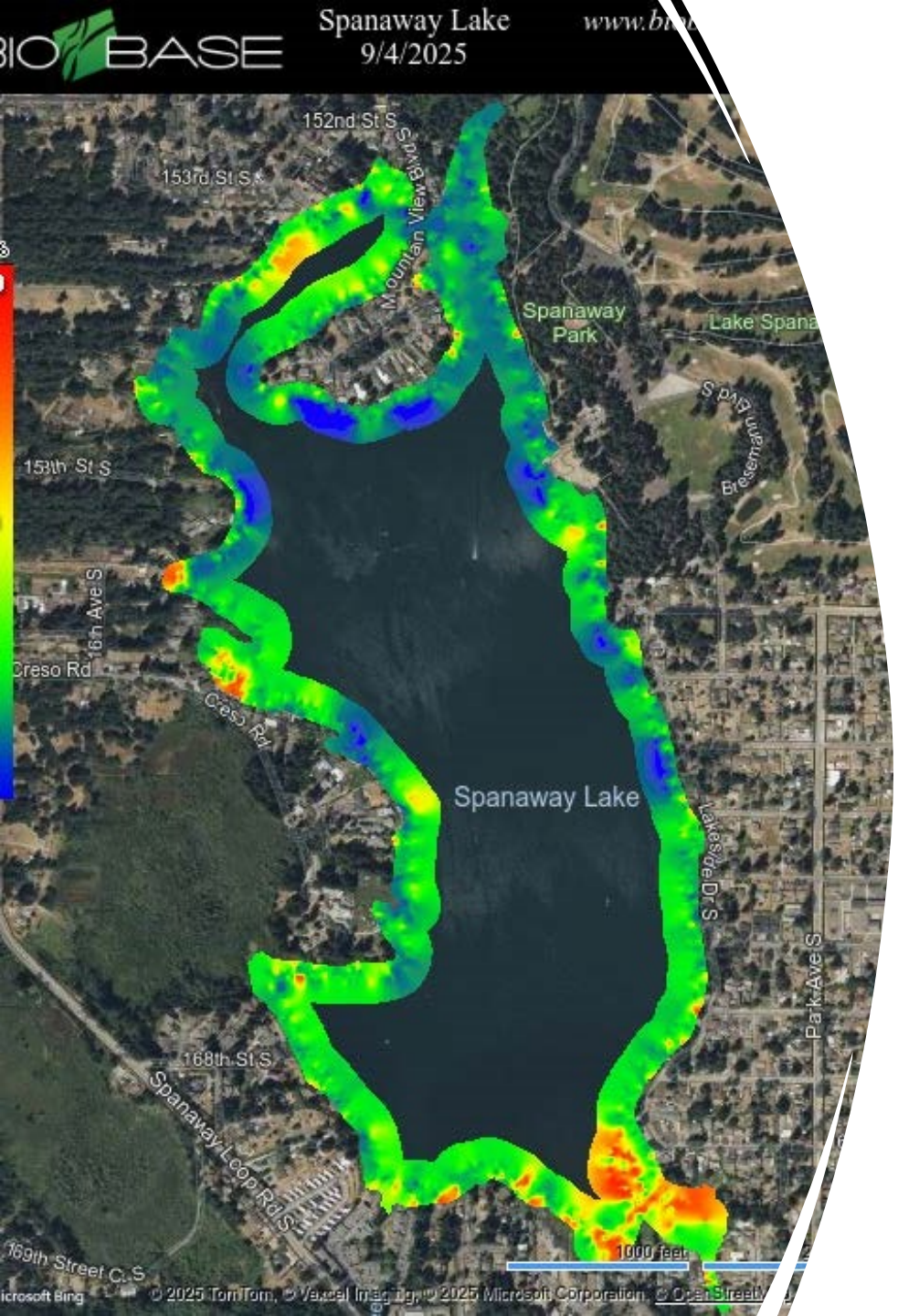
Spanaway Lake Operations, 2025

Terry McNabb, CLM

Aquatechnex, LLC

Scope of Work

- Pre treatment aquatic plant survey
- Aquatic Vegetation Control
- Pre treatment algae assessment
- Phosphorus inactivation
- Post treatment aquatic weed survey and reporting.

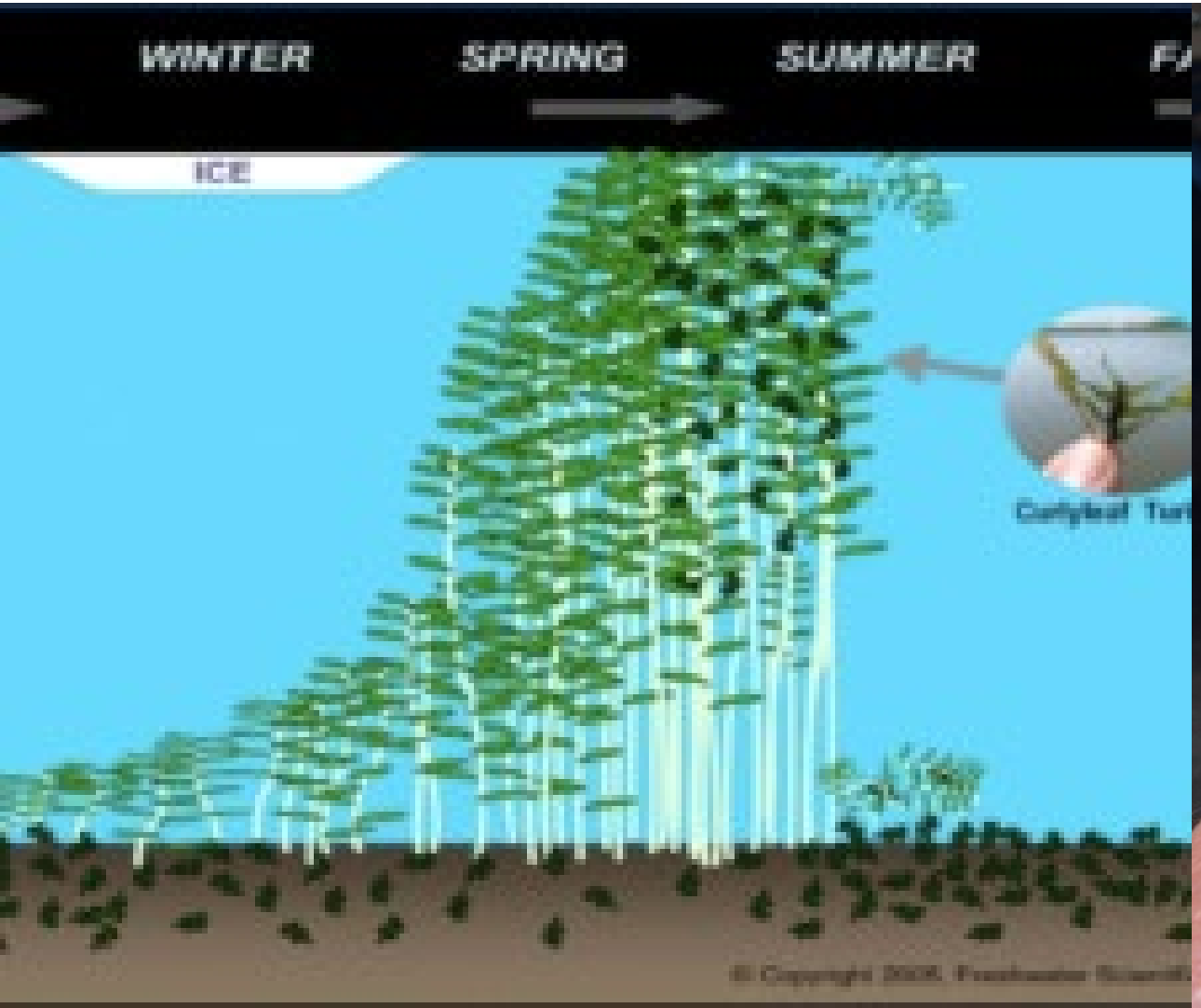


Pre treatment survey

- BioBase hydroacoustic mapping
- Boat survey
  - Trimble DGPS Data Logger
- GIS mapping
- Treatment design

Target Noxious Aquatic Weeds

Curly Leaf Pondweed



White Water Lily

Curly Leaf Control

- Galleon Herbicide Selected
  - Reduced Risk Herbicide US EPA
  - Stops turion formation withing 24 hours
  - Goal was to control and prevent 2025 contributions to turion bank
- Application May 16 and 24.49 acres targeted

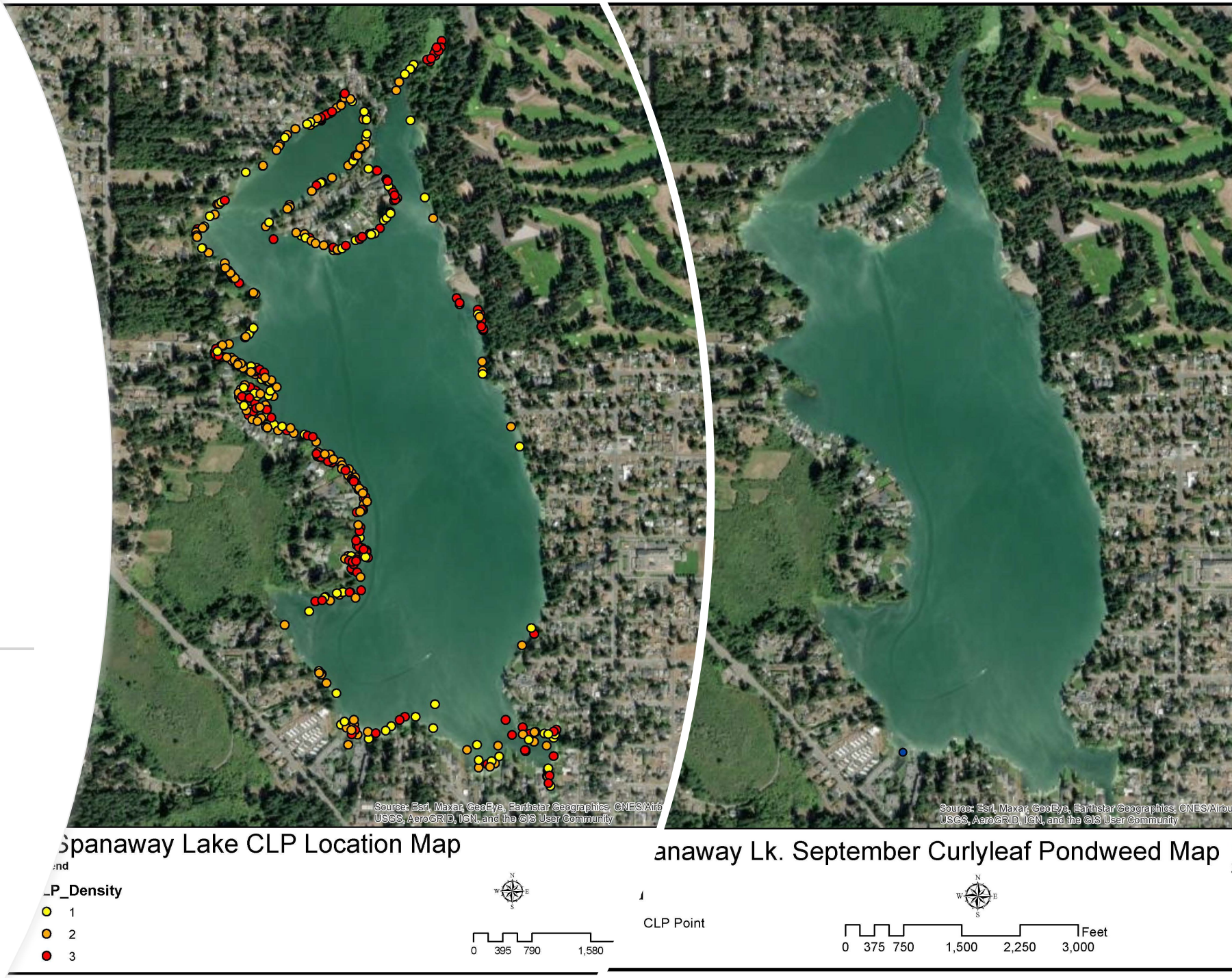
Eutrosorb G Applications

- Implemented Second Year of Herrera Plan to target Phosphorus
- First application May 20th applied 28,000 pounds to strip water column and sequester Sediment P
- Second Application August 7th 14,000 pounds to target deep water releases and water column
- 840 pounds of P removed from the system

White Water Lily Treatment

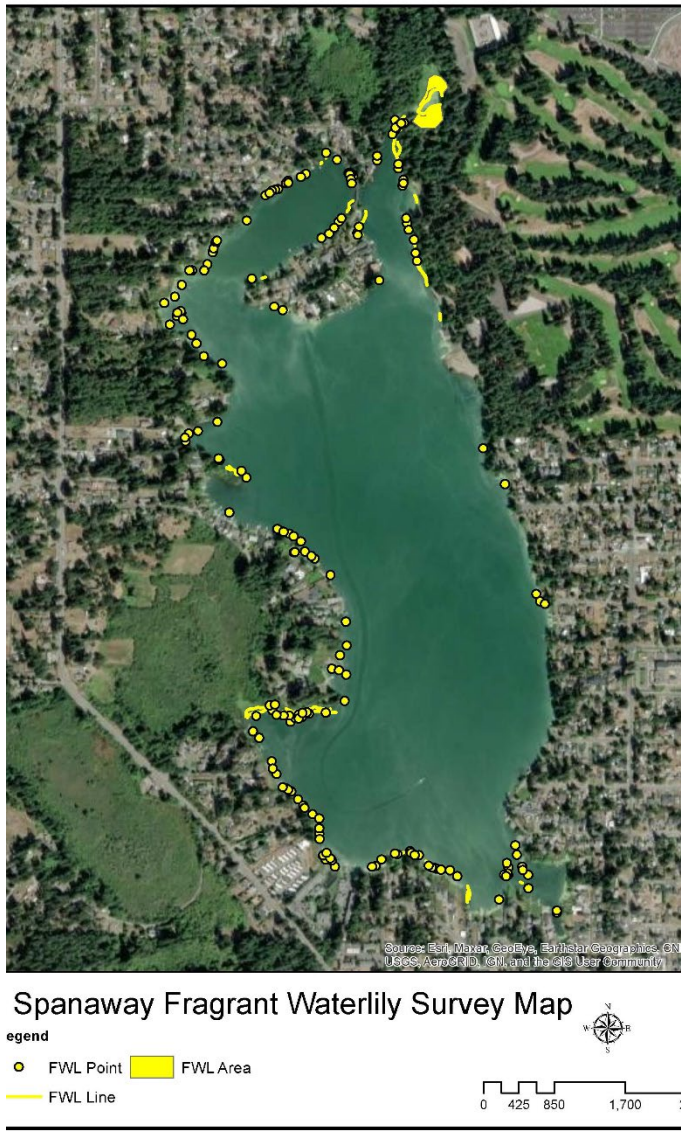
- Treatment with Rodeo and surfactant on June 26th
- Targeted scattered individual plants and larger patches
- Larger patches generally treated over time to minimize potential for mud island formation (depending on substraight)

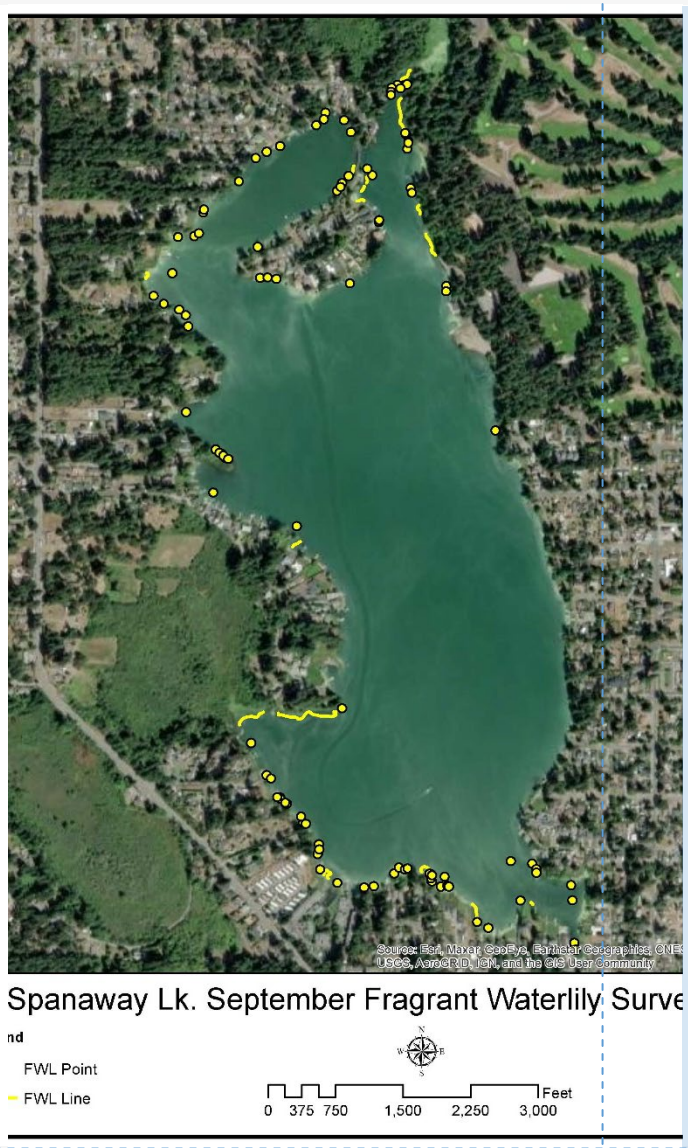
Curly Leaf Pondweed Pre and Post Treatment



White Water Lily

- Significant reduction
- There are some issues with treatment on lakes with significant boat traffic, wave action
- We target large patches over time to minimize potential for floating islands.





Spanaway Lake Water Quality Monitoring

Gopal Mulukutla, Ph.D.

Surface Water Management, Water Quality Section, Monitoring Unit

Prepared for Spanaway Lake Management District CAB

October 14, 2025

With contributions from Pierce County staff:
Carol Falkenhayn Maloy, Tom Kantz, Brianne Blackburn, Monica Ponce-McDermott, Patrick Osborne, Stephen Nelson, Scott Groce, Nannette Huber, Jared Mosier, Emile Ancelet, and Jeff Barney.

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gopal.Mulukutla@piercecountywa.gov

253-281-0378

Water Quality Monitoring

Waterbody	Locations	Monitoring Details	Data Collection	Timeframe
Spanaway Lake	Three Locations	Monthly lake water quality	Nutrients, chlorophyll, temperature, pH and dissolved oxygen (DO)	April - November 2025; Planned for 2026-2030 (April –November)
Coffee Creek (lake Inlet) and Spanaway Creek (lake outlet)	Coffee Creek Condominiums and off Military Road	Monthly creek water quality, quarterly flow, continuous sensors	Water level, dissolved oxygen, conductivity and temperature. Monthly nutrients, DO, temperature and pH	Water quality and flow measurements: October 2024-present. Sensors: June 2025- present.
Spanaway Lake weather	Enchanted Island and Coffee Creek Condominiums	Weather stations	Air temperature, rainfall, and relative humidity	2014-present
Groundwater monitoring	Two well locations	Quarterly sampling	Nutrients, temperature and pH	Planned this water year.

Spanaway Lake Sampling Plan

Three sites of data collection in the lake

- LW-1, LW-2, and LW-3

Continuous sonde data taken from surface to bottom (water column profiles) at each site for

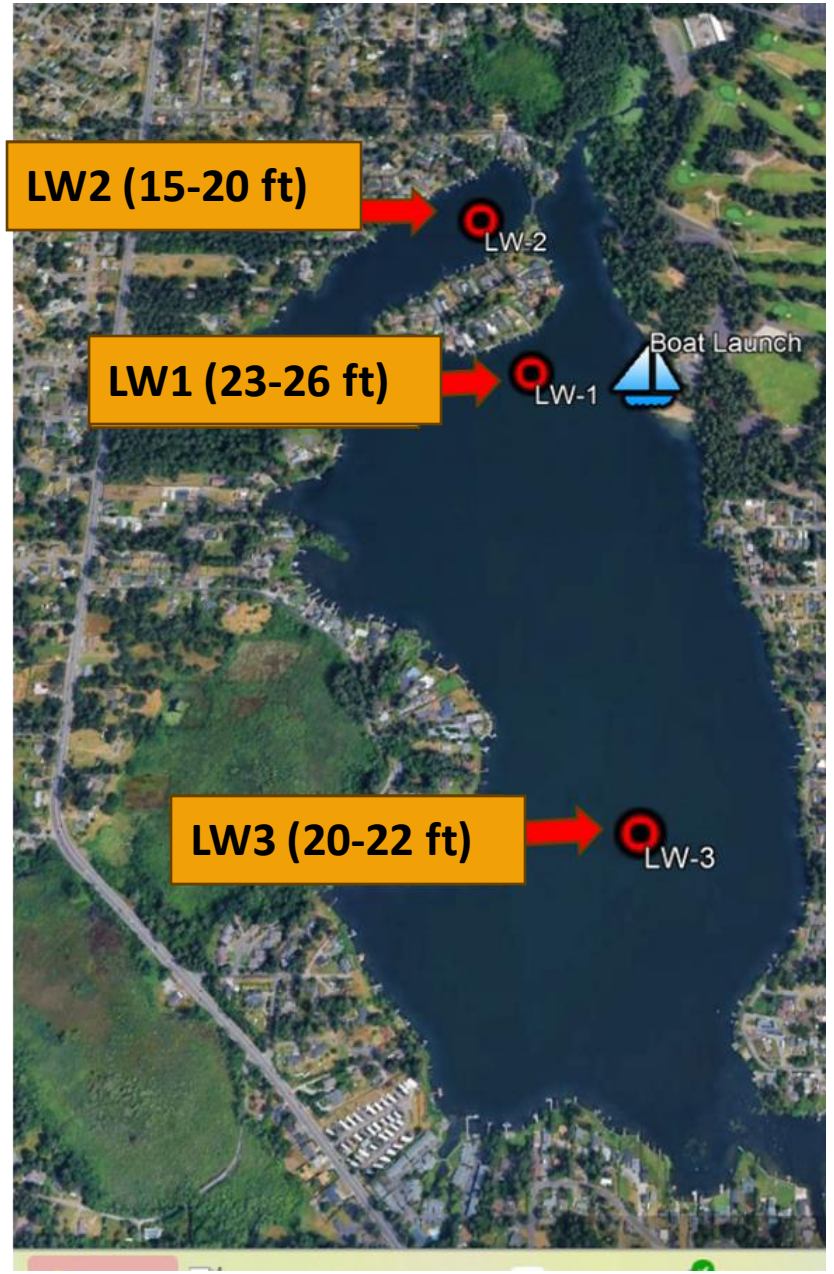
- Temperature,
- dissolved oxygen (DO),
- conductivity,
- and pH

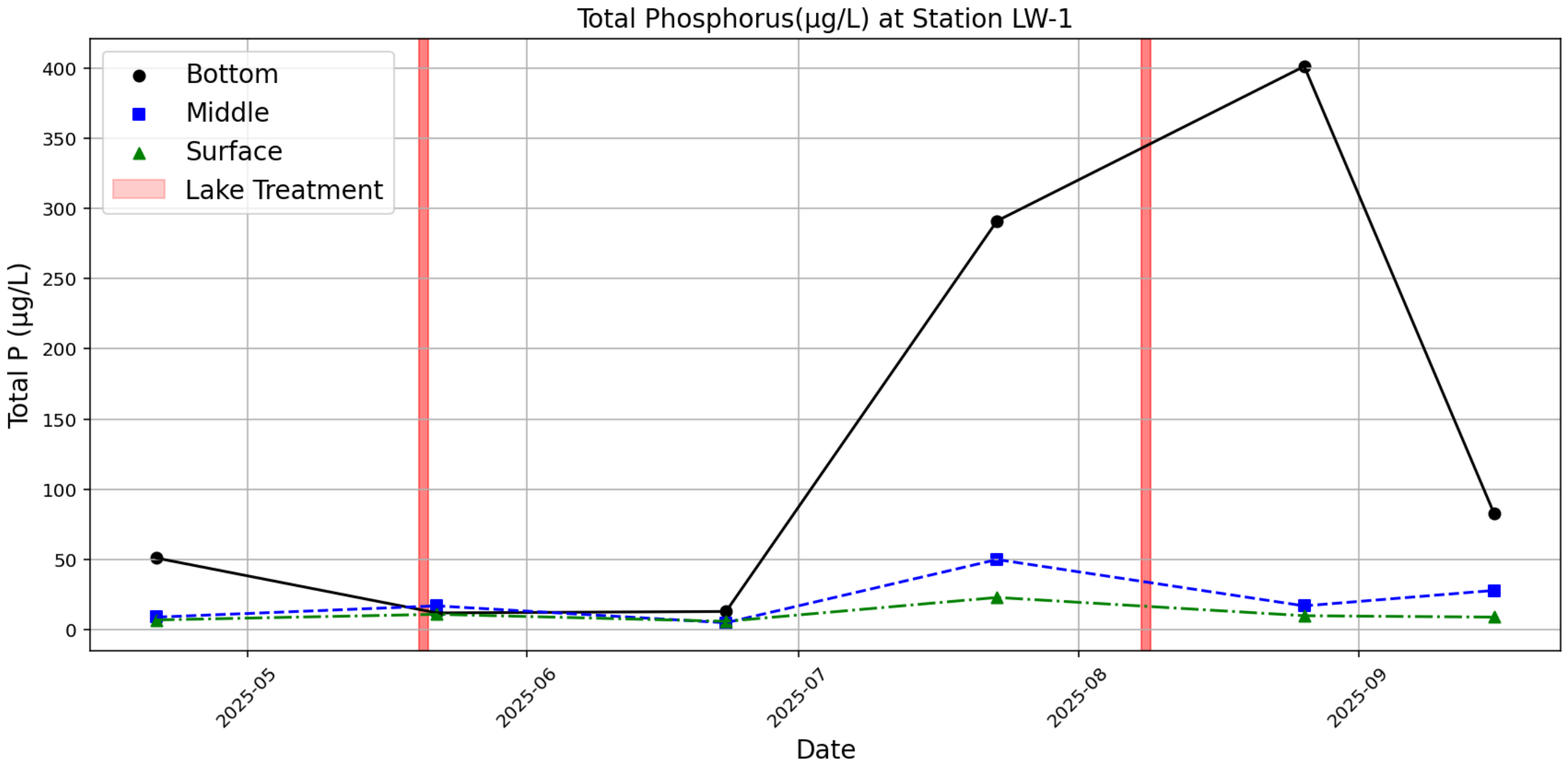
Bottle samples collected at 3 depths for

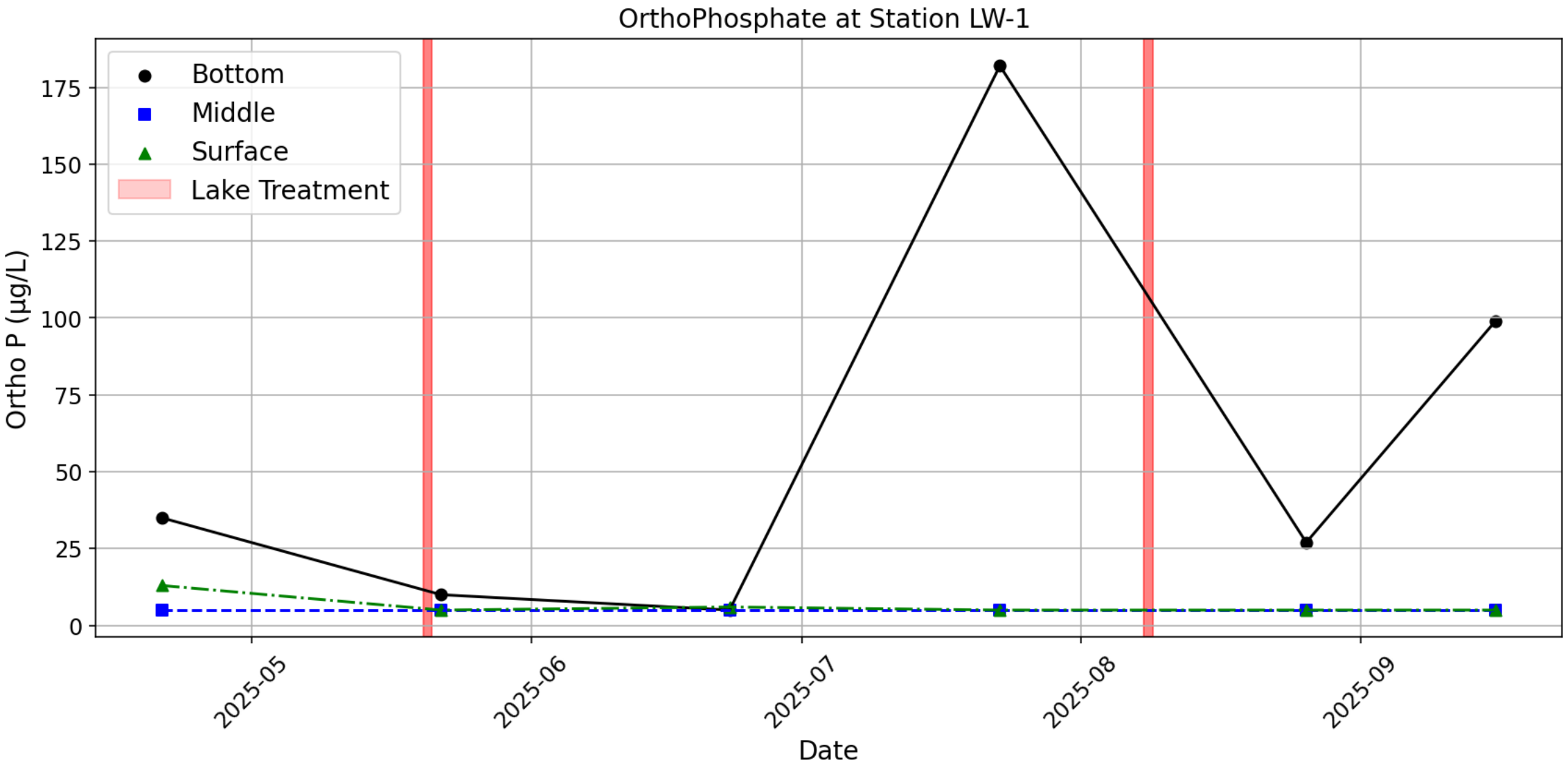
- nutrients (phosphorus and nitrogen),
- dissolved oxygen,
- and chlorophyll (algae pigment).

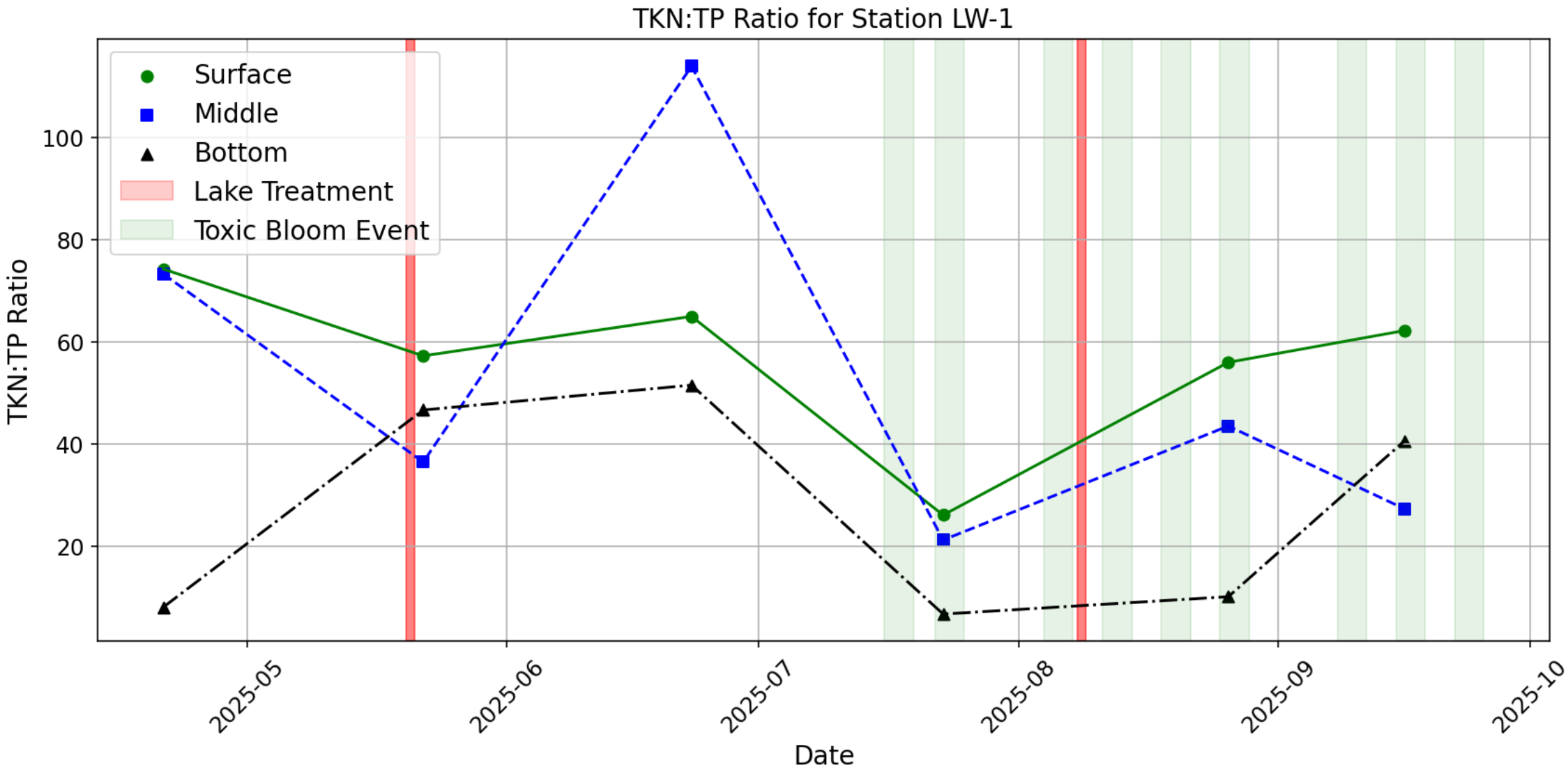
2025 sampling dates

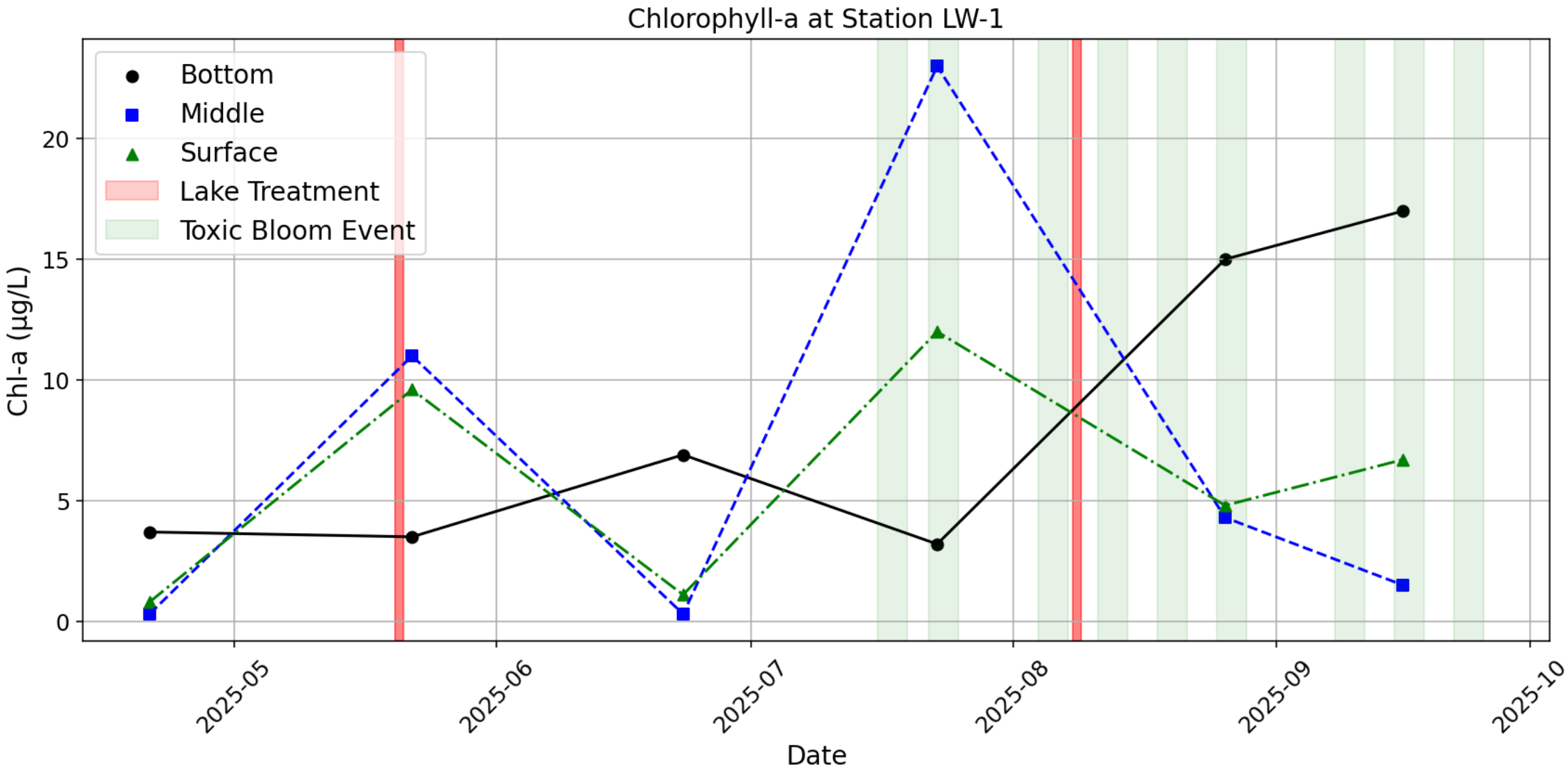
- Six samplings (April –September)
- Additional sampling planned for October and November, and into 2026-2030

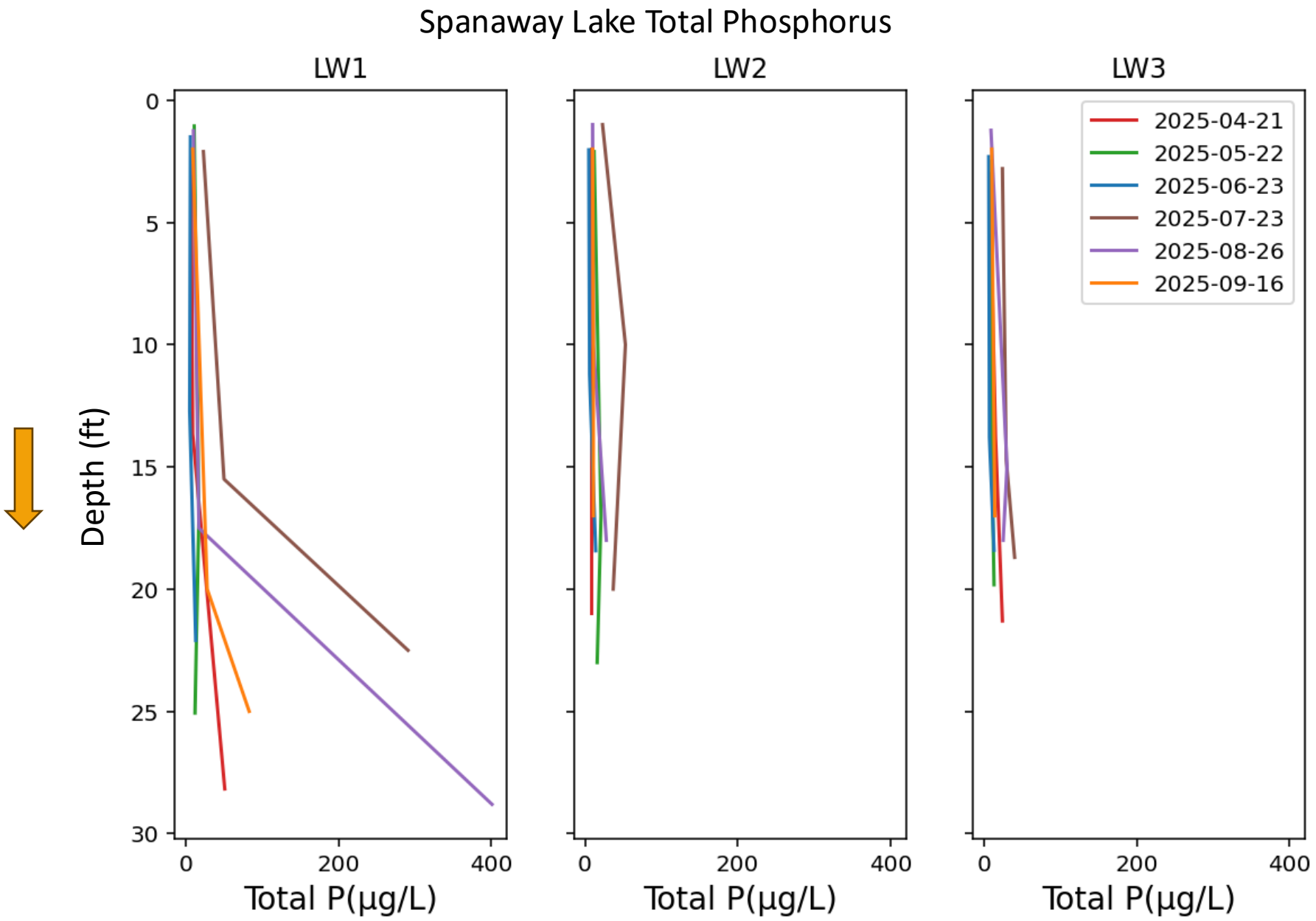



Total Phosphorus(µg/L) at Station LW-1
Bottom
Middle
Surface
Lake Treatment
Total P (µg/L)
400
350
300
250
200
150
100
50
0
2025-05
2025-06
2025-07
2025-08
2025-09
Date

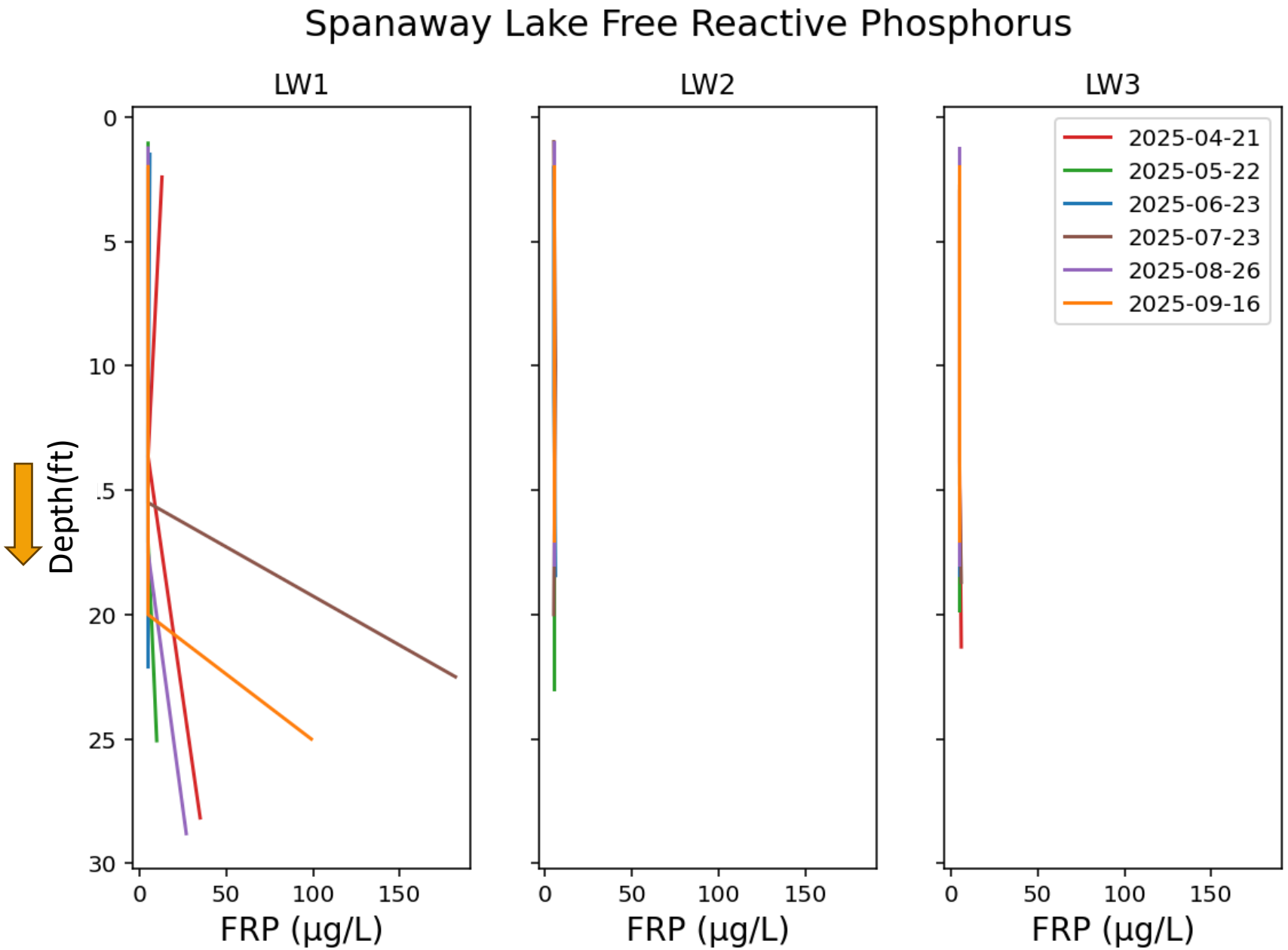

OrthoPhosphate at Station LW-1
Bottom
Middle
Surface
Lake Treatment
Ortho P (µg/L)
0
25
50
75
100
125
150
175
2025-05
2025-06
2025-07
2025-08
2025-09
Date


TKN:TP Ratio for Station LW-1
Surface
Middle
Bottom
Lake Treatment
Toxic Bloom Event
TKN:TP Ratio
100
80
60
40
20
2025-05
2025-06
2025-07
2025-08
2025-09
2025-10
Date

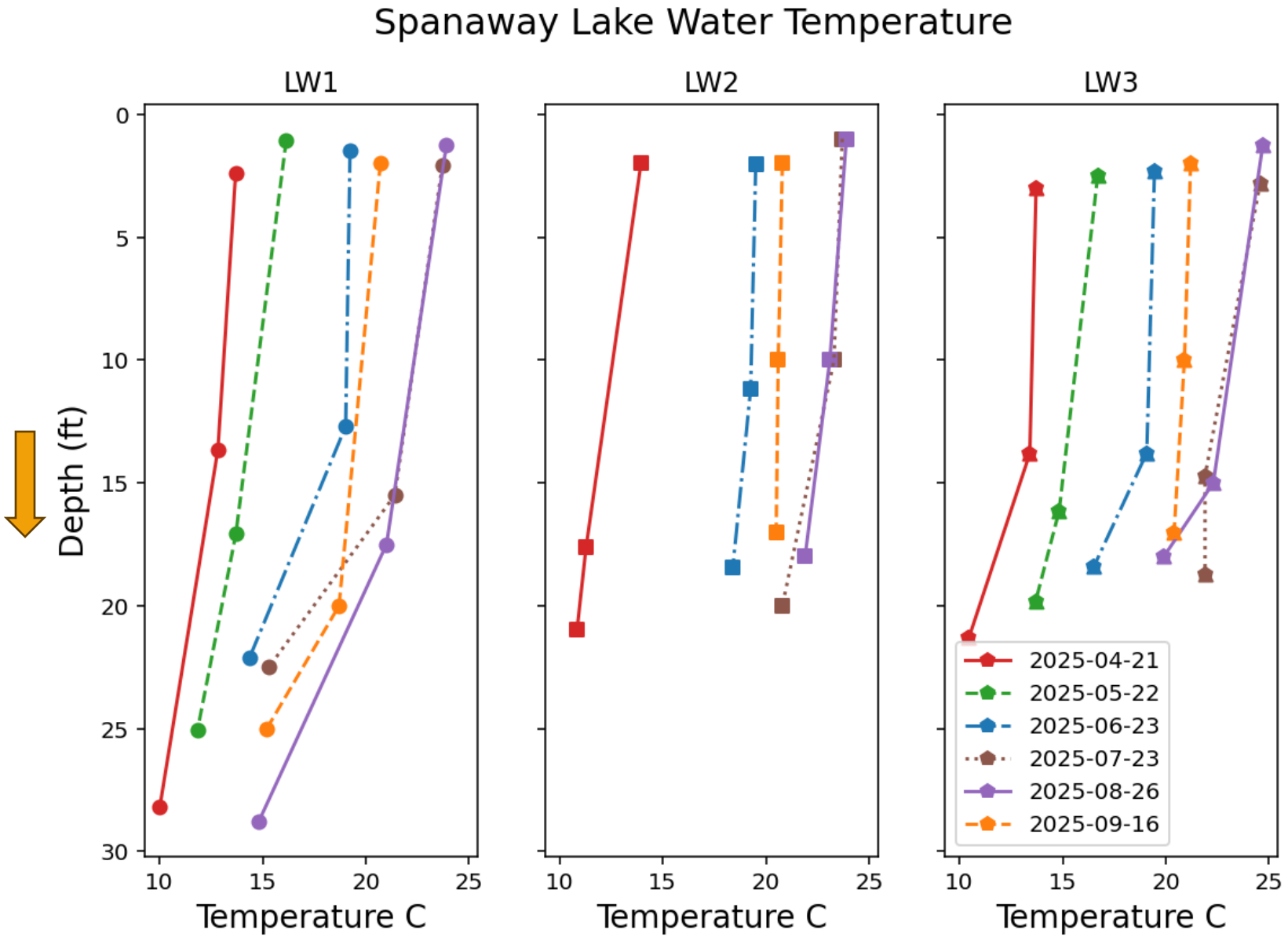

Chlorophyll-a at Station LW-1
Bottom
Middle
Surface
Lake Treatment
Toxic Bloom Event
Chl-a (µg/L)
0
5
10
15
20
2025-05
2025-06
2025-07
2025-08
2025-09
2025-10
Date



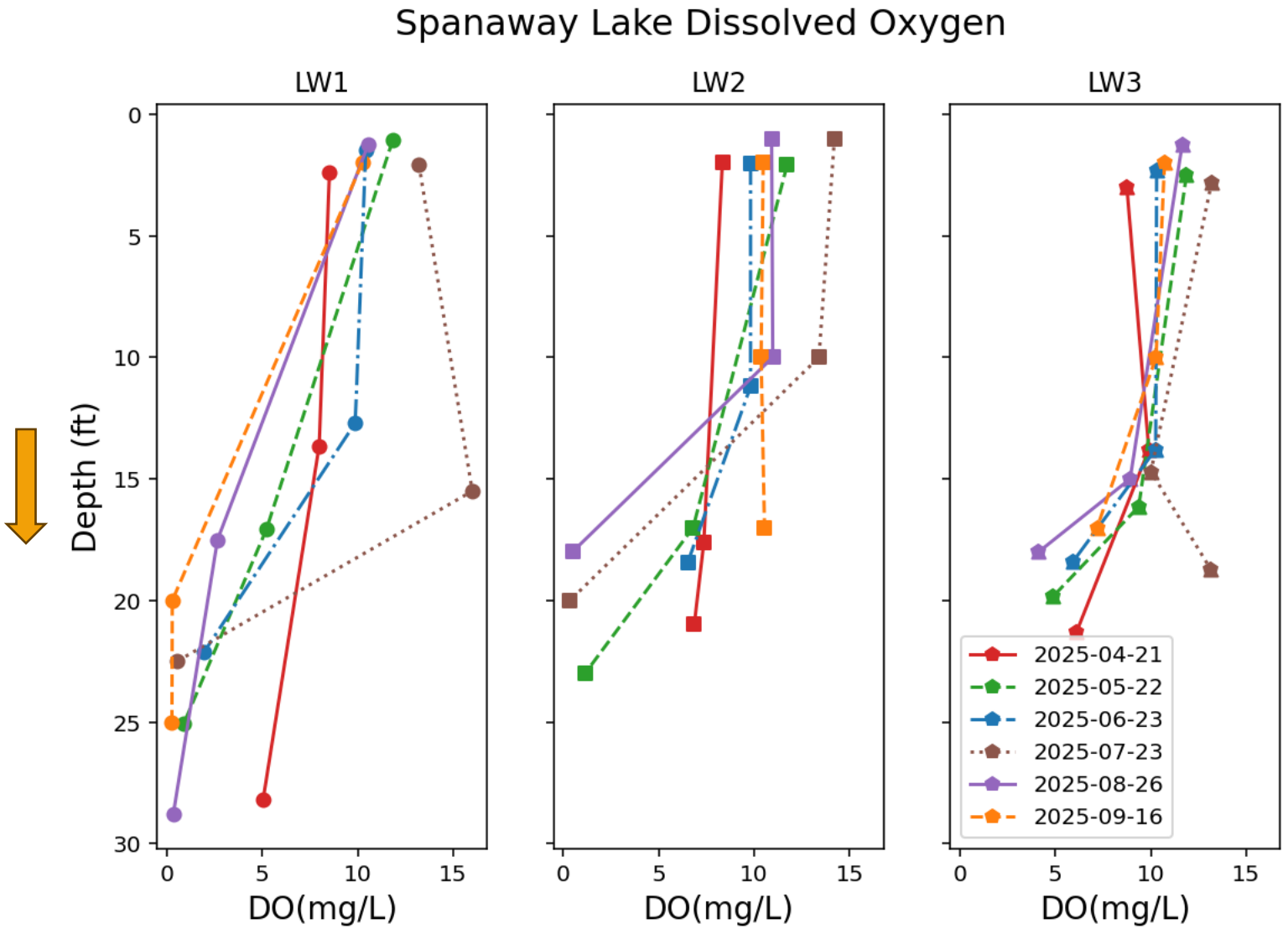
Evidence of difference in available TP between stations



Evidence of difference in available FRP between stations



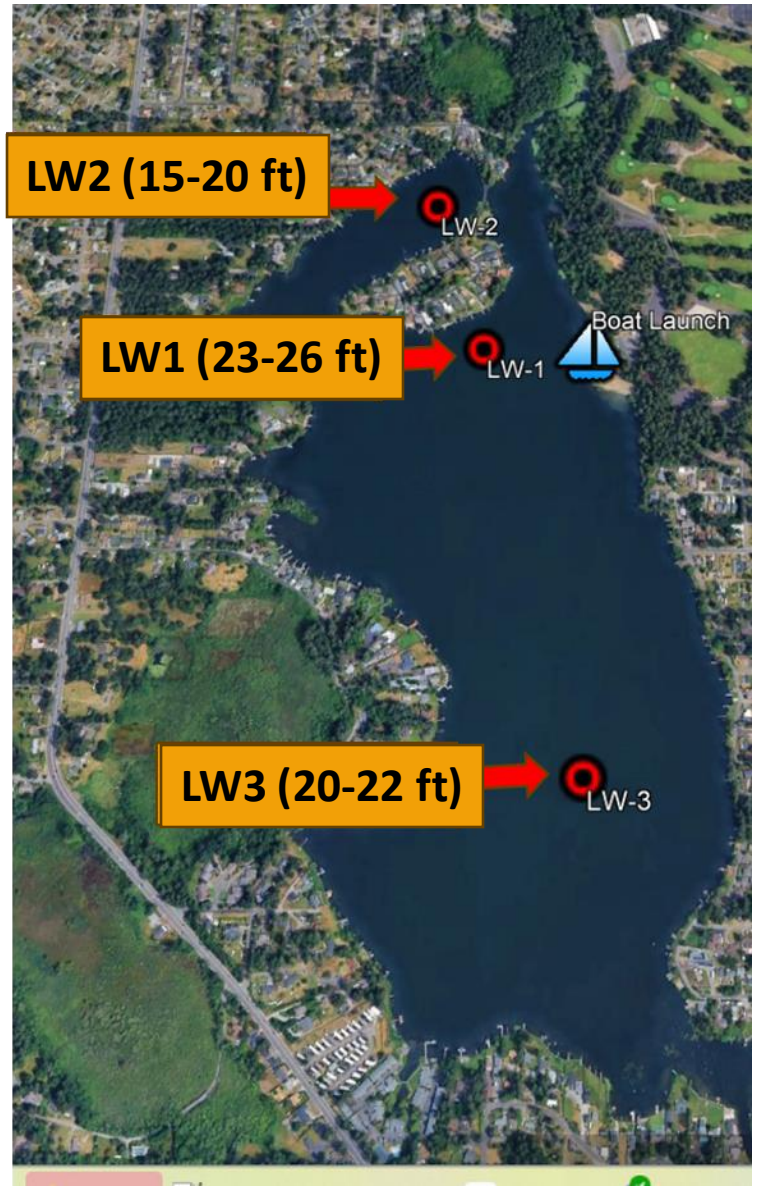
Evidence of thermal stratification occurring in the 10-20 ft depth range at station LW1 and 10-18 ft at Station LW3.
Weak stratification at station LW2.

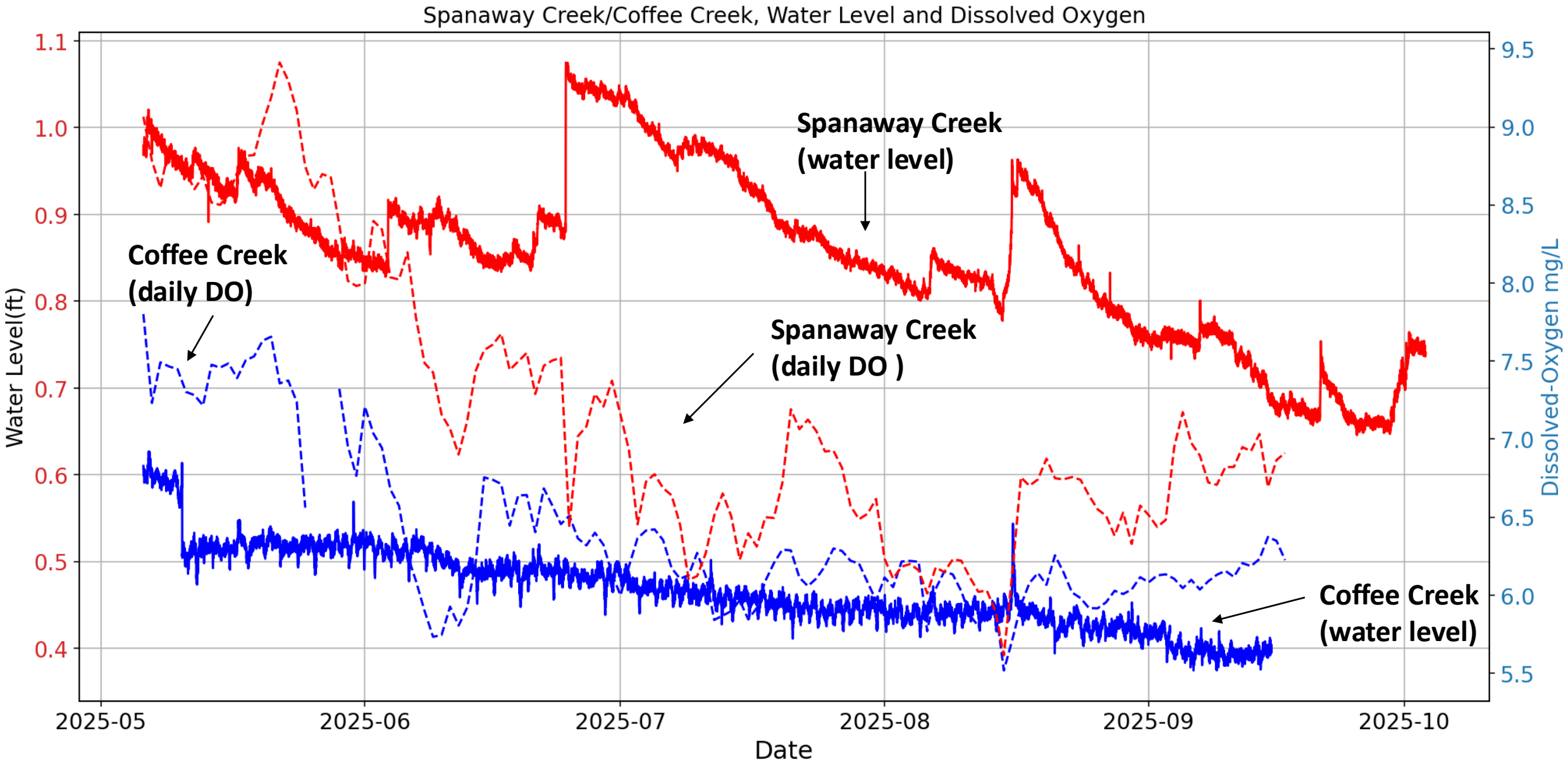


Data as expected of a lake system, with high DO values closer to the surface and lower DO levels in deeper waters.

Lake Sampling

- Evidence of stratification occurring in the 10-20 ft depth range at station LW1 and 10-18 ft at Station LW3. Weak stratification at station LW2.
- Higher values of TP and FRP observed at station LW1.
- Changing TKN:TP ratio suggests the increasing P limitation (Lanthanum treatment having an effect). Continued monitoring will help confirm/clarify this trend.
- Monitoring planned to continue – October and November 2025, and April-November in years 2026 through 2030.




Spanaway Creek/Coffee Creek, Water Level and Dissolved Oxygen
Water Level(ft)
Dissolved-Oxygen mg/L
Date
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
2025-05
2025-06
2025-07
2025-08
2025-09
2025-10
Spanaway Creek
(water level)
Coffee Creek
(daily DO)
Spanaway Creek
(daily DO)
Coffee Creek
(water level)

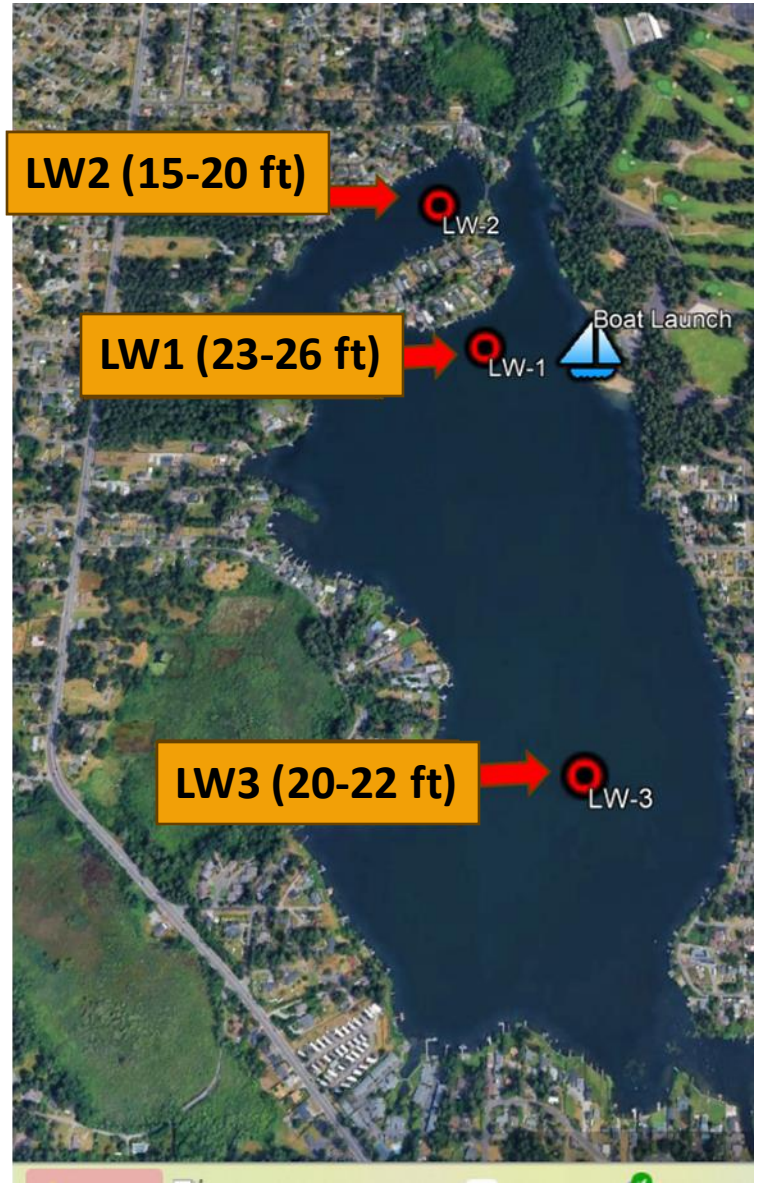
Spanaway Creek and Coffee Creek Monitoring

1. DO and Conductivity sensors were installed in June 2025. We plan to keep them operational to capture data of potential water quality concerns (e.g., fish die-off).
2. We conducted one-time sampling for Iron levels in stream water at four locations on Spanaway Creek and Coffee Creek. Data showed Total Iron concentration was within range of historic sampling.
3. We plan to continue monthly sampling for nutrients, DO, temperature, and pH, in addition to automated DO and streamflow measurements and water level monitoring at both locations.

Thank you!

Spanaway Lake data collection by Pierce County staff aboard **R/V Dewey**

Photo credit: Brianne Blackburn

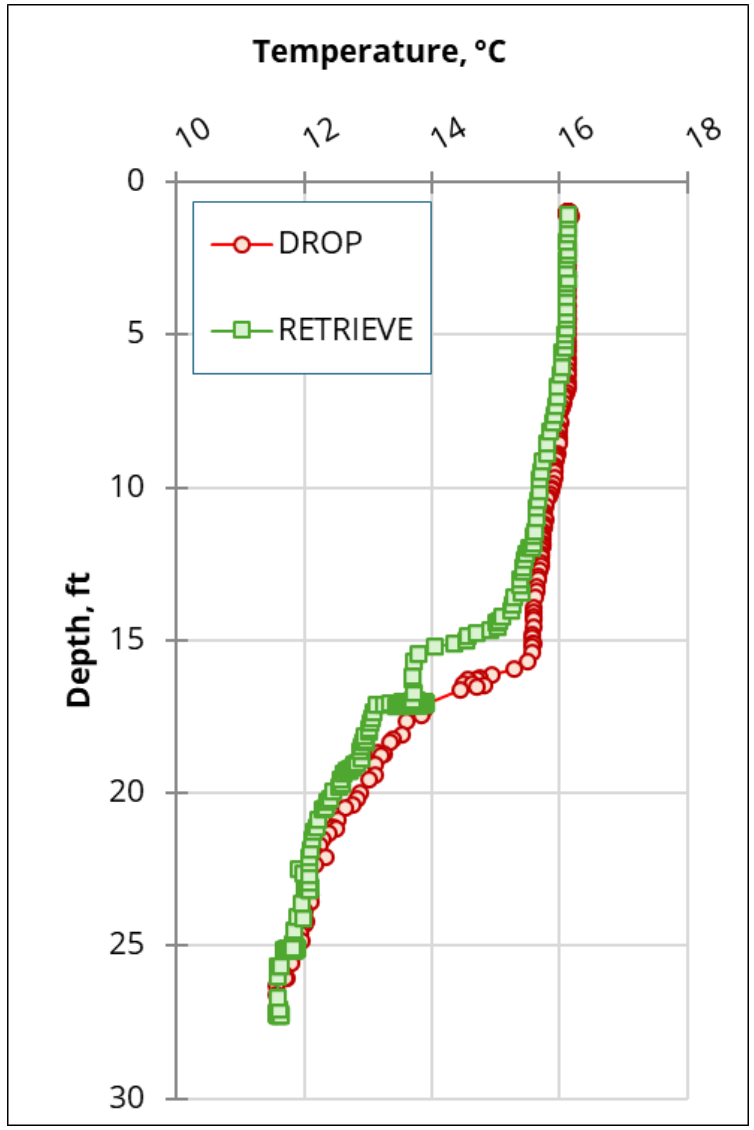


Locations	Depths	Parameter
LW1,LW2 and LW3	Epilimnion	Chlorophyll-a
		Nutrients (TKN[1], TP[2], FRP[3])
	Thermocline or Mid-depth	Chlorophyll-a
		Nutrients (TKN, TP,FRP)
	Hypolimnion	Chlorophyll-a
		Nutrients (TKN, TP, FRP)
Field Replicate	Selected depth	Chlorophyll-a
		Nutrients (TKN, TP, FRP)
Field Blank (DI H_2O)		Chlorophyll-a
		Nutrients (TKN, TP, FRP)
Total Samples		3 X 3+ 2 X 3= 15

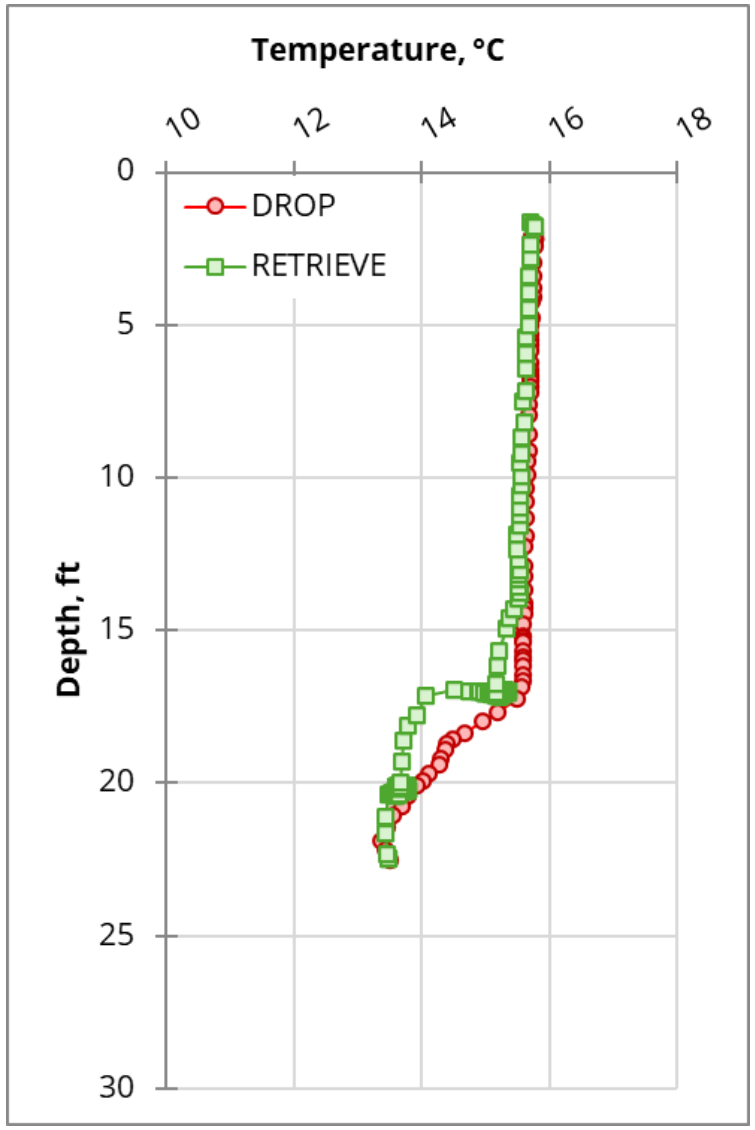
1. **TKN** - Total Kjeldahl Nitrogen
2. **TP** - Total Phosphorus
3. **FRP** - free reactive phosphate

Temperature profiles from May 2025

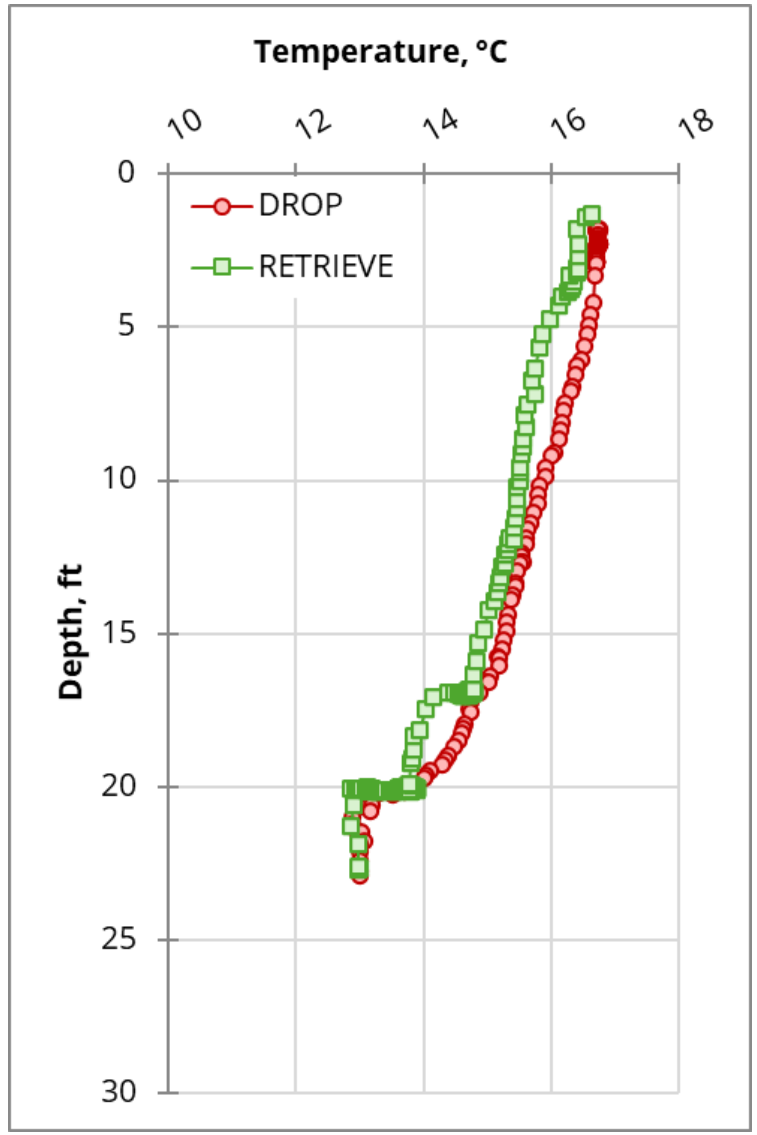
LW1



LW2



LW3



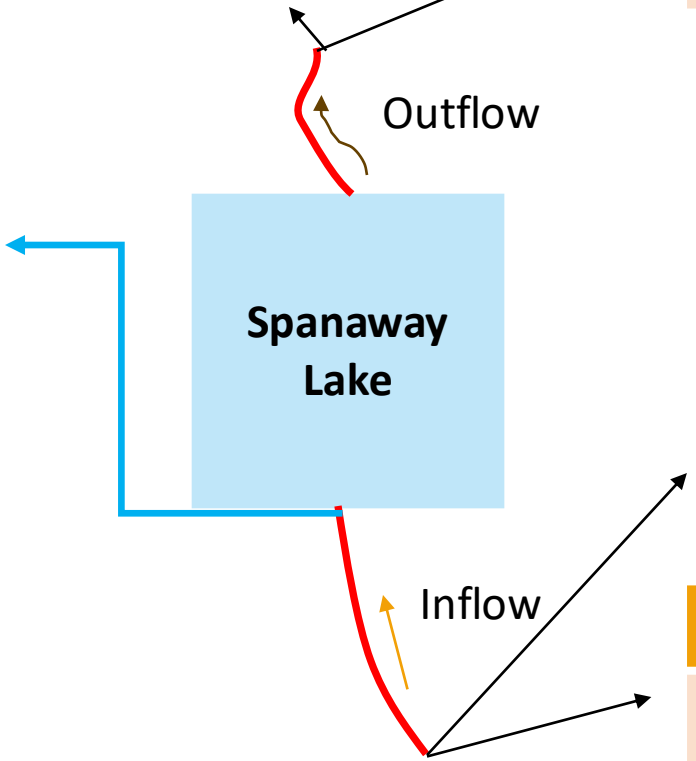
Samples Collected on March 20th,2025

Spanaway Creek at Bresemann Forest

Parameter	Sample
Total Iron	Non-Detect
Ferrous Iron	0.028 mg/L

Historic PC Data (2014-2016)(N=37)

Parameter	Value
Total Iron (Average)	0.21 mg/L
Total Iron (Max)	0.93 mg/L
Total Iron (Min)	0.092 mg/L



Coffee Creek at Coffee Creek Condos

Parameter	Sample
Total Iron	1.11 mg/L
Ferrous Iron	0.09 mg/L

Spanaway Lake at Coffee Creek Condos

Parameter	Sample	Replicate Sample
Total Iron	0.83 mg/L	0.83 mg/L
Ferrous Iron	0.088 mg/L	0.099 mg/L

Historic data (Ecology) (2014-2015) (N=73)

Parameter	Value
Total Iron (Average)	0.49 mg/L
Total Iron (Max)	1.24 mg/L
Total Iron (Min)	0.09 mg/L

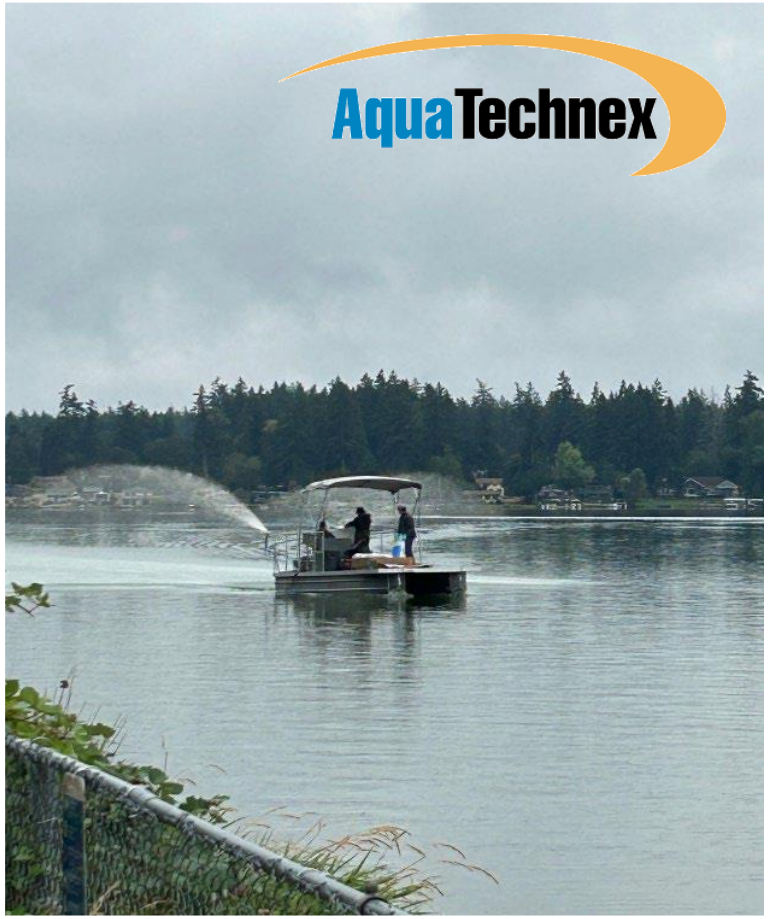
Spanaway Lake – Water Quality Restoration

Monitoring update Oct 2025

Ryan Van Goethem, CLM
Limnologist & Project Lead
ryanv@eutrophix.com
(303) 229-9622

Phosphorus Mitigation Applications to Date

- Partial doses to reduce water column phosphorus + address P release from sediment
  - August 2024 – 36,000 lbs. EutroSORB G
  - May 2025 – 28,000 lbs. EutroSORB G
  - August 2025 – 14,000 lbs. EutroSORB G
- Mitigation targeted 1,560 lbs. of P (708kg) to date
- ~25% of sediment mobile phosphorus in deep part of lake dosed to date



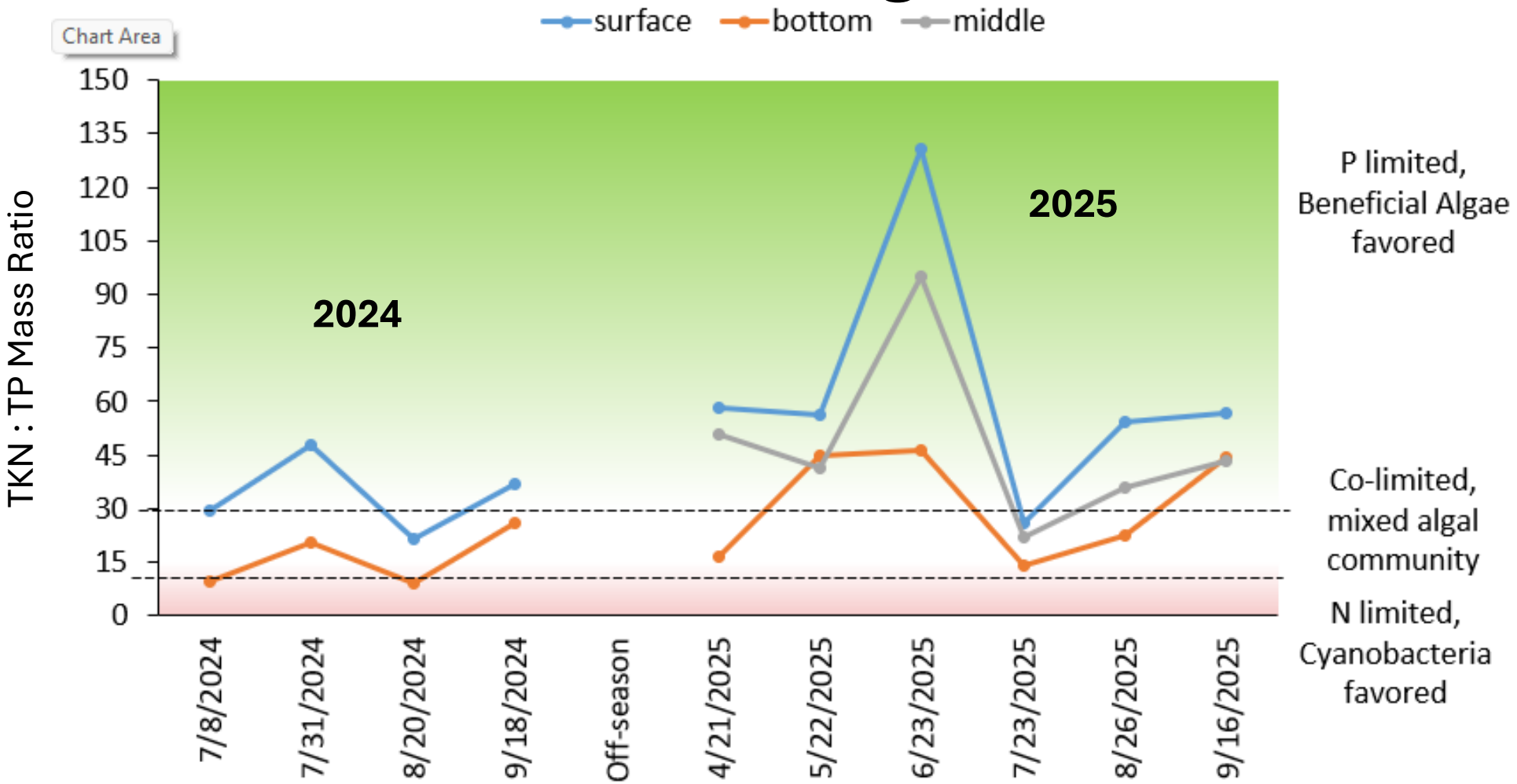
Phosphorus trends showing strong reductions in total phosphorus for 2025 to date

Total Phosphorus reported as seasonal mean in ug/L

Lake Layer	June – October 2021 (Pre-treatment)	July-Sept 2024	May – Sept 2025	
Epilimnion (Surface)	**28**	**18**	**13.6**	↓ 51 %
Hypolimnion (Bottom Water)	**215**	**211**	**87.9**	↓ 59 %
	Herrera 2023	Aquatechnex 2024	Pierce County + Aquatechnex 2025	

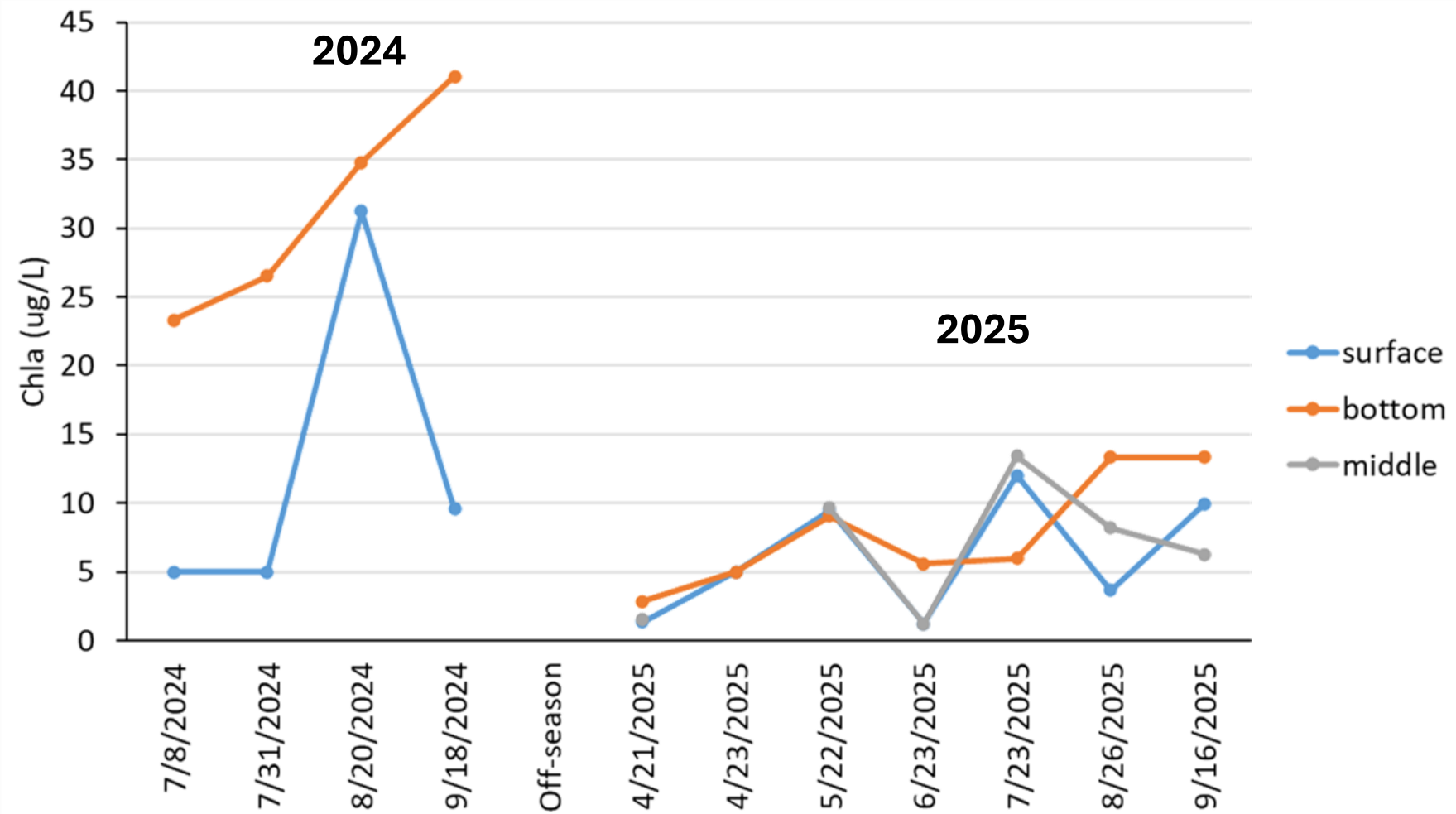
*Data as of 9/30/2025

Shift in Nitrogen : Phosphorus nutrient ratios more favorable for beneficial algae



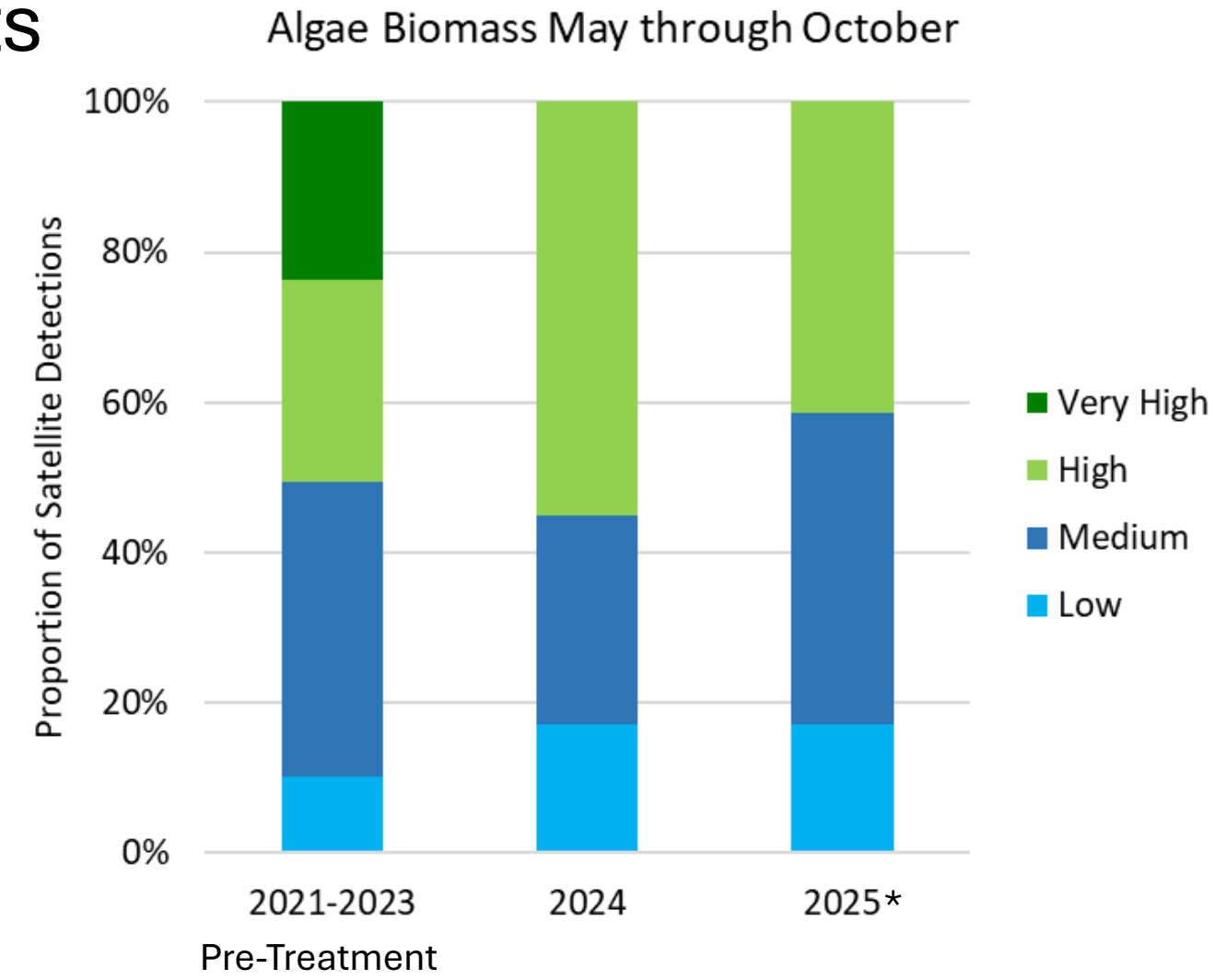
*Data as of 9/30/2025

Lower algae biomass from lab samples (chlorophyll a)



*Data as of 9/30/2025

Water Quality Improvements tracked from Satellite



*Data as of 9/30/2025

October 2022
Pre-treatment
Lakewide HAB bloom

October 2024
post-treatment

June 2025
Post-treatment

Sept 2025
Post-treatment

Lower extent and severity algae and cyanobacteria

Summary to date

- X% of mobile sediment P dosed to date, partial improvements should be expected so far
- Trends indicating improvements in water quality parameters each year (Phosphorus, N:P ratios, Chla)
- Responses in algae community detected, lower chlorophyll a and biomass