Montgomery County - Water Quality Advisory Group Meeting
September 9, 2024 (7:00 - 8:30 pm) – Draft Meeting Notes

I. Notetaker: Amy Stevens

II. Attendance:
   a. Present: Tracey Rouleau (Chair), Amanda Rockler, Bob Buglass, Travis Gorleski, Keith Brooks, Linda Silversmith, Phillip Mariscal, Miranda Reid, Mark Symborski, Amy Stevens, Dr. Kevin Sellner (guest)
   b. Not present: Allison Wright, Tim Stemann

III. Introductions of WQPC Members

IV. New Business
   a. Presentation was provided by Dr. Kevin Sellner from the Center for Coastal and Watershed Studies, Hood College. Dr. Sellner provided a presentation on the Role of Internal Phosphorus Loading in Linaganore Lakes Cyanobacteria Production. This study was a partnership between the Center for Coastal and Watershed Studies, Hood College, and Center for watershed Protection. The presentation focused on the Linganore lakes in Frederick County, MD and the role that Phosphorus has in the presence of harmful algal blooms, cyanobacteria, in lakes. He also provided a summary of actions that could be taken to reduce the likelihood of HAB and provided potential recommendations for Lake Needwood and Lake Frank in Montgomery County. His presentation is included with the meeting notes.

V. Review of the July 15, 2024, meeting summary, no comments or changes from the group

VI. Montgomery County Committee Evaluation and Review Board (CERB) Questionnaire – the WQAG reviewed the questionnaire briefly. WQAG members were going to continue to review and will have discussions at the October meeting.

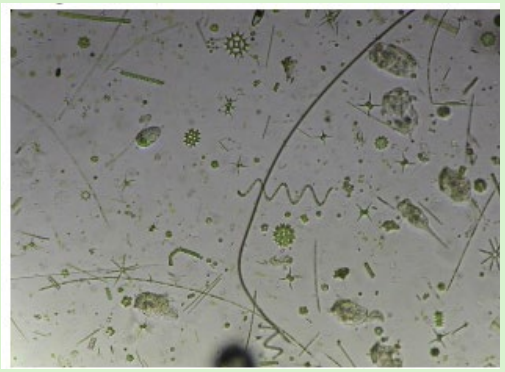
VII. Reports of Officers, Boards, Standing Committees.
   a. None at this time

VIII. Reports of Special Committees.
   a. None at this time

IX. Special Orders.
   a. None at this time

X. Unfinished Business and General Orders.
   a. None at this time

XI. Adjournment.
   a. Next meeting October 21st, 2024
   b. October Notetaker: Mark Symborski



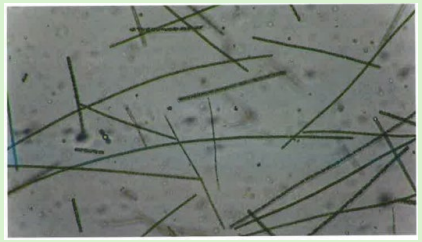
Role of Internal P in Linganore Lakes Cyanobacteria Production

K.G. Sellner[1], D. Ferrier[1], C. Gaudlip[1], K. Cappiella[2], & J. Fox[2]

[1]Center for Coastal & Watershed Studies, Hood College, Frederick, MD

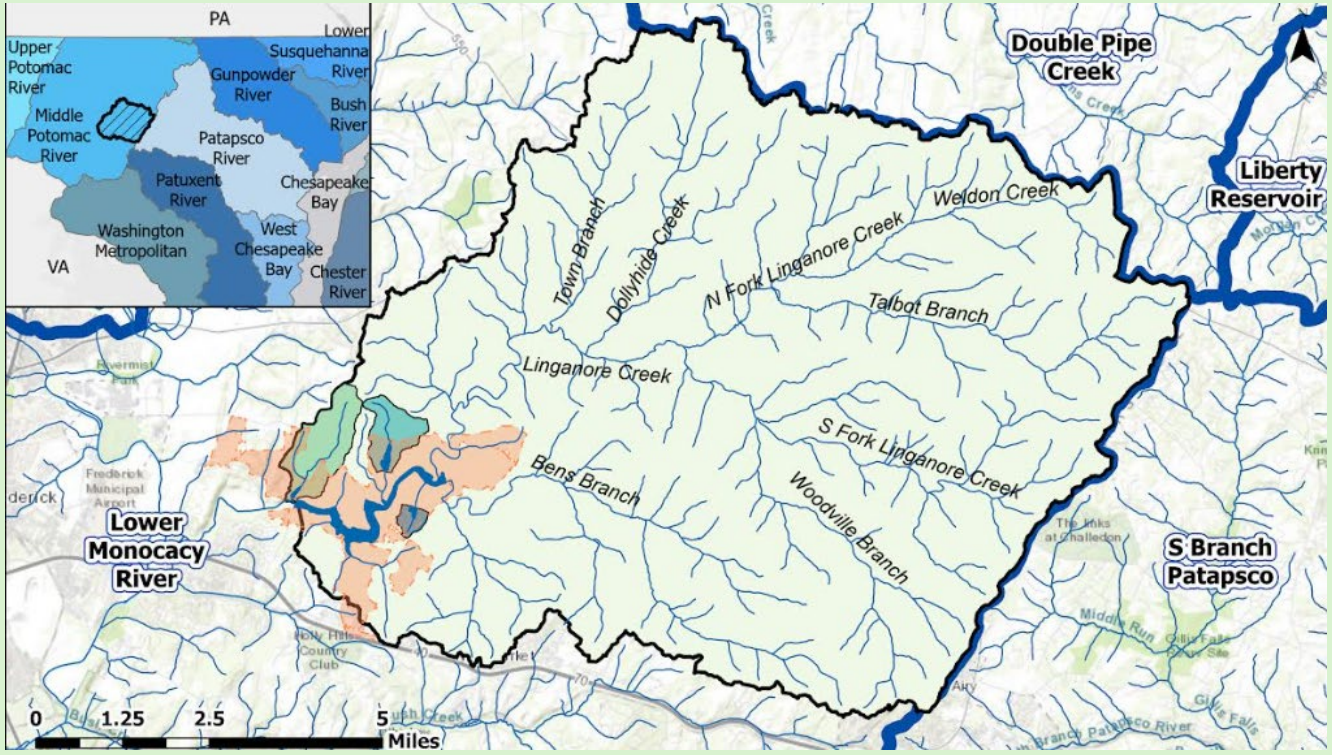
&

[2]Center for Watershed Protection, Ellicott City, MD



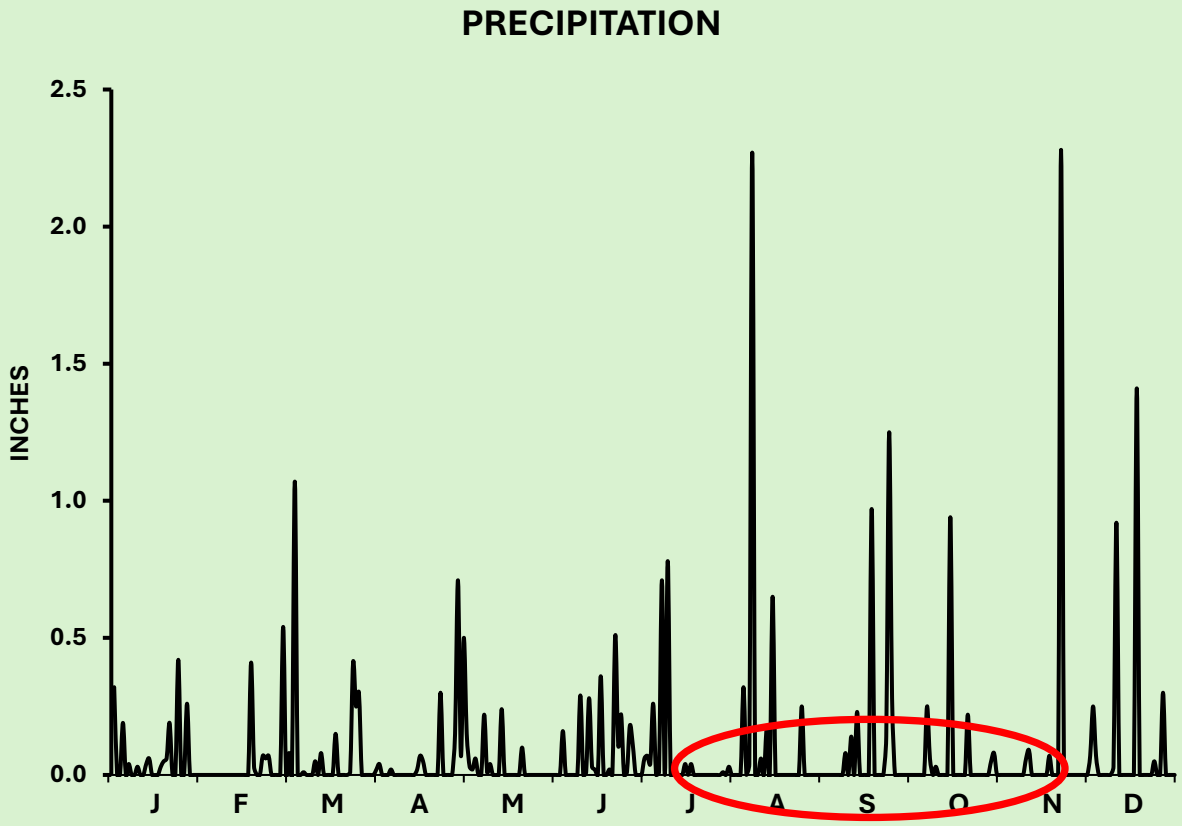
Lakes & Land Use

- Four lakes: Linganore (210 ac), Merle (14), Anita Louise (4), Marian (3)
- Approx. 6,000 residential units (more coming), mini-mall, schools
- Topography: Moderate to steep slopes
- Watersheds: Ag-dominated (3), Residential (1)
- Linganore: Drinking water source



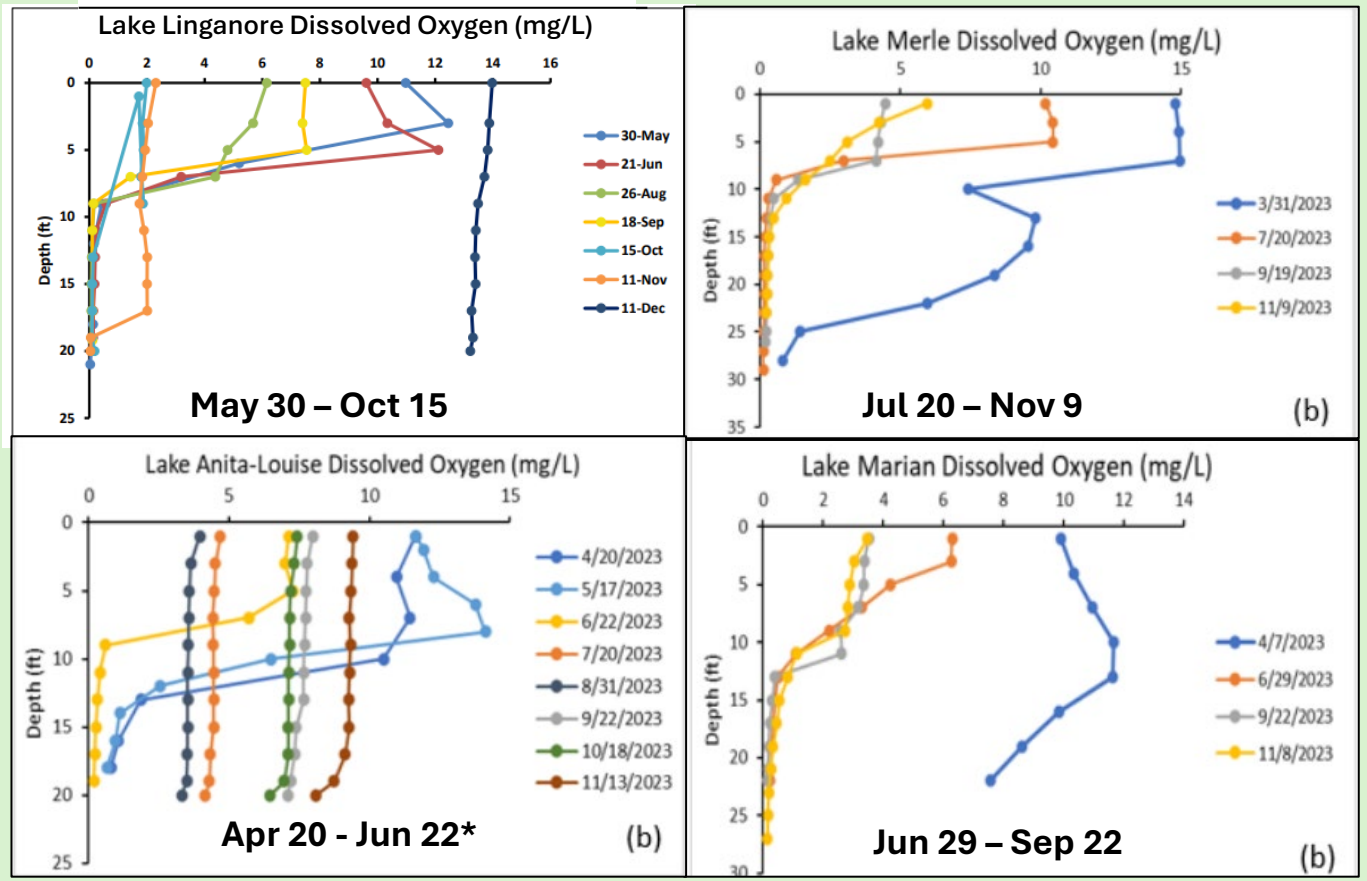
Temperate Lakes of the New Climate

- Water temperatures approach 30°C & sets up June-November stratification
- Epilimnion DIP undetectable, TN/TP ~30
- Summer drought: Stream input minimal – aperiodic intense storms
  - Assumed drought flows/spring flows for the Monocacy (~20%) are characteristic of stream flows and nutrient delivery for Linganore lakes creeks and streams
- Phycocyanin/Chlorophyll indicates cyanobacteria dominance (*Aphanizomenon*, *Dolichospermum*, *Microcystis*; *Planktothrix* at depth)
- Source of phosphorus?



Internal Phosphorus: Hypoxia/anoxia

- Stratified lakes: Hypoxia/anoxia in 45-94% of each lake from spring – fall
- Bottom area for nutrient release
  - E. Linganore – 45%; 1,877 m^2
  - W. Linganore - 94%; 415,658 m^2
  - Merle – 87%; 33,973 m^2
  - Marian – 68%; 7,034 m^2
  - Anita Louise – 0%
- Elevated N, P below thermocline
  - 96 umol N, 37 umol P m^{-2} h^{-1} (Cornwell et al. 2017)



*Aerated from July, 2023 on

Internal P from Hypoxia/Anoxia Zones

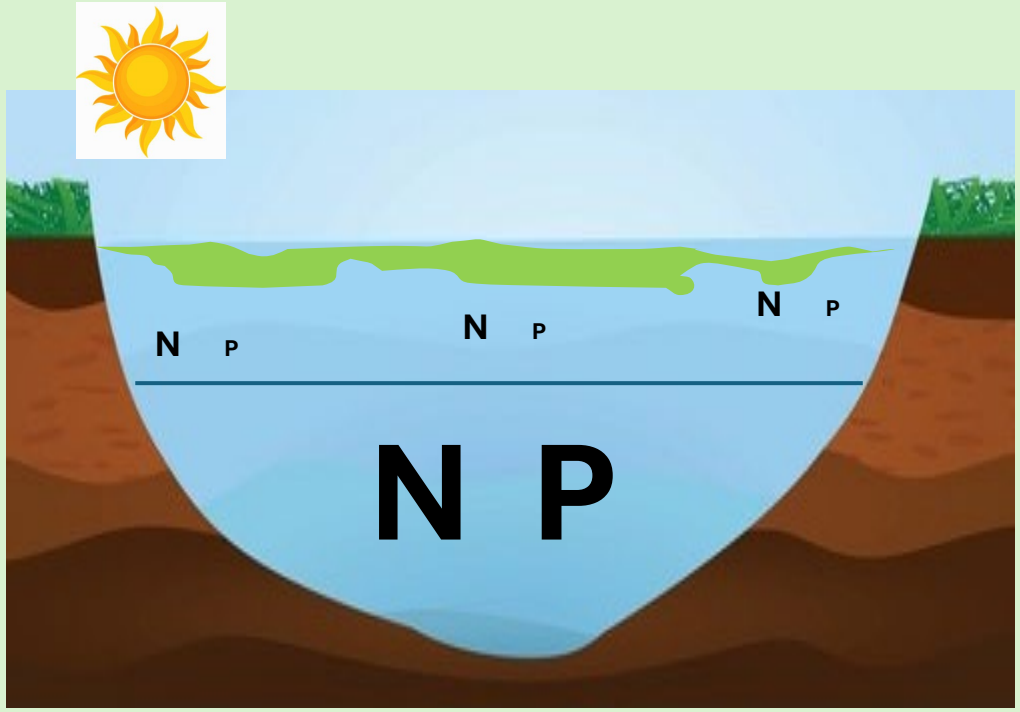
LAKE	EXTERNAL N* (lbsN/d)	INTERNAL ANOX N (lbsN/d)	I/(I+E) %	EXTERNAL P* (lbsP/d)	INTERNAL ANOX P (lbsP/d)	I/(E+I) %
MERLE	6.52	2.40	27	0.46	2.05	82
MARIAN	7.86	0.50	6	0.42	0.42	50
LINGANORE	900.38	29.4	3	50.43	25.05	33
ANITA LOUISE**	2.5	0	0	0.03	0	0

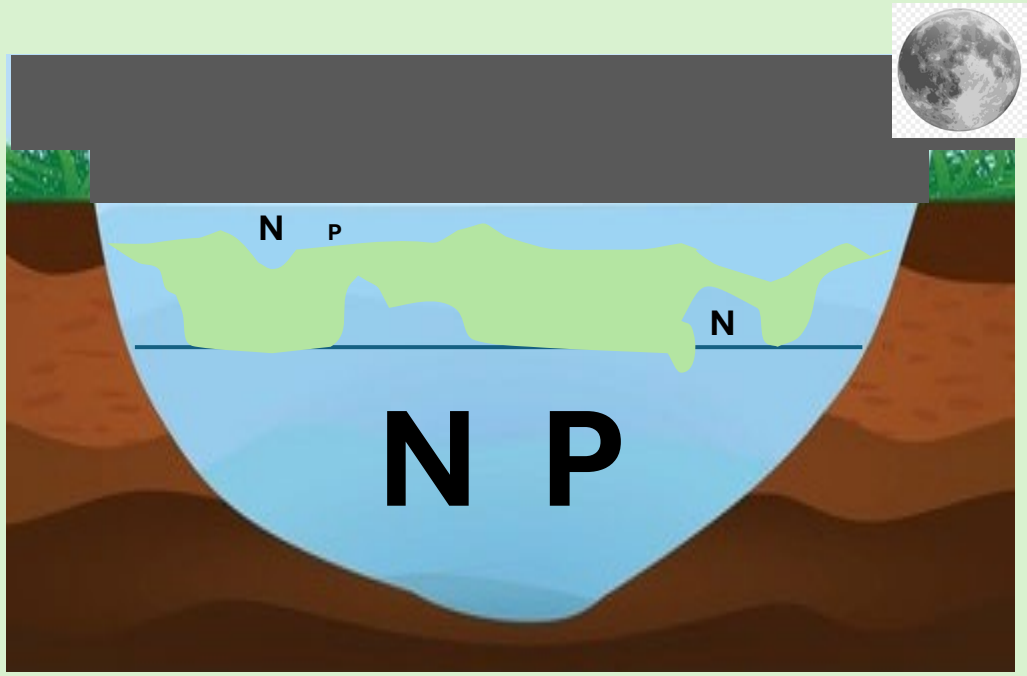
*External loads from GWLF model in Model My Watershed, 1990-2010 precipitation; summer loads 20% of winter-spring loads
**aerated

Cyanobacteria: Diel Buoyancy Control

Gas vesicles and photosynthetic carbohydrate ballast yield diel buoyancy control to access below thermocline P

near-surface aggregation in daylight, nocturnal sinking and nutrient access at depth





Aperiodic mixing events + seiching also possible to deliver bottom P to surface layer

A 2nd Source of Internal Phosphorus: High pH-induced P Flux

DIP released from Fe bound P in bottom iron oxides at pH>9 in 2023

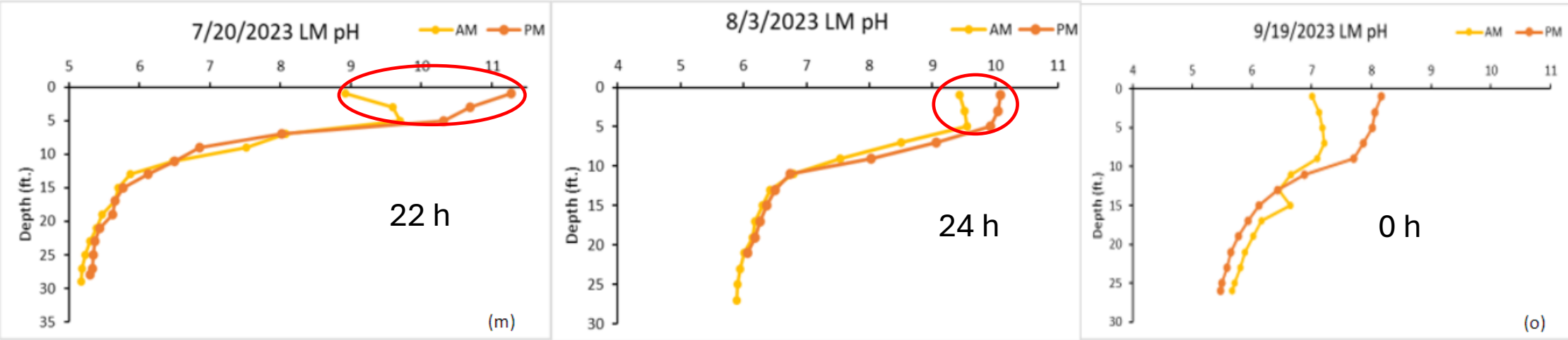


Figure A-3 (m-o). Diel vertical distributions of pH in Lake Merle in 2023.

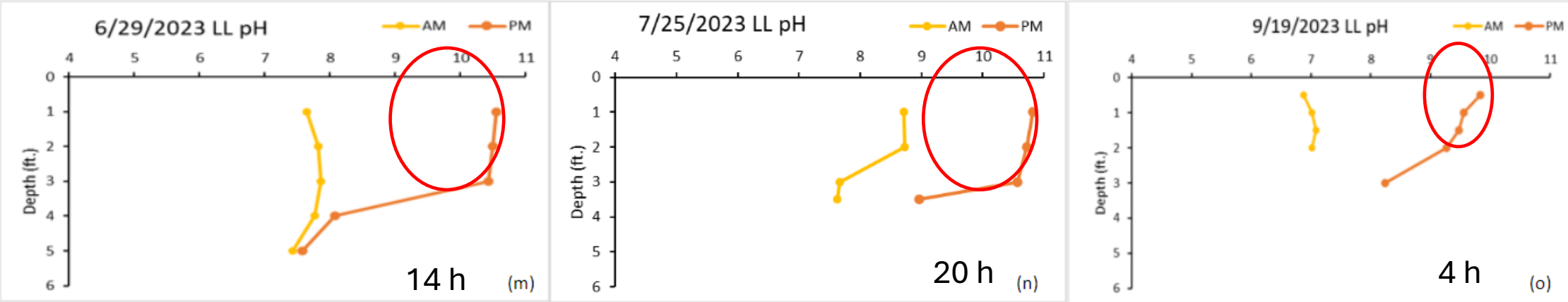


Figure B-3 (m-o). Diel vertical distributions of pH in Lake Linganore in 2023.

Observed 2x (15 & 18 h) in single month sampling in Sep 2015 (MDE), 6x (1-19 h) in Aug-Sep 2017

Aperiodic P Fluxes from pH>9

C uptake in photosynthesis in high biomass blooms results in pH>9

(P fluxes from Seitzinger 1991)

2023

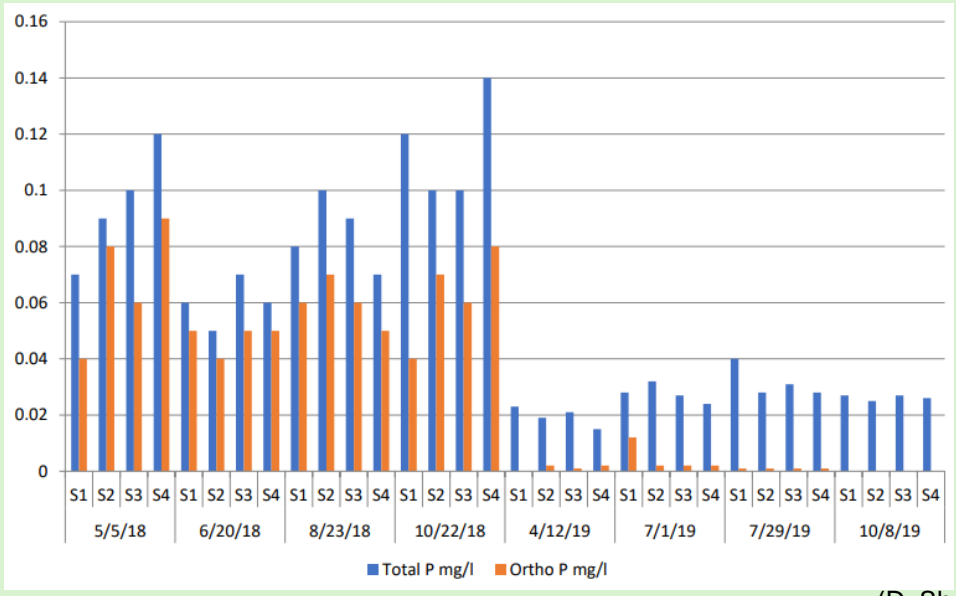
LAKE	LITTORAL ZONE AREA (m2)	MN LITTORAL ZONE P FLUX AT pH>9 (lbs/d & # of obs)	ESTIMATED EXTERNAL P LOAD (lbs/d)	ESTIMATED ANOXIA P FLUX (lbs/d)
MARIAN	2747	0.01 (1)	0.42	0.42
MERLE	7810	0.43 (2)	0.46	2.05
E LINGANORE	61198	2.05 (3)	50.43	0.01
W LINGANORE	102280	3.20 (3)	50.43	25.05

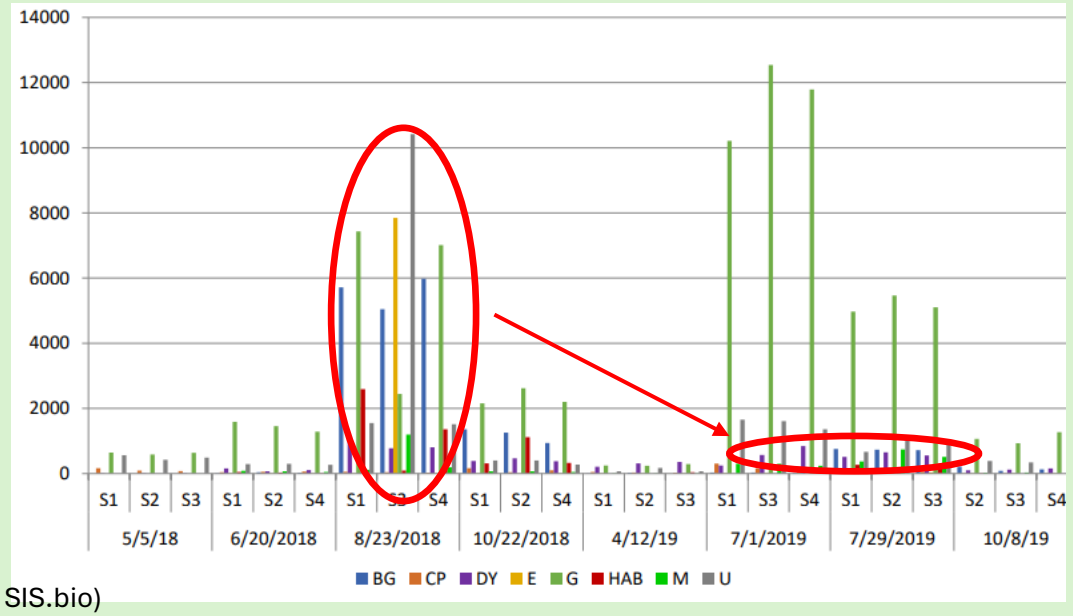
P-specific Mitigation Options

- Short-term: Alum or Phoslock® ($$$)
  - Requires reducing external P loadings

E. Shore 65 ac lake: Phoslock® application 3 x/yr $25K@

- Long-term
  - Mandated watershed BMP implementation ($$)
  - Multi-technology approach, multiple years/continuous ($$$)
    - Oxidize, then aerate bottom sediments (binds P), & mix/aerate water column

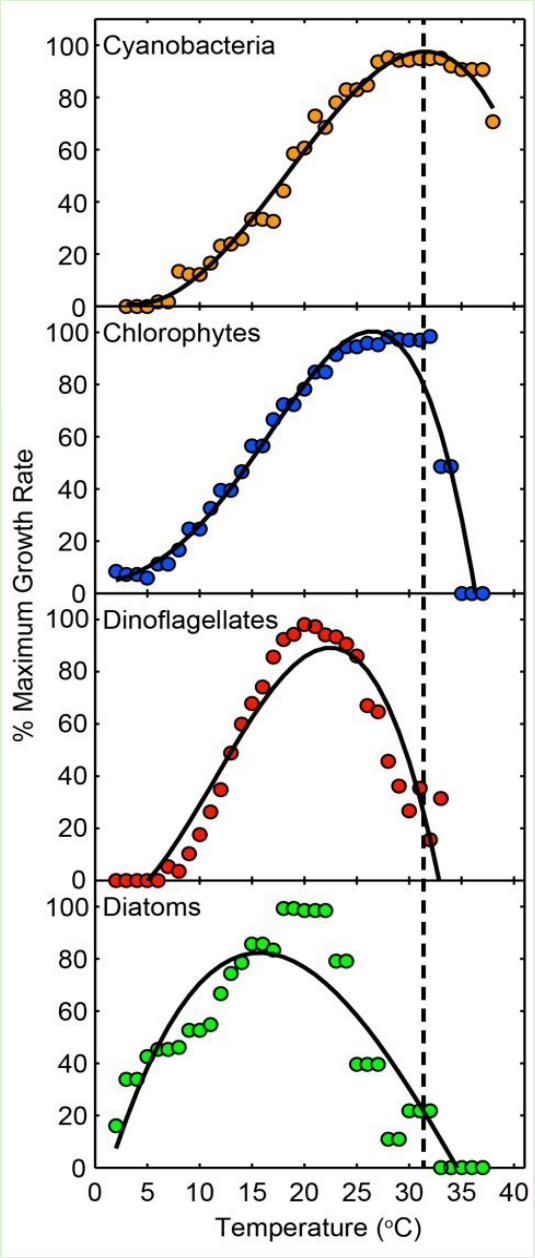




(D. Shackleton, SIS.bio)

Future Issues

- More residential development scheduled for steep topography to yield increased nutrient input
- Summer-fall water temperatures will exceed 30°C

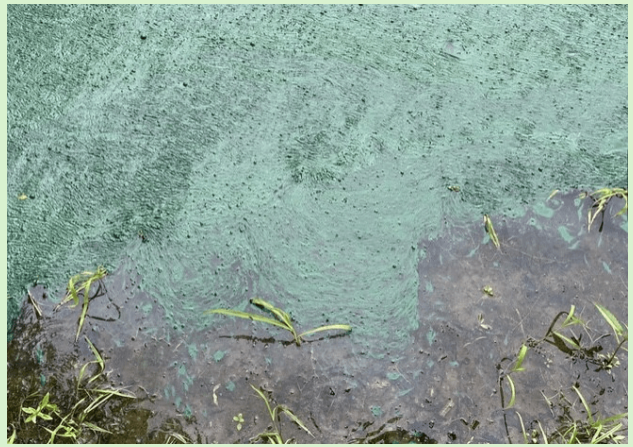


Paerl 2014

Lakes Needwood & Frank

- Reservoirs fed by Rock Creek – summer flows during drought?
- Spillway & discharge? Long or short residence time?
- Needwood 21’, Frank 26’
- Cyanobacteria histories
- Deep enough to stratify
  - Summer thermoclines?
  - Water temps >80°F?
  - Blooms elevate pH>9?

- With high temps, stratification, nutrient input from creek & high pH, ‘seed’ populations = ideal conditions for cyanobacteria blooms & toxins
- TROUBLE AHEAD!



T. Gross, 8/23/2024

THANK YOU!

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