

wood.



Testing Performance Efficiency of Innovative Nutrient Reduction Technologies with In-Situ Mesocosms

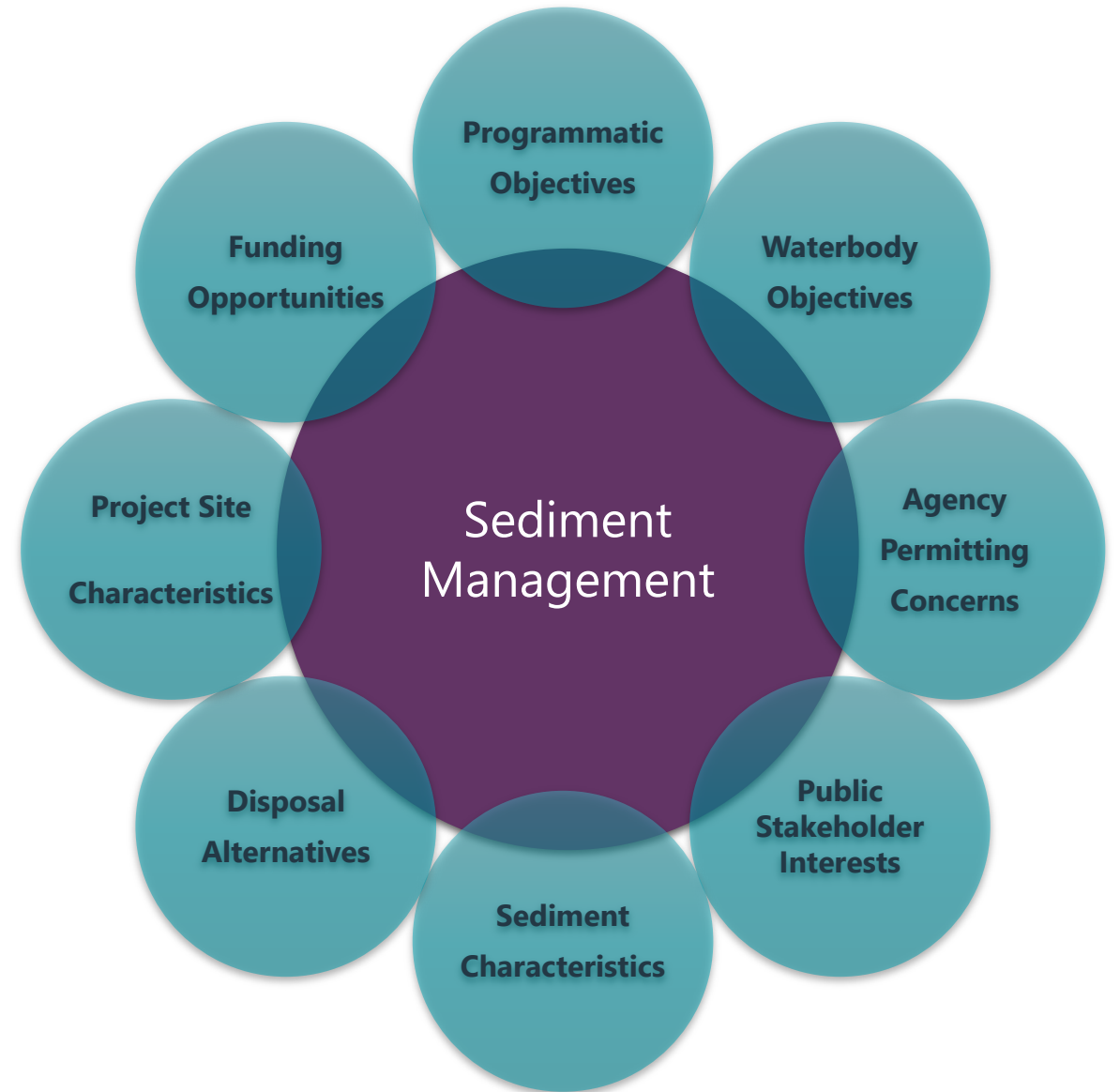
Mary Szafraniec, Laurie Smith, Sara Phelps, Francesca
Lauterman

8th Biennial UF Water Institute Symposium
February 22, 2022



Outline

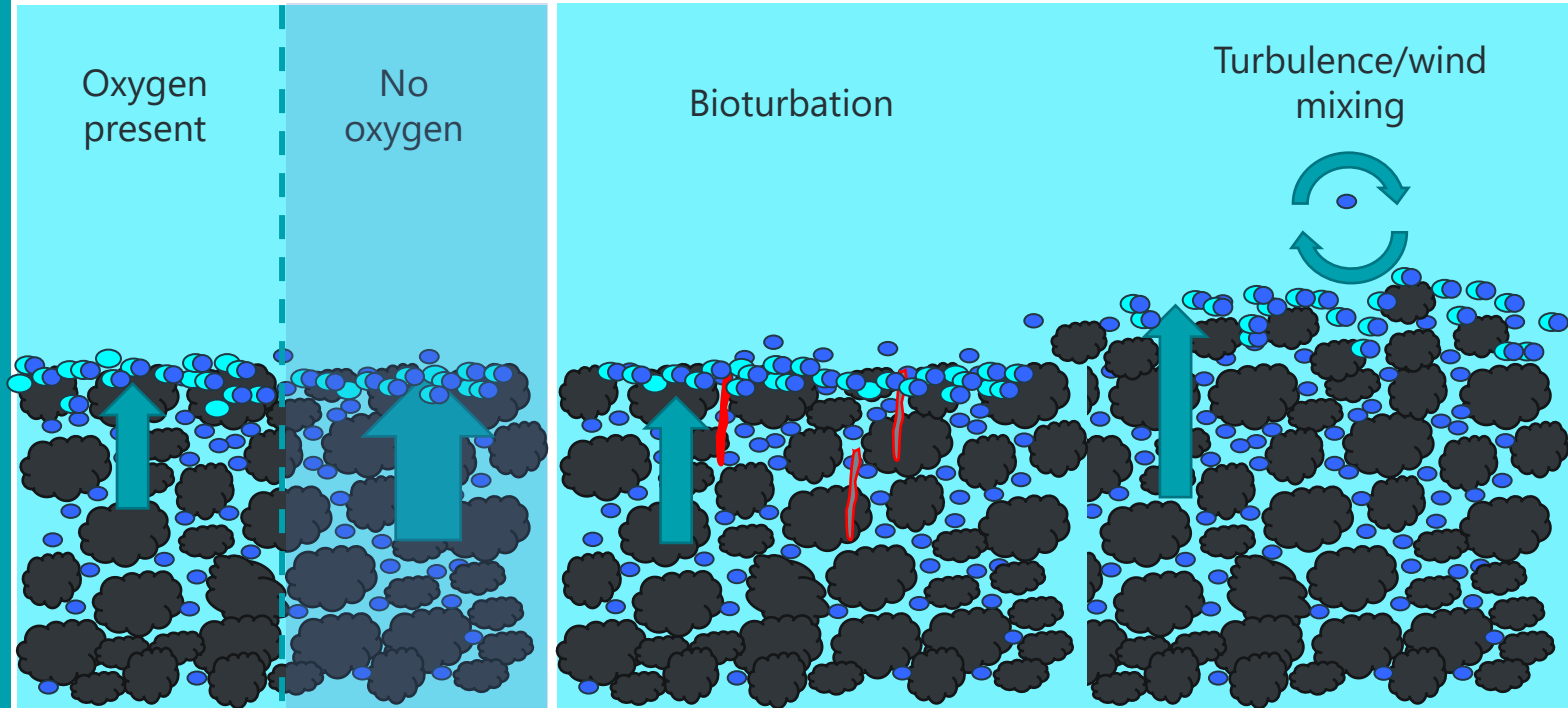
- Overview of Sediment Management Approach and Benefits
- Case Study
- Summary



Sediment Management Approach and Benefits

How does sediment quality impact water quality?

- + Stabilize sediments for aquatic vegetation establishment and growth
- + Reduce algal blooms
- Resuspension
- Diffusion
 - Release nutrients and other pollutants to water column
 - Source or sink for pollutants – internal cycling



Approaches to Sediment Management

No Action

- Natural Attenuation

Cap/Inactivate

- "Clean" fill
- Biological
- **Chemical Inactivation**
 - **Alum**
 - **Phoslock**
 - **Flock & Lock**
 - **Virophos**
 - **Nclear TPX**
 - **Coated sand**

Dredge/Dewater

- Mechanical
- Hydraulic

DMMAAs

Geotextile tubes

Subaqueous

Wastewater plant

Islands

Relocation

Is Permitting
Feasible?



A presentation by Wood.

How and When to Pursue a Sediment-Focused Waterbody Management Project

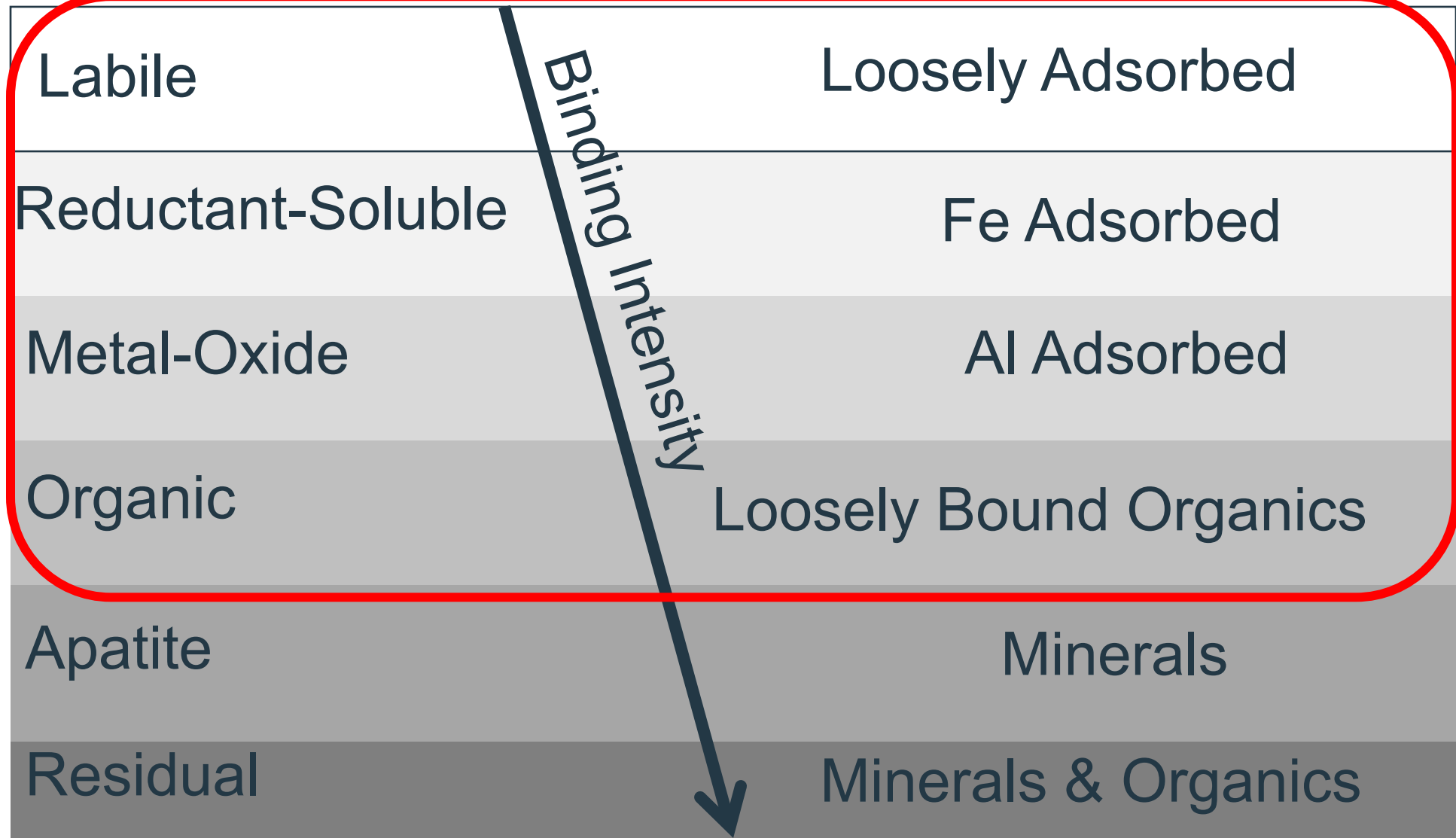
- Waterbody or alternatives analysis studies indicate that sediment cycling generates a significant portion of the pollutant loading
- Untreated stormwater inputs are limited or being addressed
- Upstream sediment transport is limited or has been addressed
- Treatment alternatives analysis has been conducted
- Funding source has been identified

Sediment Phosphorus Fractionation

Nuisance algae most readily utilize biologically available phosphorus - BAP

MUCK
HIGH
BAP

SAND
LOW
BAP

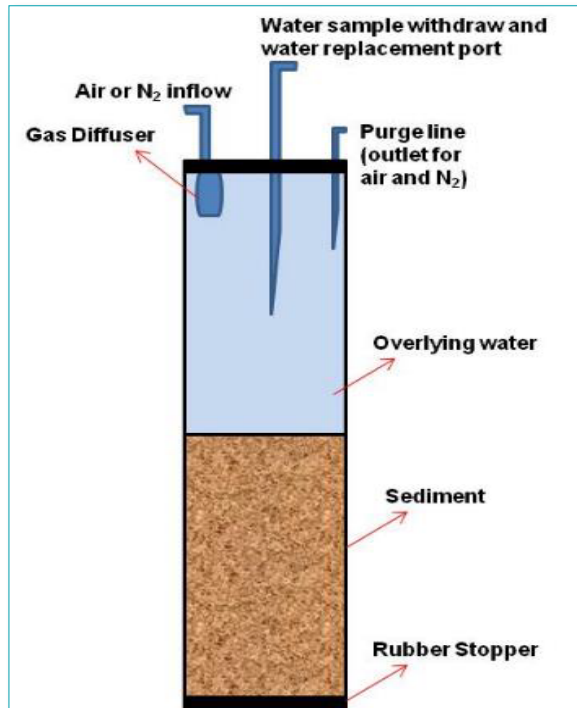


wood.

Treatment Alternative Analysis

Bench Scale Sediment Flux

Intact sediment core incubations to measure flux (release) of nutrients or other pollutants



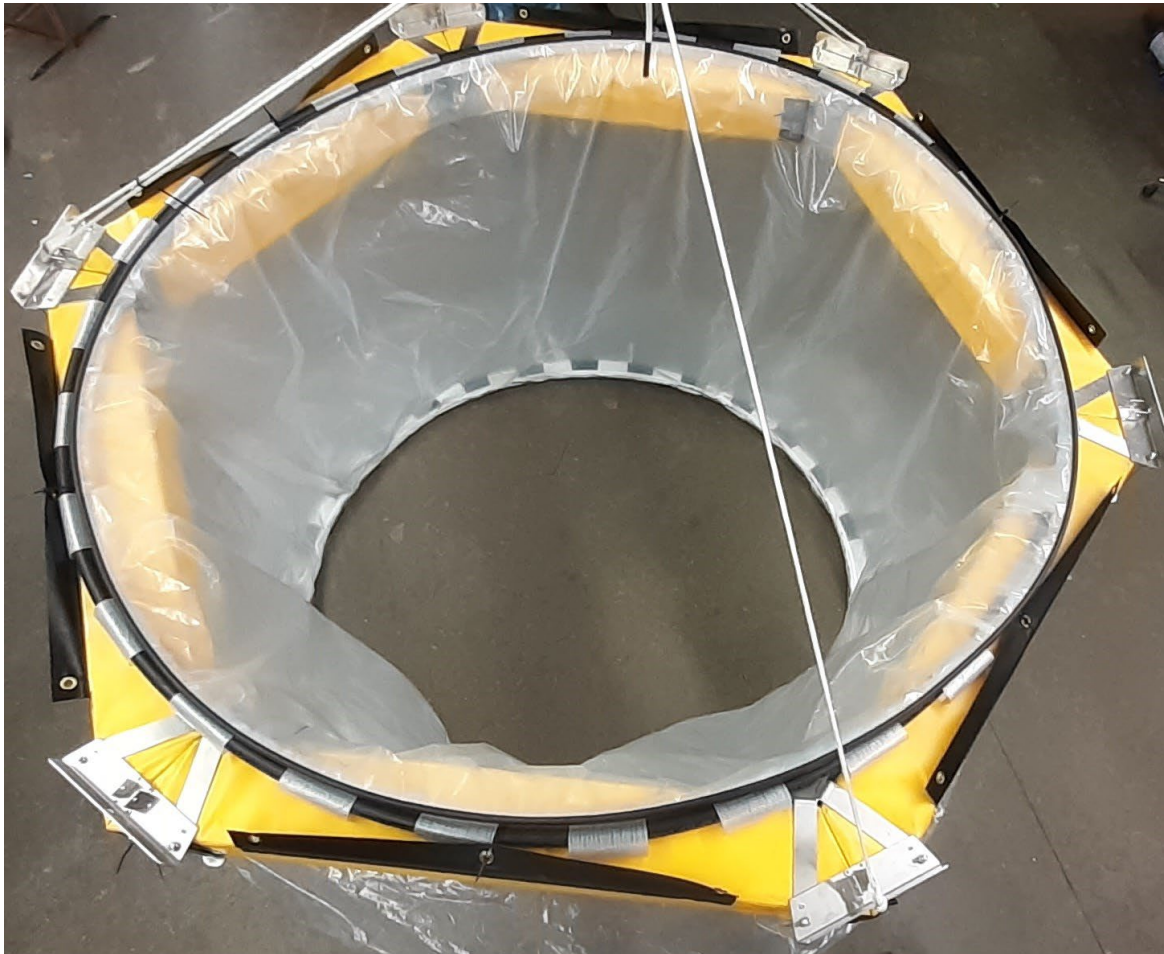
Case Study

City of Lakeland Crystal Lake Mesocosm Study

- Crystal Lake is verified impaired (per FDEP 3030(d) list) for total phosphorus (TP), total nitrogen (TN) and chlorophyll-a, and has regularly documented harmful algal blooms (HABs).
- Phased project – Phase I: Nutrient and hydrologic budget
 - Sediment = primary source
- Deferred TMDL with a 4e Pollutant Reduction Plan (PRP)
 - Developed restoration alternatives
 - Sediment management is top priority - Phase II
- Cooperative funding obtained from SWFWMD



Mesocosm Study



Evaluate
effectiveness of
various treatment
alternatives

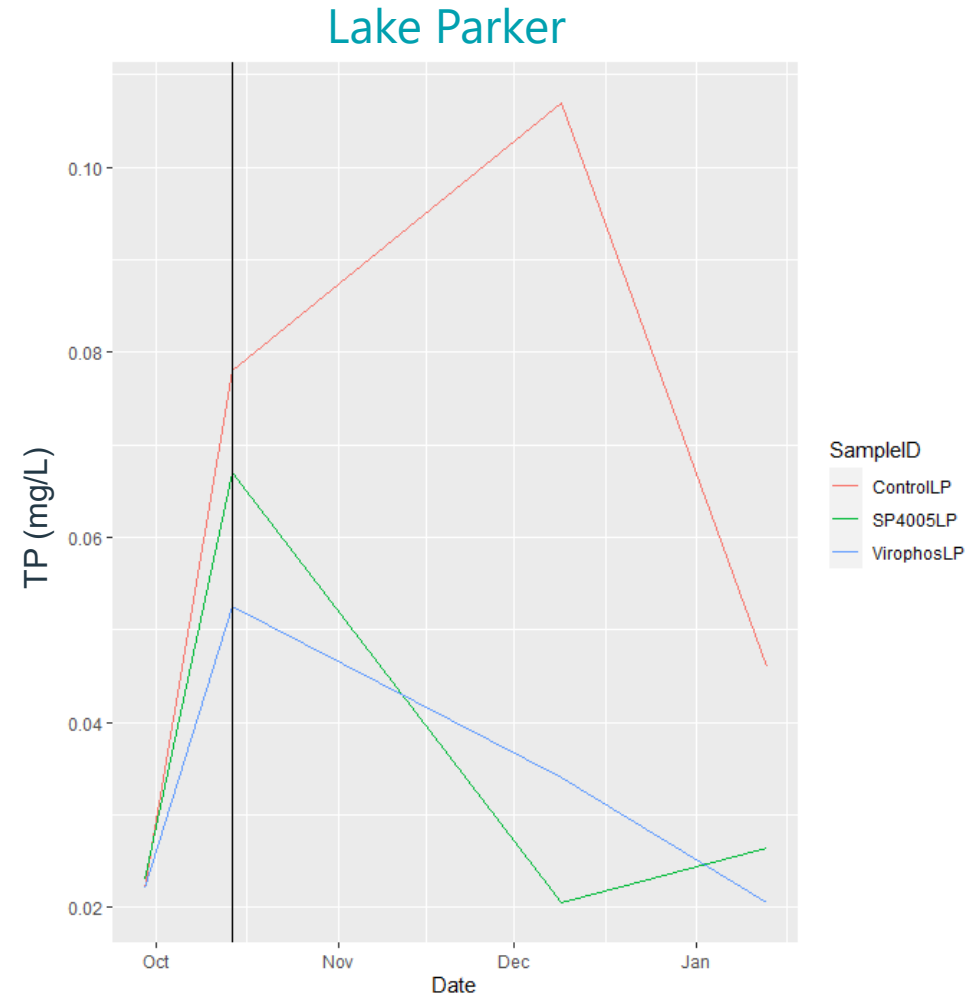
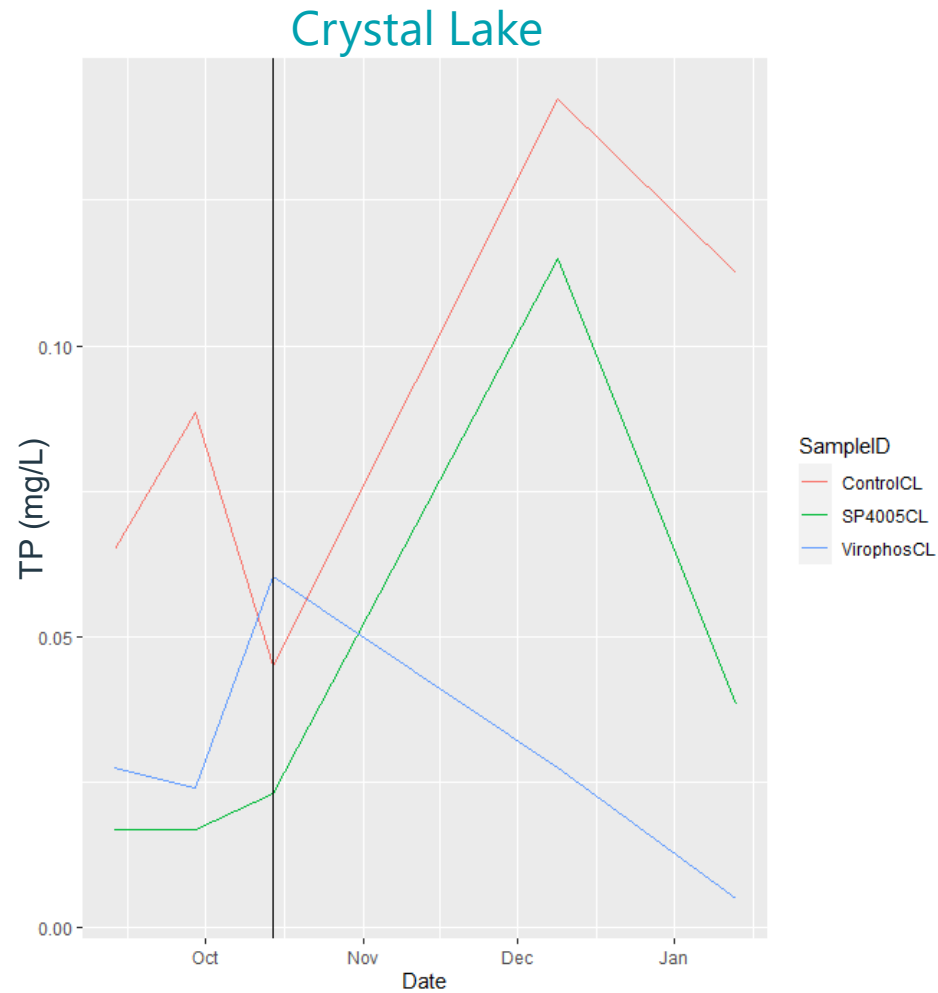
Mesocosm Study Design

- 6 limnocorrals each in Crystal Lake and Lake Parker (2m D x 4m h)
 - 2 Virophos replicates
 - 2 Phoslock replicates
 - 2 Control replicates (bare sediment)
- Product application in October 2021
- Test period includes wet and dry seasons



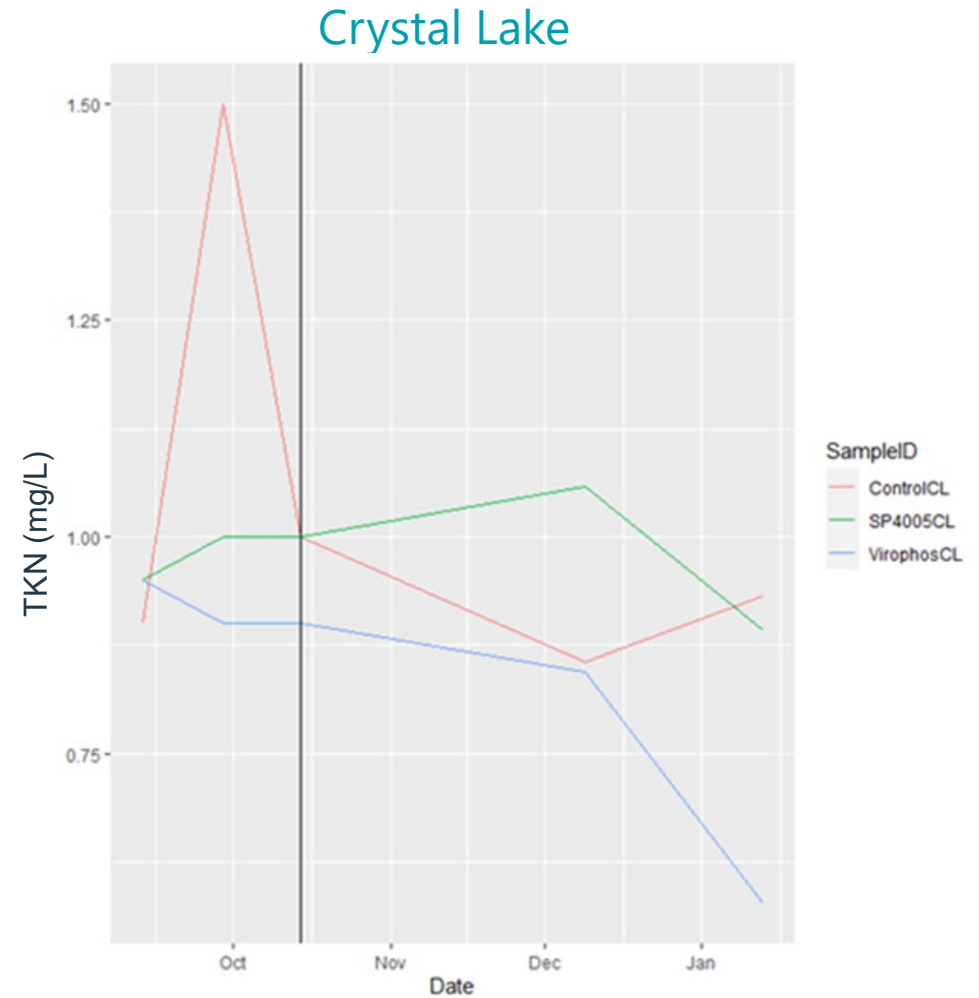
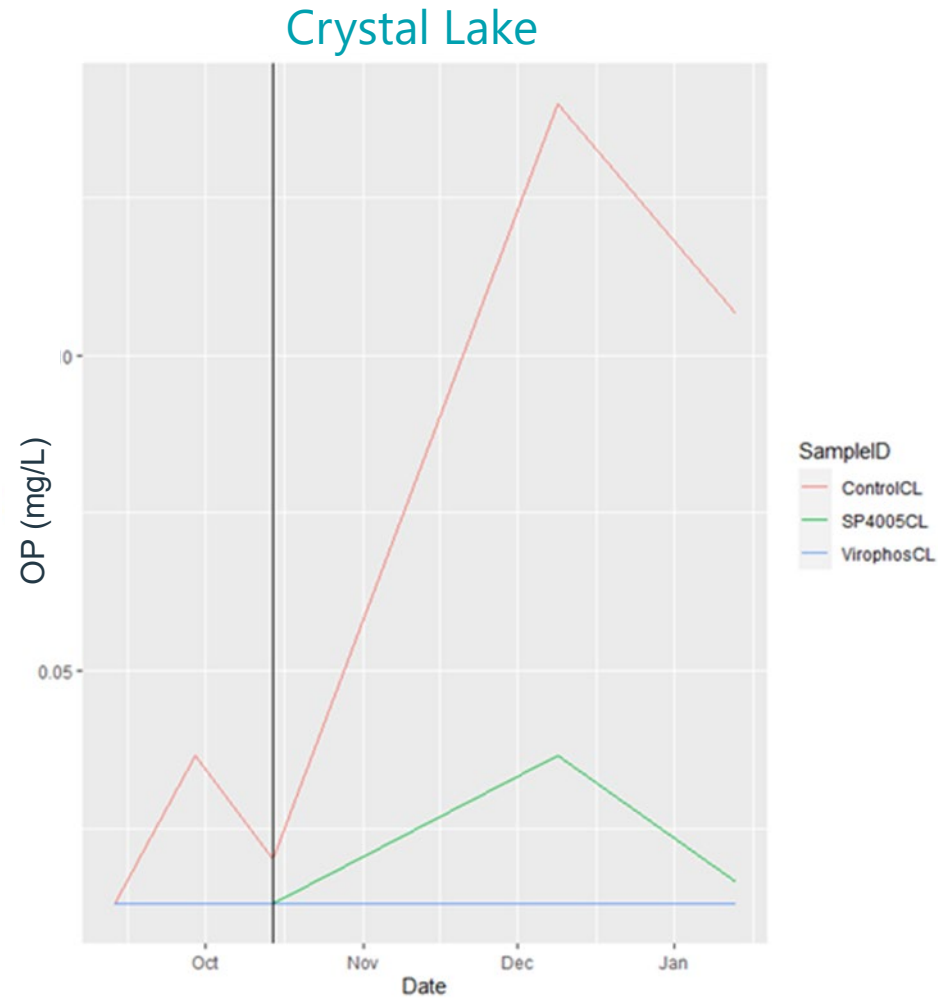
Mesocosm Study Preliminary Results

In-mesocosm Water Quality



Mesocosm Study Preliminary Results

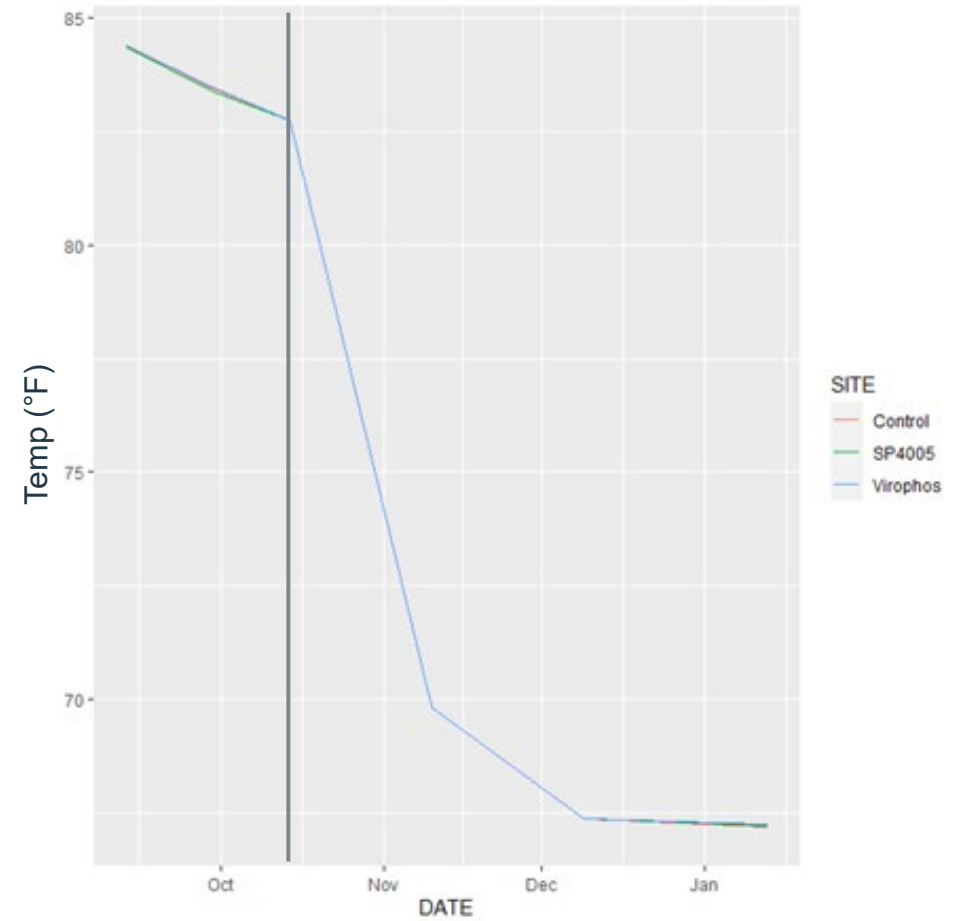
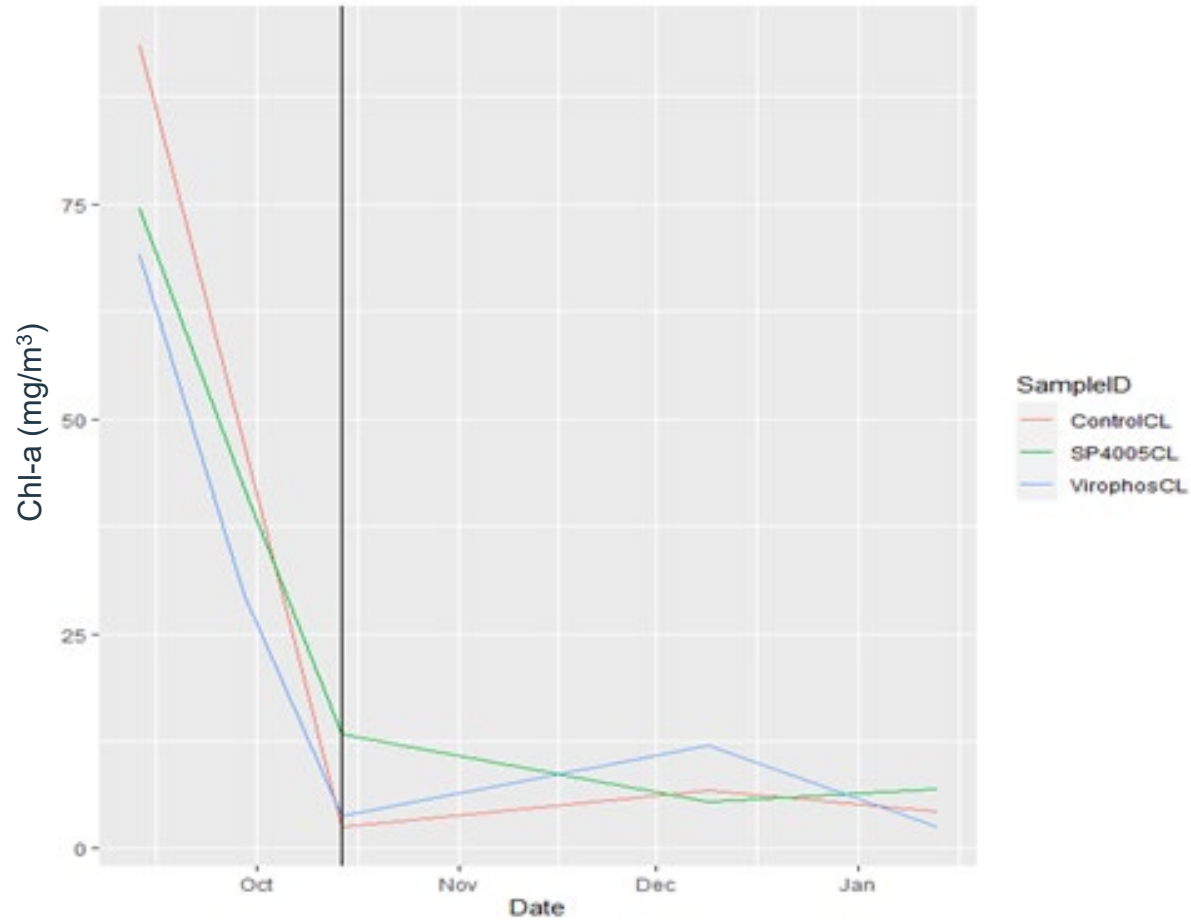
In-mesocosm Water Quality



Mesocosm Study Preliminary Results

In-mesocosm Water Quality

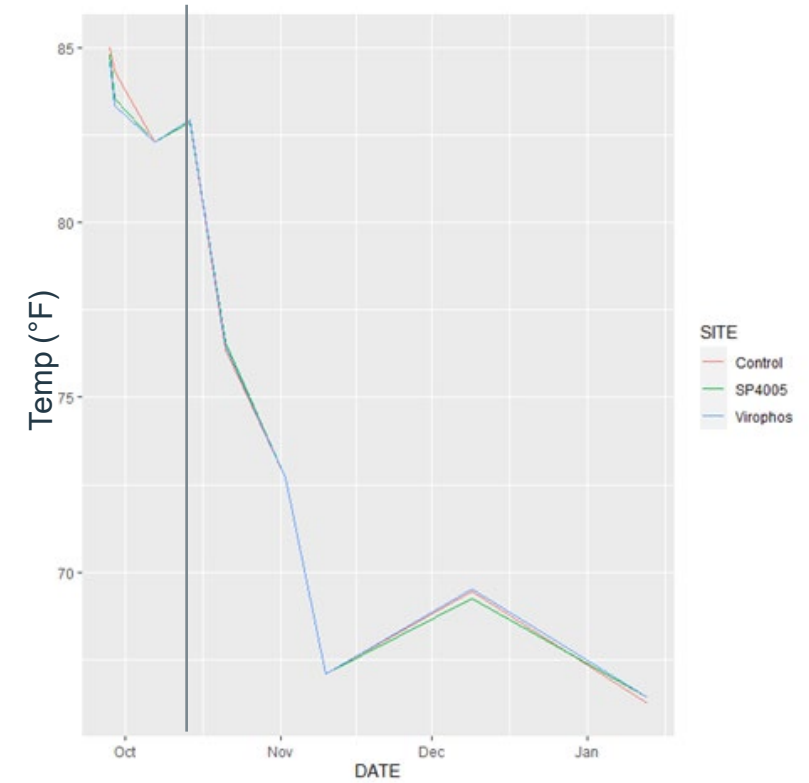
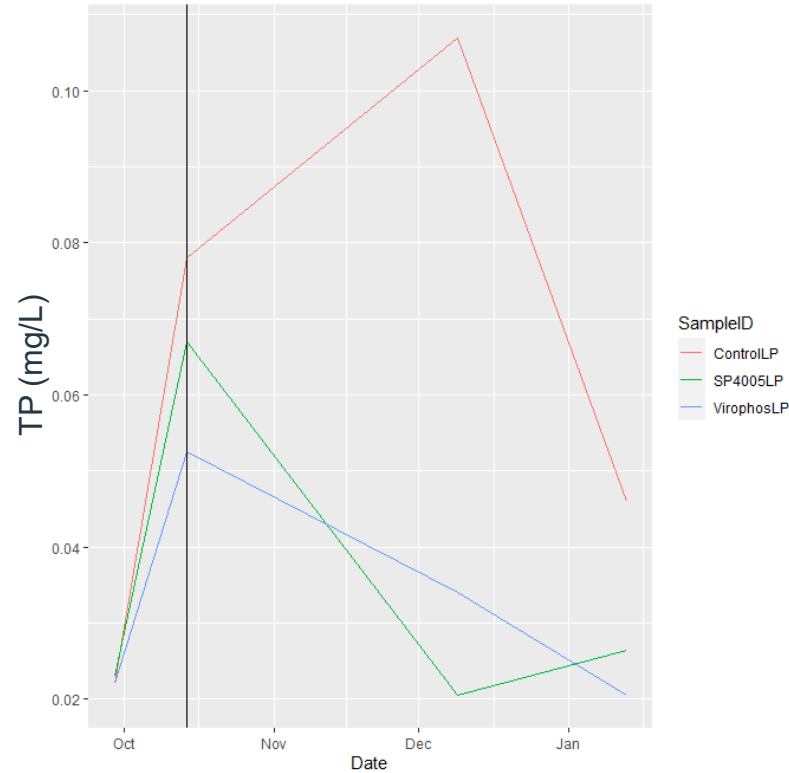
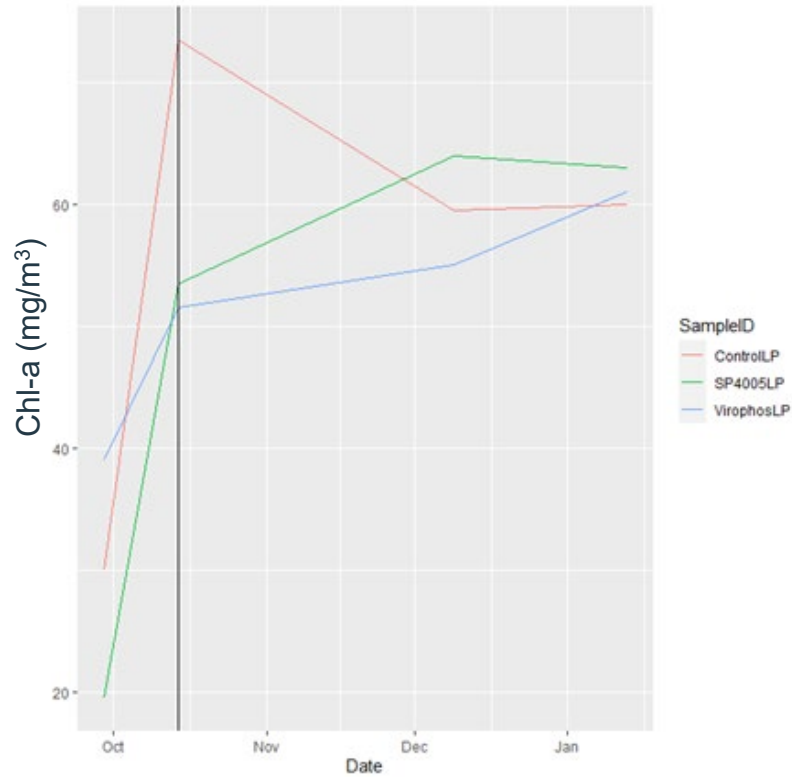
Crystal Lake



Mesocosm Study Preliminary Results

In-mesocosm Water Quality

Lake Parker



Mesocosm Study Preliminary Results

Sediment P Fractionation (Pre-application)

Location	% Solids	Biologically Available P (BAP)				Not Available	Total P
		Labile P	Reductant-Soluble P	Metal-Oxide P	Organic P	Apatite and Residual P	
Control	71	1	2	17	9	60	89
SP-4005	15	2	7	78	64	2,027	2,178
Virophos	65	1	2	27	24	120	140

Summary

- Internal loading from nutrient-laden organic sediments can be a significant source of water quality impairments
- Understanding and quantifying internal loading potential is critical
- Sediment capping and chemical inactivation may result in significant load reduction that is highly cost-effective and direly needed in many lakes in FL
- Reduced internal loading can reduce HAB abundance and improve water quality
- Additional evaluation of benefits from sediment capping are needed
 - Specifically measuring the offset of additional organic sediment accumulation from internal cycling and algal proliferation
- Need to better understand how effective products are *in-situ*



*Sediment capping projects are not **currently** permissible in Sovereign Submerged Lands

Contact Information:

Mary Szafraniec, PhD, PWS

Principal Scientist
Wood Environment & Infrastructure
Solutions

Mary.Szafraniec@woodplc.com

Mobile 813.748.3625

