

Evidence of Internal Nutrient Loading in a Mixed-Use Groundwater Drainage Lake



Adina Ott, Andrew Ott, John Schuster

Prairie Crossing Homeowners Association

2026 Illinois Lakes Management Association Conference

OUTLINE

- **Background and overview**
- History
- Measurement methods
- Seasonal evolution of the lake
- Effects of internal loading
- Impact of diurnal variation
- Observations and conclusions
- Future plans

Lake Leopold – Prairie Crossing

Bull's Brook Subwatershed

- Prairie Crossing neighborhood is the immediate watershed feeding this 20-acre excavated lake; overflow into Bull's Brook
- Multiple uses: stormwater retention, aesthetics/ viewscape, light boating, sport fishing, endangered & threatened fish habitat, swimming
- Water quality measurement data on the lake since 1995; recent study by LCHD in 2022. Multiple fish studies, plant studies, and bathymetric/sediment maps.



Lake Leopold overview

Healthy, closed-nutrient system

- Minimal inflow/outflow; long hydraulic retention time
- Nutrients have multi-year lifetime

Buffered by surrounding prairie

- Native plants filter and limit the influx of nutrients and pollutants from surrounding watershed

Stratification and turnover may occur multiple times per year

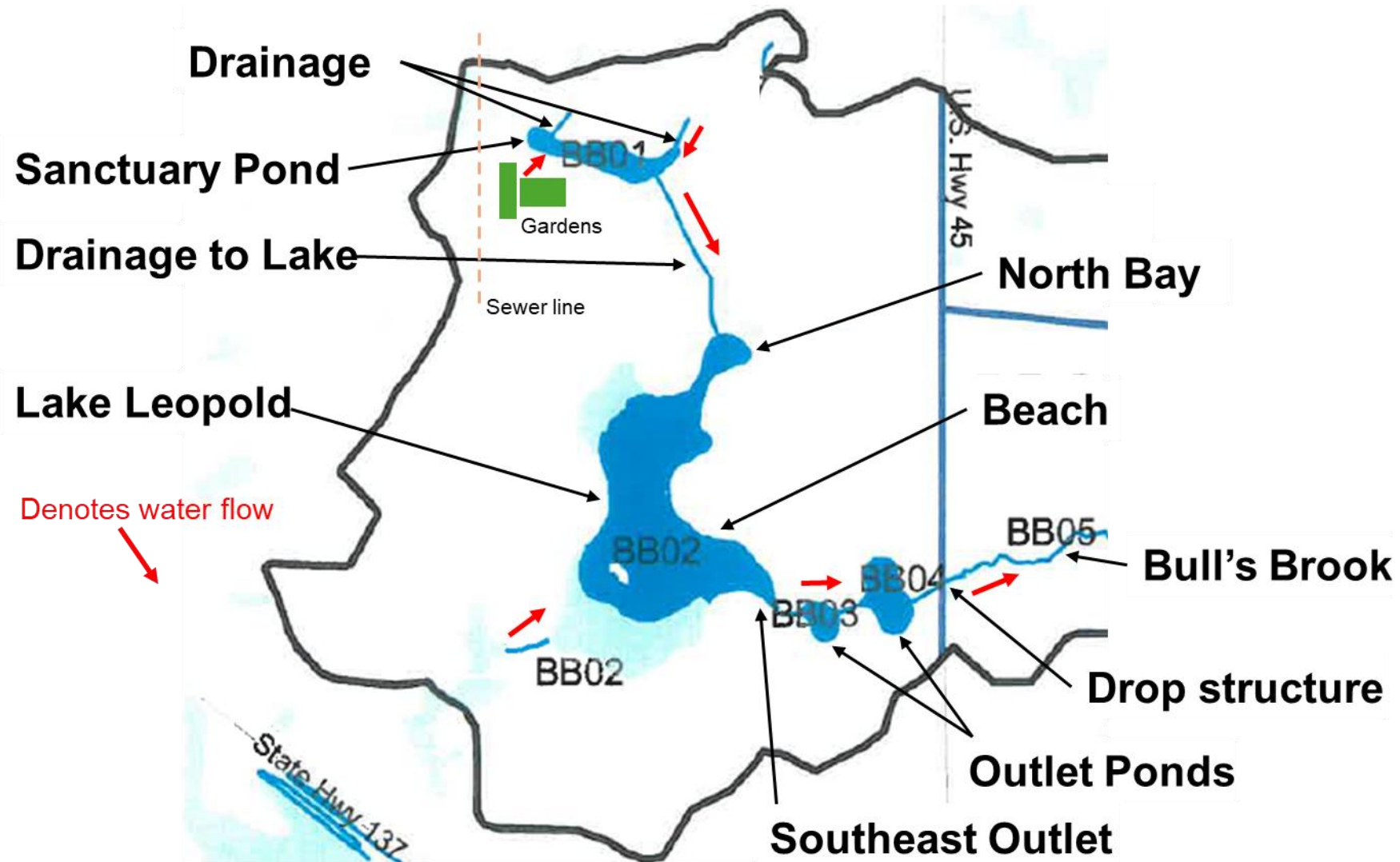
- Main lake versus bay and outlet areas

Lake Leopold faces manageable challenges that impact all lakes in our region:

- Invasive plants are present
- Bacterial contamination due to runoff
- Environmental conditions can lead to harmful algae blooms (HAB's)



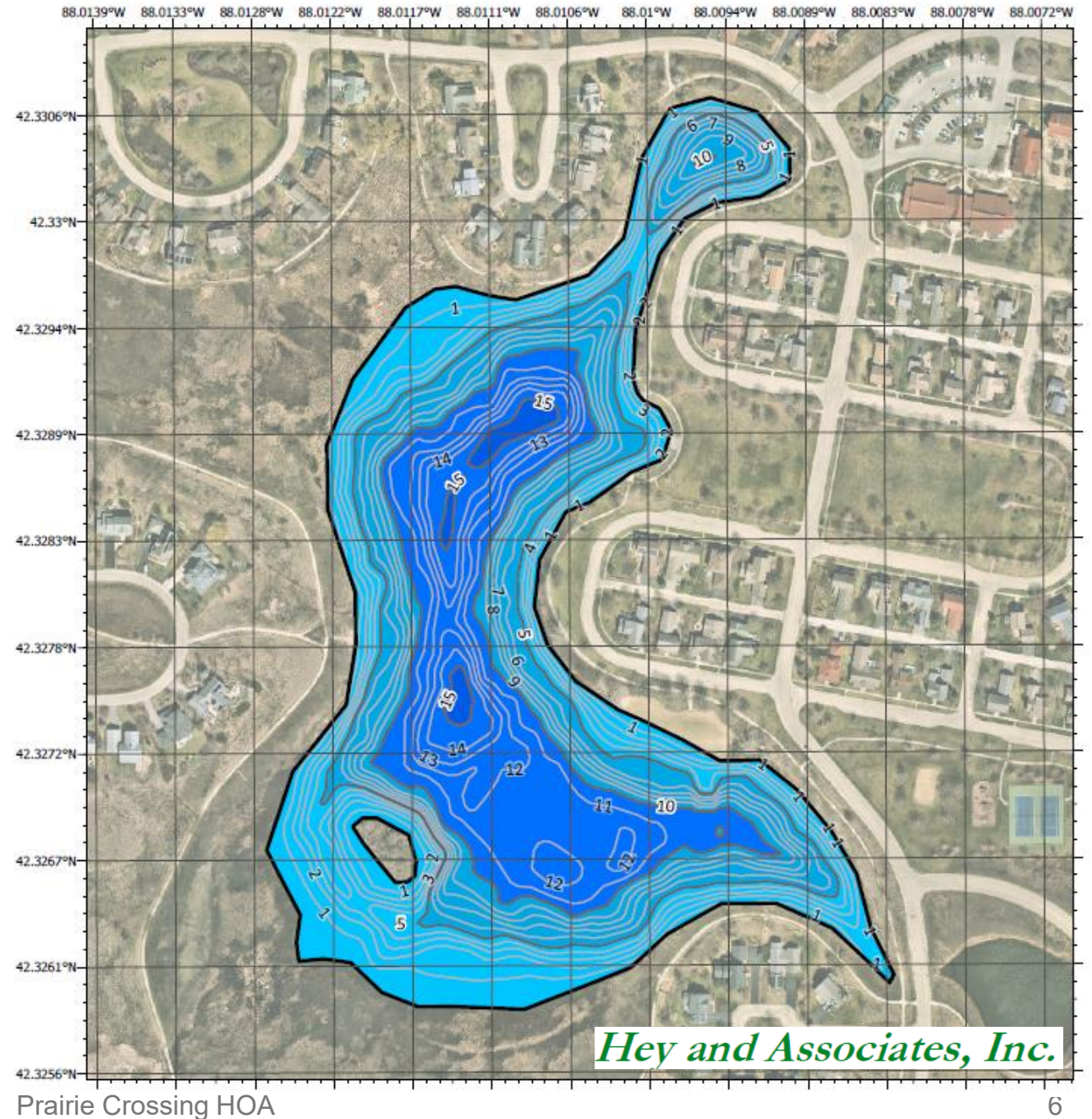
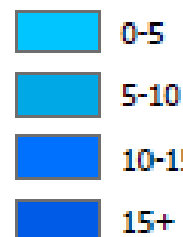
Features of the Prairie Crossing Watershed



Depth to Hard Bottom

EOW Elevation: 800.51
4/18/2025

Depth Range - Feet

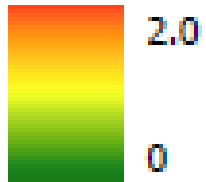


Soft Sediment Thickness

Legend:

 Edge of Water Boundaries

Sediment Thickness - Feet

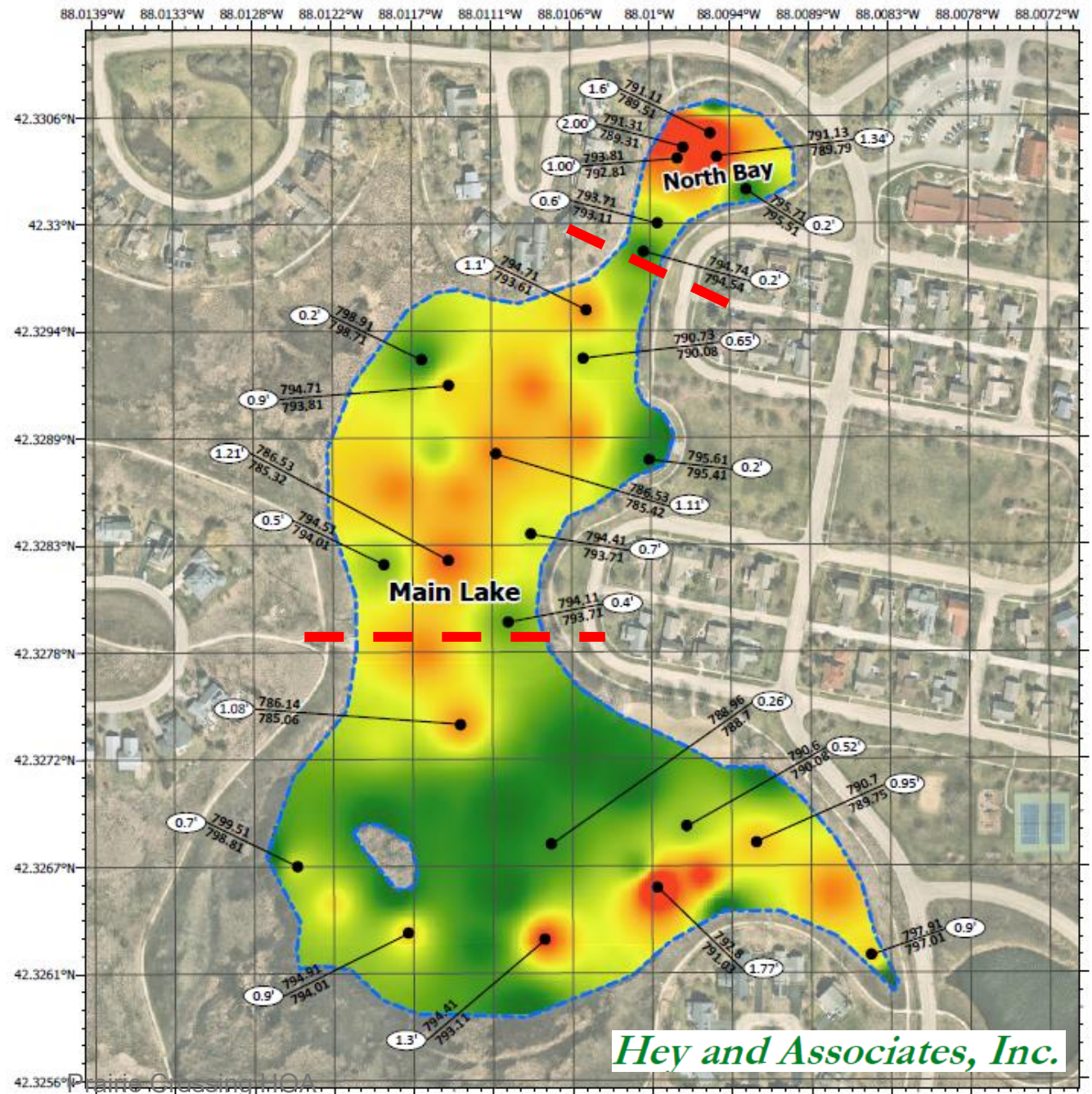


Soft Sediment Elevation
Hard Bottom Elevation

Sediment Depth

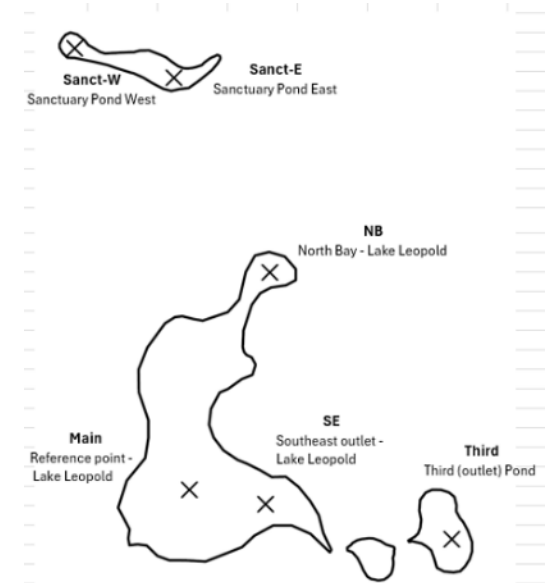
Phase 1 Dredging boundary

February 17, 2026



Basic sediment chemistry measured through the ice in February 2025 indicated phosphorus concentrations within a normal range (225 – 1175 mg/kg per IEPA)

<u>Main</u>			<u>Sanctuary East</u>		
Total P	420	mg/kg	Total P	440	mg/kg
TKN	3600		TKN	2900	
NH ₃	280		NH ₃	410	
Fe	32000		Fe	21000	
Mn	530		Mn	370	
<u>North Bay</u>			<u>Third Pond</u>		
Total P	670	mg/kg	Total P	310	mg/kg
TKN	1900		TKN	3500	
NH ₃	390		NH ₃	440	
Fe	28000		Fe	25000	
Mn	430		Mn	430	



Measured sediment phosphorus concentrations may not be considered high, but still indicate a significant source of potential phosphorus loading that could occur under anoxic conditions.

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Dissolved Oxygen levels have deteriorated: 20-Year Seasonal Comparison

Age: 10 years

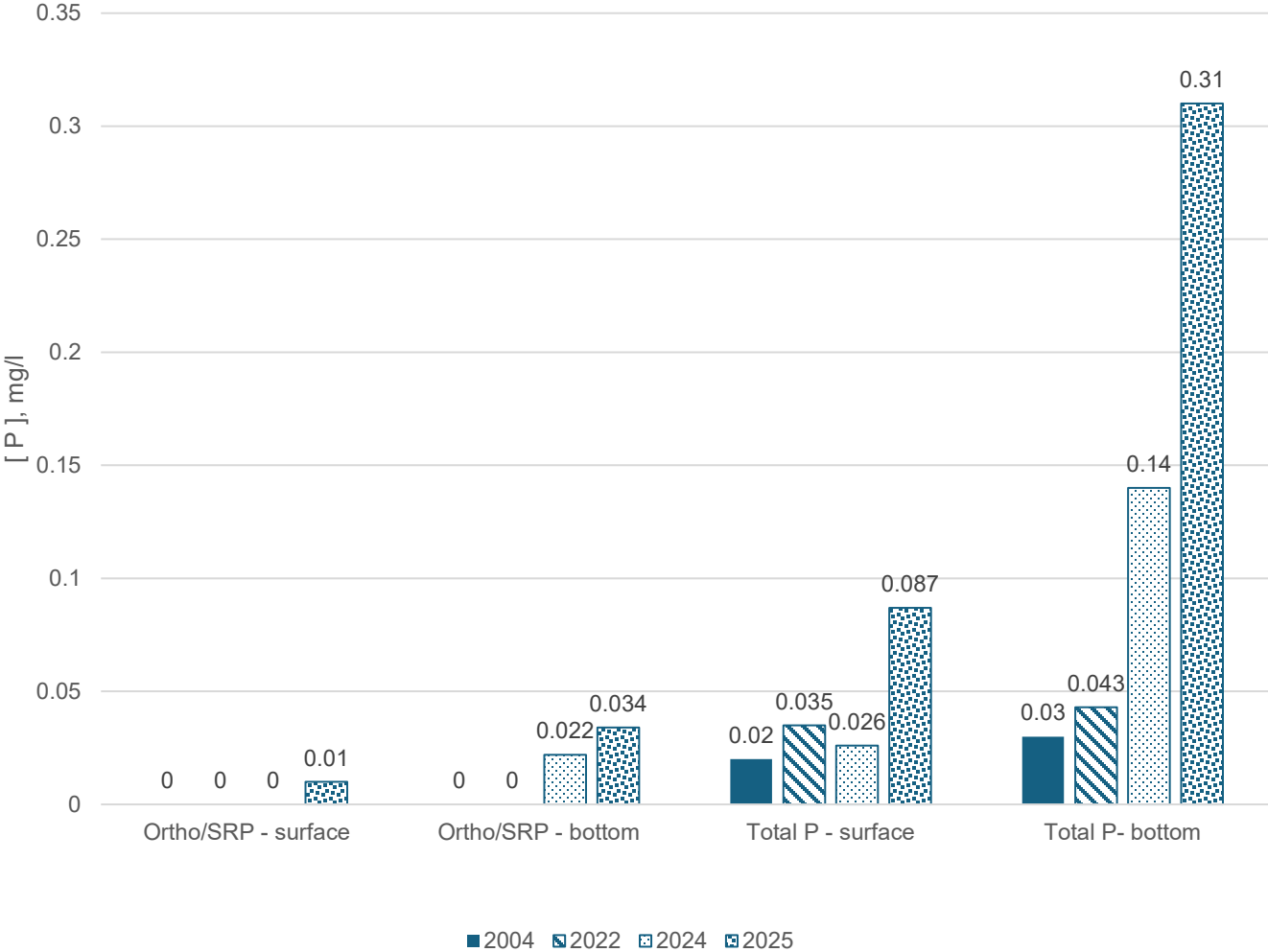
Lake Leopold Water Quality Report Year 2004 - Bland & Kubillus, ILM							
Site 1	DO, mg/l						
depth, ft	Apr-04	May-04	Jun-04	Jul-04	Aug-04	Sep-04	Oct-04
0	10.9	9.6	8.6	7.9	7.8	8.1	8.6
1	10.7	9.4	8.6	7.8	7.9	8.1	8.6
2	10.7	9.4	8.5	7.8	8	8.1	8.6
3	10.7	9.3	8.6	7.8	8	7.8	8.5
4	10.7	9.3	8.7	7.8	8	7.8	8.3
5	10.7	9.3	8.9	7.9	8.1	7.7	8.2
6	10.7	9.3	8.8	7.9	8.1	7.8	8.1
7	10.7	9.3	8.9	8	8.1	7.9	7.9
8	10.7	9.3	8.8	7.8	8.2	7.8	8
9	10.6	9.3	8.6	5.2	8.1	7.5	5.9
10	10.5	9.2	8.3	3.8	6.7	6.8	
11	10	9	7.4	2.2	5.5	5.9	
12		9		1.4			
13		8.7					
14		8.4					

Age: 30 years

Adina & Andy Ott, PCHOA DISSOLVED OXYGEN, mg/l							
Depth, ft	MAY	JUNE	JULY	AUG	SEPT		
1	10.1	10.7	7.1	8.4	6.6	6.9	7.2
2	10.1	10.9	7.0	8.4	6.4	6.8	7.1
3	10.1	11.0	6.9	8.4	6.3	6.9	7.0
4	10.1	11.2	6.9	8.2	6.2	6.9	7.0
5	10.1	11.2	6.9	7.6	5.5	7.0	6.9
6	10.1	11.2	6.8	7.1	2.1	7.0	6.9
7	10.1	11.1	6.4	3.3	1.2	6.8	6.8
8	9.9	10.5	5.0	0.9	0.7	3.8	6.8
9	9.6	9.4	4.0	0.5	0.5	1.8	6.8
10	9.5	7.1	2.9	0.4	0.4	0.8	7.0
11	9.4	4.2	1.2	0.3	0.4	0.6	7.0
12		2.4	0.6	0.3	0.3	0.5	7.0
13		1.1	0.4	0.2	0.3	0.4	6.9
14		0.7	0.4	0.2	0.3	0.4	6.8

Phosphorus levels and Trophic State Index have increased over time

Lake Leopold Phosphorus Concentrations - AUGUST



	2004	2025
	6-Jul	9-Jul
TSI-p	37	72
TSI-chl	42	50
TSI-sd	30	43
TSI	37	55

Water conditions - 2024



View from eastern shore near village



Flagstone inlet near village green

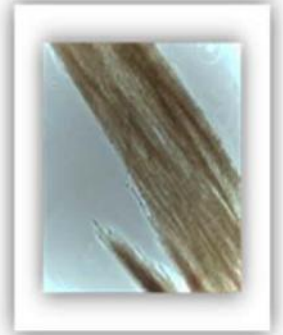
Harmful algal blooms (HAB) - 2024



Flagstones at inlet near village green
(July)



Beach as lake turnover begins
(September)



Aphanizomenon Sp.



Microcystis Sp.

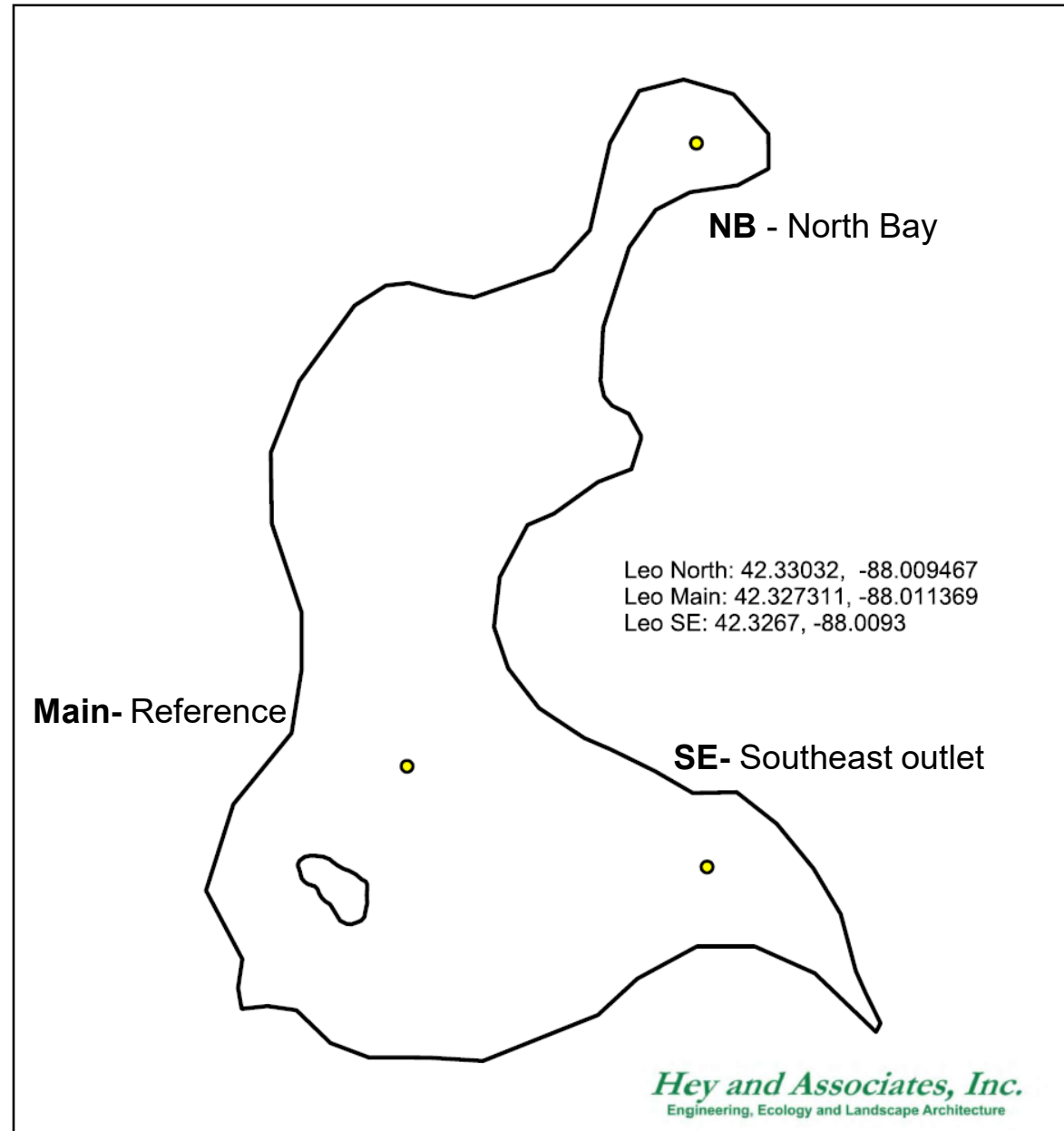
2025 strategy to address water quality was two-fold:

- apply targeted treatments to inhibit algae and limit bio-available nutrients
- take regular measurements to understand lake chemistry

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Measurement and water sampling locations



Testing methods

- Laboratory tests (plus alkalinity, calcium, chlorophyll):

PARAMETER	RESOLUTION, UNITS	METHOD
Orthophosphate/SRP	0.010 mg/L	SM 4500P F 1999
Total Phosphate	0.020 mg/L	SM 4500-P F-2011
Nitrite	0.30 mg/L	EPA 300.0 REV 2.1
Nitrate	0.30 mg/L	EPA 300.0 REV 2.1
Ammonium nitrogen	0.25 mg/L	SM 4500-NH3 G 2011
Total Kjehldahl nitrogen	1.0 mg/L	OIA/PAI-DK03 & EPA 351.2 REV 2
Total suspended solids	4.0 mg/L	SM 2540D 1997
Iron	0.010 mg/L	EPA 200.7 REV 4.4
Manganese	0.10 mg/L	EPA 200.7 REV 4.4
Chlorides	1.0 mg/L	SM 4500 CL E 2011

- On-water measurements:
 - YSI ProDSS Multiparameter field instrument
 - YSI 9800 Photometer (Soluble Reactive Phosphorus)
 - *Hach/Ott Hydrolab (temperature only)*
 - *DepthTrax (ultrasonic) depth finder and temperature gauge*
 - *Secchi disk*

Equipment provided by Lake County Lake Lovers

- Part of their Pilot Program for sharing equipment donated by YSI Xylem
- Joined their Technical Team
- Measurements 1-2x monthly
- Calibrated ProDSS instrument monthly



Equipment

ProDSS

Photometer

VanDorn sampler

Secchi Disk

Depth monitor

Boat provided by ESC



ProDSS

GPS coordinates

Barometric pressure

Depth

Installed Sensor Probes (maximum 4):

- Dissolved Oxygen
- Conductivity / Temperature
- pH / Oxidation-Reduction Potential
- Total Algae (Chlorophyll and Phycocyanin)

Data downloaded via Kor software platform:



TIME (HH:MM:SS) DATE (MM/DD/YYYY) FILE NAME SITE NAME	FAULT CODE	TAL PC RFU	TAL PC µS	BAROMETRIC PRESSURE	CHLOROPHYLL A	CHLOROPHYLL B	COND µS/C	SPCOND µS	TDS MG/L	SAL PSU	NI/F COND	DEPTH M	VERTICAL F PRESSURE	ODO % SAT	ODO MG/L	GPS LATITUDE	GPS LONGITUDE	ALTITUDE N	ORP MV	PH	PH MV	TEMP °C	
3:30:12 PM 10/4/2025 251004-15 OttCal	0	-1.45	-0.61	740.7	-0.13	-2.74	7348.4	7459.8	4849	4.11	7471.2	0.241	0.229	-0.045	98.8	8.09	0	0	0	212.7	6.98	-33.8	24.218
4:05:15 PM 10/4/2025 251004-16 OttCal	0	-1.12	-0.56	740.6	-0.33	-2.3	7134	7196.1	4677	3.96	7202.5	0.239	0.25	-0.046	98.8	8.05	0	0	0	210.7	6.94	-35.2	24.548
9:12:15 AM 10/5/2025 251005-09 leopold ma	0	-0.94	-0.4	743.1	-0.54	-3.07	851.1	901.5	586	0.44	906.4	0.387	0.403	0.163	73.4	6.39	42.32751	-88.0115	240.4	68.9	7.6	-74.5	22.072
9:12:55 AM 10/5/2025 251005-09 leopold ma	0	-0.93	-0.38	743.1	-0.81	-4.01	850.7	901.3	586	0.44	906.3	0.683	0.984	0.583	71.9	6.27	42.3275	-88.0115	240.7	69.8	7.61	-74.8	22.06
9:14:05 AM 10/5/2025 251005-09 leopold ma	0	-0.91	-0.37	743.1	-0.46	-2.77	850.6	901.2	586	0.44	906.2	0.938	0.976	0.945	71	6.19	42.32751	-88.0115	241.2	72.3	7.59	-73.9	22.061
9:14:39 AM 10/5/2025 251005-09 leopold ma	0	-0.93	-0.38	743.1	-0.72	-3.71	850.7	901.3	586	0.44	906.2	1.235	1.295	1.367	70.5	6.14	42.32752	-88.0115	240.9	73.6	7.58	-73.2	22.062
9:15:10 AM 10/5/2025 251005-09 leopold ma	0	-0.91	-0.37	743.2	-0.78	-3.91	850.6	901.2	586	0.44	906.2	1.52	1.609	1.771	70.5	6.14	42.3275	-88.0115	240.1	74.3	7.58	-73	22.058
9:15:51 AM 10/5/2025 251005-09 leopold ma	0	-0.97	-0.42	743.1	-0.57	-3.15	850.5	901.1	586	0.44	906	1.839	1.942	2.224	70.2	6.12	42.32751	-88.0115	240.5	75.2	7.57	-72.7	22.059
9:16:21 AM 10/5/2025 251005-09 leopold ma	0	-0.91	-0.37	743.1	-0.53	-3.02	850.5	901.4	586	0.44	906.3	2.138	2.197	2.647	69.3	6.04	42.32751	-88.0115	241.1	75.9	7.56	-72.1	22.048
9:16:53 AM 10/5/2025 251005-09 leopold ma	0	1.81	2.18	743.2	42.06	148.56	850.8	904.1	588	0.45	909.2	2.444	2.521	3.083	29.8	2.6	42.32751	-88.0115	241.5	80.1	7.31	-57.1	21.917

Phosphorus

VanDorn sampler

Collect samples as a function of depth

Filter samples

React for a colorimetric assay

9800 Photometer

Measures absorbance

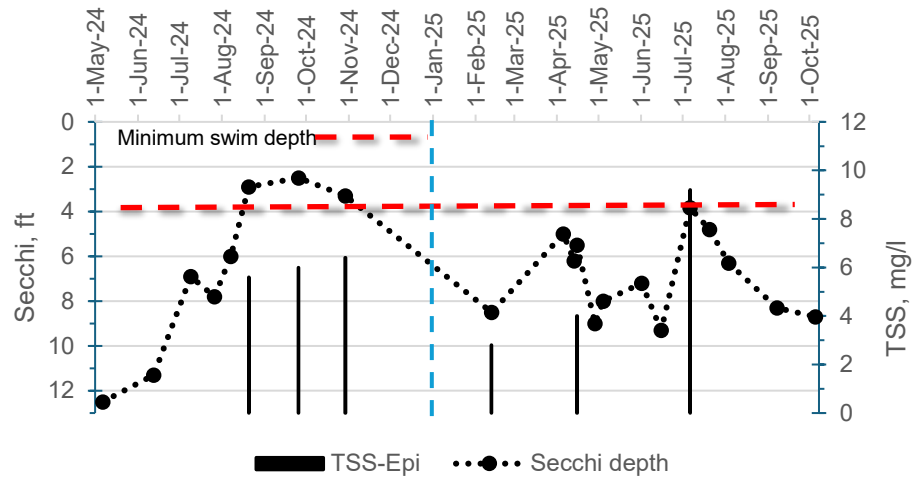
Soluble reactive phosphate



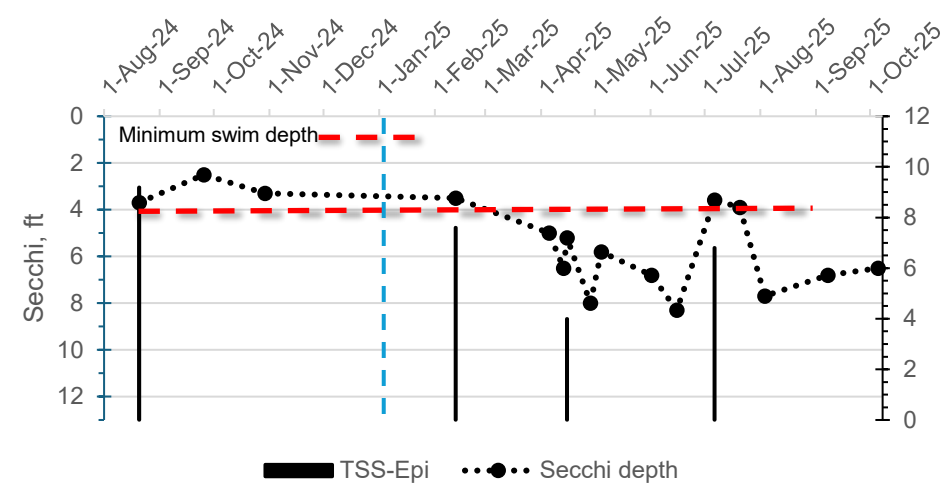
WATER CLARITY – Seasonal progression

Secchi depth & Total Suspended Solids (TSS)

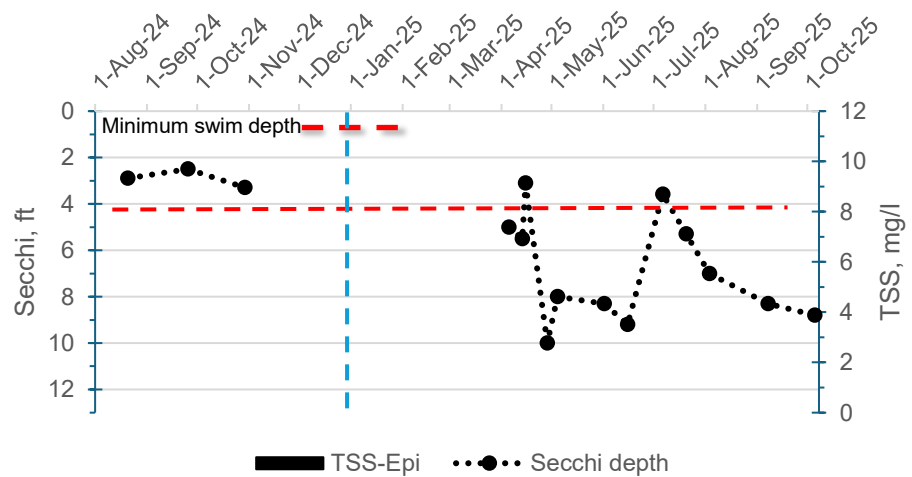
WATER CLARITY - Main



WATER CLARITY - North Bay



WATER CLARITY - Southeast Outlet



NOTE: TSS on July 6 was from hypolimnion sample (+3 ft)

Measurements were taken monthly; but increased frequency when conditions changed significantly

Prairie Crossing Test Plan- example

Rev.4

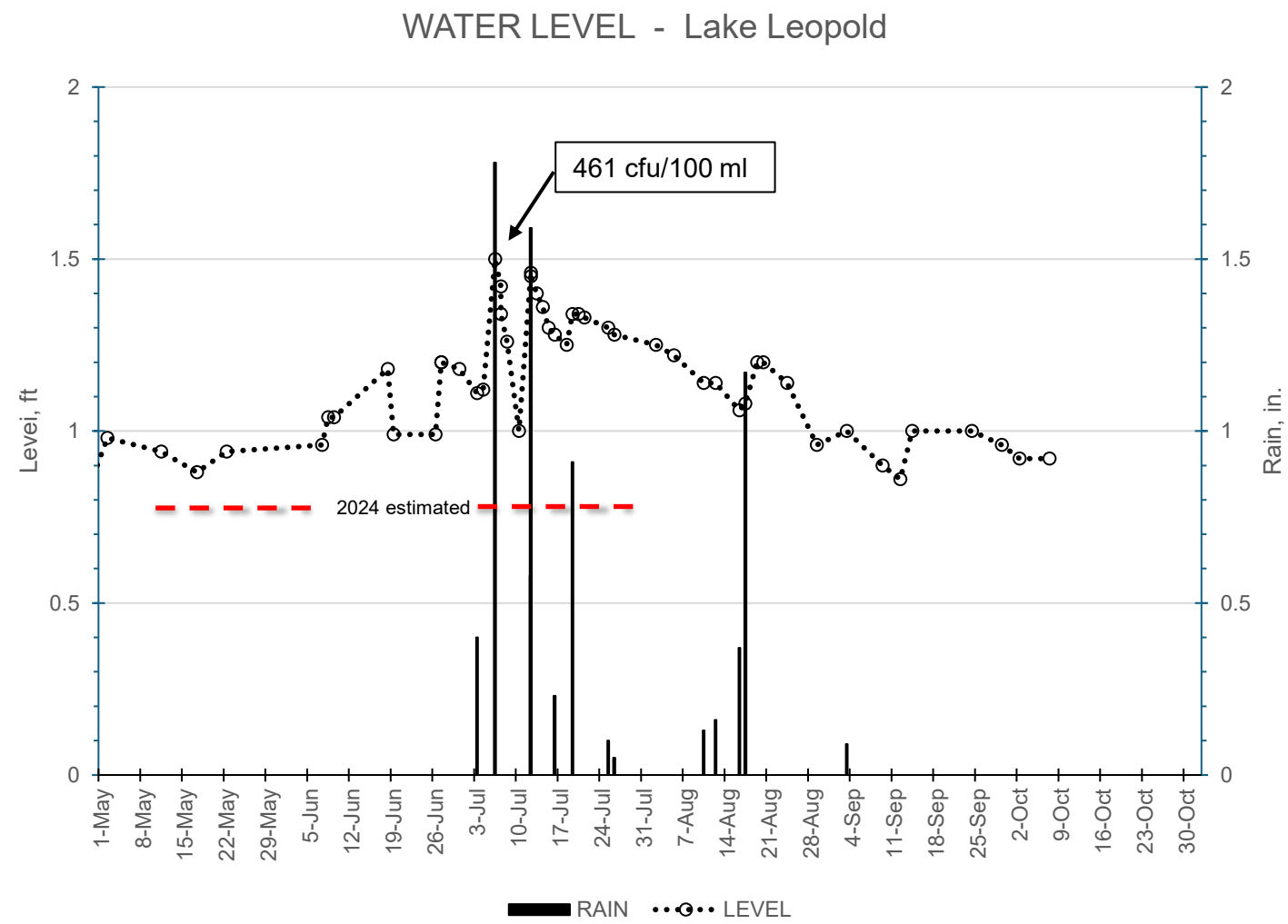
COMPLETED	JUNE					JULY				
	1	8	15	22	29	6	13	20	27	
LAKE LEOPOLD										
Profiles on-water (DO,T.....Secchi)	AO		AO			AO&Hey		AO		
Water chemistry-lab						Hey				
Water chemistry-photometer	AO		AO			AO/JS		AO		
Temp and Secchi only		JS								
Sediment nutrients										
Aquatic Plant Survey		ILM								
Bacteria count		LCHD		LCHD		LCHD		LCHD		
HAB toxin level							JS	JS	JS	
Diurnal profiles @Main*									JS	
SANCTUARY										
Profiles on-water (DO,T.....Secchi)						Hey				
Water chemistry-lab						Hey				
Water chemistry-photometer										
Temp and Secchi only										
Sediment nutrients										
Bathymetric & soft sediment level						Hey				

Staff gauge installed to measure Lake Leopold water level



- NOTES:
- 1)) Datum 0 = 799.25 NAVD88

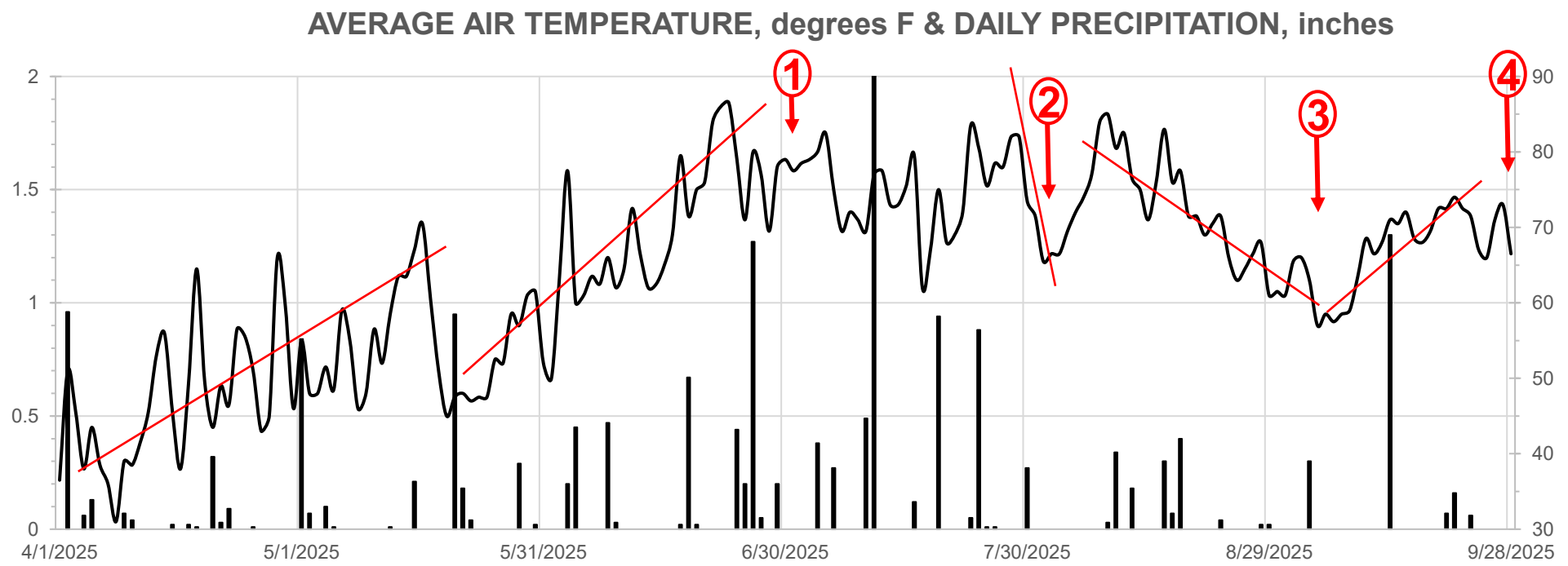
2) Rainfall data starting @1-July



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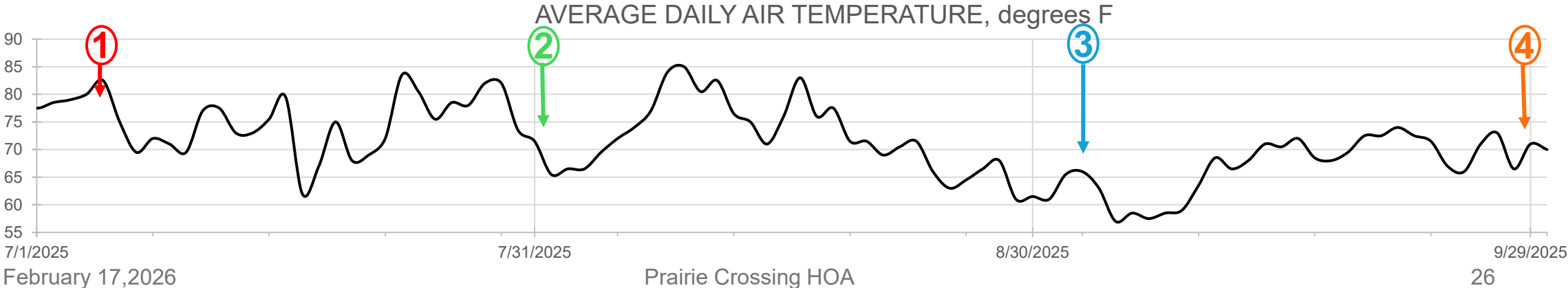
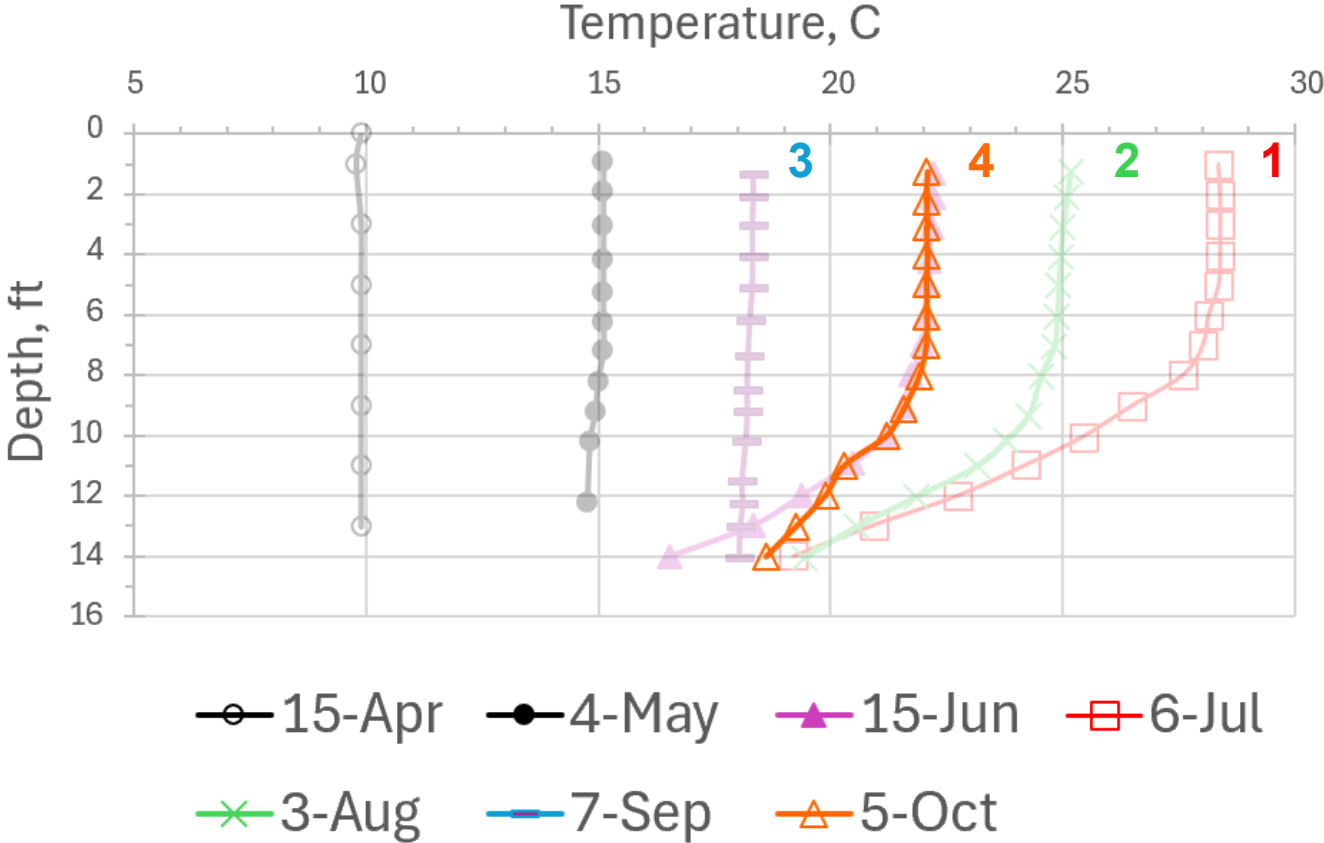
2025 Season Weather Profile



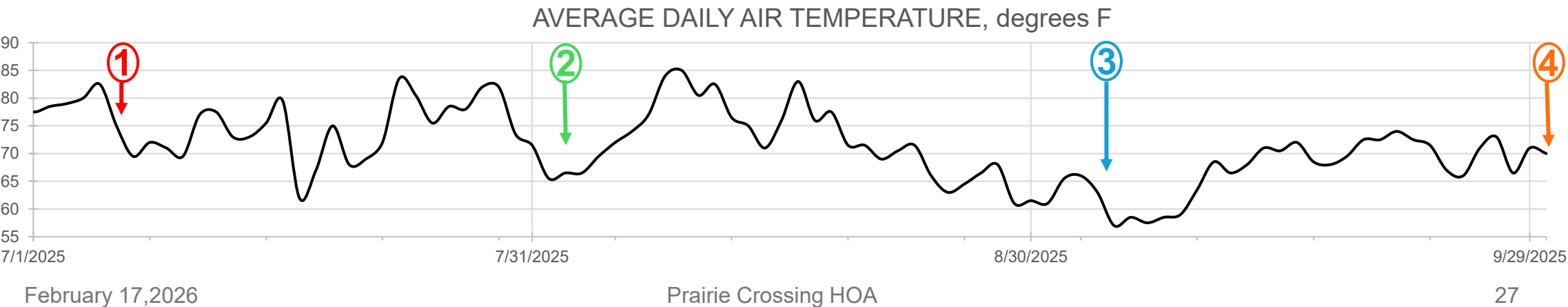
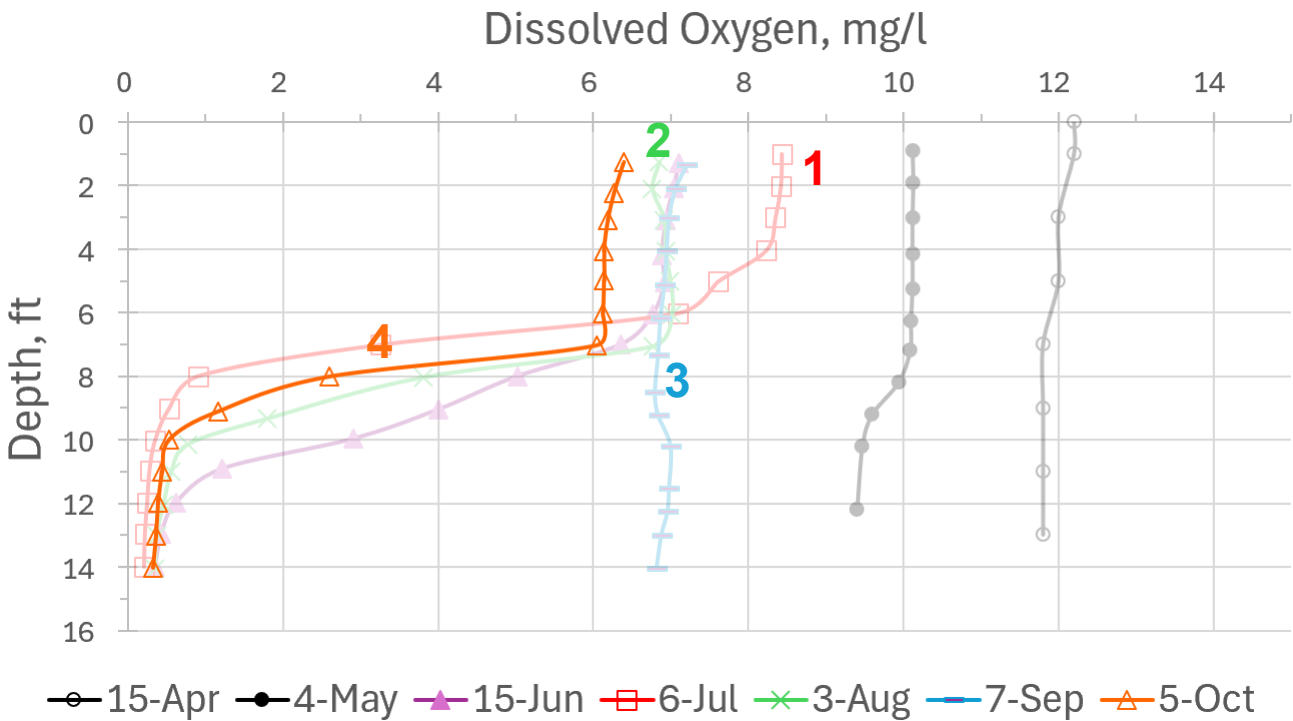
SOURCE:
Waukegan Regional Airport, station ID: KUGN
National Centers for Environmental Information
National Oceanographic and Atmospheric Administration

Seasonal temperature profiles indicating mid-summer turnover

- Main sample location



**Dissolved Oxygen profiles
corresponding to
stratification & turnover**
- Main sample location

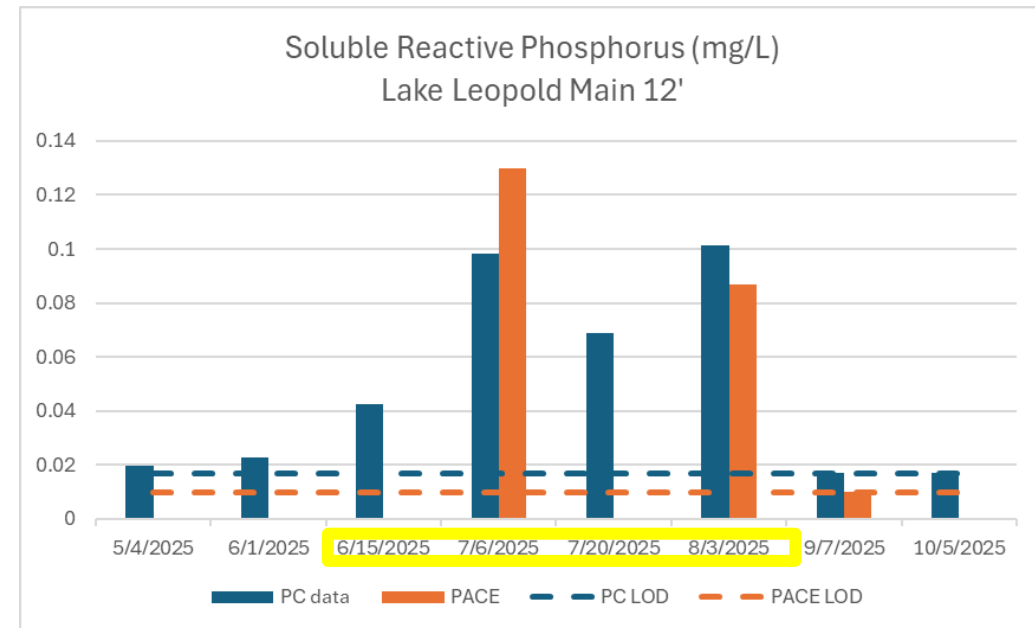


Temperature is a leading indicator of subsequent chemical conditions.....

			Temperature (C)						
Depth (ft)	Apr	May	Jun		Jul		Aug	Sep	Oct
1	9.2	15.1	19.0	22.2	28.3	25.2	25.2	18.3	22.1
2	9.1	15.1	18.5	22.2	28.4	25.3	25.1	18.3	22.1
3	9.1	15.1	18.4	22.2	28.4	25.3	25.0	18.3	22.1
4	8.9	15.1	18.3	22.1	28.4	25.3	24.9	18.3	22.1
5		15.1	18.3	22.1	28.4	25.3	24.9	18.3	22.1
6	8.8	15.1	18.2	22.0	28.1	25.0	24.9	18.3	22.1
7		15.1	18.1	22.0	28.0	24.9	24.8	18.2	22.0
8	8.7	15.0	18.0	21.7	27.6	24.6	24.5	18.2	21.9
9		14.9	17.9	21.6	26.5	24.3	24.3	18.2	21.6
10	8.4	14.9	17.6	21.2	25.4	23.7	23.8	18.2	21.2
11			16.8	20.5	24.2	23.2	23.2	18.1	20.3
12	8.2	14.8	16.4	19.4	22.7	22.3	21.9	18.1	19.9
13			15.6	18.3	20.9	21.1	20.6	18.0	19.3
14	8.1		15.2	16.5	19.2	19.6	19.4	18.0	18.6

	Oxidation Reduction Potential (mV)								
Depth (ft)	Apr	May	Jun		Jul		Aug	Sep	Oct
1	157	162	113	207	129	115	83	84	69
2	148	160	111	204	127	114	85	86	70
3	149	159	110	201	126	112	86	88	72
4	147	158	109	199	126	112	87	89	74
5		157	109	197	128	114	88	91	74
6	147	157	109	195	129	118	89	92	75
7		155	109	195	140	119	90	92	76
8	146	155	111	198	-12	119	96	93	80
9		156	114	200	-93	-86	100	94	-50
10	147	155	124	201	-137	-116	101	94	-142
11			131	202	-144	-158	68	94	-128
12	147	157	136	202	-147	-191	-60	96	-122
13			12	201	-154	-206	-151	97	-123
14	147		-128	44	-168	-213	-176	98	-157

	Dissolved Oxygen (mg/L)								
Depth (ft)	Apr	May	Jun		Jul		Aug	Sep	Oct
1	22.3	10.1	10.7	7.1	8.4	6.6	6.9	7.2	6.4
2	11.2	10.1	10.9	7.0	8.4	6.4	6.8	7.1	6.3
3	11.2	10.1	11.0	6.9	8.4	6.3	6.9	7.0	6.2
4	11.2	10.1	11.2	6.9	8.2	6.2	6.9	7.0	6.1
5		10.1	11.2	6.9	7.6	5.5	7.0	6.9	6.1
6	11.2	10.1	11.2	6.8	7.1	2.1	7.0	6.9	6.1
7		10.1	11.1	6.4	3.3	1.2	6.8	6.8	6.0
8	11.1	9.9	10.5	5.0	0.9	0.7	3.8	6.8	2.6
9		9.6	9.4	4.0	0.5	0.5	1.8	6.8	1.2
10	11.1	9.5	7.1	2.9	0.4	0.4	0.8	7.0	0.5
11			4.2	1.2	0.3	0.4	0.6	7.0	0.4
12	10.8	9.4	2.4	0.6	0.3	0.3	0.5	7.0	0.4
13			1.1	0.4	0.2	0.3	0.4	6.9	0.4
14	10.7		0.7	0.4	0.2	0.3	0.4	6.8	0.3



.....and consequently affects biological conditions

	Temperature (C)								
Depth (ft)	Apr	May	Jun		Jul		Aug	Sep	Oct
1	9.2	15.1	19.0	22.2	28.3	25.2	25.2	18.3	22.1
2	9.1	15.1	18.5	22.2	28.4	25.3	25.1	18.3	22.1
3	9.1	15.1	18.4	22.2	28.4	25.3	25.0	18.3	22.1
4	8.9	15.1	18.3	22.1	28.4	25.3	24.9	18.3	22.1
5		15.1	18.3	22.1	28.4	25.3	24.9	18.3	22.1
6	8.8	15.1	18.2	22.0	28.1	25.0	24.9	18.3	22.1
7		15.1	18.1	22.0	28.0	24.9	24.8	18.2	22.0
8	8.7	15.0	18.0	21.7	27.6	24.6	24.5	18.2	21.9
9		14.9	17.9	21.6	26.5	24.3	24.3	18.2	21.6
10	8.4	14.9	17.6	21.2	25.4	23.7	23.8	18.2	21.2
11			16.8	20.5	24.2	23.2	23.2	18.1	20.3
12	8.2	14.8	16.4	19.4	22.7	22.3	21.9	18.1	19.9
13			15.6	18.3	20.9	21.1	20.6	18.0	19.3
14	8.1		15.2	16.5	19.2	19.6	19.4	18.0	18.6

	Dissolved Oxygen (mg/L)								
Depth (ft)	Apr	May	Jun		Jul		Aug	Sep	Oct
1	22.3	10.1	10.7	7.1	8.4	6.6	6.9	7.2	6.4
2	11.2	10.1	10.9	7.0	8.4	6.4	6.8	7.1	6.3
3	11.2	10.1	11.0	6.9	8.4	6.3	6.9	7.0	6.2
4	11.2	10.1	11.2	6.9	8.2	6.2	6.9	7.0	6.1
5		10.1	11.2	6.9	7.6	5.5	7.0	6.9	6.1
6	11.2	10.1	11.2	6.8	7.1	2.1	7.0	6.9	6.1
7		10.1	11.1	6.4	3.3	1.2	6.8	6.8	6.0
8	11.1	9.9	10.5	5.0	0.9	0.7	3.8	6.8	2.6
9		9.6	9.4	4.0	0.5	0.5	1.8	6.8	1.2
10	11.1	9.5	7.1	2.9	0.4	0.4	0.8	7.0	0.5
11			4.2	1.2	0.3	0.4	0.6	7.0	0.4
12	10.8	9.4	2.4	0.6	0.3	0.3	0.5	7.0	0.4
13			1.1	0.4	0.2	0.3	0.4	6.9	0.4
14	10.7		0.7	0.4	0.2	0.3	0.4	6.8	0.3

	Chlorophyll (RFU)								
Depth (ft)	Apr	May	Jun		Jul		Aug	Sep	Oct
1	-1.7	-0.8	-0.9	-0.4	4.1	0.6	-0.9	-0.2	-0.5
2	-1.3	-1.0	-0.8	-0.7	4.5	0.7	-0.6	-0.3	-0.8
3	-1.4	-0.9	-1.0	-0.7	4.4	0.9	-0.5	-0.3	-0.5
4	-0.9	-0.9	-0.9	-0.8	4.3	0.8	-0.3	-0.3	-0.7
5		-0.8	-1.0	-0.6	4.8	1.0	-0.4	-0.3	-0.8
6	-0.3	-0.8	-0.9	-0.7	4.7	0.6	-0.6	-0.5	-0.6
7		-0.9	-1.0	-0.8	3.4	0.7	0.0	-0.4	-0.5
8	-0.3	-0.8	-0.9	-0.7	6.9	9.5	1.3	-0.6	42.1
9		-0.8	-0.9	-0.5	3.1	7.6	5.0	-0.4	2.9
10	-0.3	-0.7	-1.0	-0.5	0.3	3.4	27.4	-0.2	-0.6
11			-0.8	-1.0	0.0	5.3	16.3	-0.4	-0.3
12	-0.5	-0.6	-0.7	-0.6	-0.2	2.0	3.3	-0.4	-0.3
13			-0.8	0.5	0.6	0.8	2.0	-0.5	-0.2
14	-0.8		-0.9	0.5	1.0	0.4	1.2	-0.5	-0.1

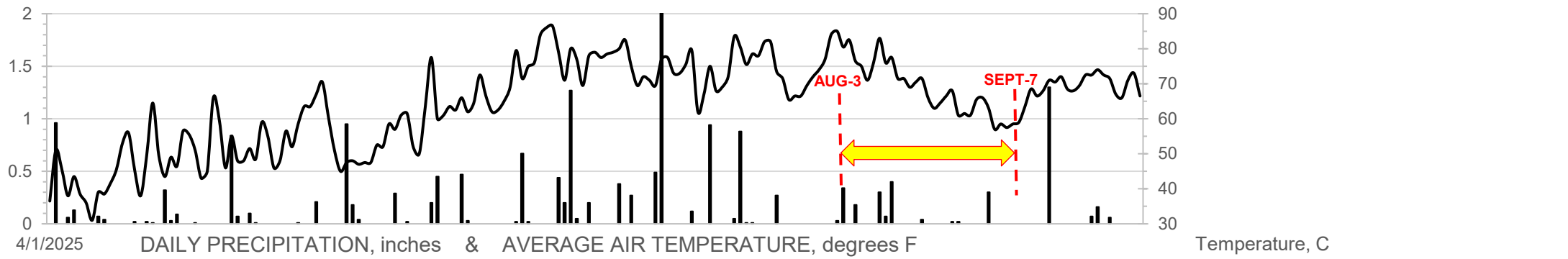
	Phycocyanin (RFU)								
Depth (ft)	Apr	May	Jun		Jul		Aug	Sep	Oct
1	0.4	0.2	0.0	0.0	0.2	-0.1	-0.8	-1.1	-0.9
2	0.5	0.2	0.1	0.0	0.1	-0.1	-0.8	-1.1	-0.9
3	0.5	0.2	0.1	0.0	0.1	-0.1	-0.8	-1.1	-0.9
4	0.5	0.2	0.1	0.0	0.1	-0.2	-0.8	-1.1	-0.9
5		0.2	0.1	0.0	0.1	-0.2	-0.8	-1.1	-0.9
6	0.5	0.2	0.1	0.0	0.2	-0.2	-0.8	-1.1	-1.0
7		0.1	0.1	0.0	0.0	-0.2	-0.7	-1.1	-0.9
8	0.6	0.2	0.1	0.0	1.4	4.9	-0.6	-1.2	1.8
9		0.2	0.1	0.0	1.0	3.3	0.9	-1.2	-0.3
10	0.6	0.1	0.1	0.0	1.0	7.1	7.9	-1.1	-0.8
11			0.1	0.1	1.6	5.9	6.4	-1.1	-0.7
12	0.5	0.1	0.2	0.4	0.8	2.2	1.5	-1.1	-0.8
13			0.2	0.7	0.3	0.9	0.6	-1.1	-0.8
14	0.5		0.2	0.8	0.5	0.6	0.7	-1.1	-0.7



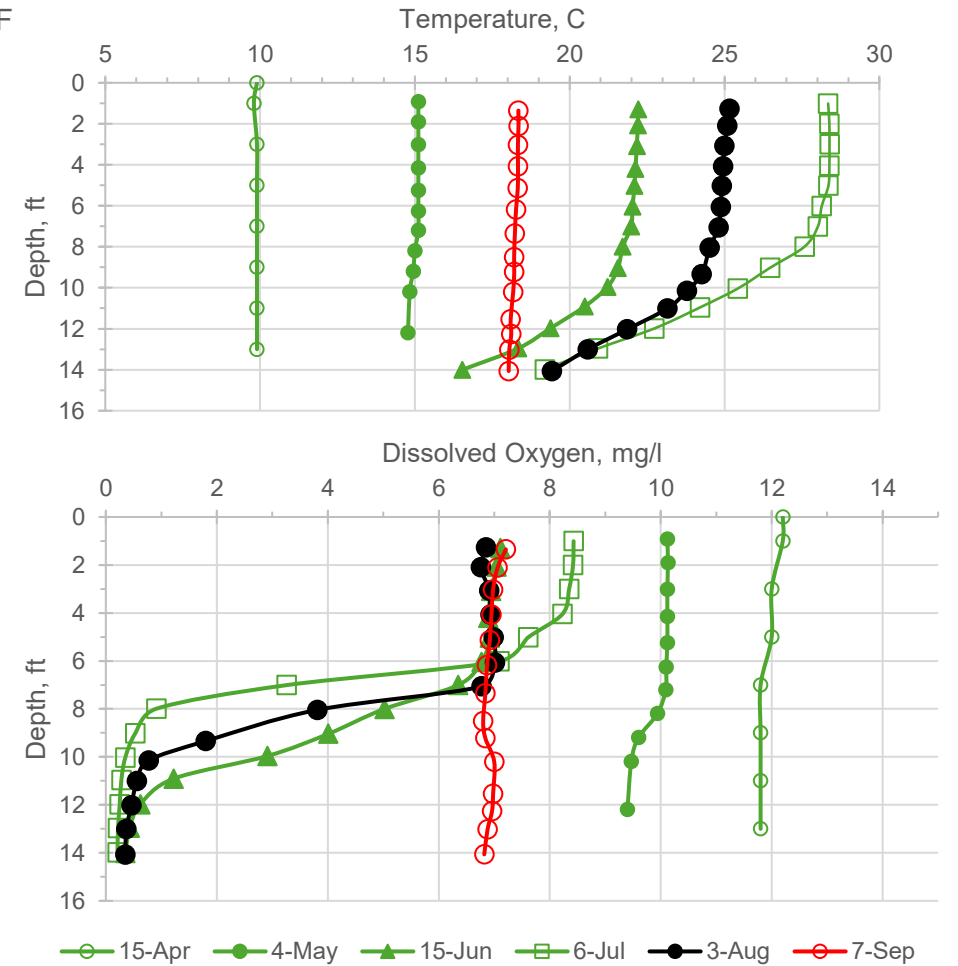
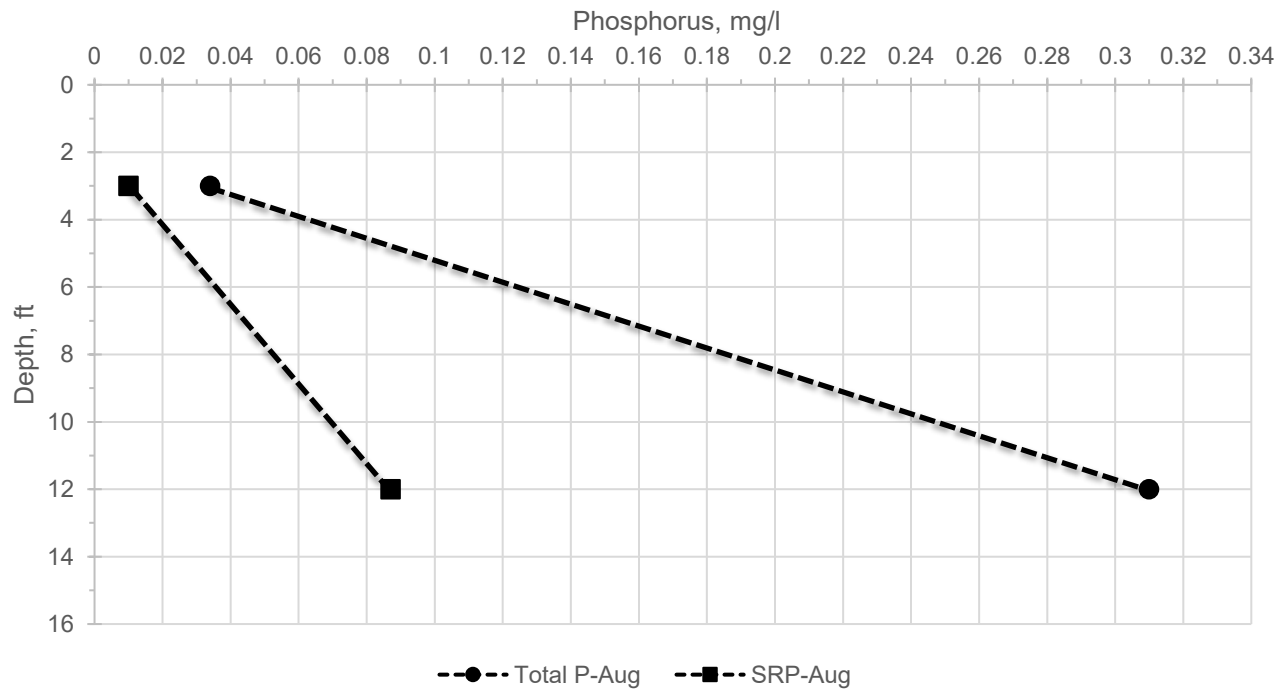
Indicates
Secchi
depth

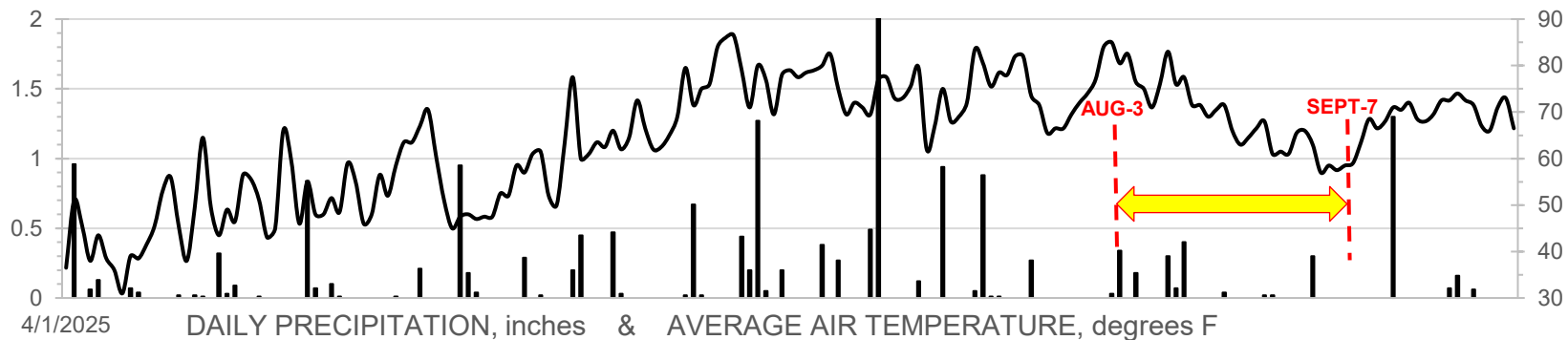
OUTLINE

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- History
- Measurement methods
- Seasonal evolution of the lake
- **Effects of internal loading**
- Impact of diurnal variation
- Observations and conclusions
- Future plans

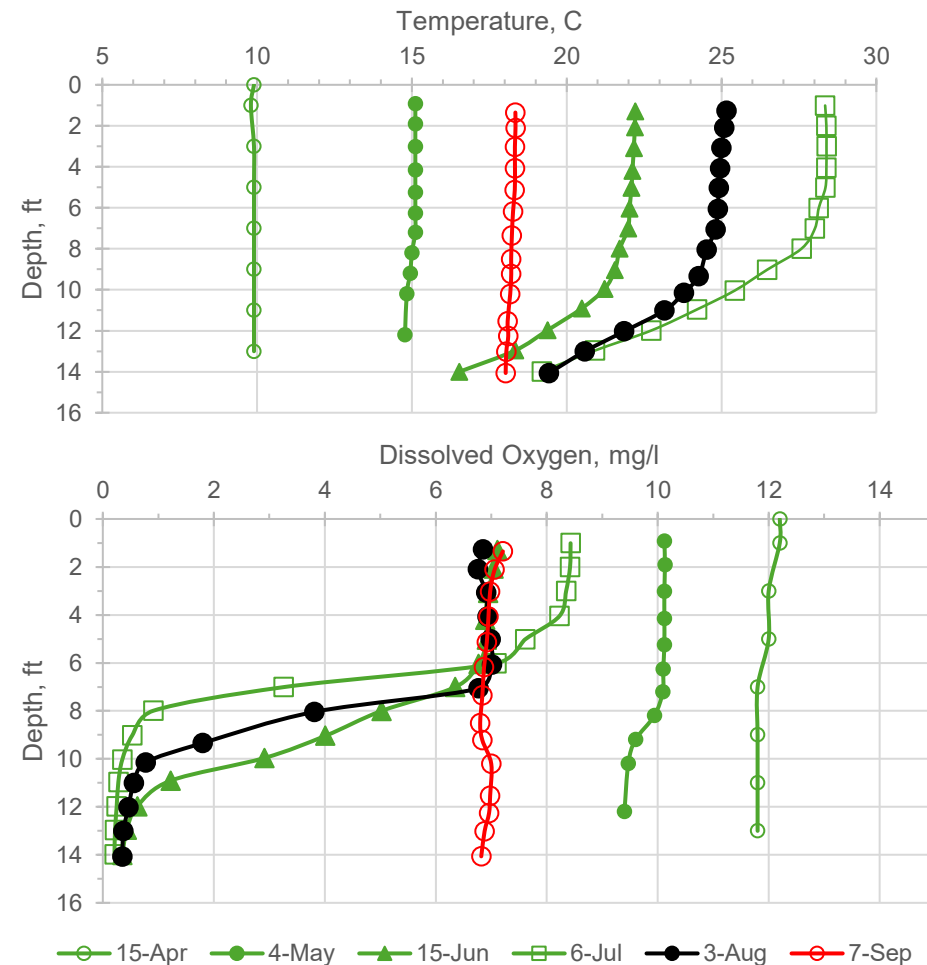
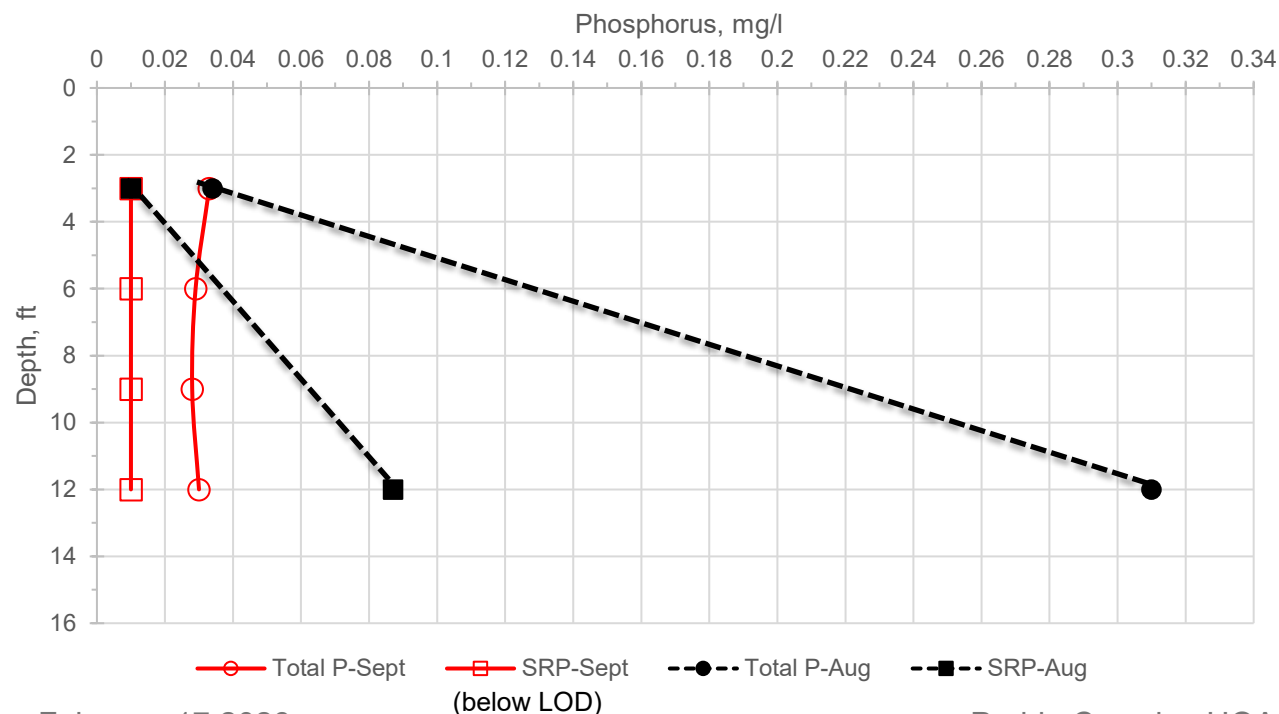


Main Sample Location





Nutrient profile (P) became uniform with depth after mid-summer turnover, suggesting mixing occurred



Oxygen depletion leads to redox-related release of nutrients and minerals

20 Phosphorus transfer and cycle in freshwater systems

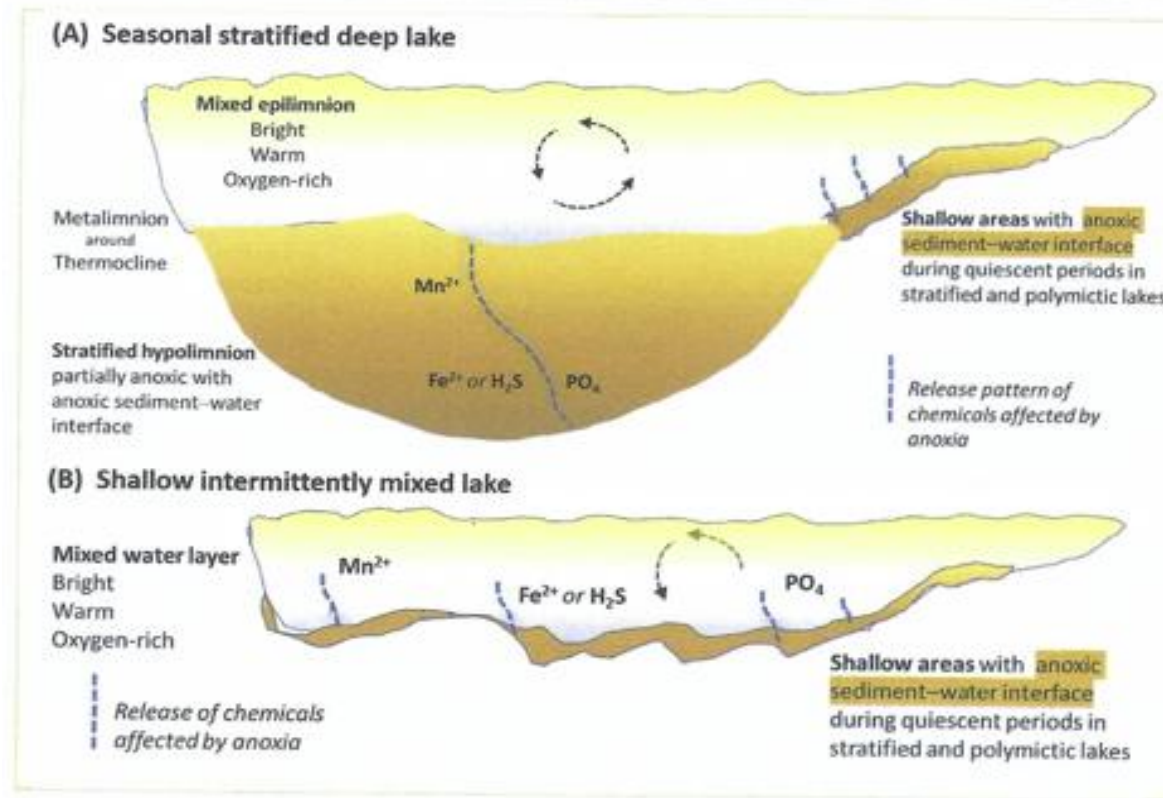
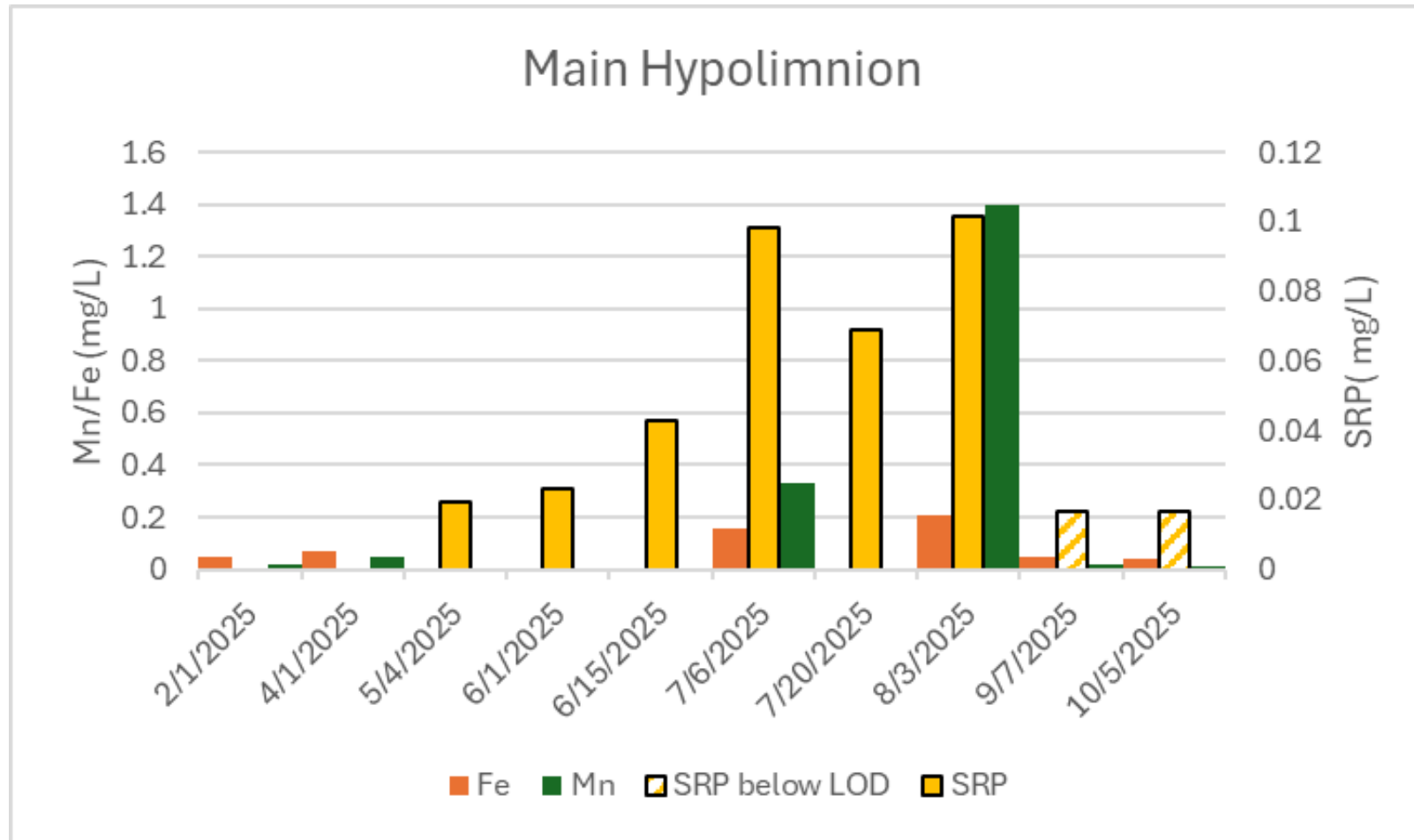


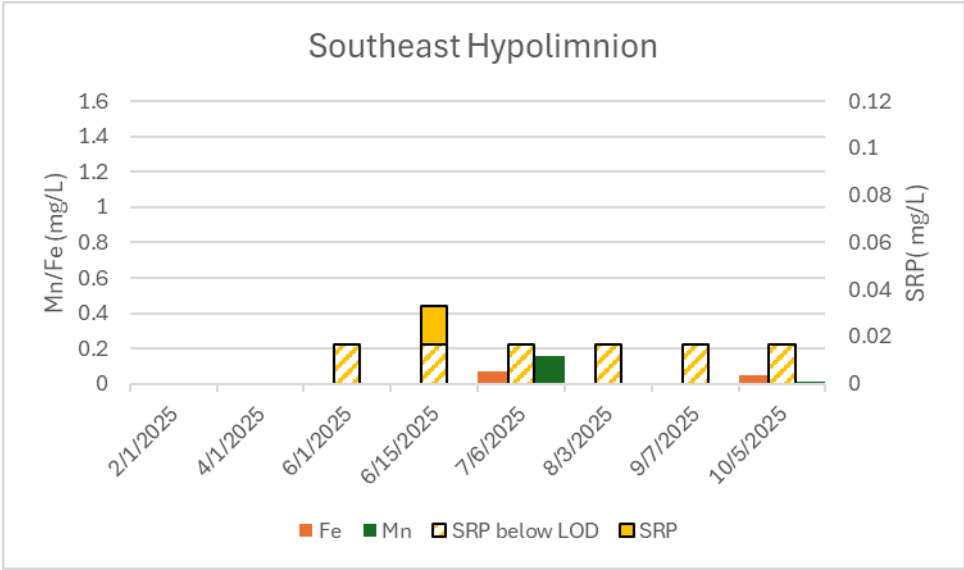
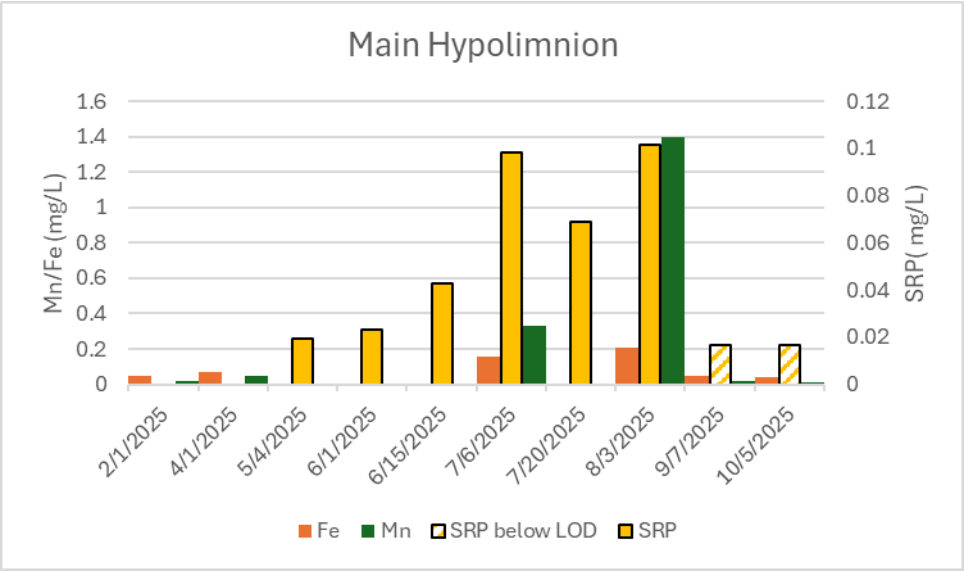
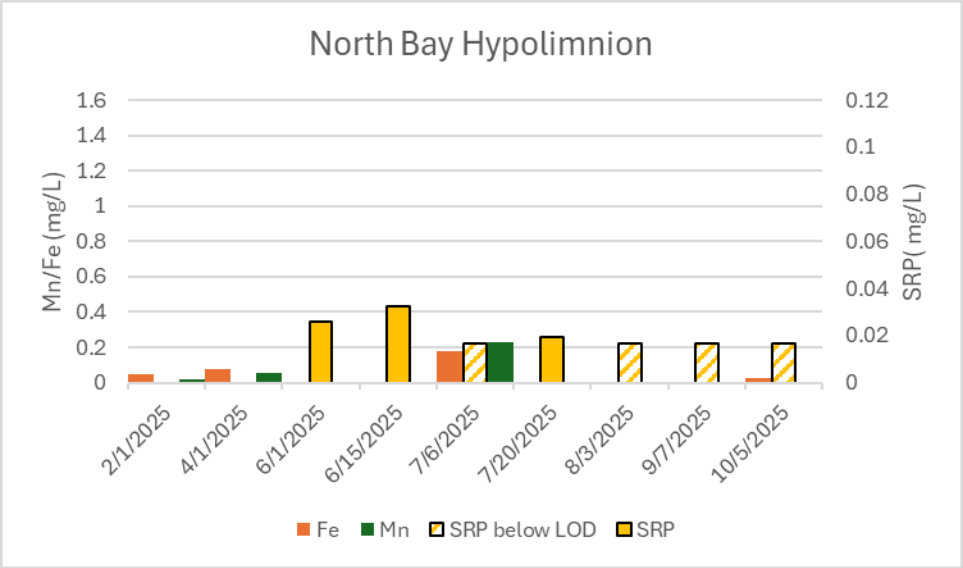
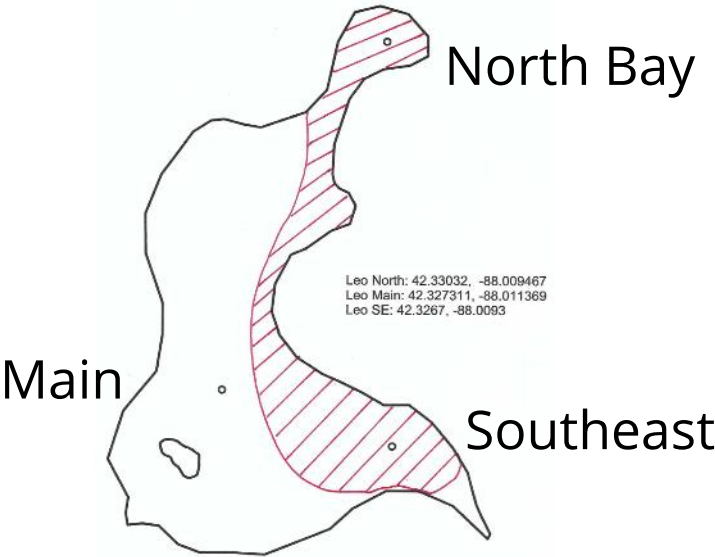
Figure 2.8 Differing mixing regimes leading to different oxygen depletion and redox-related release of phosphorus, metals, and reduced gases in stratified lakes (A) and in polymictic shallow lakes (B). (Stratified lakes have variable shallow areas with anoxic sediment interface.)

Reference: “Lake Functioning” by Gertrude Nürnberg, CRC Press, 2025

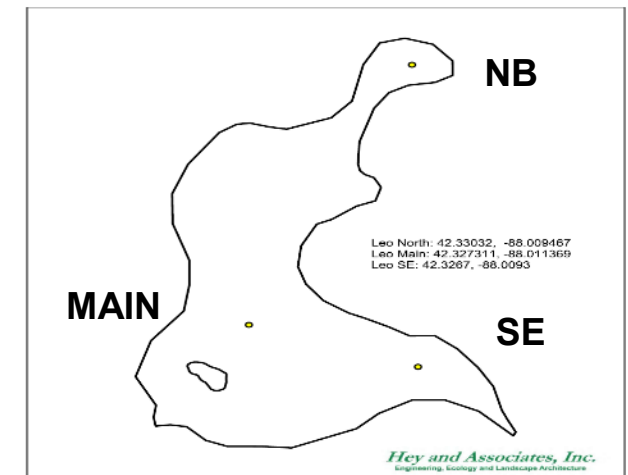
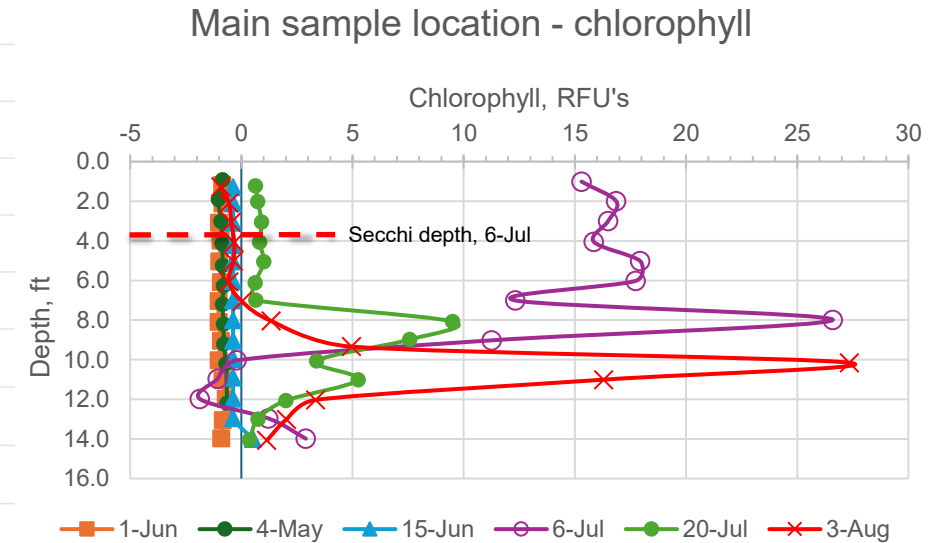
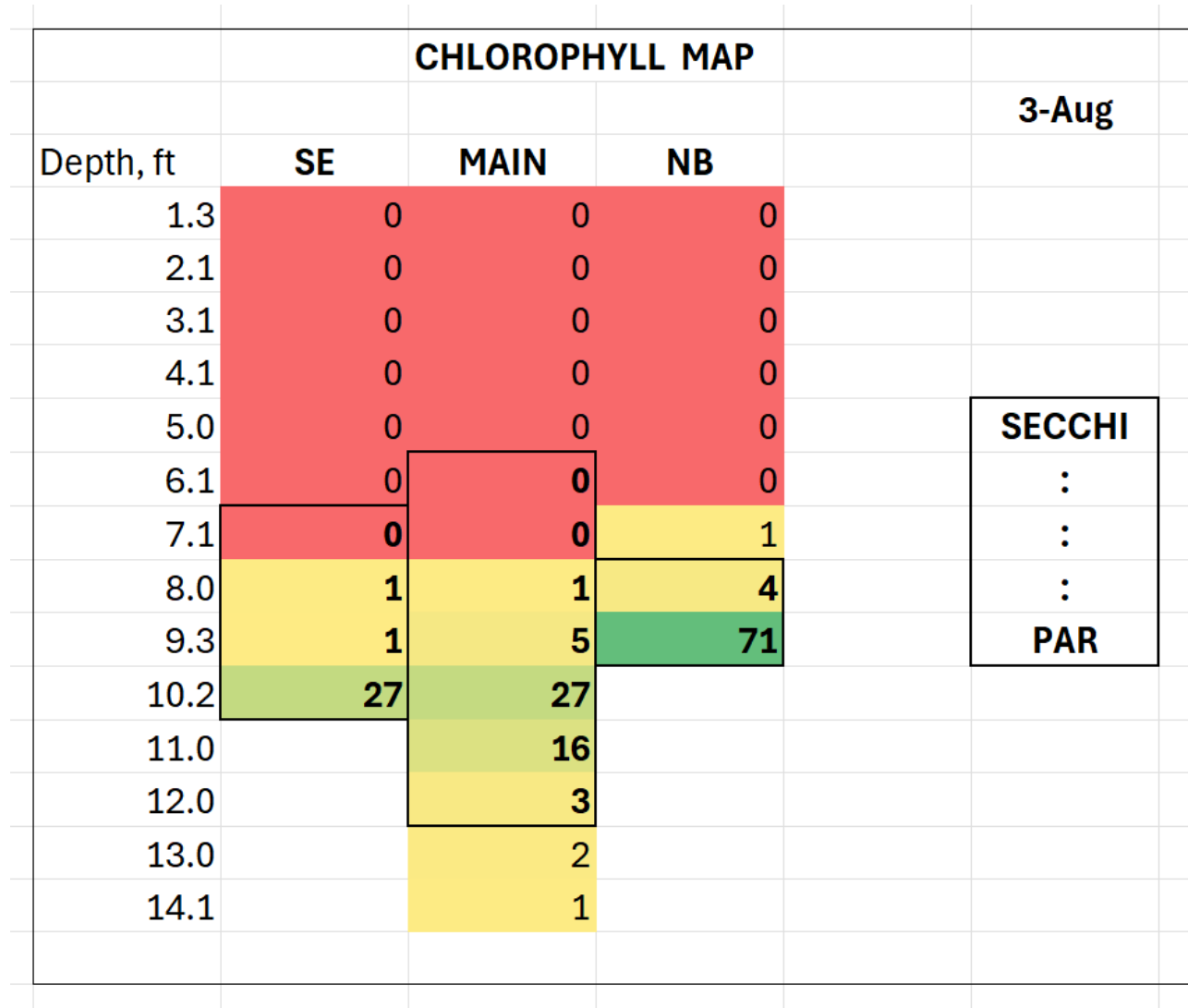
Redox and pH conditions coincide with an increase in Mn & Fe, concurrent with SRP increase



Fe, Mn, P higher at Main sample point – compared to treated areas



Chlorophyll map by location shows highest levels in the most impaired area: North Bay



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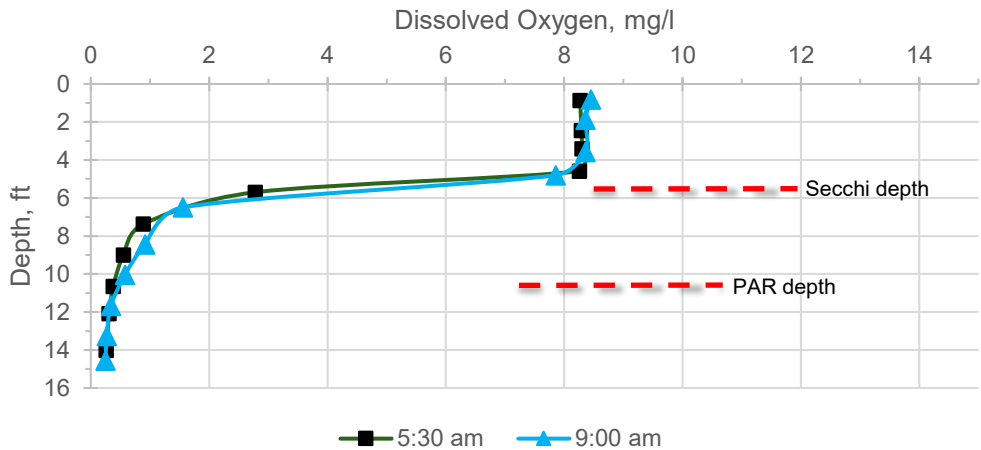
Diurnal variation of water quality parameters:

"Does it matter?"

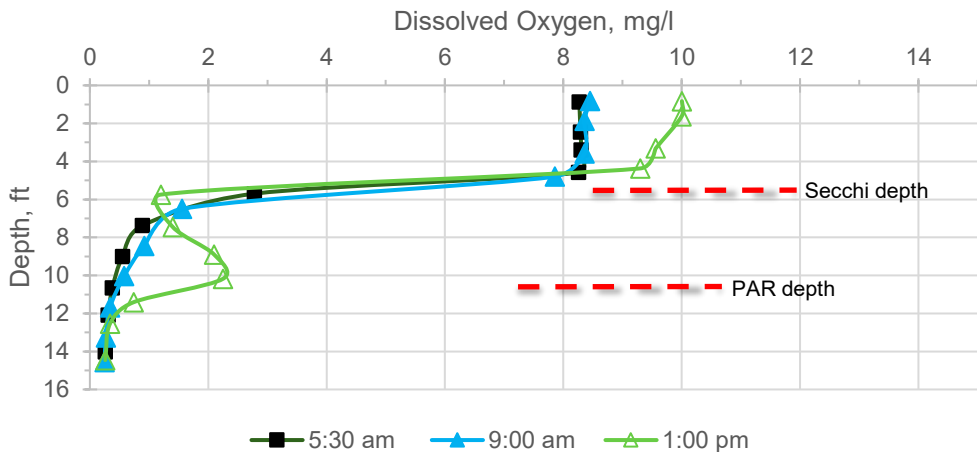
- Availability of equipment and volunteers impacts the timing of when measurements can be taken
- DO and pH variation throughout the day is well known
- How does our particular lake behave throughout the day?
 - Impact on measurements
 - Implications for treatment

Dissolved oxygen profile evolves throughout the day

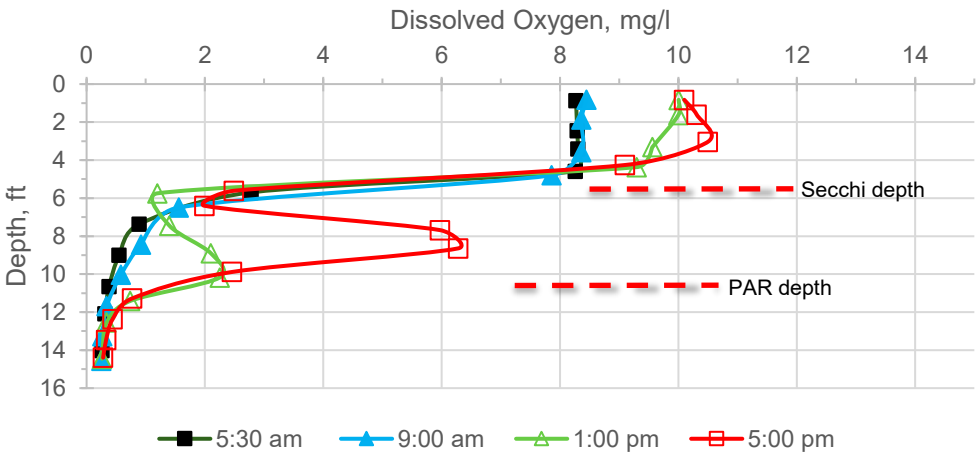
Lake Leopold - July 27 - Main sample location



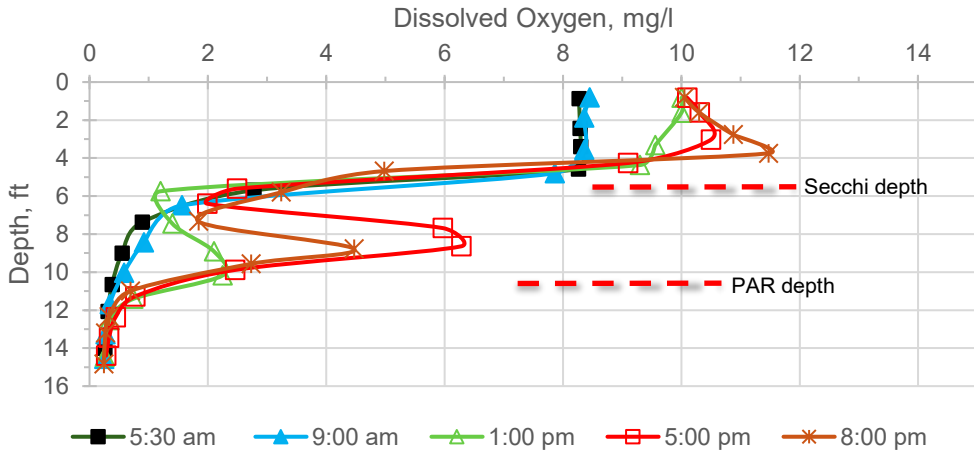
Lake Leopold - July 27 - Main sample location



Lake Leopold - July 27 - Main sample location



Lake Leopold - July 27 - Main sample location



Diurnal Cycle - Lake Leopold- Main Sample Location

"It matters what time you measure."

Temp. C	26-Jul	27-Jul	27-Jul	27-Jul	27-Jul	27-Jul
Depth, ft	8:00 pm	5:30 am	9:00 am	1:00 pm	5:00 pm	8:00 pm
0.8	28.2	27.3	27.9	29.5	31.1	30.4
1.6	28.2	27.3	27.8	29.2	30.9	30.4
3.3	28.1	27.4	27.5	29.0	29.2	29.3
4.4	27.2	27.4	27.4	27.9	28.1	27.7
5.7	26.4	26.7	26.2	26.6	26.9	27.0
7.4	25.2	25.5	25.1	25.8	25.7	25.9
8.9	24.2	24.6	24.2	24.8	25.0	24.9
10.2	23.5	23.5	22.5	24.1	22.9	23.4
12.5	22.1	22.2	20.7	21.4	20.4	20.3
14.5	19.9	19.7	18.8	19.1	19.0	18.8

DO, mg/L	26-Jul	27-Jul	27-Jul	27-Jul	27-Jul	27-Jul
Depth, ft	8:00 pm	5:30 am	9:00 am	1:00 pm	5:00 pm	8:00 pm
0.8	10.8	8.27	8.45	10.0	10.1	10.1
1.6	10.8	8.29	8.36	10.0	10.3	10.3
3.3	10.4	8.3	8.36	9.6	10.5	10.9
4.4	5.2	8.26	7.86	9.3	9.1	5.0
5.7	2.0	2.78	1.56	1.2	2.5	3.2
7.4	2.0	0.89	0.92	1.4	6.0	1.8
8.9	0.9	0.55	0.58	2.1	6.3	4.5
10.2	0.4	0.38	0.34	2.3	0.8	0.7
12.5	0.3	0.31	0.27	0.3	0.3	0.3
14.5	0.3	0.26	0.25	0.3	0.3	0.2

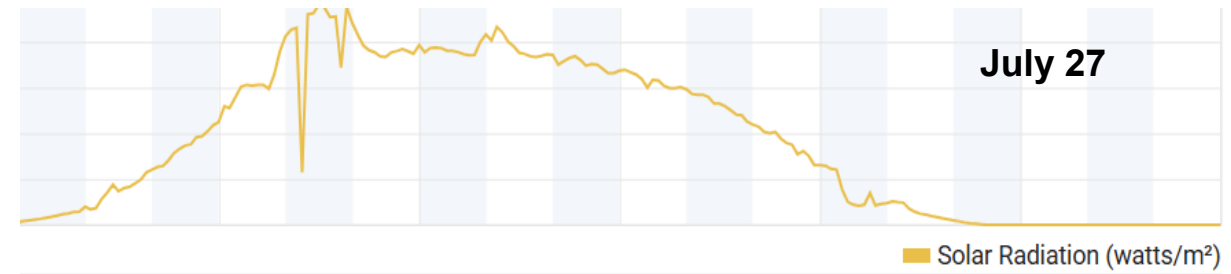
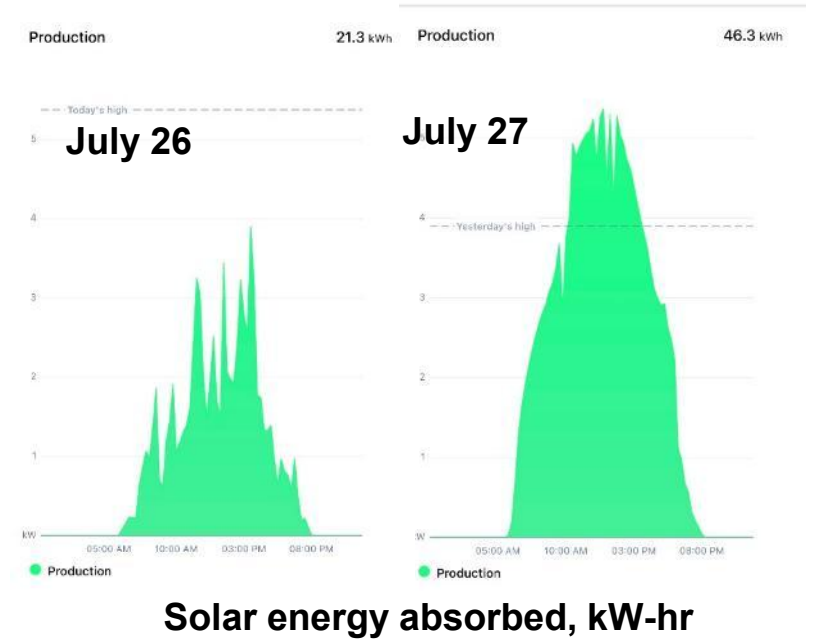
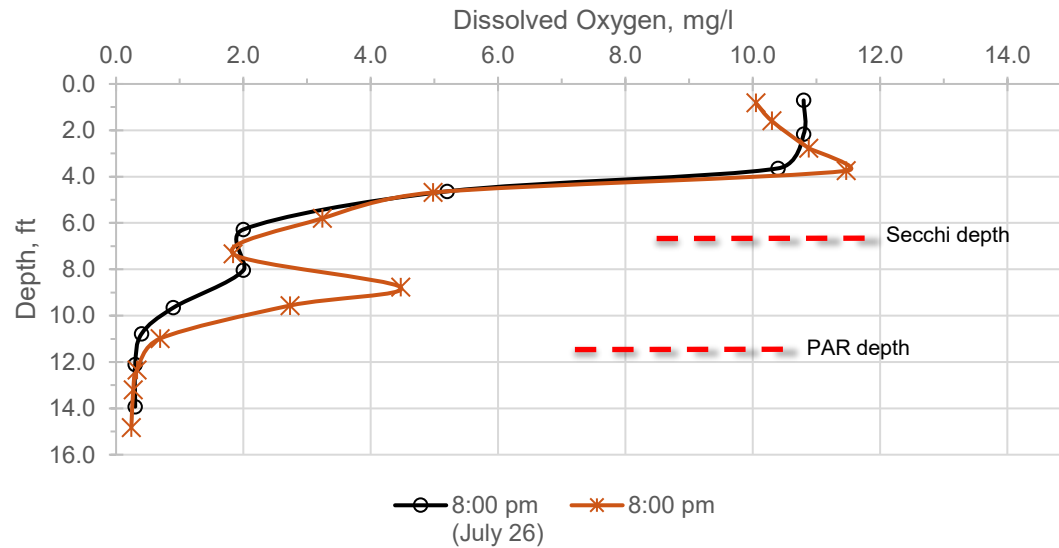
Chlor. RFU	26-Jul	27-Jul	27-Jul	27-Jul	27-Jul	27-Jul
Depth, ft	8:00 pm	5:30 am	9:00 am	1:00 pm	5:00 pm	8:00 pm
0.8	0	0	0	0	0	0
1.6	0	1	0	0	0	0
3.3	1	0	0	0	0	1
4.4	1	0	0	0	0	1
5.7	1	1	1	1	1	2
7.4	0	1	0	1	1	1
8.9	5	1	10	11	1	2
10.2	34	12	2	3	15	5
12.5	20	27	1	1	1	6
14.5	1	2	1	1	1	1

Phyco. RFU	26-Jul	27-Jul	27-Jul	27-Jul	27-Jul	27-Jul
Depth, ft	8:00 pm	5:30 am	9:00 am	1:00 pm	5:00 pm	8:00 pm
0.8	0	0	0	0	0	0
1.6	0	0	0	0	0	0
3.3	0	0	0	0	0	0
4.4	0	0	0	0	0	0
5.7	0	0	0	0	0	0
7.4	0	0	0	0	0	0
8.9	11	2	10	2	0	1
10.2	16	12	1	11	7	5
12.5	10	13	0	1	1	2
14.5	0	1	1	0	0	1

NOTE: Bold offsets indicate Secchi-to-PAR region

Dissolved oxygen profiles impacted by sunlight (photosynthesis)

Lake Leopold - Main Sample Location - July 27 vs. July 26



Conclusion on the effects of diurnal variation

- Our regular 9:00 - 11:00am time window is okay for our measurement by volunteer lake monitors.
- Variable measurement times may have an impact on treatment decisions, if aquatics contractor scheduling limits the consistency of visit time of day.

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Observations and Conclusions

- Targeted treatment strategy dramatically improved water quality near swimming beach.
- Data indicate internal loading is the primary mechanism adding nutrients to Lake Leopold, fueling plant and algae growth:
 - Severe hypolimnetic anoxia, low redox potential
 - Increasing TP and SRP with depth
 - Increasing TP and SRP throughout summer
 - Concomitant iron and manganese
 - Phytoplankton blooms with turnover
- Lake Leopold has limited sediment accumulation;
 - Aquatic plant and algae decay are the most likely source of sediment,
 - Sediment P content is not high; but is sufficient to be a source of internal loading under anoxic conditions.
- Lake Leopold is polymictic.



Future Plans

- Implement trial treatments on sediment and water column in North Bay to improve dissolved oxygen levels, lock-up phosphorus, and manage muck chemically and/or with organic digestion; assess effectiveness with more detailed sediment analysis and water quality measurements.
- Investigate potential impact of Sanctuary Pond on Lake Leopold; capture flow measurements coincident with a rainfall event.
- Increase monitoring of environmental data (air temperature, sunlight/cloud cover, wind.) Increase frequency of measuring water temperature profiles as an early indicator.
- Long term: develop a comprehensive lake management plan.

Acknowledgements

- YSI Xylem
- Lake County Lake Lovers: Mary Eggert, Paul Spiewak
- Hey and Associates: Leonard Dane, Jeremy Husnick, et.al.
- Pace Analytical
- Jim Bland
- ILM Environments: Chris Ryan, Emily Zajecka
- Prairie Crossing Homeowners Association:
 - Board of Directors
 - Lake Management Committee

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- John Schuster is chair of the Lake Management Committee for the Prairie Crossing Homeowners Association. He has held positions in engineering and technical management with Continental Automotive and Motorola's automotive electronics groups in research, product development, and manufacturing of sensors and transducers for measurement and control systems. Prior experience includes R&D on topics related to combustion, emissions formation, and air quality at Ford's Scientific Research Laboratory and NASA's Glenn Research Center. He received a Master of Science in Mechanical Engineering from Cornell University, a Bachelor of Science in Engineering Science from the University of Miami and has completed studies in electrical engineering at the Illinois Institute of Technology.

A wide-angle photograph of a sunset over a calm lake. The sky is filled with dramatic, dark clouds tinged with orange and pink from the setting sun. The sun is a bright, glowing orb on the horizon, reflecting its light across the water. In the background, a row of houses is visible, their silhouettes and some lights reflecting in the lake. A large, dark tree stands on the left side of the frame, its branches partially obscuring the sky. The foreground is a grassy area with some reeds or tall grasses near the water's edge.

Thank you!