Nutrient Reduction Project

Silver Lake Stream Improvement Report

October 16, 2024

Silver Lake Water Quality Committee

Nutrient Reduction Project Timeline/Outline

- History
  - Pre-project
  - Input Sources of nutrients in Silver Lake/Silver Creek Watershed
- Nutrient Reduction Project
  - Product selection : SePro/EutroSORB F
  - Purchase of EutroSORB
  - Deployment
  - Monitoring and Verification
- Testing and Verification Summary
  - Stream/Lake sites Total Phosphorus (TP) readings
  - Product TP adsorption performance in Lab conditions process
  - Product TP adsorption performance in Stream conditions
- Plans and Recommendations

Project timeline

- History
  - Pre-project
    - First blue-green algae bloom
    - Testing – monitoring 27 sites (lake and input flow)
    - Phosphorus as limiting nutrient
  - Input Sources of nutrients in Silver Lake/Silver Creek Watershed
    - Focus on three input streams with high Phosphorus readings
    - Probable sources: Legacy agriculture/sediment, current Ag, unpaved road
- Nutrient Reduction Project
  - Product selection : Manufactured by SePro
    - EutroSORB F

Testing sites

- Pre-project –
  27 lake / input sites

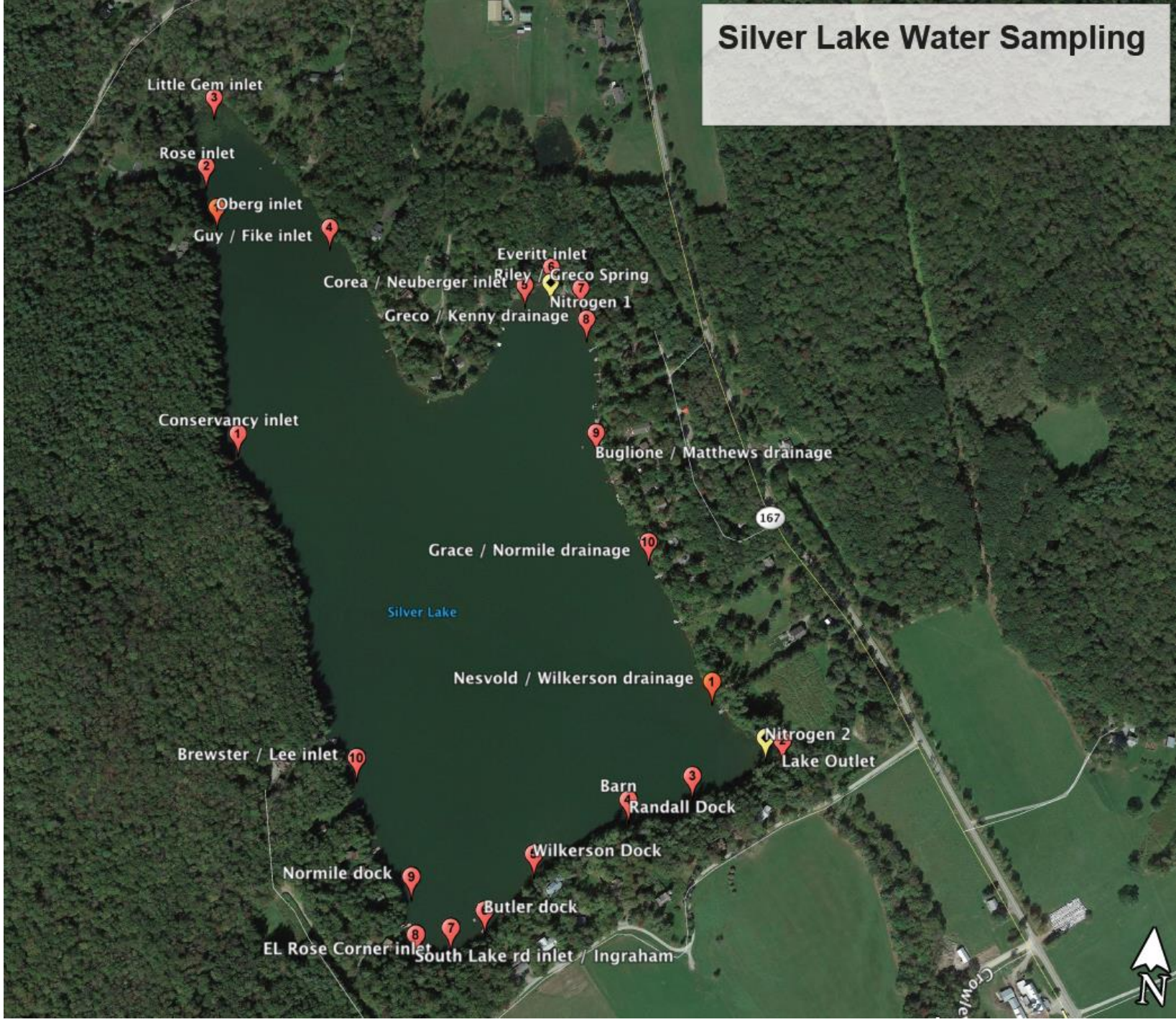
- Three inlet streams

With repeatedly high TP readings;

#3, off Quinn road

#6, off farm field/pond

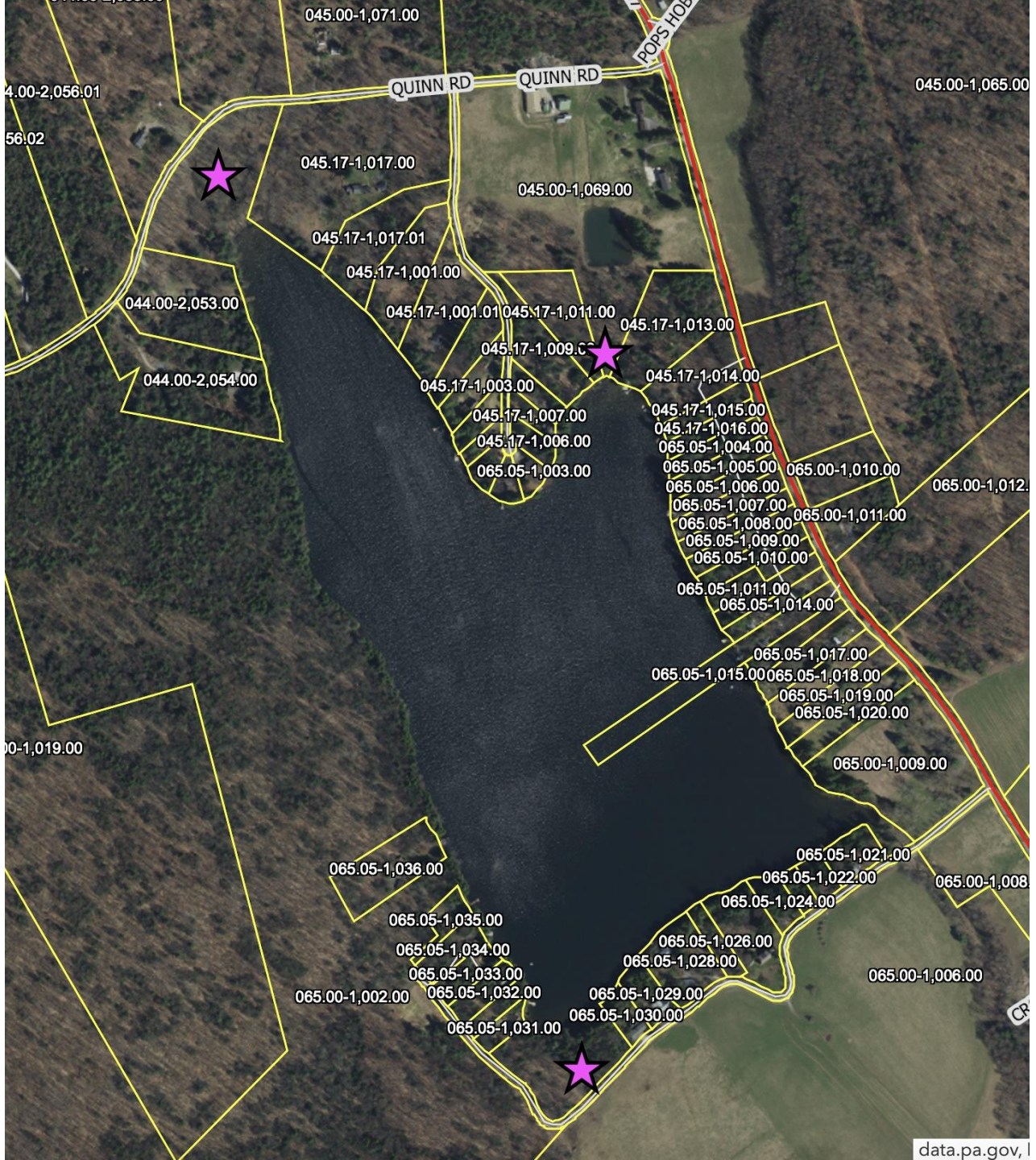
#17, off farm field



Three selected
inlet stream sites:
#3 – Two streams, from
under Quinn (unpaved)
road, merge;
no farm fields

#6 – Horse pasture/pond

#17 – Cow pasture



Project timeline

- Nutrient Reduction Project
  - Goal – reduce the amount of Phosphorus entering the lake via three inlet streams
  - Product selection : SePro/EutroSORB F
    - Fairly new product in the market
    - Porous, fabric bags containing 25 lbs of EutroSORB F
      - Advertised adsorptive capacity of ¼ pound of Phosphorus per bag

"EutroSORB filters are a novel technology specifically designed for intercepting soluble reactive phosphorus (SRP) from moving water. EutroSORB provides water resource managers an efficient and economical solution to reduce phosphorus inputs, slow down or stop the eutrophication process, and restore water quality."

Project timeline/outline

- Nutrient Reduction Project cont.
  - Purchase of EutroSORB
  - First 6 bags – (EutroSORB V1)
    - SCCD Phase 1 – 66 bags deployed into three streams. (2023 EutroSORB (V2))
    - Additional EutroSORB product development sample (2024 EutroSORB (V3))
  - Deployment
    - Stream Site #3
    - Stream Site #6
      - Additional 10 bags – EutroSORB (V3)
    - Stream Site #17

Project timeline/outline

- Nutrient Reduction Project cont.
  - Purchase of EutroSORB
  - First 6 bags – (EutroSORB V1)
  - SCCD Grant Phase 1 – 66 bags deployed in three streams. (EutroSORB (V2)
  - Additional EutroSORB product development sample (EutroSORB V3)

- Video note: after a rain, bags are almost completely immersed in the stream. Rebar anchors are visible.

Project timeline

- Nutrient Reduction Project cont.
  - Monitoring and Verification testing (Upstate Freshwater Institute (UFI) Lab
    - Lake sites monitoring – outlet and middle of lake (controls) for Total Phosphorus (TP)
    - (3) Streams monitoring – water samples from upstream of bags and downstream of bags
    - EutroSORB F – bag sampling for verification of TP adsorption *
      - Testing process development – Binghamton University – TP filtrate extraction
      - Independent testing of EutroSORB filtrate: UFI Lab and SePRO Lab
  - * Lab process for determining how much Phosphorus was adsorbed in the stream;
  - Testing sets completed in
  - December 2023 (EutroSORB F (V2))
  - June 2024 (EutroSORB F (V2))
  - July 2024 (EutroSORB F (V3))

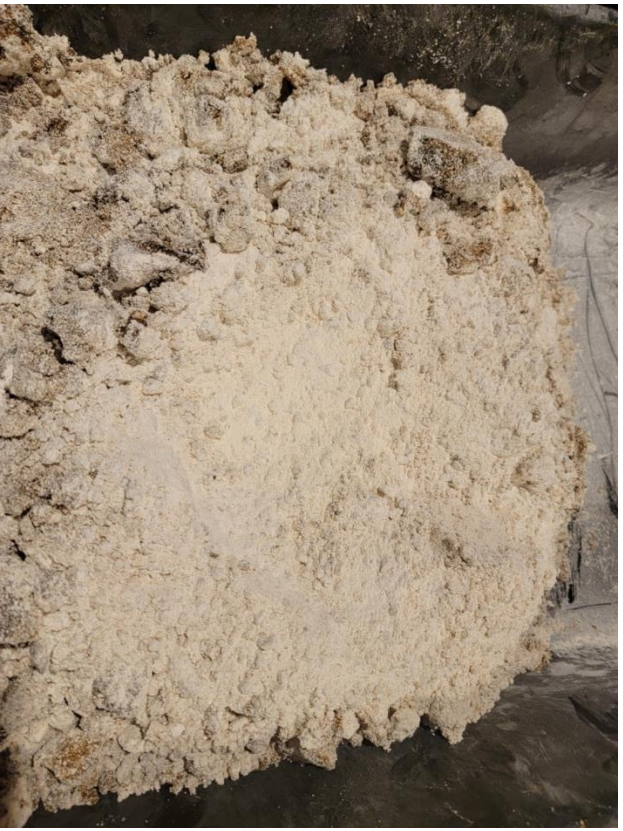
Verification process – Observe inside bags

- EutroSORB F (V1)
  - Darkened EutroSORB around outer section of material (near bag fabric)
  - Central volume inside bag is still ‘white’ and not very wet.
  - Bottom of bags covered in sediment

- Observations – stream water penetrated only a small distance into the material. Local modifications made to try to improve efficiency:
  - Option – insert hollow area in center of material to enable water penetration
  - Option – Lay bag in a perforated tray to raise the bag and allow water flow beneath the bag
  - Option – flip bag over periodically to improve saturation

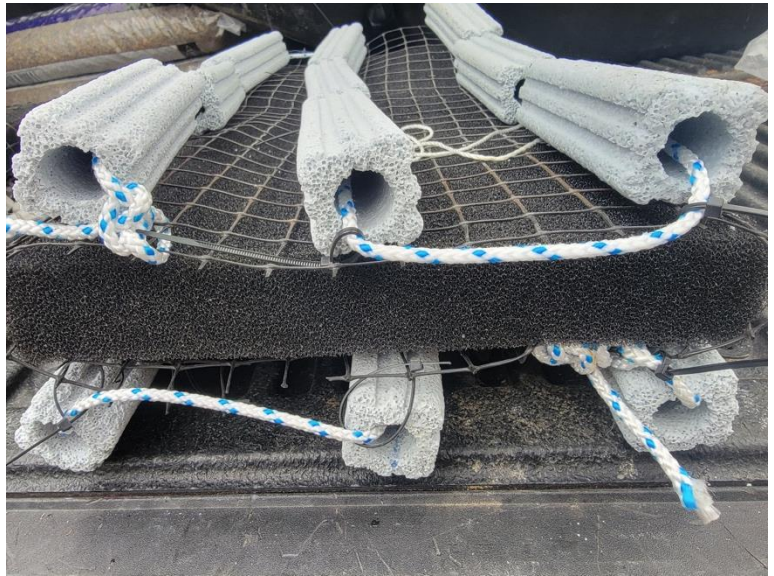
Verification process – Observe inside bags

- EutroSORB F (V2) – 2nd generation product
  - Darkened clumping EutroSORB around outer section of material (near bag fabric)
  - Hollow core center showed increased water penetration but also showed clumping
  - Volume inside bag not clumped was still ‘white’ and not very wet.
  - Bottom of bags shows increased water penetration (tray effect)
- Observations – stream water penetrated further than with V1.
  - Significant clumping of V2 material – self-sealing
  - Additional modification made to improve V2 efficiency:
    - Option – insert filter spacer in center of material to enable water penetration
    - Option – insert ceramic blocks around periphery to break up clumps



Physical Modifications (V2 prototypes) to improve water penetration

- Perforated tray to lift bag slightly off stream bottom
- Allow better water penetration into center of material
  - Central hollow core or
  - Central filter spacer
- Periodically flip bags
- Ceramic moveable spacers within material to break up clumping

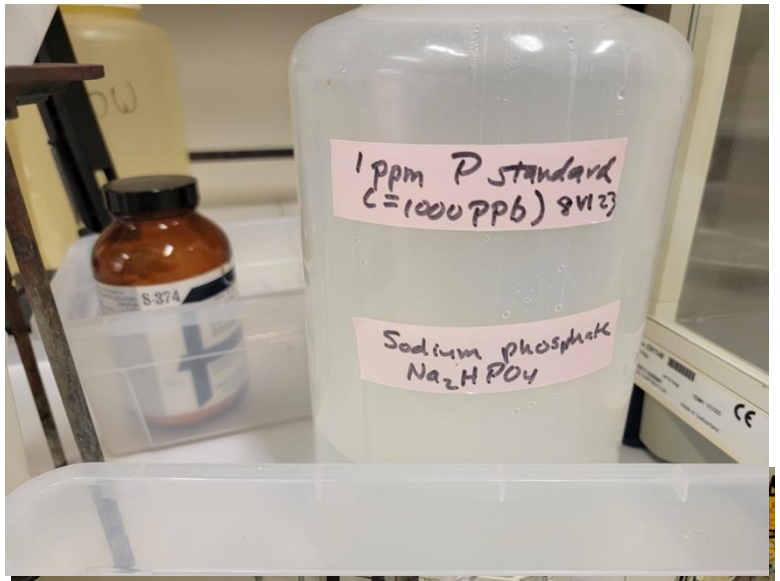


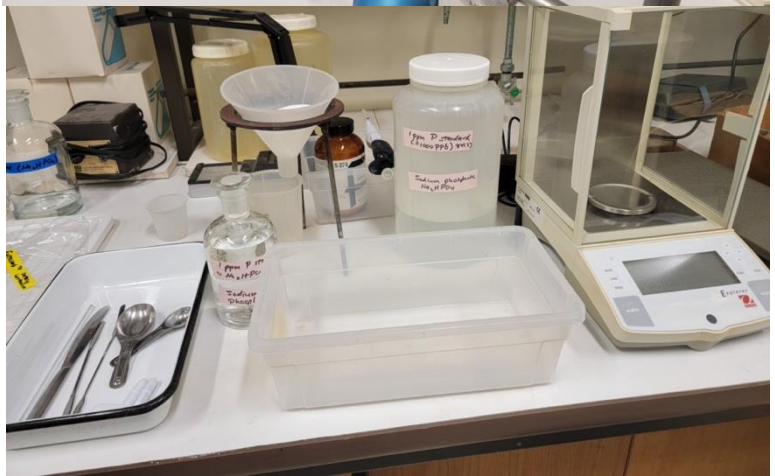
Cooperation with SePRO – 2024 data/product sharing

- EutroSORB F (V3). - prototype product partially based on our data
  - (Pellets with surrounding powdery material)
  - No clumping EutroSORB anywhere
  - Larger Bag Fabric pores allowed more penetration
  - Volume inside bag - wet and more uniformly discolored.
- V3 Observations – Improvements
  - Better water penetration
  - No clumping
  - Filter spacer in center of V3 material - effective and non-clogging
  - Similar performance of V3 in 1 month to V2 in 6 months

EutroSORB BU Lab Verification Process

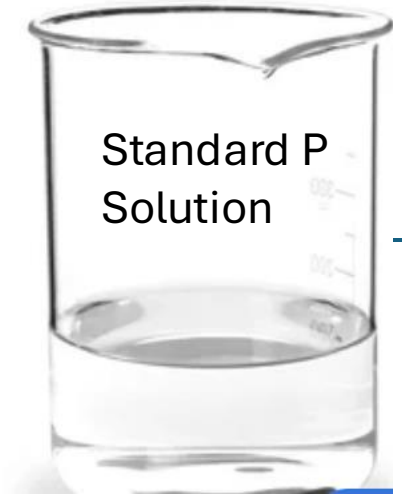
- Goal – prepare a filtrate to show how much Phosphorus was adsorbed by a used sample of EutroSORB





John Titus, Prof. Emer.
The filtrate solution was sent to the UFI lab for Total Phosphorus analysis. That TP was <u>not</u> adsorbed as it passed through the EutroSORB Sample at the BU lab.

Lab goal – prepare used and unused samples

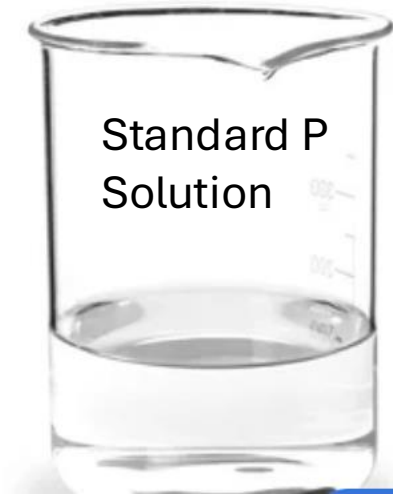


Mixed thoroughly and Filtered

Filtrate sent to UFI Lab for TP processing

<u>Filtrate</u>: Total P <u>not</u> adsorbed after filtering

Expected results: High % of P Adsorbed



Mixed thoroughly and Filtered

Filtrate sent to UFI Lab for TP processing

Expected results: Less P adsorbed in lab because previous adsorption of P in Stream

General Stream observations

- Variability in stream flow
  - Stream flow highest during and after rain events
  - Flow varies by stream
- Most stream water by-passes the bags
  - Bags were arranged to not block stream flow
  - A few bags were displaced during storm flow events
- EutroSORB F (V2) bags were distributed in three streams
- EutroSORB F (V3) prototype material bags were placed

  in the stream at Site #6 – highest flow, highest TP
- Comparison of instantaneous water samples upstream and downstream of bags was done

Typical Total Phosphorus Data

- Stream water TP content. (PPB). (Lower number is better)
  - site 3 site 6 site 17
  - 2021 67.5 339.6 20.4
  - 2022 98 48 58.6
  - 2023 159.2 77 91.9
  - 2024 70.7 107.2 87.5
- EutroSORB Bag testing TP (PPB) (Higher % number is better)

Product	Lab - Unused Sample* % TP adsorbed (ability to adsorb P in Lab)	Stream - Used Sample % TP adsorbed * (Adsorbed in stream)	Stream exposure time (months)
EutroSORB (V1)	90%	0.3 – 10%	6 months
EutroSORB (V2)	98.5%	0.6 – 3.7%	6 – 9 months
EutroSORB (V3)	99%	1.9 - 2%	1 month

* Lab -Ten minute agitation/stirring;

Plans and Recommendations

- Continue stream water monitoring
- Stream bags sampling of V2 versus V3 for longer exposure
  - Next sampling planned for December 2024
  - Sampling from 3 bag setups for V2 and V3:
    - Original bag – no modifications
    - Modified bag with central spacer filter
    - Subdivided smaller bags in crates
- Test EutroSORB F bags suspended in lake
- Continue independent TP testing – review results
- Searching for alternate products to try
- Communicate with SCCD – revisit in 9 months
- No purchase of additional bags at this time