NJDEP
2023 Virtual HAB Summit

New Challenges, Lasting Solutions

March 30, 2023

NJDEP 2023 HAB Summit Agenda

Theme: New Challenges, Lasting Solutions

- 9:00 - 9:10 Opening Remarks by Assistant Commissioner Katrina Angarone
- 9:10 - 9: 15 Summit Logistics
- 9:15 - 10:10 Session 1: The Year In Review, New Jersey and Beyond
  - Vic Poretti: 2022 Season Stats & Response
  - John Abatemarco: Autonomous Surface Vehicle
  - Fred S. Lubnow, Ph.D.: HABs Around the Nation
- 10:10 - 10:20 Break
- 10:20 - 11:50 Session 2: Turning Data into Action
  - Mike Pisauro: The Watershed Approach
  - Kate Douthat: New Jersey Watershed Restoration and Adaptation Planning Tool
  - Bob Schuster: Problem Characterization
  - Gabe Mahon: MS4/Watershed Improvement Plans
  - Paul Hauch: Funding Sources
- 11:50 - 12:50 Lunch
- 12:50 - 1:30 Session 3: It's Complicated - Cause Analysis Case Studies
  - Jason Adolf: Deal Lake
  - Vic Poretti: Millstone River
  - Heather Desko: Spruce Run
- 1:30 - 1:40 Break
- 1:40 - 2:15 Session 4: Getting Smarter on HABs
  - Jason Adolf: Expert Team Read-Out
  - Sarah Mahmoud: One Health Task Force - HABs & Agriculture
- 2:15 - 2:25 Q&A
- 2:25 - 2:30 Closing Remarks by Assistant Commissioner Patricia Gardner

Opening Remarks

Kati Angarone

Assistant Commissioner
Watershed and Land Management
NJDEP

Poll Question

How to join poll:

- Go to vevox.app and enter the below session ID

- Click on the link in the chat

- Use QR Code

Join at:
vevox.app

ID:
184-925-240

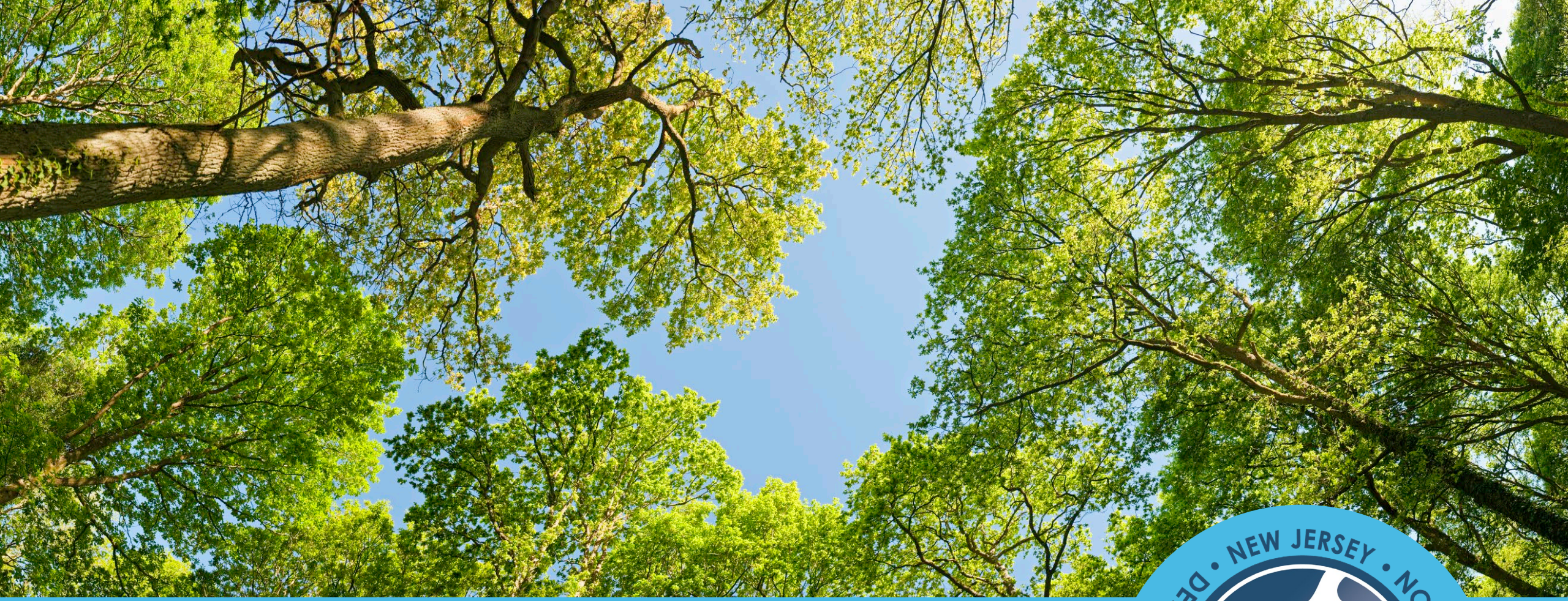
Session 1: The Year in Review, New Jersey and Beyond

March 30, 2023

2022 Season Stats & Response

Vic Poretti

Bureau Chief
Freshwater and Biological Monitoring
NJDEP



2022 HAB Summary: Year in review; weathered challenges

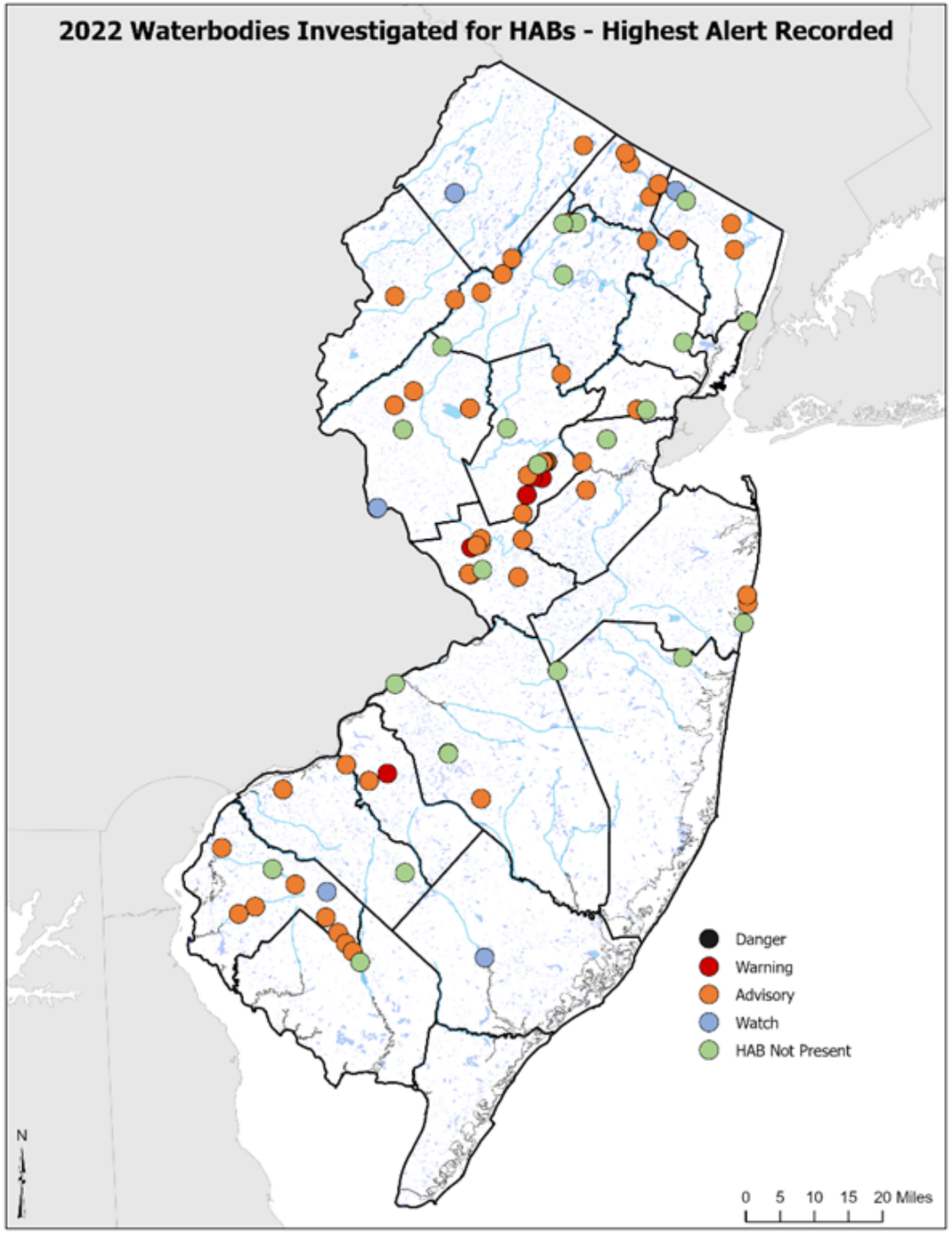
HAB Summit

March 30, 2023

Victor Poretti, Bureau Chief
Bureau of Freshwater and Biological Monitoring

2022 HAB Season Summary

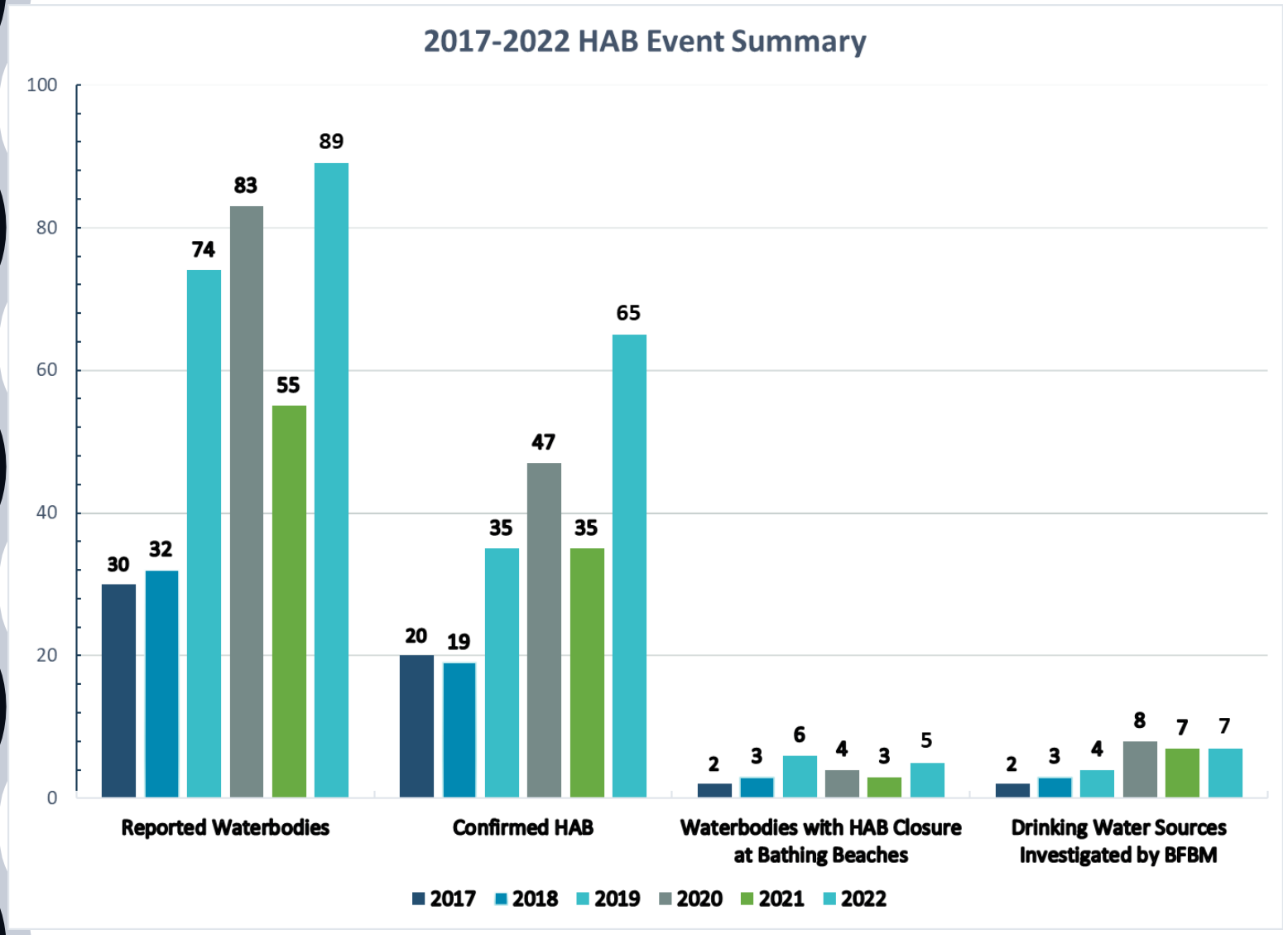
- Record year for confirmed HABs
- New Challenges/ New Responses.



2022 HAB Season Summary

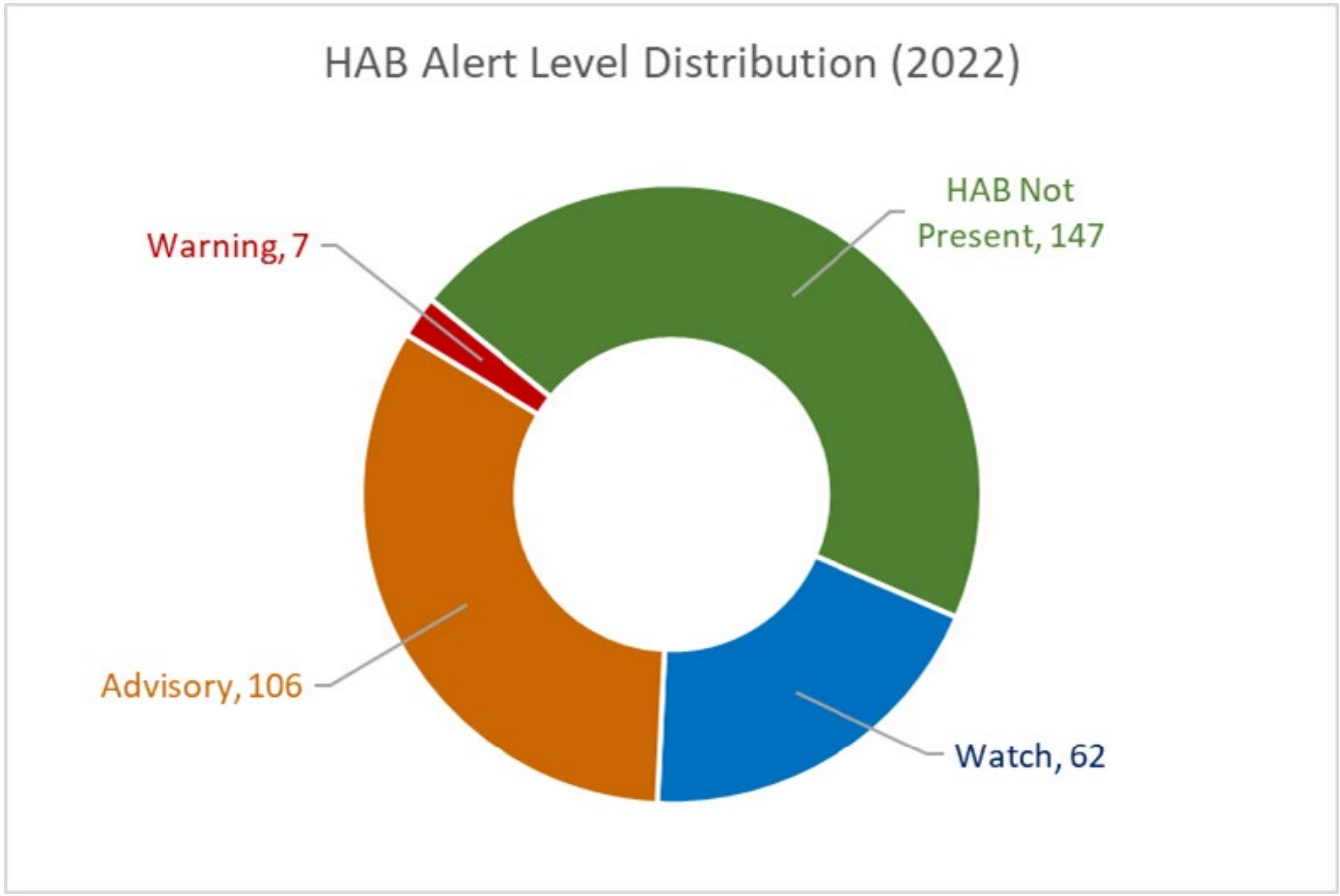
- 89 reports of suspected HABs.
- 62% increase in reports from 2021
- 7% increase in reports from 2020 which at the time had the highest occurrence of suspected HAB reports.

- 65 confirm HABs
- Increase of 38% since the program began.
- As compared to 2021, confirmed HABs rose by 85%



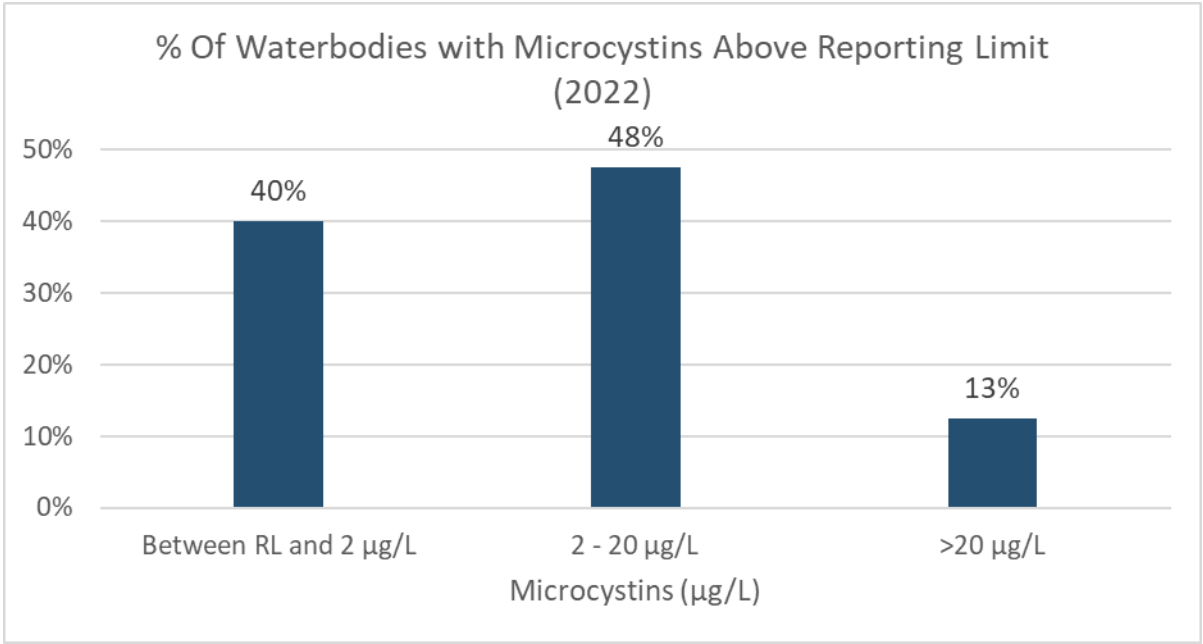
2022 HAB Season Summary

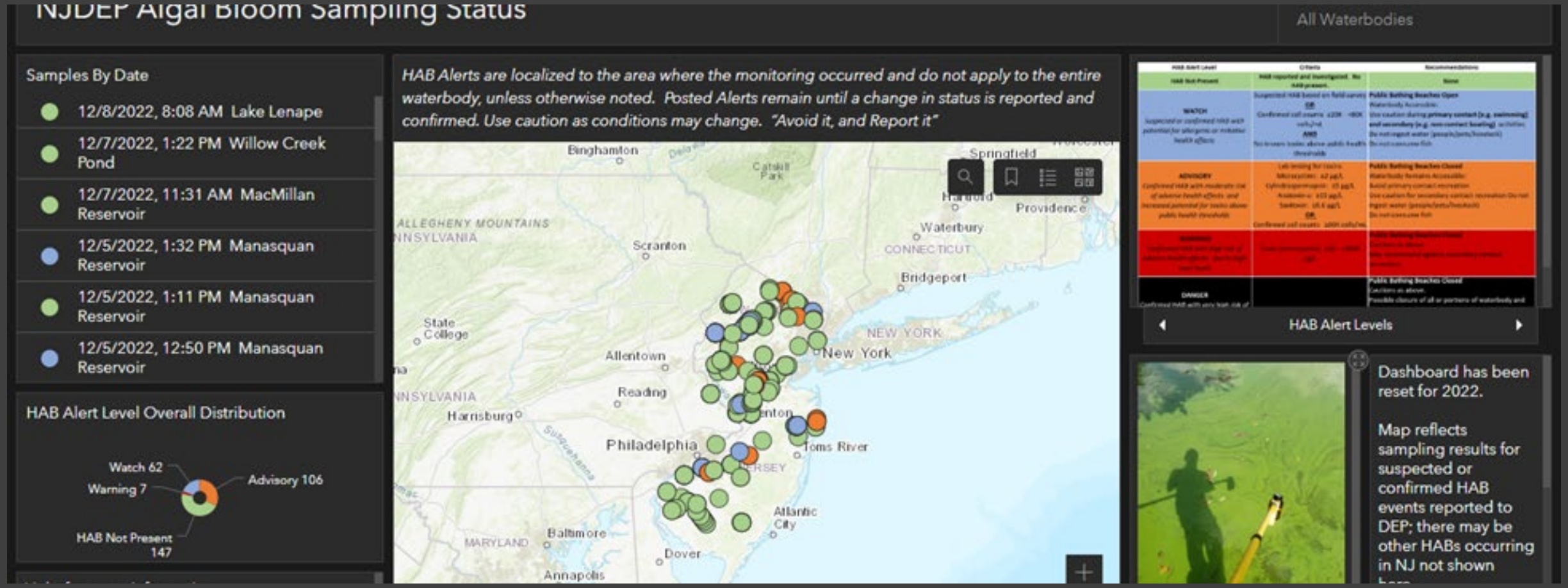
- At each of the 89 waterbodies investigated, multiple sites may have been sampled
- 322 site-specific HAB postings.



2022 HAB Season Summary

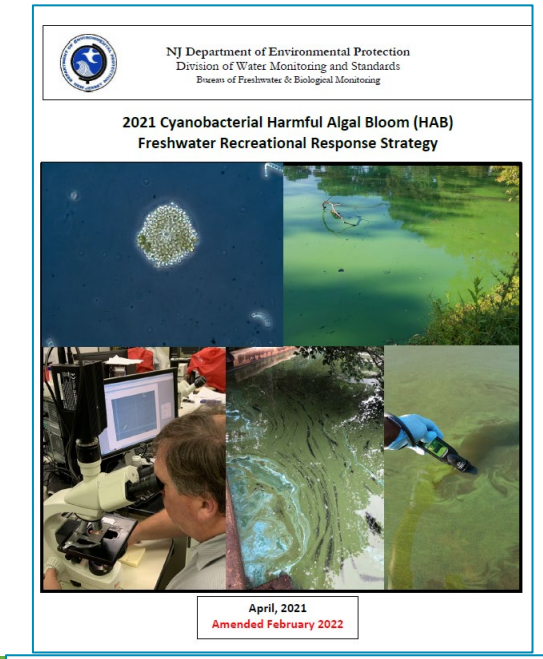
- Highest occurrence of toxins.
- Highest occurrence > 20 (Warning Alert)





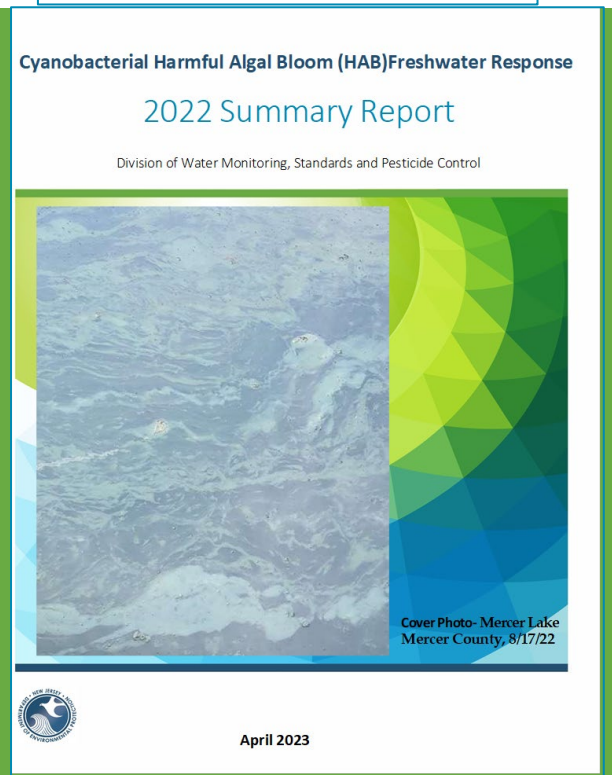
HAB Dashboard

[NJDEP Harmful Algal Bloom (HAB) Dashboard (arcgis.com)]



HAB Recreational Strategy

No changes for 2023.
Guidance and thresholds remain aligned with current science.

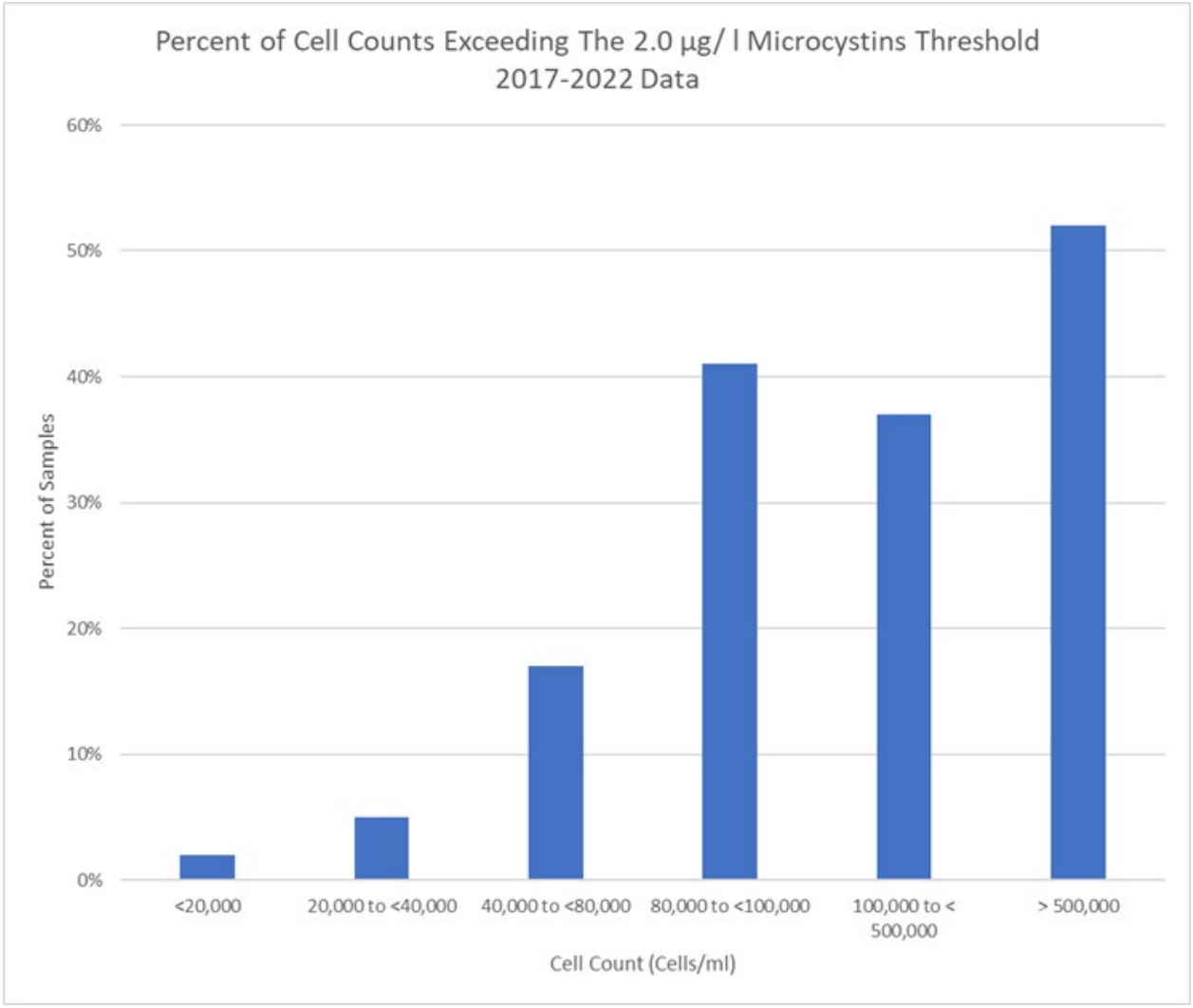


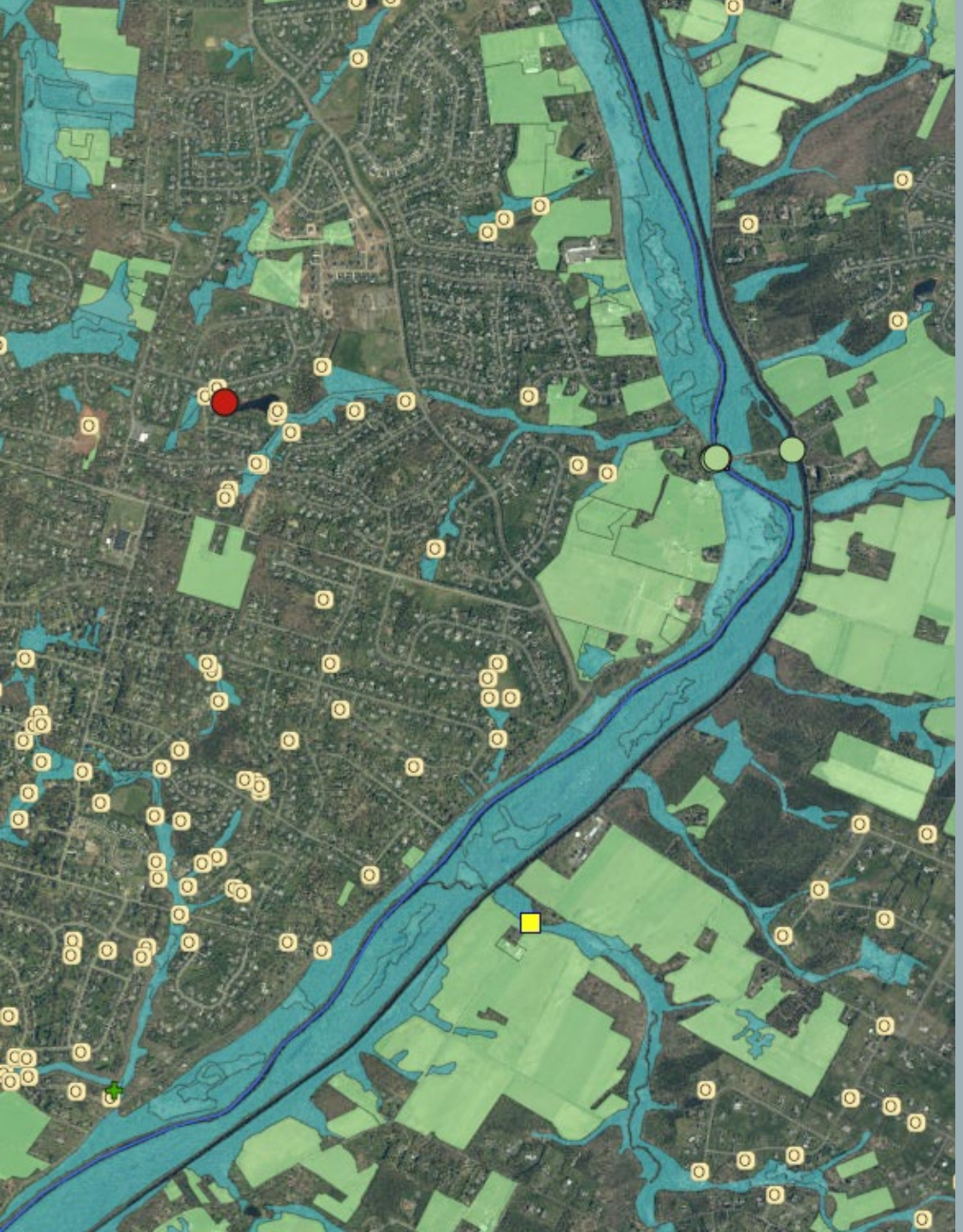
Annual Report

- Posted in April.
- Summary of previous season and comparison to past years.

Strategy Review/ Threshold Analysis

- Strategy Reviewed each year for any new science developments; no changes for 2023.
- Bathing Beach closing threshold for cell count vs toxin reviewed each year using new data.
- No changes – 80K still level toxins are more probable.
- Details of analysis in Annual Report





2022 WEATHERED CHALLENGES

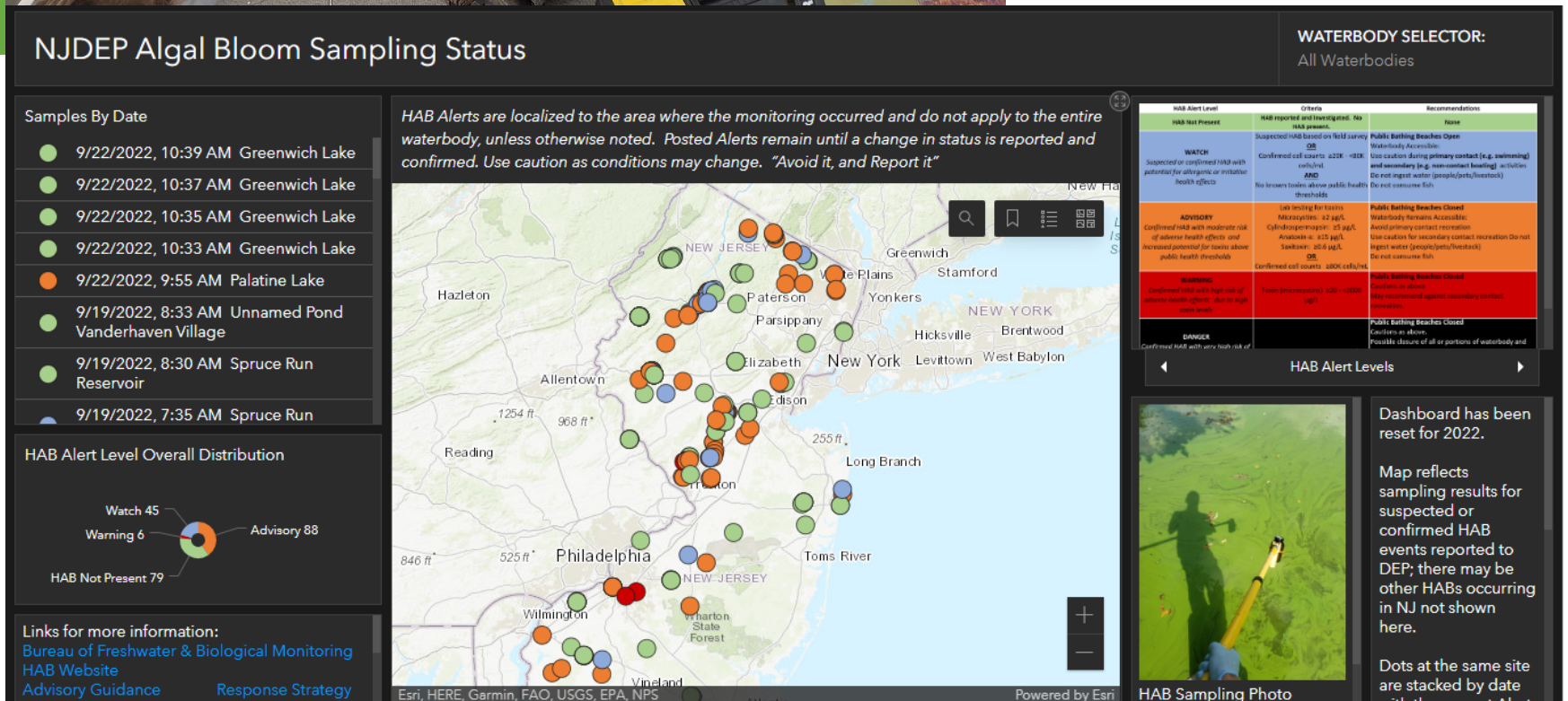
Drinking Water Concerns
Source and Finished Water Analysis
Stream HABs

Actions

- Source Trackdown (nutrients feeding HABs)
- Enhanced Lab capacity for finished DW analysis
  - Certified for Microcystin analysis for both surface water and finished drinking water.
- Collaborated/ Coordinated with many new agencies including DW purveyors, discharge permittees.

- New technology: YSI HYCAT Autonomous Surface Vehicle to characterize HAB and water quality conditions for an entire lake.

NORTH AMERICAN LAKE MANAGEMENT SOCIETY (NALMS) 2022 AWARD FOR ADVANCEMENT IN LAKE MANAGEMENT TECHNOLOGIES



Contact

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http://www.state.nj.us/dep/wms/bfbm/

609-292-0427

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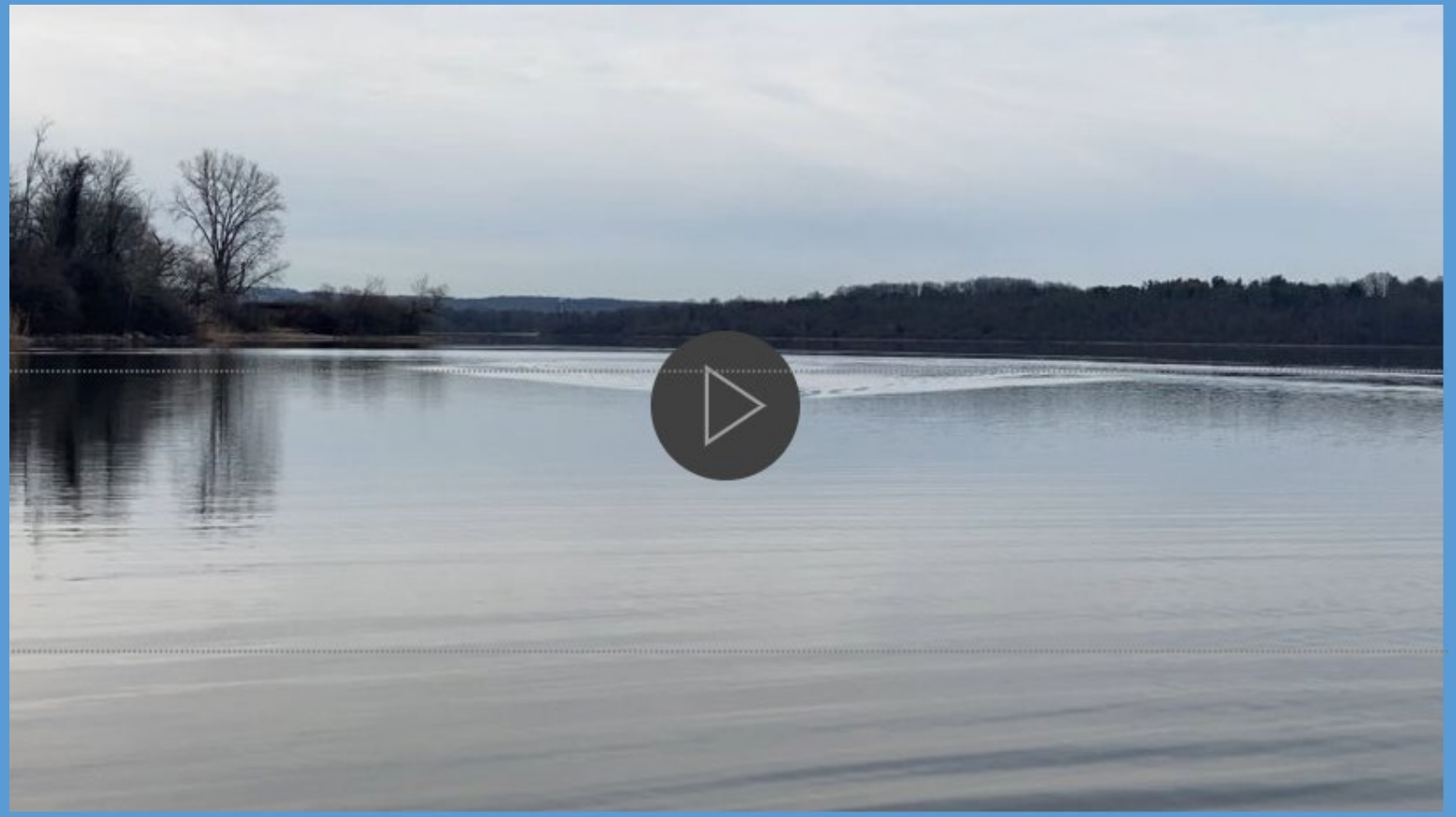
Autonomous Surface Vehicle

John Abatemarco

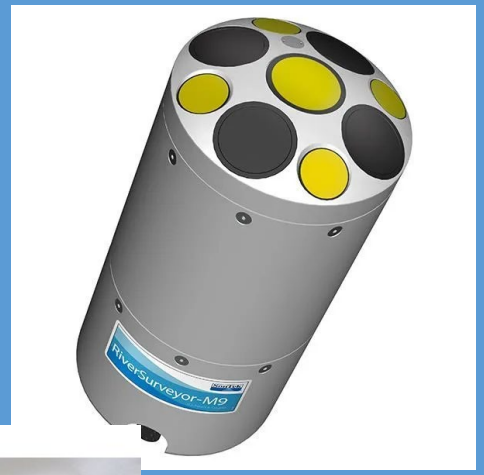
Environmental Specialist 2
Freshwater and Biological Monitoring
NJDEP

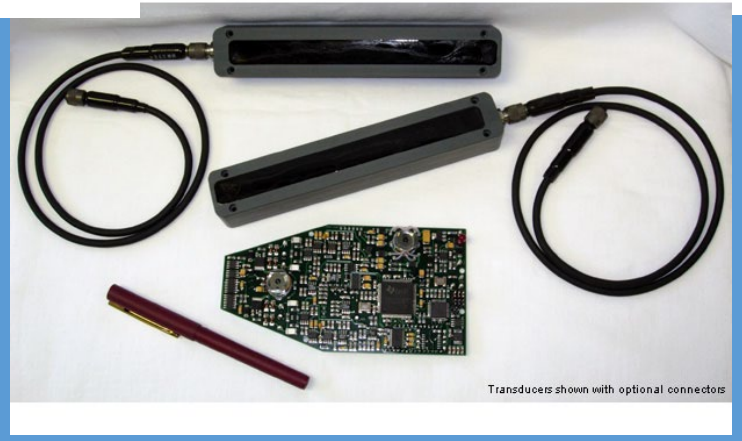
Hycat Autonomous Surface Vehicle



Monitoring +

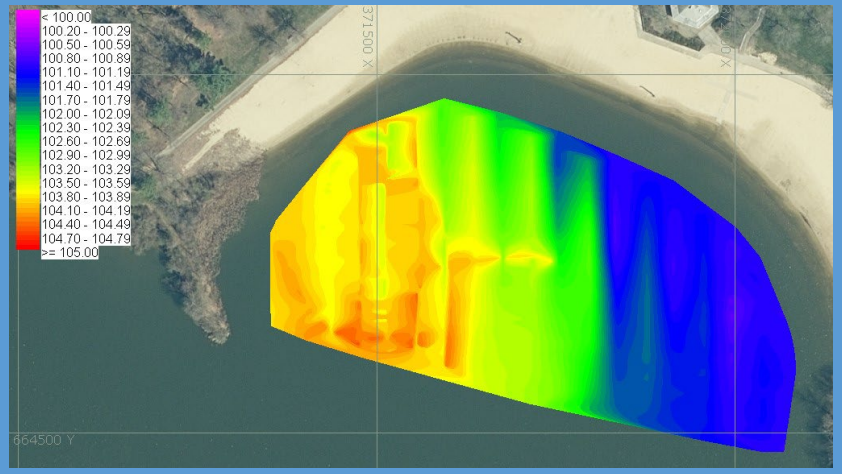
- Water Quality : ODO%, ODO conc., SpC, pH, Phycocyanin, Temp, Turbidity
- Side Scan Sonar
- Bathymetry
- Water Velocity



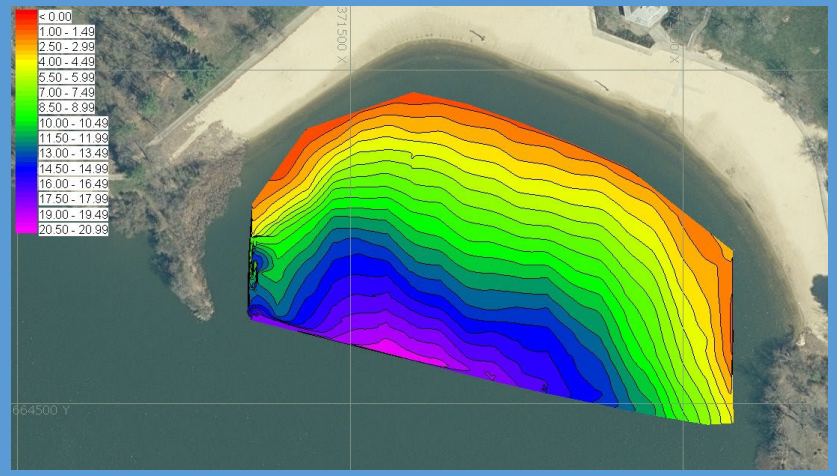


Data Processing

- Heat Maps for each water quality parameter



- Bathymetric Maps with the ability to overlay the Side Scan Sonar imaging

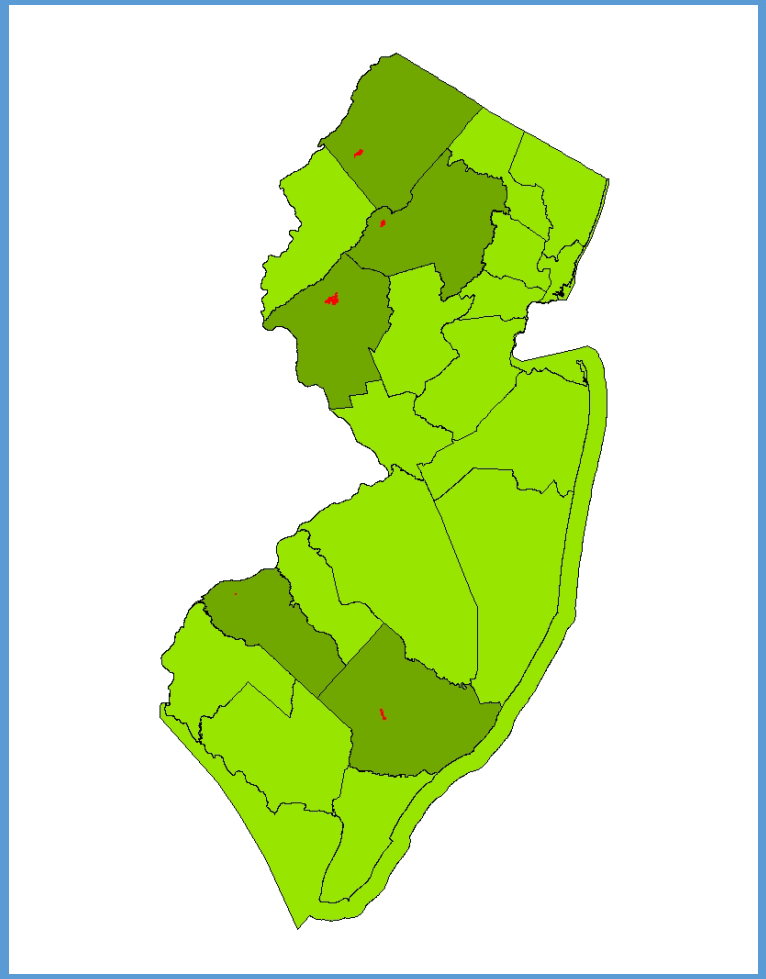


Deployments

- Portable base station
- Power supplied by lithium power packs with a backup solar array
- This gives us the ability to deploy the Hycat almost anywhere

How We Plan to Use the Hycat

- Deployments 3x per year at 6 of the 11 buoy locations
- Greenwich Lake, Lake Lenape, Spruce Run Reservoir *, Budd Lake and Swartswood Lake*
- Due to logistics and safety concerns we are not sampling Lake Hopatcong and Greenwood Lake



* Entire waterbody will not be sampled

HABs Around the Nation

Fred S. Lubnow, Ph.D.

Senior Director, Ecological Services
Princeton Hydro

HABs Around the Nation and in our Waterways

NJDEP 2023 HAB Summit
March 30th, 2023

Fred S. Lubnow, Ph.D.

With offices in New Jersey, Pennsylvania, Maryland and Connecticut

flubnow@princetonhydro.com

PRINCETON HYDRO
SCIENCE ENGINEERING DESIGN

National Lakes Assessment (US EPA, 2022)

- ✓ Latest assessment conducted in 2017; information used by the North American Lake Management Society's White Paper to reinstate funding into the Clean Lakes Program (Section 314 of the Clean Water Act).
- ✓ Across the US, 45% of lakes are in "poor" condition relative to elevated phosphorus concentrations and 46% in "poor" conditions relative to elevated nitrogen concentrations.
- ✓ Nutrient pollution, high levels of algal growth and lower water clarity are increasing and observed in 24% of the nation's lakes.

National Lakes Assessment (US EPA, 2022)

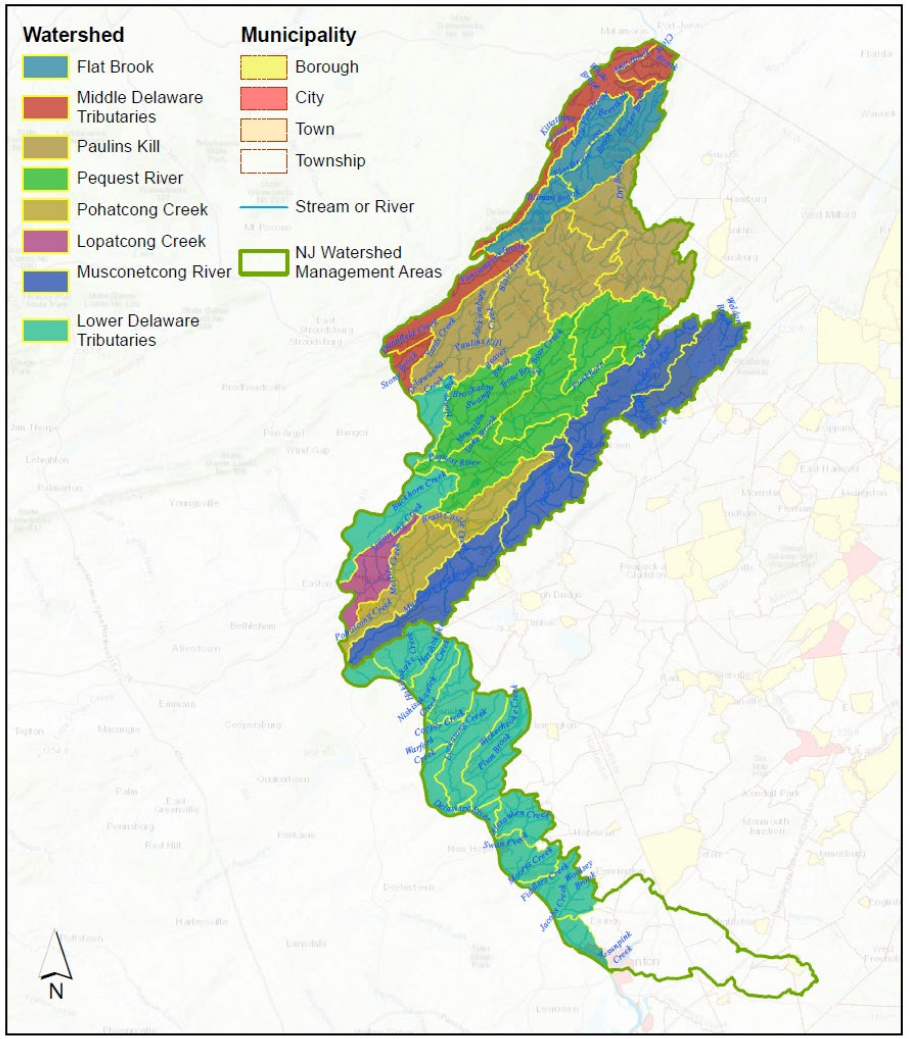
- Microcystins were detected in 21% of the surveyed lakes.
- Based on biological indicators, 24% of continental US lakes were in poor conditions for lake life.

Economic Impacts / US EPA Clean Lakes Program

- ✓ One study found that lakes with excess phosphorus resulted in a 0.4 to 3.3% decrease in lakefront housing prices.
- ✓ Another study found that properties surrounding lakes with high levels of algal toxins experienced a 2-17% decline in property values.
- ✓ Based on EPA, the Clean Lakes program spent $9.5 million and achieved an estimated $90 million in return on investment.

Economic Value of NJ Tributaries to the Delaware River

- University of Delaware Water Resources Center worked with MWA and Environment NJ.
- The NJ tributary watersheds contribute an economic value of $1.6 to $2.3 billion annually.



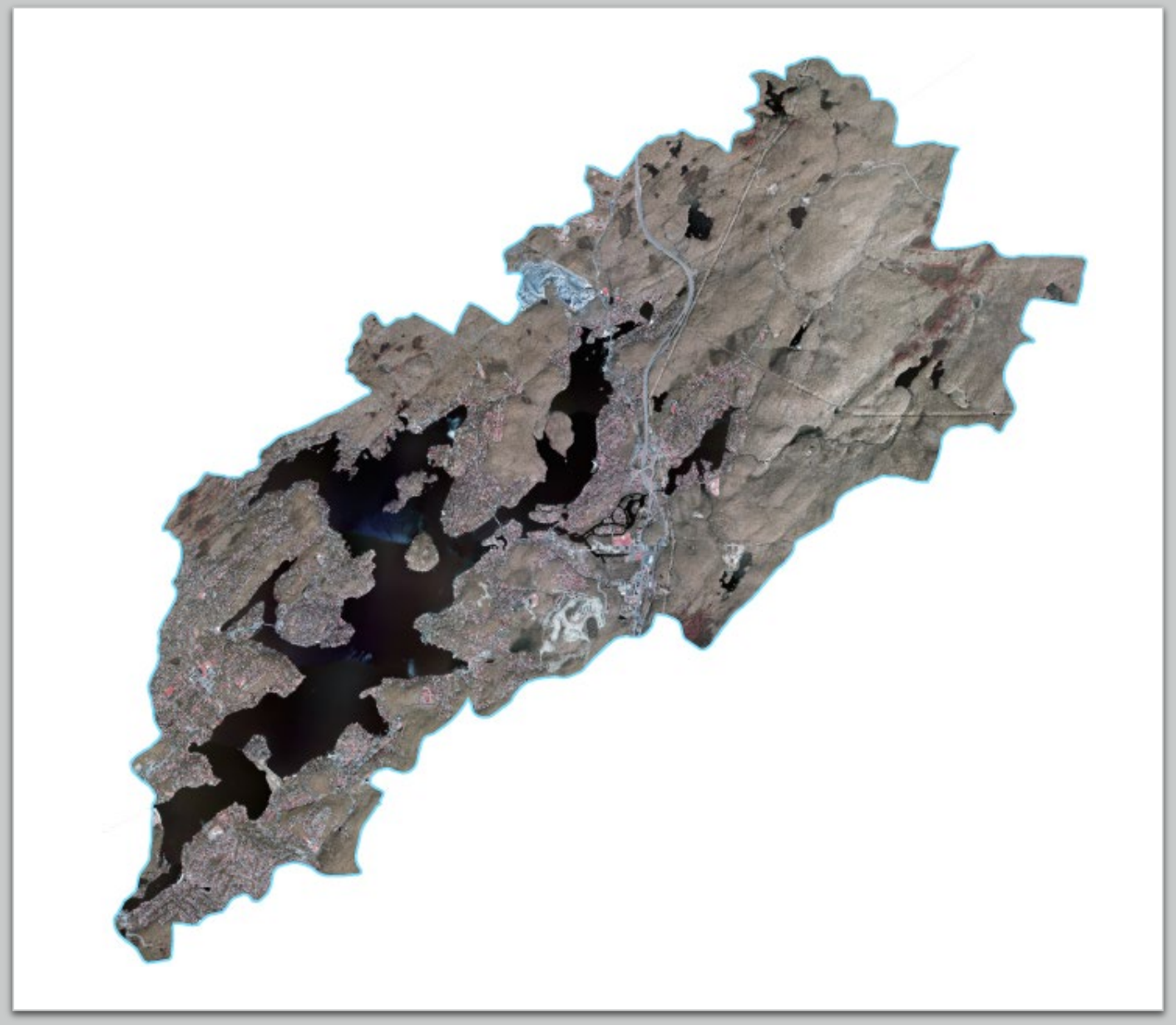
Delaware River Watersheds in New Jersey Above Trenton

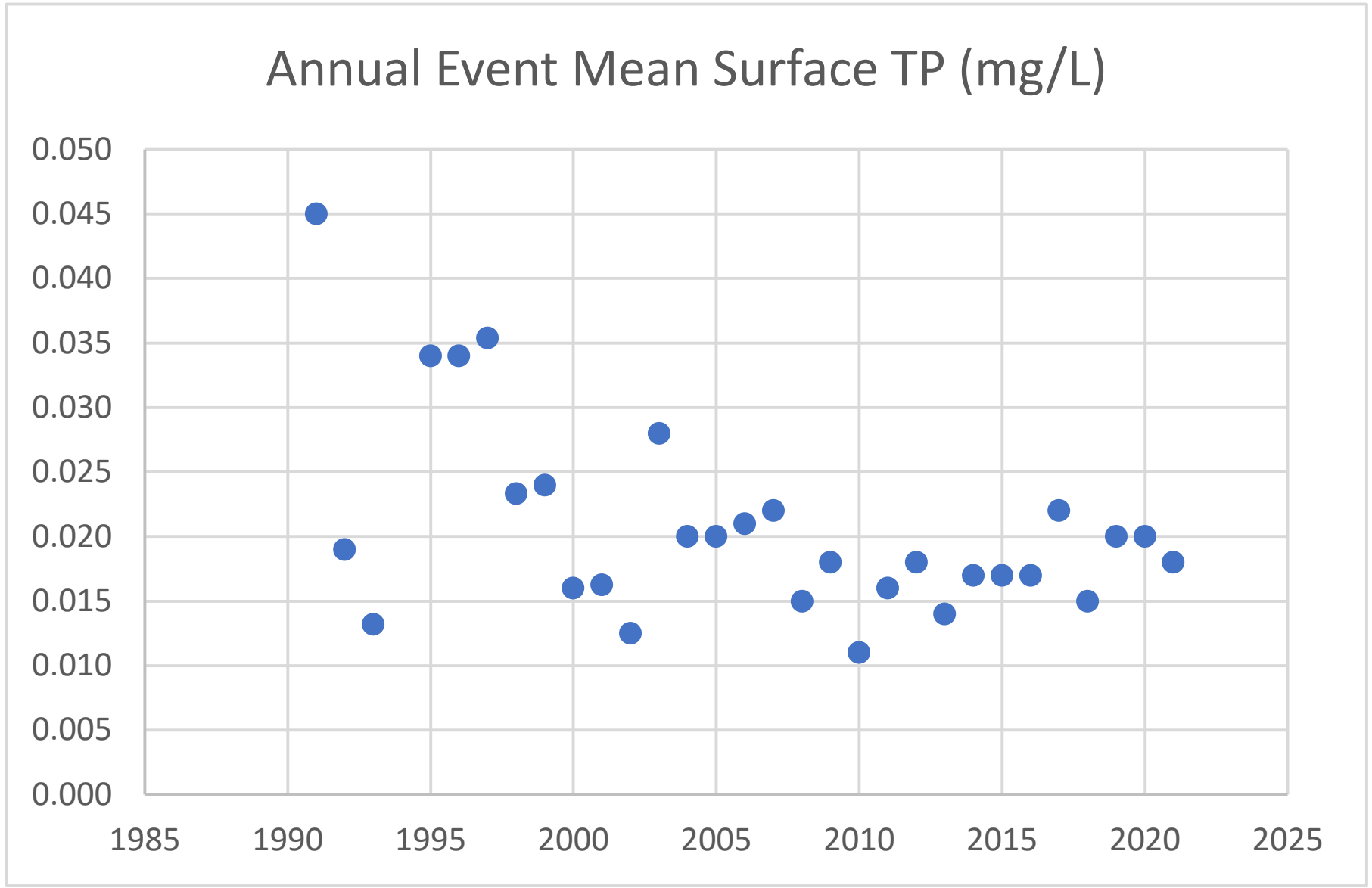
US EPA Clean Lakes Program

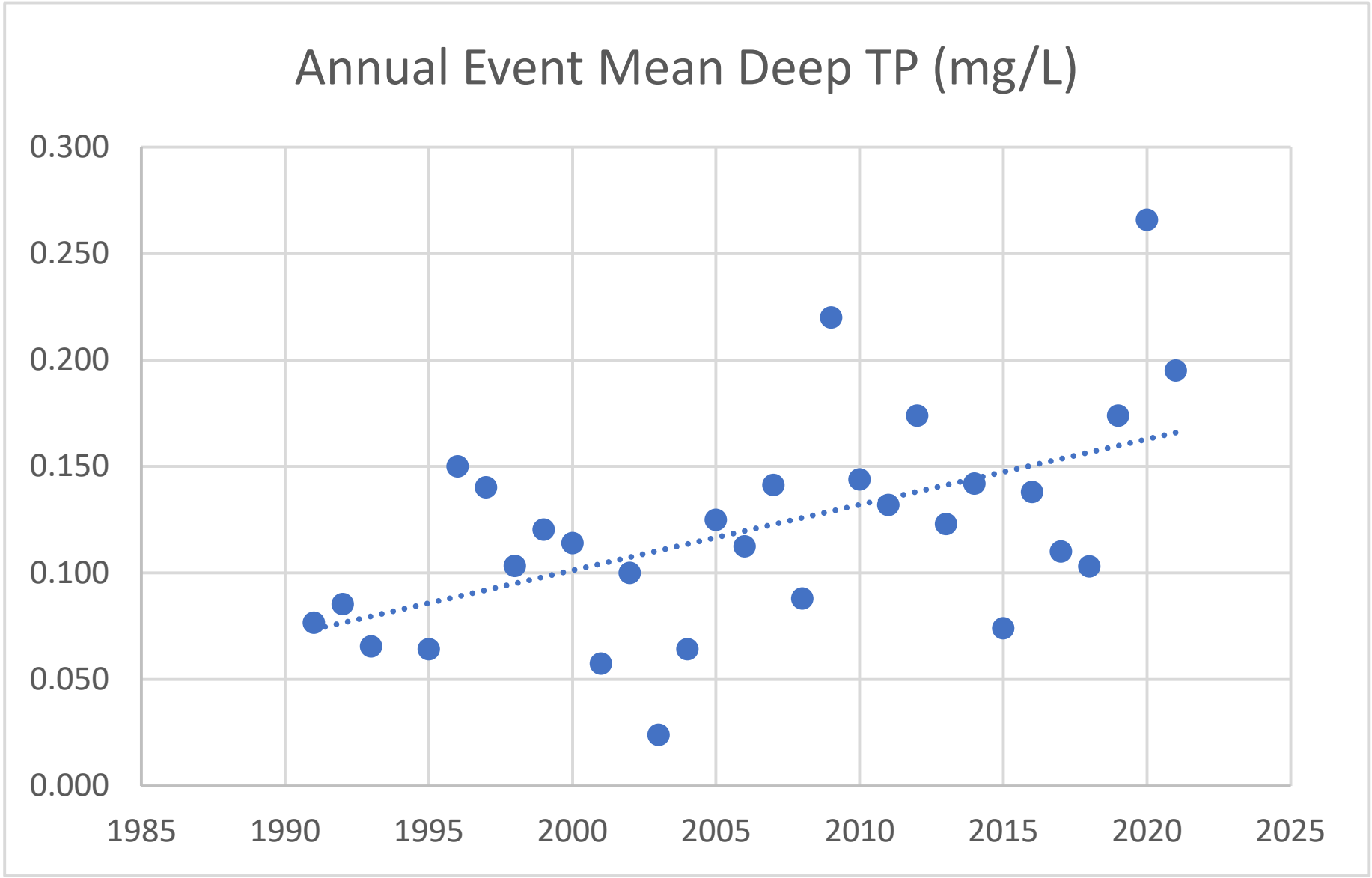
- ✓ Proposed to **reinstate** funding to the Clean Lakes Program.
- ✓ Section 314 Committee under NALMS
- ✓ HABs
- ✓ Invasive Species
- ✓ Impacts of Climate Change on Lakes
- ✓ Preservation / Protection of Sensitive Lakes
- ✓ Environmental Justice for Lake Users

Lake Hopatcong

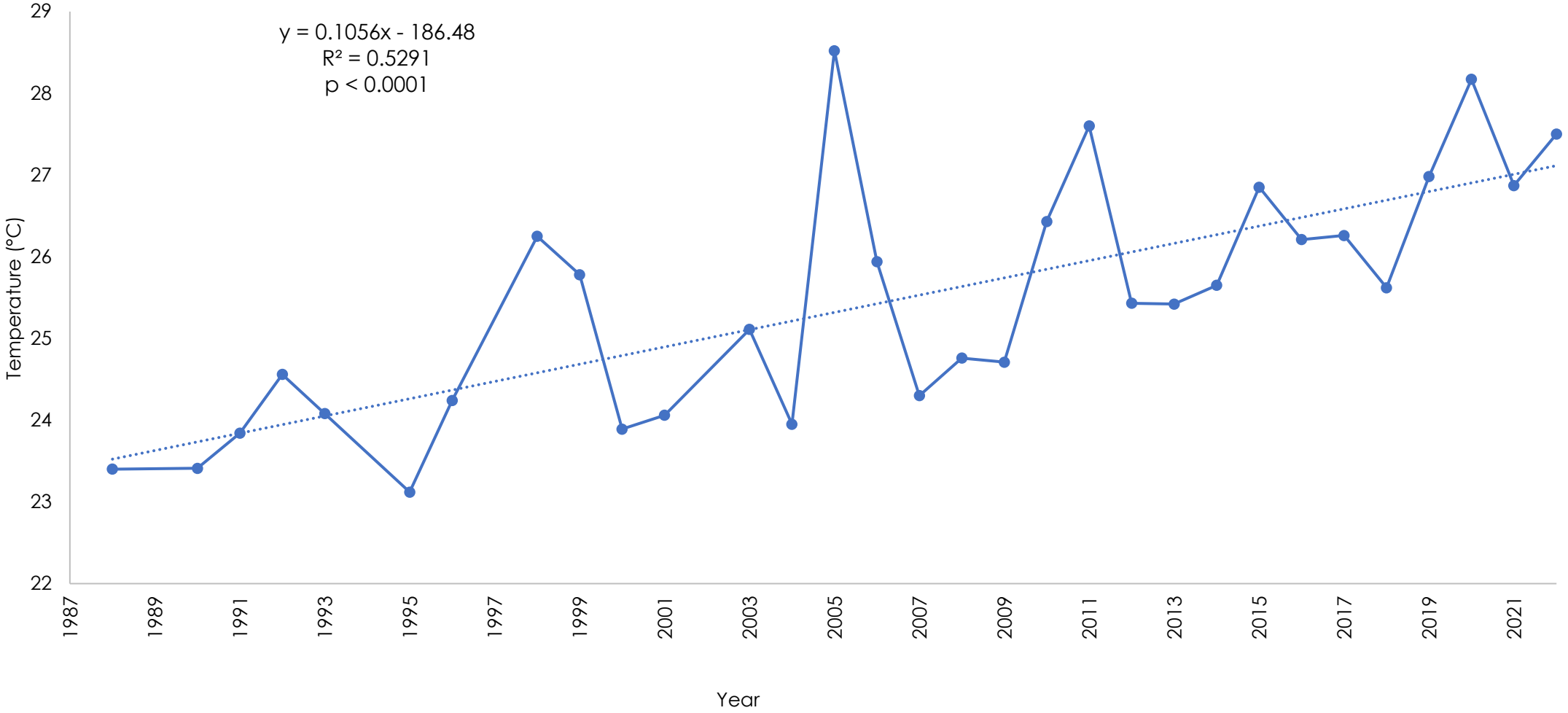
- Completed the HAB grant projects.
- Working on completing projects for an existing 319-grant.
- Initiating both a NFWF grant (streambank stabilization) and the Lake Restoration projects.
- Township of Jefferson updating a feasibility study for sewering.

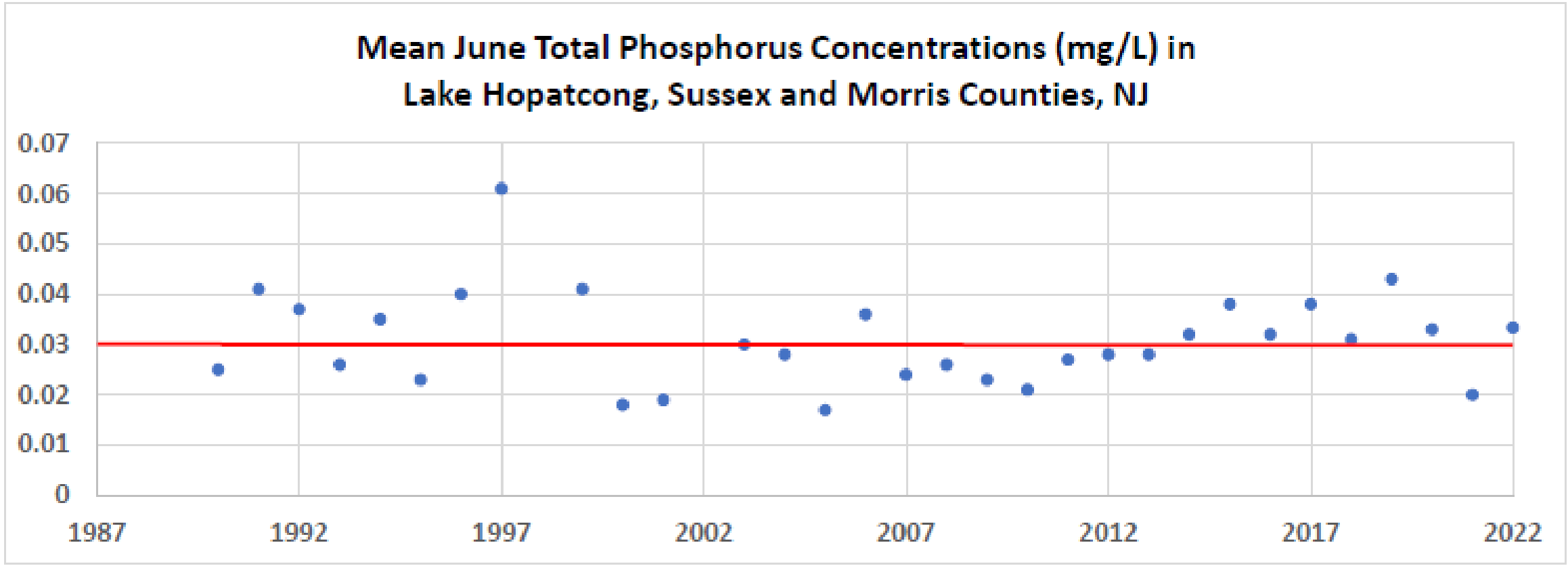



Annual Event Mean Surface TP (mg/L)
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
1985
1990
1995
2000
2005
2010
2015
2020
2025


Annual Event Mean Deep TP (mg/L)
0.300
0.250
0.200
0.150
0.100
0.050
0.000
1985
1990
1995
2000
2005
2010
2015
2020
2025

Lake Hopatcong July Surface Temperature, Station 2

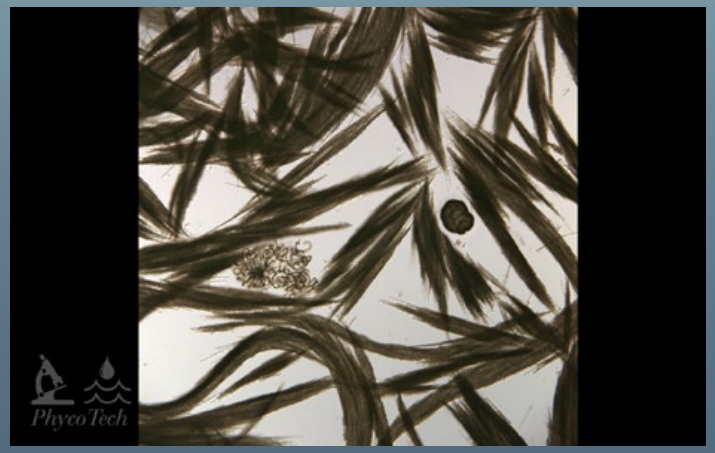


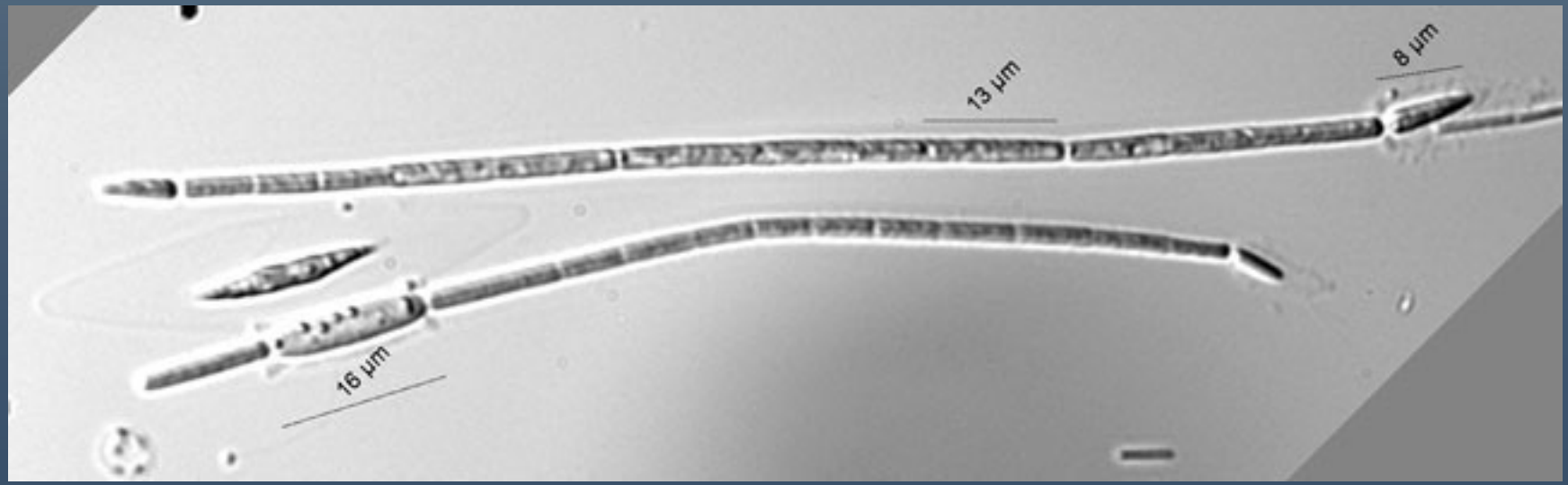

Mean June Total Phosphorus Concentrations (mg/L) in
Lake Hopatcong, Sussex and Morris Counties, NJ
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1987
1992
1997
2002
2007
2012
2017
2022

2019 and beyond – “one, two punch”

- **Watershed sources** (stormwater and septic leachate) in June triggered the HABs.
- However, **internal sources of phosphorus** (from the deep-water sediments when they go anoxic) allowed the HABs to remain through the entire growing season.

Common Cyanobacteria in Lake Hopatcong over 2022





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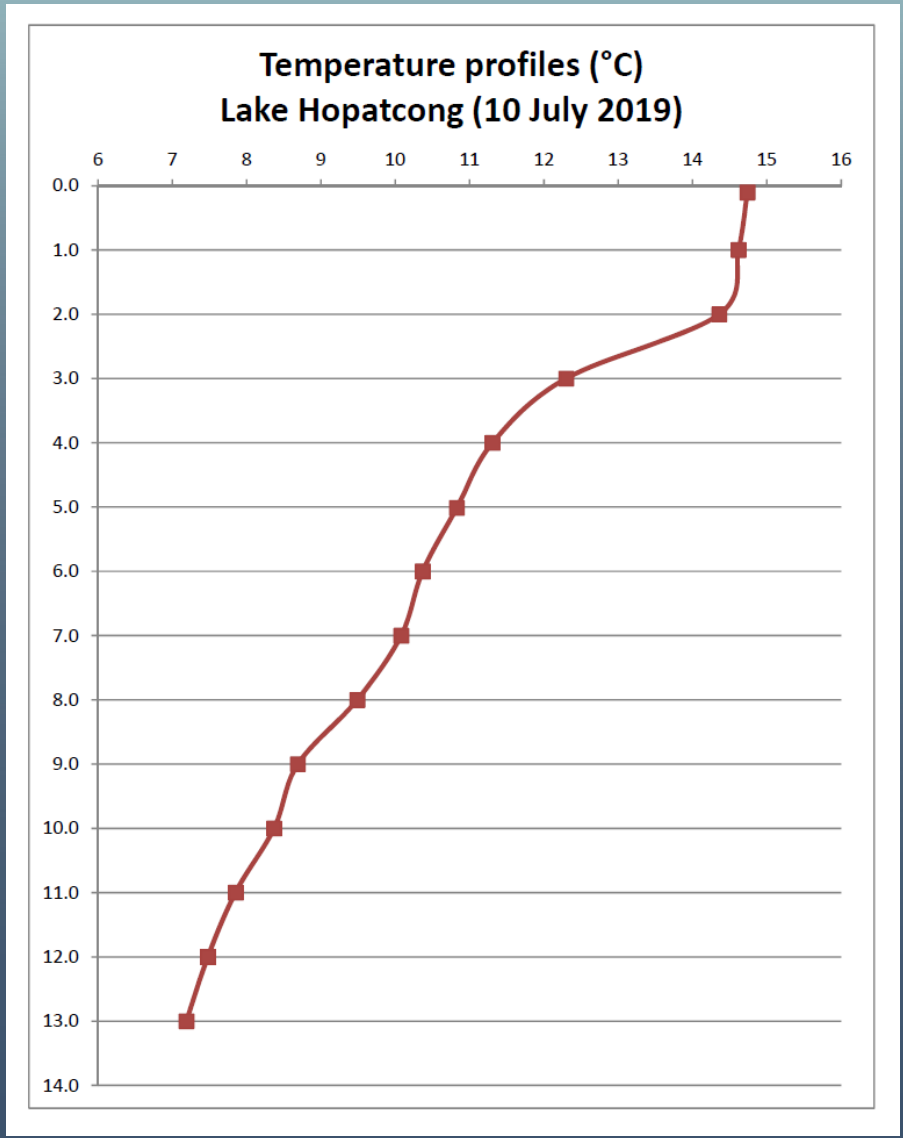
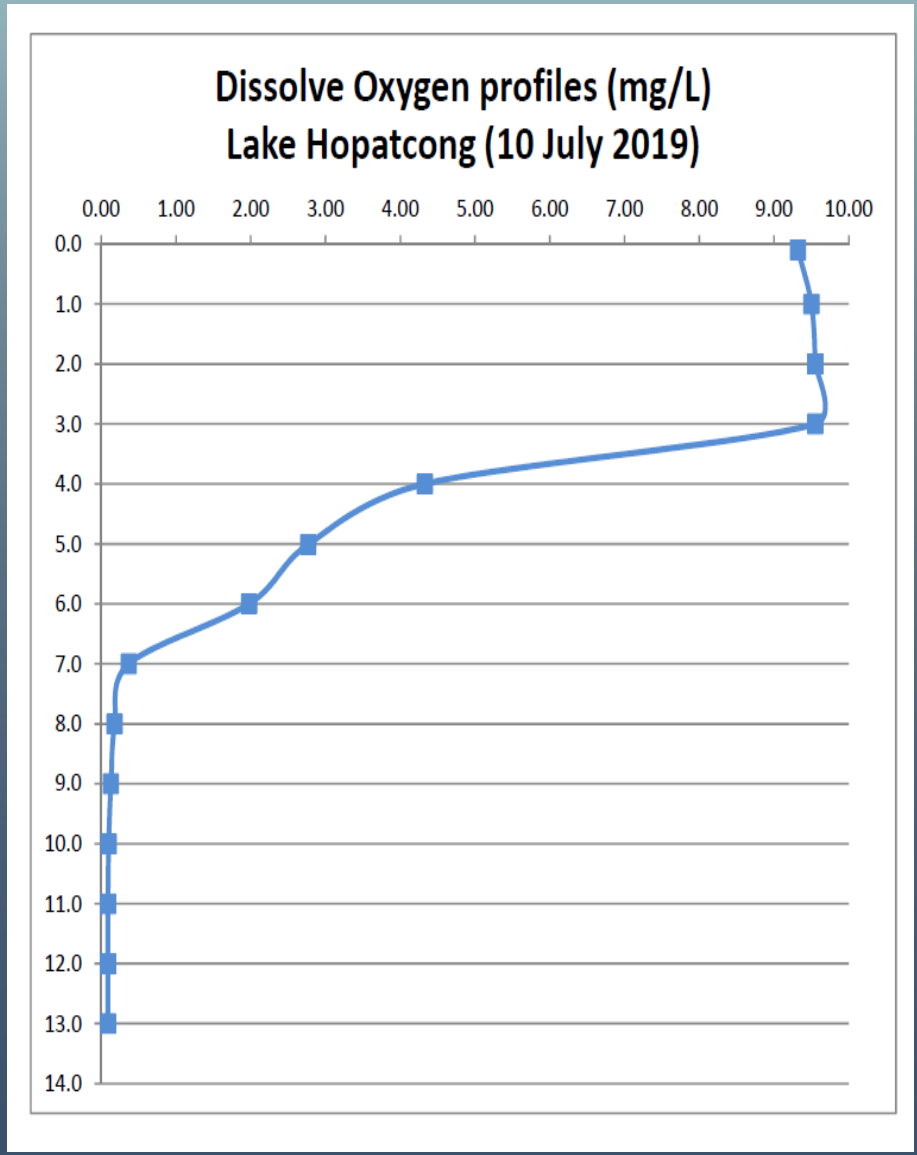
Lake Hopatcong

Station #2	Secchi Depth (meters) May	June	July	Mean
2016	2.2	2.6	2.4	2.4
2017	2	2.6	2.2	2.3
2018	2	1.8	2.1	2.0
2019	1.6	1.8	1.8	1.7
2020	1.5	1.8	1.4	1.6
2021	1.8	2.5	2	2.1
2022	1.5	1.5	1.7	1.6

Summary of Weed Harvesting at Lake Hopatcong

Year	Weeds Harvested in cubic yards	TP removed in lbs (as % of TP targeted for removal)
2016	4,042	647 (8.9%)
2017	3,872	622 (8.6%)
2018	3,925	631 (8.7%)
2019	**1,415**	**227 (3.1%)**
2020	35	6 (< 0.1%)
2021	**No harvesting occurred**	
2022	1,178	189 (2.6%)





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Harveys Lake, Luzerne County, PA

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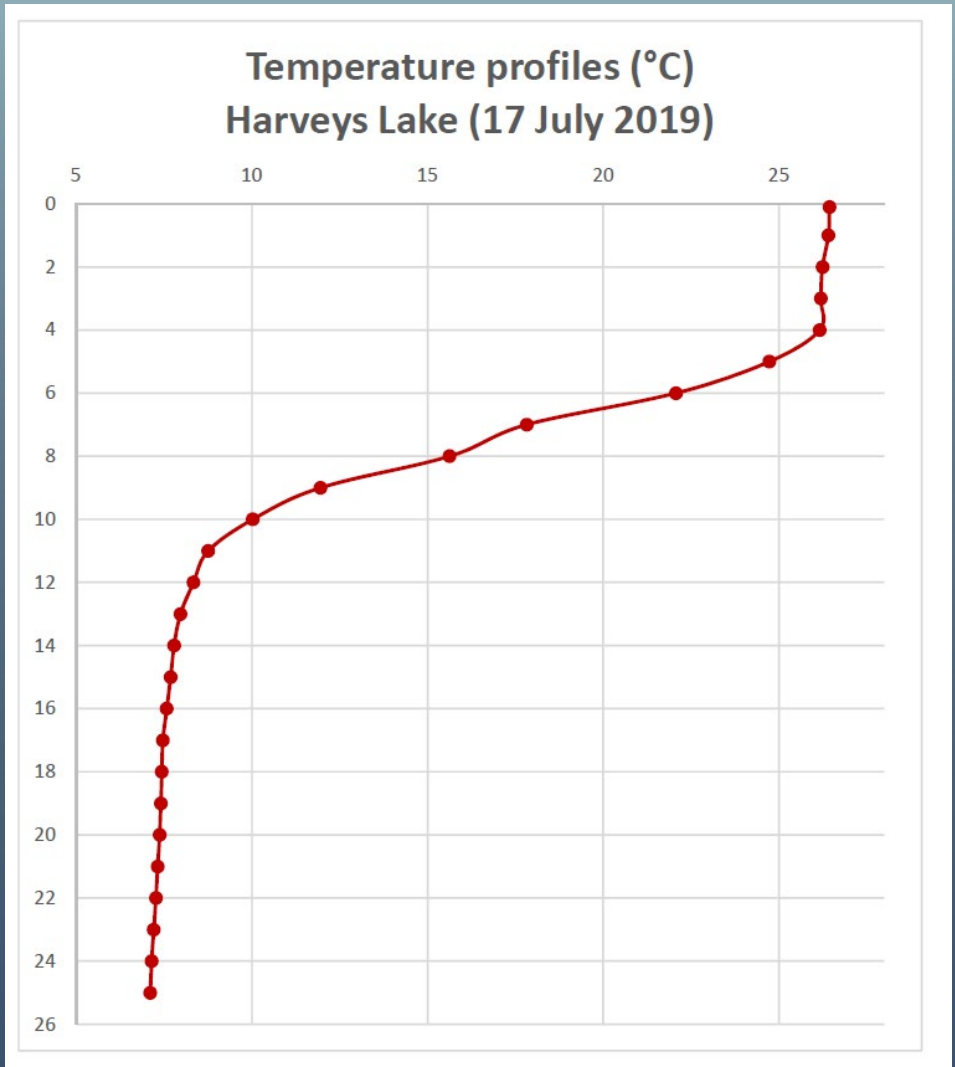

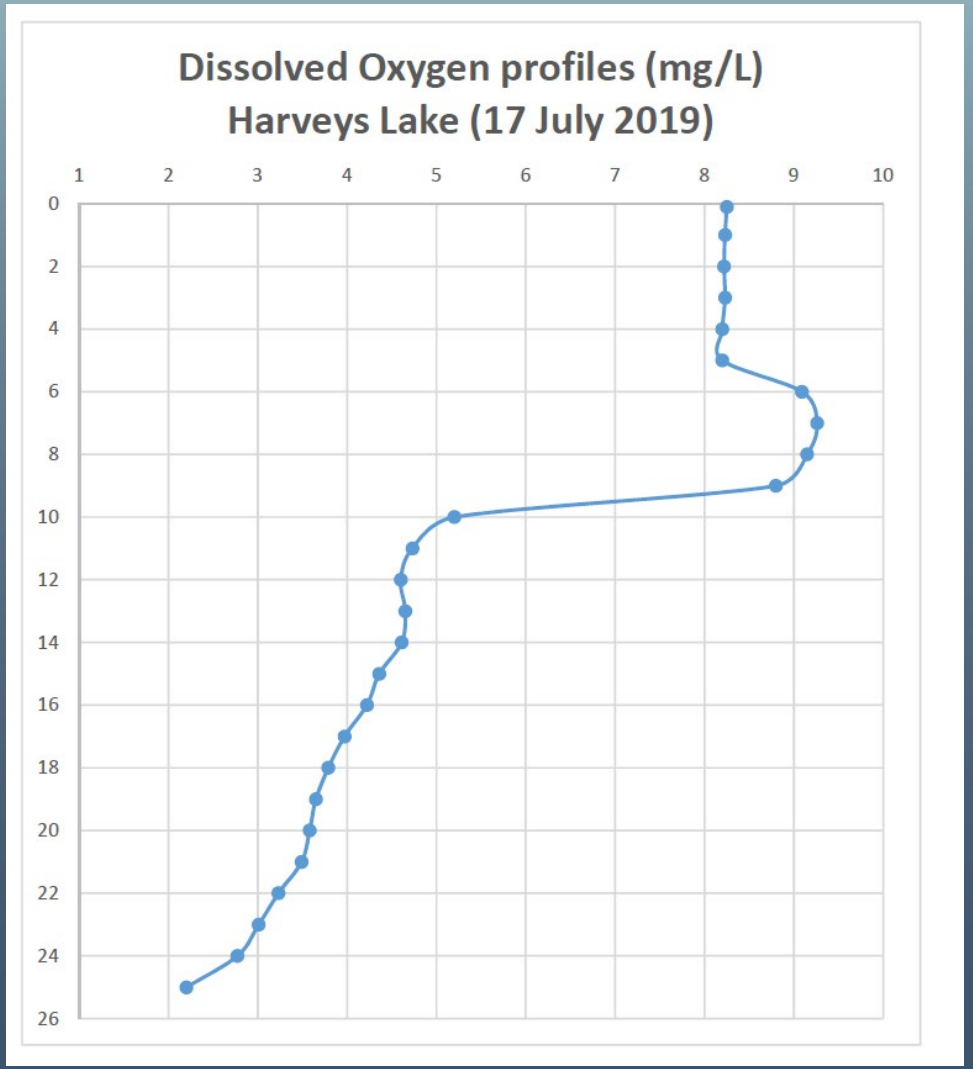

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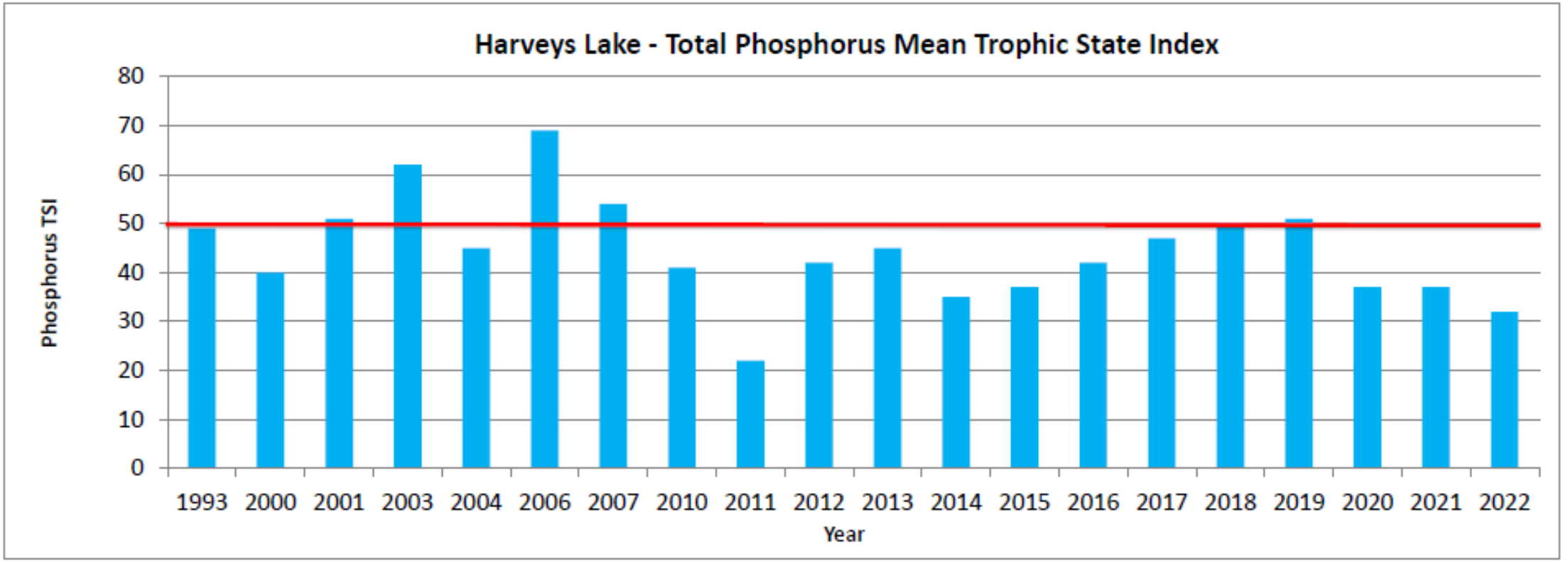

Harveys Lake - Total Phosphorus Mean Trophic State Index
Phosphorus TSI
80
70
60
50
40
30
20
10
0
1993
2000
2001
2003
2004
2006
2007
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Year

Harveys Lake

- A HAB event in mid-October.
- Not associated with a storm event.
- TP concentrations at 0.01 mg/L.
- Cyanobacteria cell counts between 9K and 48K cells / mLs

EPA/WHO Guidance

Relative Probability of Acute Health Effects	Cyanobacteria (cells/mL)	Microcystin-LR (µg/L)	Chlorophyll-a (µg/L)
Low	< 20,000	<10	<10
Moderate	20,000-100,000	10-20	10-50
High	100,000-10,000,000	20-2,000	50-5,000
Very High	> 10,000,000	>2,000	>5,000

https://www.epa.gov/nutrient-policy-data/guidelines-and-recommendations#what3

Near-shore cyanobacteria in Harveys Lake over October 2022

- ✓ The three dominant cyanobacteria (in order).
- ✓ *Dolichospermum (Anabaena)* – akinetes / heterocysts / gas vacuoles (no gas vacuoles in *Anabaena*).
- ✓ *Aphanocapsa* – no akinetes / no heterocysts. Gas vacuoles are rare.
- ✓ *Aphanizomenon* - akinetes / heterocysts / gas vacuoles

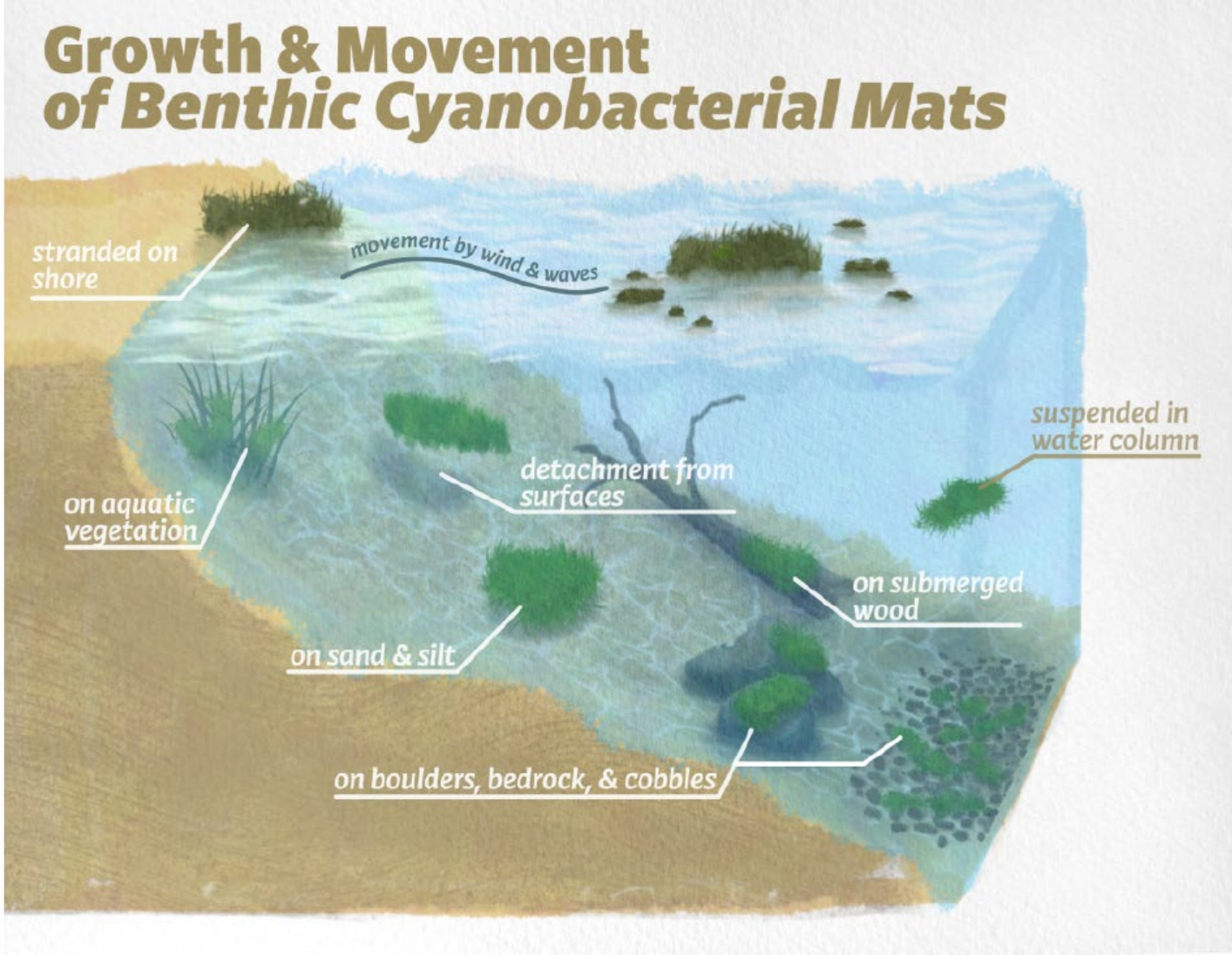


Figure 1-3. Potential growth habitats and movement of cyanobacterial mats in a water body.

Source: D'yani Wood and Morgan Tarbell.

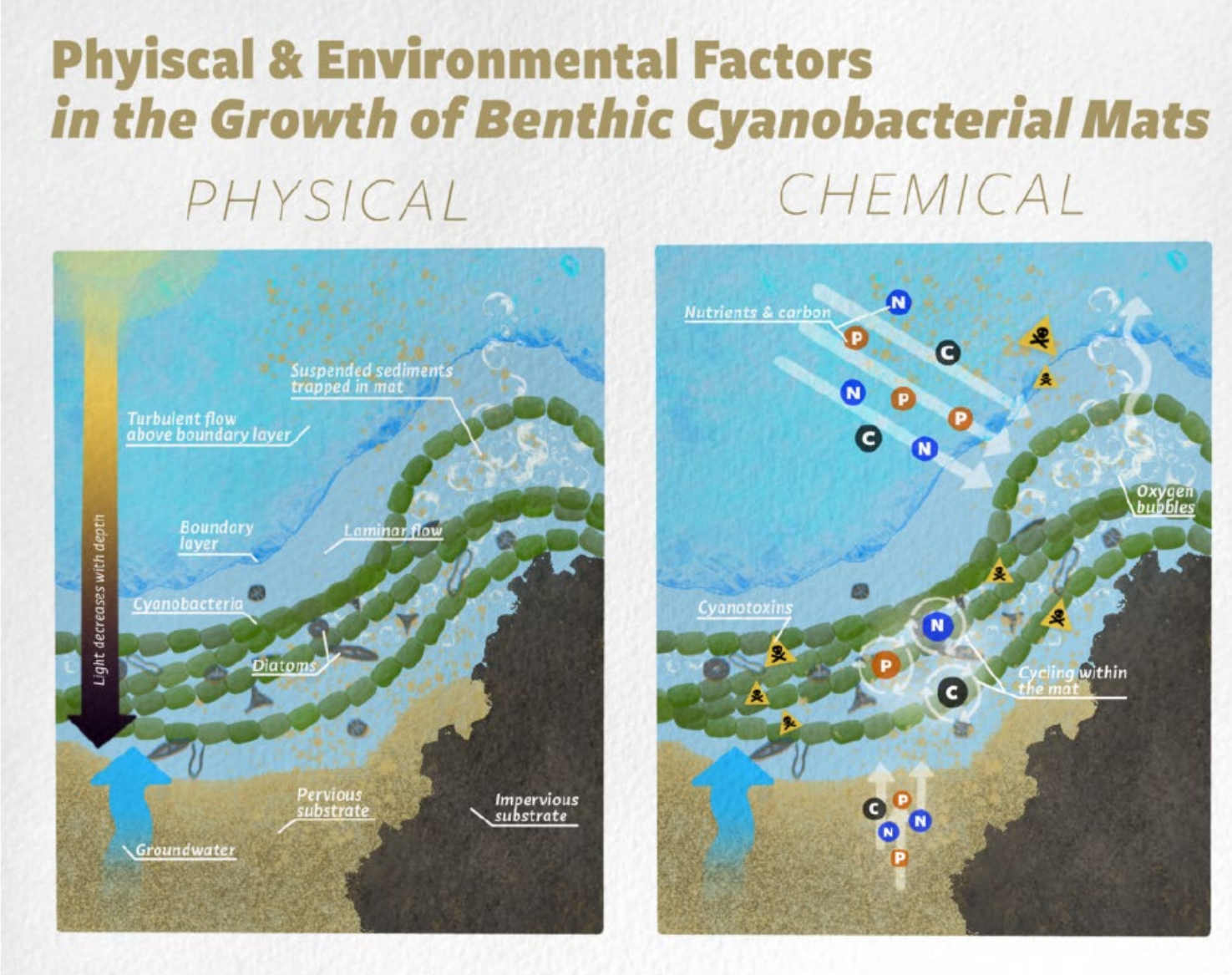


Figure 1-4. Conceptual model of some of the physical and chemical factors that control the growth and development of attached cyanobacterial mats.

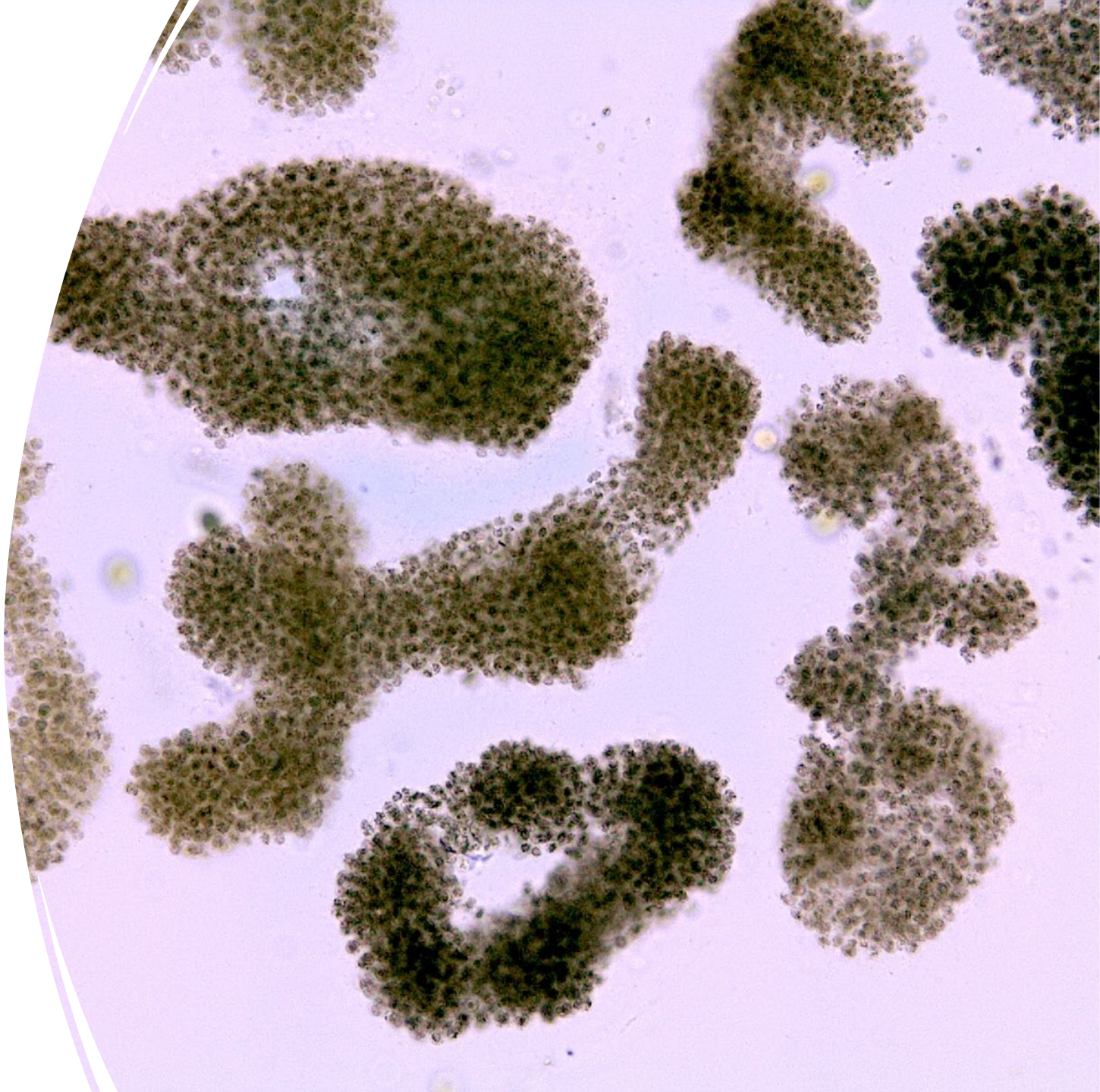
Source: D'yani Wood and Keith Bouma-Gregson.

Akinetes

- ✓ Thick-walled, dormant cells that develop from vegetative cells when exposed to unfavorable environments.
- ✓ Lower temperatures or drying out.
- ✓ Akinetes have been documented to be viable for over 70 years.

Microcystis

- No akinetes but overwinter as vegetative colonies.
- Can survive months or years without light or oxygen.
- Increase in temp. probably contributes to reactivation.
- Wind induced mixing / bioturbation result in resuspension of the colonies into the water column.



Recruitment of HAB from the Sediments

- ✓ The majority of planktonic and benthic cyanobacteria originate from the sediments.
- ✓ Studies have shown that the recruitment of cyanobacteria from the sediments is enhanced under anoxic conditions (DO < 1 mg/L).
- ✓ The exception appears to be *Aphanizomenon*, where recruitment is better under oxygenated conditions over the sediments.
- ✓ *Aphanizomenon* is a little more tolerant of cooler temperatures and is commonly the first cyanobacteria to appear in the plankton.

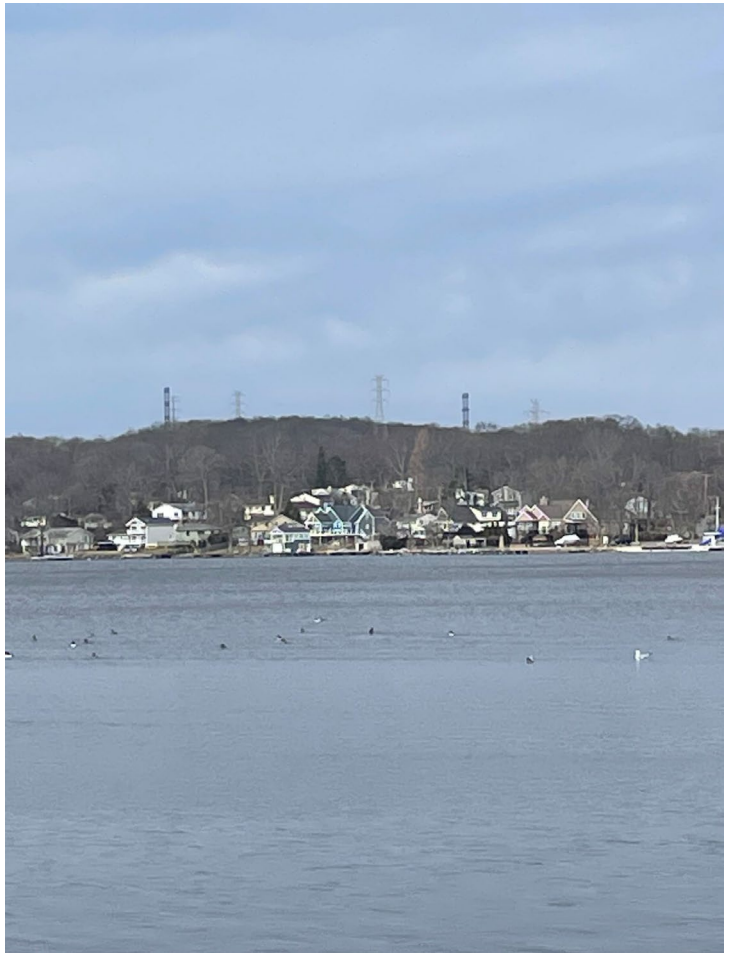
Impacts of Climate Change

- ✓ While a review of climate models indicates that HAB biomass is likely to increase in a warmer climate, the magnitude of this response will be strongly dependent of nutrient concentrations.
- ✓ However, climate change can impact the timing and availability of nutrients.
- ✓ "ultimately nutrients are the more important predictor of cyanobacterial biovolume."
- ✓ Additionally, pulses of nutrients (nitrogen and phosphorus) can trigger cyanobacteria to produce cyanotoxins.

Impacts of Climate Change

- ✓ Microcystins (the most common group) tends to be produced by planktonic (scum) cyanobacteria. Requires a lot of nitrogen for its production.
- ✓ Thus, while phosphorus tends to drive the production of cyanobacteria, the increased available of nitrogen (ammonia-N, nitrate-N, organic forms) can trigger the production of cyanotoxins.

Lake Hopatcong - 2023



- Further to the left was taken on 11th January 2023.
- Center photo was taken 19th February 2023 (just starting to get a thin layer of ice as of 26th February 2023).

Harveys Lake 2023

- Both photos below are Harveys Lake over the weekend of the 25th to 26th of February 2023.

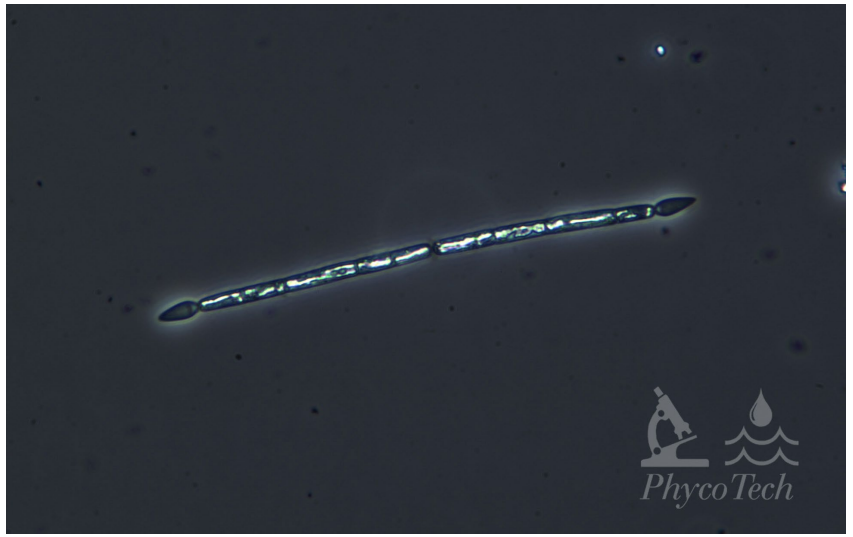
Impact of Climate Change on Invasive Plants

- ✓ Curly-leaved pondweed (top). An invasive species that prefers colder waters; however, has been appearing earlier.
- ✓ Hydrilla (bottom). An aggressive invasive species that was primarily sub-tropical but has been moving up the East Coast.

SCIENCE
ENGINEERING
DESIGN

Invasive Cyanobacteria?

- *Cylindrospermposis raciborski*
- Tends to be more common in tropical systems; however, has been showing up in more temperate lakes.
- First observed in Lake Hopatcong (by Princeton Hydro) in July / August of 2023) and was gone by early October 2022.
- Has heterocysts (tends to bloom under nitrogen limited conditions), and gas vacuoles. Can also have akinetes.



Managing the benthic source of HABs

- ✓ Consider watershed BMPs that address N as well as P (septic management, green infrastructure, Floating Wetland Islands, Biochar?).
- ✓ Use PhosLock and other nutrient inactivation products (alum, poly-aluminum chloride) in shallow, oxygenated sections where HABs are known to occur.
- ✓ Supersaturation of the water / sediment interface to not only prevent internal P loading but also to oxidize the sediments (help control akinetes and recruitment of most HABs). Typically uses oxygenation instead of aeration.

Near-Shore or Shallow Treatments with Nutrient Inactivators

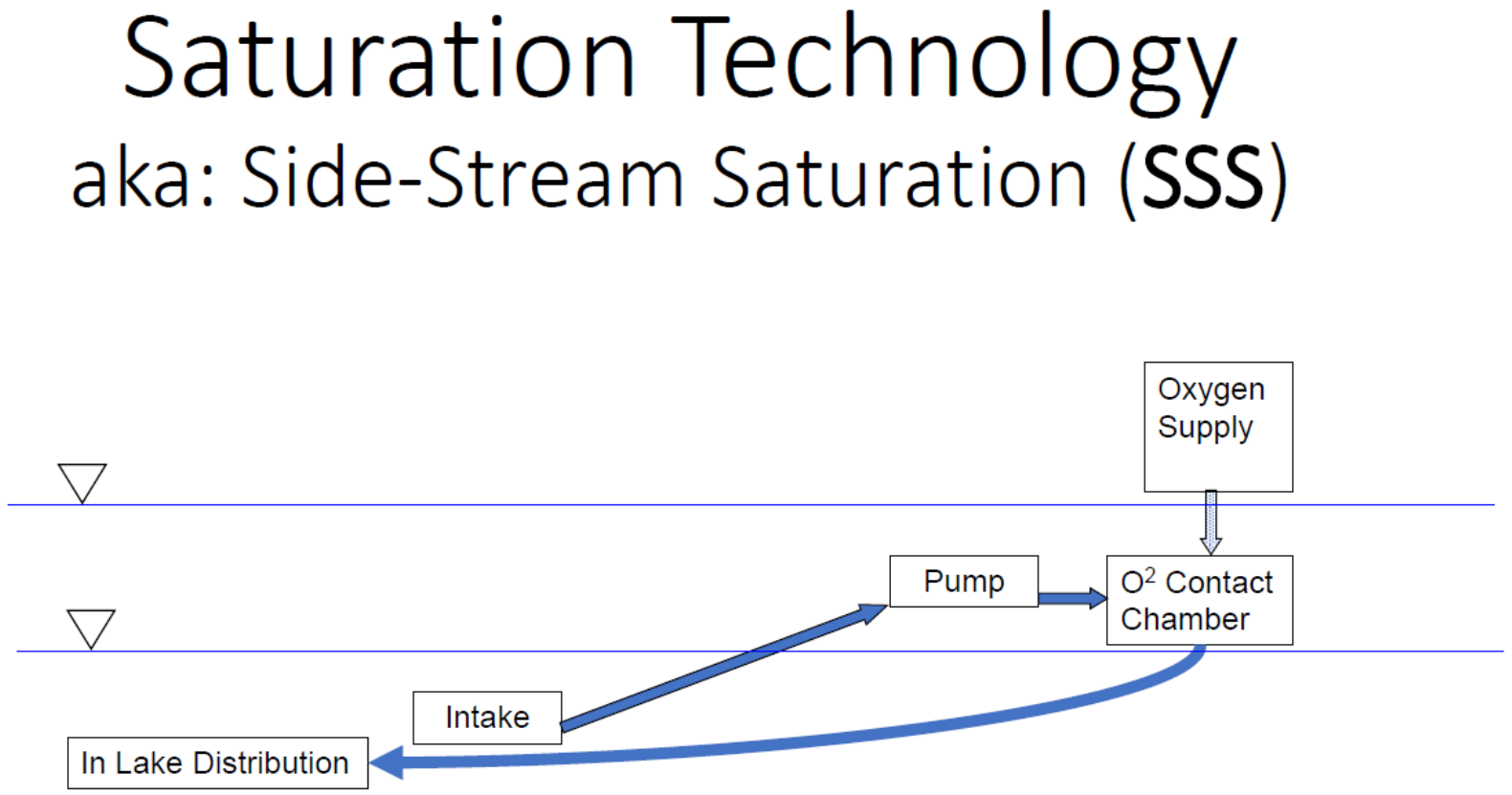
- ✓ PhosLock - clay-based product that inactivates phosphorus like alum (aluminum sulfate) but does not use aluminum. Instead, it uses lanthanum.
- ✓ Can be used to strip the water column of phosphorus and/or inactivate deep-water phosphorus from anoxic waters (DO < 1 mg/L).
- ✓ Can also be used to inactivate phosphorus over shallow water sediments where there may be a lot more organic phosphorus.
- ✓ More expensive than alum or other products.

Figures 4.10: Duke – Mermaid Pool – Biochar Install

Table 4.2: Duke – Mermaid Pool - Total phosphorus

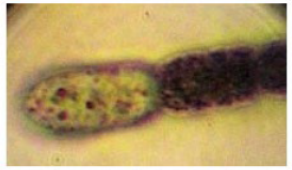
Mermaid Pool - TP (mg/L)						
	4/20/2022	5/19/2022	6/28/2022	7/21/2022	8/25/2022	9/23/2022
In	0.04	0.03	0.04	0.40	0.29	0.20
Out	0.02	0.03	0.04	0.03	0.04	0.01
% Change	-50%	0%	0%	-93%	-86%	-95%

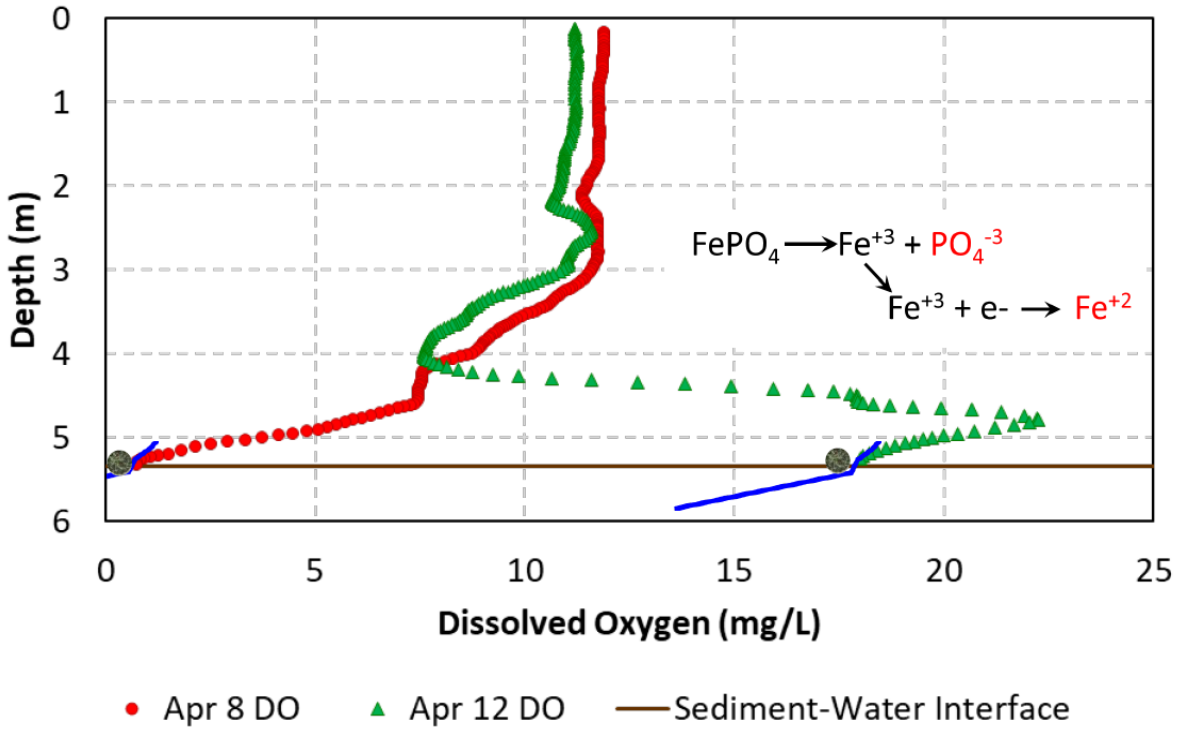
Oxygenation
(from Paul Gantzer)



Supersaturation of DO
(from Paul Gantzer)

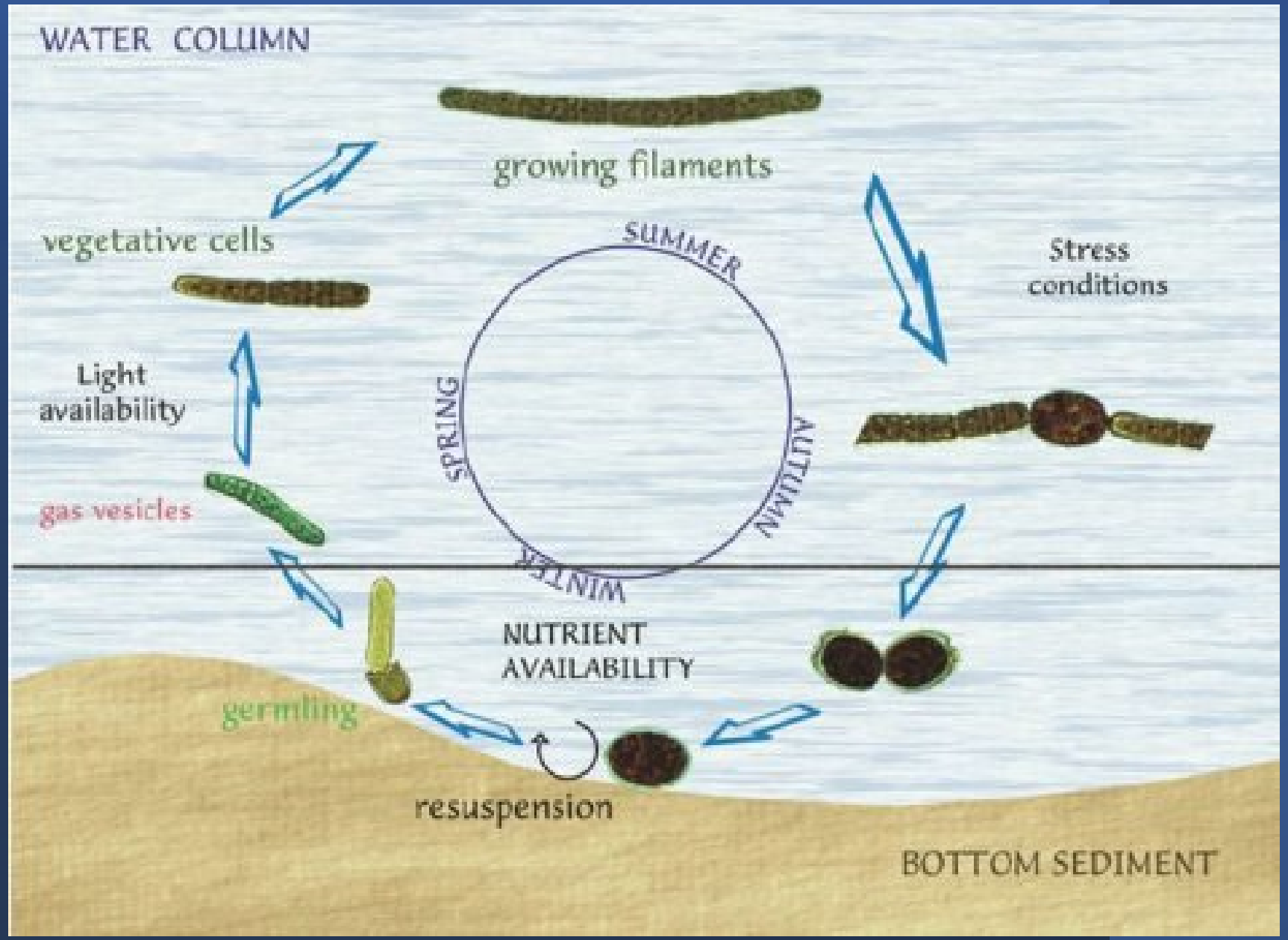
Akinetes and the Sediment-Water Interface





Recommendations on Monitoring

- ✓ Include vertical sampling in both deep and shallow lakes.
- ✓ While most monitoring focuses on the "high summer season," consider initiate monitoring in earlier in the year, particularly after a mild winter and under ice-free conditions. Also, may need to sample into fall / winter.
- ✓ Depending on the type of cyanobacteria, you may want to consider sampling for specific cyanotoxins.
- ✓ Microcystins tend to be produced by planktonic genera, while anatoxin-a tends to be produced by benthic genera.


WATER COLUMN
growing filaments
vegetative cells
SUMMER
AUTUMN
WINTER
SPRING
Stress conditions
Light availability
gas vesicles
NUTRIENT AVAILABILITY
germling
resuspension
BOTTOM SEDIMENT

Riverine HABs

- Late summer 2022 was particularly dry; low water levels.
- Clear water and observed benthic growth.
- The dominant cyanobacter on the 6th was Oscillatoria.

Delaware River at Trenton NJ - 01463500		
September Date	gage height (ft)	Cyanobacteria cell count (cells / mLs)
5th	8.02	
6th	8.08	36,185
7th	8.52	
8th	9.07	
9th	11.1	877
10th	10.18	
11th	9.41	
12th	9.01	412
13th	9.01	
14th	9.19	245

USGS Studies on River HABs in 2017 – 2019 by Graham and Others

- ✓ Survey of 11 rivers (3 in the eastern region, including the Delaware River).
- ✓ Cyanobacteria were found in 82% of the samples (n=50) but were rarely the dominant group.
- ✓ Most common genera were *Pseudanabaena* and *Planktothrix*.
- ✓ 64% of the identified cyanobacteria known to produce cyanotoxins.

USGS Studies on River HABs in 2017 – 2019 by Graham and Others

- ✓ Specifically for the Delaware River, no cyanotoxins were directly measured in collected samples from 2017, 2018 and 2019.
- ✓ However, the genes to produce cylindrospermopsin, microcystins and saxitoxin were detected.
- ✓ Thus, the **potential** to produce cyanotoxins was present in the Delaware River.
- ✓ How will climate change impact this potential?

Riverine HABs

- ✓ Could be produced in the river itself, benthic forms growing along the bottom or planktonic forms, blooms under drought conditions.
- ✓ Low flow / water levels, coupled with treated wastewater contributing a larger portion of the baseflow may contribute to riverine HABs.
- ✓ However, impoundments may also serve as "batch incubators" for HAB and seed a river.
- ✓ Thus, in addition to ecosystem services such as fish passage and hydrological improvements, dam removal may also aid in eliminating a source of HABs.

Conclusions

- ✓ Climate change may contribute toward HAB events occurring earlier or later in the year.
- ✓ May need to expand monitoring beyond the summer and develop an inter-annual database.
- ✓ Consider collection of benthic samples to identify potential sources of HABs.
- ✓ Watershed-based sources of nutrients (both phosphorus and nitrogen) need to be addressed to prevent / minimize the develop of HABs and triggering the generation of cyanotoxins.
- ✓ Please support NALMS efforts to reinstate the Clean Lakes Program.

Session 2: Turning Data into Action & Panel Discussion

March 30, 2023

Panel Moderator

Kati Angarone

Assistant Commissioner
Watershed and Land Management
NJDEP

Poll Questions

How to join poll:

- Go to vevox.app and enter the below session ID
- Click on the link in the chat
- Use QR Code

Join at:
vevox.app

ID:
139-691-194

Panelists

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Management
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Paul Hauch
Bureau Chief
Construction, Payments,
and Administration
NJDEP

Building Support For Action

Mike Pisauro, Esq.

The Watershed Institute Assistant

Building Support
For
Action

March 30, 2023

Michael Pisauro, Esq. – Director of Policy

The Watershed Institute

Your water. Your environment. Your voice.

Issues

- Stormwater Management is a site-by-site process
- Stormwater Management does not improve water quality/reduce flooding
- Master Plans are municipal centric
- Existing issues do not inform:
  - Ordinances
  - Zoning
  - Land Use Approvals
  - DEP permits

Regional Approaches

- *Stormwater Management Rules – N.J.A.C. 7:8-3*
- *MS4 Permit's Watershed Improvement Plans*
- *Clean Stormwater and Flood Reduction Act – N.J.S.A. 40A:26B-1 et seq.*
- *Open Space Plans*
- *Zoning and ordinances*

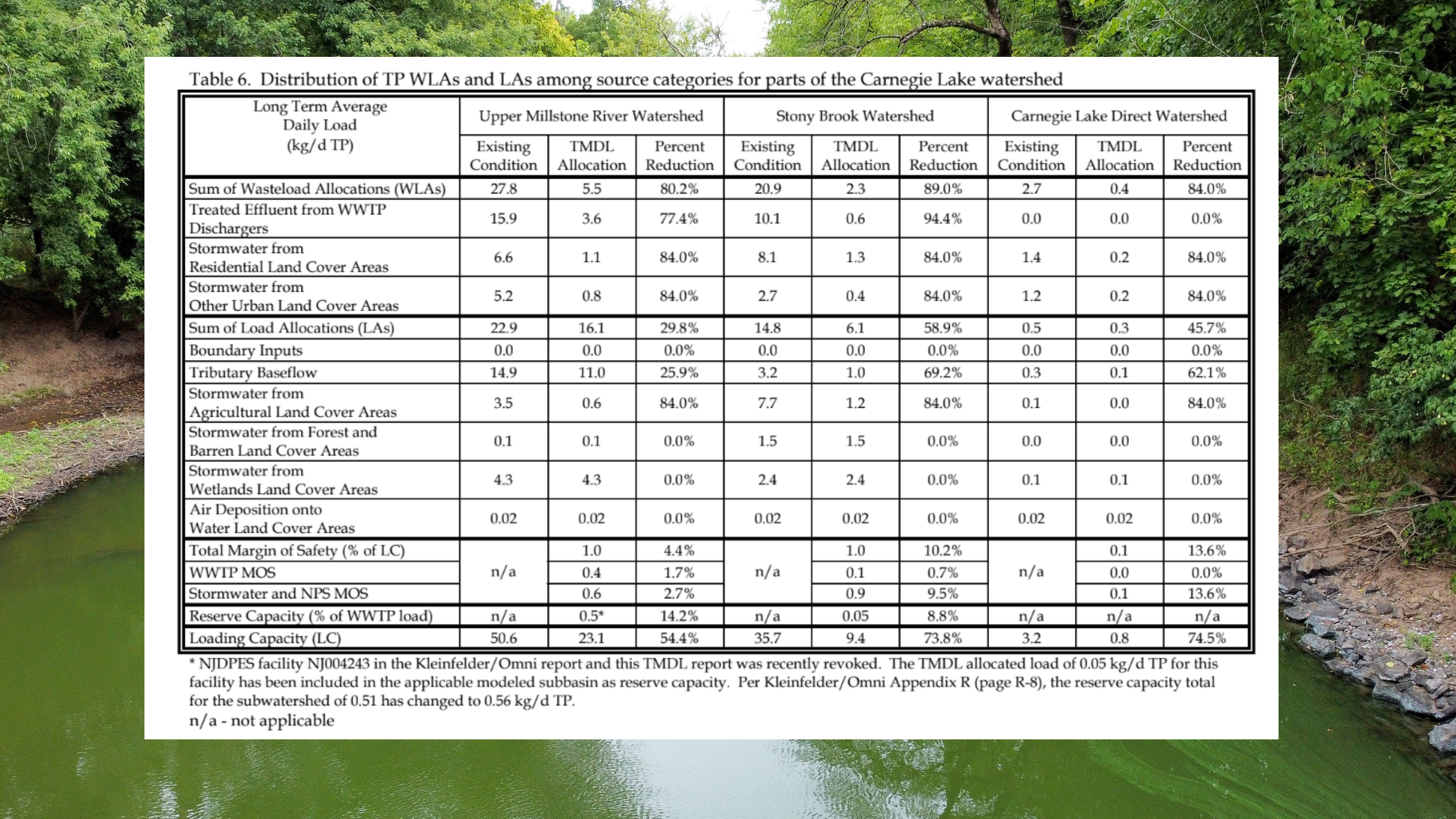
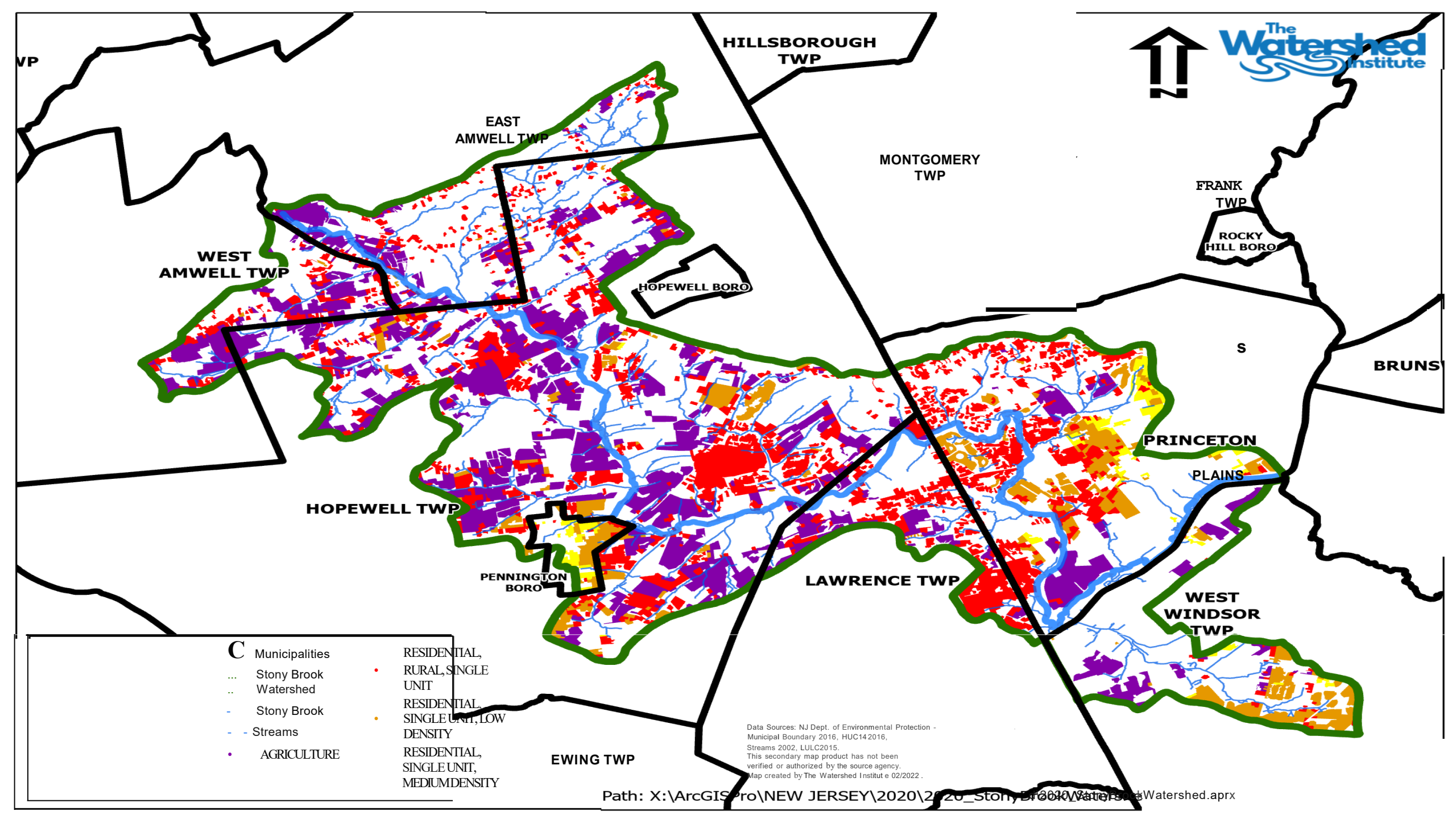


Table 6. Distribution of TP WLAs and LAs among source categories for parts of the Carnegie Lake watershed

Long Term Average Daily Load (kg/d TP)	Upper Millstone River Watershed			Stony Brook Watershed			Carnegie Lake Direct Watershed		
	Existing Condition	TMDL Allocation	Percent Reduction	Existing Condition	TMDL Allocation	Percent Reduction	Existing Condition	TMDL Allocation	Percent Reduction
Sum of Wasteload Allocations (WLAs)	27.8	5.5	80.2%	20.9	2.3	89.0%	2.7	0.4	84.0%
Treated Effluent from WWTP Dischargers	15.9	3.6	77.4%	10.1	0.6	94.4%	0.0	0.0	0.0%
Stormwater from Residential Land Cover Areas	6.6	1.1	84.0%	8.1	1.3	84.0%	1.4	0.2	84.0%
Stormwater from Other Urban Land Cover Areas	5.2	0.8	84.0%	2.7	0.4	84.0%	1.2	0.2	84.0%
Sum of Load Allocations (LAs)	22.9	16.1	29.8%	14.8	6.1	58.9%	0.5	0.3	45.7%
Boundary Inputs	0.0	0.0	0.0%	0.0	0.0	0.0%	0.0	0.0	0.0%
Tributary Baseflow	14.9	11.0	25.9%	3.2	1.0	69.2%	0.3	0.1	62.1%
Stormwater from Agricultural Land Cover Areas	3.5	0.6	84.0%	7.7	1.2	84.0%	0.1	0.0	84.0%
Stormwater from Forest and Barren Land Cover Areas	0.1	0.1	0.0%	1.5	1.5	0.0%	0.0	0.0	0.0%
Stormwater from Wetlands Land Cover Areas	4.3	4.3	0.0%	2.4	2.4	0.0%	0.1	0.1	0.0%
Air Deposition onto Water Land Cover Areas	0.02	0.02	0.0%	0.02	0.02	0.0%	0.02	0.02	0.0%
Total Margin of Safety (% of LC)	n/a	1.0	4.4%	n/a	1.0	10.2%	n/a	0.1	13.6%
WWTP MOS		0.4	1.7%		0.1	0.7%		0.0	0.0%
Stormwater and NPS MOS		0.6	2.7%		0.9	9.5%		0.1	13.6%
Reserve Capacity (% of WWTP load)	n/a	0.5*	14.2%	n/a	0.05	8.8%	n/a	n/a	n/a
Loading Capacity (LC)	50.6	23.1	54.4%	35.7	9.4	73.8%	3.2	0.8	74.5%

* NJDPES facility NJ004243 in the Kleinfelder/Omni report and this TMDL report was recently revoked. The TMDL allocated load of 0.05 kg/d TP for this facility has been included in the applicable modeled subbasin as reserve capacity. Per Kleinfelder/Omni Appendix R (page R-8), the reserve capacity total for the subwatershed of 0.51 has changed to 0.56 kg/d TP.

n/a - not applicable


HILLSBOROUGH TWP
EAST AMWELL TWP
MONTGOMERY TWP
FRANK TWP
ROCKY HILL BORO
WEST AMWELL TWP
HOPEWELL BORO
PRINCETON
PLAINS
HOPEWELL TWP
PENNINGTON BORO
LAWRENCE TWP
WEST WINDSOR TWP
EWING TWP
Municipalities
Stony Brook Watershed
Stony Brook
Streams
AGRICULTURE
RESIDENTIAL, RURAL, SINGLE UNIT
RESIDENTIAL, SINGLE UNIT, LOW DENSITY
RESIDENTIAL, SINGLE UNIT, MEDIUM DENSITY
Data Sources: NJ Dept. of Environmental Protection - Municipal Boundary 2016, HUC14 2016, Streams 2002, LULC2015.
This secondary map product has not been verified or authorized by the source agency.
Map created by The Watershed Institute 02/2022.
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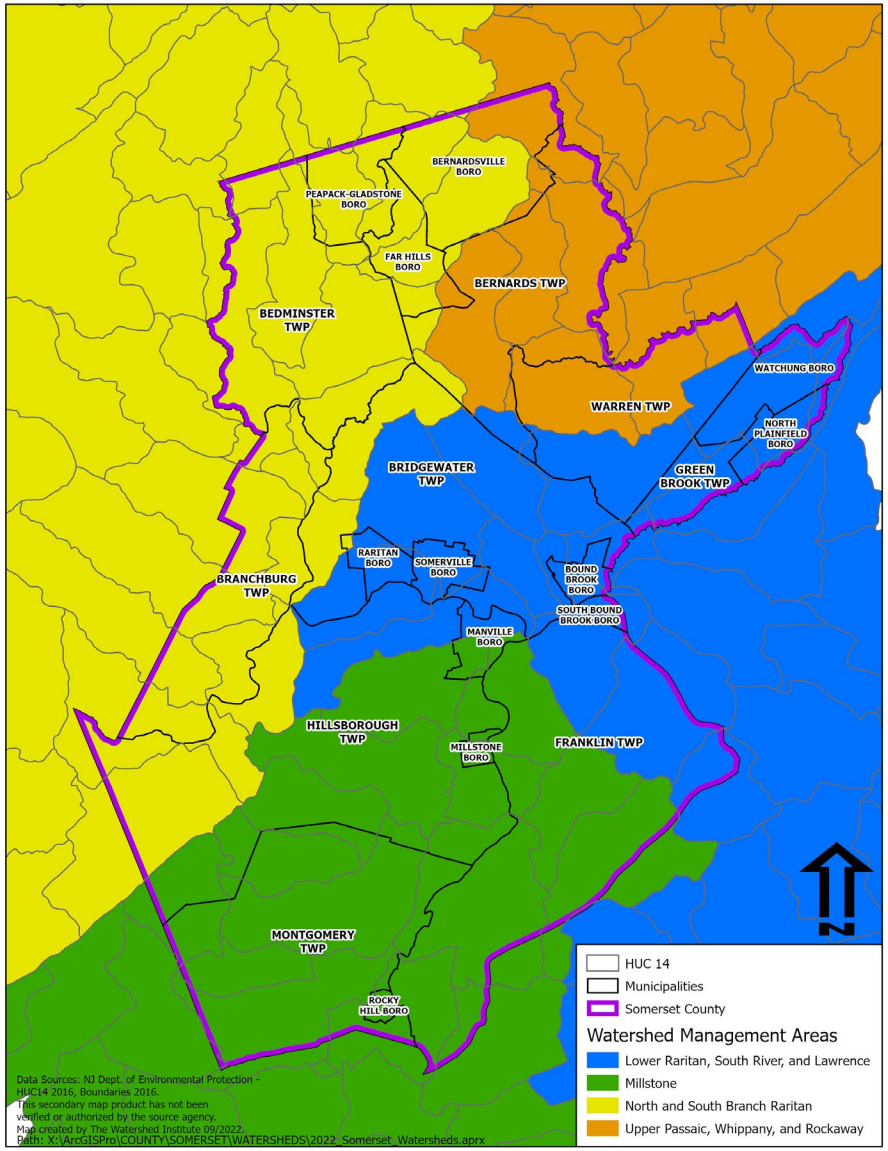
BERNARDSVILLE BORO
PEAPACK-GLADSTONE BORO
FAR HILLS BORO
BERNARDS TWP
BEDMINSTER TWP
WATCHUNG BORO
WARREN TWP
NORTH PLAINFIELD BORO
BRIDGEWATER TWP
GREEN BROOK TWP
RARITAN BORO
SOMERVILLE BORO
BOUND BROOK BORO
BRANCHBURG TWP
SOUTH BOUND BROOK BORO
MANVILLE BORO
HILLSBOROUGH TWP
MILLSTONE BORO
FRANKLIN TWP
MONTGOMERY TWP
ROCKY HILL BORO
N
HUC 14
Municipalities
Somerset County
Watershed Management Areas
Lower Raritan, South River, and Lawrence
Millstone
North and South Branch Raritan
Upper Passaic, Whippany, and Rockaway
Data Sources: NJ Dept. of Environmental Protection - HUC14 2016, Boundaries 2016.
This secondary map product has not been verified or authorized by the source agency.
Map created by The Watershed Institute 09/2022.
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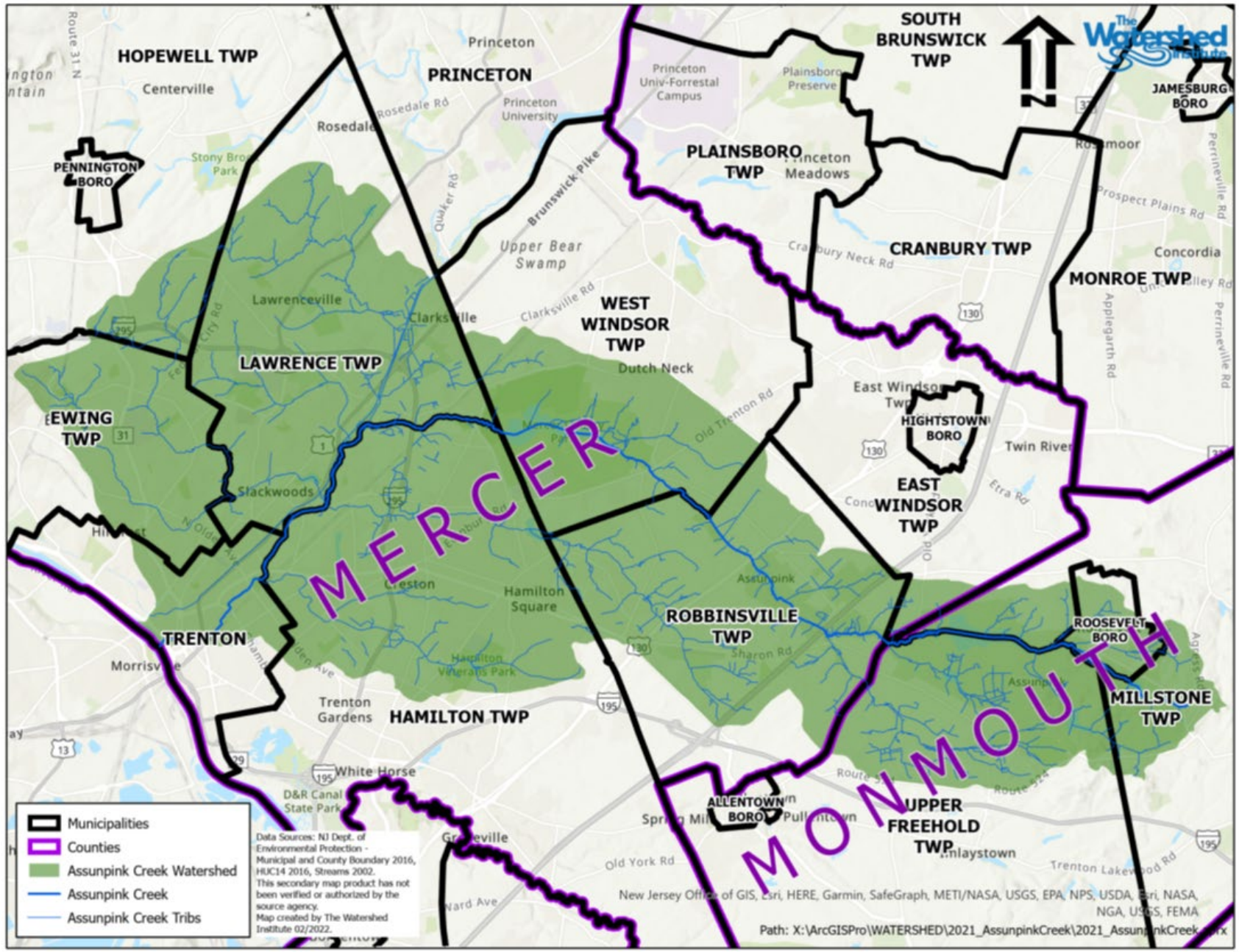
HOPEWELL TWP
PRINCETON
SOUTH BRUNSWICK TWP
PLAINSBORO TWP
CRANBURY TWP
MONROE TWP
JAMESBURG BORO
PENNINGTON BORO
WEST WINDSOR TWP
LAWRENCE TWP
EWING TWP
EAST WINDSOR TWP
HIGHTSTOWN BORO
ROBBINSVILLE TWP
TRENTON
HAMILTON TWP
ROOSEVELT BORO
MILLSTONE TWP
UPPER FREEHOLD TWP
ALLENTOWN BORO
MERCER
MONMOUTH
Municipalities
Counties
Assunpink Creek Watershed
Assunpink Creek
Assunpink Creek Tribs
Data Sources: NJ Dept. of Environmental Protection - Municipal and County Boundary 2016, HUC14 2016, Streams 2002.
This secondary map product has not been verified or authorized by the source agency.
Map created by The Watershed Institute 02/2022.
New Jersey Office of GIS, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, Esri, NASA, NGA, USGS, FEMA
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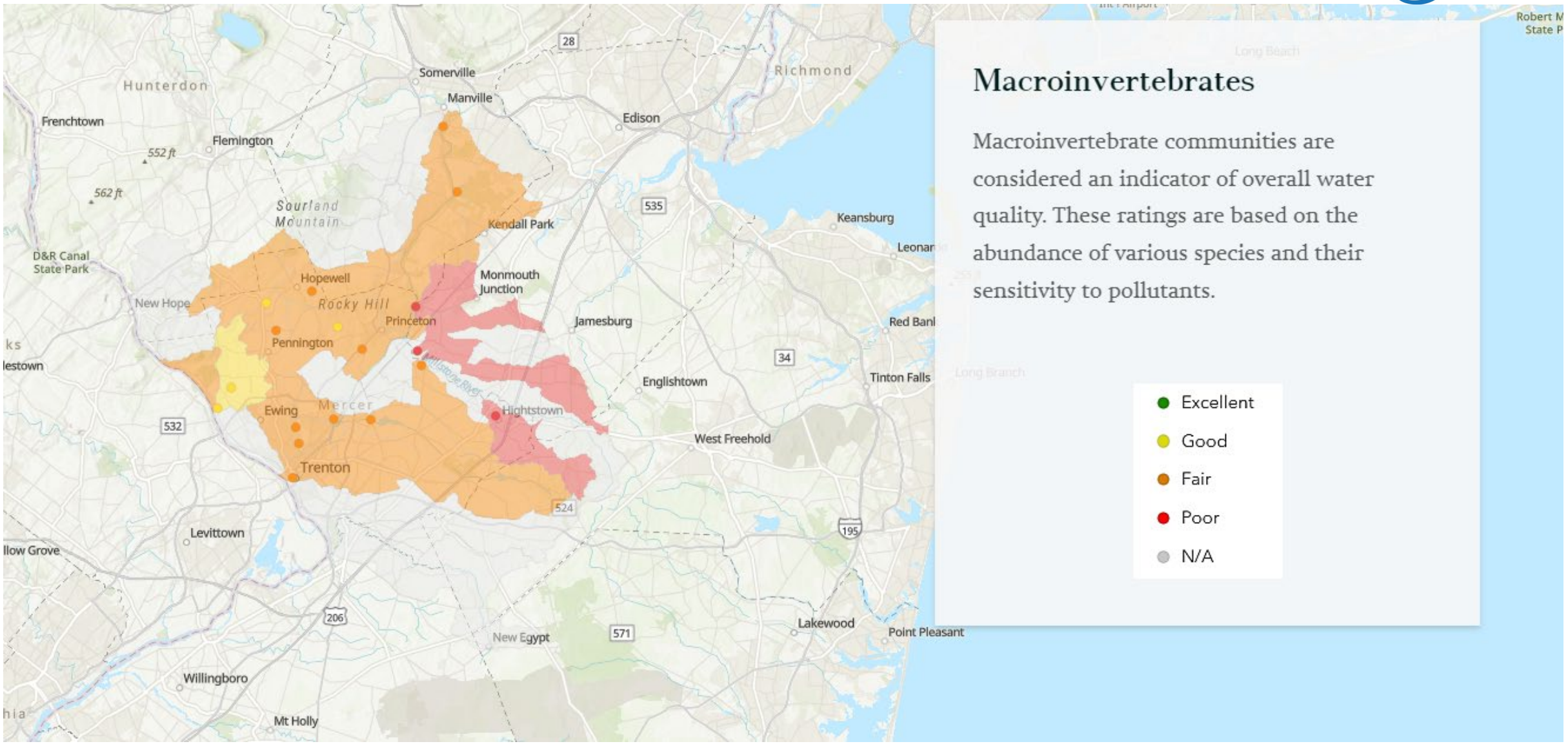
Solutions Need Support

- *Environmental Commissions*
- *Green Teams*
- *Community Advocates*
- *Volunteer Scientists*
- *Local Watershed Org*

Existing community support



Opportunities

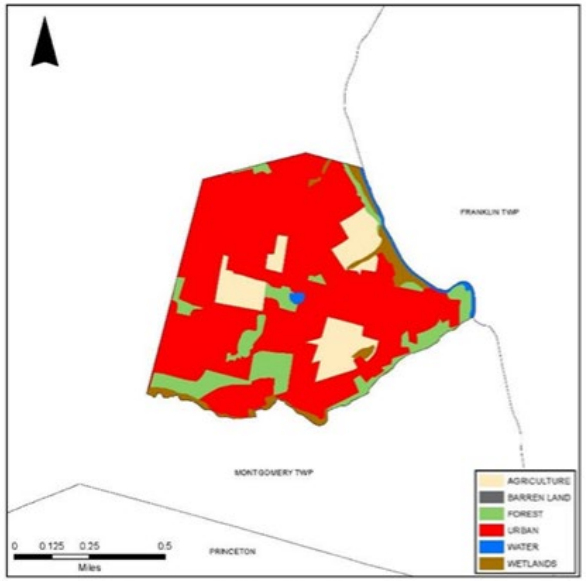


Figure 3: Land-use aerial of Rocky Hill

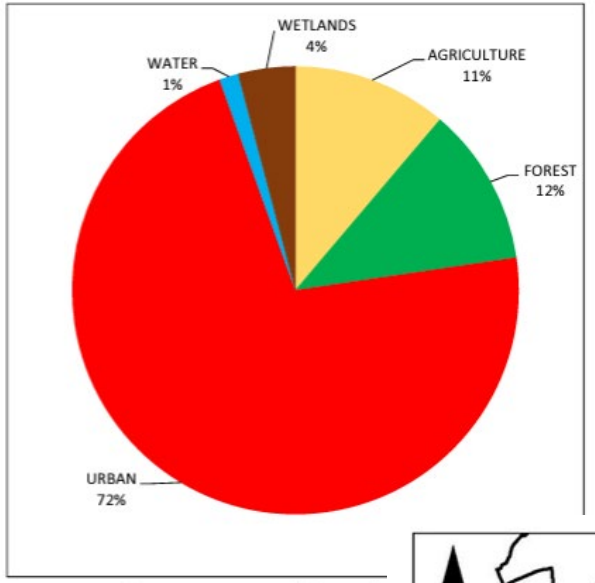


Figure 4: Land-use composition (%) in Rocky

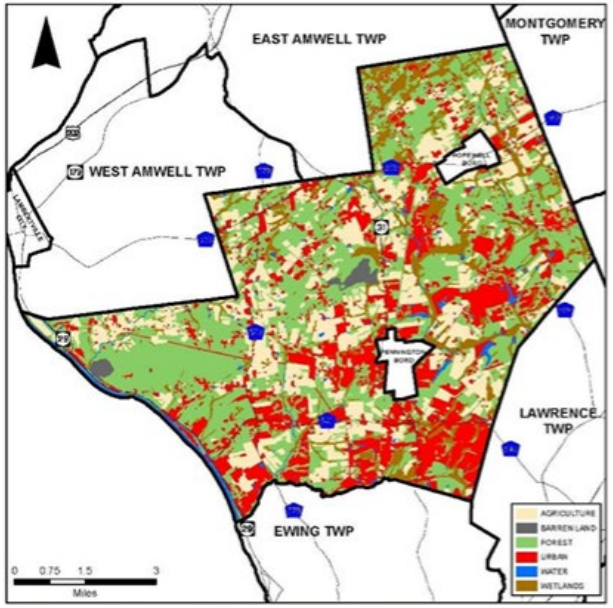


Figure 3: Land-use aerial of Hopewell Township

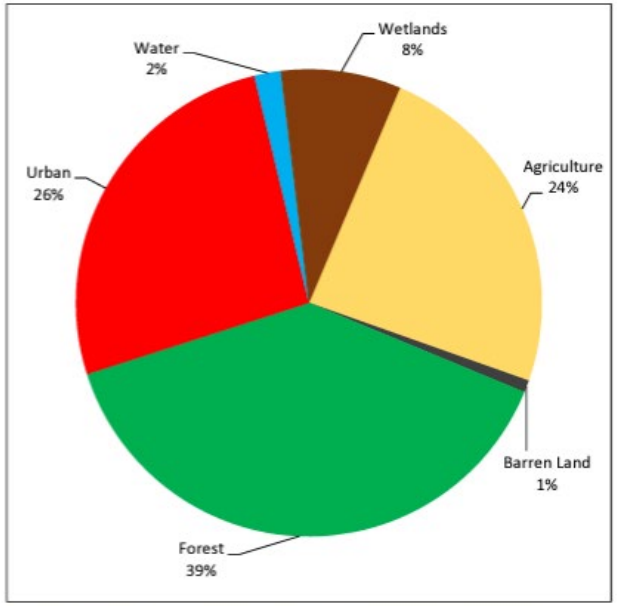


Figure 4: Land-use composition (%) in Hopewell Township

Regional Stormwater Planning

- Allows for regional stormwater controls
- Can create different standards to address localized issues
- Can provide for innovate approaches
  - Nonpoint source pollutant trading
  - Mitigation strategies
  - Enhanced protections

MS4 Permit- Regional Incentives

Watershed Inventory Report

- Interconnection from municipality into another entity
- Drainage areas for those interconnection

Watershed Assessment Report

- Assessment of potential water quality improvement projects
- Estimate of percent reduction in loading of TMDL/Impaired

Final Watershed Improvement Plan Report

- Summary of proposed locations and load reductions
- Problems identified outside of the jurisdiction

Clean Stormwater and Flood Reeducation Act

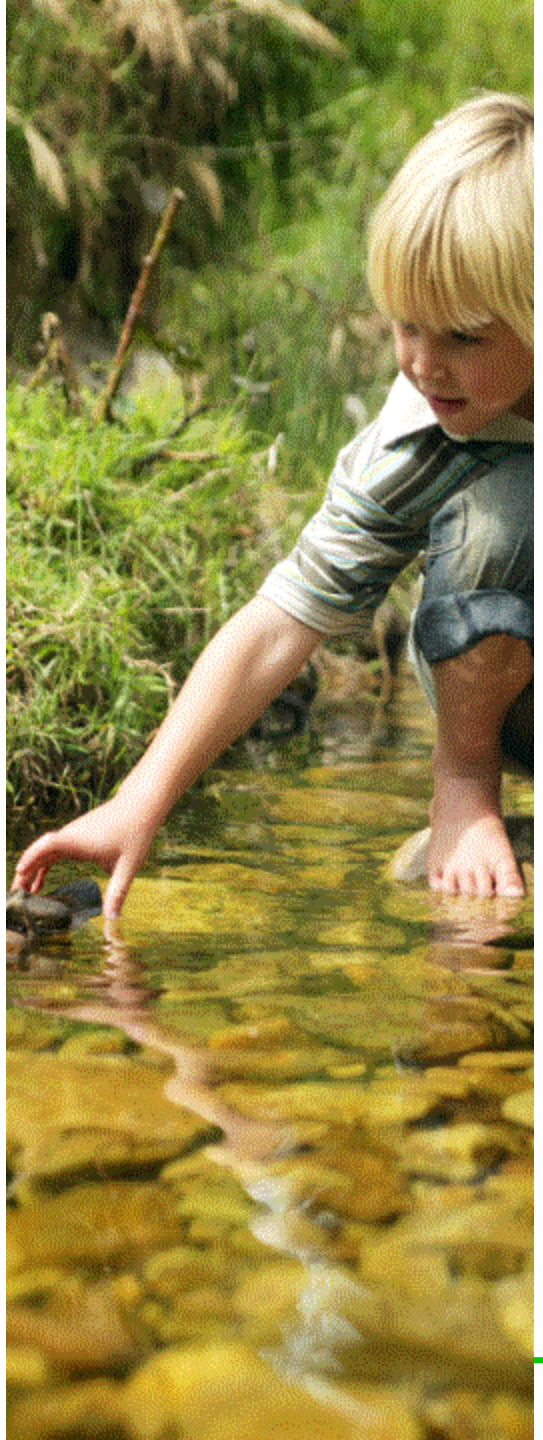
Statutes allows for local and regional utilities

- Municipalities
- Counties
- Municipal Sewerage Authorities
- Municipalities may establish SWU with a service agreement

Open Space

Allowed to:

- support of regional open space or conservation initiative
- create or extend a greenway or protects a water resource area including forests, shorelines and stream corridors
- facilitate water resource protection efforts
- Provide significant natural flood protection
- Protect headwaters, tributaries, or corridors of any waterbodies classified as C1



Thank You

Questions?

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NJ Watershed Restoration and Adaptation Planning

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NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

RUTGERS
THE STATE UNIVERSITY OF NEW JERSEY

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- Kim Cenno
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- Anika Andrews
- Nicholas Procopio
- Jess Cobb

Goal: Maintaining and Improving Water Quality

Watershed characterization

Scope and limits of local planning

Decision support – Build NJWRAP as a tool that:

- Is dynamic and holistic
- Relies on best available data
- Can support:
  - ✓Identification of watershed conditions and stressors,
  - ✓Track down of pollution sources
  - ✓Locating opportunities for water quality improvement
  - ✓Comprehensive and integrated watershed management

Who is NJWRAP for?

- ✓ Local governments (i.e. mayors, councils, shade tree, parks & open space efforts, green teams, planning boards, environmental commissions, public works)
- ✓ NGOs (i.e. land trusts, watershed associations, etc.)
- ✓ Counties and regional planning entities
- ✓ Funders
- ✓ NJDEP internal groups

What uses will NJWRAP support?

- ✓Stormwater utilities
- ✓EPA's Integrated Permitting/Planning approach
- ✓Standard setting (TMDLs, 303(d) impaired waters identification)
- ✓Community-based/watershed-based partnerships
- ✓Local planning (climate resilience, zoning, environmental justice, open space, etc.)
- ✓319 (and other) grant applications and management
- ✓MS4 and other permits
- ✓To be determined by your needs

Filling information gaps

Creating specific maps and analyses

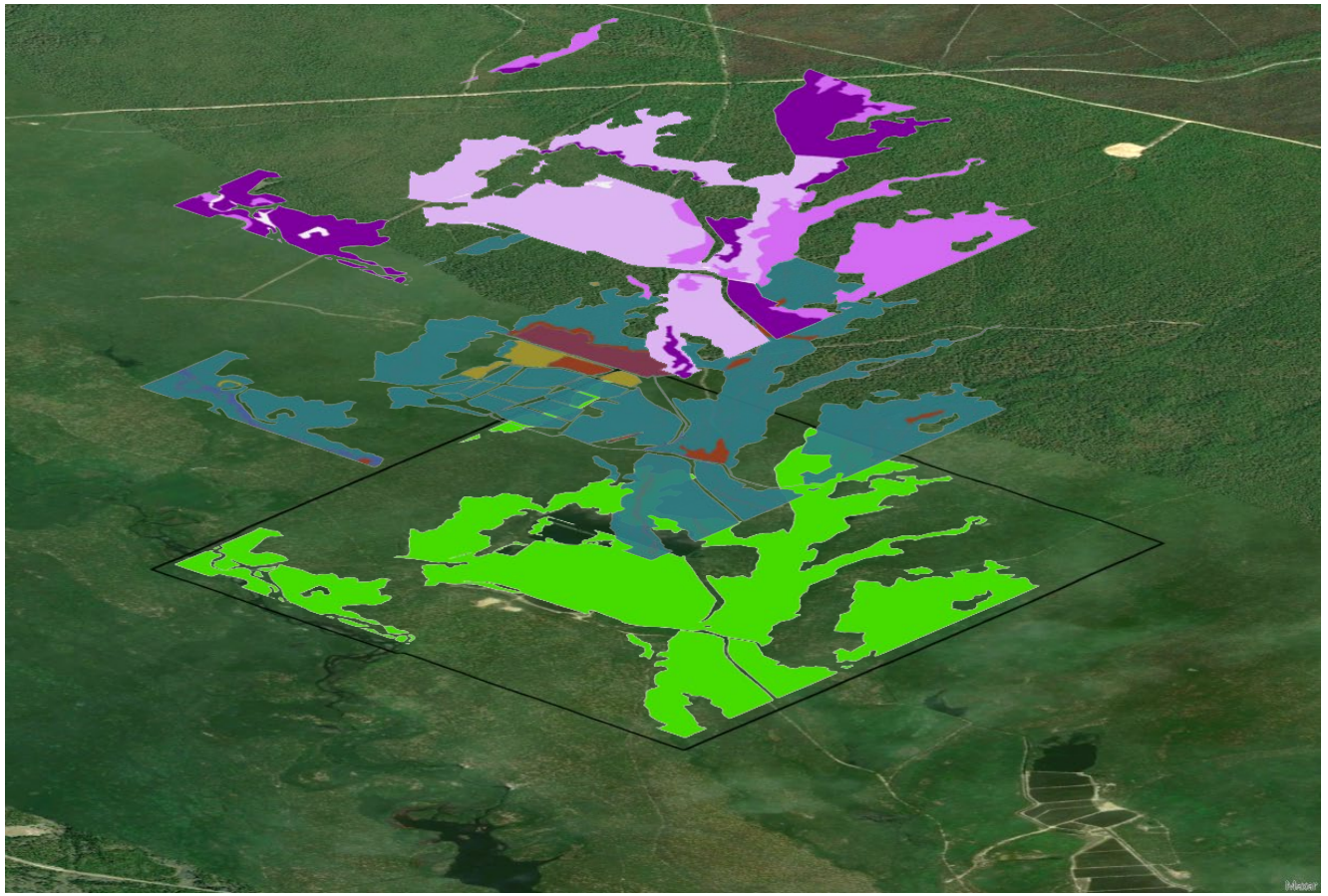
Wetlands Map

Integrating multiple information sources

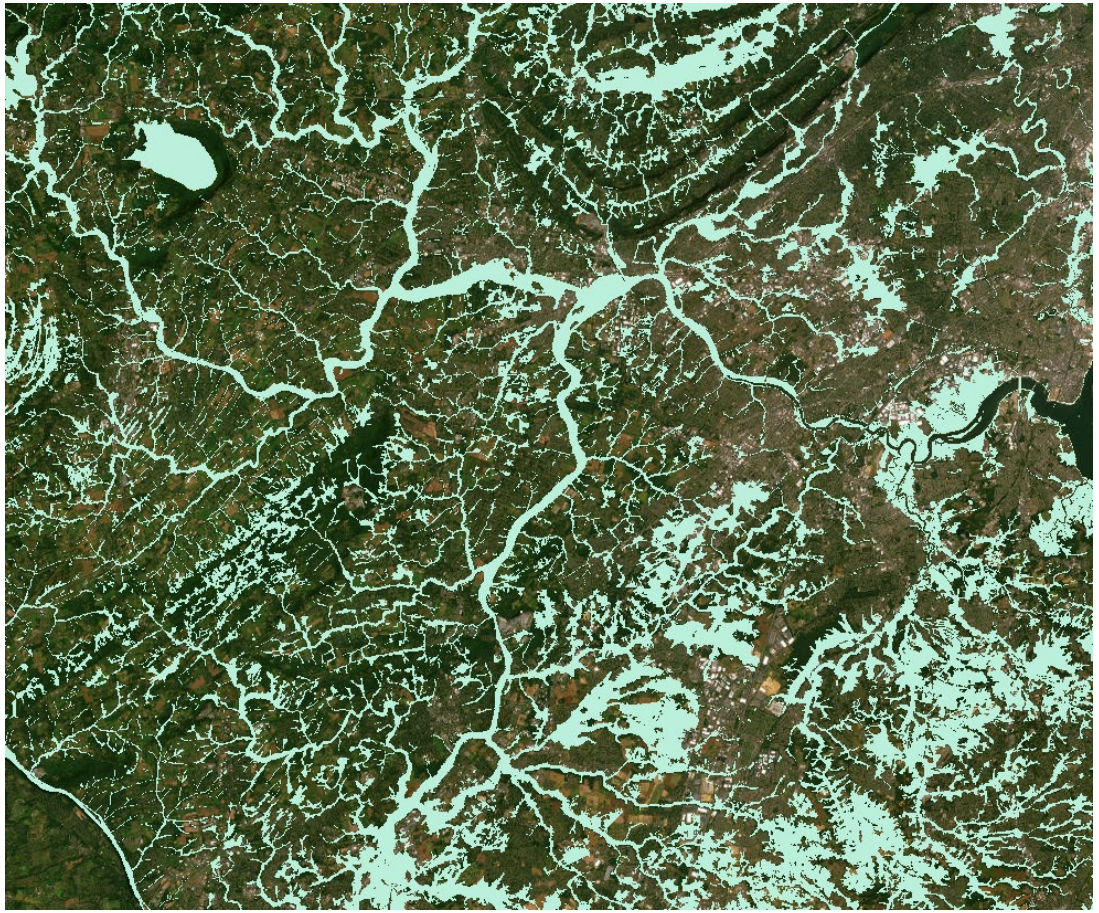
NWI+/Hydrogeomorphic, wetland function codes and preliminary scores

National Wetlands Inventory, detailed vegetation, habitat, and hydrology (historic and estimated)

NJ **Land Use Land Cover** Wetlands



Ecological Riparian Zone



- Map
  - Statewide map of hydrologically connected areas
- Analysis
  - Effect of riparian area width/integrity on water quality

Regulatory Buffer Maps

Stream riparian area and wetland buffers

Translating written regulations onto maps

:13-4.1 The riparian zone

) A riparian zone is the land and vegetation within and adjacent to a regulated water. Riparian ones exist along both sides of every regulated water and include the regulated water itself, cept as provided at N.J.A.C. 7:13-2.3(c)1. The extent of a riparian zone is determined in ccordance with (b) through (h) below.

) The portion of the riparian zone located outside of a regulated water is measured landw om the top of bank.

) The width of the riparian zone is as follows:

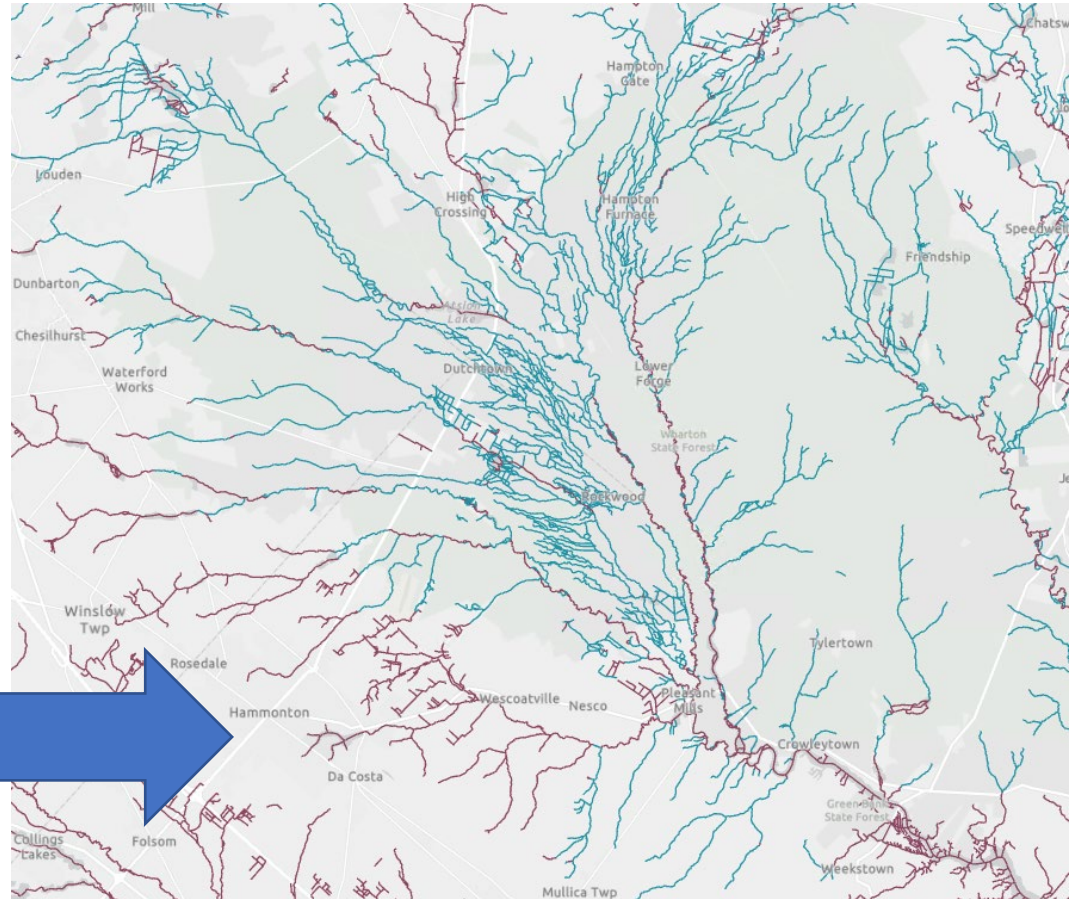
1. The width of th watershed, is 300

NEW JERSEY REGULATIONS

waters listed at (c)1 above, the width of the riparian owing regulated waters is 150 feet:

i. Any trout production water and all upstream waters (including tributaries);

ii. Any trout maintenance water and all upstream waters (including tributaries) locate within one mile of a trout maintenance water (measured along the length of the



Three integrated web-based tools for you

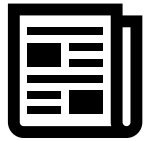
1. Watershed Health Assessment

What is the state of my waters?

What are the trends?

What is the state of action?

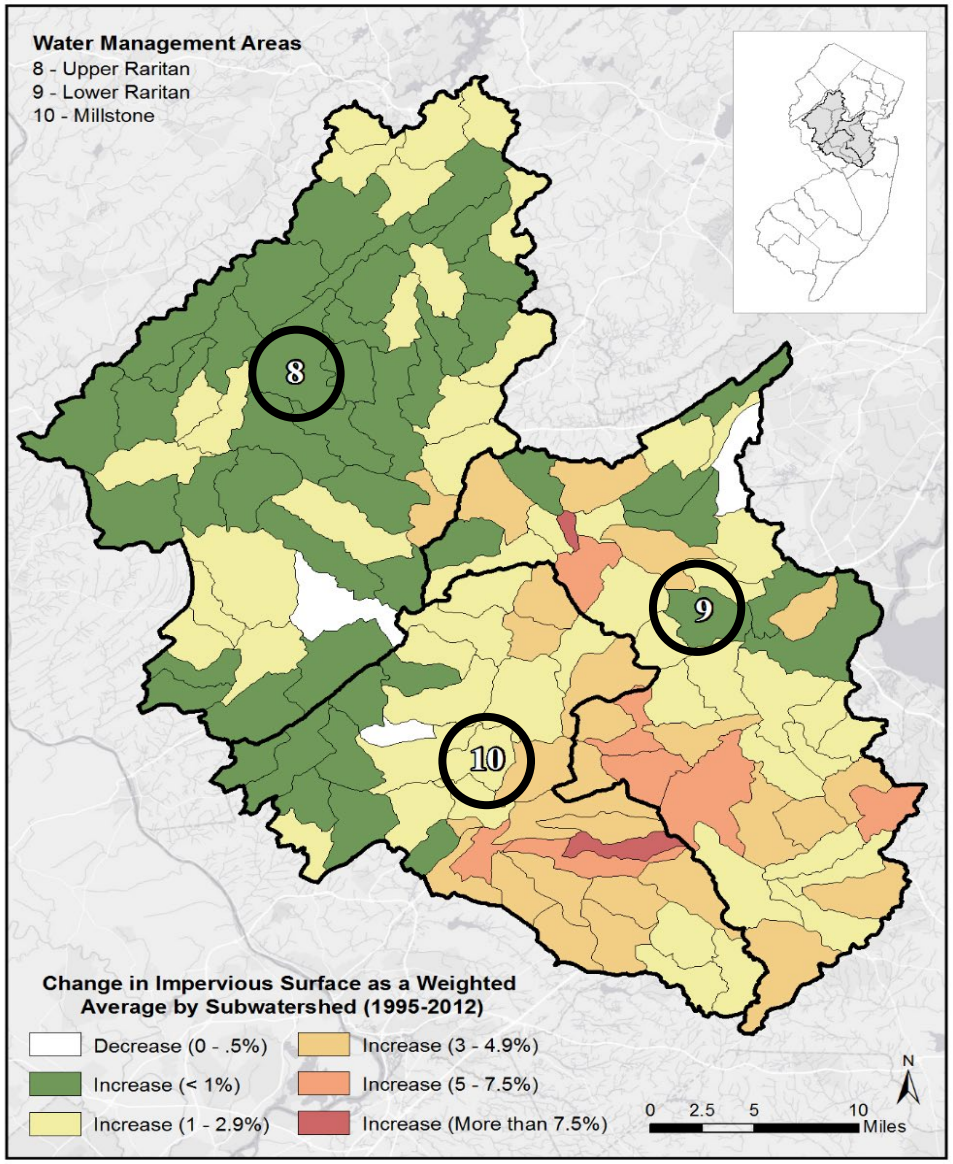
What can I do to improve it?



Summary and Report

Geography and indicators
- Maps
- Tables

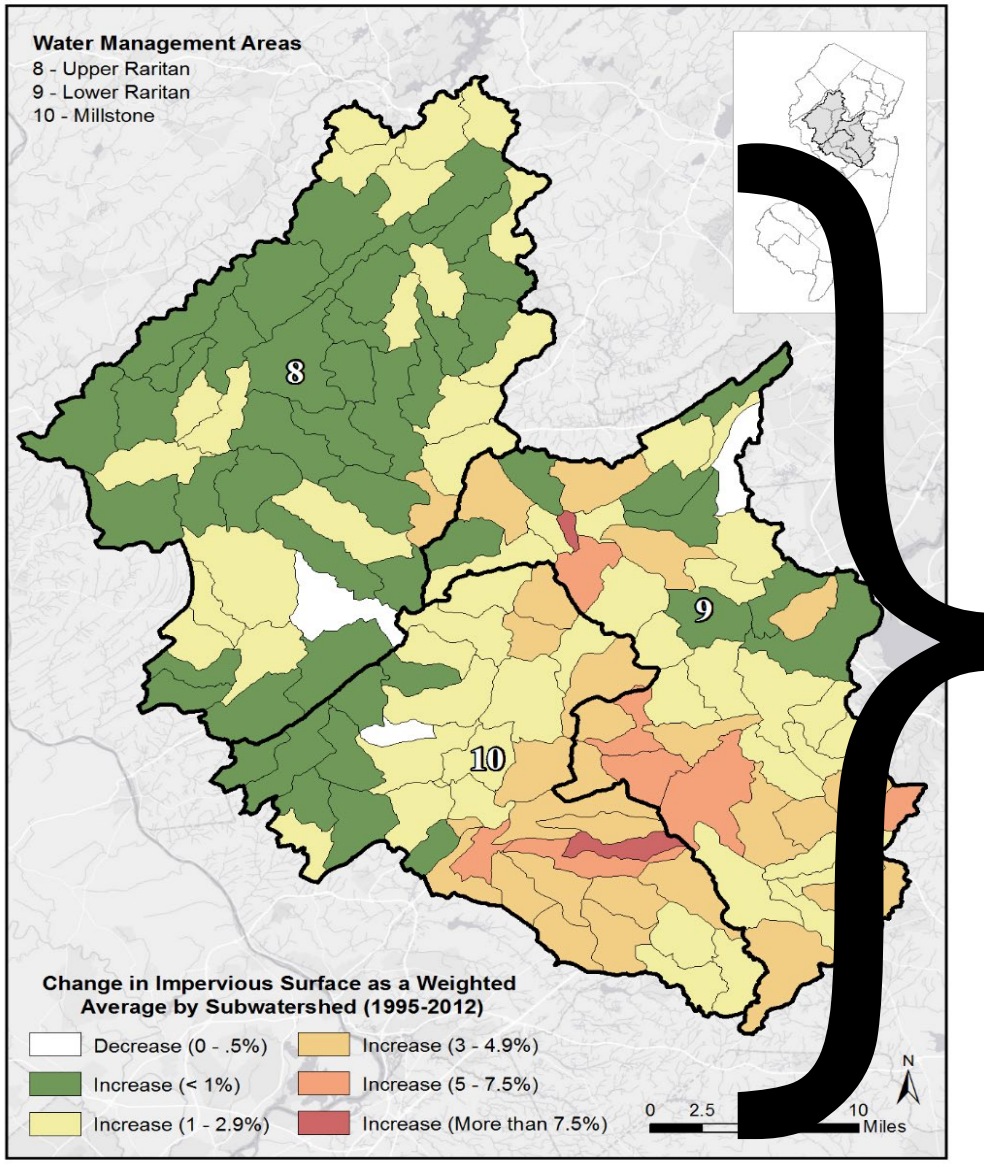
- Local context
  - Suggested action
  - Watershed partners and resources
  - Potential funding sources



Relevant scales

Nested, connected watersheds

Year	1995	2002	2007	2012
Upper Raritan	5.7	6.3	6.6	6.6
Lower Raritan	19.9	21.2	22.1	22.4
Millstone	9.4	10.4	11.1	11.5
Raritan Basin	11.2	12.1	12.7	12.9



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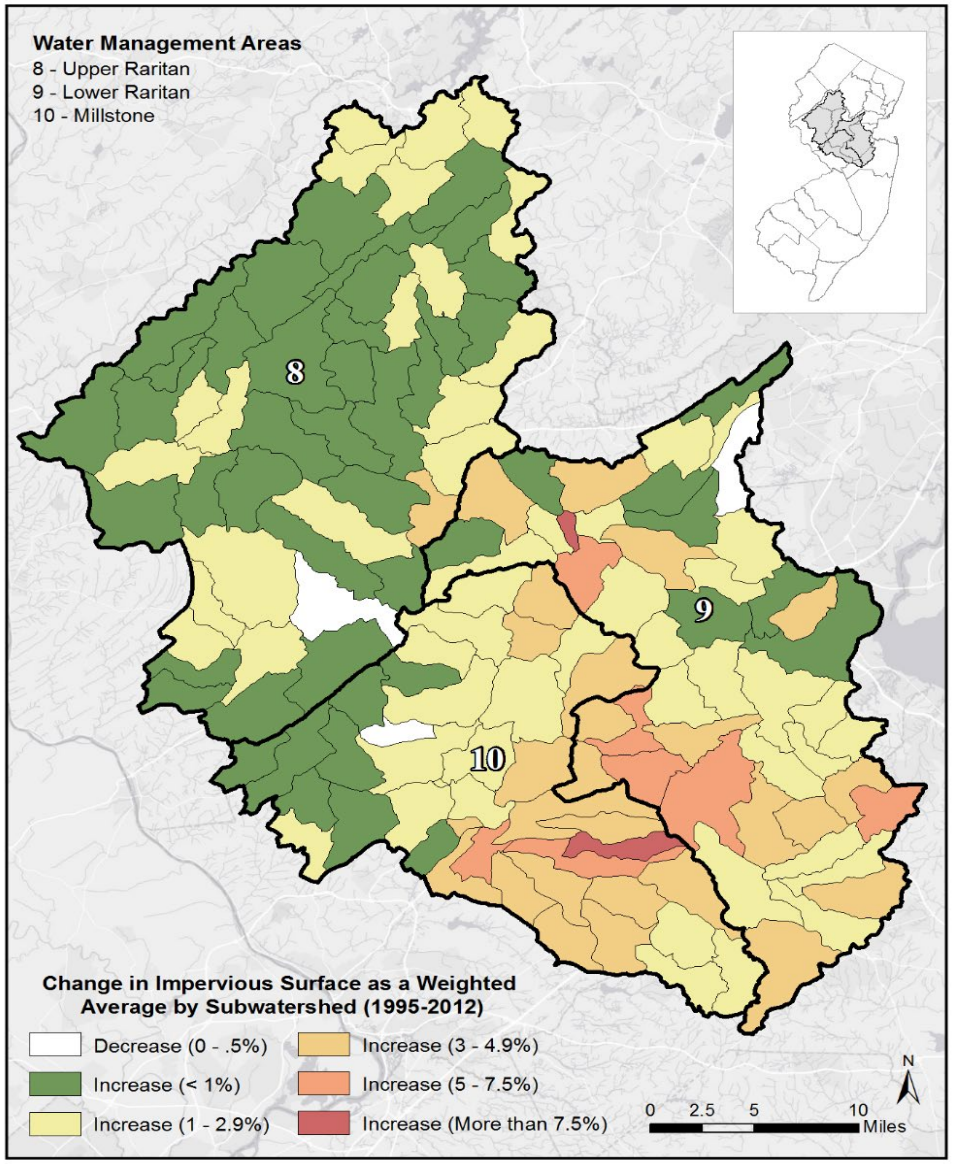


Trends

Impervious surface percentage

Year	1995	2002	2007	2012
Upper Raritan	5.7	6.3	6.6	6.6
Lower Raritan	19.9	21.2	22.1	22.4
Millstone	9.4	10.4	11.1	11.5
Raritan Basin	11.2	12.1	12.7	12.9

Increasing over time

2. Water Quality Stressor Tool

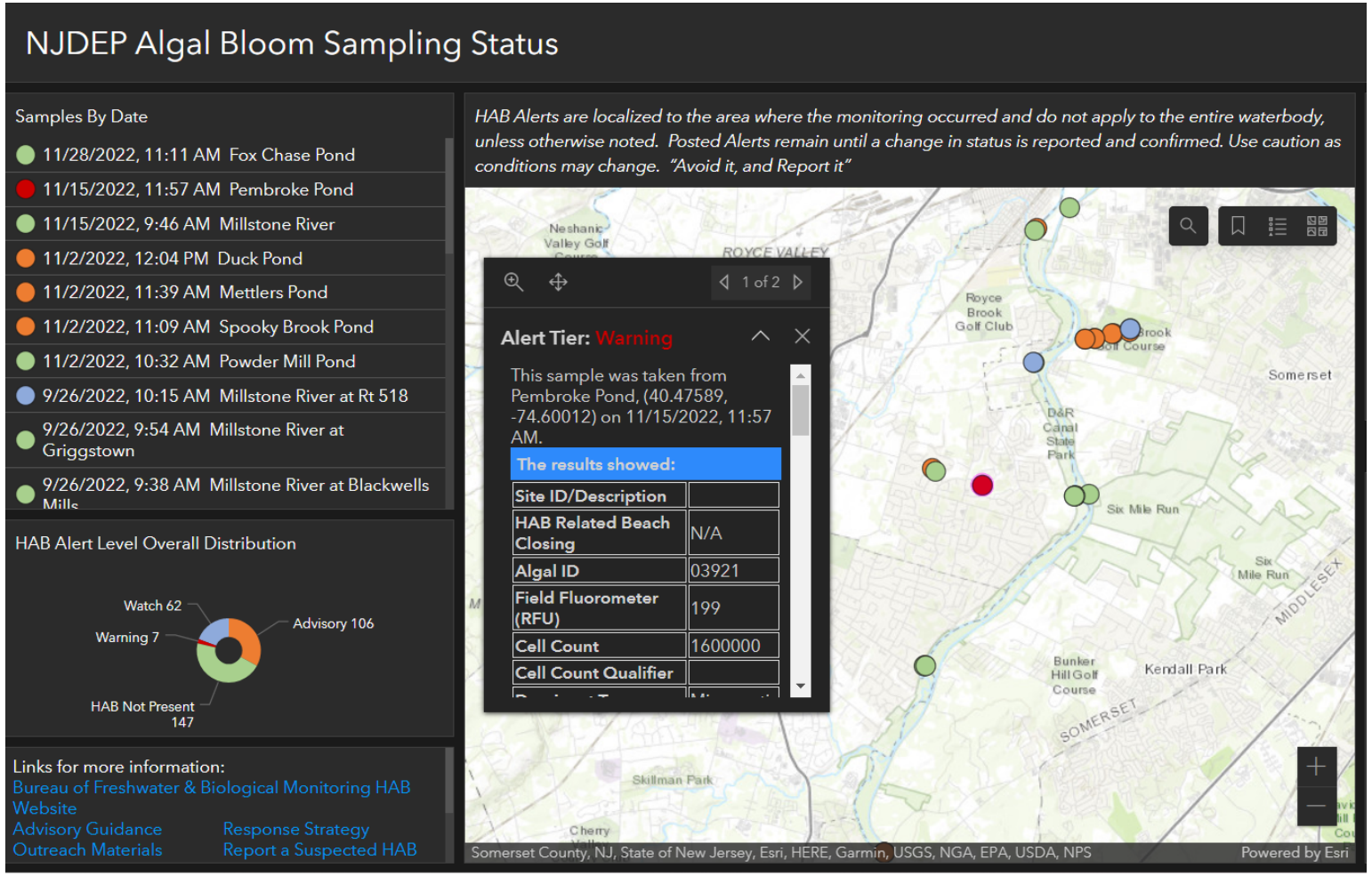
What sources are contributing to impairments in a waterbody?

How can I make a watershed plan to improve water quality?

Interactive Map

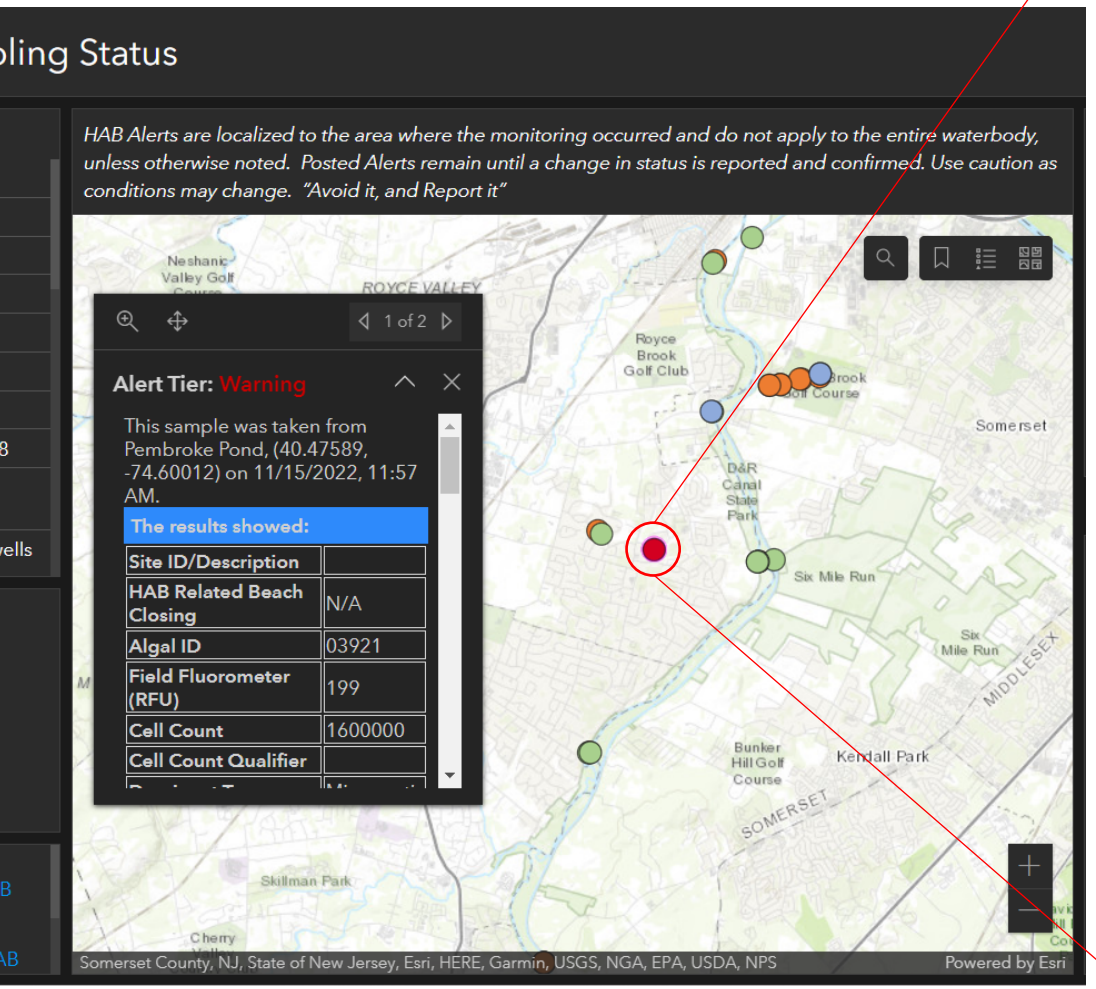
- Identify possible sources of water quality impairments
- Serve as a starting point to track down sources of water quality issues and build watershed management plans.

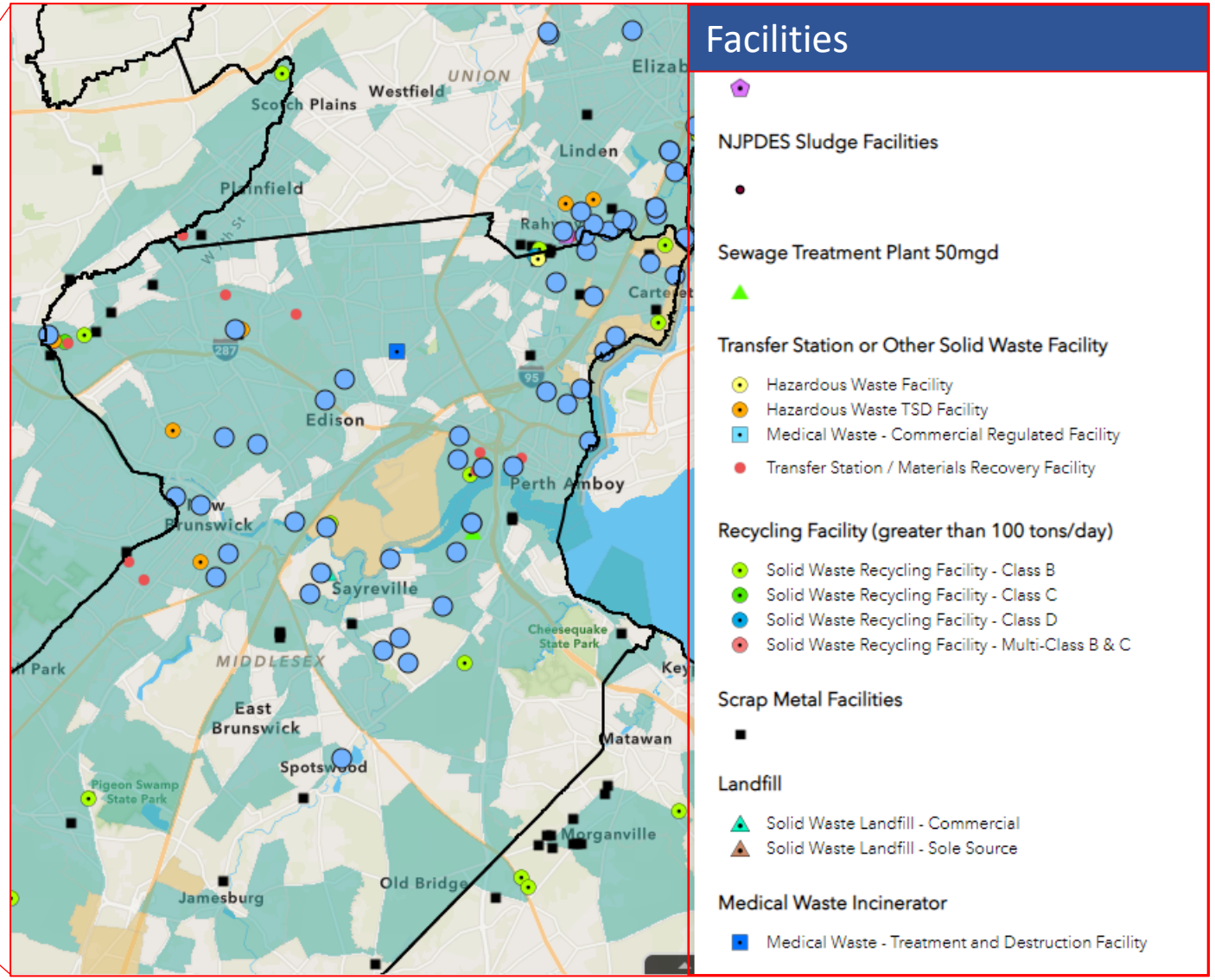
Connecting impairments with stressors



Connecting impairments with stressors

Tracking down sources





3. Water Quality Improvement Opportunity Tool

Which waterbodies need restoration or improvement?

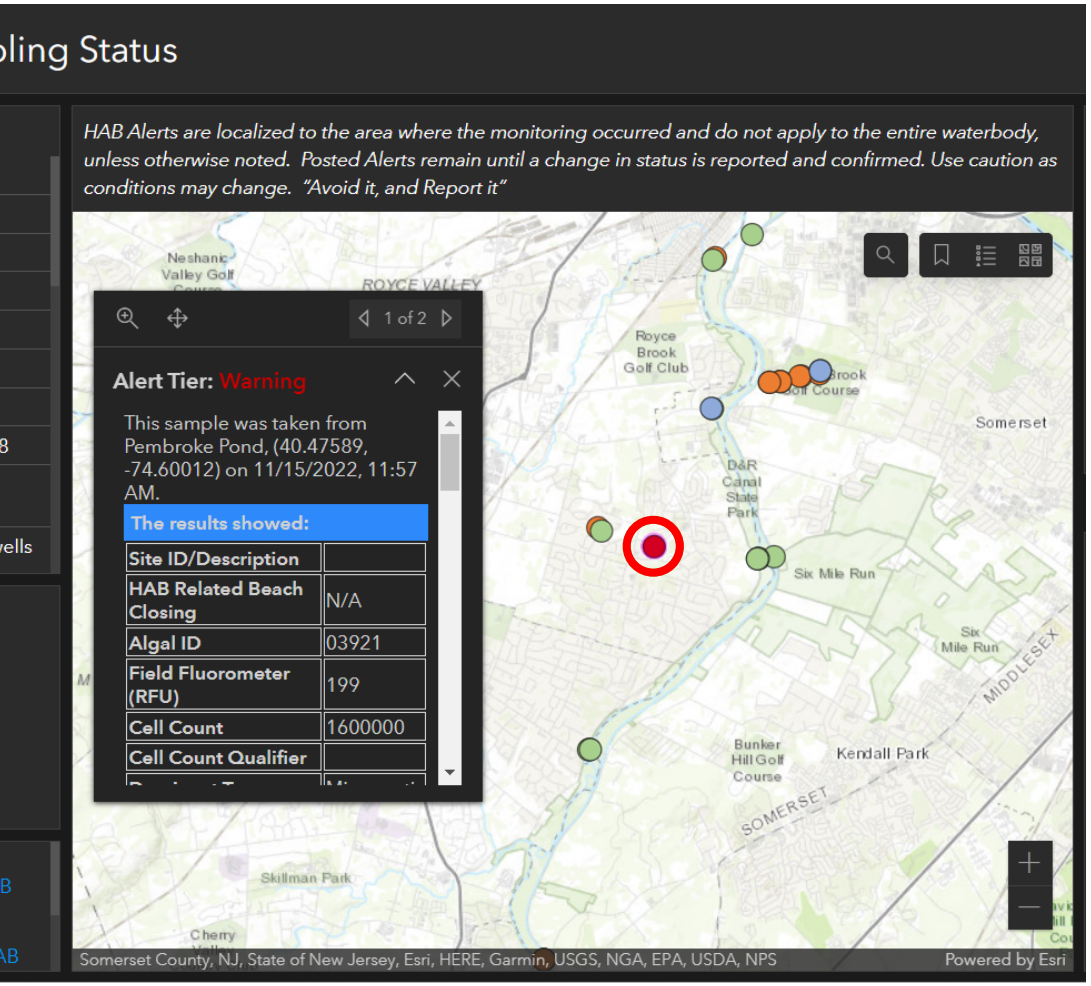
What best management practice should I use?

What information is missing to inform restoration decisions?

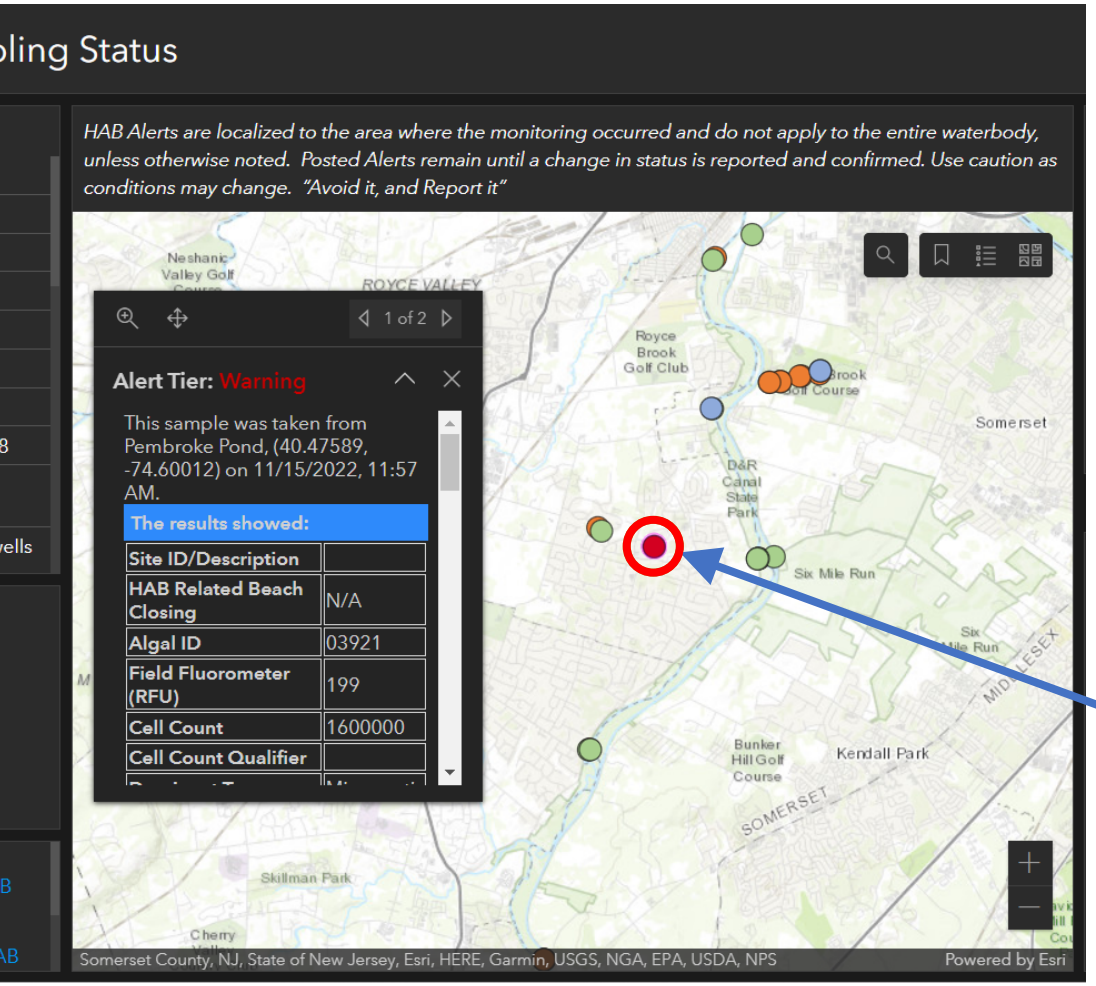
Interactive Map

- Identify specific locations in need of restoration or BMPs
- Identify where additional monitoring is needed

Connecting impairments with improvement opportunities



Connecting impairments with improvement opportunities



GREEN INFRASTRUCTURE in New Jersey

- Cistern
- Dry Well
- Grass Swale
- Green Roof
- Pervious Paving System
- Small-Scale Bioretention System (2.5 acre DA limit)
- Small-Scale Infiltration Basin (2.5 acre DA limit)
- Small-Scale Sand Filter (2.5 acre DA limit)
- Vegetative Filter Strip

Learning from existing resources

Combining the best of what is already working

What are your watershed management information needs?

How might the NJWRAP application support your efforts?

YOUR VOICE MATTERS

Be heard!

Take our survey:

go.rutgers.edu/NJWRAP-Uses-Survey

Get Involved!

Take the survey

go.rutgers.edu/NJWRAP-Uses-Survey

Email us

janine.barr@rutgers.edu

kate.douthat@rutgers.edu

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

YOU

RUTGERS
THE STATE UNIVERSITY OF NEW JERSEY

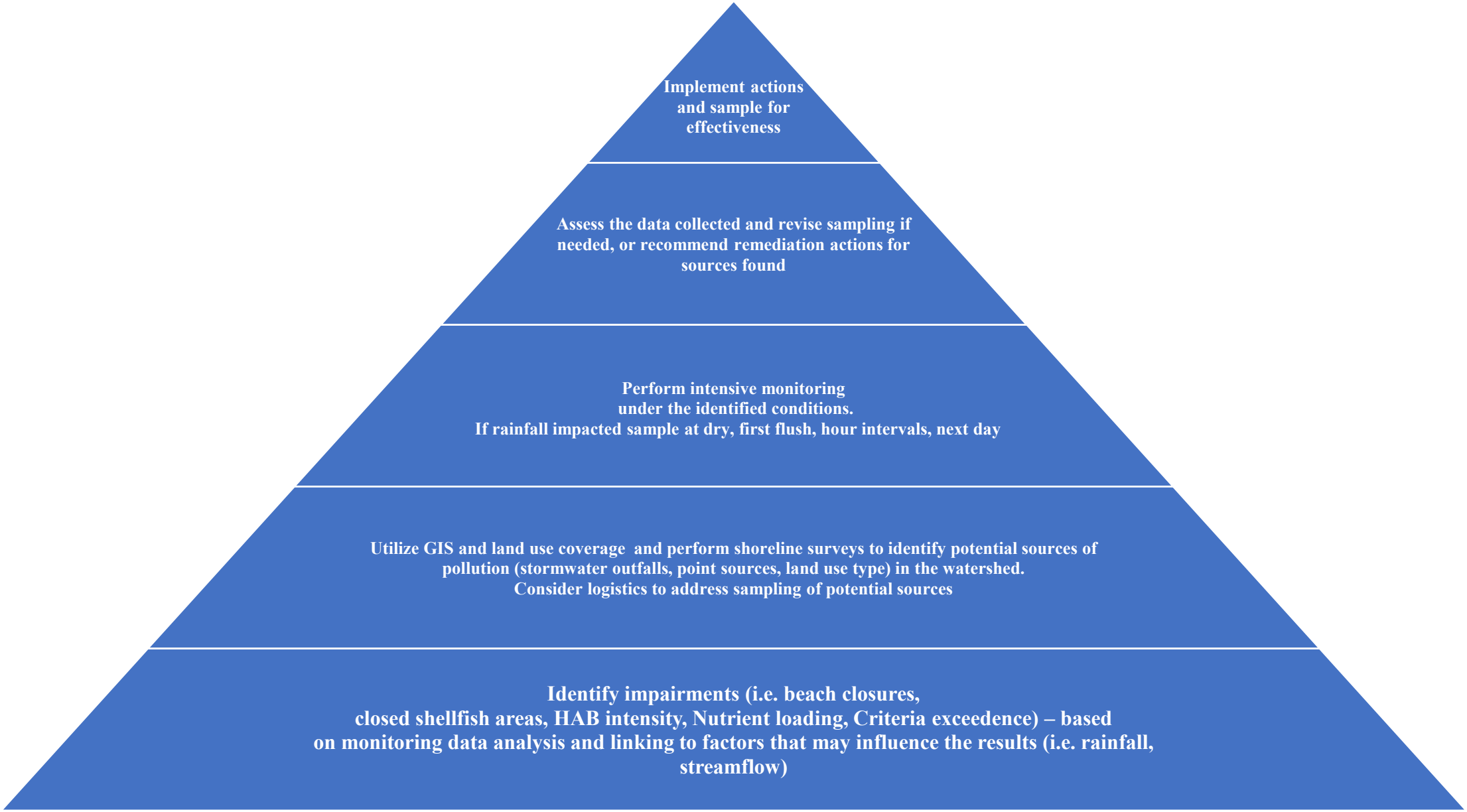
HABs, Problem Characterization

Bob Schuster

Bureau Chief
Marine Water Monitoring
NJDEP

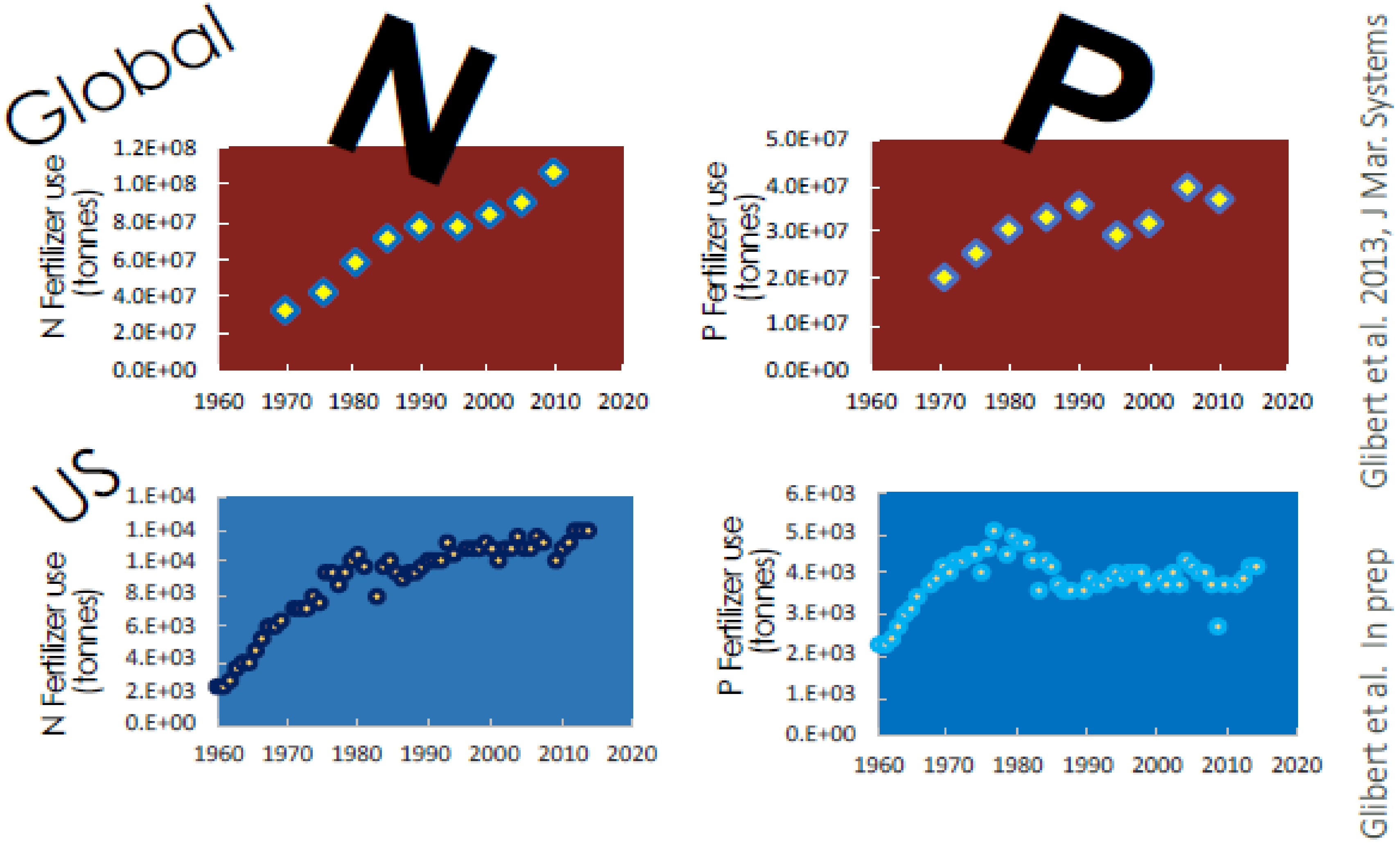
HABs, Problem Characterization

Bob Schuster, NJDEP Marine Water Monitoring
3/30/2023

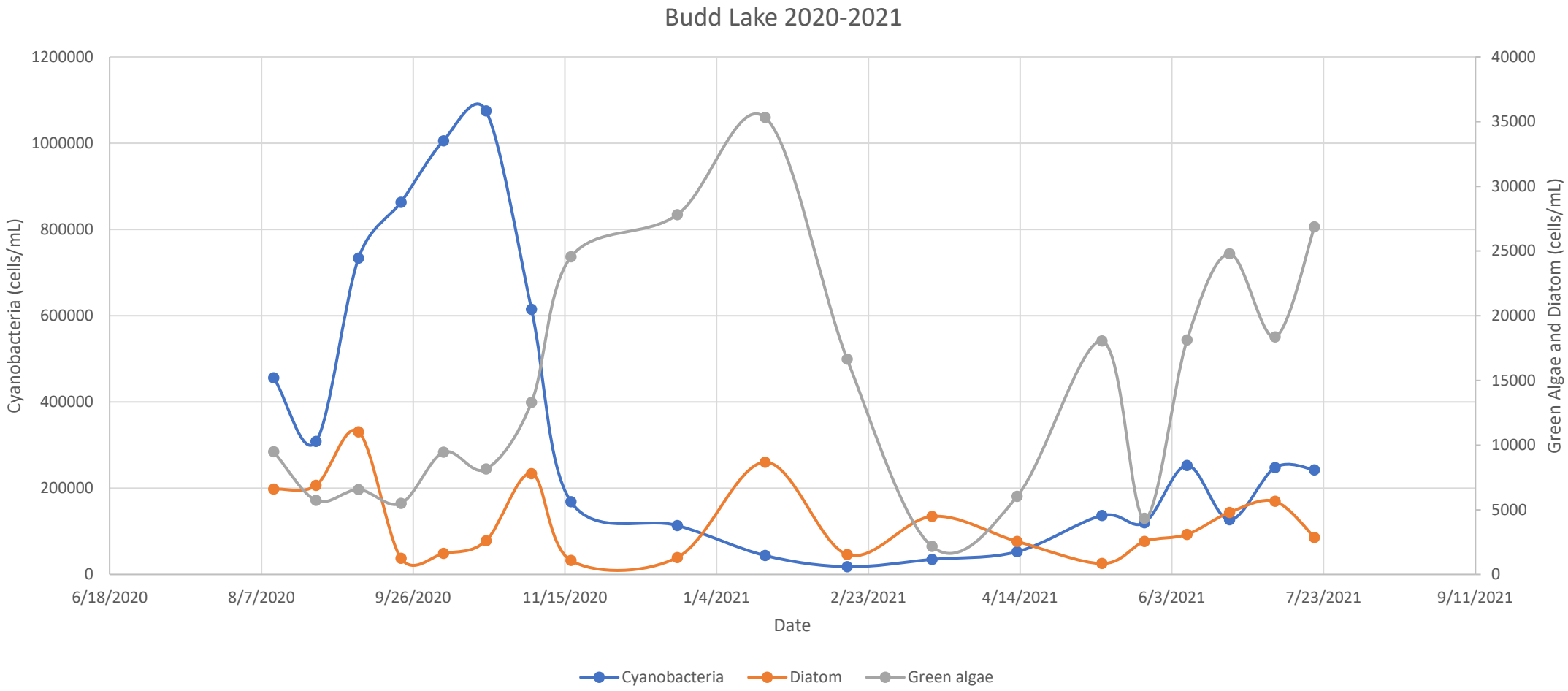

Implement actions and sample for effectiveness
Assess the data collected and revise sampling if needed, or recommend remediation actions for sources found
Perform intensive monitoring under the identified conditions. If rainfall impacted sample at dry, first flush, hour intervals, next day
Utilize GIS and land use coverage and perform shoreline surveys to identify potential sources of pollution (stormwater outfalls, point sources, land use type) in the watershed. Consider logistics to address sampling of potential sources
Identify impairments (i.e. beach closures, closed shellfish areas, HAB intensity, Nutrient loading, Criteria exceedence) – based on monitoring data analysis and linking to factors that may influence the results (i.e. rainfall, streamflow)

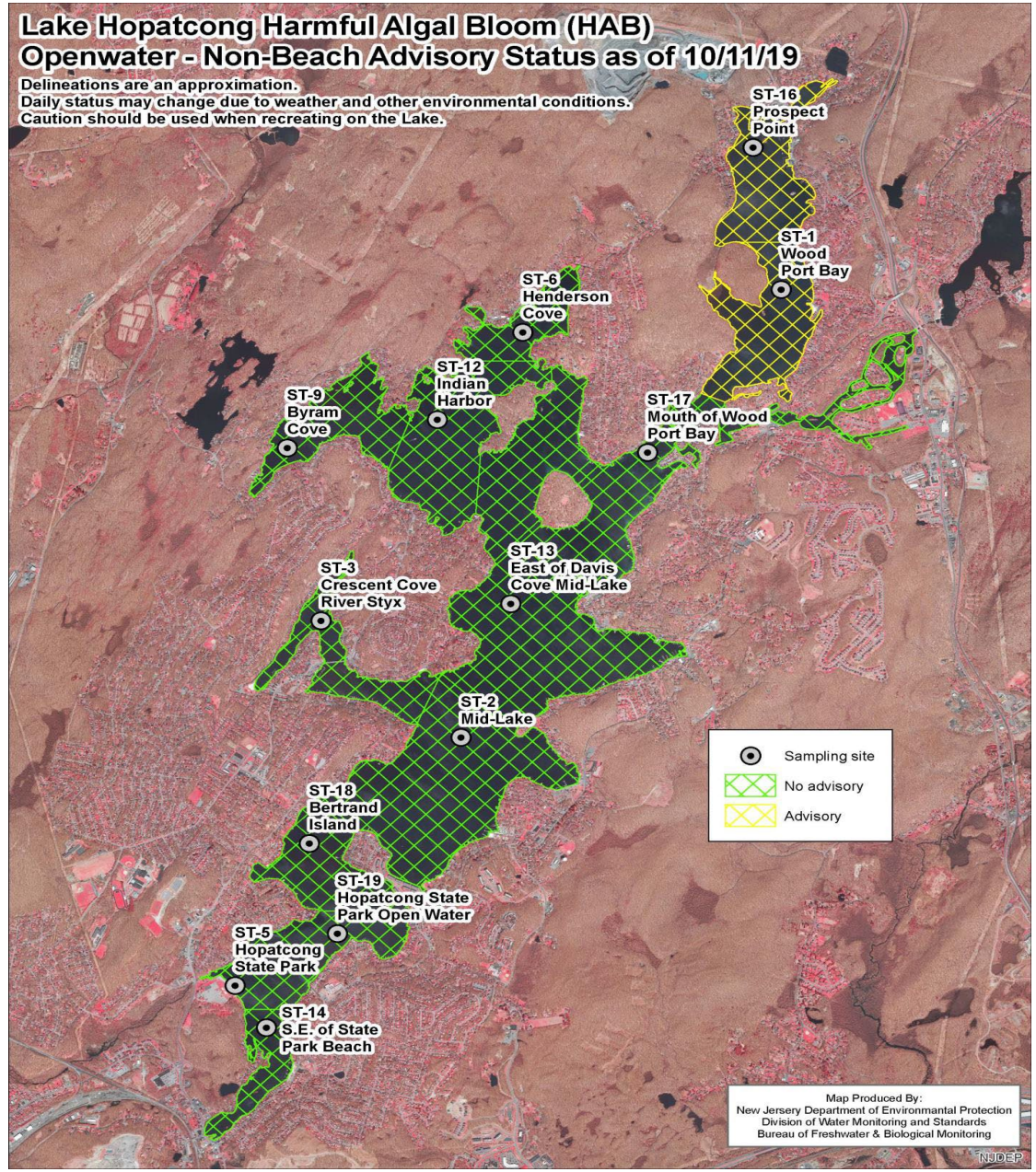
Problem Characterization

- Many factors influence HAB formation.
  - Nutrients (in-lake/external sources), seasonal changes
  - Spatial differences
  - Sunlight
  - Temperature (Air and Water)
  - Rainfall Patterns Dry/Wet
  - Flow
- Data Collection and assessment, land use, shoreline surveys, meteorological conditions are some of what is needed for characterization of HAB occurrence and nutrient loads.


Global
N
P
US
N Fertilizer use (tonnes)
P Fertilizer use (tonnes)
1.2E+08
1.0E+08
8.0E+07
6.0E+07
4.0E+07
2.0E+07
0.0E+00
5.0E+07
4.0E+07
3.0E+07
2.0E+07
1.0E+07
0.0E+00
1.E+04
1.E+04
1.E+04
8.E+03
6.E+03
4.E+03
2.E+03
0.E+00
6.E+03
5.E+03
4.E+03
3.E+03
2.E+03
1.E+03
0.E+00
1960 1970 1980 1990 2000 2010 2020
Glibert et al. 2013, J Mar. Systems
Glibert et al. In prep

Seasonal

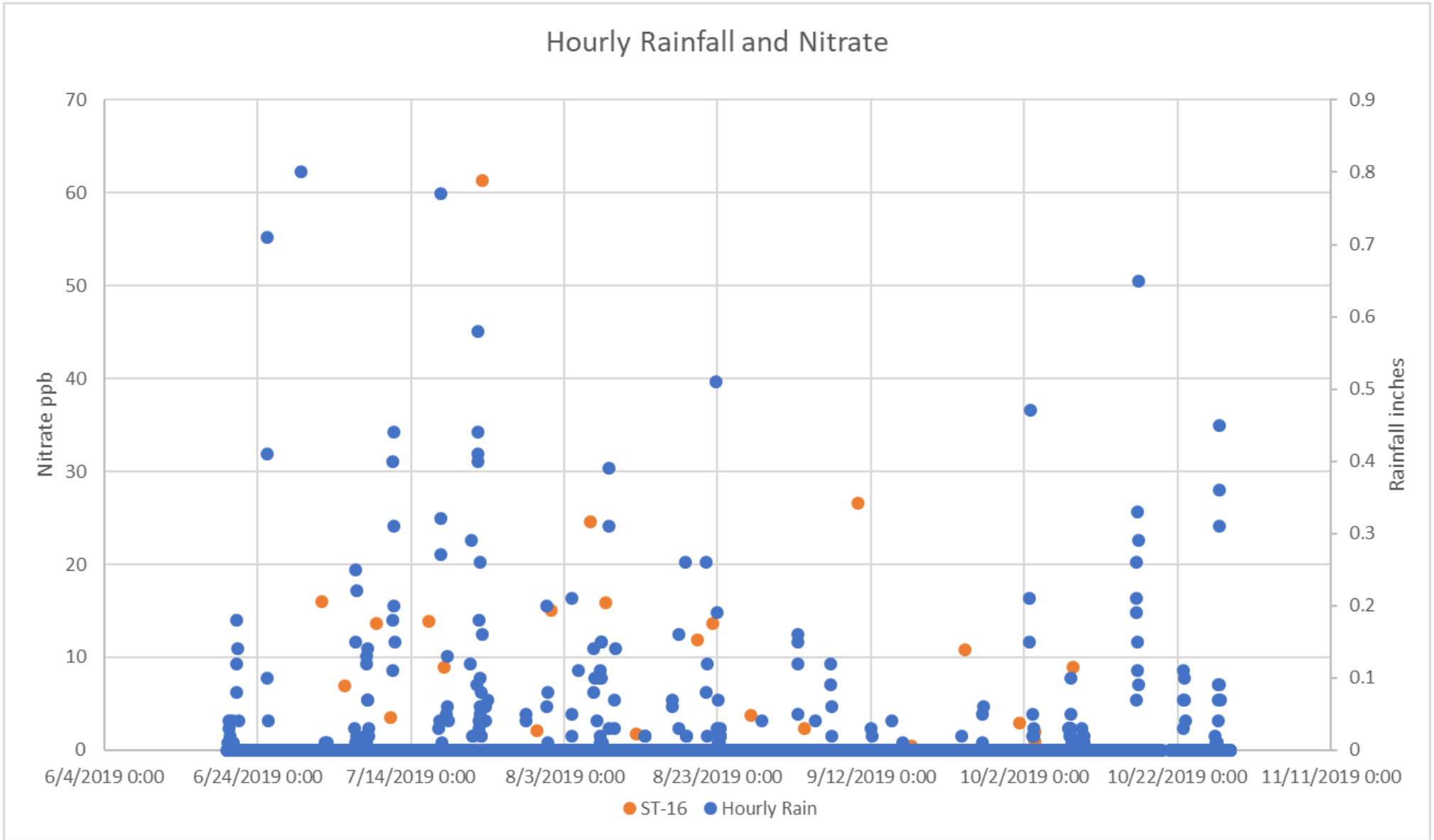

Budd Lake 2020-2021
Cyanobacteria (cells/mL)
Green Algae and Diatom (cells/mL)
1200000
1000000
800000
600000
400000
200000
0
40000
35000
30000
25000
20000
15000
10000
5000
0
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
Date
Cyanobacteria
Diatom
Green algae


Lake Hopatcong Harmful Algal Bloom (HAB)
Openwater - Non-Beach Advisory Status as of 10/11/19
Delineations are an approximation.
Daily status may change due to weather and other environmental conditions.
Caution should be used when recreating on the Lake.
ST-16 Prospect Point
ST-1 Wood Port Bay
ST-6 Henderson Cove
ST-12 Indian Harbor
ST-9 Byram Cove
ST-17 Mouth of Wood Port Bay
ST-13 East of Davis Cove Mid-Lake
ST-3 Crescent Cove River Styx
ST-2 Mid-Lake
ST-18 Bertrand Island
ST-19 Hopatcong State Park Open Water
ST-5 Hopatcong State Park
ST-14 S.E. of State Park Beach
Sampling site
No advisory
Advisory
Map Produced By:
New Jersey Department of Environmantal Protection
Division of Water Monitoring and Standards
Bureau of Freshwater & Biological Monitoring
NJDEP

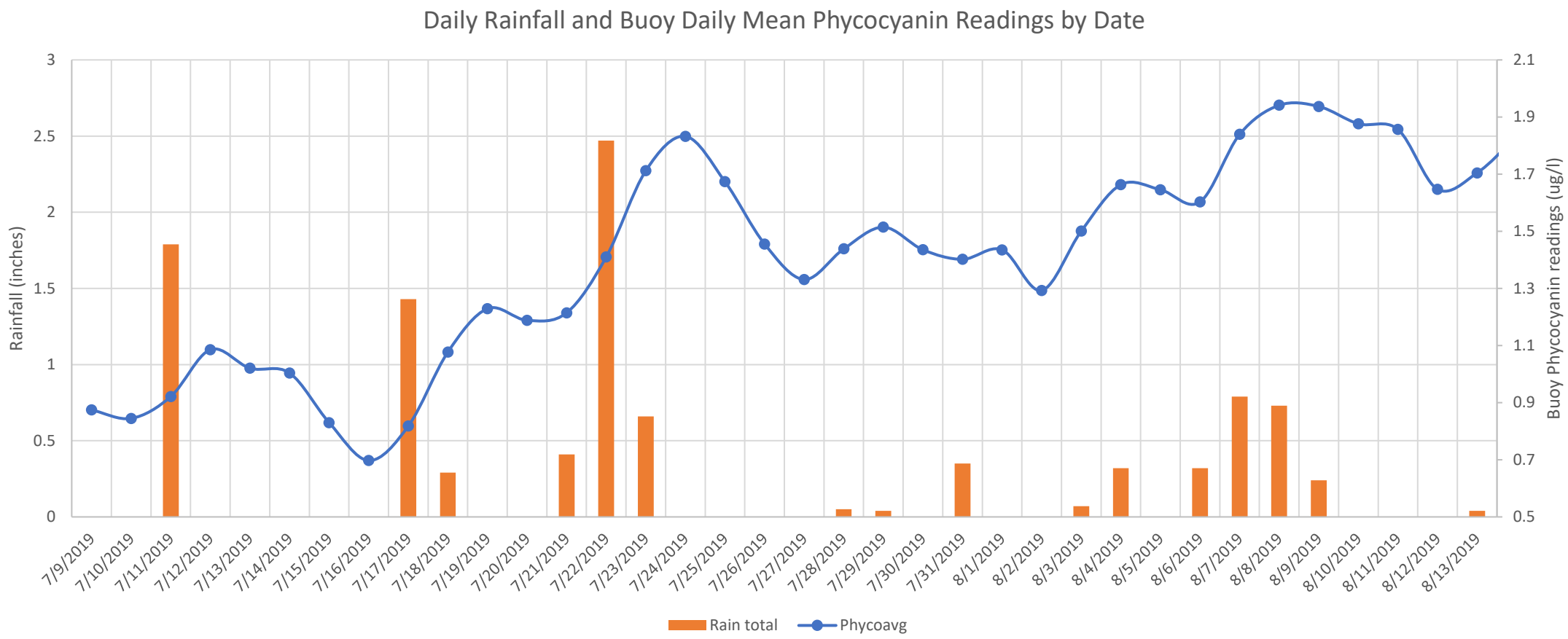
Lake Hopatcong

Average surface concentration (PPB) by Station

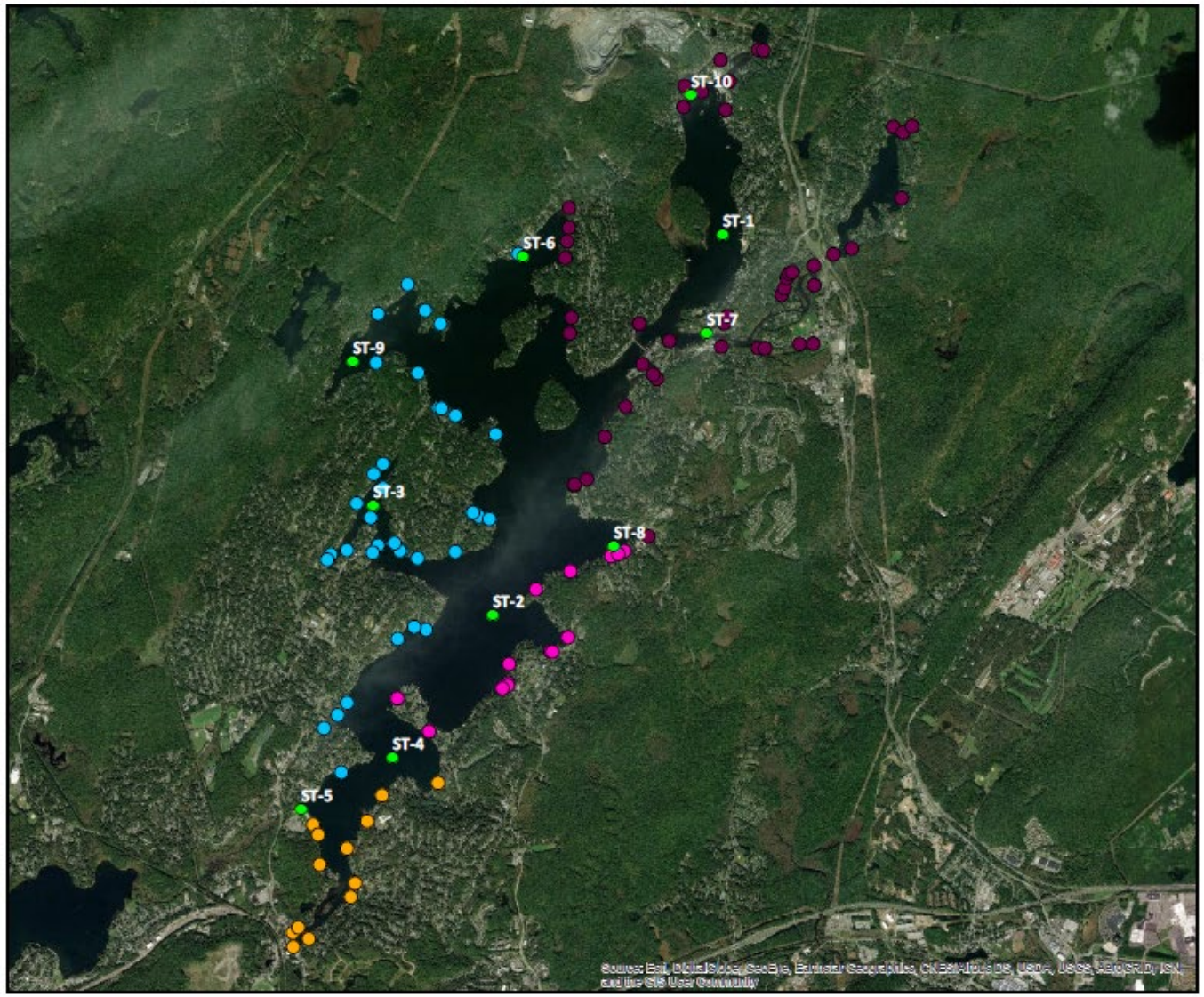
tation_Nam	NH3	NO3	PO4	TN	TP
ST-16	6.412791	10.12333	21.37024	833.6555	49.12833
ST-17	13.346	4.931667	21.59	672.1233	47.09333
ST-3	7.572727	8.733182	17.44955	722.545	42.69818
ST-1	4.537917	9.940833	18.02417	710.4433	38.14125
ST-5	3.405455	5.23	14.26364	573.1255	31.605
ST-14	2.581053	7.05421	13.82158	551.4279	30.89684
ST-19	0	0	10.68	569.12	29.3
ST-9	1.376429	10.34571	11.41786	490.5821	23.18
ST-6	2.051333	3.778	10.17133	455.8727	22.54133
ST-13	1.861429	3.218571	10.907	461.6348	21.46333
ST-2	2.095439	7.154386	10.54772	469.5647	20.90772
ST-18	0.831667	6.93	10.385	451.4317	20.70667
ST-15	18.13	3.28	10.3	666.2	19.72
ST-12	2.195333	3.734	10.08733	445.918	19.47933


Hourly Rainfall and Nitrate
Nitrate ppb
Rainfall inches
70
60
50
40
30
20
10
0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
6/4/2019 0:00
6/24/2019 0:00
7/14/2019 0:00
8/3/2019 0:00
8/23/2019 0:00
9/12/2019 0:00
10/2/2019 0:00
10/22/2019 0:00
11/11/2019 0:00
ST-16
Hourly Rain

Lake Hopatcong Buoy Data ST-14



MS4 Outfalls and WQDE Monitoring Locations on Lake Hopatcong



Legend

- WQDE Monitoring Locations
- Hopatcong Borough
- Jefferson Township
- Mount Arlington Borough
- Roxbury Township

N

0.8 0.4 0 0.8 1.6
Miles

Station ST-2 Surface

Sample_CollectDate	Station_Name	NH3	NO3	PO4	TN	TP	% orgN	% org P	inorgN:P
6/28/2019	ST-2	0	1.79	9.18	482.09	14.64	99.6287	37.29508	0.431762
7/2/2019	ST-2	0	8.8	9.59	503.8	16.55	98.25328	42.05438	2.031878
7/5/2019	ST-2	0	18.72	9.33	507.25	17	96.30951	45.11765	4.442811
7/9/2019	ST-2	0	0.43	6.76	466.25	16.42	99.90777	58.83069	0.14085
7/11/2019	ST-2	3.57	9.31	9.63	477.41	22.22	97.30211	56.66067	2.961578
7/16/2019	ST-2	1.55	4.02	7.98	450.22	16.71	98.76283	52.24417	1.54556
7/18/2019	ST-2	0	67.71	9.14	419.11	15.6	83.84434	41.41026	16.40364
7/23/2019	ST-2	1.21	2	12.64	486.82	22.08	99.34062	42.75362	0.56233
7/25/2019	ST-2	1.23	0	10.96	451.8	23.69	99.72776	53.73575	0.248501
7/30/2019	ST-2	3.16	1.05	10.81	455.88	19.1	99.07651	43.40314	0.862363
8/1/2019	ST-2	0	3.86	8.83	507.26	22.56	99.23905	60.85993	0.967966
8/6/2019	ST-2	1.57	1.92	14.3	536.8	24.75	99.34985	42.22222	0.54041
8/8/2019	ST-2	3.62	29.14	13.24	567.46	23.76	94.22691	44.27609	5.478852
8/12/2019	ST-2	3.17	0	13.94	523.95	31.48	99.39498	55.71792	0.503536
8/20/2019	ST-2	0	19.5	13.78	484.62	18.16	95.97623	24.11894	3.133423
8/22/2019	ST-2	2.71	0.97	13.46	471.25	16.12	99.2191	16.50124	0.605392
8/27/2019	ST-2	0	2.06	8.55	429.35	17.32	99.5202	50.6351	0.5335
9/3/2019	ST-2	7.71	17.25	9.4	449.62	11.22	94.44865	16.22103	5.879635
9/10/2019	ST-2	3.79	13.17	9.1	456.13	26.46	96.28176	65.60847	4.126845
9/17/2019	ST-2	0	0	9.11	423.82	21.65	100	57.92148	0
9/24/2019	ST-2	0	0	7.7	414.24	19.66	100	60.83418	0
10/1/2019	ST-2	6.25	0.03	6.28	436.09	25.48	98.55993	75.35322	2.214286
10/3/2019	ST-2	15.19	2.21	6.04	582.03	20.38	97.01046	70.3631	6.378903
10/29/2019	ST-2	229.95	43.87	7.27	566.21	19.79	51.63985	63.26427	83.39969

RABCH010 (26th St - Brigantine)
RABCH011 (33rd St - Longport)
RA050 (Babcock Creek near Mays Landing)
RA044 (Great Egg Harbor River Lower)
RA061 (Hammonton Creek at Westcoatville)
RABCH008 (Lincoln Ave - Atlantic City)
RA059 (Mullica River)

Add >

< Remove

RA144 (Musconetcong River)

Date Range: ○ 6 Hours ago ○ 24 Hours ago ○ 48 Hours ago ◉ Custom

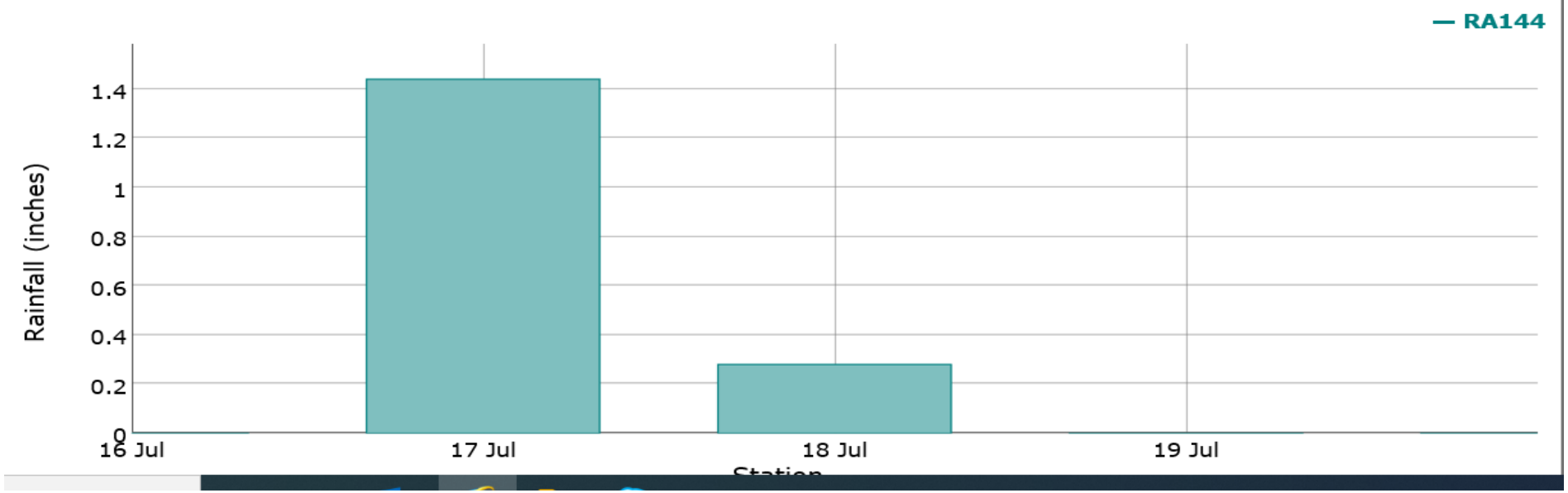
Start Date: July 17 2019 00 Clear

End Date: July 20 2019 23 Clear

Group Data By: ○ Year ○ Month ◉ Day ○ Hour

Graph Type: ○ Line ◉ Bar

Graph



Average Nutrient Concentrations Hopatcong vs. Greenwood

Greenwood Lake				
Ammonia	**Nitrate**	**orthophosphate**	**Total Nitrogen**	**Total Phosphorus**
37.92	20.24	20.39	720.93	44.85
Lake Hopatcong				
Ammonia	**Nitrate**	**orthophosphate**	**Total Nitrogen**	**Total Phosphorus**
3.65	7.08	13.72	559.87	29.71

Microcystin Toxin Analysis

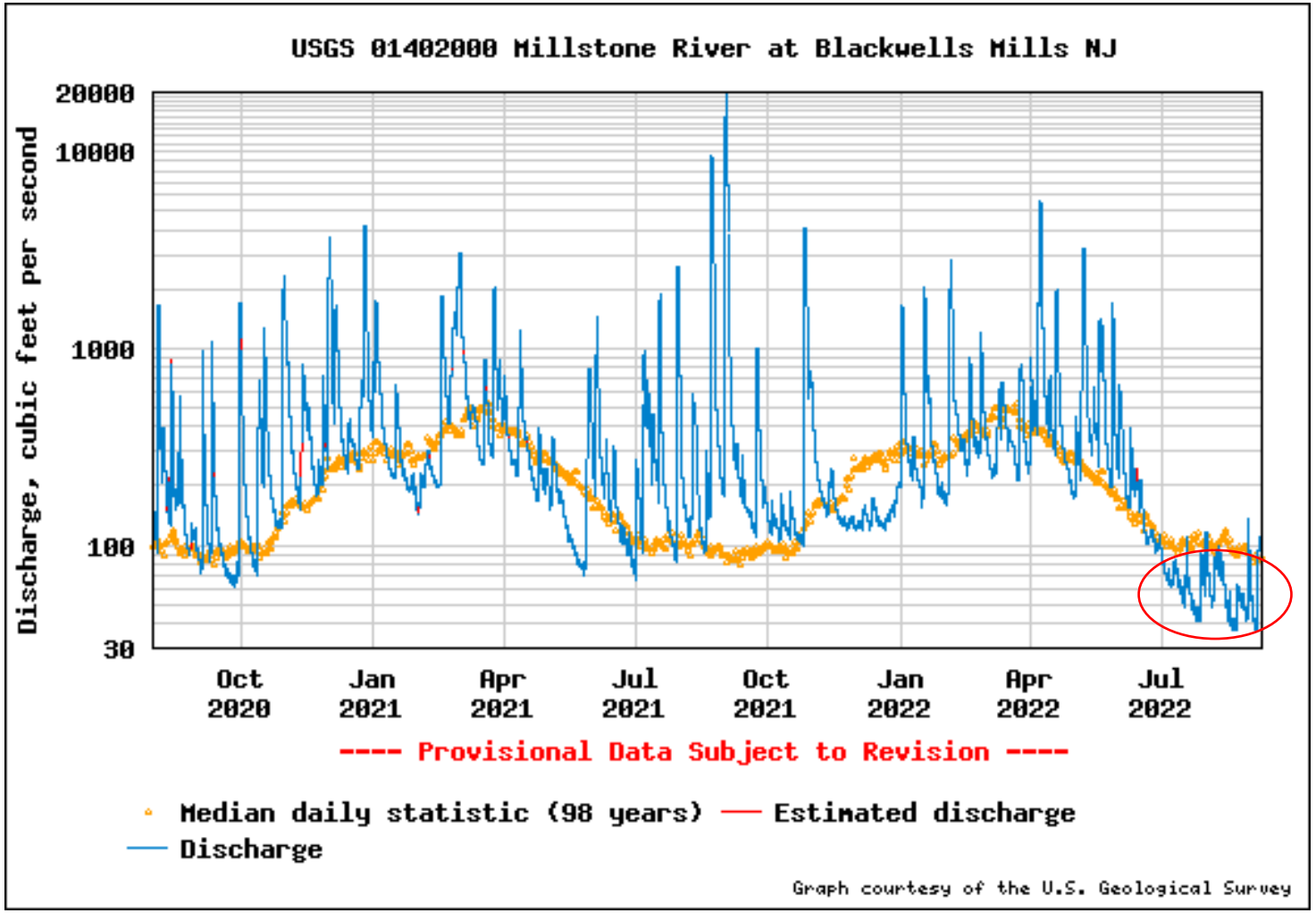
- Hopatcong – range Below Detection (0.15)-2.3 ug/l; 5 results above 1 ug/l, only one above 2 ug/l. 42 results below detection.
- Greenwood – range Below Detection (0.15)-6.21 ug/l; 180 results above 1 ug/l, 44 results above 3 ug/l. 2 results below detection.

Greenwood Lake vs. Lake Hopatcong

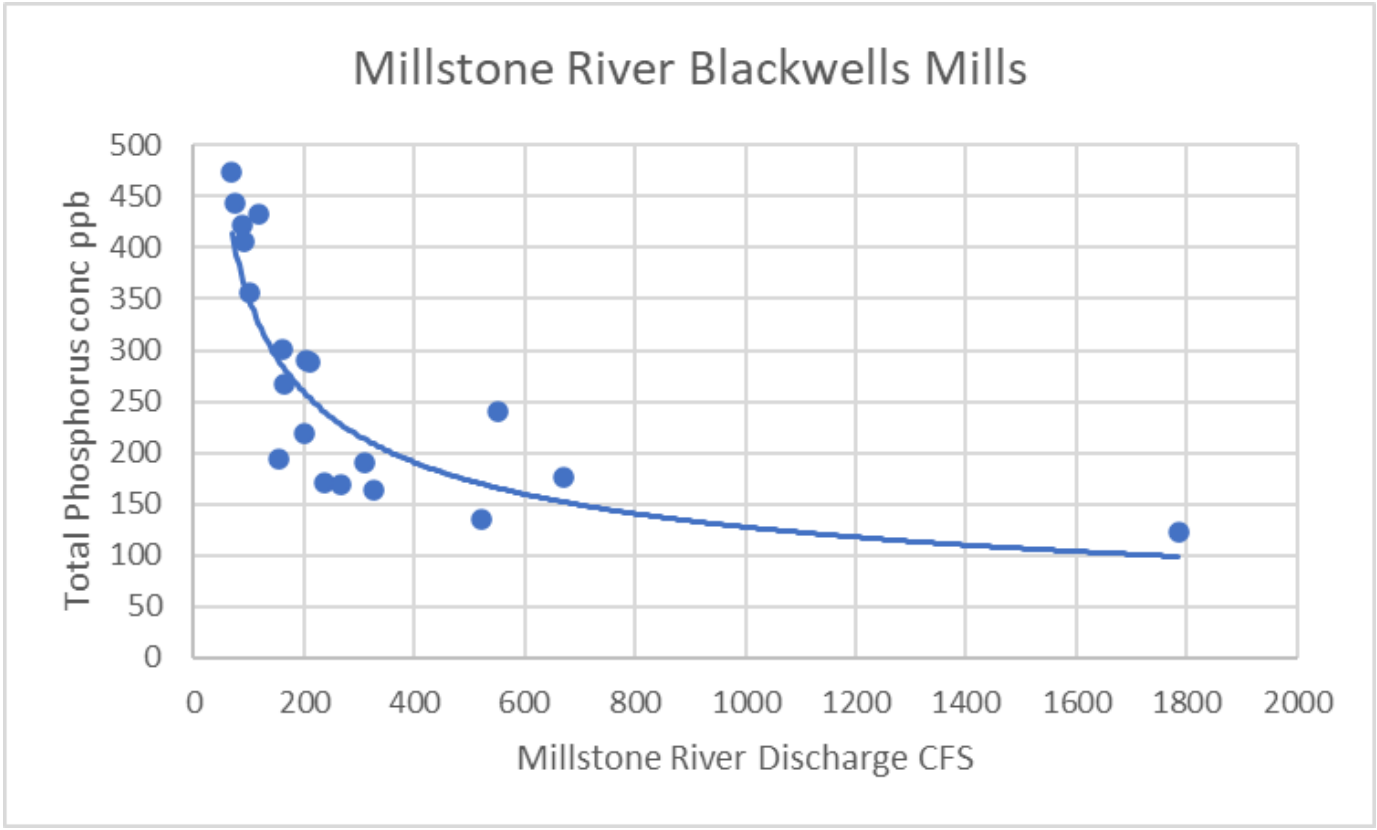
- All nutrient concentrations are higher in Greenwood Lake.
- Still see a link to rainfall, but ambient levels are always higher for all nutrients, suggests a continuous source (septics?).
- Toxin levels measured in Greenwood Lake were significantly and consistently higher than in Lake Hopatcong.

2022 Millstone River HAB

- HAB started in July 2022.
- Millstone Flow was low, drought conditions.
- Data shows elevated nutrients during low flow.
- Source of nutrients is continuous, and not due to just rainfall.


USGS 01402000 Millstone River at Blackwells Mills NJ
Discharge, cubic feet per second
20000
10000
1000
100
30
Oct 2020
Jan 2021
Apr 2021
Jul 2021
Oct 2021
Jan 2022
Apr 2022
Jul 2022
---- Provisional Data Subject to Revision ----
Median daily statistic (98 years)
Estimated discharge
Discharge
Graph courtesy of the U.S. Geological Survey

2020-2021 Raritan Basin Project Sampling



NJ Northern Section Rainfall (State Climatologist Office)

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
2017	3.64	2.01	3.83	3.9	5.53	3.51	5.95	4.77	2.15	5.32	1.23	1.52	43.36
2018	3.07	5.35	3.84	4.76	4.93	3.03	6.6	8.14	7.37	3.93	8.64	5.86	65.52
2019	4.92	3.07	3.68	4.59	8.69	5.18	7.19	3.92	1.01	6.71	2.49	4.9	56.35
2020	2.04	2.45	3.22	3.95	2.86	2.59	5.62	5.9	4.03	4.47	3.38	5.34	45.85
2021	1.63	4.11	3.19	2.04	4.67	2.96	7.52	7.29	9.31	6.01	1.24	1.47	51.44
2022	2.91	3	2.4	6.07	5.72	3.53	1.91	2.25	3.57	5.85	2.74	4.97	44.92

Conclusion

- Nutrients influence HAB occurrence.
- Nutrient loads can be linked to land use, storm water runoff, direct land run off (Ag, urban, commercial), septic areas, wastewater discharges.
- Identifying source of nutrients and control of storm water in key identified areas can lead to remediation actions that can be applied to the area, and if effective, used in other similar areas.
- Monitoring and thorough assessment is a key component, partnerships may be needed.

Contact

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Bureau Chief

Marine Water Monitoring

Robert.Schuster@dep.nj.gov

https://www.nj.gov/dep/bmw/

609-748-2000

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Watershed Improvement Plans

Gabriel Mahon, P.E.

Manager
NJPDES Stormwater Permitting and Water Quality Management
NJDEP

Watershed Improvement Plans

Municipal Separate Storm Sewer System (MS4)

- **The MS4 permitting program is required by both federal and state regulations**
  - to address water quality, as well as flooding concerns related to poor design and improper maintenance
  - The Tier A permit is equivalent to the Federal small MS4 permit
  - The Tier B permit was a NJ state-only permit and can not incorporate water quality related requirements
- **The Federal regulations require states to periodically re-evaluate their MS4 permitting designations**
  - Is there potential to result in exceedances of water quality standards
  - Are there discharges into waters with TMDLs
  - Are there other significant water quality impacts, including habitat and biological impacts (e.g. HABs)
  - Are there discharges to sensitive waters

Review of Water Quality & Population Information

- **<u>All</u> former Tier Bs towns have receiving waters within or bordering their towns with water quality impairments and/or TMDLs**
  - 82 towns also have sensitive receiving waters with classifications of FW1, PL, Category 1, Trout Production, and/or Trout Maintenance
  - Some also have or have had HABs occur in their receiving waters

MS4 Permit Renewal Overview

- Preliminary outreach sessions August 25th, 26th, and 31st of 2021
  - A total of 122 people attended the sessions
- Pre-draft permit issued on March 2, 2022
- Pre-draft outreach sessions March 22nd and 24th of 2022
  - A total of 71 people attended these sessions
- Tier reassignments July 1, 2022
- Draft permit issued July 28, 2022
- Final permit issued December 1, 2022 (effective January 1, 2023)

Watershed Improvement Plan

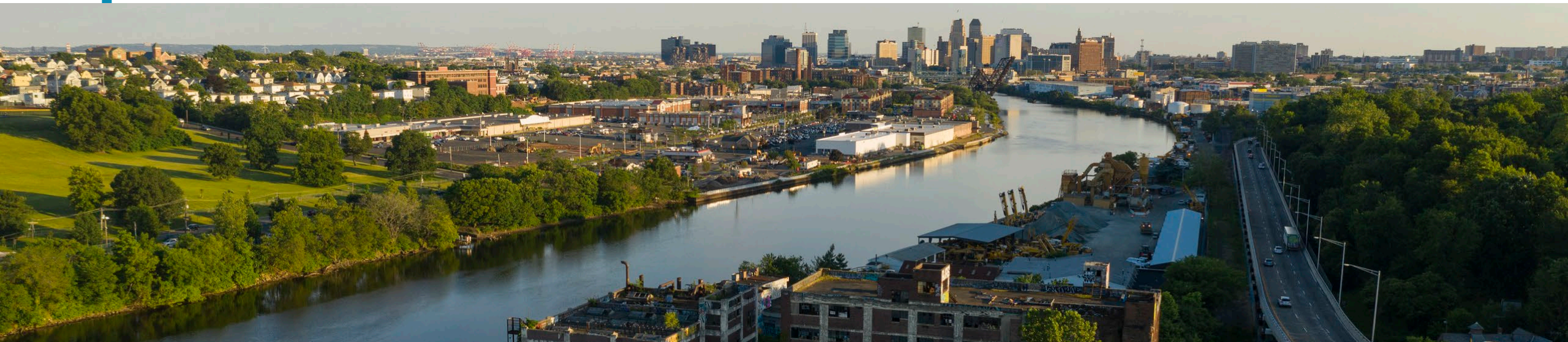
Permit section IV.H.

- Improve water quality by reducing MS4 contribution of pollutants to waterbodies with listed impairments and TMDLs
- Reduce/eliminate flooding with priority given based on human health and safety, environmental impacts, and frequency of occurrence
- Develop plan with input from residents, businesses, neighboring towns, other dischargers

Watershed Improvement Plan

Permit section IV.H.

- Phase 1 – Prepare and submit the Watershed Inventory Report; conduct outreach
  - Summarize/map required information, some is available from the Department's GIS database
- Phase 2 – Prepare and submit the Watershed Assessment Report; conduct outreach
  - Assess potential projects with estimates of the reduction in pollutant loading & funding need
  - Solicit public comments by posting the Watershed Assessment Report with a 60-day public comment period
- Phase 3 – Prepare and submit the Watershed Improvement Plan Report; conduct outreach
  - Summarize proposed projects with improvement expected, comments received, costs, coordination with other regulatory programs, and implementation schedule



Watershed Inventory Report

Permit section IV.H.
due Dec. 31, 2025

An electronic map of:

i. All stormwater outfalls owned/operated by the permittee;

ii. The drainage area for each outfall(s);

iii. The receiving waterbodies of those outfalls;

iv. The water quality classification of all receiving waterbody segments;

v. All stormwater interconnections from the municipality into another entities' storm or sanitary sewer system;

vi. The drainage area for each interconnection into another entities' storm or sanitary sewer system;

vii. All stormwater connection points into the municipality from another entities' storm sewer system;

viii. All storm drain inlets owned/operated by the permittee;

ix. Area associated with each TMDL for waters that lie within or bordering the municipality;

x. Area associated with each water quality impairment for waters that lie within or bordering the municipality;

xi. Overburdened communities;

xii. Impervious areas; and

xiii. The location and ownership of all stormwater outfalls and basins/infrastructure not owned/operated by the permittee.

Watershed Assessment Report

Permit section IV.H.
due Dec. 31, 2026

i. An assessment of potential water quality improvement projects by sub-watershed and parameter;

ii. An estimate of the percent reduction in loading of the TMDL/impaired parameters due to projects in (i) above;

iii. A summary of feedback from public information sessions;

iv. An estimate of funding needs for each project, and identification of potential funding sources, including the NJWB, the formation of a SWU, using 319 grants, FEMA BRIC grants; and

v. An estimate of an implementation schedule.

The report must also be posted on the municipal website for a 60 public comment period.

Final Watershed Improvement Plan

Permit section IV.H.
due Dec. 31, 2027

i. A summary of proposed locations and load reductions of water quality improvement projects, both public and private, to be implemented;
ii. A summary of the public comments received, and the changes made to the Final Plan;
iii. A summary of how the projects will be coordinated with other regulatory requirements;
iv. The proposed implementation schedule for the water quality improvement projects;
v. A schedule of the public information sessions to be held;
vi. Problems identified that are outside the jurisdiction of the permittee, if any. These can be related to pollutant loading due to agricultural properties, or other lands not under the jurisdiction of the municipality, and opportunities to address them;
vii. Costs, broken down by project and year, the funding opportunities that will be sought; and
viii. This plan shall describe how stormwater related problems in overburdened communities have been prioritized.

Questions?

Thank You!

Gabriel.Mahon@dep.nj.gov

Water Bank – BIL and Technical Assistance

Paul Hauch

Bureau Chief
Construction, Payments and Administration
NJDEP

Water Bank-BIL and Technical Assistance

2023 Harmful Algal Bloom Summit

March 30, 2023

NJ Water Bank Program Overview

Clean Water & Drinking Water State Revolving Funds

What is the New Jersey Water Bank?

The NJWB is a partnership between the New Jersey Department of Environmental protection and the New Jersey Infrastructure Bank. It is the steward of NJ's SRF financing program.

Mission:

- Incentivize investment to sustain and improve NJ's aging water infrastructure systems
- Provide low-cost financing for the planning, design, construction & implementation of projects

1972
Clean water Act (CWA) adopted and set up construction grant program

1987
State Revolving Funds (SRFs) authorized by the CWA

1990s
Safe Drinking Water Act (SDWA) recognized the cost burden of compliance

1996
SDWA authorizes Drinking Water SRF

2014
Water Resources Reform and Development Act added principal forgiveness and affordability to CWSRF

Sources of Funding

Bipartisan Infrastructure Law

State Revolving Fund (SRF)

NEW JERSEY WATER BANK

BELOW MARKET RATE FUNDING

REPAYMENTS

CJ

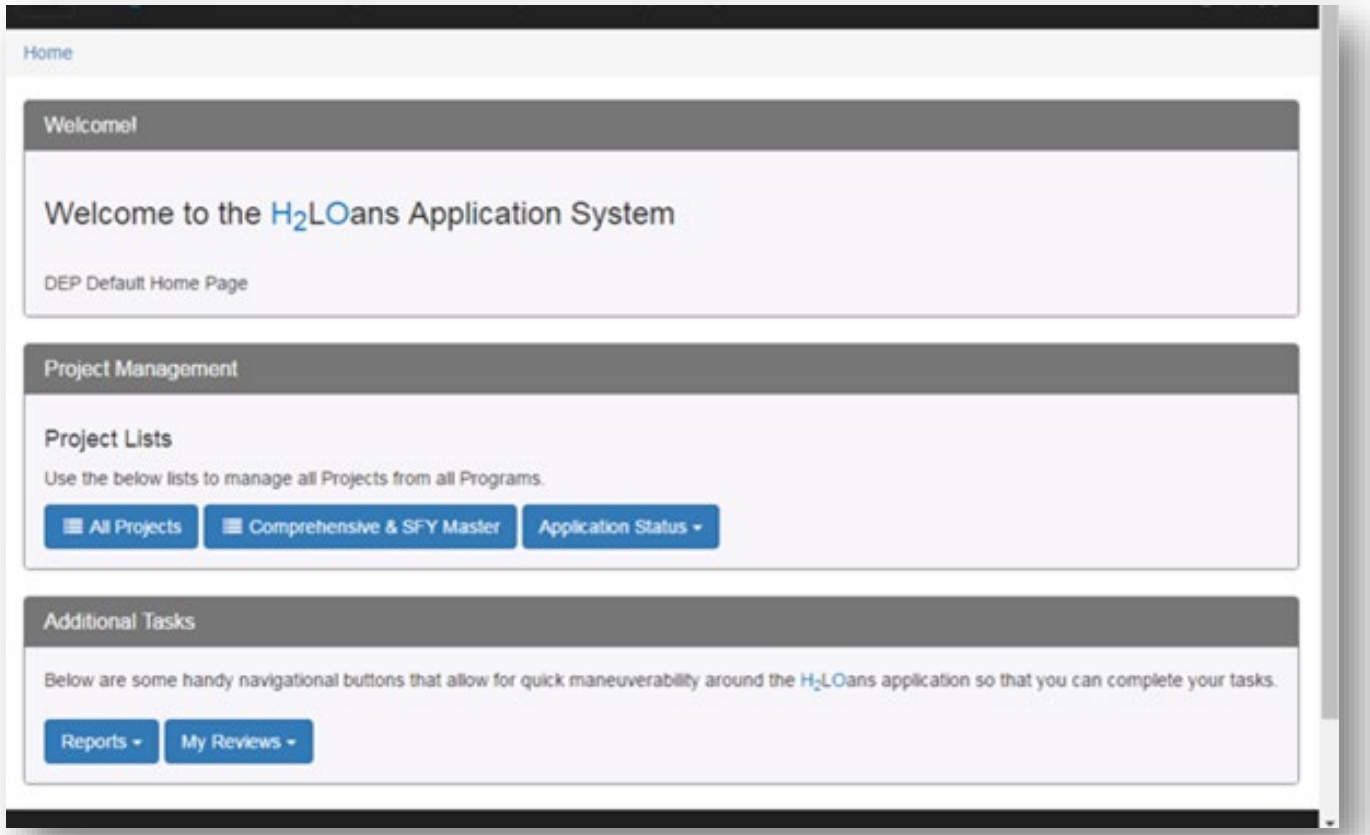
PROJECTS

Benefits of Water Bank Loan

- Up to 30 Year loans terms
- Rolling applications
- Financing for Planning and Design Costs
- Rolling awards for Clean Water projects based upon readiness to proceed
- Drinking Water loan awards based upon readiness and Priority Ranking
- Low-interest Construction “Bridge” Loans
- No out-of-pocket costs

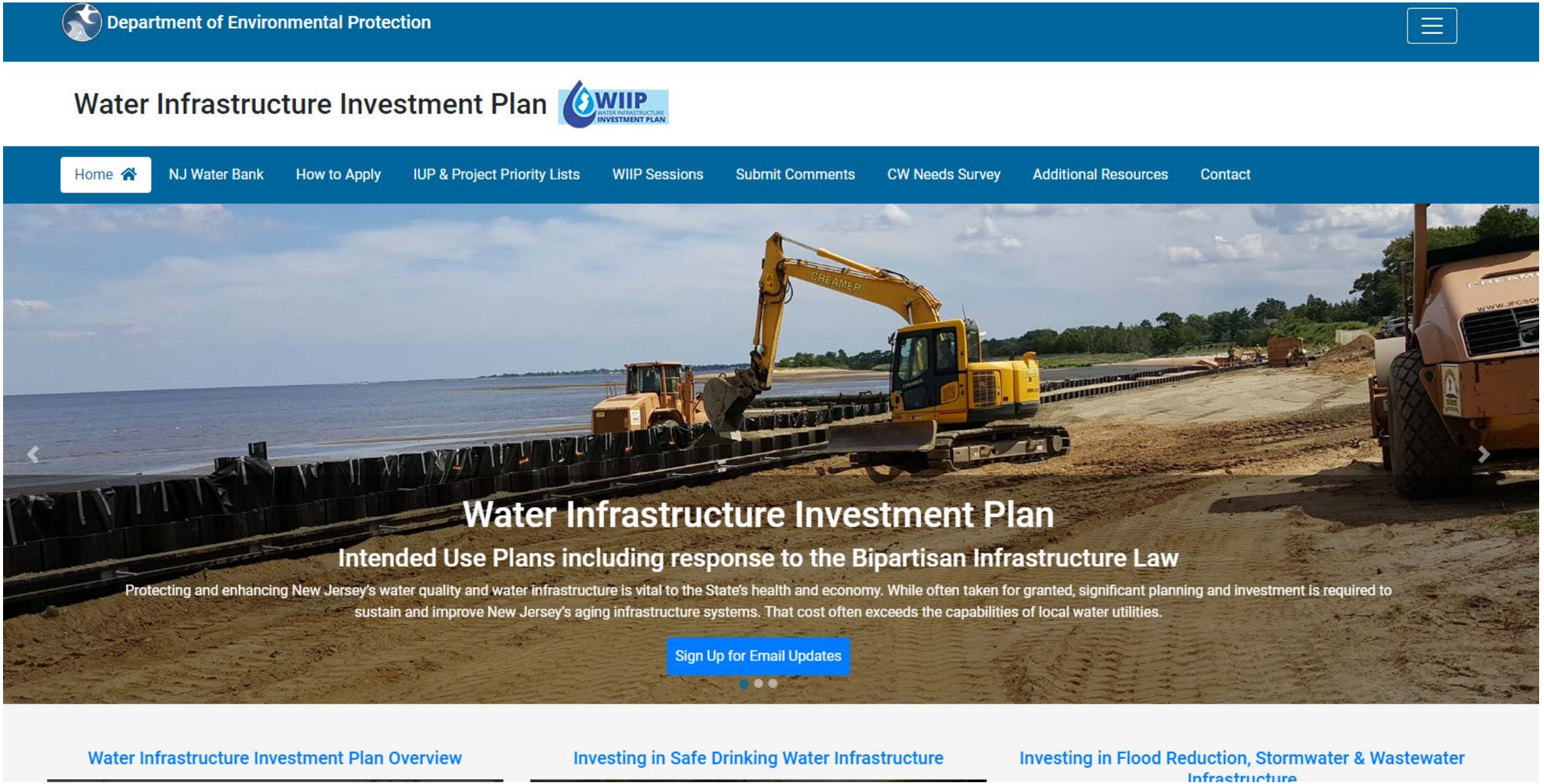
H_2LOans APPLICATION START STEP 1

- Receive a User Account from
  - NJ I-Bank: (609) 219-8601
- Log into H2LOans.com
- Create a project
- Assign collaborators
- Complete Project Info Page
- Request a Meeting (Checkbox)



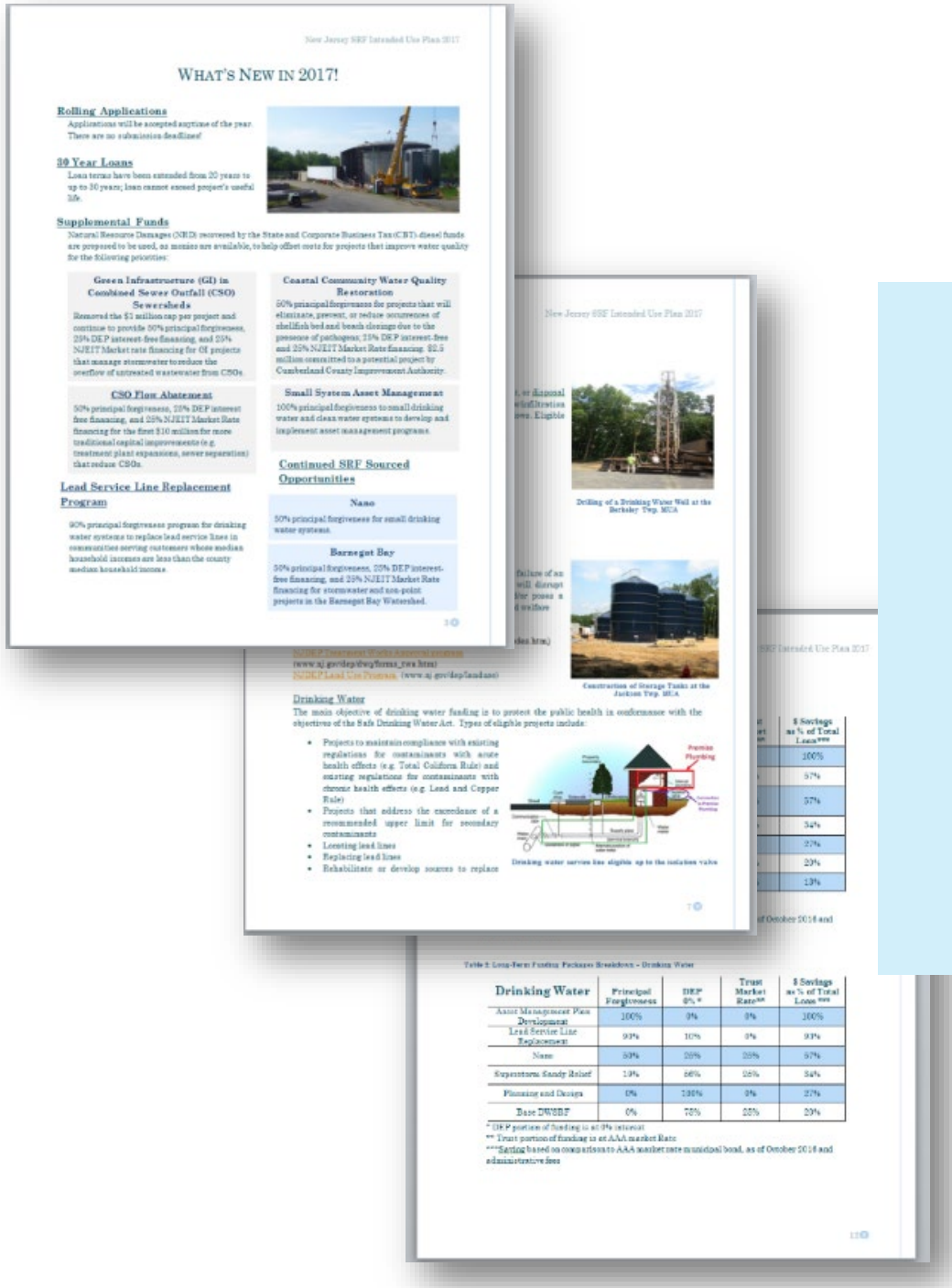
System Questions/Assistance: Support@H2Loans.com

https://www.nj.gov/dep/wiip



The Intended Use Plan (IUP)

- Annual EPA Requirement
- Must be open to public comment
- Establishes funding eligibilities and terms
- Interactive Links
- Pictures, charts, and graphics



CJ

Available at DEP WIIP Website https://www.nj.gov/dep/wiip/project-lists.html

Clean Water

Eligible Recipients:

- Local government units, municipal utilities authorities, counties, regional water authorities that own stormwater or wastewater collection and treatment works
- Private entities (through public conduit borrowers above)
- Private colleges and universities (nonpoint source only)

Not Eligible for Assistance:

- Federally-owned stormwater or wastewater collection and treatment works (i.e. military bases or prisons)
- Privately-owned wastewater and stormwater collection and treatment works

Wastewater Infrastructure

- Treatment Plants
- Sewer Mains/ Interceptors
- Combined Sewer Overflow Control Facilities

Stormwater Management

- Conveyance or Treatment (Grey Infrastructure)
- Green Infrastructure
- Stormwater Management

Site Remediation

- Water Quality related components of Landfill, Brownfield, etc.

Wastewater Recycling and Reuse Facilities

Equipment Purchases

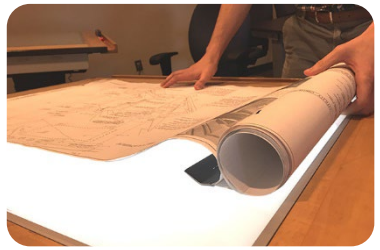
- Street Sweepers
- Vacuum Trucks, etc.
- Skimmer Boats
- Weed Harvesters
- Backhoes/loader/dump trucks

Planning and Design

- Must result in a Capital Improvement Project





SFY24 CWSRF Funding Packages & Principal Forgiveness

Clean Water Funding Packages	PF Share	PF Cap per Applicant	Projected PF Available	DEP Share (Loan w/ PF)	I-Bank Share
CSO LTCP ARPA Projects[1]	80%	No Cap	$148M	90%	10%
CSO Abatement	50%	$5M	$30M[6]	75%	25%
CSO Abatement/ Affordability Criteria[2]	100%[5]	$5M	$30M[6]	75% Min	25% Max
Water Quality Restoration	50%	$2.5M	$6M	75%	25%
Affordability Criteria[3]	100%[5]	$2M	$36M	75% Min	25% Max
Energy and Water Efficiency Projects	50%	$2M	$18M	75%	25%
Overflow and Stormwater Grant (OSG) CW SRF PF Loans[4]	20%	$0.2M	$1M	-	-
Emerging Contaminants	100%[5]	$2M	$9 M	75% Min	25% Max
Base CWSRF	-	-	-	50%	50%
Brownfield Redevelopment (Conduit/PPP)	-	-	-	25%	75%

1. When CSO LTCP ARPA principal forgiveness funds are exhausted, applicants may access financing available under other applicable CWSRF principal forgiveness and funding categories
2. CSO Abatement/Affordability project costs from $10 million to $20 million may be financed under the Affordability Criteria package. Costs over the caps may be financed under the Base CWSRF package.
3. CSO Abatement and CSO Abatement/Affordability cannot be stacked. CSO Abatement/Affordability and Affordability Criteria can be stacked, totaling the PF Cap at $7M
4. OSG CW SRF PF Loans will be awarded to CWSRF projects that receive an Overflow and Stormwater Grant. The OSG will cover 80% of the project costs (capped at $1 million) and the OSG CW SRF PF Loan will cover 20% of the project costs. OSG/OSG CW SRF PF Loan project costs are capped at $1 million. Costs in excess of $1 million may be eligible for funding and PF under the CSO Abatement or CSO Abatement/Affordability Criteria categories.
5. The first $5 million of CSO Abatement/Affordability projects, the first $2 million of Affordability Criteria projects, and the first $2 million of Emerging Contaminants project will receive 100% principal forgiveness to the extent principal forgiveness funds are available.
6. $5M set aside for CSO Green Infrastructure Projects

Borough of Hopatcong, Hudson Avenue Sewer Extension Project

- Summer 2019 extensive HABs in Lake Hopatcong. WB added HAB PF to SFY21 IUP.
- 32 homes with failing septic systems adjacent to Lake Hopatcong's Crescent Cove.
- Construction completed in Spring of 2021
- $460,634 Water Bank loan - 50% or $230,317 of principal forgiveness.

NJ-TAP

New Jersey's Technical Assistance Program

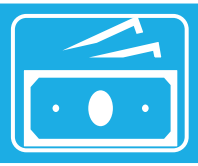
helping communities improve water infrastructure

No cost assistance!

Focus to assist Water Systems that:

- **Serve Disadvantaged Communities** with Lead, PFAS, and SDWA compliance issues, CSOs, sewer infrastructure rehab and upgrades, and more.
- **May lack sufficient resources** to perform full assessment of needs (e.g. LSLIs, AMPs, CIPs)
- **May lack financial, managerial, and/or community support** for infrastructure projects and require assistance with stakeholder outreach & engagement.
- **May not be aware of funding opportunities or lack familiarity** and comfort with navigating Water Bank program application processes.
- **May need eventual engineering services** to assist with planning and design.

Program Navigation



Financial and Needs Assessments

Community Engagement

Engineering Services (DW only)

New Jersey Water Bank

Paul Hauch, Bureau Chief

Bureau of Construction, Payments, and Administration

Municipal Finance and Construction Element

Division of Water Quality

New Jersey Department of Environmental Protection

Paul.Hauch@dep.nj.gov

609-633-1180

Water Bank Information:
https://www.nj.gov/dep/wiip

Send Email with Questions or Comments:
waterbankinfo@dep.nj.gov

NJ Infrastructure Bank:
https://www.njib.gov/

How to Apply:
https://www.njib.gov/nj/Setup+H2LOans+Account.19

Session 3:
It's Complicated – Cause Analysis Case Studies

March 30, 2023

Deal Lake

Jason Earl Adolf, Ph.D.

Professor of Marine Science
Monmouth University

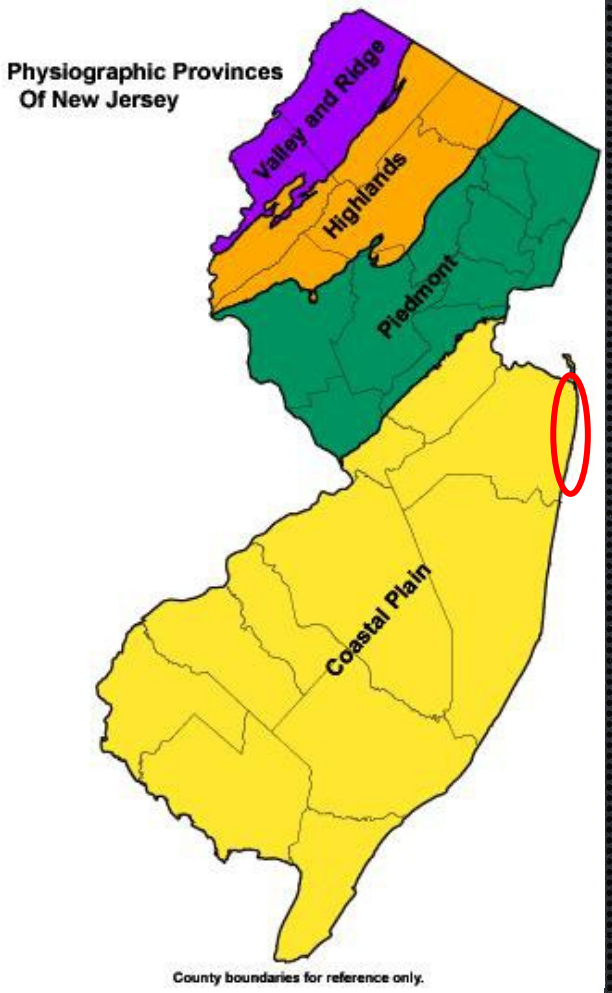
HABs (or not!) in coastal lakes of Monmouth County, New Jersey:

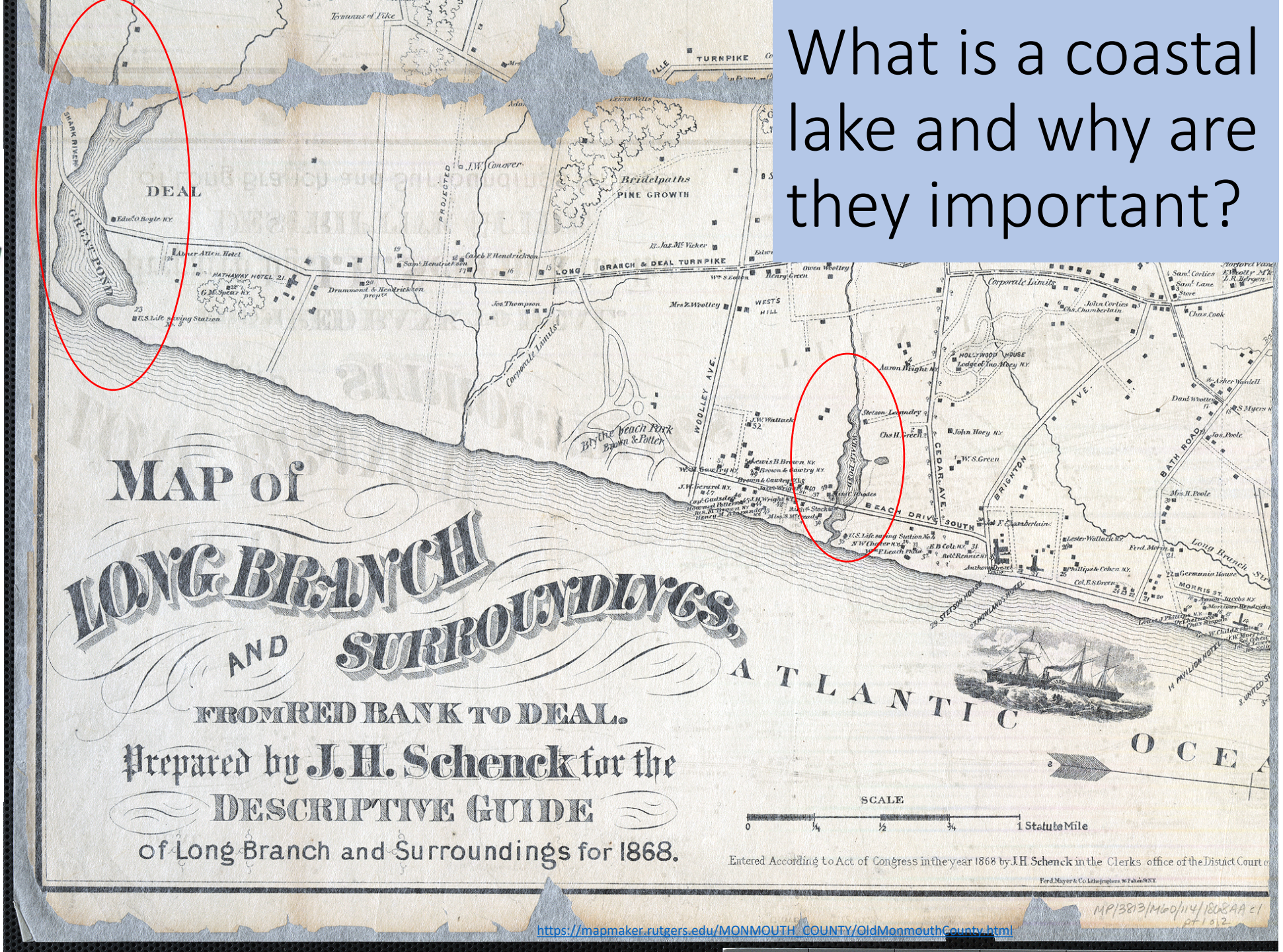
a comparative analysis using university, state, and citizen data

Jason E. Adolf[1,2], Erin Conlon[1,2], Eric Ernst[3], Geoffrey Fouad[1], Bill Heddendorf[3], Tom Herrington[1,2], Sydney Lucas[1], Robert Newby[3], Robert Schuster[3], Ariel Zavala[1]

1. Monmouth University, Biology Dept., West Long Branch, NJ
2. Monmouth University Urban Coast Institute, West Long Branch, NJ
3. NJ Department of Environmental Protection

What is a coastal lake and why are they important?





https://mapmaker.rutgers.edu/MONMOUTH_COUNTY/OldMonmouthCounty.html

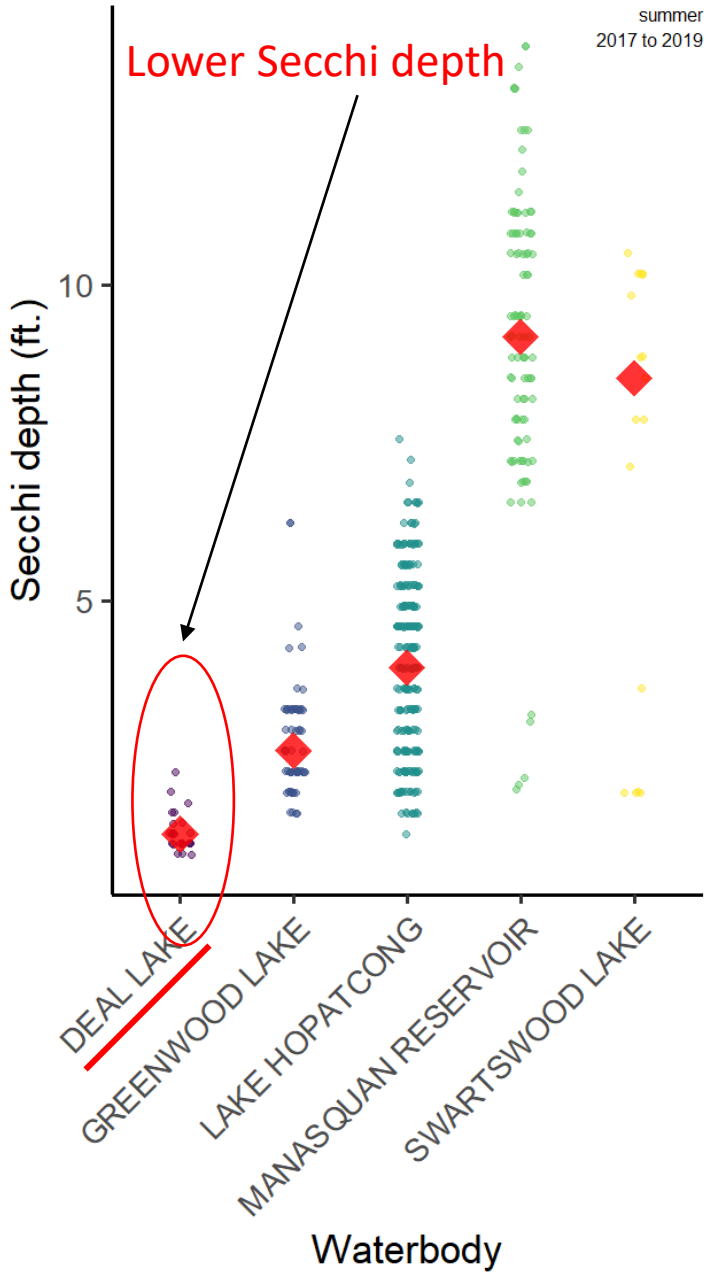
Outlet of Deal Lake
to the Atlantic Ocean

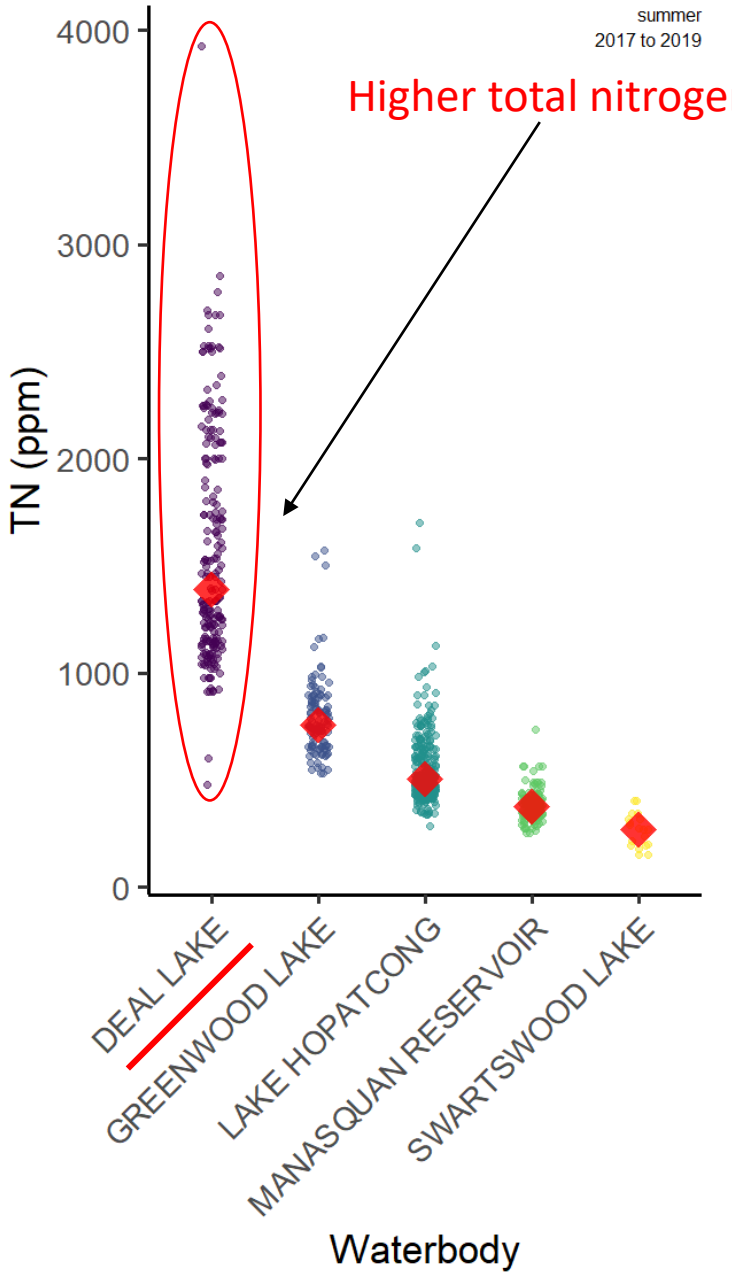
Aerial imagery from the New Jersey Office of Geographic Information Systems of "leaf-off" (winter) conditions in 2020, using one-foot grid cells on the ground

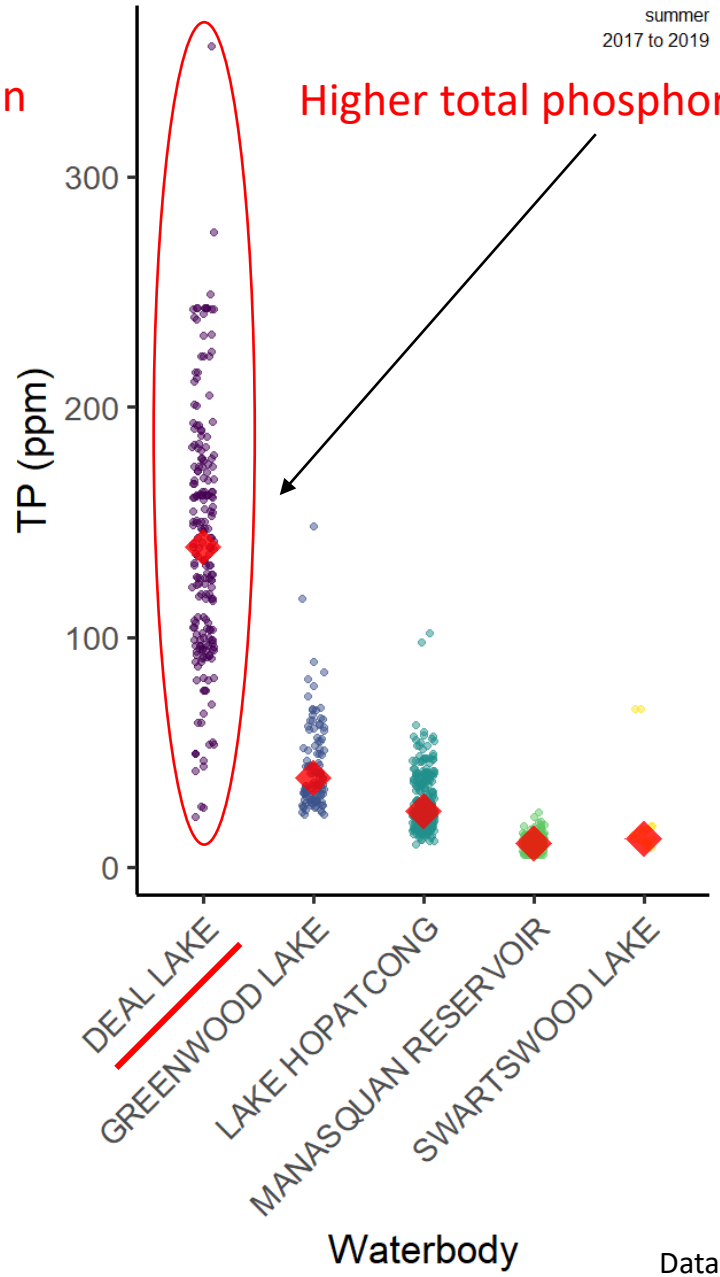
0 50 100 meters

N

Coastal Lakes are eutrophic compared to other NJ lakes





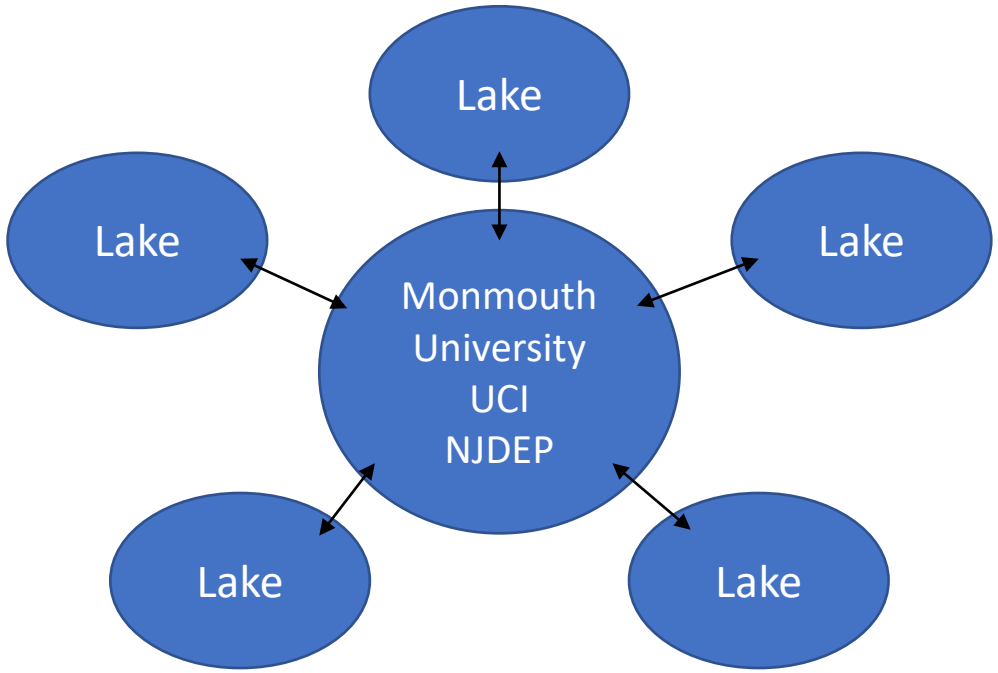


Data courtesy NJDEP

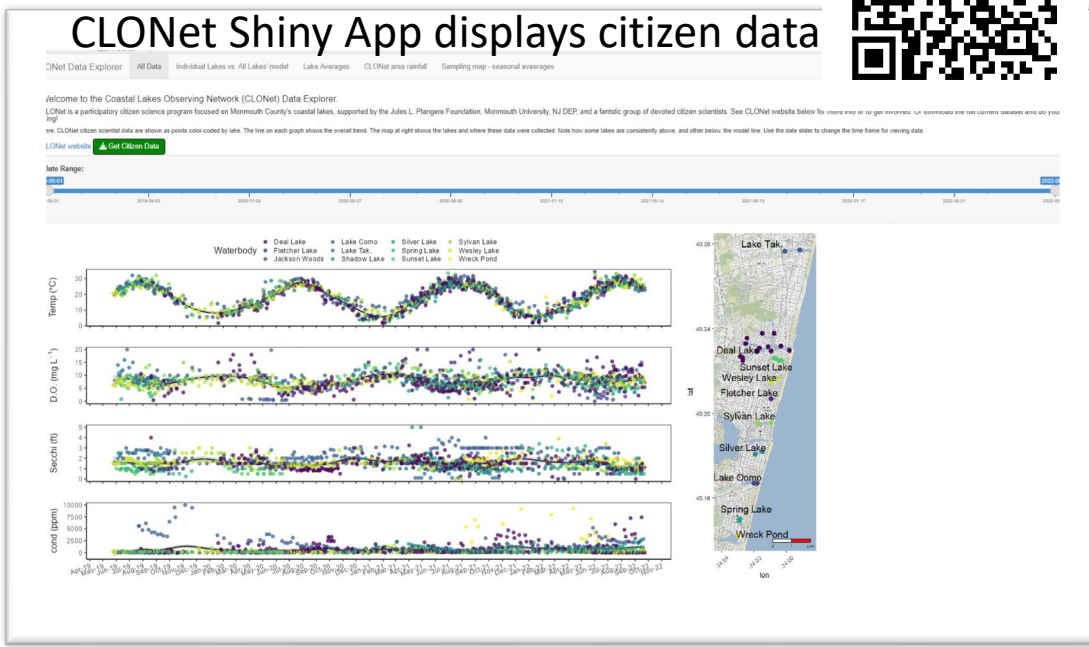
CLONet

Coastal Lakes Observing Network

- A community-based, participatory research and restoration group that will allow communities to address coastal lake issues *based on their own knowledge and use of the underlying scientific data*.

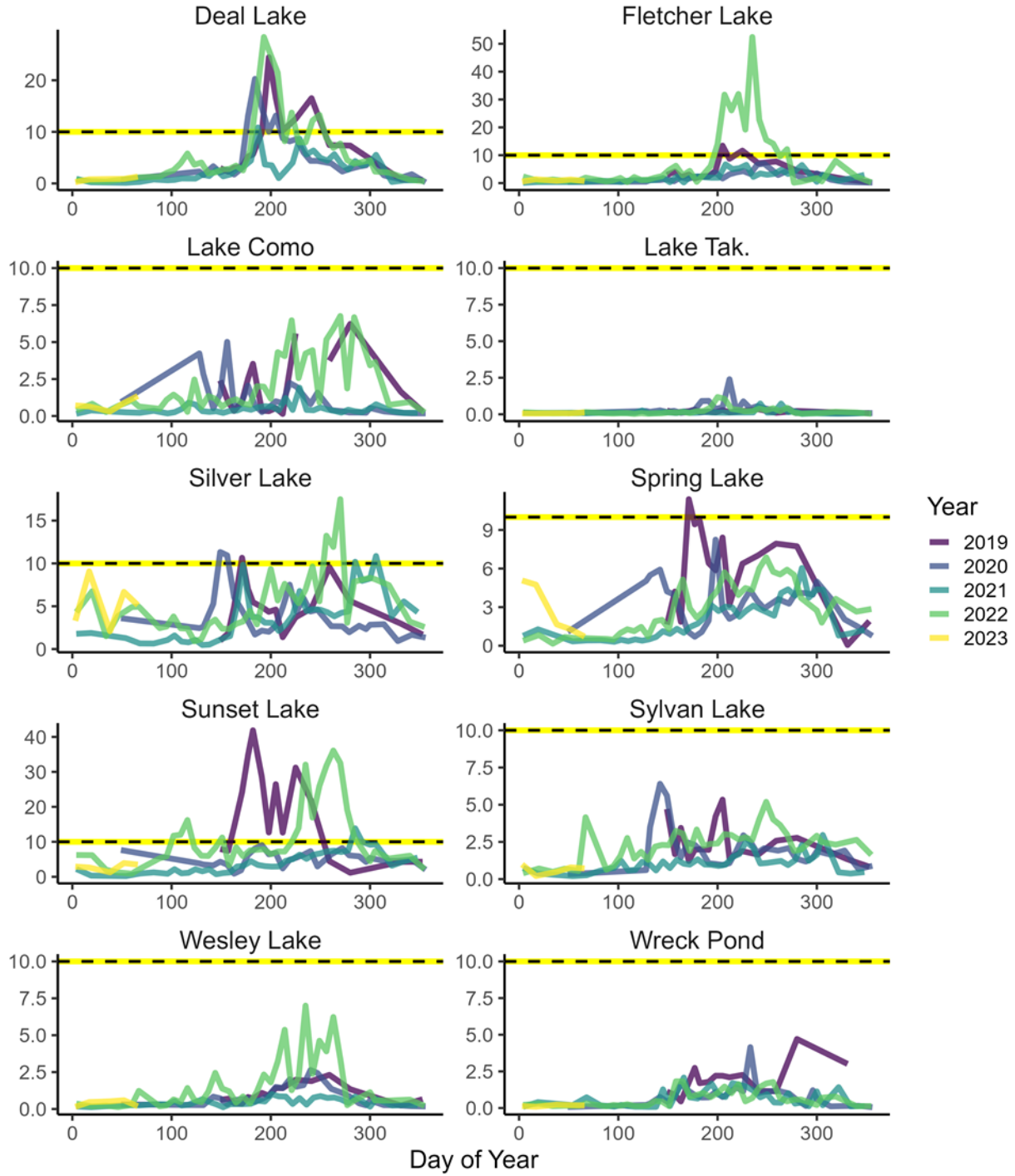


3+ years of citizen data have taught us a lot about these lakes and engaged the community



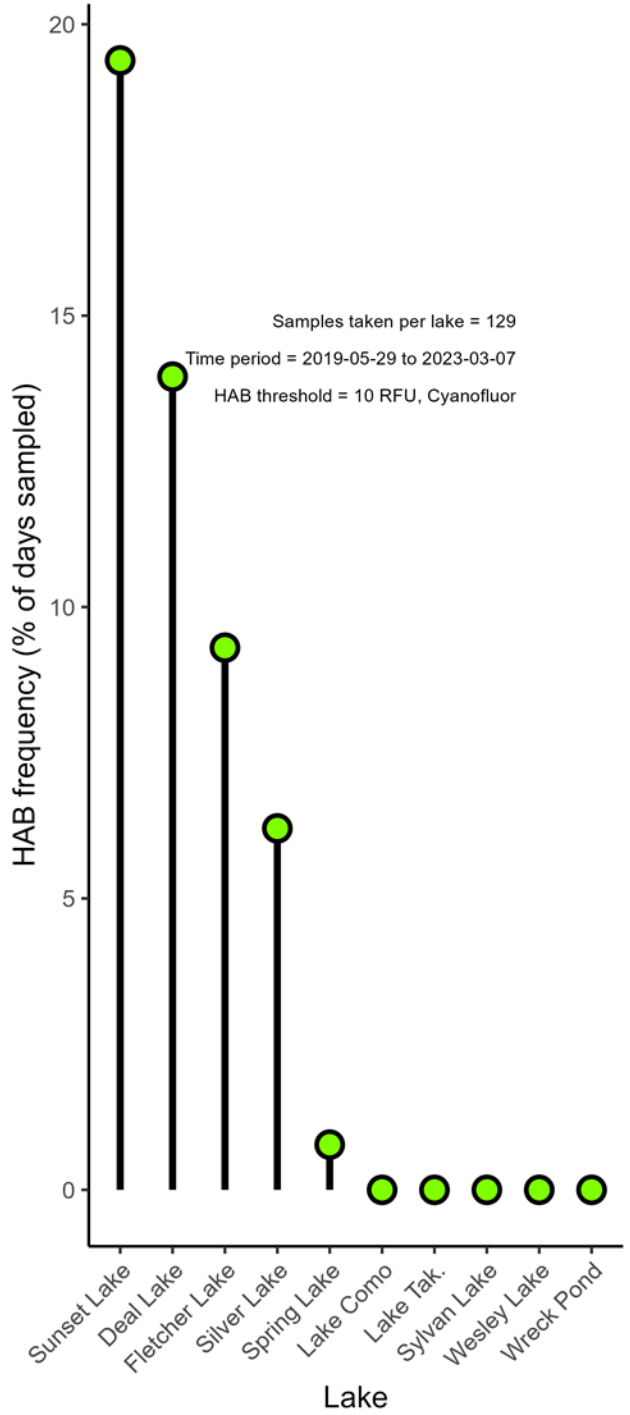
HAB (or not) time series in two coastal lakes

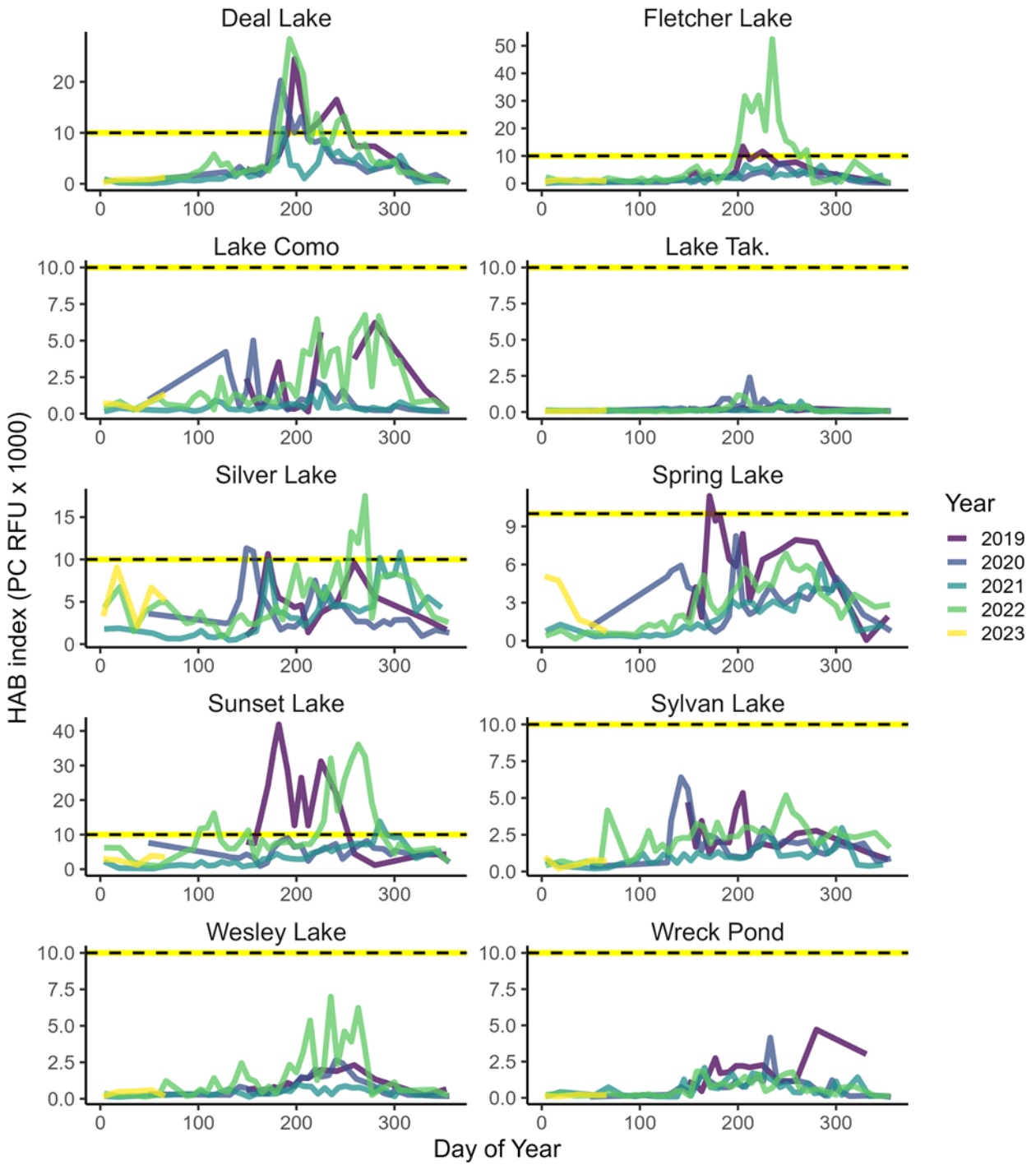
HABs – some lakes have them, some do not!



HABs – some lakes have them, some do not!

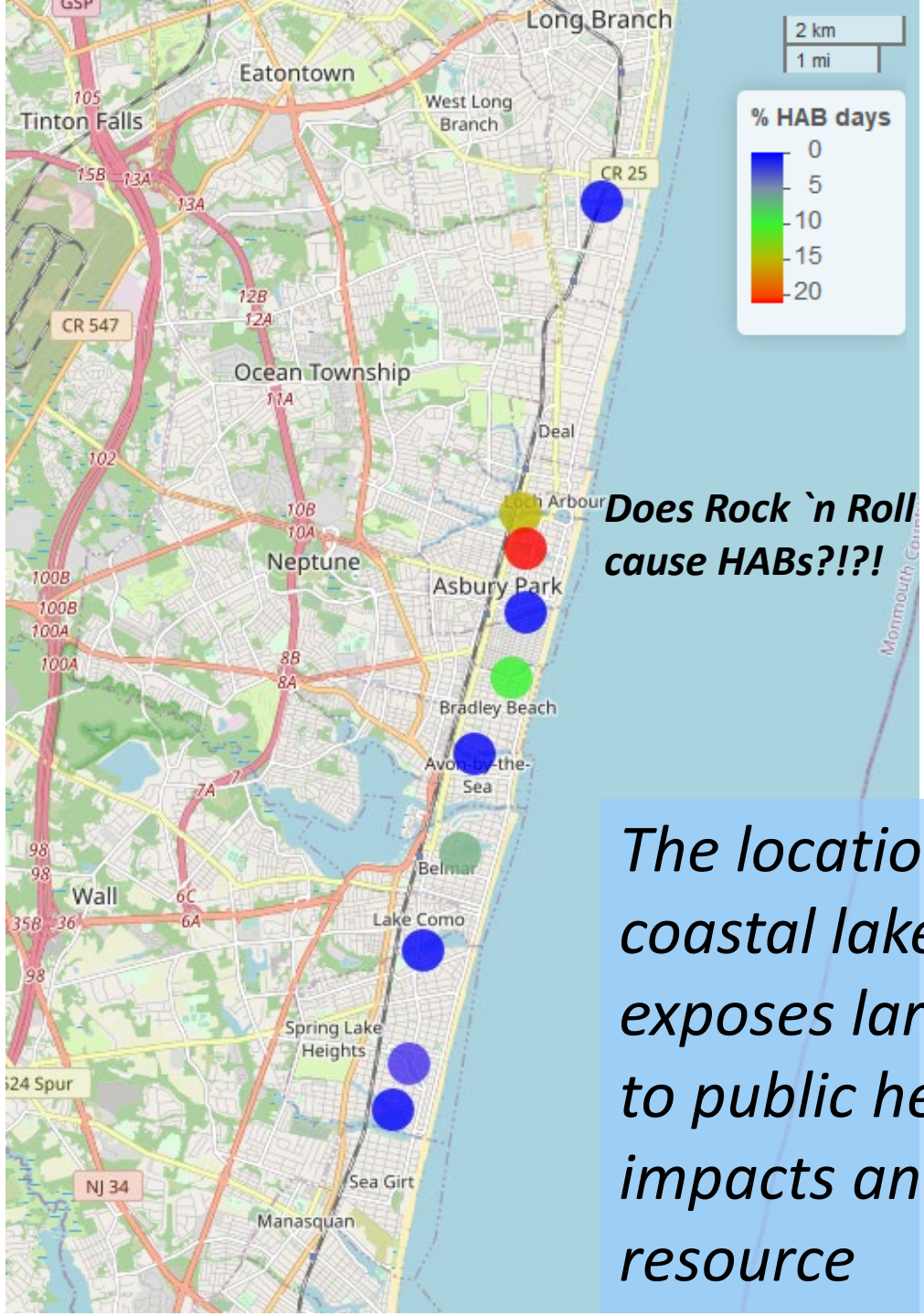
Why the differences among lakes that are so close together?





The two HAB-iest lakes are in Asbury Park

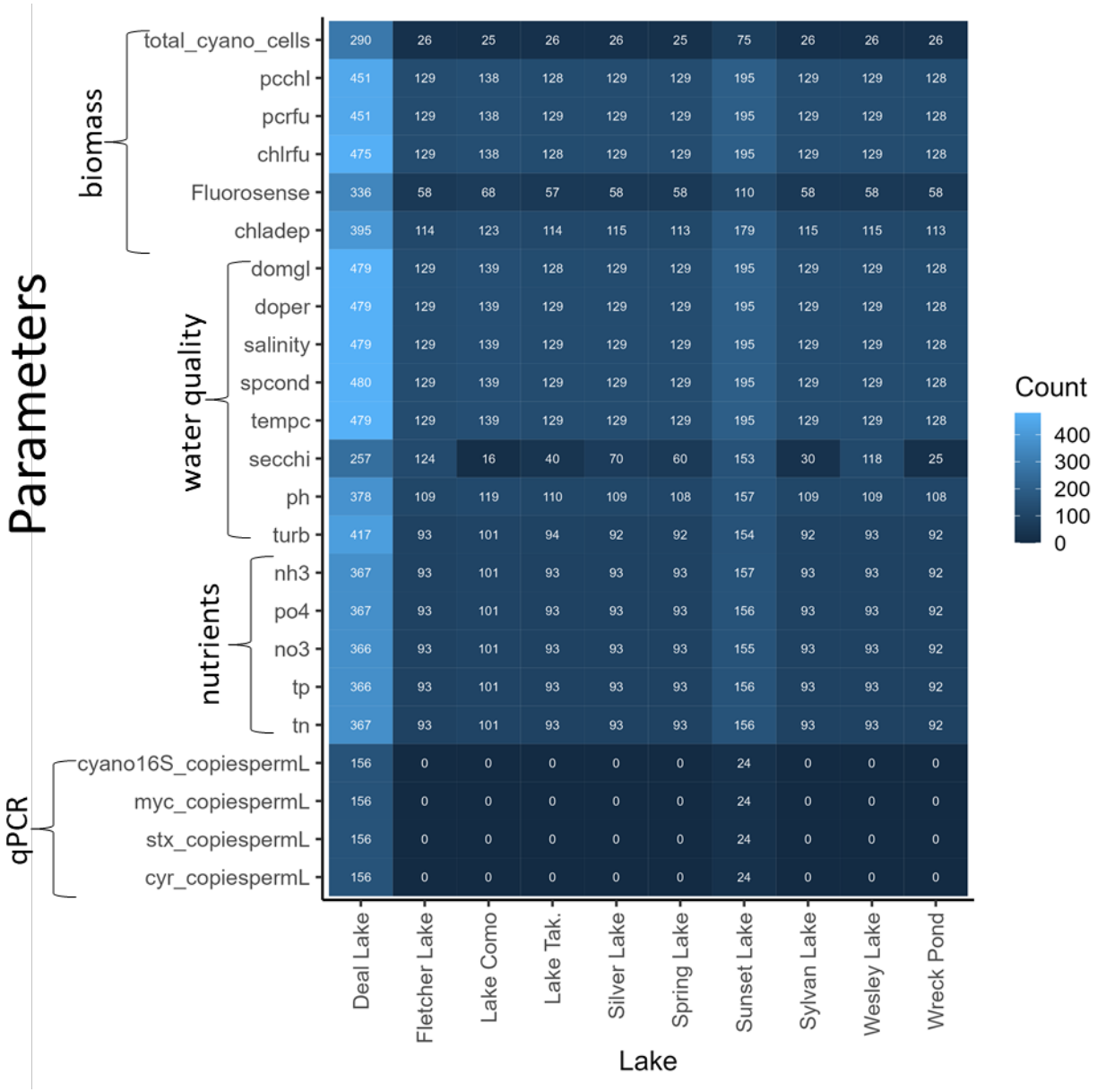
We have examined watershed characteristics of each lake to understand this



Does Rock `n Roll cause HABs?!?!

The location and timing of coastal lakes' HABs potentially exposes large numbers of people to public health issues and impacts an important natural resource

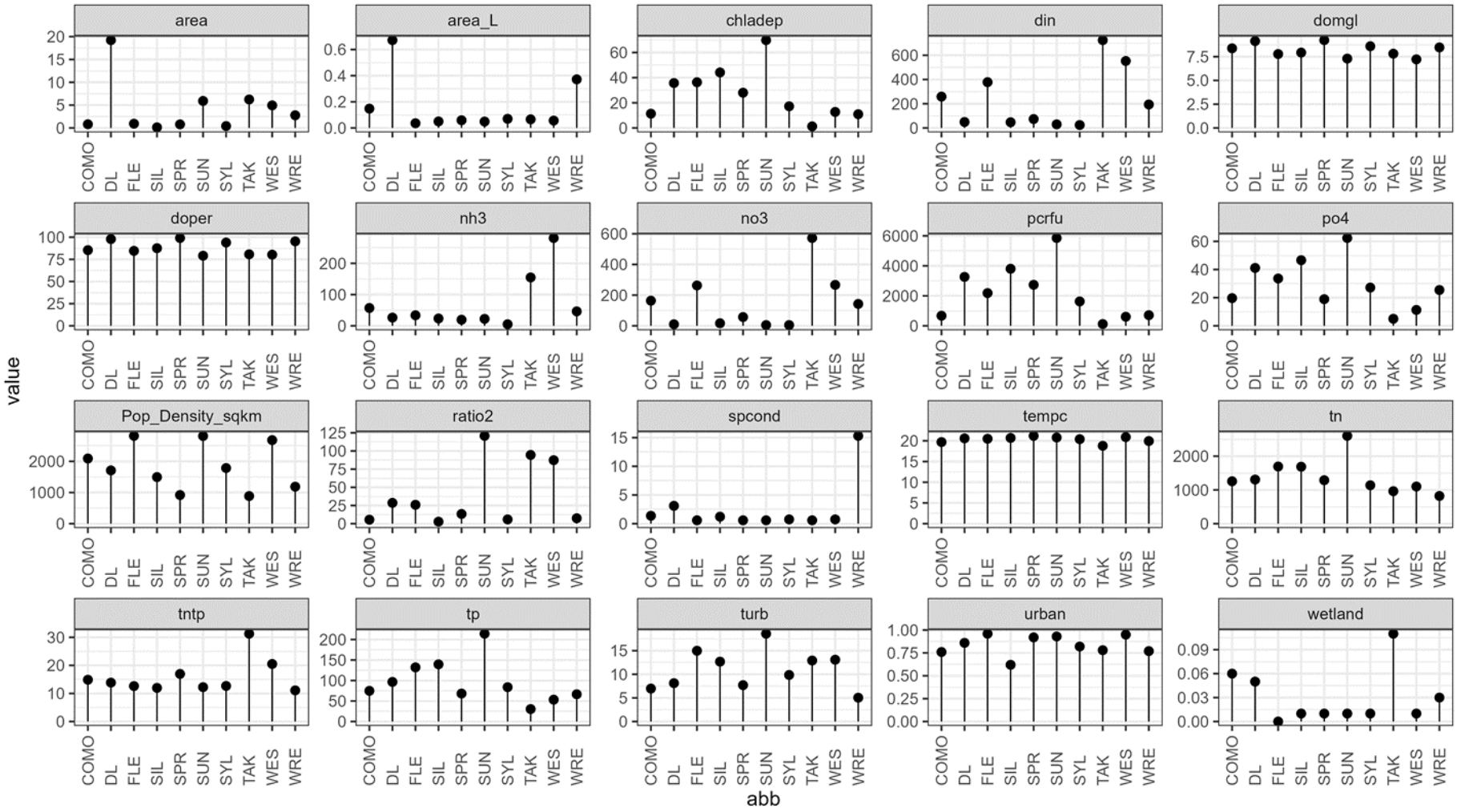
Research questions and the data to address them…



Research questions:

1. *How do coastal lakes differ from each other in terms of water quality, including HABs*
2. *What environmental factors drive spatial / temporal variability in water quality, including HABs*
3. *How does coastal lake WQ impact adjacent ocean beaches?*
4. *Can we predict HABs in coastal (or other NJ) lakes?*

We've measured a lot… are the lakes different?

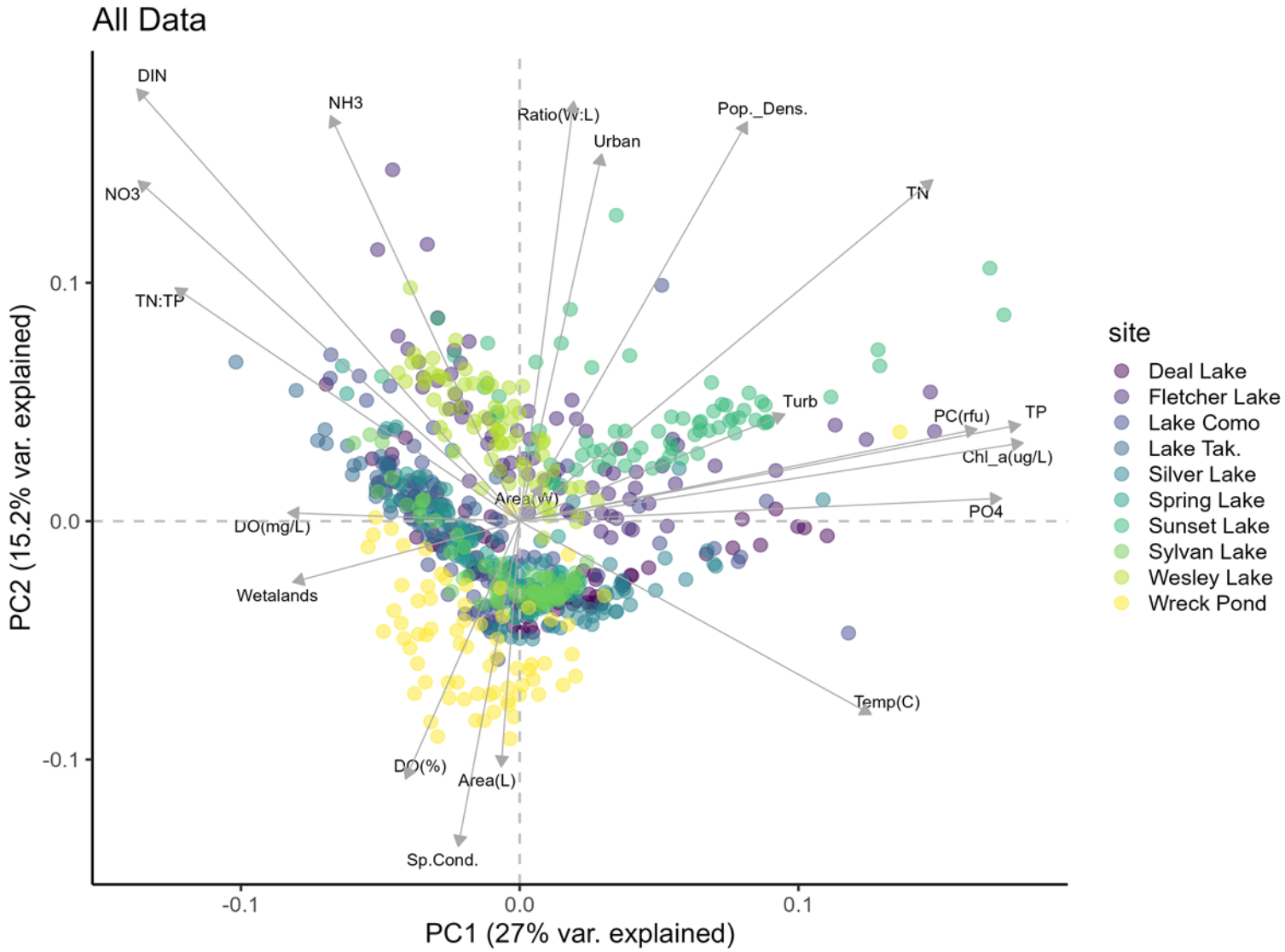


These are 20 potential 'dimension' with which to differentiate lakes… *Too much!!*

Clustering methods reduce dimensionality of data to look for similarities or differences among samples.

Q1: How do coastal lakes differ from each other in terms of water quality, including HABs

Principal components analysis (PCA) sorts the lakes pretty well based on measurements we've made



<u>PCA identified 6 dimension from the 20 fed to it:</u>

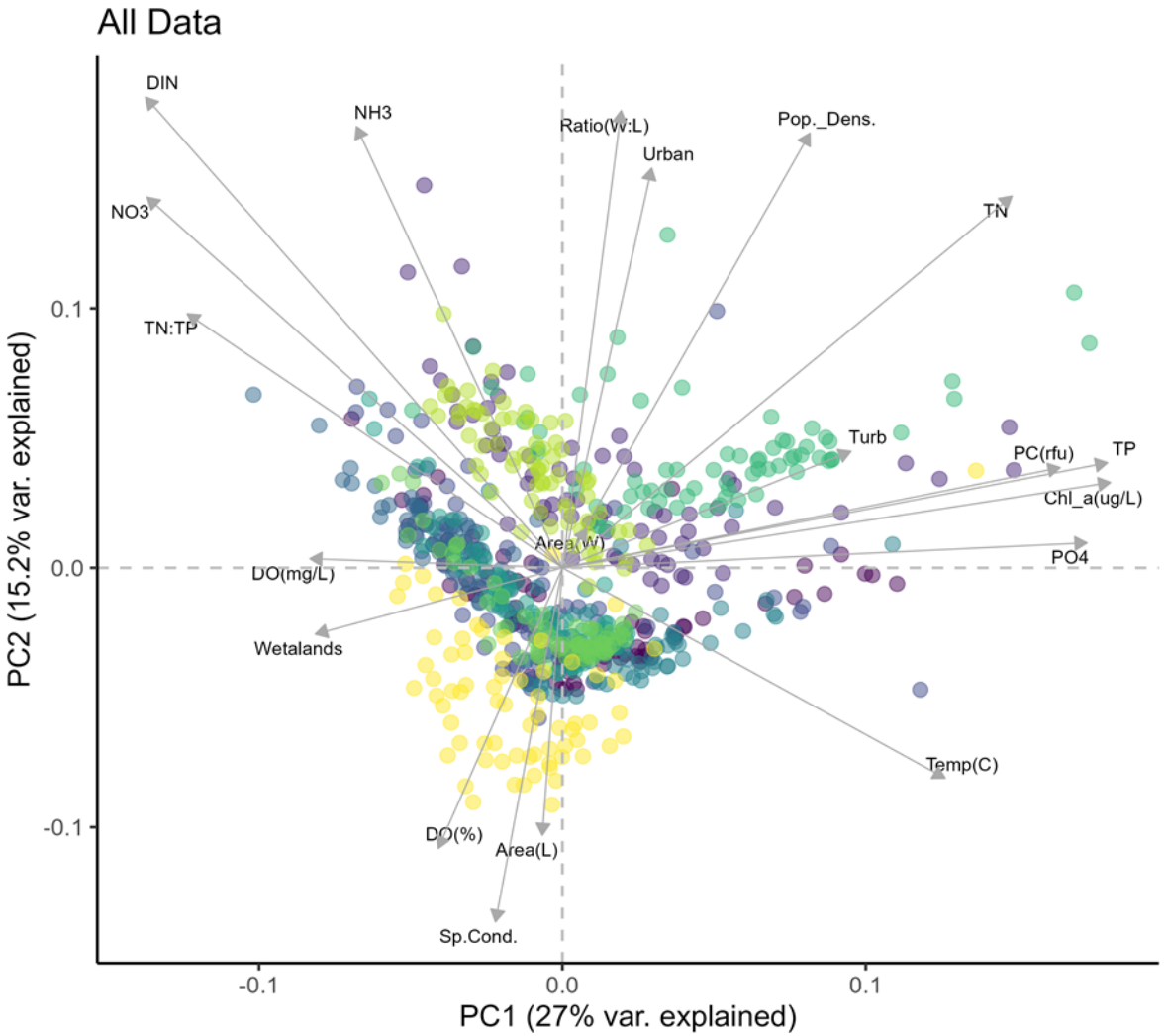
PC1: + PC, Chl, TP, Temp / - DIN, TN:TP

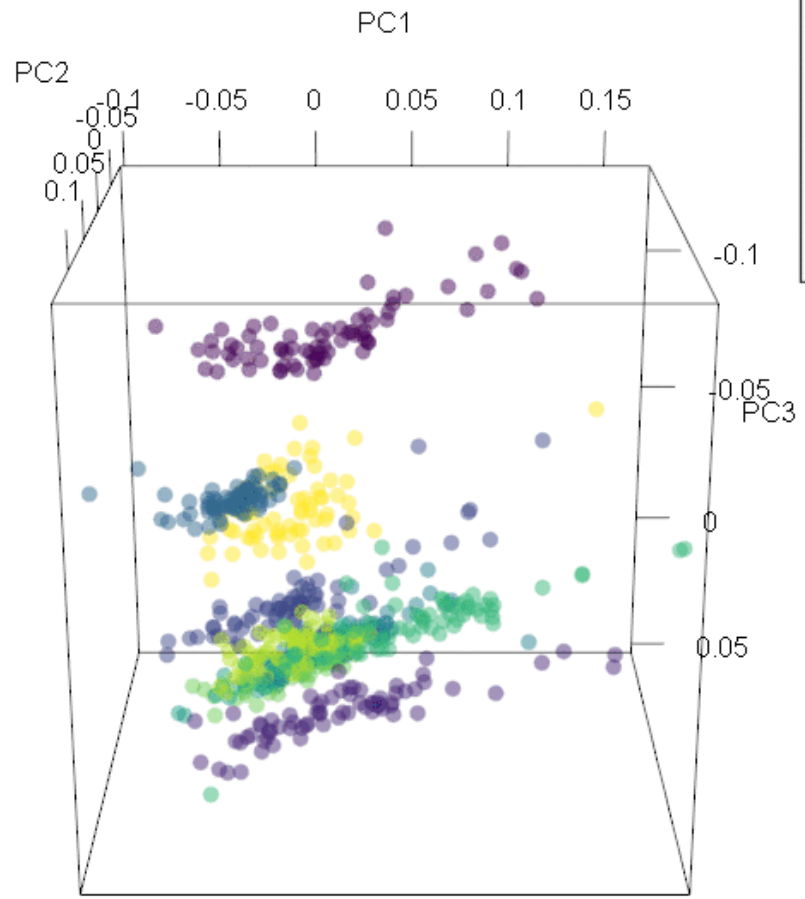
PC2: + DIN, Ratio(W:L), Pop. Dens. / - sp. cond, DO%

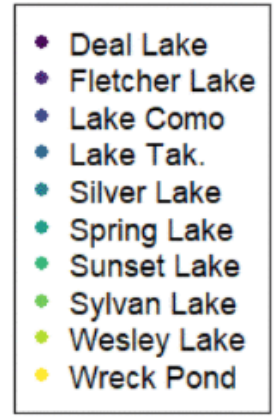
PC3: +DO%, pop. Dens. / - Area (W), wetlands

Q1: How do coastal lakes differ from each other in terms of water quality, including HABs

Three dimensions are better than two to illustrate lake differences!

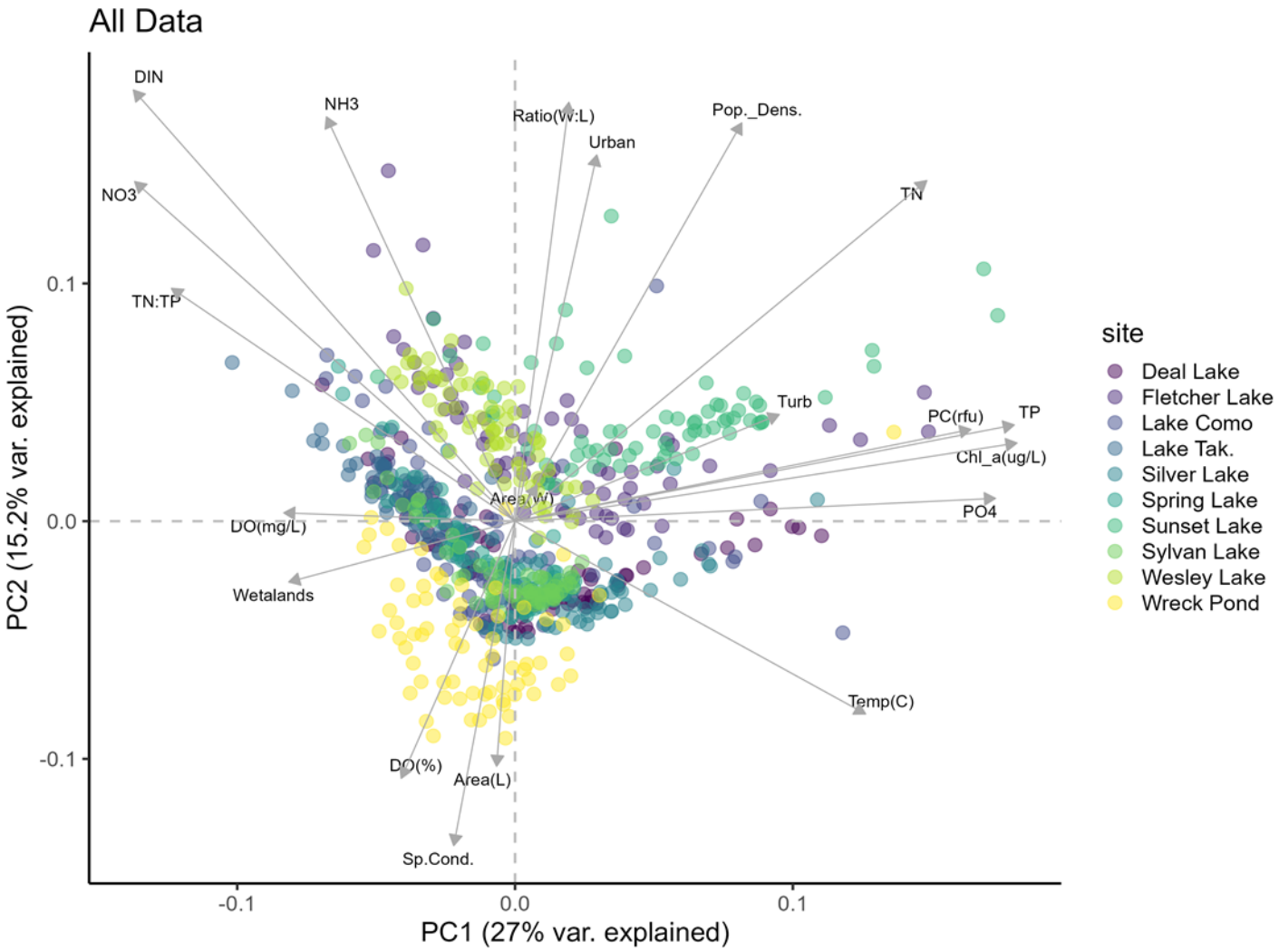






Q1: How do coastal lakes differ from each other in terms of water quality, including HABs

Q1: *How do coastal lakes differ from each other in terms of water quality, including HABs*



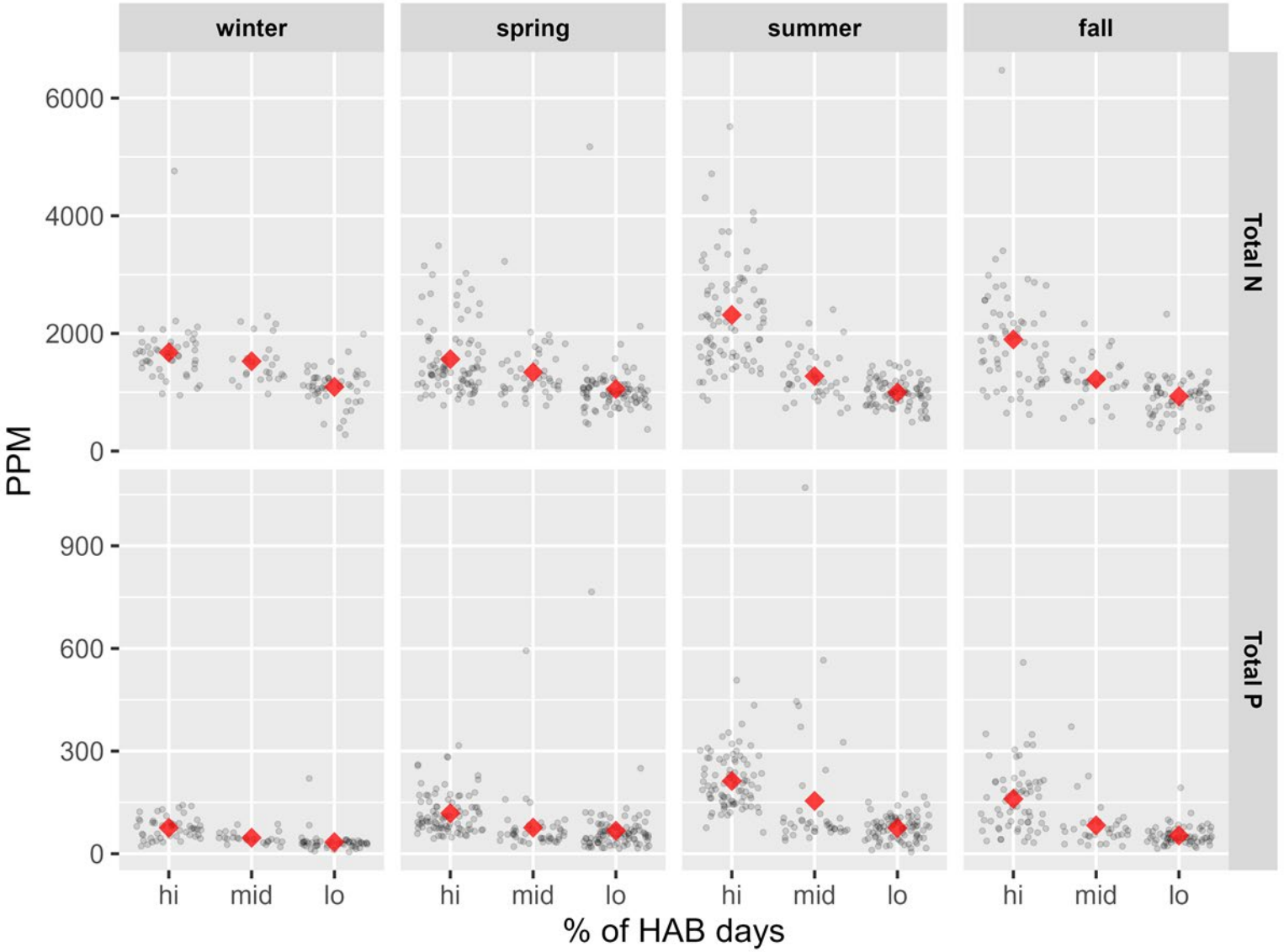
Coastal lakes differ from each other based on a range of factors including HABs, TN and TP, wetland% in watershed, conductivity, and DIN

This may vary if broken out by season

Restoration strategies can be informed by different characteristics and issues characterizing each lake

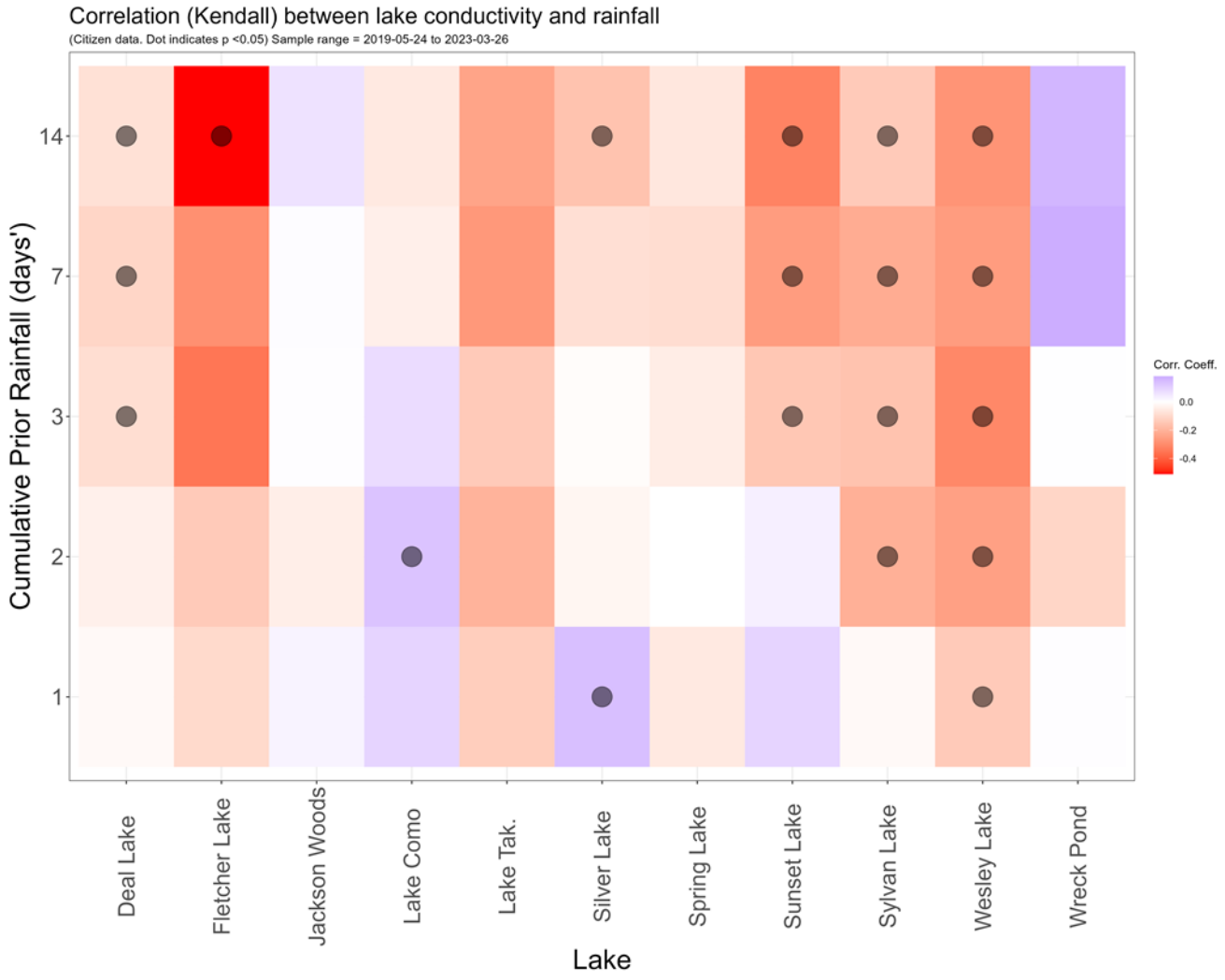
Q1: How do coastal lakes differ from each other in terms of water quality, including HABs

Q2: What environmental factors drive spatial / temporal variability in water quality, including HABs?



- Compared all env. conditions among lakes with highest and lowest % HAB days
  - *Year-round* TN and TP tended higher in high %HAB lakes
- High %HAB lakes tended to have low % wetland watersheds

Rainfall impacts water quality of coastal lakes



Citizen science data collected over 4 years illustrates the linkage between stormwater runoff and coastal lakes

Similar relationships found in PHAB data

6 of 10 lakes sampled show significant (-) correlation between rainfall and conductivity

Let's focus now on Deal and Sunset Lakes

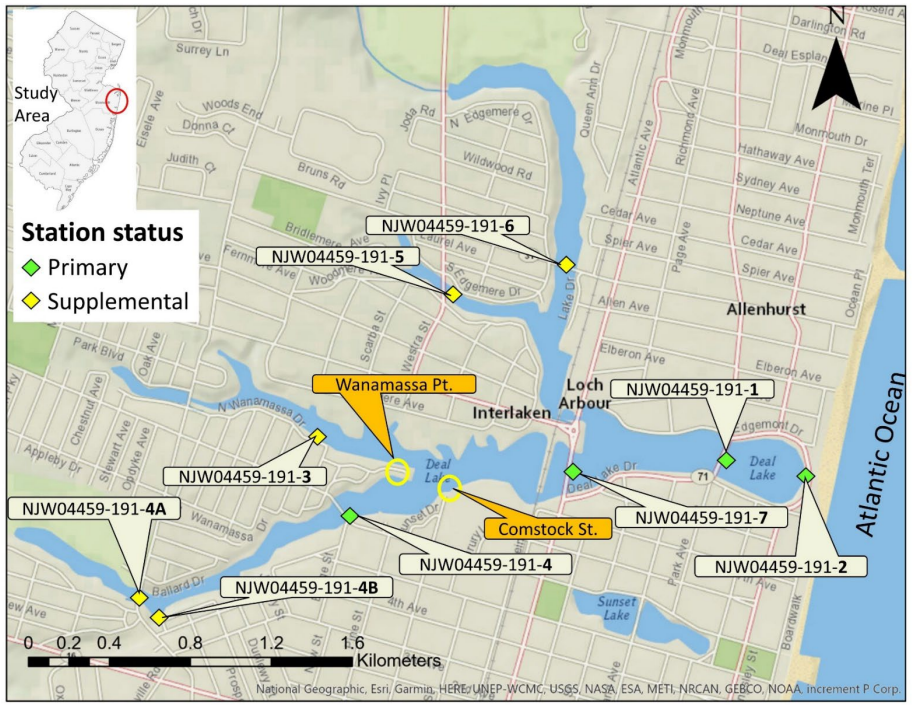
Q2: What environmental factors drive spatial / temporal variability in water quality, including HABs?

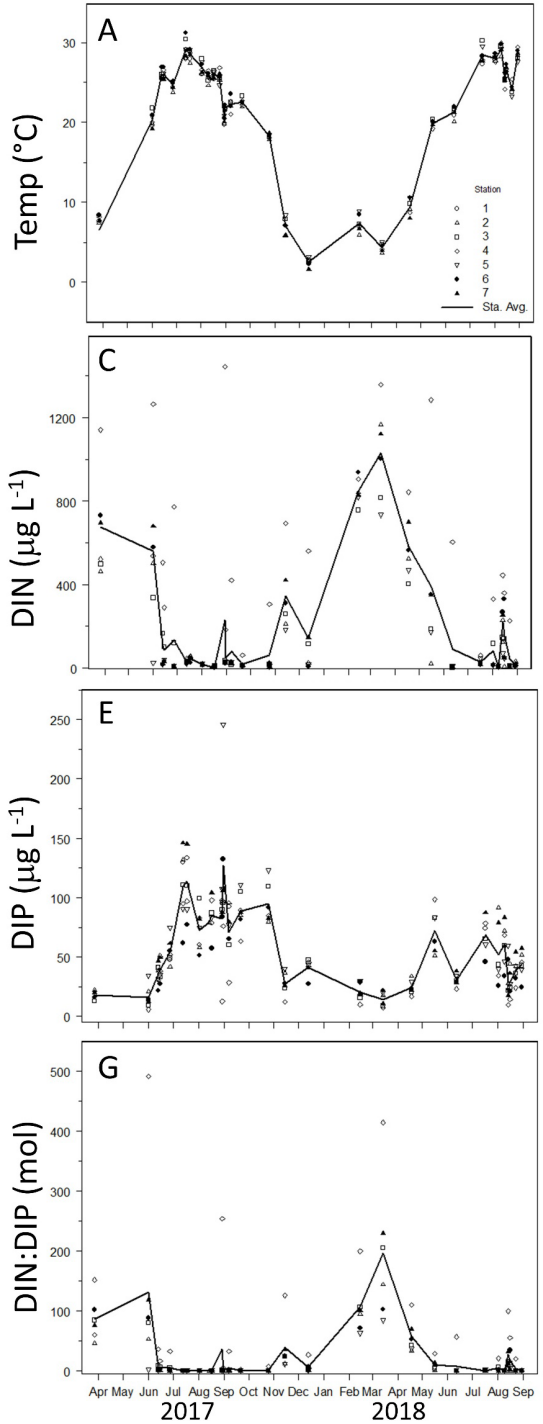
2017-2018 Deal Lake study

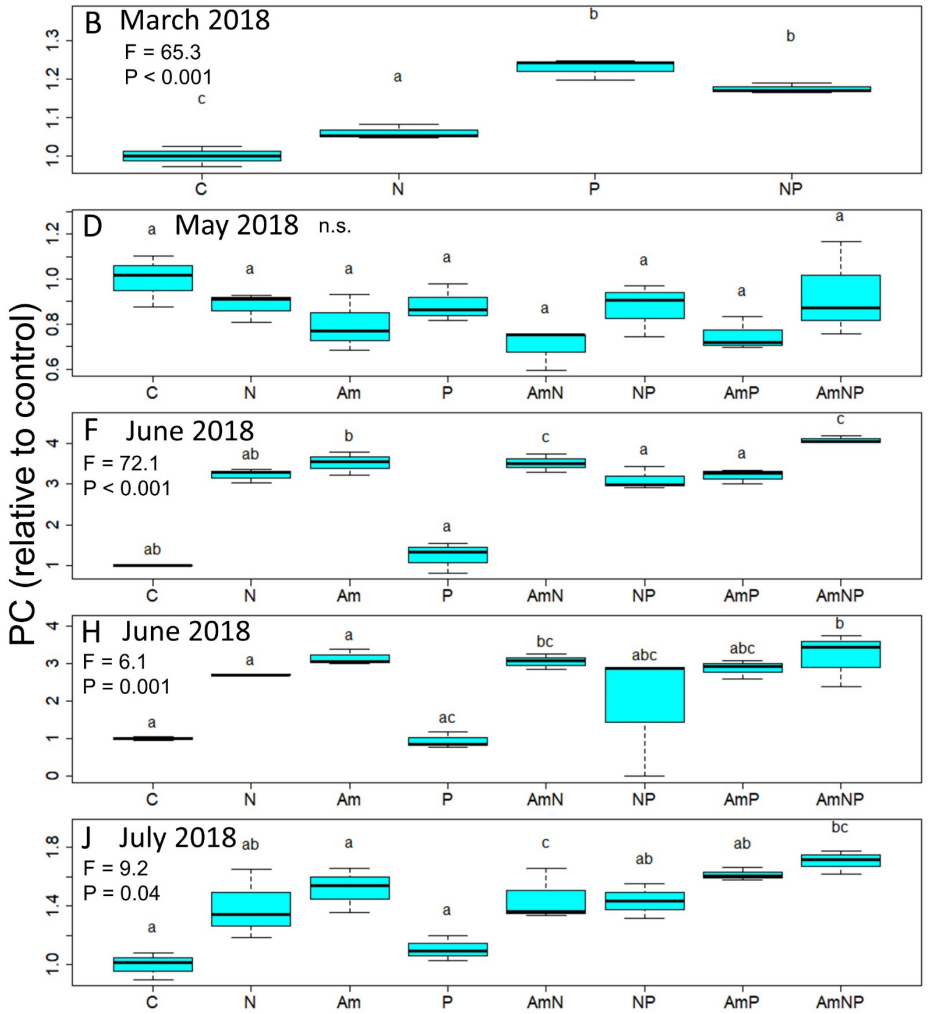
-Spatial variability among stations related to DIN and TN

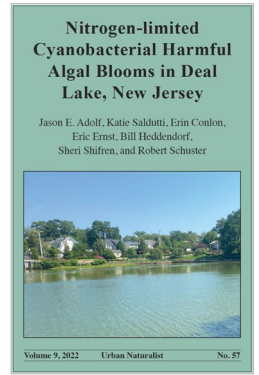
-Seasonal shift in DIN / DIP levels in lake

-Seasonal shift from P-limitation (winter) to N-limitation of cyanobacteria in bioassays

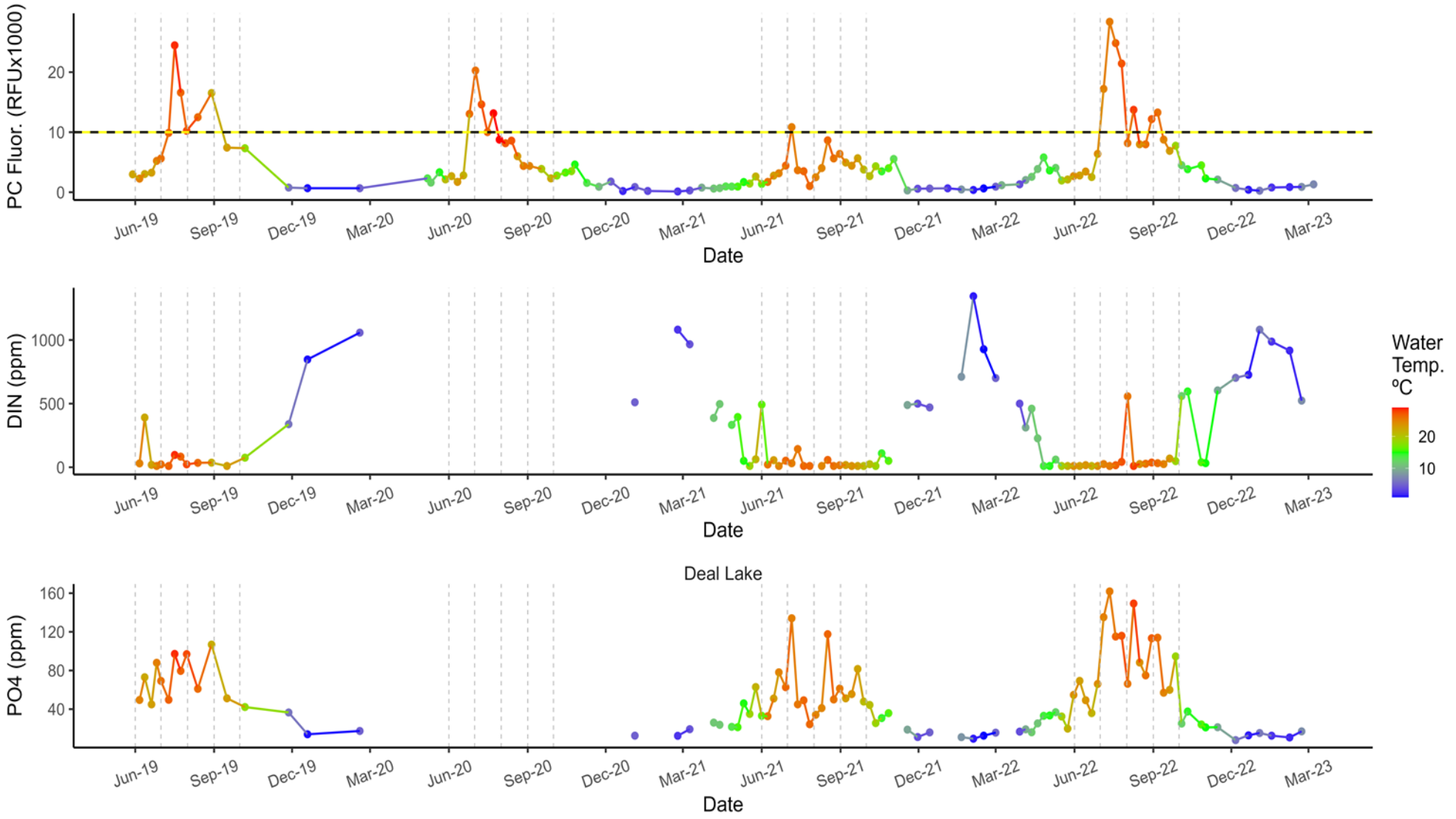








Deal Lake nutrient time series, 2019 - 2022



Confirms seasonal DIN / DIP dynamics

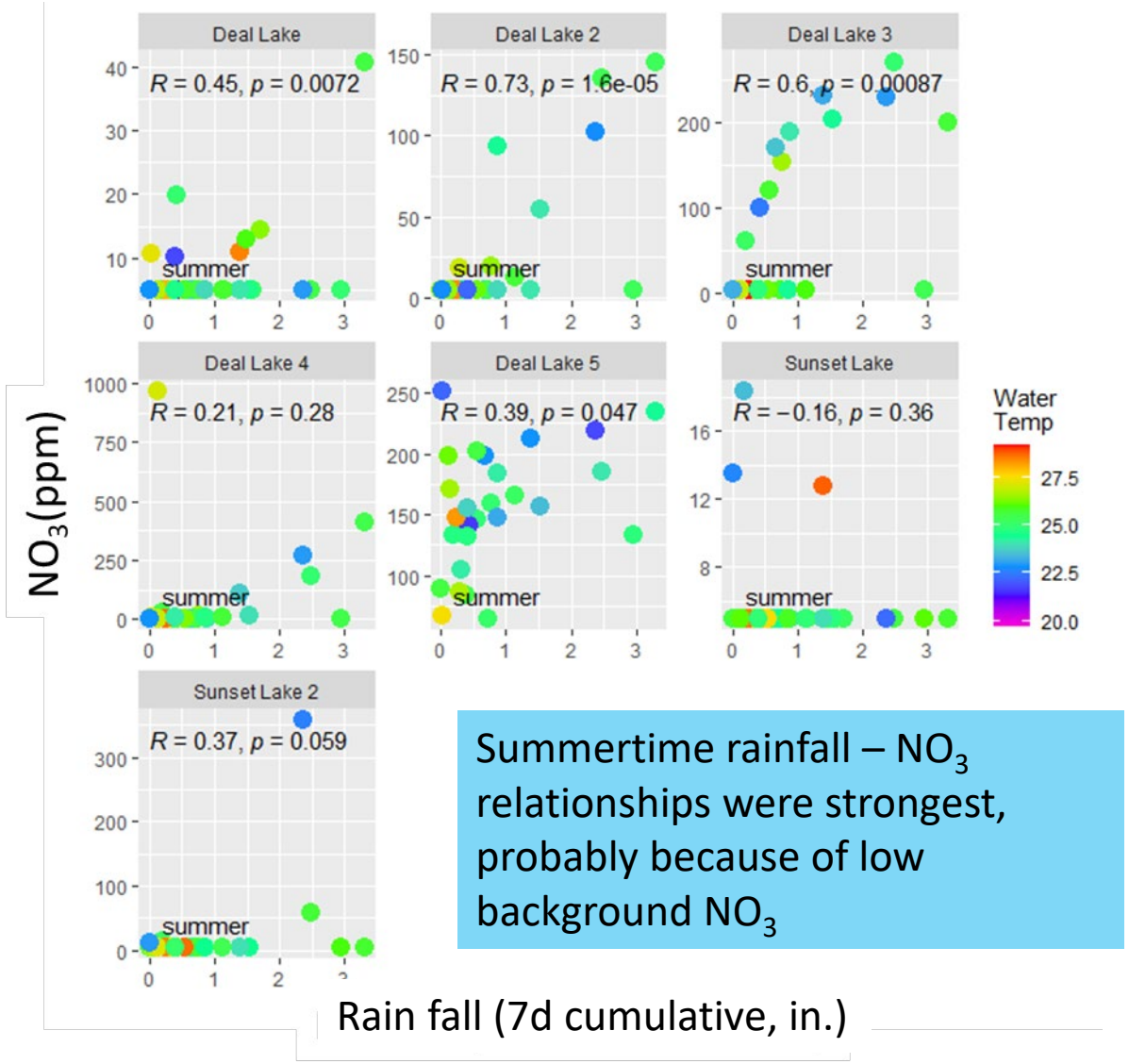
Summer 2022 was a drought – rain is not likely responsible for summer DIP

Autochthonous? Other?

Q2: What environmental factors drive spatial / temporal variability in water quality, including HABs?

Rainfall – nutrient relationships in Deal / Sunset Lakes

Coastal Lakes portion of the 2020 EPA HABs Multi-purpose Grant (PI: Robert Newby, NJDEP)

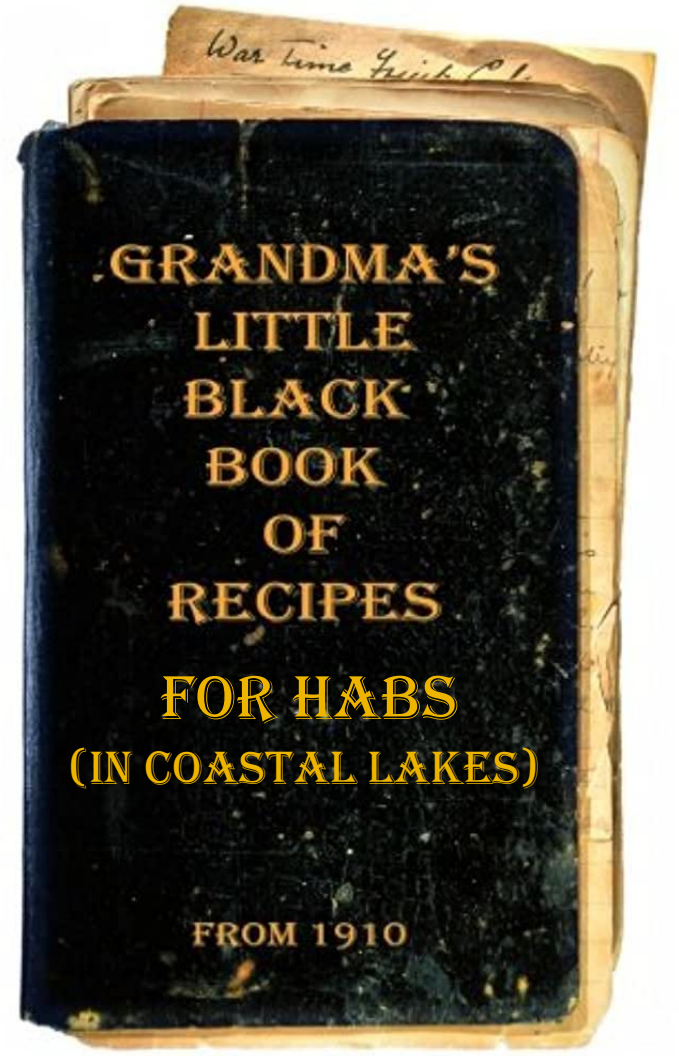


Summertime rainfall – NO_3 relationships were strongest, probably because of low background NO_3

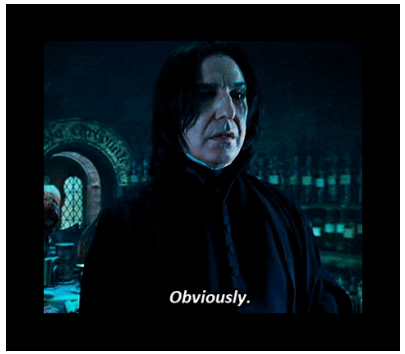
Q2: What environmental factors drive spatial / temporal variability in water quality, including HABs?

What causes HABs in Deal and Sunset Lakes?

(an hypothesis!)

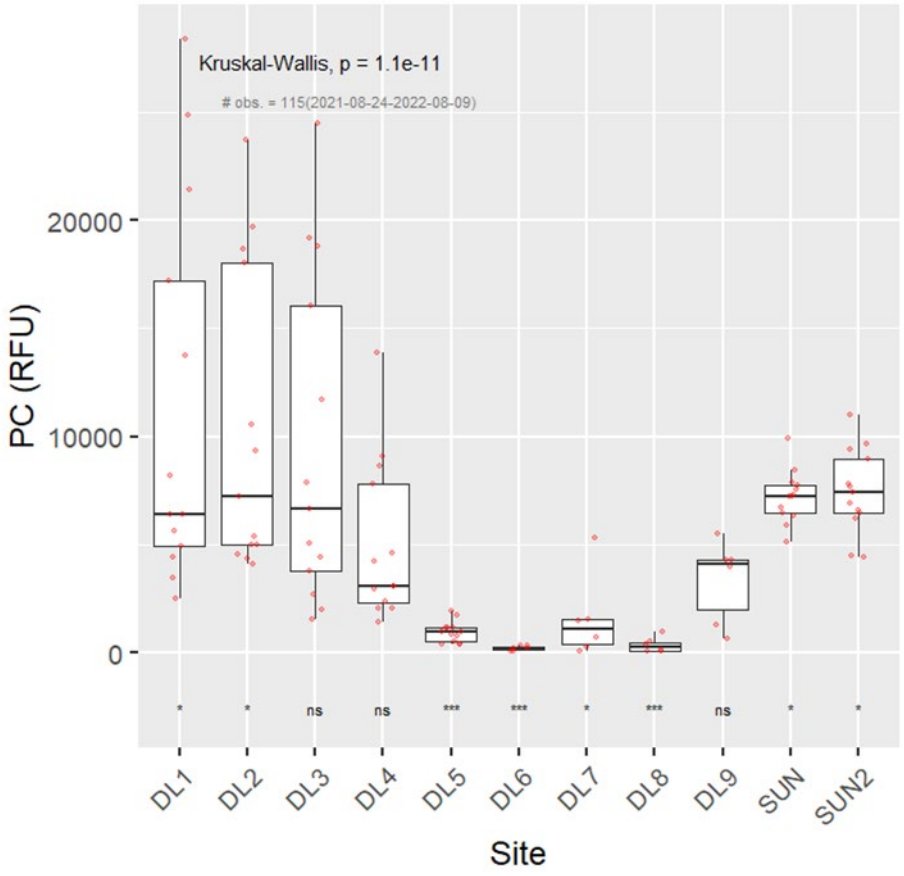


1. Start with an urbanized watershed that has low %wetland in it
2. Pre-load lake with bound inorganic PO_4 (or other source…)
3. Add a wet winter / spring (not too wet!) to make a DIN-rich broth
4. Increase the lake water temperature to >25 °C by late May – June
5. Turn off the rain by late May / Early June
6. Remove D.O. from sediments, releasing bound DIP (see step 2). Now we're baking!
7. Sprinkle rainstorms occasionally while baking (~1-2 in. per week). Enough to resupply DIN but not enough to cause washout
8. Bake for at least 1-week up to 3 months to achieve deep fluorescent green color
9. Call DEP / put up signs / mind yourself and your pets!



Spatial variation among Deal and Sunset Lake stations

Coastal Lakes portion of the 2020 EPA HABs Multi-purpose Grant (PI: Robert Newby, NJDEP)



Please see Marie Mauro's (MU MEBP student) project on Deal Lake – Ocean connectivity

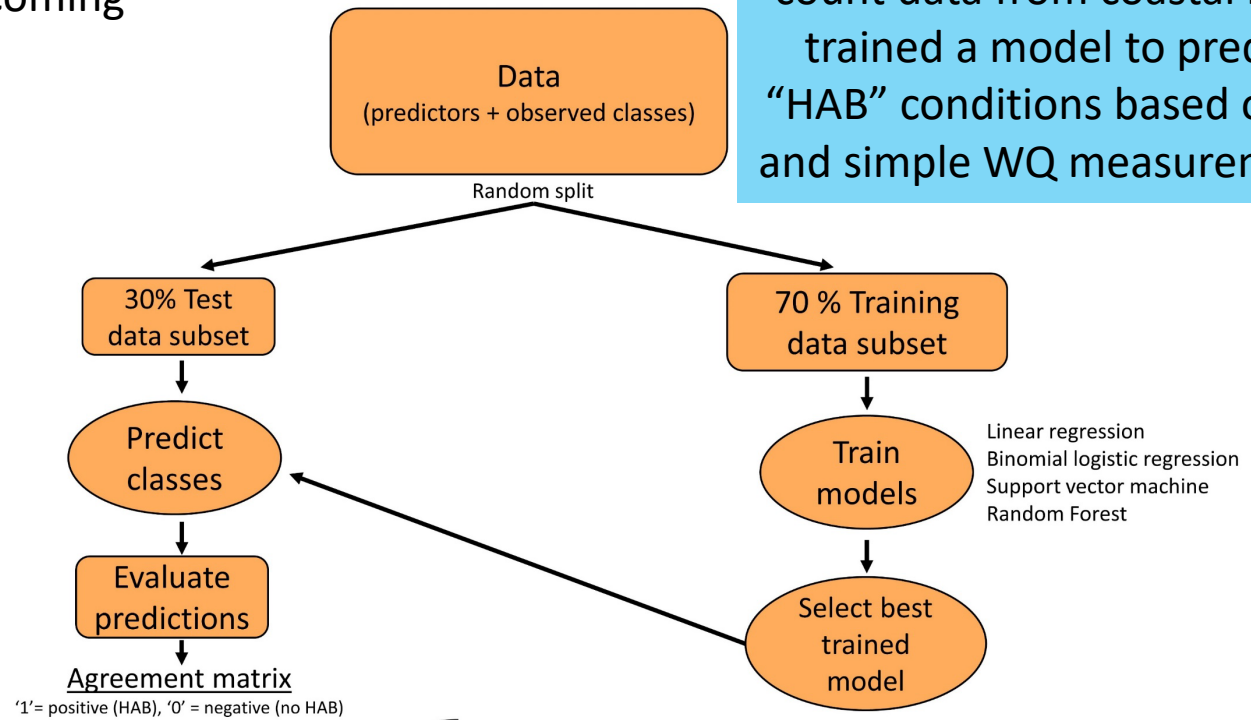
Q3: How does coastal lake WQ impact adjacent ocean beaches?

Are there HABs in your future?!?!? Ask a neighbor!

- Predicting HABS… What do we want to predict?
  - HABs tomorrow? HABs next week? An upcoming HAB-y season? Next decade?

HAB monitoring platform → Model "HAB" ~ indicator(s) → Response / verification

Paired PC fluorometer / cell count data from coastal lakes trained a model to predict "HAB" conditions based on PC and simple WQ measurements



Agreement matrix

'1'= positive (HAB), '0' = negative (no HAB)

Predicted classes \ Observed classes	0	1	
0	True negative (A)	False negative (B)	*Total pred. '0' (A+B)*
1	False positive (C)	True positive (D)	*Total pred. '1' (C+D)*
	Total obs. '0' (A+C)	*Total obs. '1' (B+D)*	*Total observations (n) = (A+B+C+D)*

Accuracy (observed) - the proportion of correct predictions ('1' or '0') throughout the matrix
Accuracy(observed) = A+D ÷ n

Kappa - the observed accuracy relative to the expected accuracy:
Kappa = Accuracy(observed) – Accuracy(expected) ÷ (1-Accuracy(expected))
where, Accuracy(expected) = [((A+B)/n) × ((A+C)/n)] + [((C+D)/n) × ((B+D)/n)]

Sensitivity – Correctly *predicted* HABs as a proportion of total *observed* HAB + non-HAB events.
Sensitivity (True Positive Rate) = D ÷ B+D

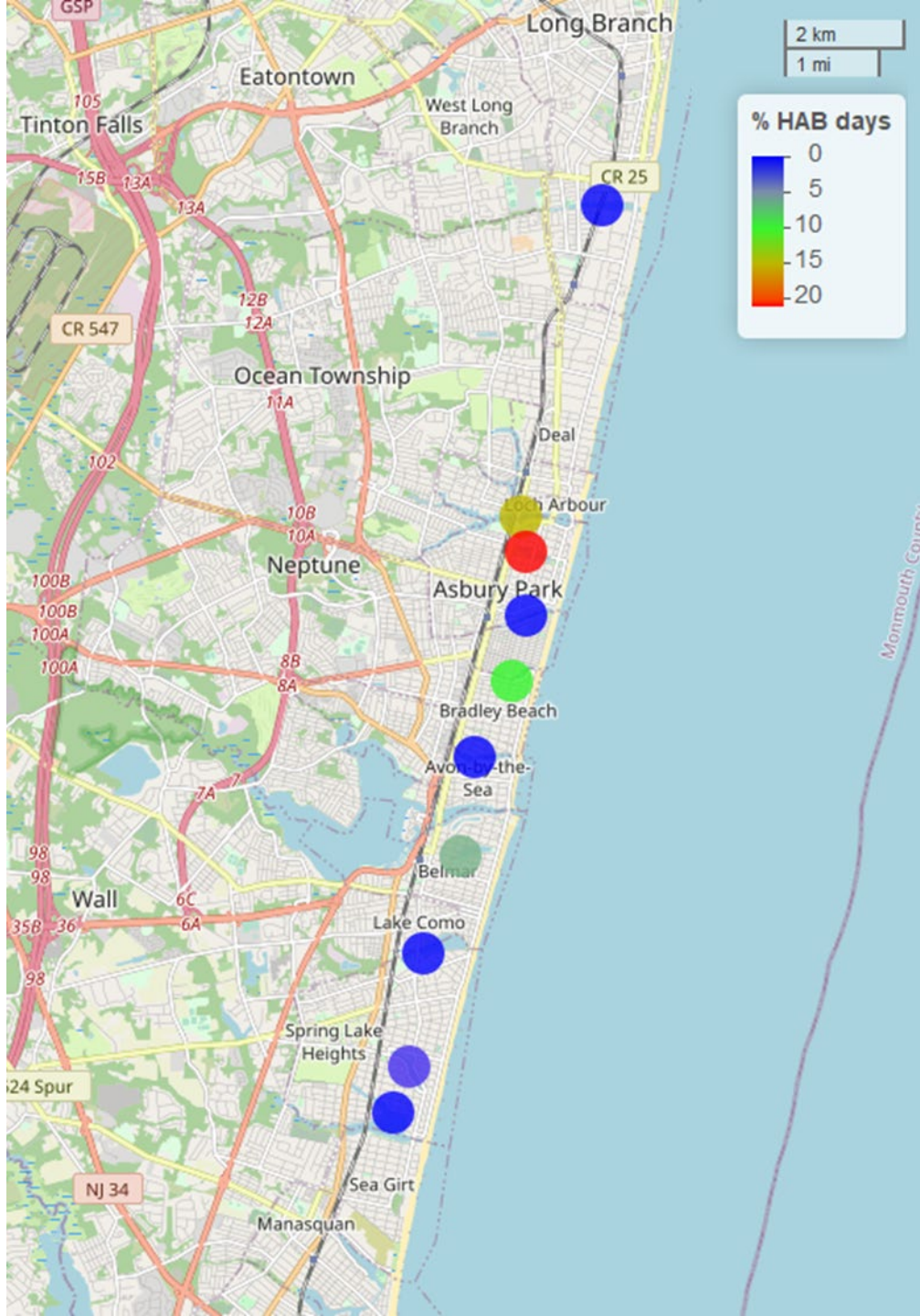
Specificity – Correctly *predicted* non-HAB events as a proportion of total *observed* non-HAB events.
Specificity (True Negative Rate) = A ÷ A+C

Balanced Accuracy – The average of sensitivity and specificity.

Q4. Can we predict HABs in coastal (or other NJ) lakes?

Conclusions

- Sunset, Deal, and Fletcher get the most HABs
  - ~10-20% of days sampled
  - These lakes tend to have higher TN and TP year around, and less wetlands in their watersheds
- Lake restoration strategies can benefit from understanding lake-to-lake variability, and efficacy of restoration actions can be measured
- Deal Lake has some impact on the adjacent ocean
  - Further work with USGS, NJDEP, Montclair
- HAB prediction is tough, but citizen scientists can help
  - So does a lot of data!



Thank you for your attention

- Questions?

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MONMOUTH UNIVERSITY | URBAN COAST INSTITUTE

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https://jadolf.wixsite.com/phytoplankton

Acknowledgements

Jules Plangere Foundation

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NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

Robert Schuster, Bill Heddendorf, Eric Ernst, Sherri Shifrin

Millstone River

Vic Poretti

Bureau Chief
Freshwater and Biological Monitoring
NJDEP

2022 Millstone HAB Investigation

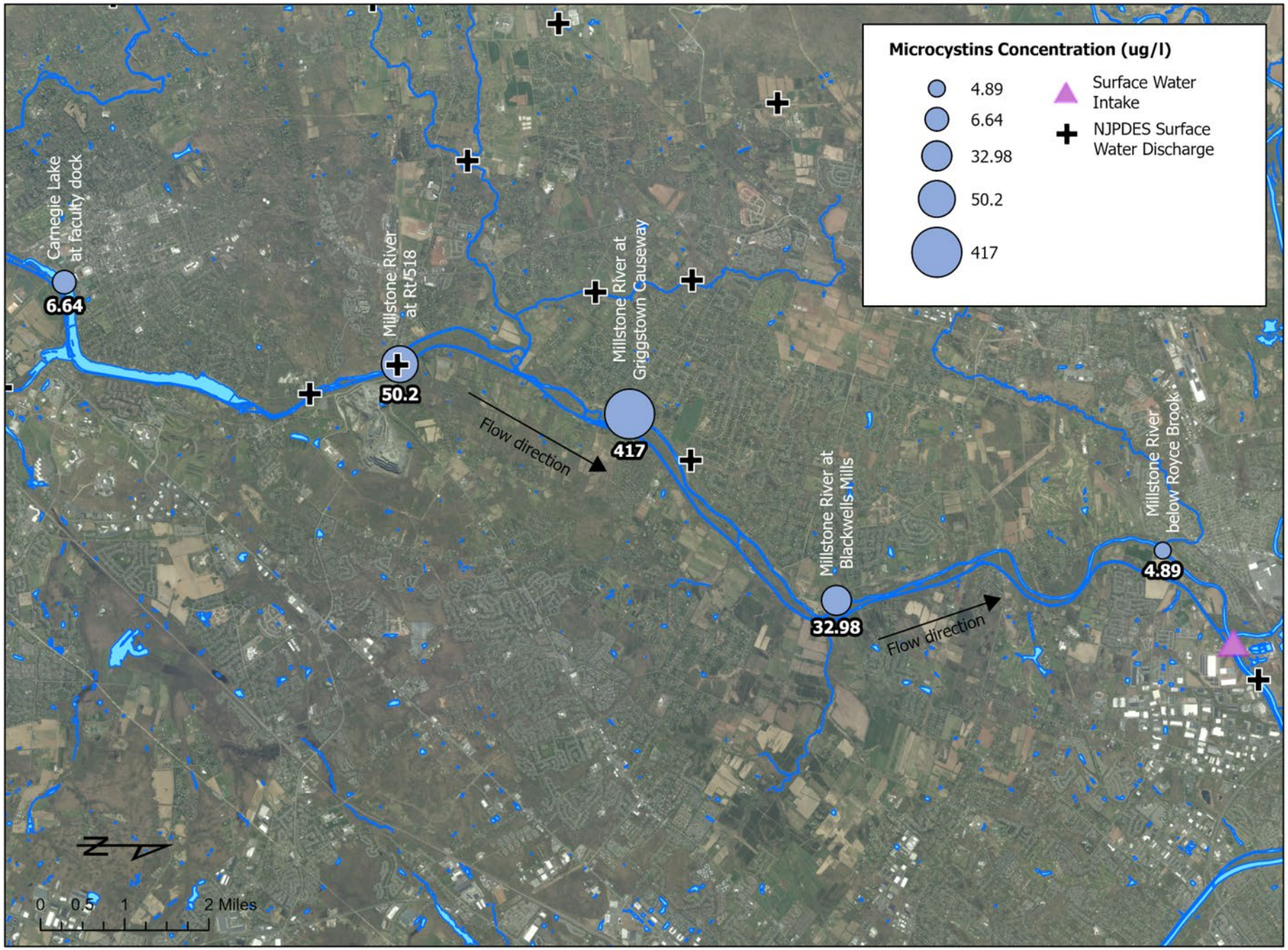
Victor Poretti, Bureau Chief
Bureau of Freshwater and Biological Monitoring

HAB Summit

March 30, 2023

2022 Millstone HAB Summary

- 7/21/22 HAB discovered at Millstone River at Rt 518 during routine water quality monitoring.
- The HAB was tracked along a 9-mile stretch downstream up to the Raritan confluence.
- Several sites sampled to confirm HAB levels.
- Drinking water threat identified.

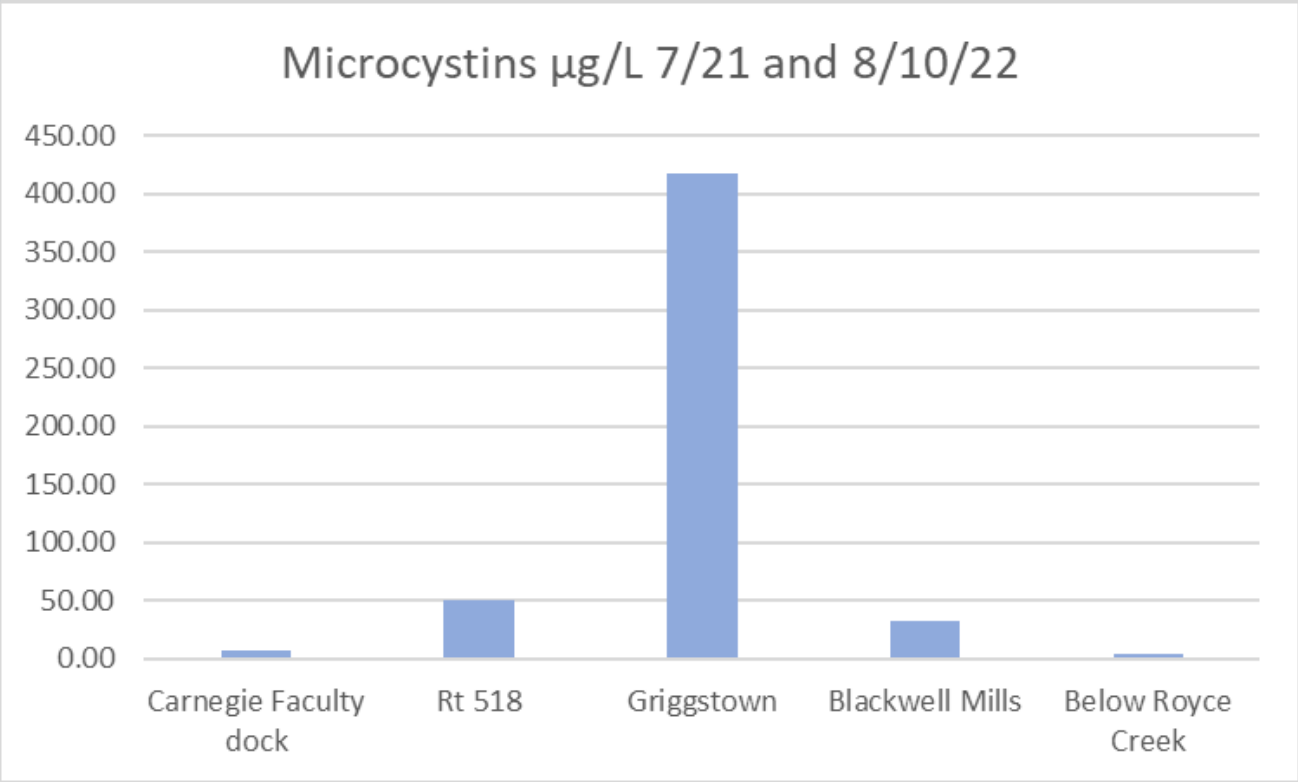


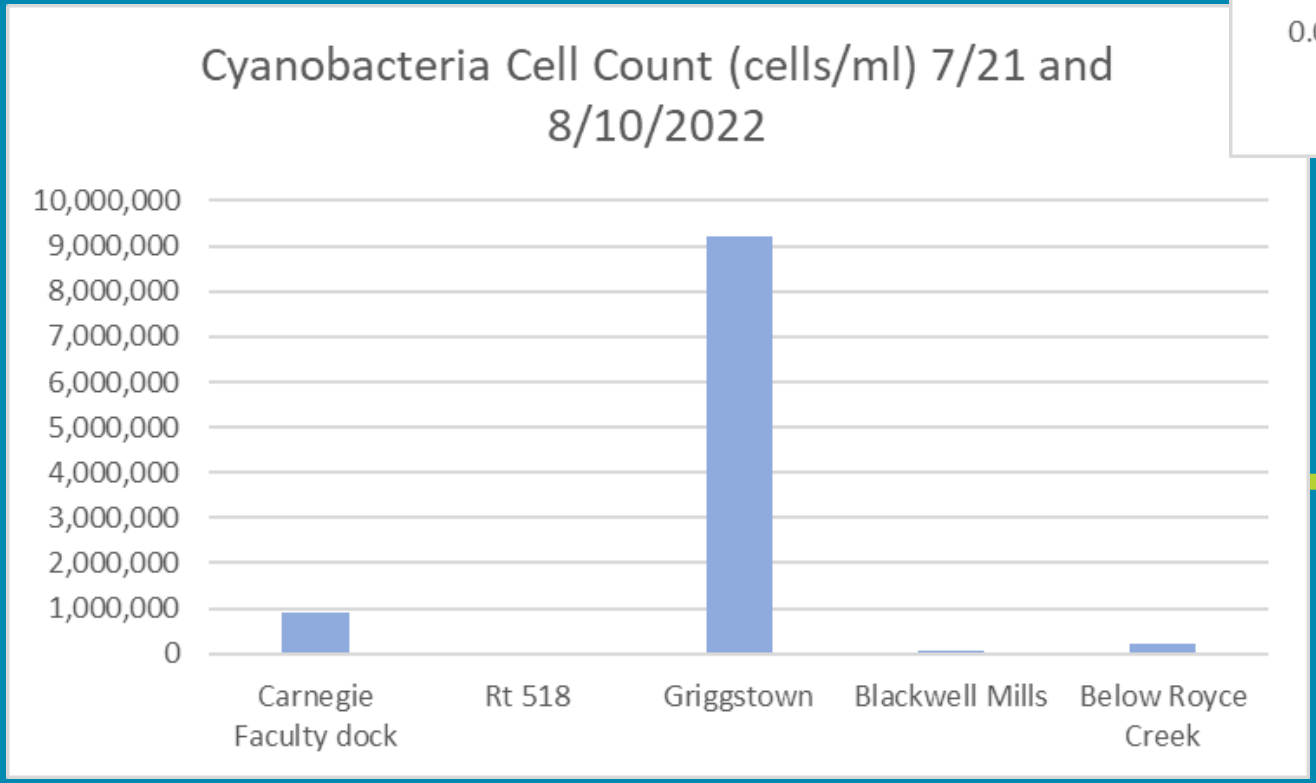
Initial Results: 7/21/2022

HAB Sampling

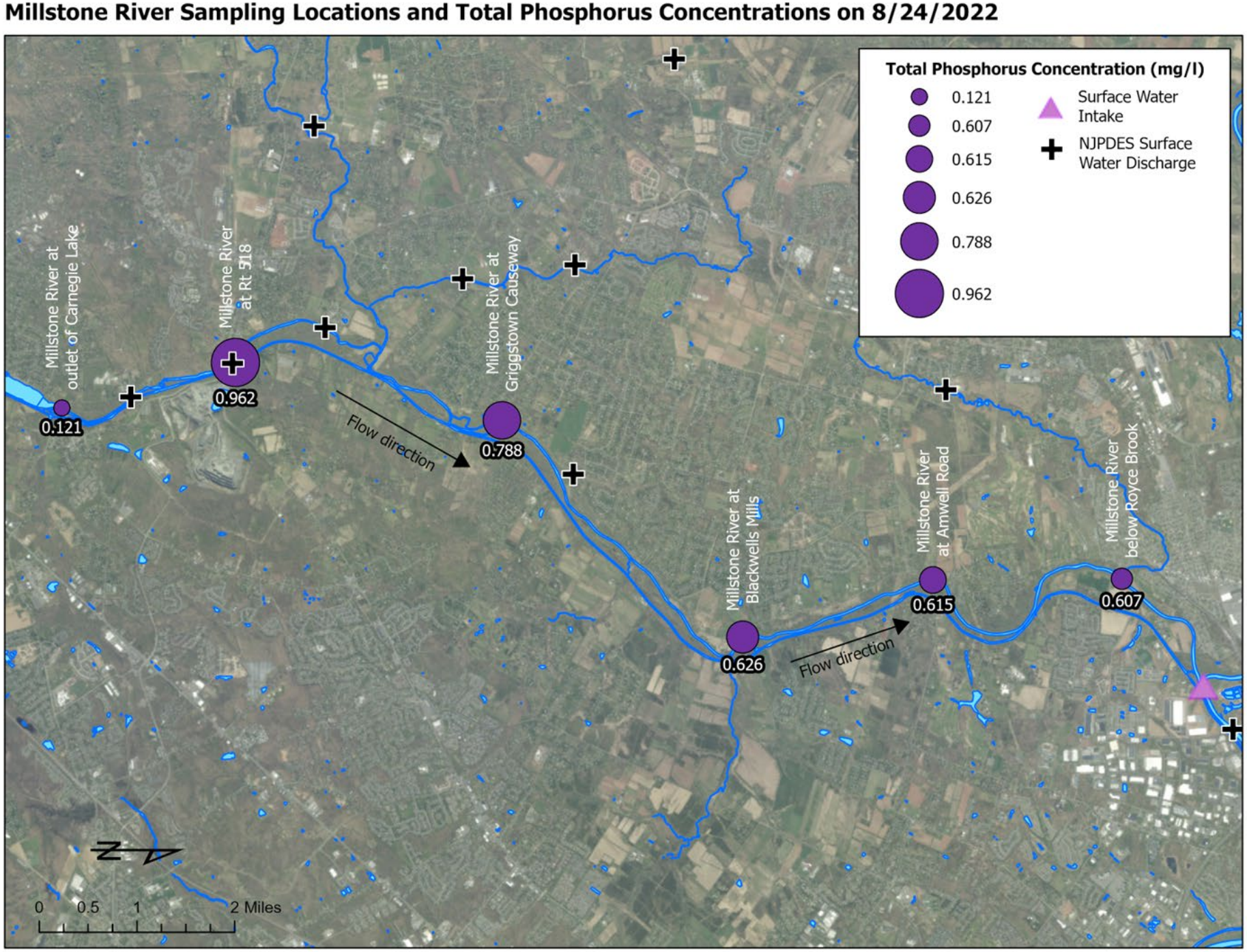
Initial Results: 7/21/2022

12th highest toxins
8th highest cell count on record



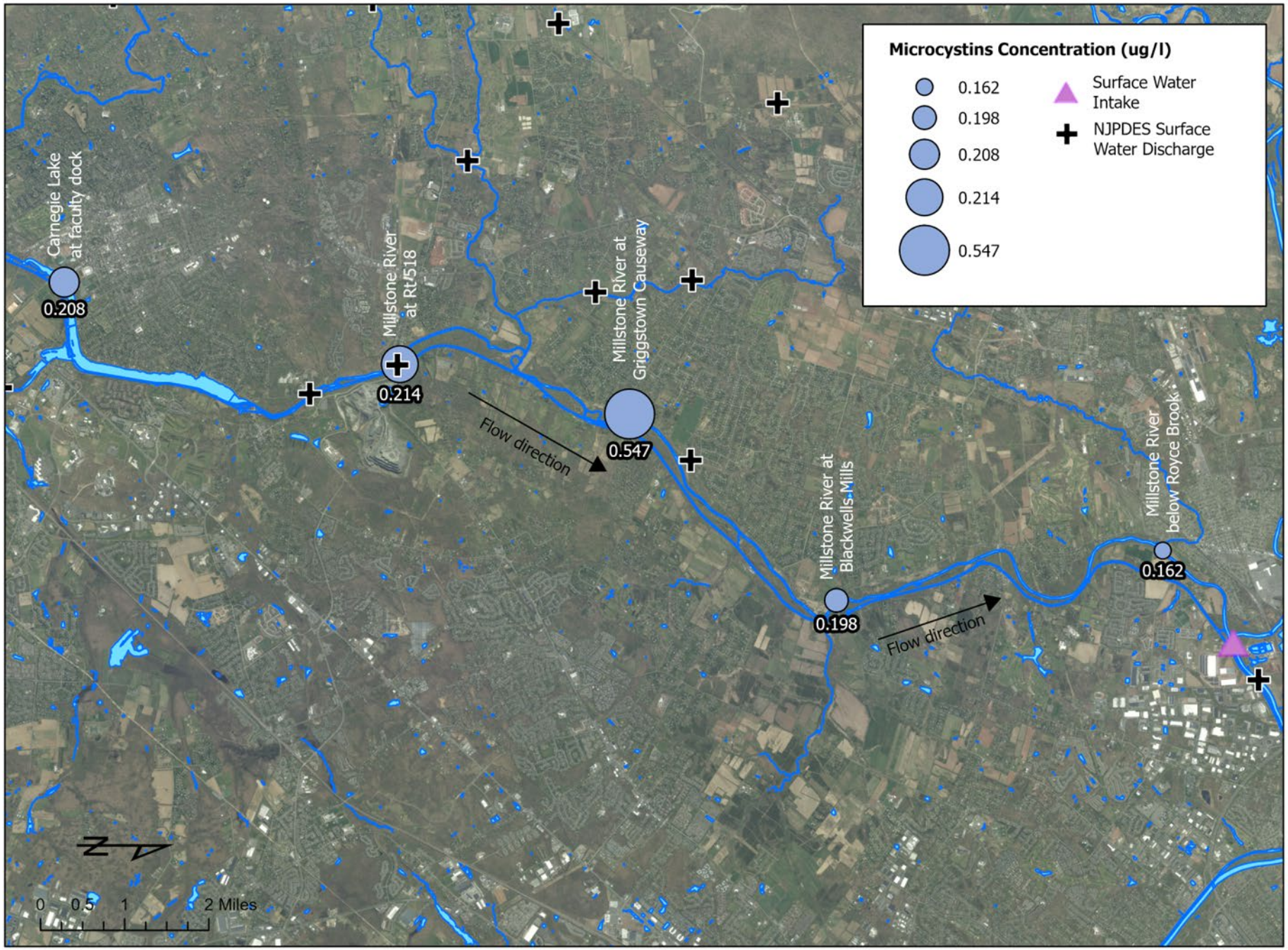


Site Location	Microcystins (µg/l)	Cell count (cells/ml)
Carnegie Faculty dock	6.64*	900,250
Rt 518	50.20**	Present; below quantification
Griggstown	417.00**	9,210,000
Blackwell Mills	32.98**	73,750
Below Royce Creek (8/10)	4.89*	226,500
*Above Advisory Alert 2.0 ug/L microcystin & 80,000 cells/mL		
**Above Warning Alert 20-2000 ug/L microcystin		



Source Trackdown Study: Results

Total Phosphorus Concentrations

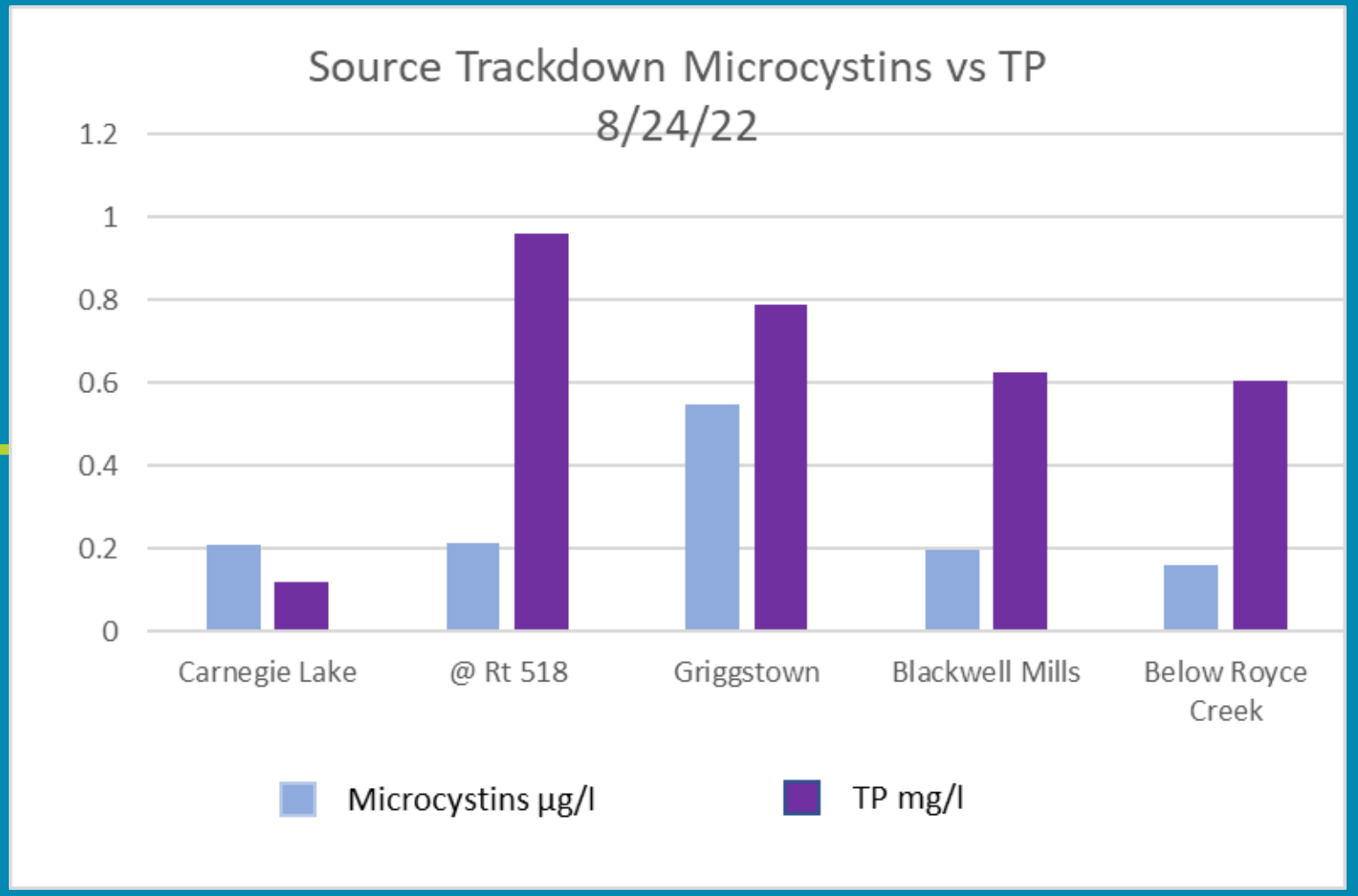


Source Trackdown Study: Results

Microcystin Concentrations

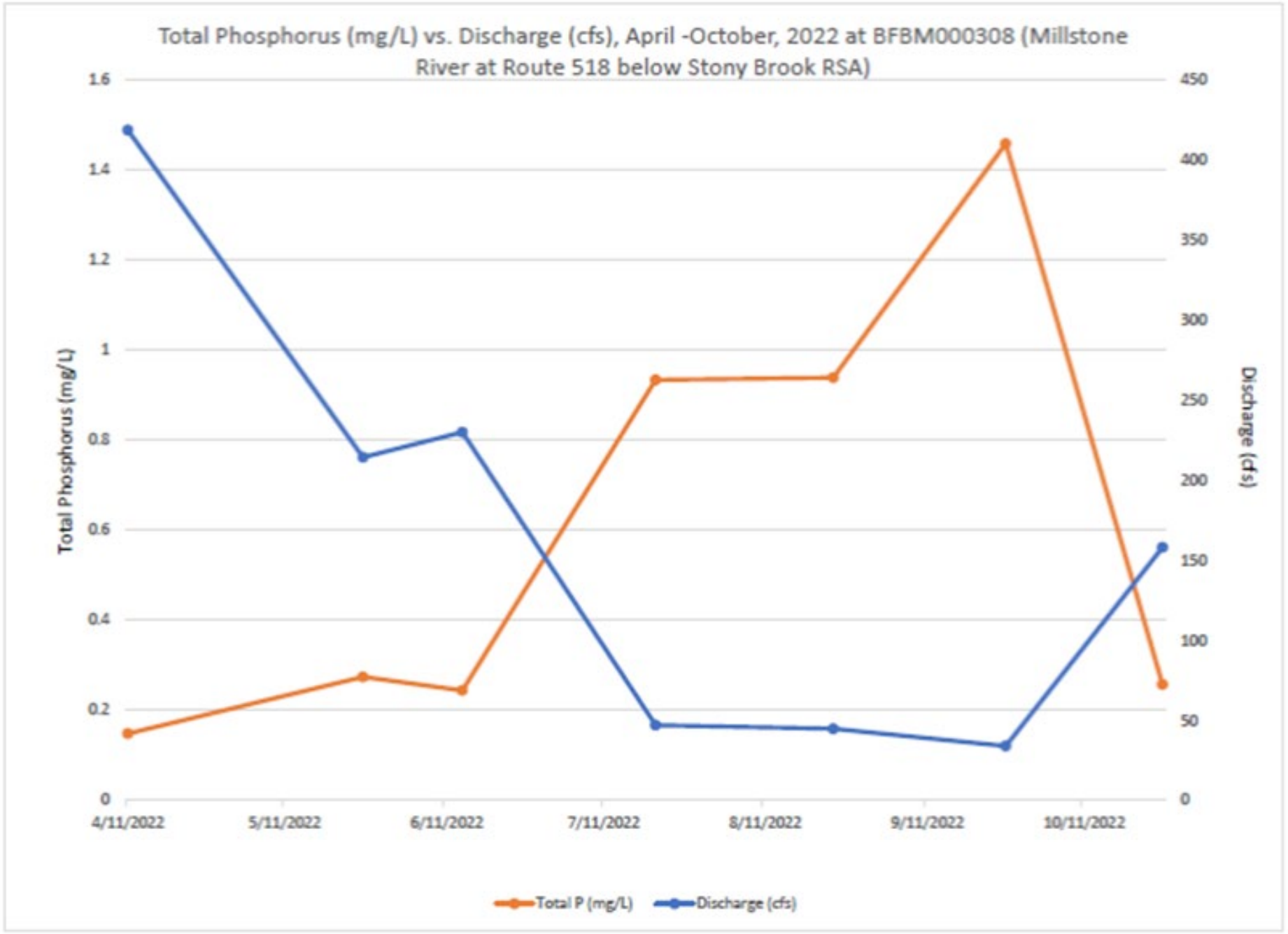
Source Trackdown Study: Results

Site	Microcystins (µg/l)	TP (mg/l)	Ortho-P (mg/l)
Carnegie Lake	0.208	0.121	0.00556
@ Rt 518	0.214	0.962	0.831
Griggstown	0.547	0.788	0.683
Blackwell Mills	0.198	0.626	0.531
Below Royce Creek	0.162	0.607	0.506



Stream SWQS for TP = 0.1 mg/l

TP vs Stream Discharge at RT 518

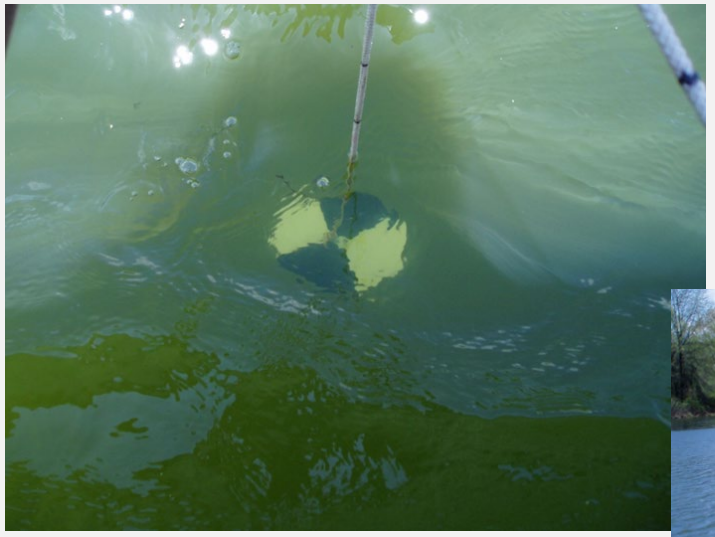


Routine Lake Monitoring

Multiple sites sampled 4 X in 2022

2 year sampling, returning in 2023

Average TP approximately 0.09 mg/L



Biological Trackdown of Cyanobacteria

Millstone River Bloom

- Most of our understanding of blooms come from studying planktonic events
- Events in flowing water are rare but have been documented
  - Bloom starts in one waterbody and moves to another through the water column
  - Bloom begins to grow in low flow regions of flowing water or in shallow areas where temperature can increase
    - Globally we see benthic events more in flowing water than planktonic events

Driving Force of Blooms

- Key nutrients and physical properties of the aquatic system are driving forces of bloom development
  - Nutrients like TP and Nitrogen are the two largest factors, with TP usually the limiting nutrient.
- Through evolutionary adaptations, cells are particularly good at acquiring external nutrients
  - Cells can pass nutrients through successive generations
  - Cells can manipulate the environment to access more key nutrients or change the biological state of a nutrient
- Physical properties include things like:
  - Temperature
  - Water "stillness"
  - Wind activity
  - Predation
  - Rainfall

Millstone River Bloom Event

Cell populations were different at different sampling points

Not just proportions of cells but entire species were present or absent depending on where sampling occurred

Visual indication of cells highlighted different species even among genera present - E.g. *Microcystis auerginosa* was present at some locations, but *Microcystis wesenbergii* was present at others.

Based on cell sampling evidence this indicates that a sole source, or a bloom originating in one location and moving through the water column was not what was occurring for the Millstone Event

Conclusions

Based on the trackdown study, the 9-Mile long Millstone HAB of 2022 was able to propagate because:

- Low flow/Lake-like conditions due to the drought
- Significant levels of total phosphorus being discharged to the Millstone River.

DEP is working with partners and investigating ways to decrease TP inputs and increase stream flow.

Monitoring at Carnegie Lake as well as the Millstone will continue in 2023.
We hope to be able to identify a HAB if it happens again before conditions increase to 2022 levels so we can take appropriate action before a threat to DW occurs.

Contact

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Spruce Run

Heather Desko

Senior Watershed Protection Specialist
New Jersey Water Supply Authority

The Ins and Outs of HABs at Spruce Run Reservoir: Watersheds and Water Supply

Heather Desko

Senior Watershed Protection Specialist

New Jersey Water Supply Authority

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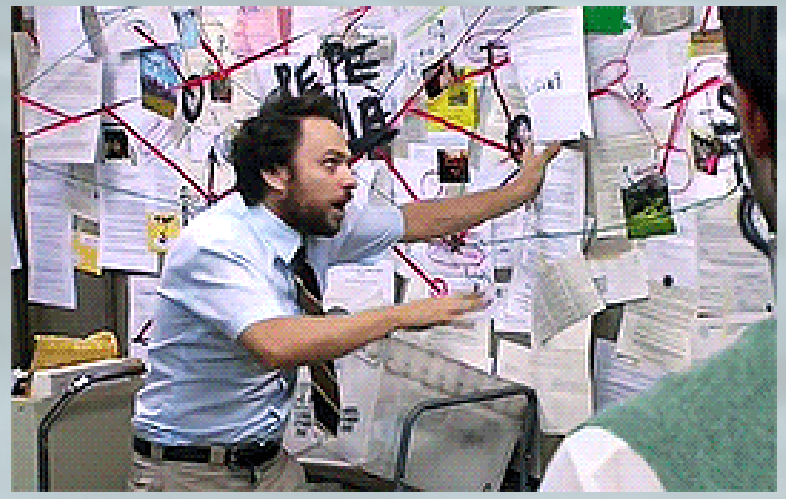
NJDEP HAB Summit 2023
March 30, 2023

Outline

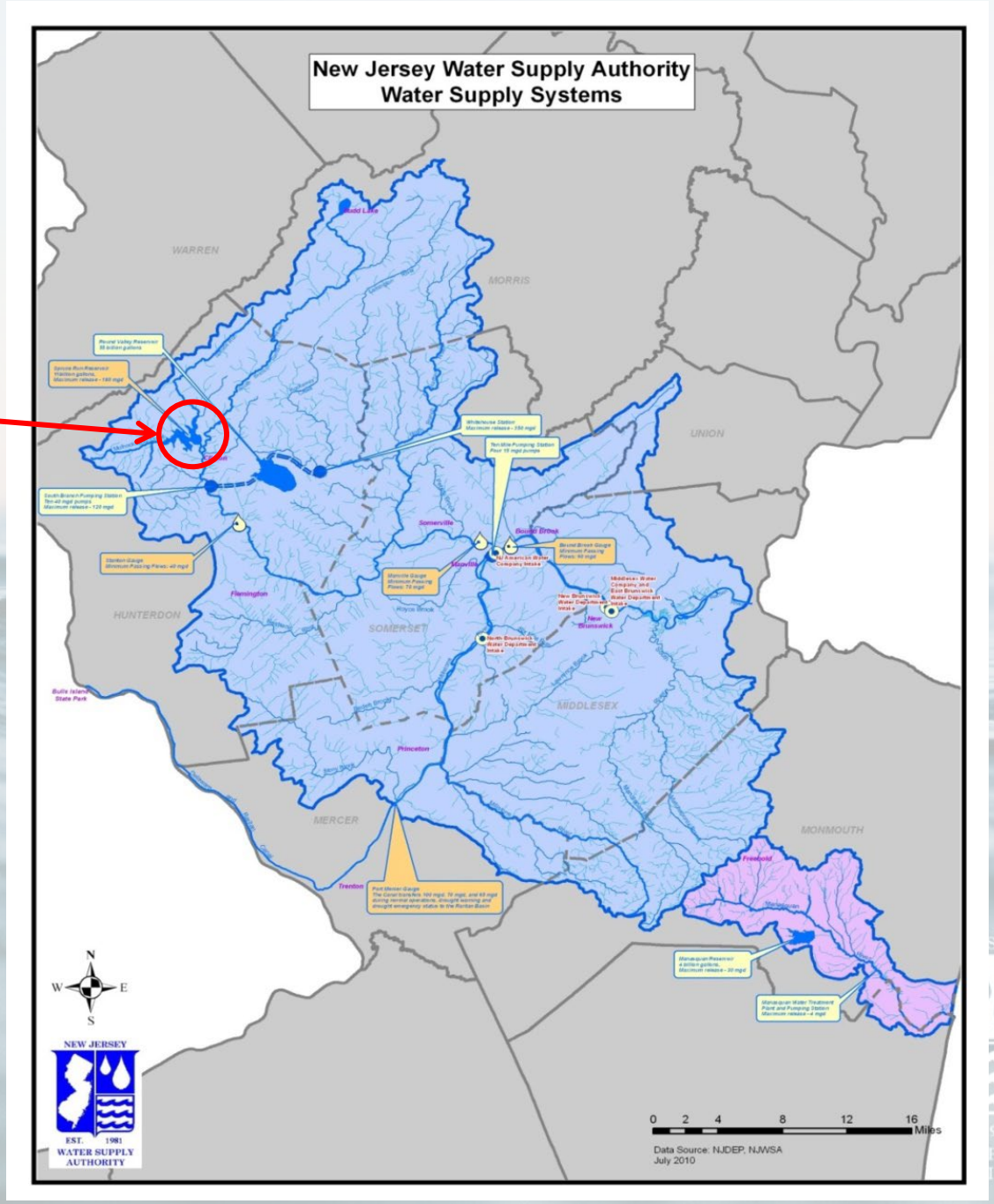
- NJWSA & Spruce Run Background
- Spruce Run HAB History
- Input Watersheds
- In-Reservoir Assessment
- Downstream Transport
- Planned Investigations



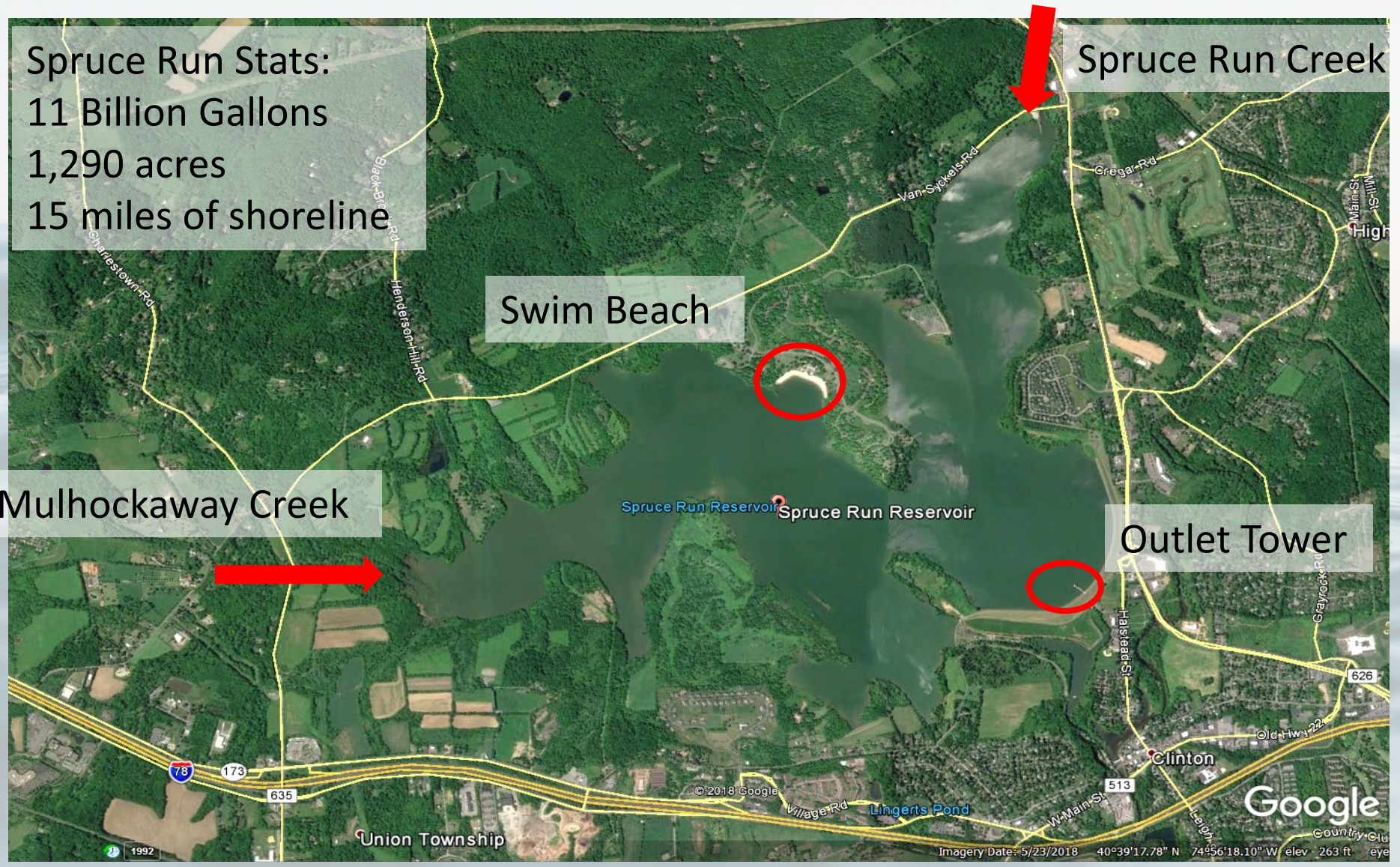
New Jersey Water Supply Authority

- Raritan Basin Surface Water Supply
  Safe Yield 241 MGD
  - Spruce Run Reservoir
  - Round Valley Reservoir
  - Delaware & Raritan Canal
- Manasquan Surface Water Supply
  Safe Yield 30 MGD
  - Manasquan Reservoir

➢ Water for ~2 million NJ Residents



Spruce Run Reservoir



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Recent HABs in the Spruce Run Watershed

Manny's Pond (Mulhockaway)
December 2017, Summers 2021 & 2022

Crystal Springs Preserve (Spruce Run)
September 2018, Summers 2021 & 2022

Spruce Run Reservoir
September-October 2018

Spruce Run Reservoir
June 2019-ongoing

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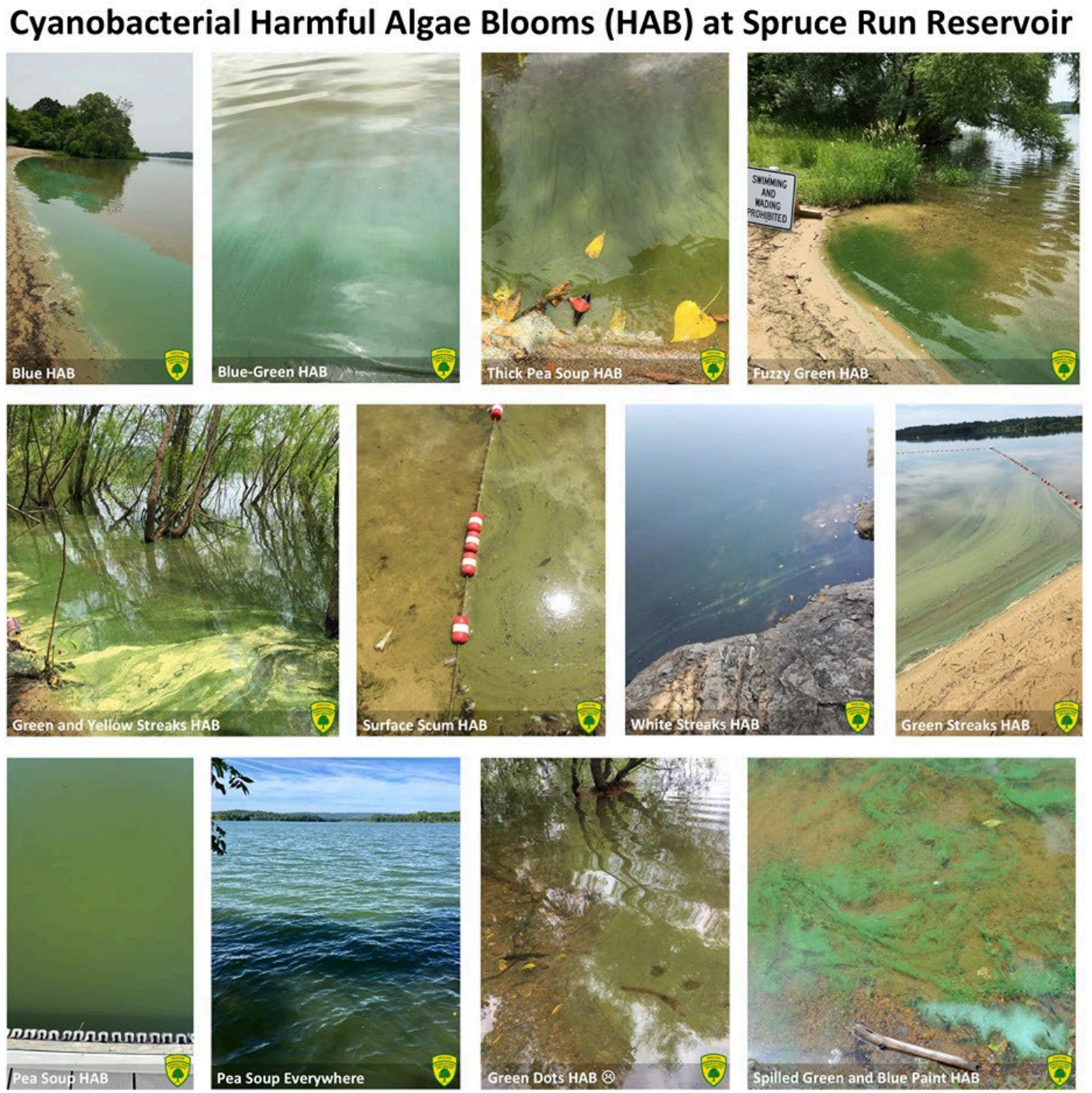
Reservoir Blooms

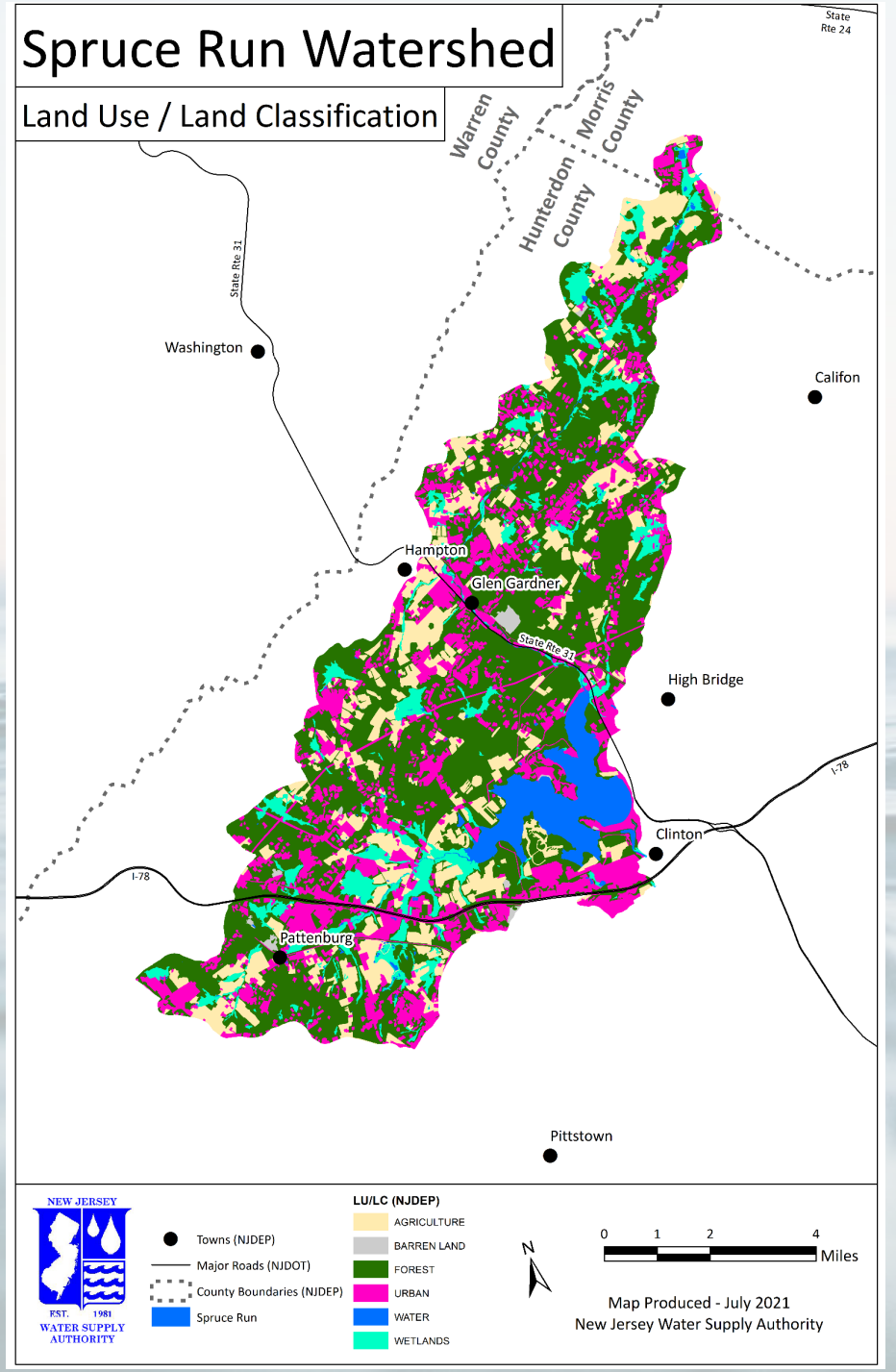
- Shoreline vs. Reservoir-wide
- Surface vs. Depth
- Summer & Fall (& winter?!)
- Cell counts vs. cyanotoxins



SR Watershed Land Use

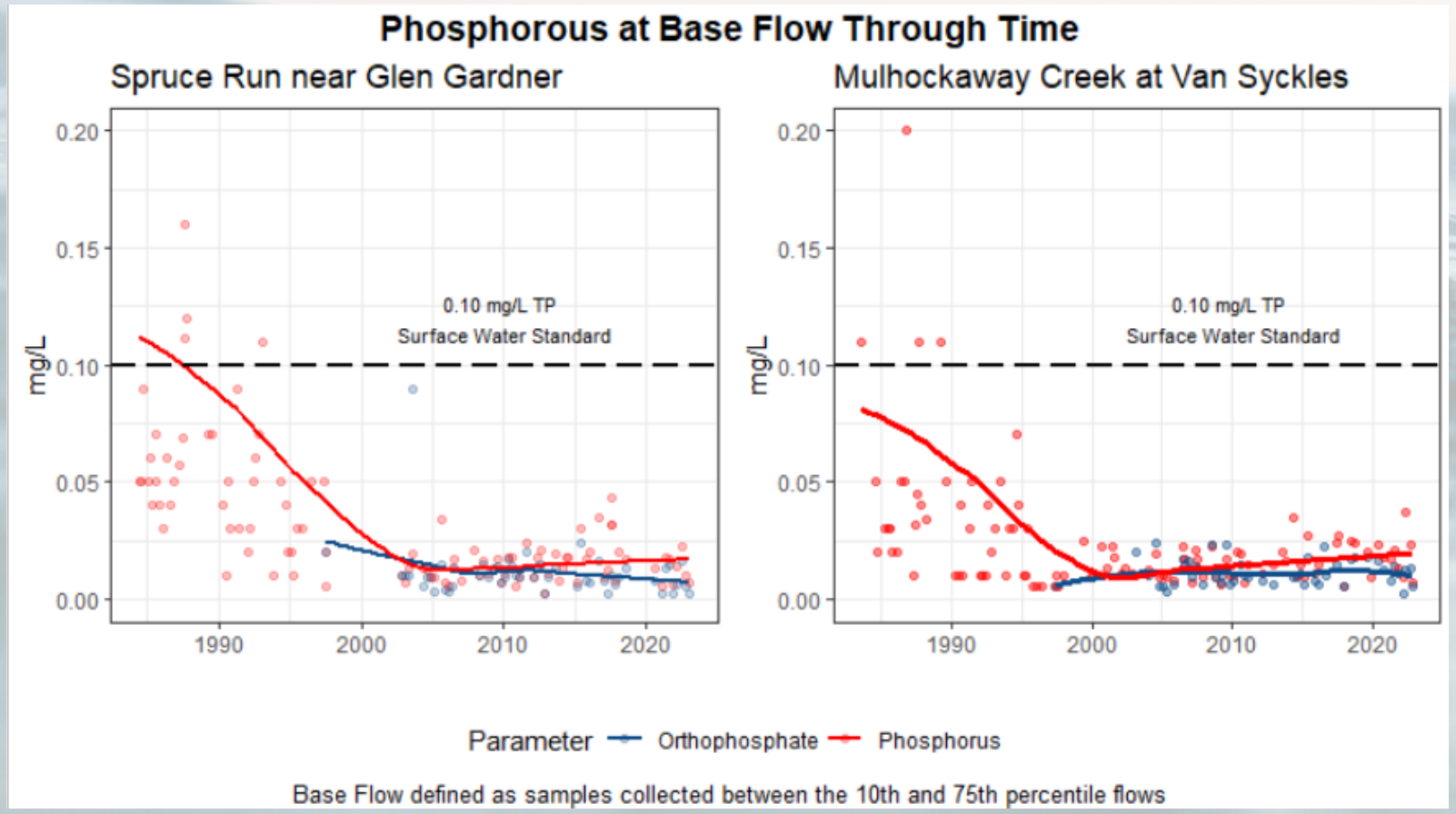
- Forest (47%)
- Urban (22%)
- Agriculture (16%)

- Loading calculations indicate that agricultural land use is responsible for nearly 50% of the annual phosphorus load and 13% of the sediment load



Watershed Nutrient Input Potential Influences

- SR Creek watershed: more volume, more nutrient loading than Mulhockaway
- Phosphorus decreasing in both watersheds over time



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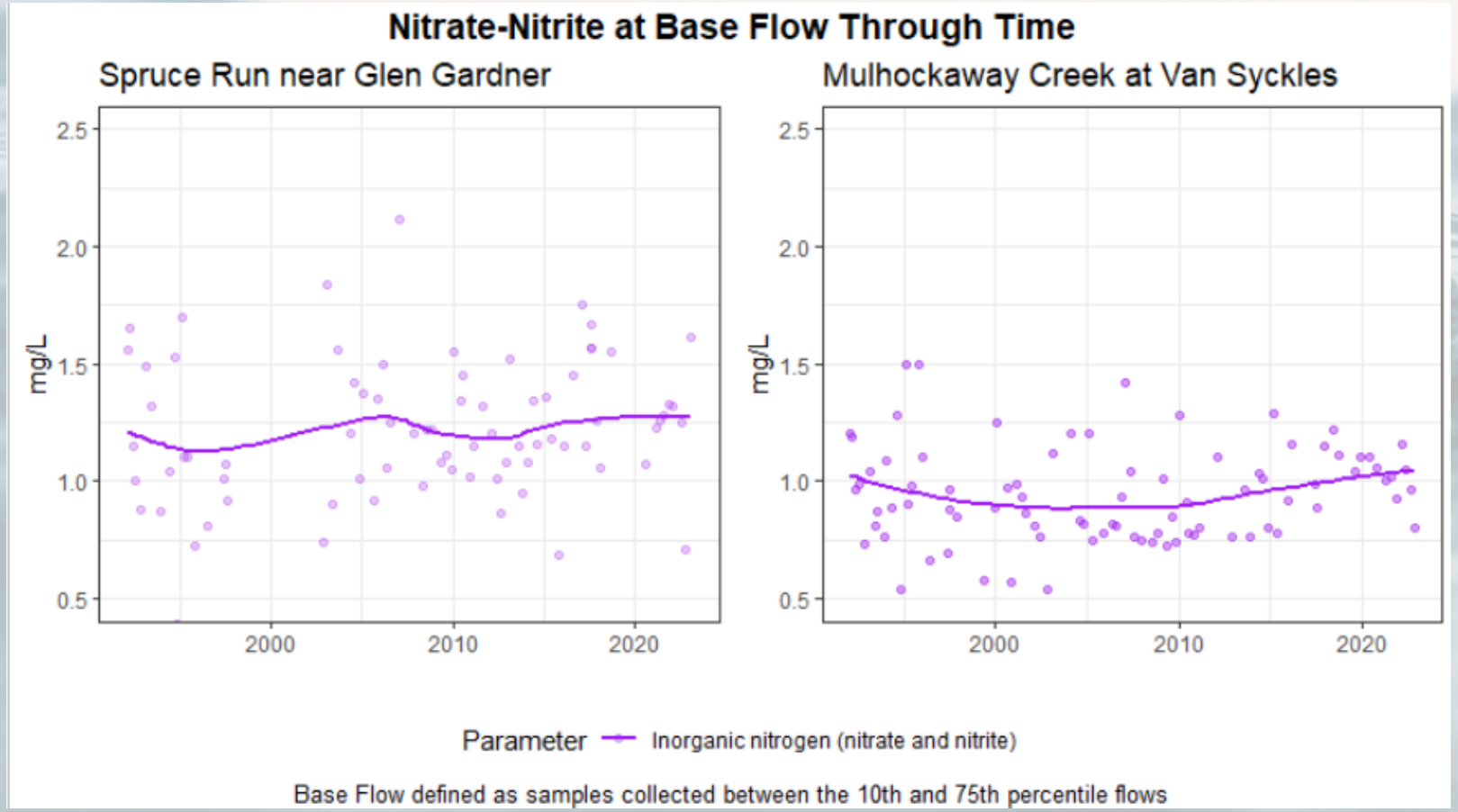
Watershed Nutrient Input Potential Influences

- SR Creek watershed: more volume, more nutrient loading than Mulhockaway
- Nitrate-nitrite levels remain relatively stable over time in both



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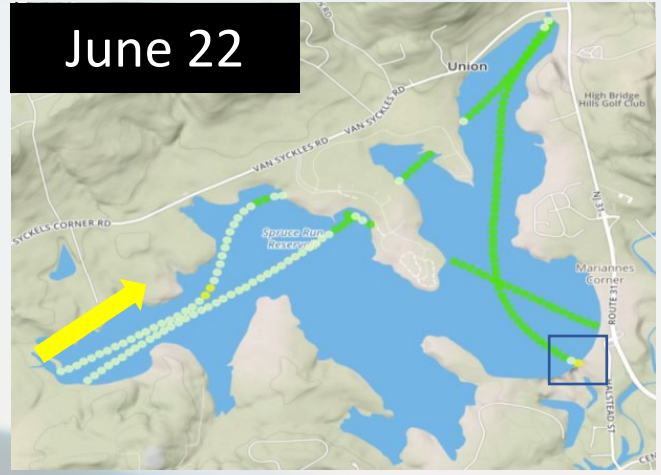

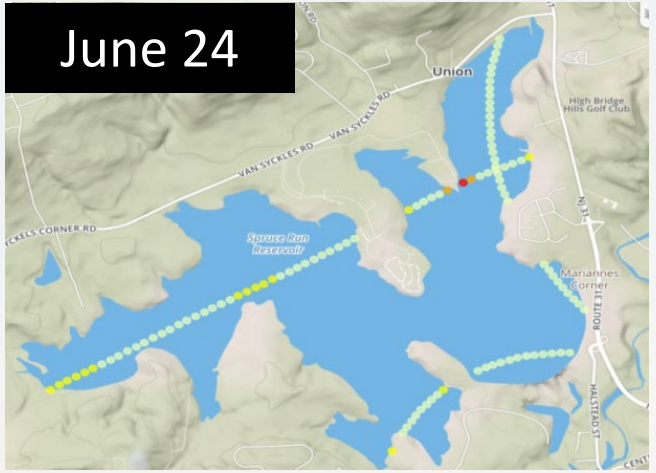

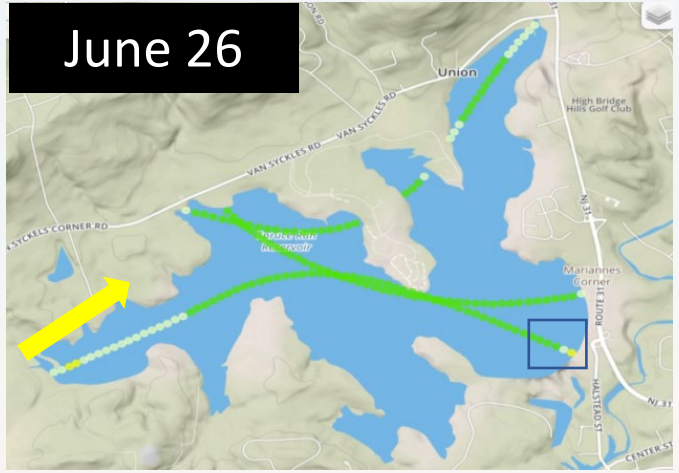

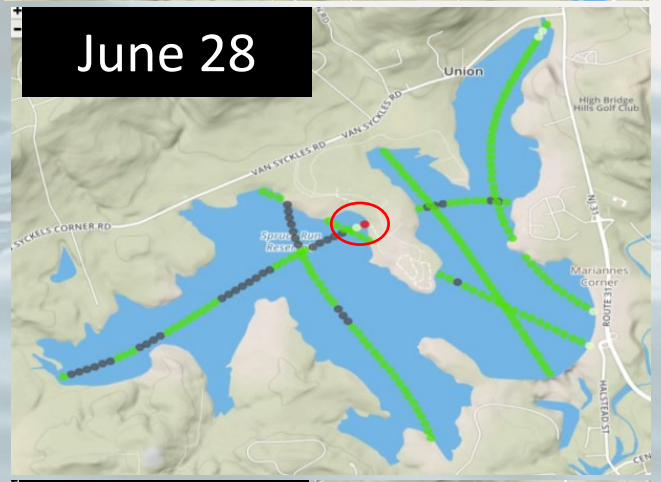

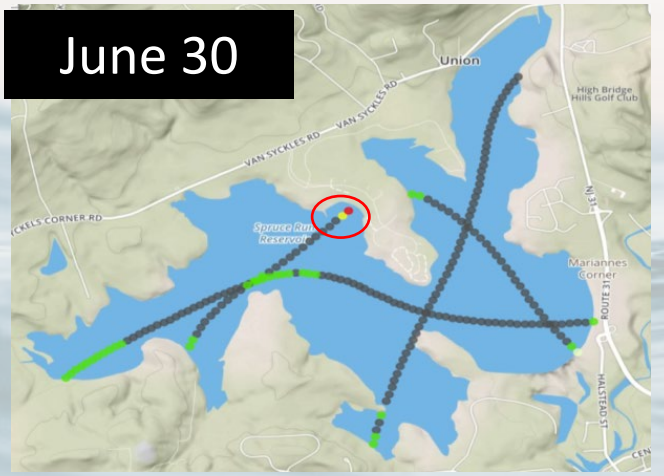

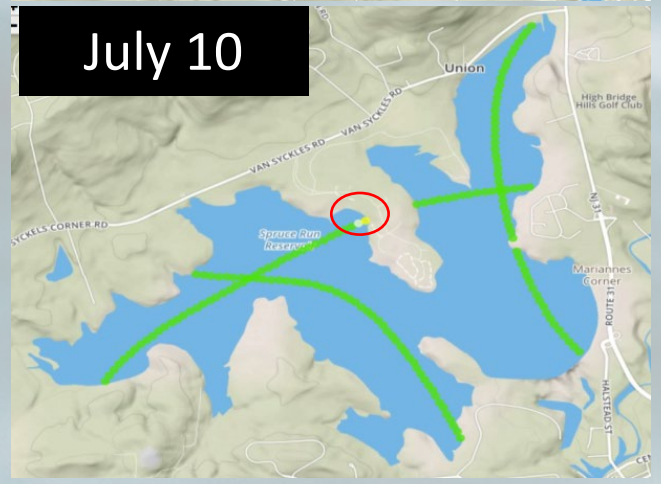

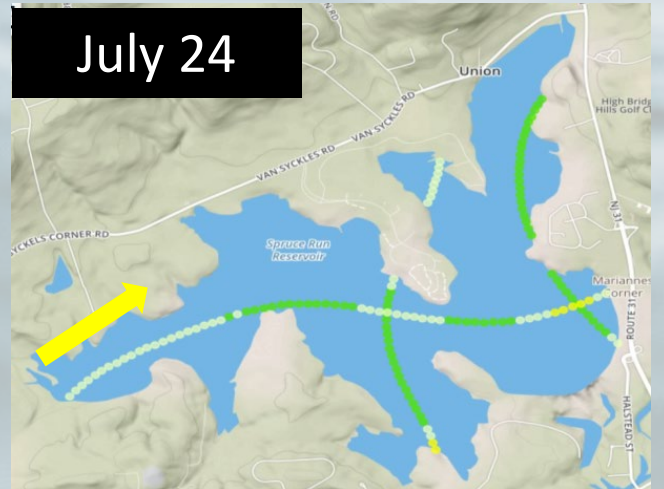

Estimated Cells per ml	
0 - 10,000	
10,000 - 20,000	
20,000 - 40,000	
40,000 - 60,000	
60,000 - 80,000	
80,000 - 100,000	
> 100,000	

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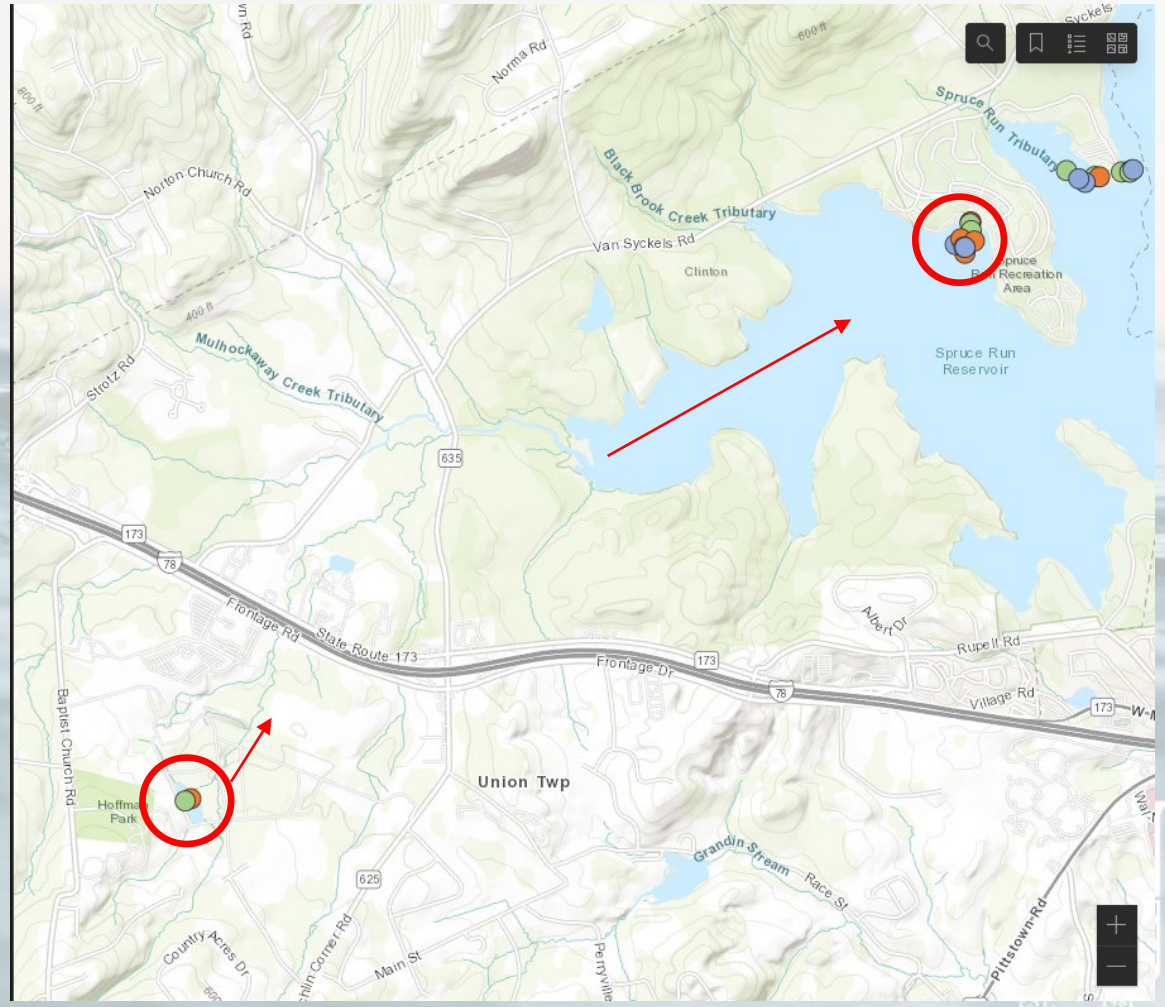
Algal Loading Hypothesis

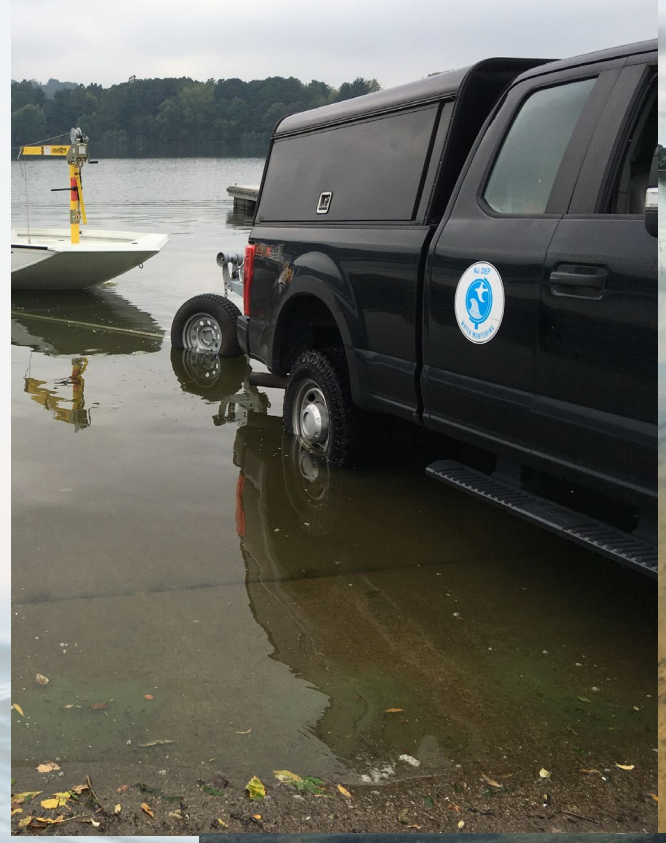
- The watershed is a source of algal loading – seeding of algal cells – into the reservoir where bloom conditions are more favorable (warmer temperatures, increased light, slower velocity, available nutrients)
- When Spruce Run blooms- the dominant taxa often varies at different places in the reservoir
  - Correlation with Manny's Pond (Mulhockaway) taxa to SR Beach taxa



NJDEP HABs Dashboard

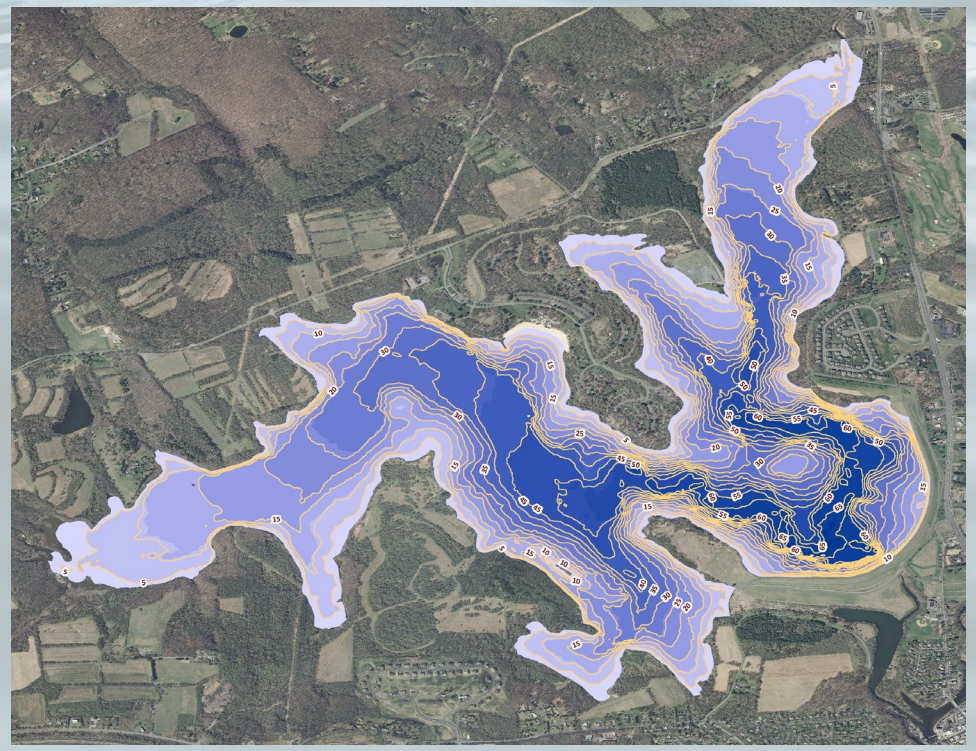
In-Reservoir Monitoring

- Phycocyanin Monitoring & Grab Sample Collection (State Parks)
- In-situ Multi-parameter Vertical Profiles (NJWSA)
- Cyanobacteria & Cyanotoxin Analyses (NJDEP)
- Continuous Monitoring Buoys (USGS & NJDEP)
- Nutrient analyses



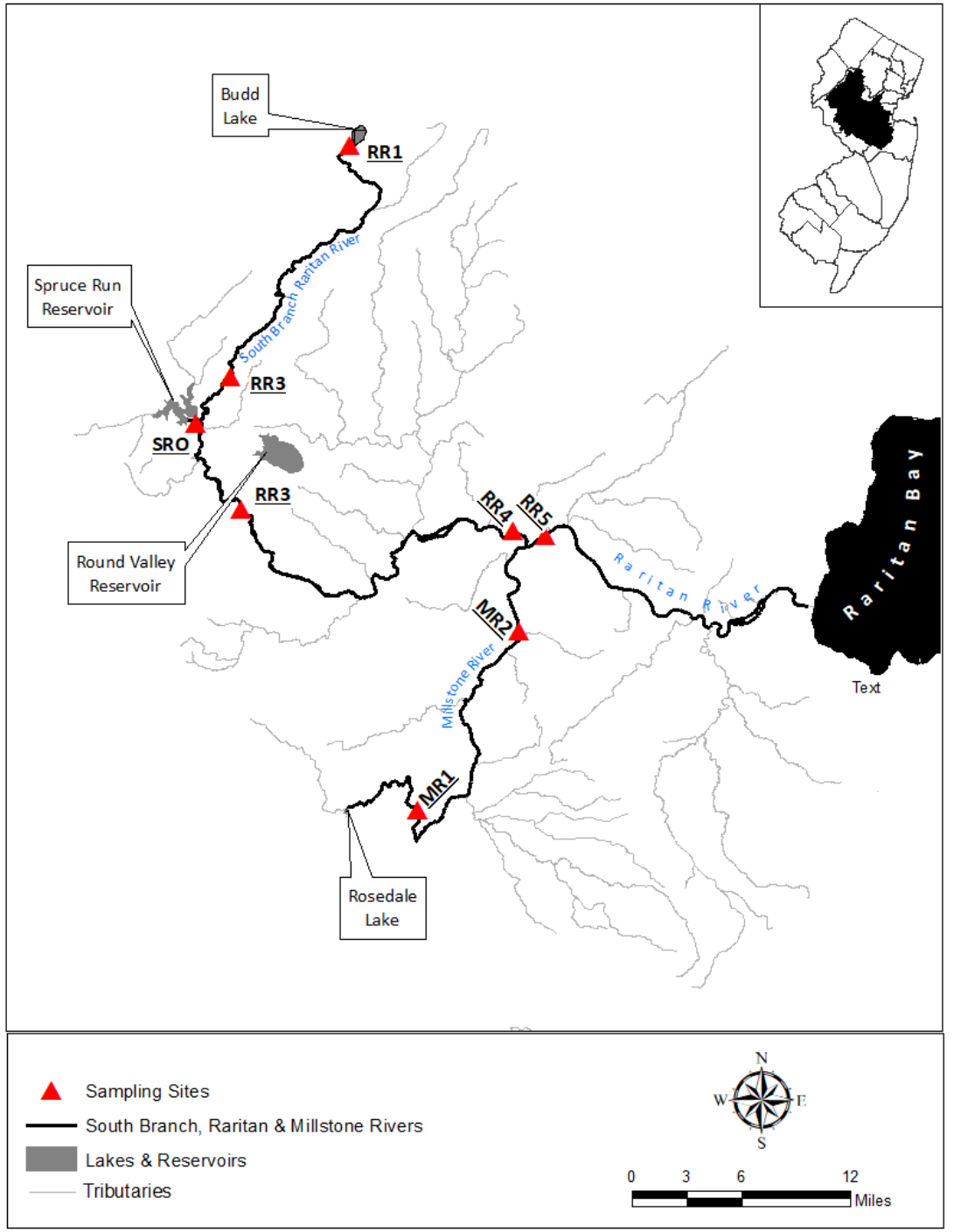
In-Reservoir Monitoring & Assessment

- Bathymetric Survey
- Sediment Testing
- Internal Phosphorus Load Calculation



Downstream Fate and Transport of Cyanobacteria and Cyanotoxins in the Raritan Basin

- Applied research cooperative study
- Continuous sensors & grab samples July 2020-August 2021
- Spruce Run Reservoir contributes more algal cell load in Raritan River than from Budd Lake
- Millstone River provides more opportunity for cell growth



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USGS science for a changing world

MONTCLAIR STATE UNIVERSITY New Jersey Center for Water Science and Technology

New Jersey DEPARTMENT of ENVIRONMENTAL PROTECTION

Planned Investigations & Management

- Spruce Run Reservoir Characterization Plan
- Agricultural Best Management Practices-Spruce Run Reservoir Watershed
- Boat Cleaning Stations for Aquatic Invasive Species Prevention

Questions?

Heather Desko

hdesko@raritanbasin.org

Session 4:
Getting Smarter on HABs

March 30, 2023

Expert Team Read-Out

Jason Earl Adolf, Ph.D.

Professor of Marine Science
Monmouth University

HAB Expert Team Read Out

Jason E. Adolf, Ph.D., Monmouth University

Harmful Algal Bloom Summit

March 30, 2023

HARMFUL ALGAL BLOOM EXPERT TEAM

Ecosystem Consulting Services
A Division of GZA GeoEnvironmental, Inc.

MONMOUTH UNIVERSITY

RUTGERS
THE STATE UNIVERSITY OF NEW JERSEY

CWC
CLEAN WATER CONSULTING

NAIAD BIOLOGICAL CONSULTING

MONTCLAIR STATE

USGS

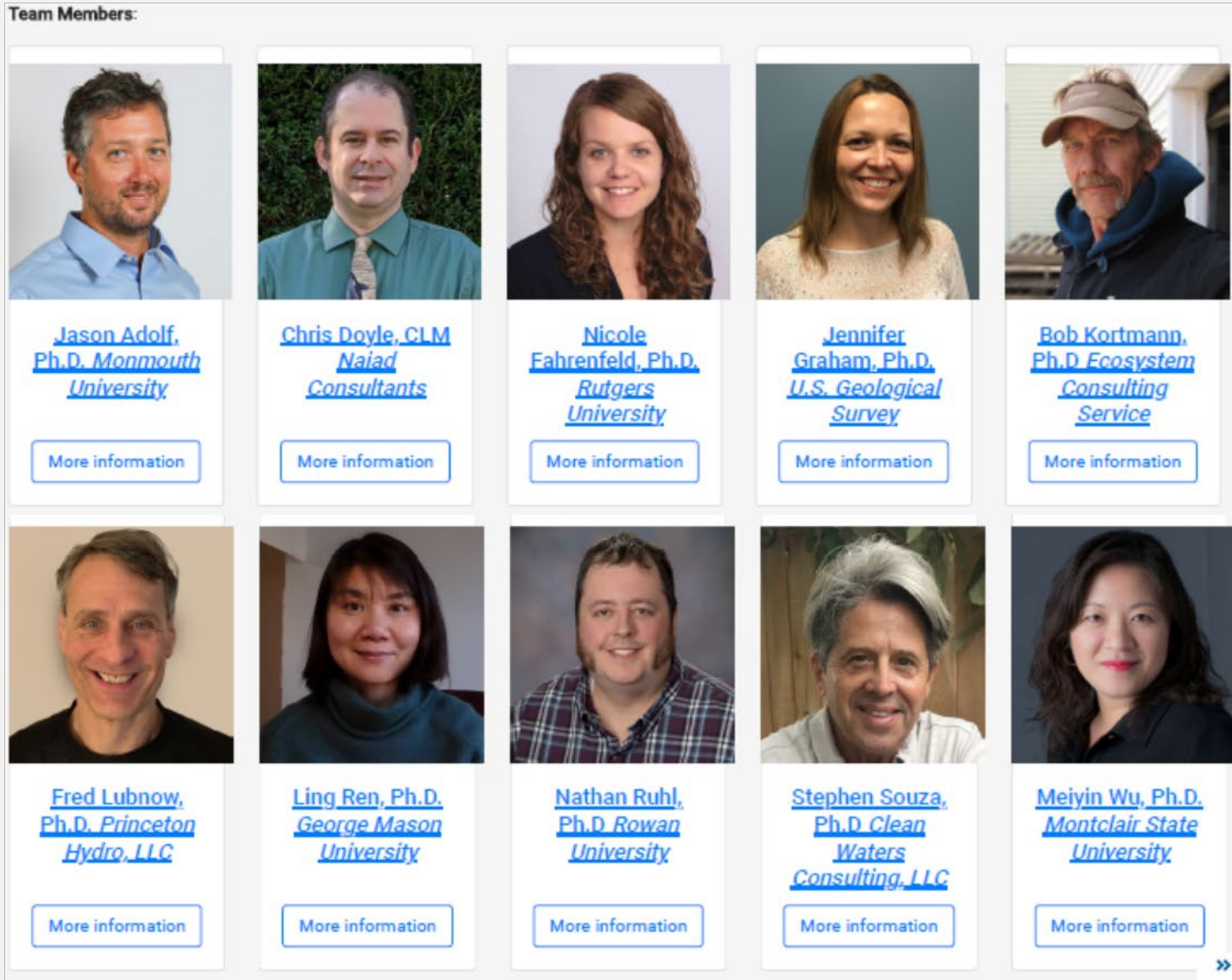
PRINCETON HYDRO

Rowan

GEORGE

HAB and Lakes Management Expert Team

- Established in 2021 by NJDEP to enhance scientific expertise and building the State's capacity for HAB response
  - Agreement extended to continue the work of the 10 member HAB Expert Team through 2023
  - 2022 Milestones
    - NJDEP HAB Expert Team Overall Charge Questions
    - Water Quality Monitoring Guidance Recommendations for NJDEP
  - 2023 Tasks
    - Complete guidance document for developing a lake-specific HAB action plan
    - Provide training opportunities on nutrient sources, preventing and controlling HABs and management measures



And thanks the Mike Danko of NJ Sea Grant Consortium for keeping us on task!

HAB Expert Team Overall Charge Questions

- Review of permitted and non-permitted applications of pesticides
  - “Quick Fixes” should be evaluated for impacts to long term goals
  - Potential for lasting impacts? – Copper not recommended
  - Treating a HAB that is producing cyanotoxins with an algaecide can increase exposure to the toxins
  - Non-copper algaecide alternative
    - Sodium carbonate peroxyhydroxate
    - More effective for cyanos but expensive
  - Incompatibility with other management measures?
    - Yes, there are specific guidelines for best practices / incompatibilities between management actions

HAB ET Overall Charge Questions cont.

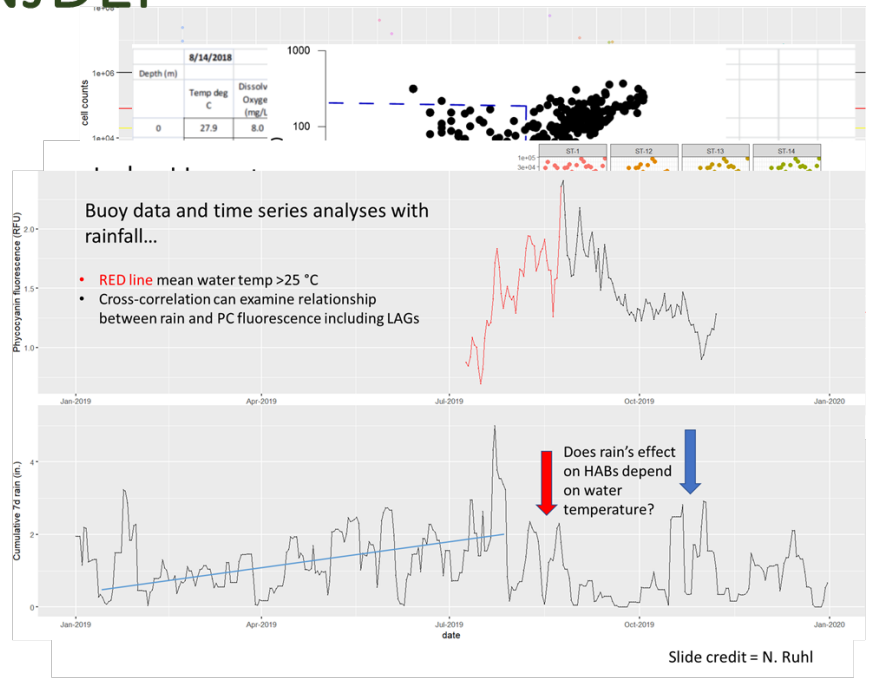
- Encourage Coordination of Pesticide Applications
  - Lake Groups/Homeowners Associations/Consultants
- Timing of Treatment Delivery
  - Varies from year to year
  - Lake specific and within lakes
  - Consider the data needed to make informed decisions on timing

HAB ET Overall Charge Questions cont.

- Weed Harvesting – timing and best practices?
  - Late season harvesting is recommended when the primary goal is to remove nutrients from the system
  - Key factors to determine timing - plant species, temperature and lake activity
  - Implement a plant community monitoring program
    - Provides guidance on need and timing
    - Measure success of previous harvesting
- Lake Winter Drawdowns permitted by NJDEP
  - Suggest evaluating how the lake will respond to a dry versus wet/normal year due to rainfall variability that results from climate change
  - Research – potential long-term impacts in subsequent years following a drawdown

Water Quality Monitoring Guidance Recommendations for NJDEP

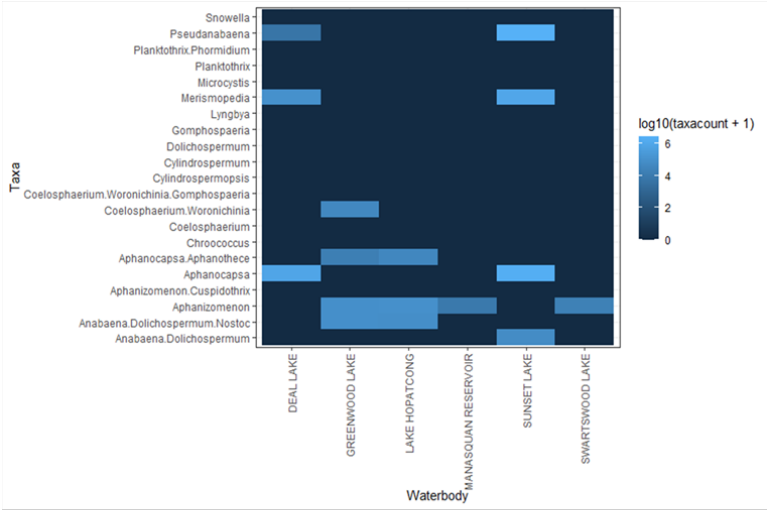
- **Question and Answer Session Held with Key NJDEP Staff**
- Overall Recommendations
  - Shift to more proactive (than reactive) sampling
    - Begin monitoring earlier and continue later – March to October
  - Need targeted vertical profile samples
    - Clearer picture of cyanobacteria biomass, species and nutrients
  - Data modelling / analyses outcomes
    - + relationship between cells / toxins and nutrients
    - Relationship between cell density and toxicity varies among lakes
    - High within (and between) lake variability must be factored into sampling designs
    - Need more concurrent HAB density / toxicity measurements
    - Monitoring platforms hold promise if integrated well with overall sampling program and other data



Slide credit = N. Ruhl

Water Quality Monitoring Guidance Recommendations for NJDEP cont.

- Overall Recommendations
  - Cyanobacterial community composition data recommendations
    - Need depth resolution and additional times of day
    - Proactive (year-round sampling)
    - Current ‘dominant taxa’ focus limits utility of data for community analyses
    - Genomics approaches (qPCR, metabarcoding) should be examined to supplement
  - Climate Change
    - Continued, long-term monitoring is necessary to understand GCC influences on NJ HABs



2023 HAB Expert Team Tasks

- New Jersey HABs Management Plan Guidance Document
  - Guidance for developing a HAB prevention, mitigation and management plan
    - Establishing goals, monitoring , identifying pollution sources, data gaps, etc.
  - Late summer/early fall 2023
- Training Events
  - Focus on HAB prevention, mitigation and management
    - Nutrient sources
    - Actions to prevent HABs
    - Restoration options
    - Treatment options
  - Fall 2023

One Health Task Force: HABs & Agriculture

Sarah Mahmoud

NJ Department of Agriculture

One Health Task Force: HABs & Agriculture

Christine Hernandez, Ph.D.

Eagleton Institute of Politics,
Science & Policy Fellow
NJ Department of Agriculture

New Jersey Department of Agriculture

One Health: HABs & Agriculture

Sarah Mahmoud
One Health Coordinator

Christina Hernandez, PhD
Science Policy Analyst

One Health

"One Health is a collaborative, multisectoral, and transdisciplinary approach — working at the local, regional, national, and global levels — with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants, and their shared environment."
—CDC One Health Office

UN environment programme
Food and Agriculture Organization of the United Nations
World Health Organization
World Organisation for Animal Health
Founded as OIE

One Health to Protect Public Health

Population Increase & Geographical Expansion

Movement of People, Animals, and Agricultural Products

Climate Change: Disruptions in Environmental Conditions

One Health Legislation

(P.L. 2021, Chapter 117)

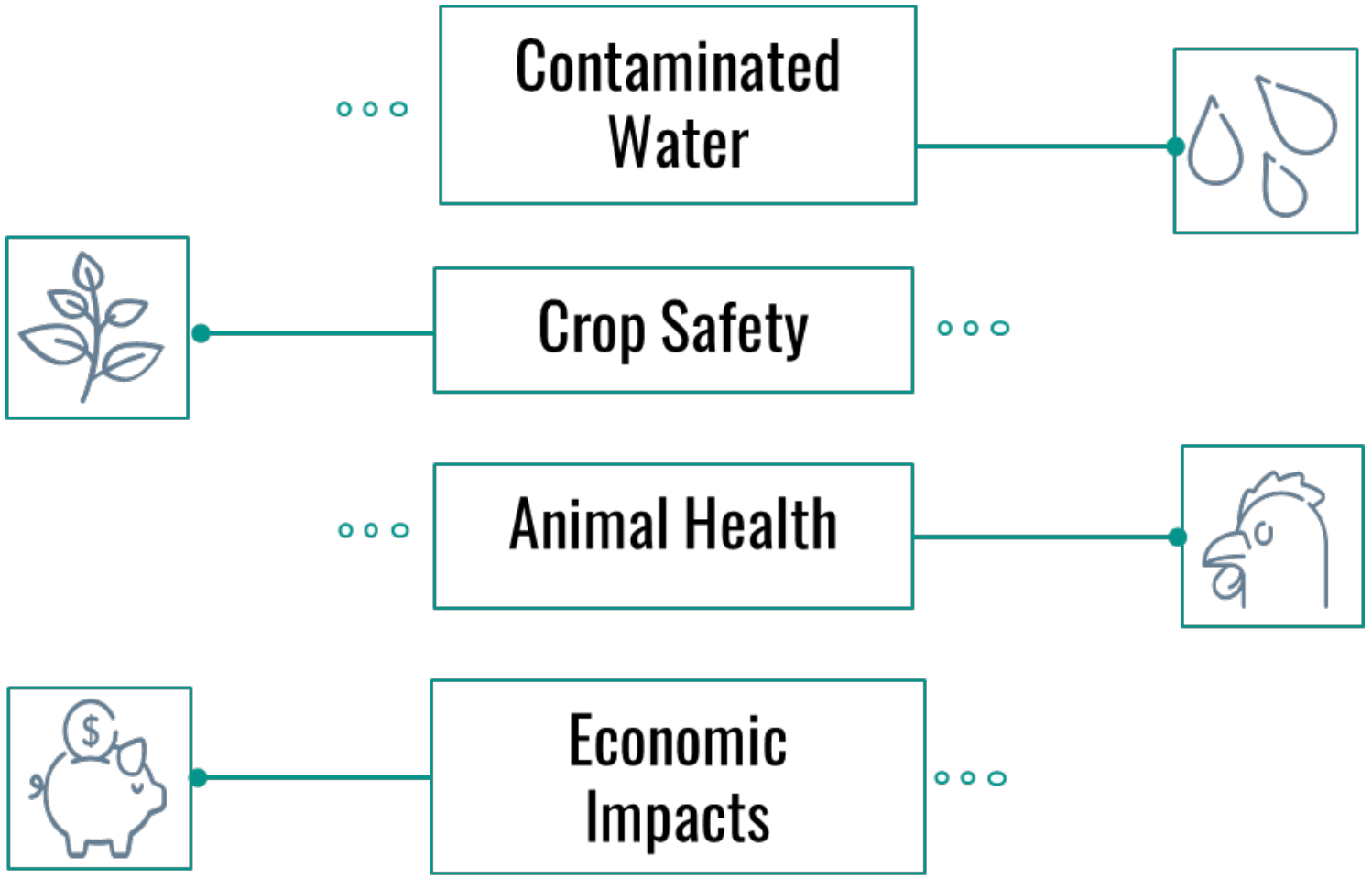
The NJ One Health Task Force shall consist of 13 members:

(1) The Secretary of Agriculture*
(2) The Commissioner of Health*
(3) The Commissioner of Environmental Protection*
(4) Ten Public Members – Interdisciplinary Expertise

*or their designees

Department of Agriculture + **Department of Health** + **Department of Environmental Protection**

HABs: A One Health Issue



The One Health Harmful Algal Bloom System (OHHABS) is a voluntary reporting system available to state and territorial public health departments and their environmental health, or animal health partners.

OHHABS collects data on:

HAB Events | Human & Animal Illness | Foodborne Illness

https://www.cdc.gov/habs/index.html

Agricultural Recommendation #1

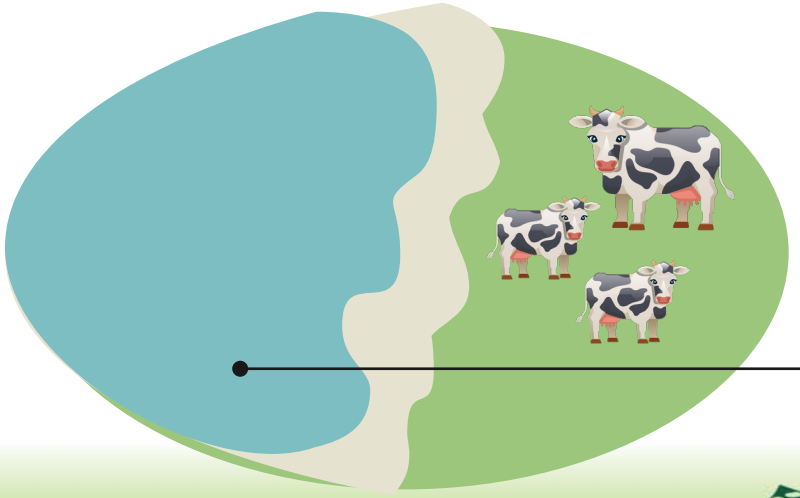
- Testing the soil for nutrient levels *prior* to fertilization
  - Save money & time
  - “Best Management Practices”

Agricultural Recommendation #2

- Planting trees & vegetation as barrier methods
  - Ex. coconut-fiber & different species of grasses
  - Protect against rain-induced runoff

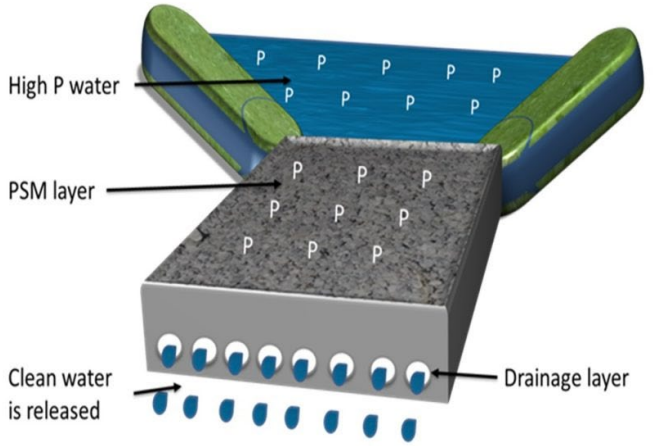
Agricultural Recommendation #3

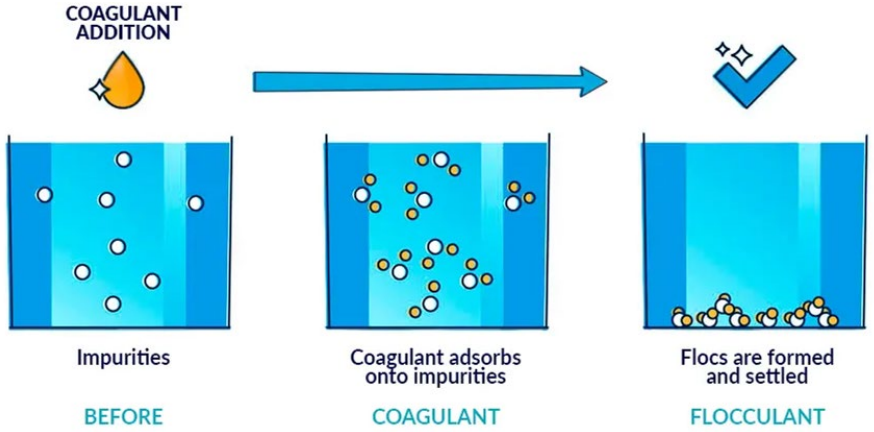
- Lining manure piles
  - Protect soil from manure contamination
- Lining personal watering holes
  - Protect water from soil leaching



Agricultural Recommendation #4

- Remediation Options:
  - Phosphorous traps
    - Built to direct runoff to specific locations where absorption facilities will be waiting
  - Flocculating agents
    - Cyanobacteria cells coagulate together, net-like, causes them to sink to the bottom of the body of water

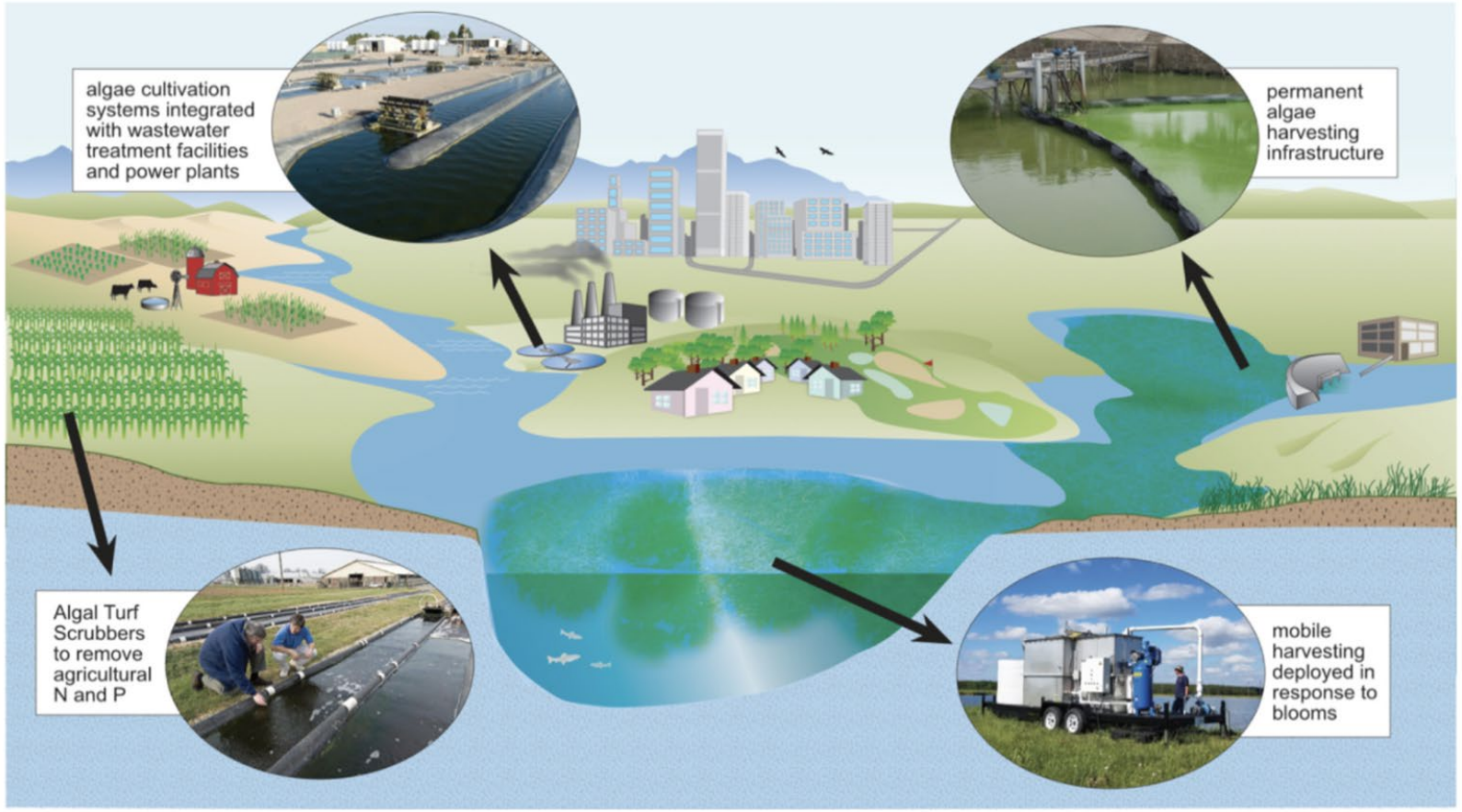




Agricultural Recommendation #5

- Monitoring Programs
- Restoring Wetlands to provide natural filtrations systems
  - Effective
  - Ex. Ohio invested $90M to restore, enlarge, & construct wetlands→ removed 90% of phosphorus

HABs in the Future

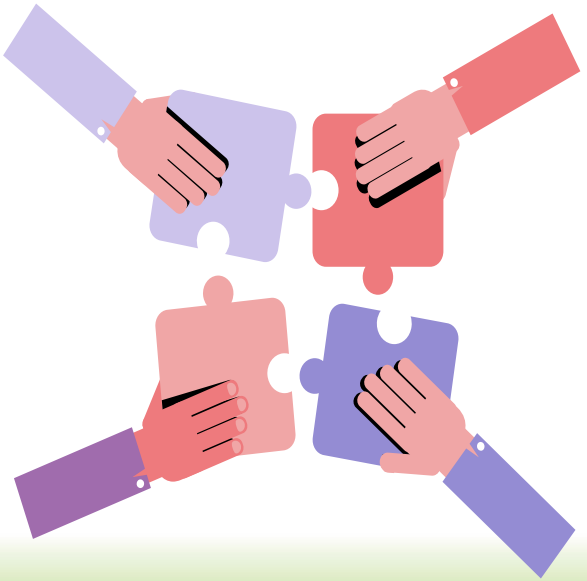


Corcoran et al., Algal Research, 2021.

Conclusions

- HAB events are a One Health issue
  - Affecting humans, animals, plants, & environments
- There are minimal options for remediation
- Prioritize preventative & proactive measures

Now it's up to you!



Questions?

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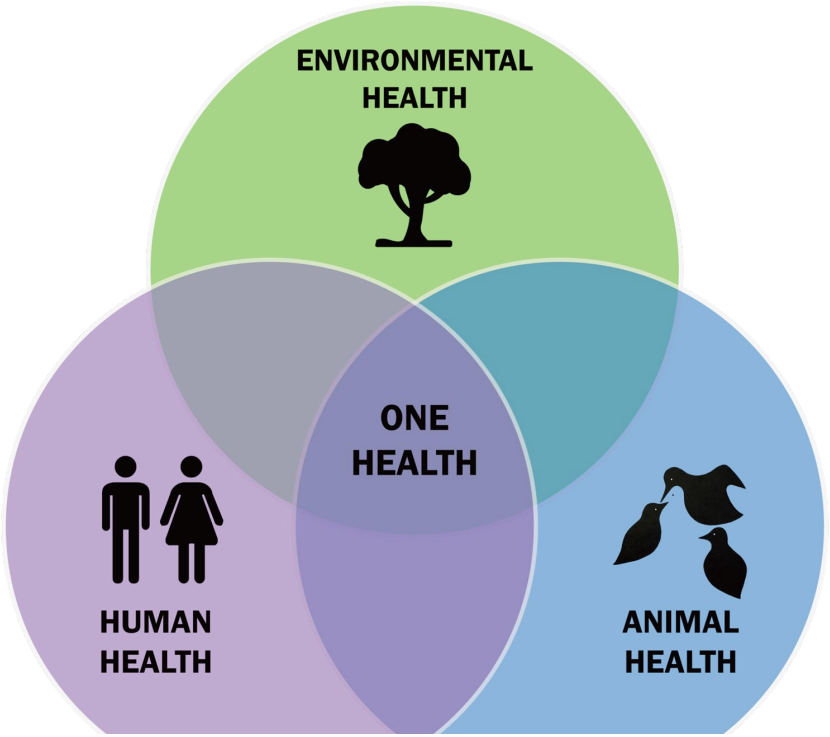

Closing Remarks

Patricia Gardner

Assistant Commissioner
Water Resource Management
NJDEP