ESF State University of New York College of Environmental Science and Forestry

Seneca Lake PURE WATERS Association

Measuring 9E Plan Phosphorus Reduction Goals

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NYS Nine Element Plans

A Nine Element (9E) Watershed Management Plan is a comprehensive, non-regulatory strategy designed to restore, protect, and improve water quality in specific watersheds. It identifies nonpoint source pollution (like nutrients or sediment), sets reduction goals, and outlines actions for community partners to improve water quality and become eligible for state/federal funding.

- Keuka/Seneca Lake 9E Plan for Phosphorus was released in August 2022
  - Seneca Watershed Intermunicipal Organization
  - Keuka Watershed Improvement Cooperative
  - Seneca Lake Pure Waters Association
  - Keuka Lake Association
- Phosphorus Loading estimated with the USGS Soil and Water Assessment Tool (SWAT)

Reduction Targets range from 20-40% per HUC based on land use

Project Objectives

1. Demonstrate feasibility of volunteer run multi-site gaging and sampling program

2. Evaluate whether modeled differences in nutrient contribution across tributaries matches observed differences

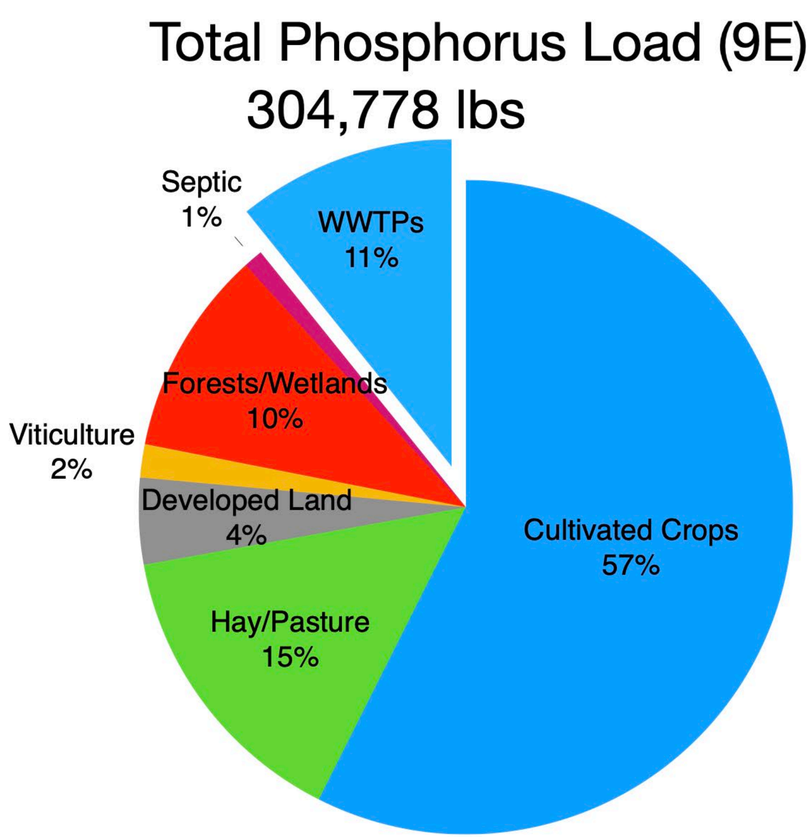
3. Evaluate total nutrient loads to Seneca Lake and methods to improve estimates

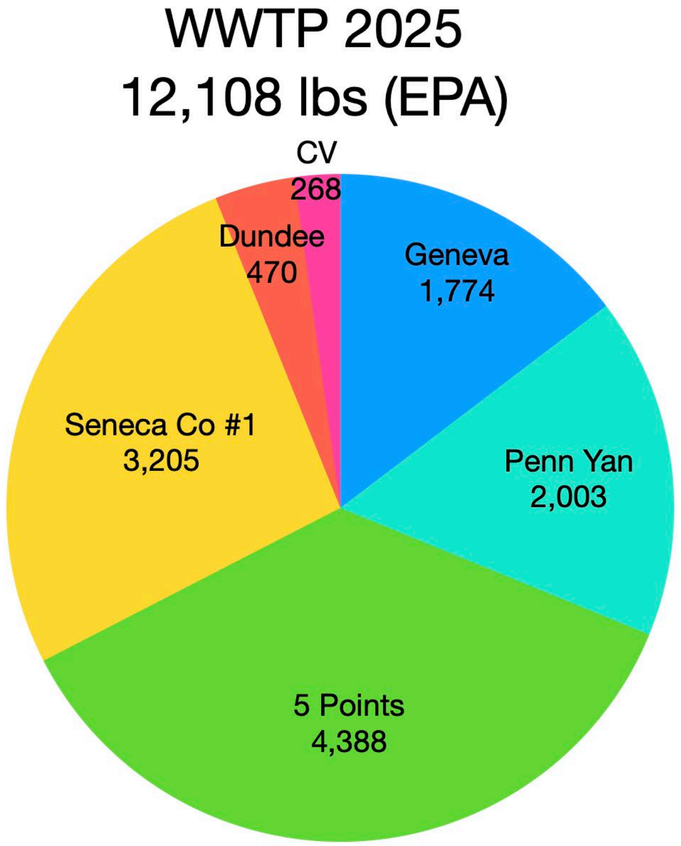
9E Plans and Measuring Progress

- How do we know progress is being made on Phosphorus Reduction?
  - Many 9E Projects have an estimate of Phosphorus savings.
    - 9E Project Phosphorus Savings may be negated by other actions.
  - The 9E Plan estimates more Phosphorus will enter the lake due to increased severity of rainfall.
- The 9E Plan states calculating Phosphorus Loads is a metric of success.

Pure Waters began a Stream Flow Project with ESF in 2025 to calculate Loads

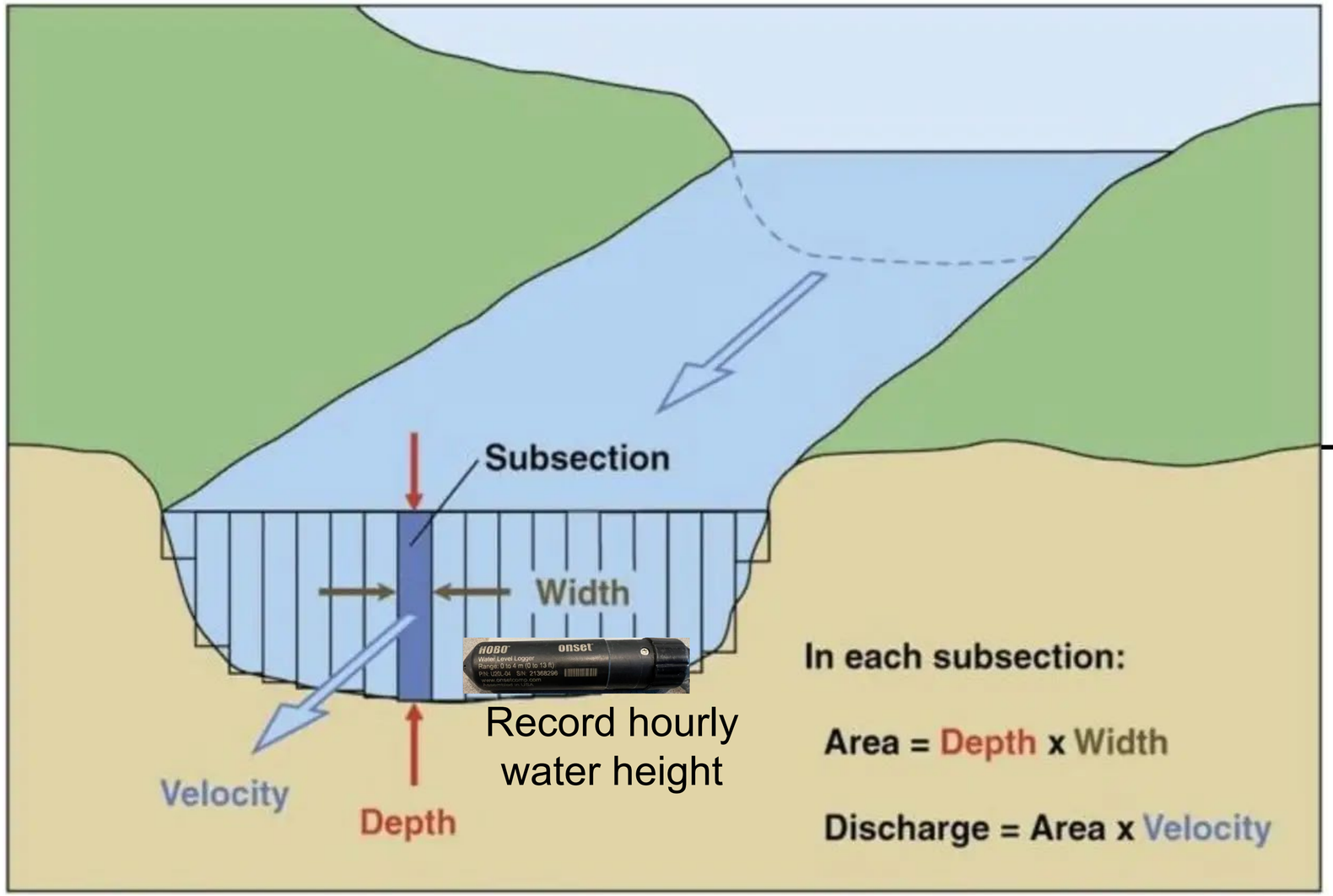
Annual Phosphorus Sources





SWAT Non Point Source Phosphorus - Keuka 41,346 lbs, Seneca 234,534 lbs

P-Loads - Step 1 Flow



Record hourly water height

Calc Discharge for Subsection

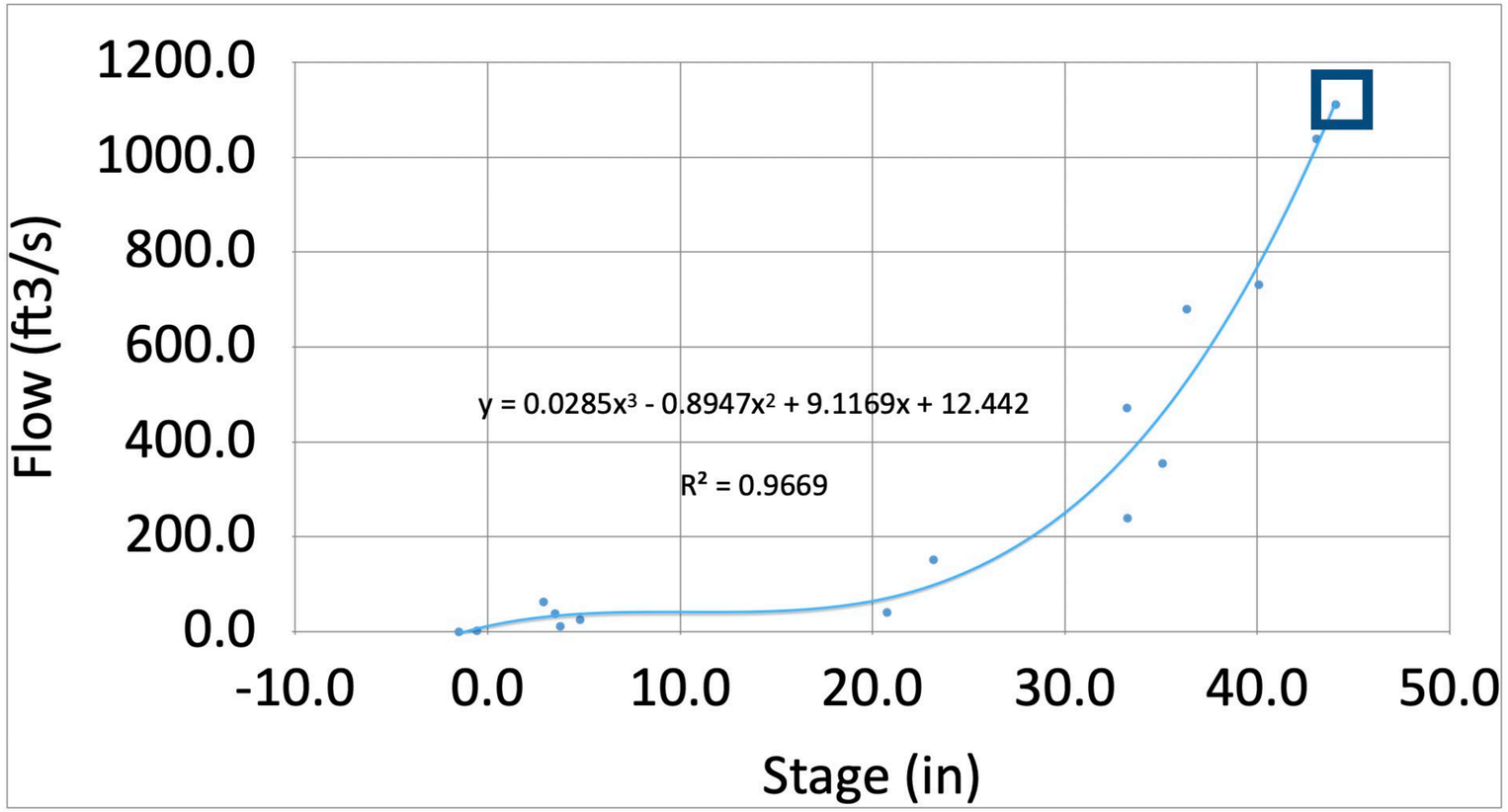
Add them up for Total Discharge

Repeat across different water height

Collect TP Samples

Developing the Flow Discharge (cubic feet / sec) is Step 1

P-Loads - Step 2 Flow Curve



Plot Flow Points

Add a Trendline

Apply Equation to the HOBO Sensor Hourly Stage

Stage is the X variable

Flow Curve provides the Flow at any Stage

P-Loads - Step 3 -Nutrients

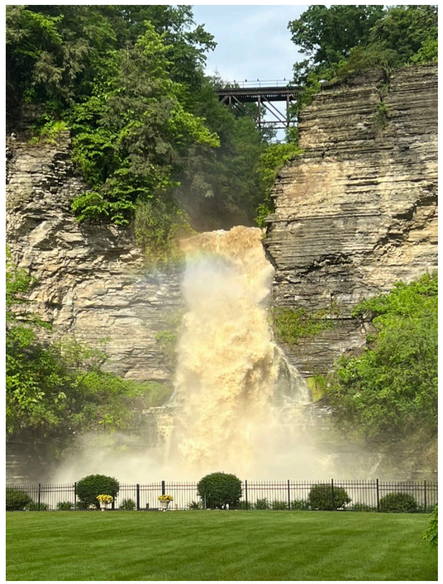
Phosphorus Loads = Water Volume * TP Concentration

Volume in Gallons = Discharge * Duration * Ft3 to Gallons

- 1110 ft3/sec * 3600 seconds * 7.48052 ft3 to gallons = 29,892,158 Gallons

TP Concentration comes from the water sample

- 29,892,158 Gallons * 770 ug/L * 0.0000000083454 (ug/L to lbs/gallon) = 192 lbs

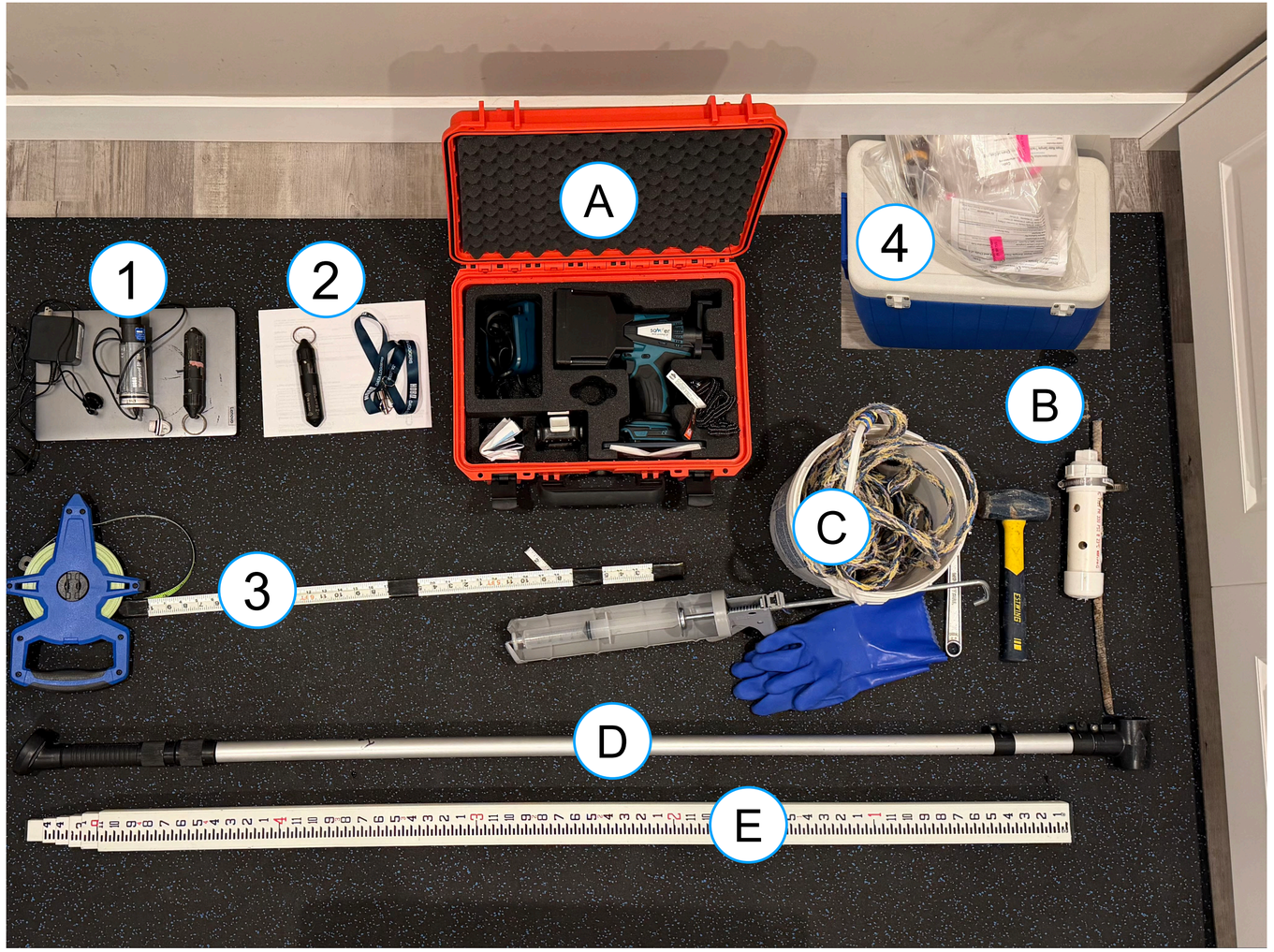


TP = 770 ug/L

Phosphorus Loads are Key to understanding Watershed Inputs to Lake

Equipment for Stream Flow

1. Hobo Sensor, Shuttle, Laptop Hobo
2. Hobo Bluetooth Sensor / Magnet
3. Tape / Yard Stick
4. Cooler/Bottles



A. HSR-10 Radar Flow Meter

B. PVC, Rebar, Hammer, Wrench

C. Bucket Sampler, Gloves, SRP Filtering Device

D. Global Water FP111 Meter

E. Bridge Measuring Device - 25’

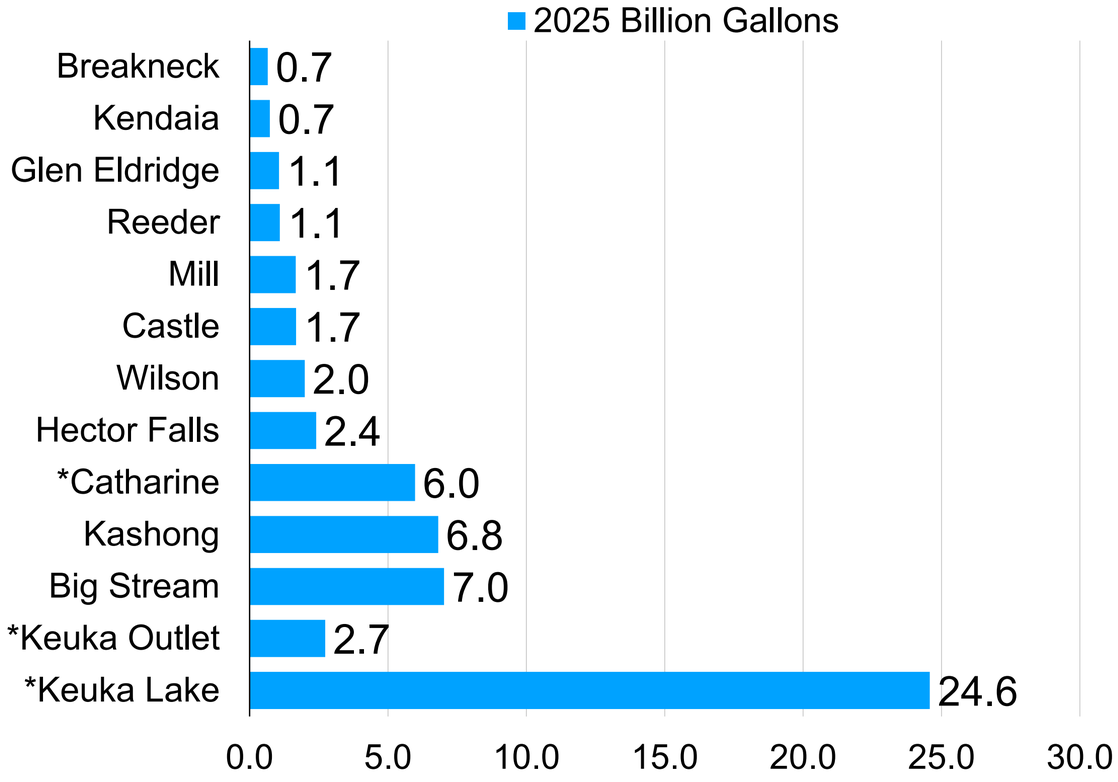
More Junk for Your Frunk

High Flow Measuring

- Pre-Measure Height to Stream Bed
  - Heights and Segment Widths
  - At each bridge post
- Measure Bridge Railing to Water
  - Difference is Water Height
- Take Velocity Measurements

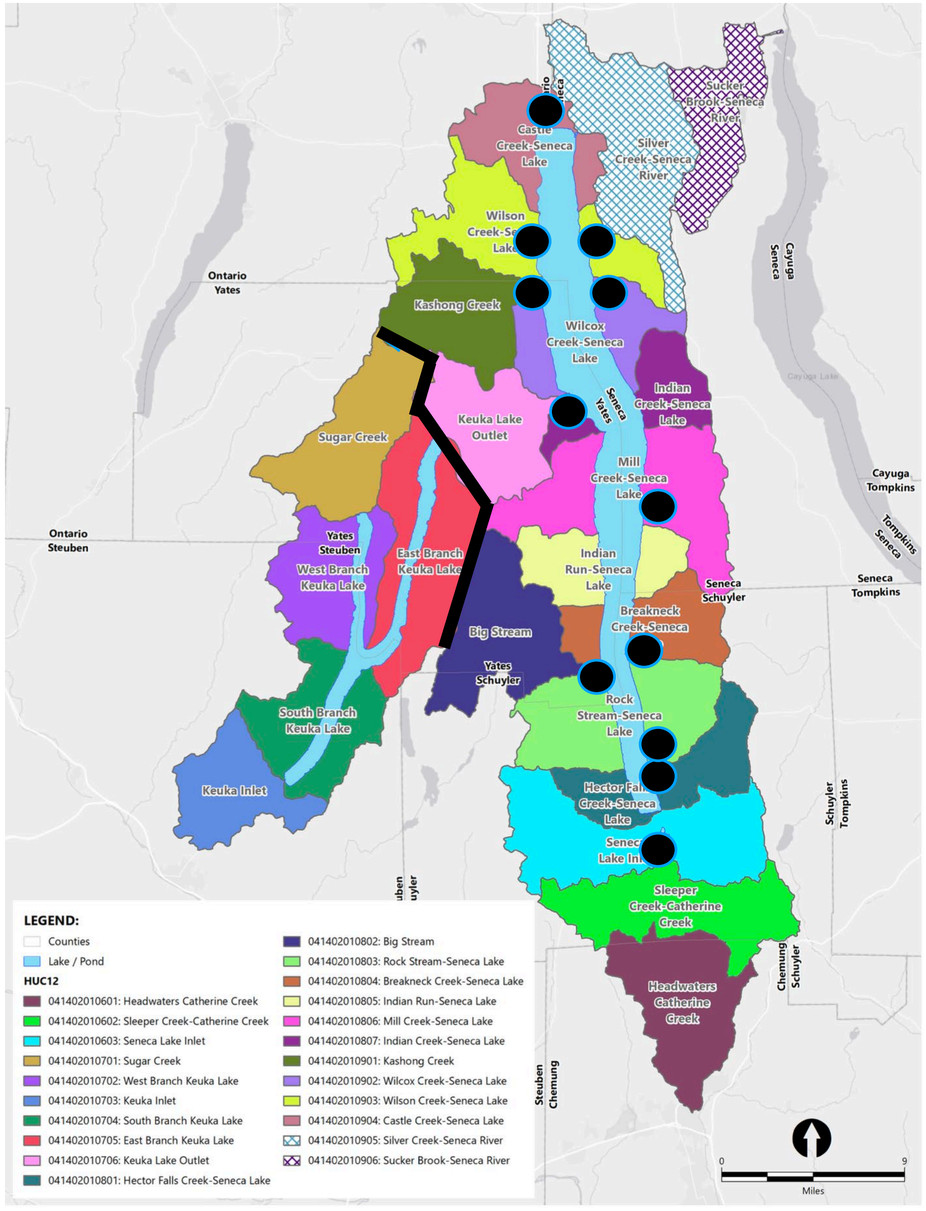
Bridges Allow You to Safely Measure High Flow

2025 Flow Results

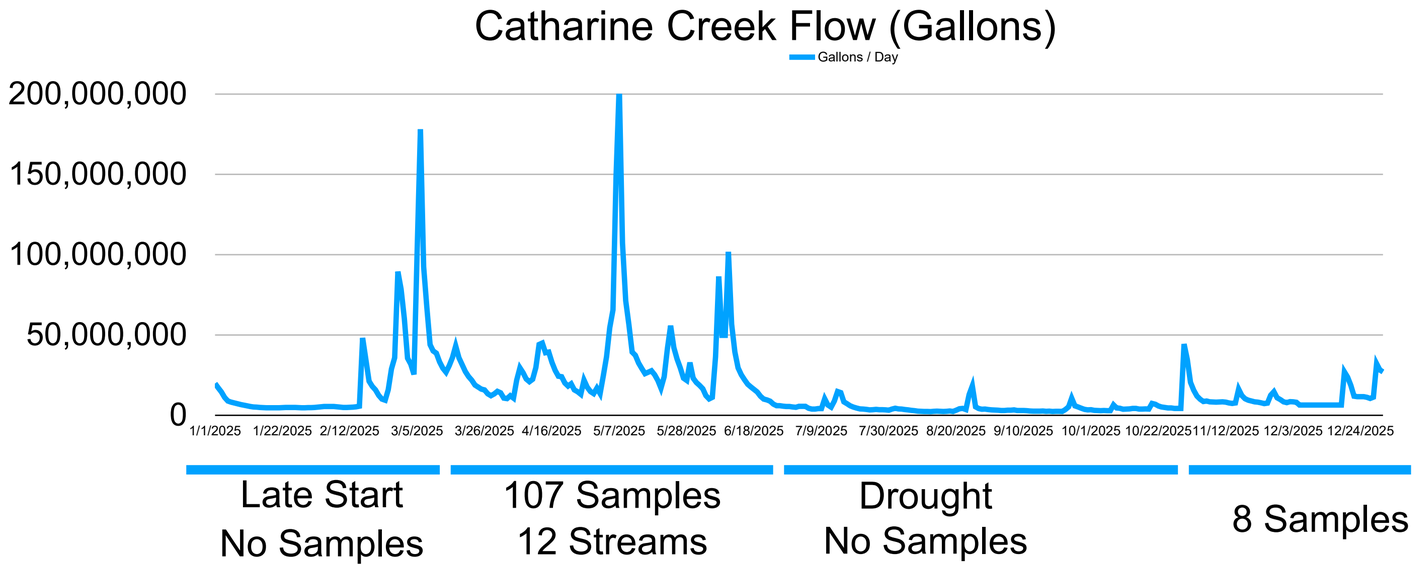


*USGS

Totals include estimated data for months when a sensor was absent



2025 TP Results - Summary

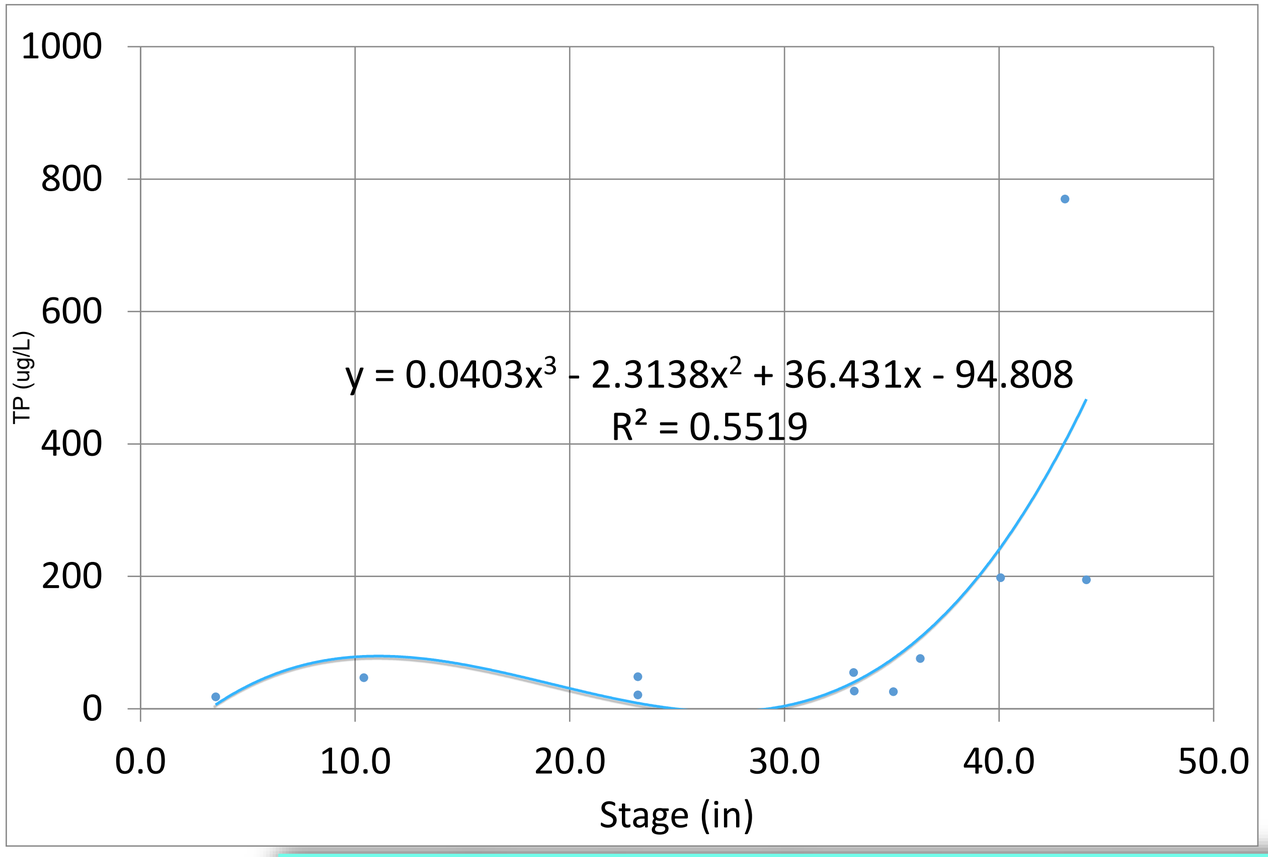


- Limited number of Storms
- Attempts to treat TP as a Stage relationship were mixed
  - ~85% of samples were Storm flow
  - Did not capture storm rise/fall data

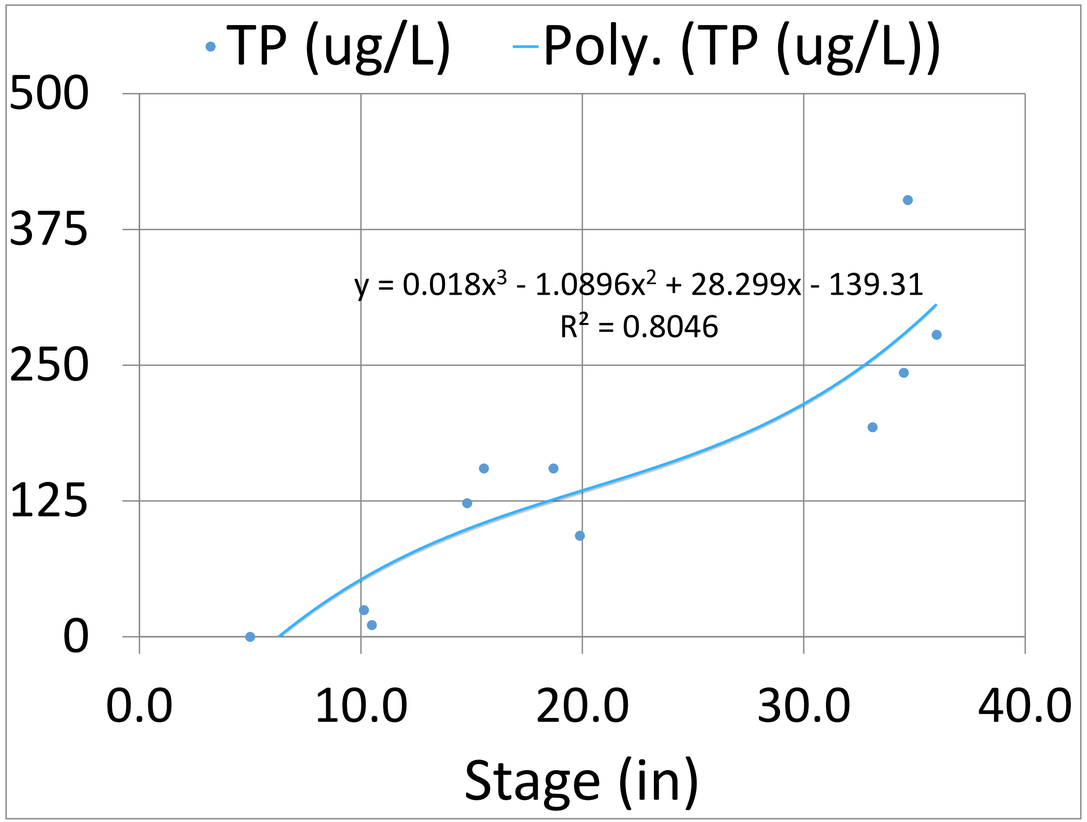
If your sample is not near the storm peak, you miss the high TP

2025 TP Results - Curves

Big Stream



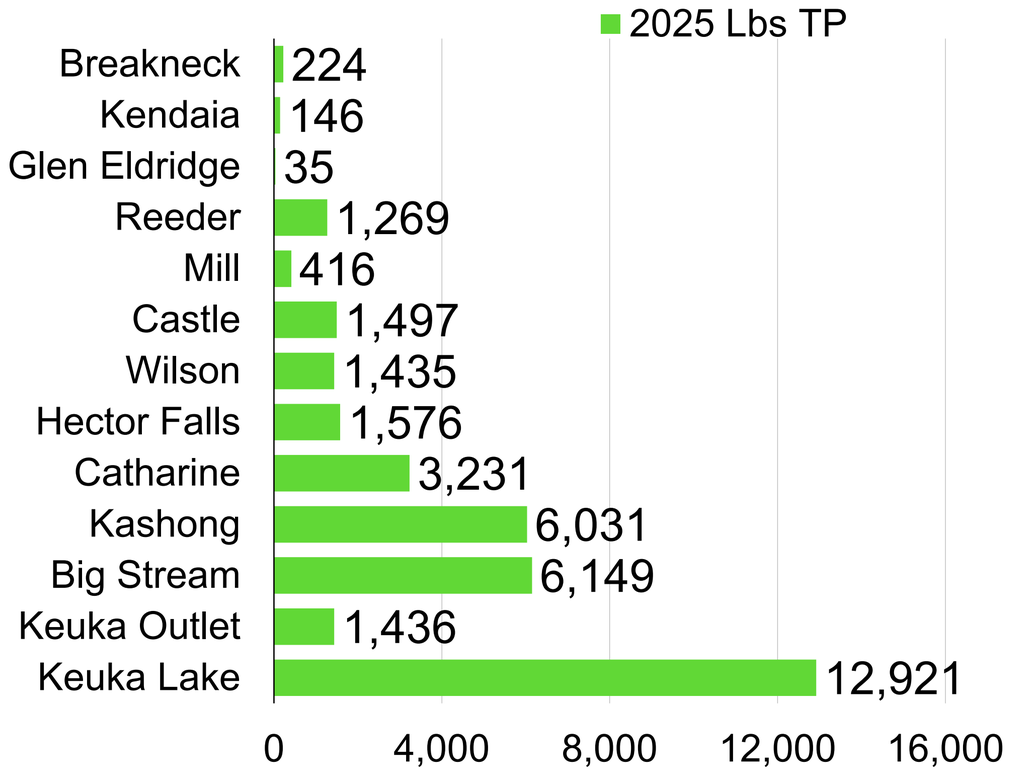
Kashong Creek



Phosphorus Curves are not as strong a relationship as Flow

Time of Year, Farming Activities

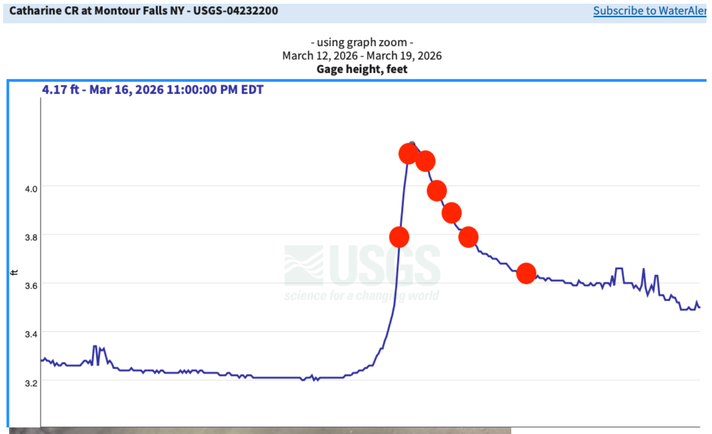
2025 TP Results - Lbs



- 36,366 Lbs Total
- Streams sampled approx 58% of Watershed

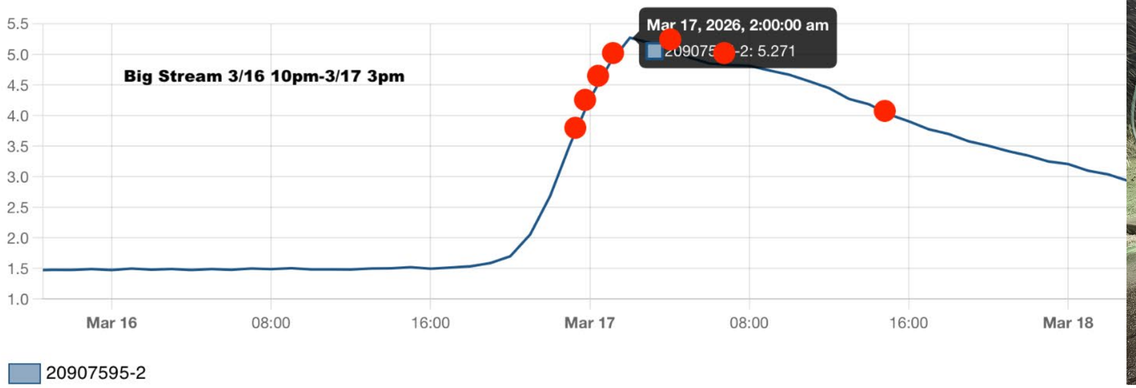
Different Approach from TP Curves needed for 2026

2026 TP Strategy



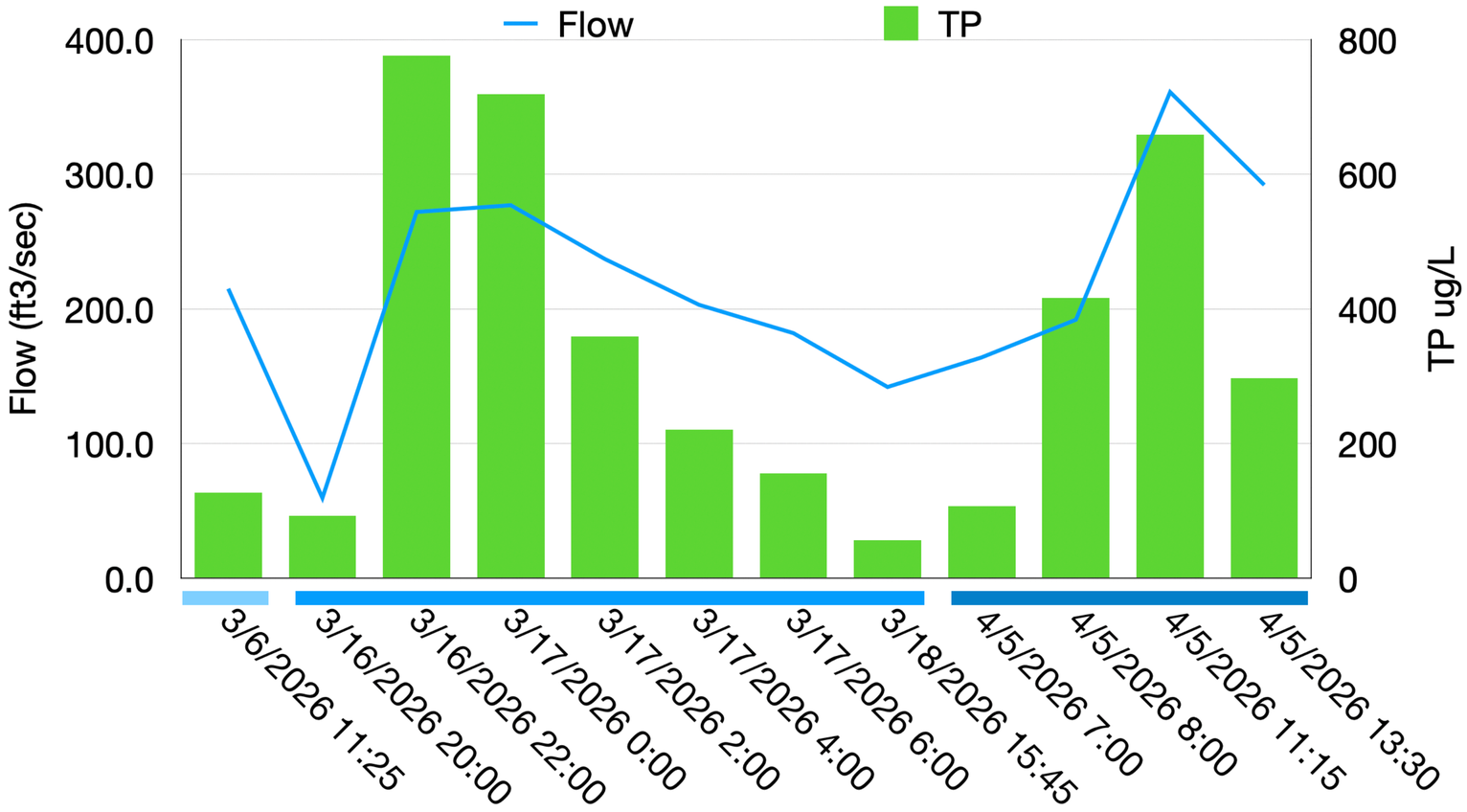
- Focus on the Rise and Fall during Storms
  - On Every Stream Once, Large Streams Multiple Times

2026 TP Strategy



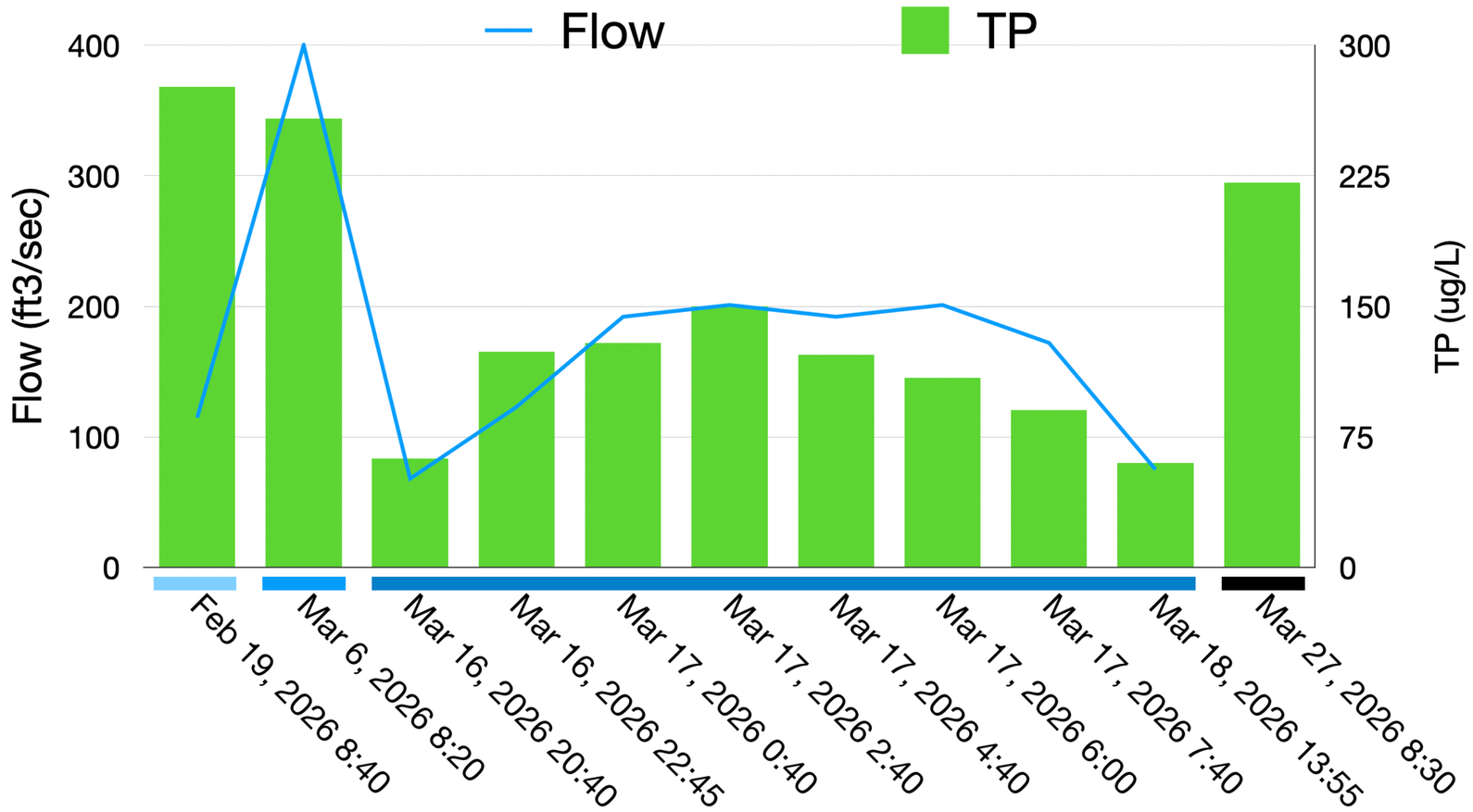
- Stay up all night
- Use multiple ELAP Labs
- 177 Samples as of 5/6
  - Goal of 250+
- 19 Rise/Fall Events (4-8 samples)

2026 Rise/Fall - Catharine



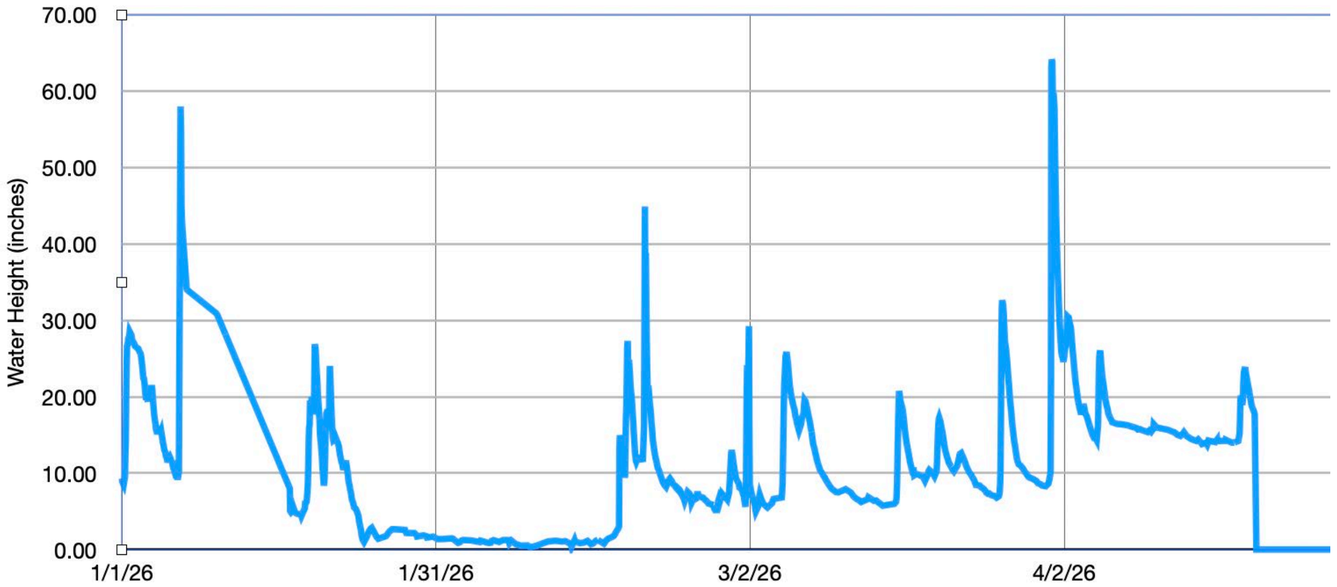
3/16 High TP at Peak for 4-6 Hrs, Single Sample Approach Most Likely Misses

2026 Rise/Fall Kashong Creek



High TP during Low and High Flow

Big Stream



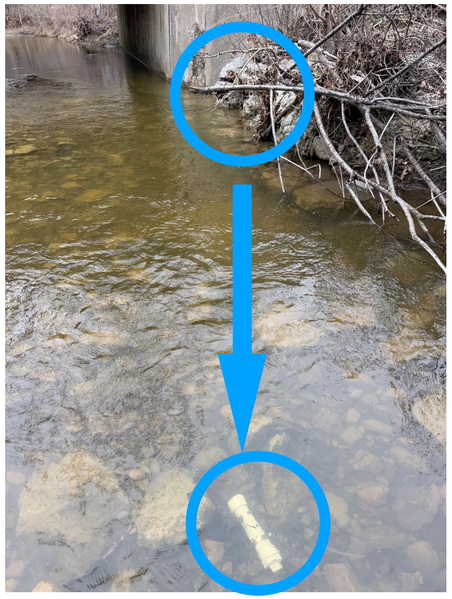
37.1 Square Miles
Drainage Area

Time	Height (in)
3/31/26 4:00 PM	10.20
3/31/26 5:00 PM	22.24
3/31/26 6:00 PM	63.30
3/31/26 7:00 PM	64.16
3/31/26 8:00 PM	63.93
3/31/26 9:00 PM	59.89
3/31/26 10:00 PM	58.76
3/31/26 11:00 PM	59.78
4/1/26 12:00 AM	59.87

53” Rise in 2 Hours

Lessons Learned

- Your going to lose sensors, accept it but don’t beat yourself up!
  - Object Strikes, Cell Sensor Cable damage, Things happen
  - PVC Enclosure Protects the Sensor and Keeps Sensor in Same Position
- High Velocity Water - The GW flow meter will “walk”. That’s the advantage of the radar meter.
- Hobo Sensors - The Bluetooth model makes data retrieval simple - cell phone, magnet, and a wrench
- Hobo Cell Sensors - Data Plan adds expense ($2K), but help with identifying stream rise.
- Phosphorus Samples
  - Labs can be the limiting element - No Weekend Service, Capacity Constraints, Hold Times
    - Using 3 ELAP Labs in Geneva (FLI), Ithaca (CSI), and Syracuse (UFI)
  - Capturing Stream Rise and Fall is Hard - Plan on All Nighters
- Spreadsheet work is more effort than the field work



Phosphorus Loads are Critical for Managing Water Quality on Lakes

Questions

Thanks to Steve, Stu, Dan, Doug, Allison, Ken, J, Mark, Art, Grascen, Lisa, Trevor, Gina, Tom, Bill, Michelle, Sean, Jim