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Lake Oscawana 2025 Monitoring Report

Prepared for the Town of Putnam Valley, NY
& Lake Oscawana Management Advisory Committee (LOMAC)

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Executive Summary

- The March clarity was very poor at all stations. There was no ‘clear-water’ phase observed in late spring 2025; no clarity measurements exceeded 3.0 meters.
- The temperature sensor data from 2024 and 2025 were compared in detail. There was no major temperature change from one year to the other, and water temperature did not directly explain the poor 2025 water quality.
- Anoxia in 2025 was generally more severe than normal; the anoxic boundary was higher than the established 6m target maximum. Greater anoxia presented higher than normal internal nutrient loads for 2025.
- The total nitrogen in the lake was very high, unlike values seen in many years.
- Total phosphorus was also higher than normal throughout the lake for most of the 2025 season.
- The dominant cyanobacteria taxa present throughout the 2025 season were *Planktothrix*, *Dolichospermum, Aphanothece,* and *Planktolyngbya*.
- We recommend that records of opening and closing the outlet pipe be kept in a spreadsheet and reported to LOMAC annually for long-term record-keeping. This will help develop a data-driven procedure for determining when and how much to adjust the outlet pipe to fine-tune the lake water level. We also recommend installing a continuous water-level sensor logger for a period in 2026, to track subtle changes in water level resulting from rainfall.
- Aquatic plant biomass and species diversity were low in 2025; no rooted invasive Eurasian milfoil was found. Native plant coverage and density have declined considerably over the past several years due to the additional stocking of grass carp in 2021. Native Tapegrass (*Vallisneria americana*) is the primary remaining native submersed aquatic plant in the lake, while surface floating-leaf Waterlilies remain widespread.
- We recommend that LOMAC open conversations with NYDEC regarding Grass carp removal in 2026 and/or 2027. Small numbers of grass carp removal from the lake will reduce the number of seasons where plant growth is considerably reduced. The high total nitrogen in the lake in 2025 could be related to changes in nitrogen cycling in the littoral zone related to the considerably reduced plant growth in 2025.
- Mechanical harvesting in 2025 targeted cyanobacteria mat removal, particularly in Wildwood Cove. Small pieces of cyanobacteria mats were observed floating in recently harvested areas. Sediment disturbance from the mechanical harvester operations is an ongoing concern for water quality, particularly in the absence of dense aquatic plant growth lakewide. Harvesting should not disturb wetland areas and established waterlily beds without wetlands permits.
- The Lake Oscawana surface water quality index score for 2025 was 4 out of 12 possible points, an overall poor value. The 2024 score was 8 out of a maximum 12 points.
- We recommend a multi-year effort to collect and organize the watershed septic systems and pumping information from the County Health Department into a working spreadsheet that can be used to create a map-database to aid in Town septic pumping compliance and tracking system inspections and upgrades.

Introduction

Applied Watershed Sciences (AWS) was hired to perform water quality sampling and management consulting for Lake Oscawana in 2025. Please refer to the *Basic Lake Monitoring Parameters Descriptions* Appendix for a refresher on lake terminology and general explanations of the various monitoring components.

In-situ profile measurements were taken using calibrated probes at 1-meter increments from top to bottom of the water column at three stations. Temperature, dissolved oxygen (DO mg/L), and dissolved oxygen percent saturation (DO%) were the primary monthly profile parameters; other profile parameters measured throughout the season included specific conductivity (SPC), pH, and algae pigment fluorometry. The algae fluorometry provided values for total chlorophyll (CHL) and total phycocyanin (PC) in both relative fluorescence units (RFU).

Water samples were collected from four distinct depths in the water column at the deep hole site (Station 1): 1 (top), 4, 6, and ~9.5m (consistent bottom depth relative to sediment depth). Top and bottom water samples (1m and ~7m) were collected from Stations 2 and 3.

Samples were all tested for total phosphorus (TP). Total nitrogen (TN) was tested on St1 samples. Ammonia nitrogen (NH3) was only tested in bottom water St1 samples on select late summer dates; Nitrate+nitrite nitrogen (NOx) was tested on select samples.

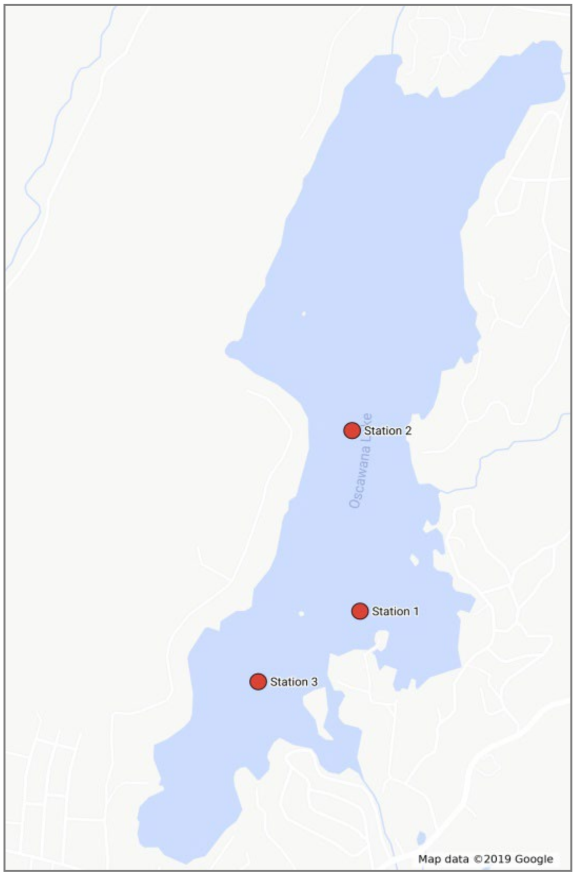
Station 1: The "Deep Hole" is approximately 35-ft deep and is the primary water quality monitoring site. The St1 temperature buoy and line of sensors was placed out of the main navigation channel but still in ~32ft of water.

Station 2: The northern monitoring station is located in approximately 27-ft of water.

Station 3: The southern station is also located in roughly 26-ft of water and represents water quality near some of the most populated and disturbed areas of the lake.

All water quality monitoring stations are too deep to support the growth of aquatic plants. All stations experience a loss of oxygen from late spring to late summer in bottom waters. At specific points during the season, the three sites have differed substantially depending on variable lake conditions.

Map 1. Sampling Sites



Water Clarity

Data collected in 2025 is displayed below. All measurements were taken with a view scope. The March clarity was very poor at all stations. There was no ‘clear-water’ phase observed in late spring 2025; no clarity measurements exceeded 3.0 meters. Late July to early October clarity measurements were worse or very near the 2m critical threshold. Secchi measurements less than 2m at Oscawana indicate high algae turbidity and high likelihood for cyanobacteria blooms in summer and fall.

Figure 1. 2025 Water Clarity (Secchi Measurements in meters)

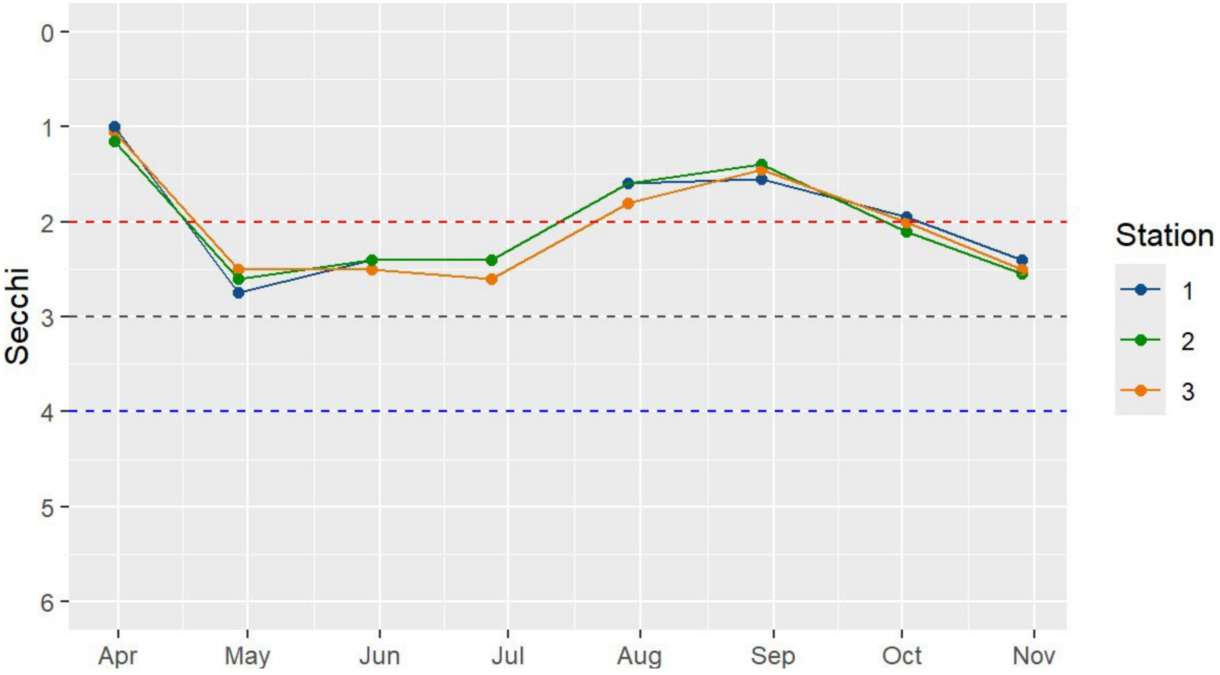
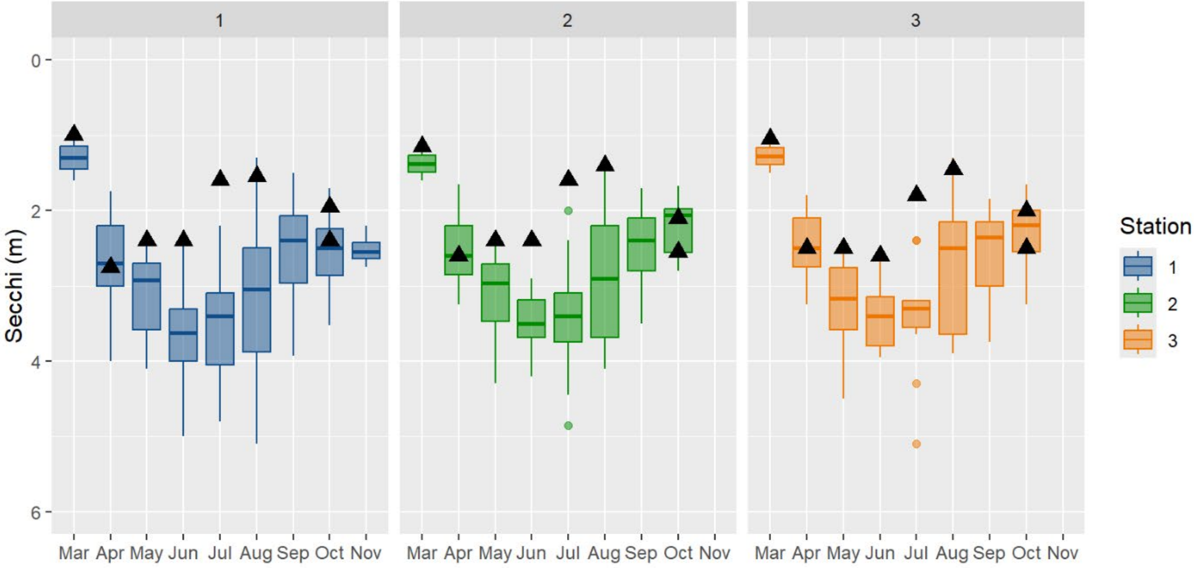


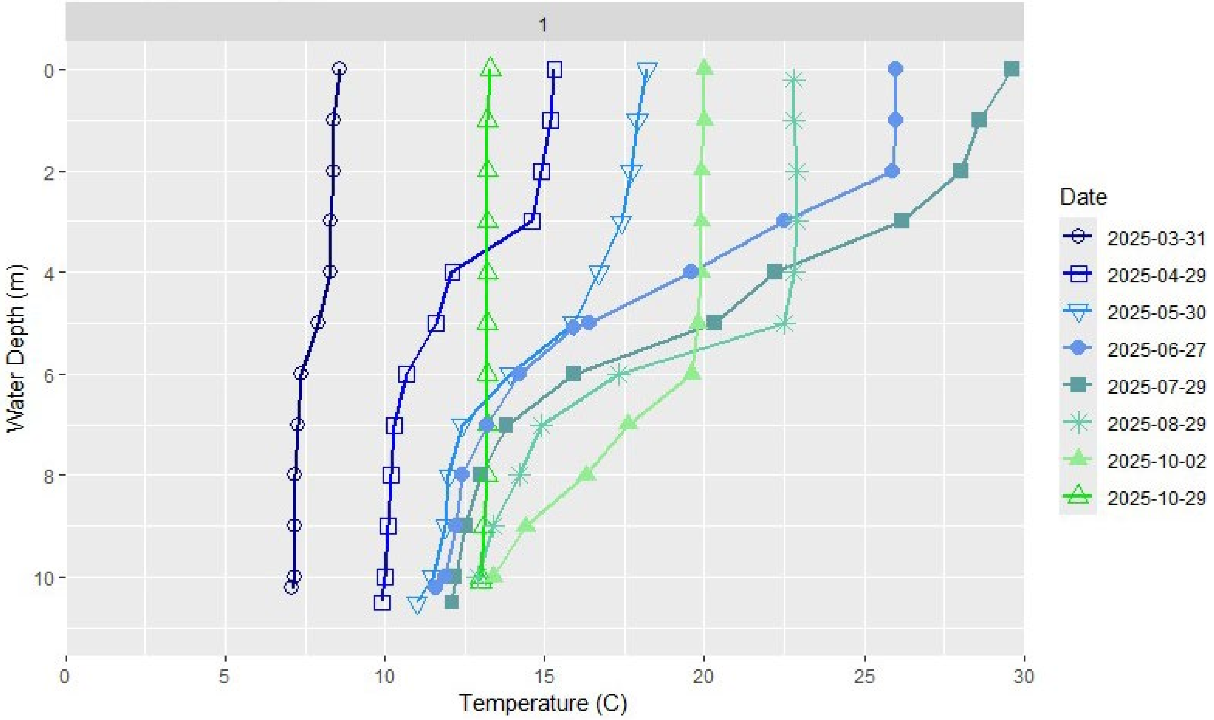
Figure 2. 1995-2025 Box Plots compared to 2024 Values by Station (black triangles)



Temperature

The 2024 water temperature profiles measured at Station 1 are shown in Figure 3. Profiles show that the lake was thermally mixed during the late March sampling visit. The lake had begun to thermally stratify by the end of April. The surface waters reached their maximum temperature in mid-July, exceeding 30°C for a short period, as shown by the continuous temperature logger sensor data (Figure 4). Peak summer surface temperatures were similar to 2023. The lake cooled considerably by September, with a deepening of the thermocline and uniform temperature between the surface and approximately 6 meters.

Figure 3. 2025 Temperature Profile Measurements at Station 1



Temperature data loggers were deployed again in 2025, at the same locations and depths as in 2024. The 2025 duplicate surface temperature data loggers showed excellent correlation, and the two loggers were typically no more than 0.25 degrees Celsius apart; and less than half a degree difference across all measurements.

In the 2024 annual monitoring report, AWS noted that the mid-depths sensor data at Oscawana showed higher than typical daily fluctuations. The reasoning was unclear but possibly related to a wide, dynamic thermocline and lake seiche. The 2025 six-meter data also recorded an interesting change in daily fluctuation throughout the season, where the daily range increased as the thermocline became weaker in late August to September (Figure 5). The 2024 and 2025 depth-specific logger data is shown as an overlay comparison in Figure 6. AWS has documented in other waterbodies that internal nutrient loading changes based on water temperature. It is likely that years where sediments in the 6-7m depth range warm earlier in the season, would have higher annual P loads in that season. Higher rates of sediment P-release are associated with warmer temperatures. The 2025 4-8m depths were warmer in June and early July compared to 2024, but by mid-July, those depths were actually cooler than in 2024. Overall, the temperature to internal nutrient load relationship is not clear for Oscawana at this time.

Figure 4. 2025 - St1 Temperature Loggers Data

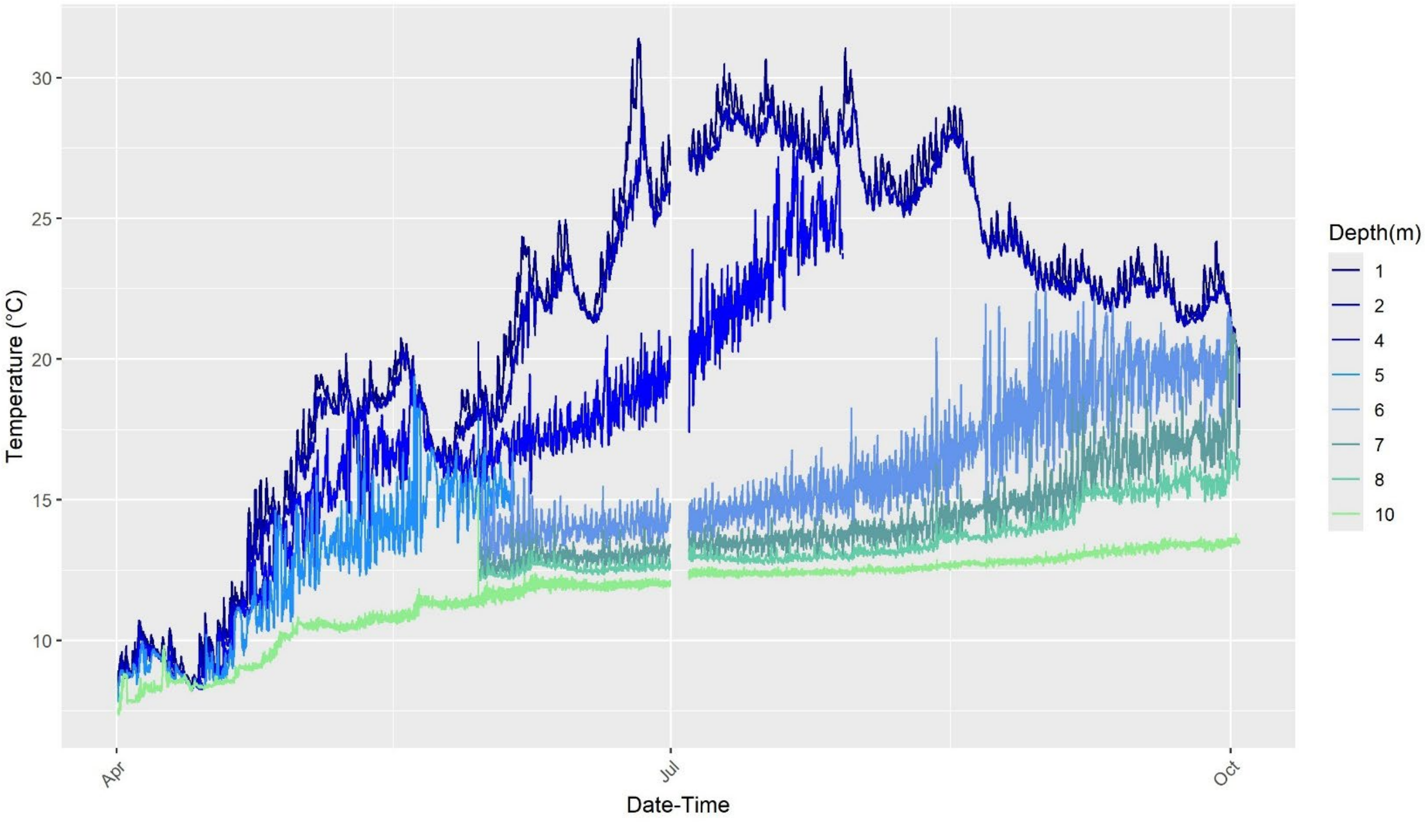


Figure 5. 2025 Temperature Data 6m Logger Results

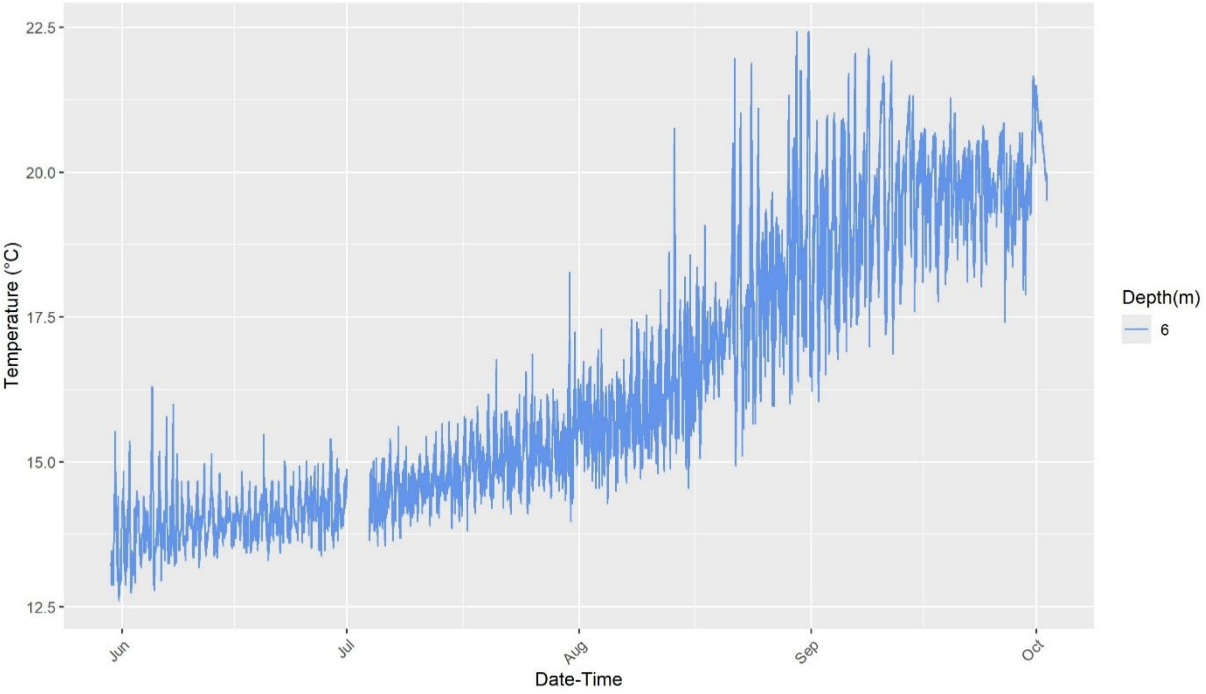
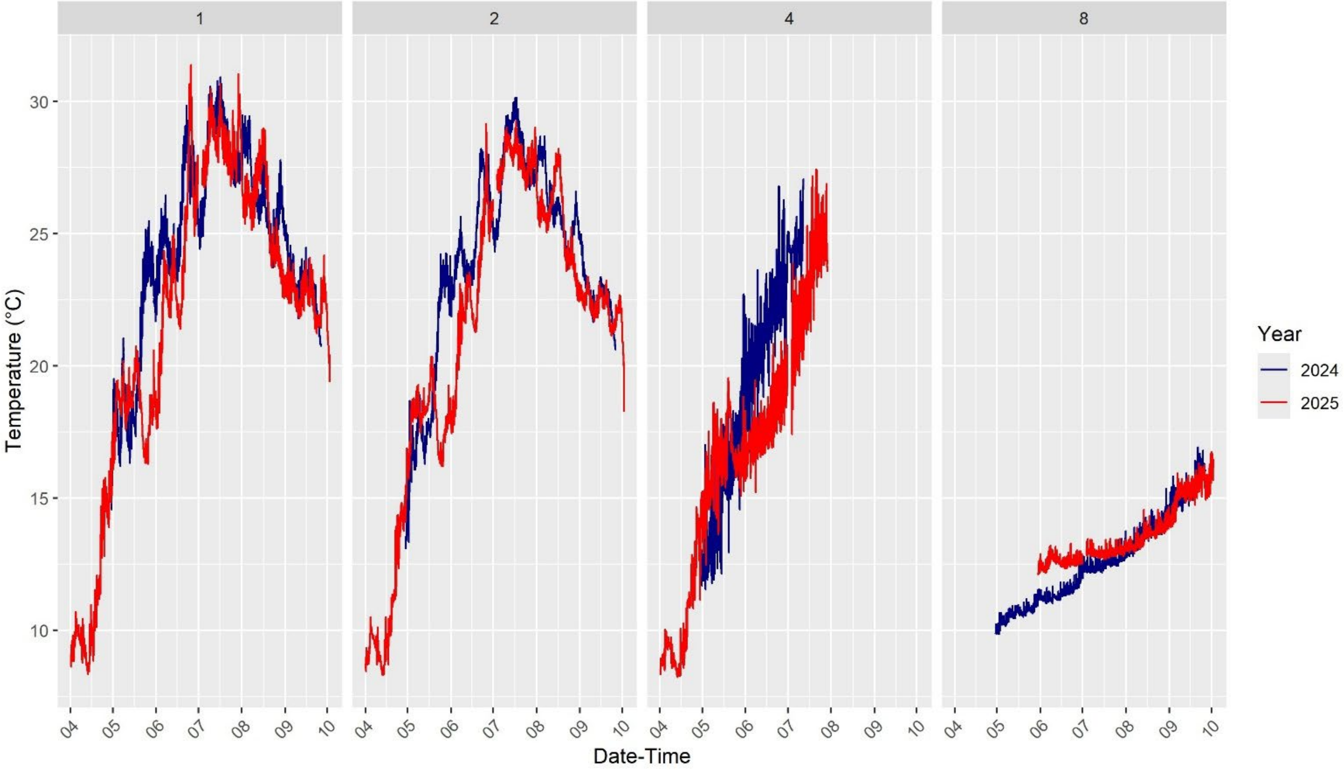


Figure 6. Temp Logger Data 2024-2025 Compared by Select Depths (meters as headers, months x-axis)



It does not appear that temperature substantially influenced the higher phytoplankton and reduced 2025 clarity.

Dissolved Oxygen

2024 recap: The first 2024 monitoring date on 03/20/2024 already showed some reduction in hypolimnetic dissolved oxygen (DO in mg/L). Anoxic water was present below 8 meters by the end of May 2024. The peak period of anoxia was later in the season than normal in 2024, at the end of August. The anoxia in late July was lower in the water column than it normally is in that time period.

2025: Anoxia reached roughly the 5m contour at Stations 2 and 3 in 2025. This is considerably worse than normal levels of anoxia. The target seasonal maximum for anoxia is 6m. Anoxia was also worse than normal at Station 1. This level of anoxia, where the anoxic water extends into the central and upper thermocline zone, allows phytoplankton much more access to internally-loaded nutrients than if the anoxia was below 6m all season. At this time, it does not appear that the higher anoxia was directly related to temperature and earlier stratification in 2025. The lake may have, instead, just had a higher overall organic matter deposition and decomposition rate in 2025. Water clarity was very poor and phytoplankton biomass was high in March 2025, this could have also led to overall higher rates of oxygen consumption in 2025, compared to normal levels. Reduced aquatic plant growth may also affect the lake's overall oxygen seasonal dynamics.

Figure 7. Station 1 Dissolved Oxygen Monthly Profile Measurements 2025

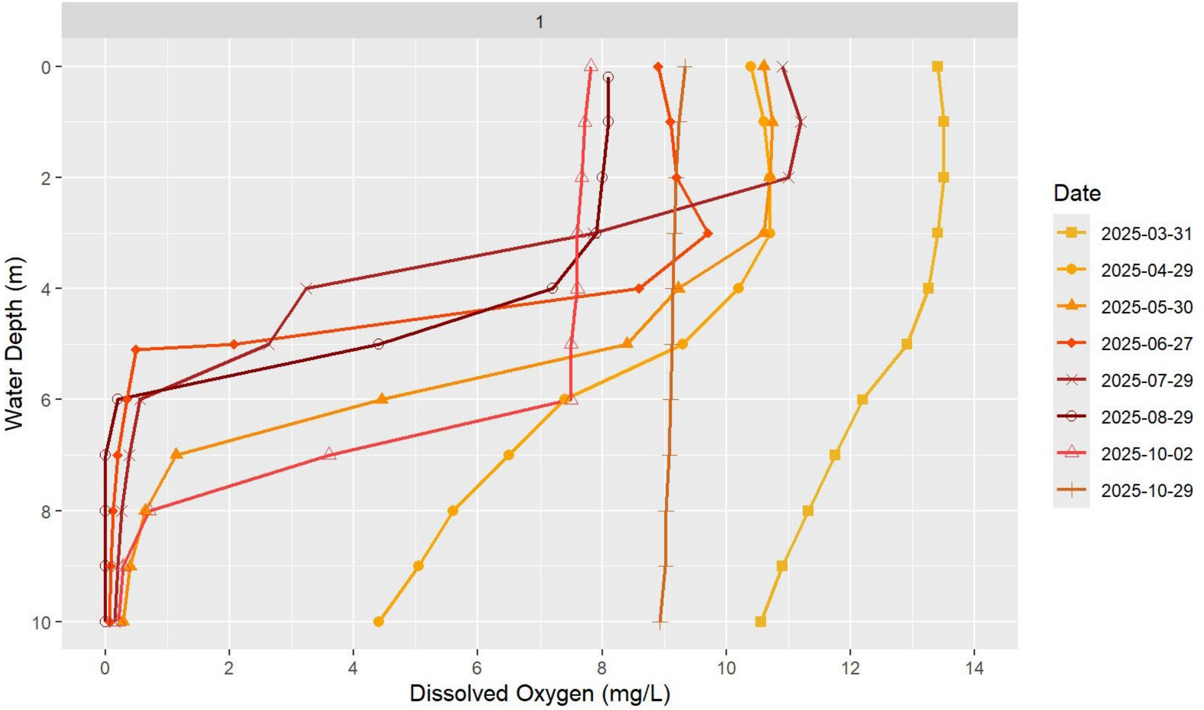
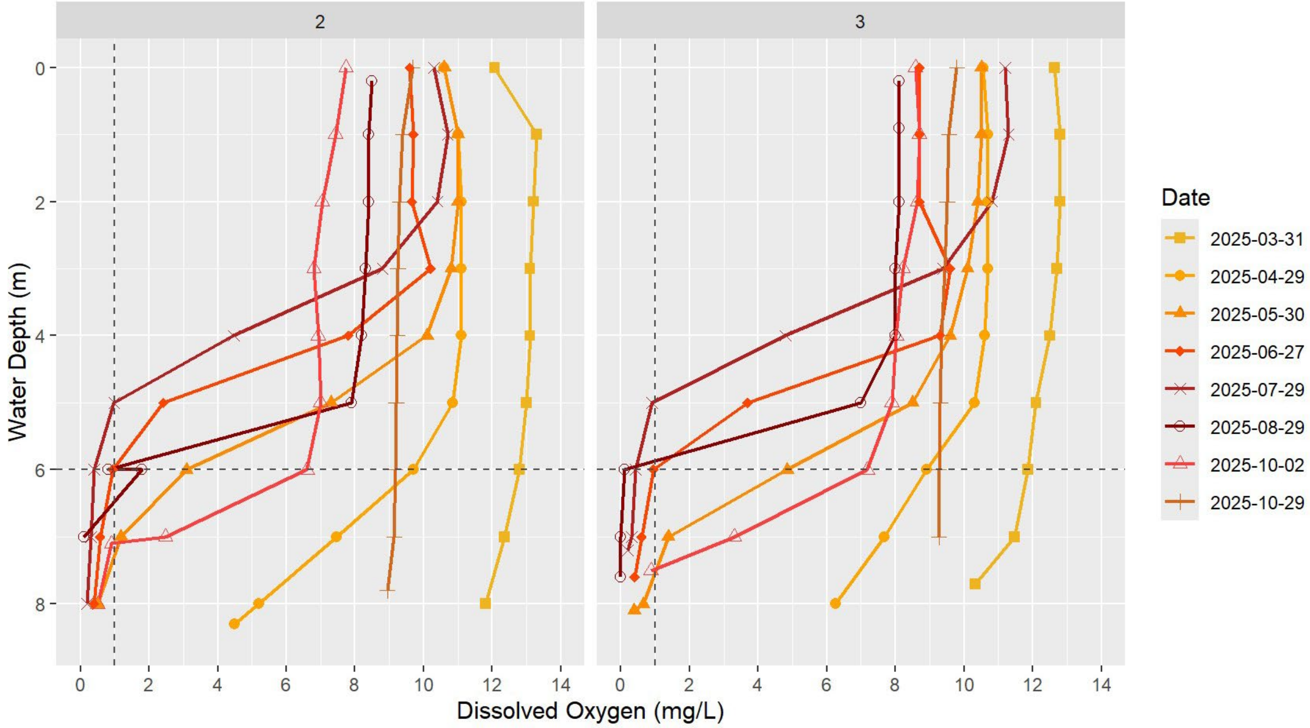


Figure 8. Station 2 & 3 Dissolved Oxygen 2025

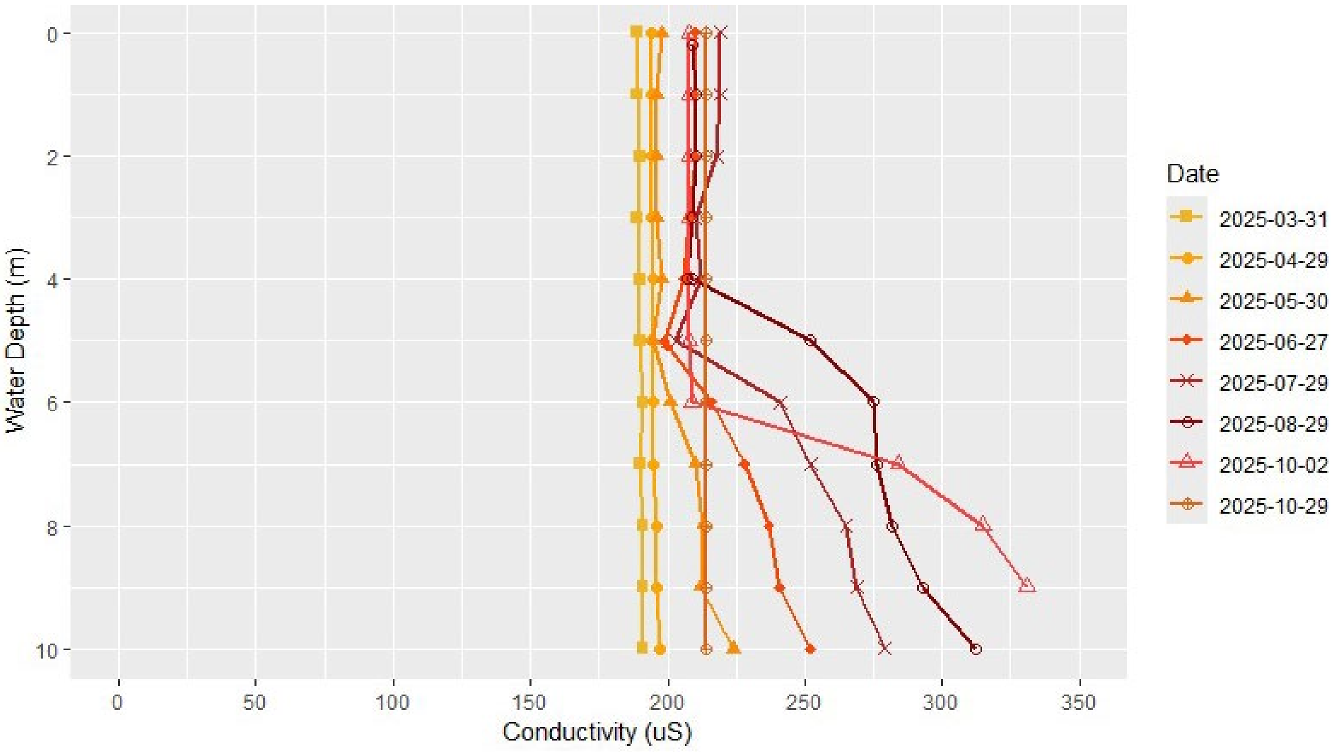


Specific Conductivity

Specific conductivity was measured as a profile measurement at each station throughout 2024 and 2025. Data from both years show a seasonal hypolimnetic increase in conductivity coinciding with anoxic bottom-water conditions and the release of ions from sediment (such as phosphate). Most historical surface measurements exceeded 225 µS/cm², and the range of surface measurements in 2024 to 2025 was considerably lower than historical data. Surface conductivity in 2025 ranged from 182 to 220 µS/cm² across all three stations. The range of bottom-water seasonal increase in conductivity was very similar to 2024 data.

Background conductivity concentrations are dependent on the soils and geology of an area. Conductivity is also related to road-salting and salt runoff from watersheds. It is also sometimes associated with septic system leachate. Many northeastern lakes are experiencing increases in conductivity over time, but that is not clear at Oscawana. The range of values measured at Oscawana is not concerning for aquatic life. A range of ±30 µS/cm² in surface waters over a season is expected for Oscawana, and precise probe calibration is essential for highly accurate results. AWS probes are calibrated with low and high-conductivity standards, and calibration is verified using lab-grade deionized water.

Figure 9. Conductivity Profiles 2025 (Station 1)

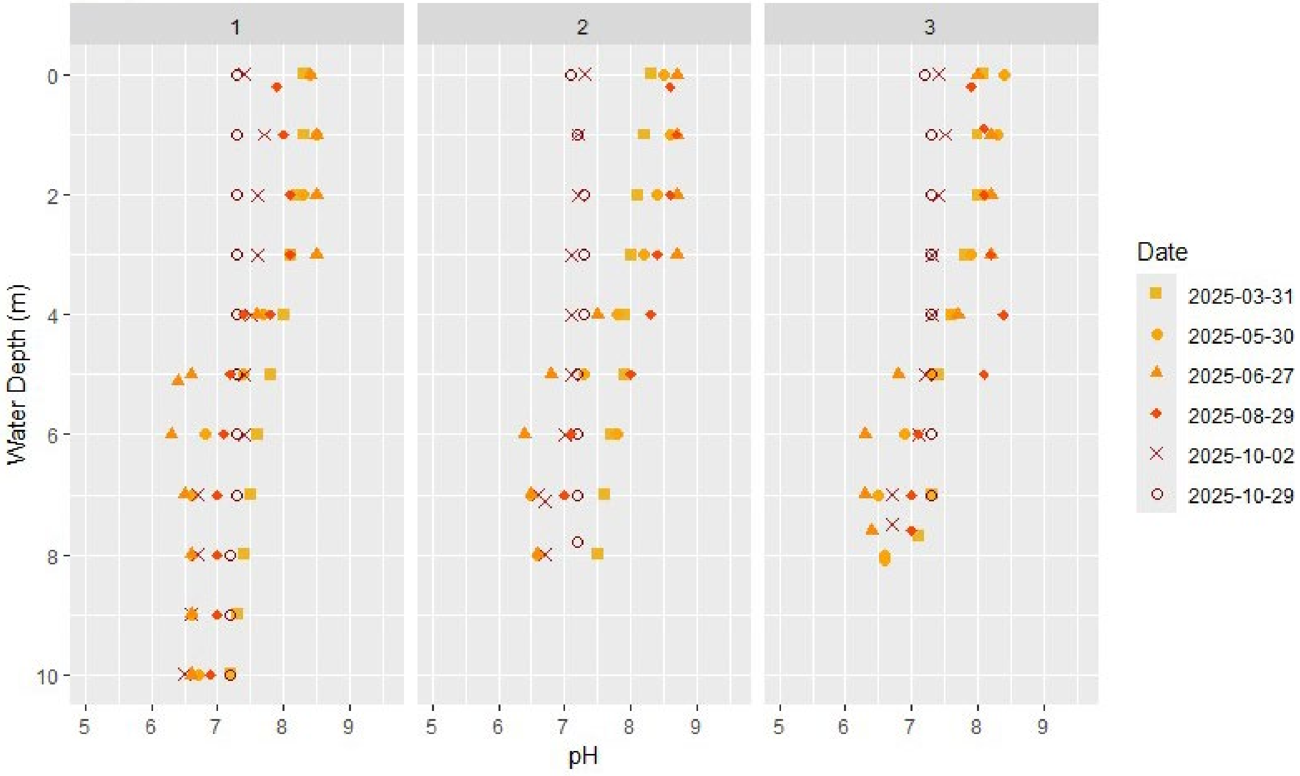


pH

The pH profiles measured at Lake Oscawana in 2025 were considered normal. In summer, pH values greater than 8 on the surface may result from increased phytoplankton and photosynthetic consumption of dissolved CO_2. Cyanobacteria can both cause and thrive in high >8.5 pH conditions. There were several summer values that exceeded this range.

As mentioned in the 2024 report, understanding the seasonal pH range from the top to the bottom of the water column is particularly important if in-lake phosphorus-binding treatments are to be considered in the future. Historically, the NY Department of Environmental Conservation (NYSDEC) has not permitted such in-lake treatments, but various pilot projects were done in recent years, and NYDEC may begin to allow more phosphorus-remediation treatments in the future. The pH of a lake dictates the potential dosage buffering requirements of any future aluminum-based phosphate-binding treatments. It is also essential to monitor real-time pH during any such future treatment. If Oscawana is to be considered in the future for a treatment project, NYDEC would require adequate pH data in the application and justification for dose determination. In addition to pH, AWS recommends total hardness and Dissolved Organic Carbon (DOC) measurements in 2026 in spring and summer (two dates at St 1). These combined parameters are used to establish a modeled maximum total aluminum concentration criteria for permitting phosphate binding treatments, if that were to be pursued in the future.

Figure 10. 2025 Station 1-3 pH profile measurements

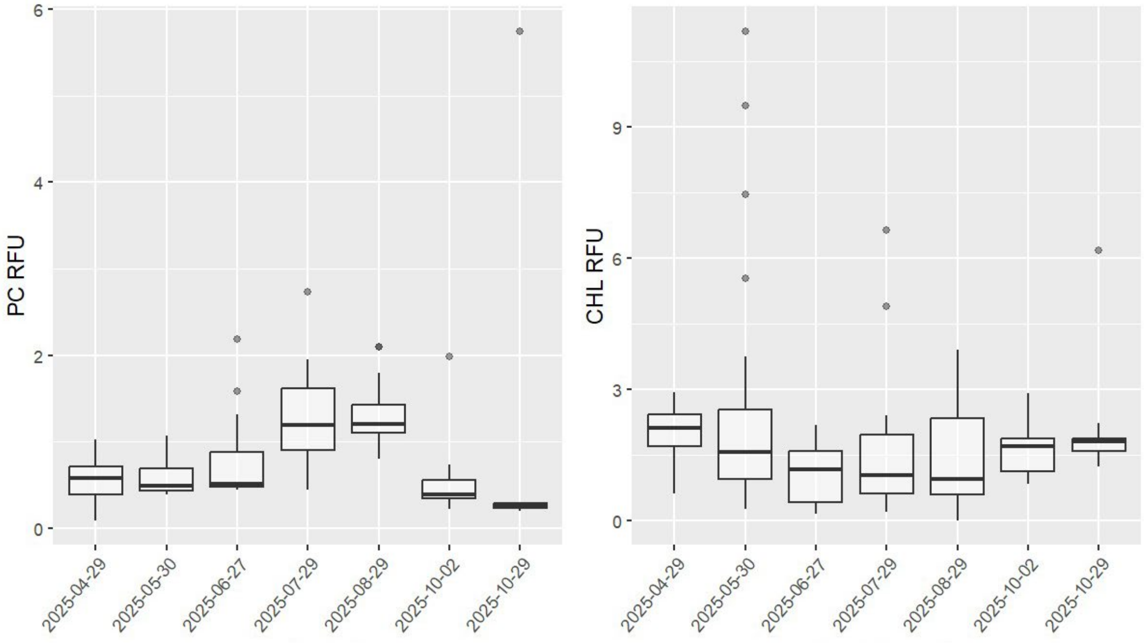


In-situ Algae Pigments

Algae fluorometry monitoring was done using a YSI dual-pigment algae probe and meter. This probe provided in-situ values for total chlorophyll (CHL) and total phycocyanin (PC) in both relative fluorescence units (RFU) and as calculated µg/L concentrations using a YSI concentration model internal to the meter. Fluorometry is calibrated using rhodamine dye standards and deionized water. PC data from 2024 was shown in the 2024 report in µg/L rather than RFU, but RFUs are reported by all types of algae pigment sensors, whereas only some sensors convert RFU to modeled µg/L concentrations. For that reason, AWS has decided to use RFU at Oscawana for reporting herein. PC is a pigment that is produced by freshwater cyanobacteria. In situ fluorometry can provide relative, qualitative information about phytoplankton biomass and distribution in the water column. Elevated PC fluorometry can also serve as an early indicator for cyanobacterial blooms. Many lake monitoring programs use PC & CHL measurements to determine if there is an elevated risk to swimmers during active cyanobacteria blooms along the shore. PC and CHL fluorometry measurements skyrocket under dense-bloom conditions along the shore, as cells in the water coalesce into surface scums.

Some cyanobacterial blooms begin lower in the water column, forming layers before migrating to the surface to form scums. PC monitoring shows deep layers of cyanobacteria, if they are present, before surface blooms occur. But at Oscawana, no distinct, concentrated cyanobacterial layers have been detected thus far. It seems that bloom development is more of a whole-water-column event in this case. There have been generally consistent increases in algae pigment in the lower part of the water column, and the highest values have often occurred directly above the sediment at each station in 2024 and 2025. If in-situ fluorometric PC or CHL > 6 RFU at a certain location or depth, it warrants taking an additional deep-water algae sample at that specific depth. AWS believes that algae pigment fluorometry is most useful for seasonal pre-bloom predictions, rather than for long-term comparative analyses. This is because the PC and CHL RFU range is highly variable and dynamic. However, these measurements will also help decide whether future use of algaecides would make sense for Oscawana, and to monitor potential effectiveness.

Figure 11. In-situ St 1 Total Algae Sensor Fluorometry for Phycocyanin (PC) and Chlorophyll (CHL) in RFU



Plankton

Phytoplankton

Phytoplankton samples are collected as integrated samples from the top three meters of the lake in open water at Station 1. Identification and cell counts are done via microscope at the lab post-sampling. Viewers should note that Diatom algae cells are typically much larger than cells of Cyanobacteria and some Green algae. Therefore, a smaller number of Diatom cells can correlate to reduced water clarity. The World Health Organization and US Environmental Protection Agency provide guidance on cyanobacteria exposures and toxins presence. The consensus is that when cyanobacteria cell counts are less than 20,000 per mL, the risk of recreational contact exposure to cyanotoxins is low. Shoreline surface accumulations of cyanobacteria are the greatest risk for swimmers, particularly children and pets and accidental swallowing of water. If the water in a swim area is generally clear of wind-blown surface accumulations and has no observable macroscopic chunks or floating mats, the risk of acute cyanotoxin exposure is generally low.

Cyanobacteria and green algae were present throughout most of the 2025 season. During the July and August sampling visits, small cyanobacteria shoreline surface accumulations were present along multiple shoreline zones. When surface scums appear, the open-water samples do not always correspond to shoreline conditions. Additional phytoplankton samples were taken from the south basin near Hilltop beach in July, where the dominant cyanobacteria observed was Microcystis and *Dolichospermum*. The dominant cyanobacteria taxa present throughout the 2025 season were *Planktothrix, Dolichospermum, Aphanothece*, and *Planktolyngbya*. *Microcystis* and several other taxa were also present in surface samples and occasionally in open-water samples. Ample organic matter and non-algal fine material in the water column were also present in all samples. Cell counts from the St1 open water epilimnion site were lower than expected based on shoreline accumulations observed in July and August 2025. It is possible that calm weather allowed cyanobacteria to accumulate on the surface near shore, thus reducing open water cell density during the time of sampling. This occurs most observably with larger colonies of *Dolichospermum* and *Microcystis*.

Table 1. 2025 Station 1 Phytoplankton Algae Counts (cells/mL by group)

2025	**4/29/2025**	**5/30/2025**	**6/27/2025**	**7/26/2025**	**10/2/2025**	**10/29/2025**
Cyanobacteria	5,800	7,647	16,000	13,588	10,700	10,437
Green algae	5,720	21,705	4,118	5,412	4,950	7,313
Diatoms	580	117	0	0	950	0
Chrysophytes	0	0	0	0	0	0
Dinoflagellates	0	0	0	0	0	0
Euglenophytes	0	59	0	0	0	0

Photo 1. July 26, 2025. Green water with visible small patches of cyanobacteria mats at surface.

Zooplankton

Rotifers have been the dominant zooplankton present in Lake Oscawana in most months of both 2024 and 2025. They are smaller than most other zooplankton. It is typical for rotifers to be present and potentially exceed 300 organisms per liter at Oscawana, but it is less common for the rotifers to exceed 600 organisms per liter, based on historical zooplankton data at Oscawana. High Rotifer numbers are typically associated with more eutrophic waterbodies with lower flushing rates. Rotifers are known to respond quickly to environmental and ecological changes. Reduction in aquatic plant biomass, extreme weather events (droughts vs. floods), and other water quality variables will all affect zooplankton populations, including rotifers.

Adult Copepod abundance was moderately higher in 2025 than compared to 2024 across the season. Cladoceran abundance was higher in 2025 than in 2024, but similarly dominated by smaller size classes, mostly less than 0.5mm and almost all less than 1.0mm. Oscawana experiences frequent shifts in when either Copepods/Copepod nauplii or Cladocerans are dominant. There was a definitive boom in Cladoceran and Rotifer population following fall lake turnover. The crash in August and September zooplankton overall may suggest impacts from toxic hydrogen sulfide that had accumulated in the hypolimnion. Because zooplankton abundance was moderate in other periods of the summer, the late summer decline seems unrelated to excessive alewife predation in 2025.

Figure 12. 2024 – 2025 Total Rotifer Counts

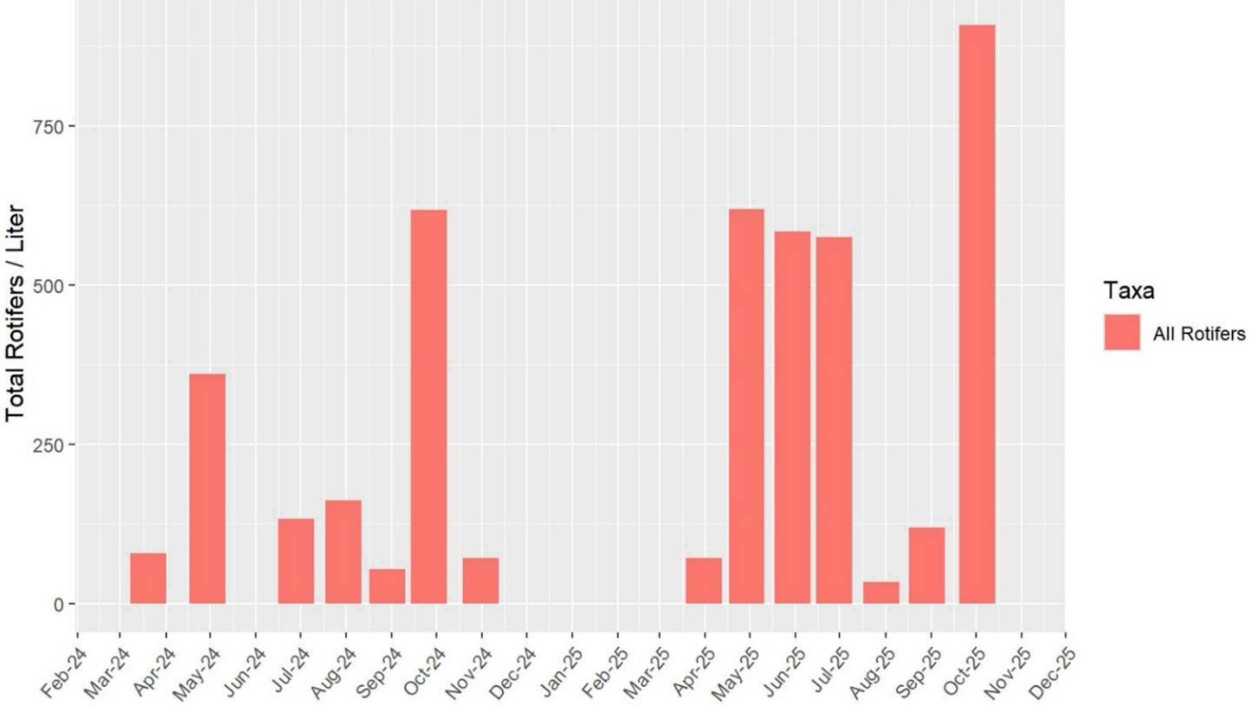
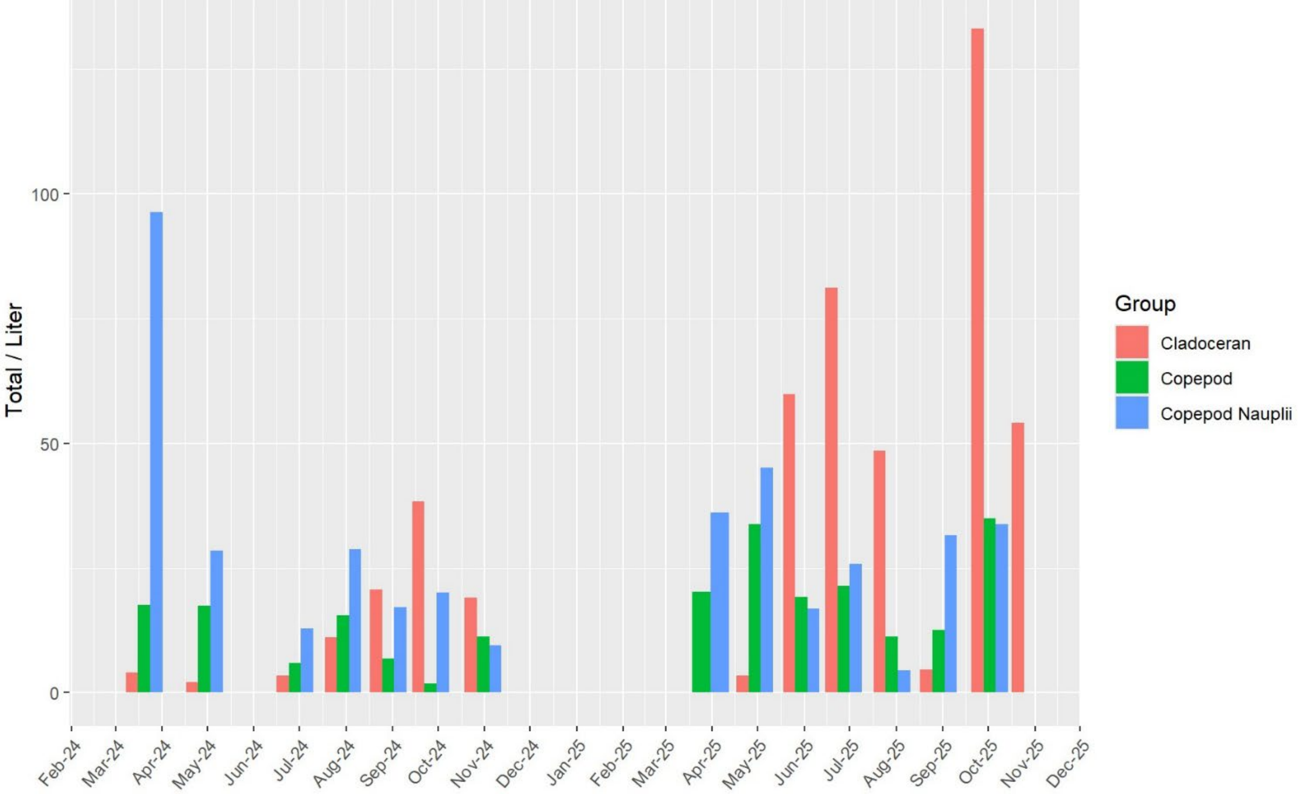


Figure 13. 2024 – 2025 Totals Other Zooplankton Groups



Nutrients

Nutrient samples were collected monthly from the three long-term monitoring stations. Total phosphorus (TP) was measured at four depths at Station 1, and at the top and bottom of Stations 2 and 3. Total nitrogen (TN) was only measured at Station 1. The bottom samples were taken relative to the bottom depth on each date. Nutrient results are shown below in Table 3. Surface TP across the season was high at all three stations, with the exception of one sample at Station 1 at the end of August. All surface samples taken at the stations in 2025 exceeded the target threshold of 20 µg/L TP for surface waters. Several samples also exceeded the 30 µg/L TP critical eutrophic threshold. Only a few samples from Station 1 since the early 2000s have exceeded this critical TP threshold. There has been a generally increasing trend in surface TP over the last three years, coinciding with the rapid decline of lake-wide vegetation as it is eaten by grass carp.

Table 2. Laboratory Total Phosphorus Concentrations 2025 (µg/L)

Total Phosphorus								
Depth_m	3/31/2025	4/29/2025	5/30/2025	6/27/2025	7/29/2025	8/29/2025	10/2/2025	10/29/2025
Station 1								
1	24	*21*	*26*	*25*	28	12*	*32*	36
4	26	25	37	47	34	27	30	31
6	34	34	69	55	57	250	35	32
9.5-10.2	41	74	240	384	-	1088	822	34
Station 2								
1	27	21	26	28	34	20	29	27
7-7.5	29	29	29	180	289	387	284	26
Station 3								
1	24	23	28	24	28	25	32	33
6.5-7.7	37	35	120	237	414	536	97	32

[Concentrations displayed in µg/L, ~ppb equivalent; NSS = Not Sampled, ND = Not Detected (below laboratory detection limits; * = possible laboratory error, - = lab error]

When summer surface TP exceeds 20 µg/L (ppb), there is an increased risk of algae and cyanobacteria blooms. It is common for surface TP to exceed 20 µg/L in early spring at Lake Oscawana due to high spring watershed loading following snowmelt. Late summer to fall high surface TP at Oscawana is typically associated with internal sediment nutrient loading, as evidenced by an annual increase in bottom-water (6-10m) TP. Following the fall lake water column 'turnover', some of the bottom-accumulated nutrients are mixed into surface waters – evidenced by the increase in surface TP in October 2025. Figures below show the range of annual values as boxplots by Station (Figure 14) and combined (Figure 15).

Figure 14. 2016-2025 Surface Total Phosphorus (1-meter depth)

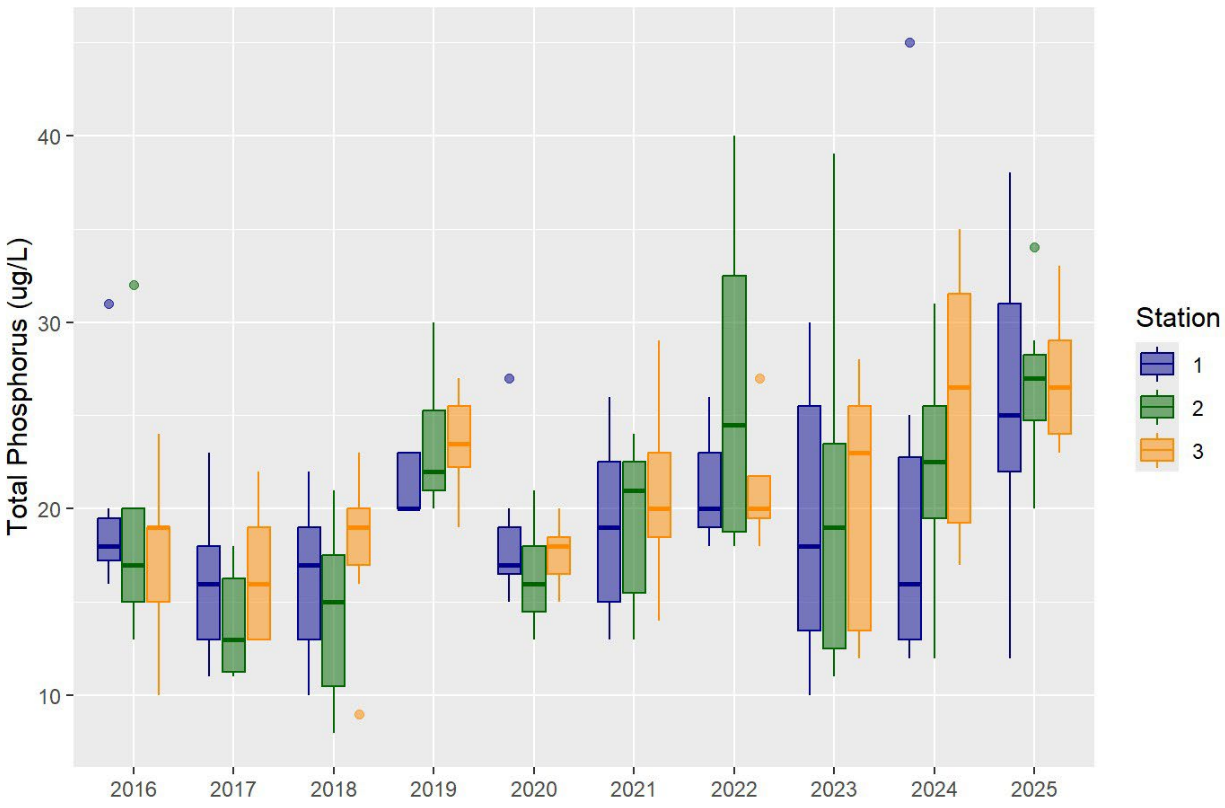


Figure 15. Combined Stations 2016-2025 Surface TP Boxplots

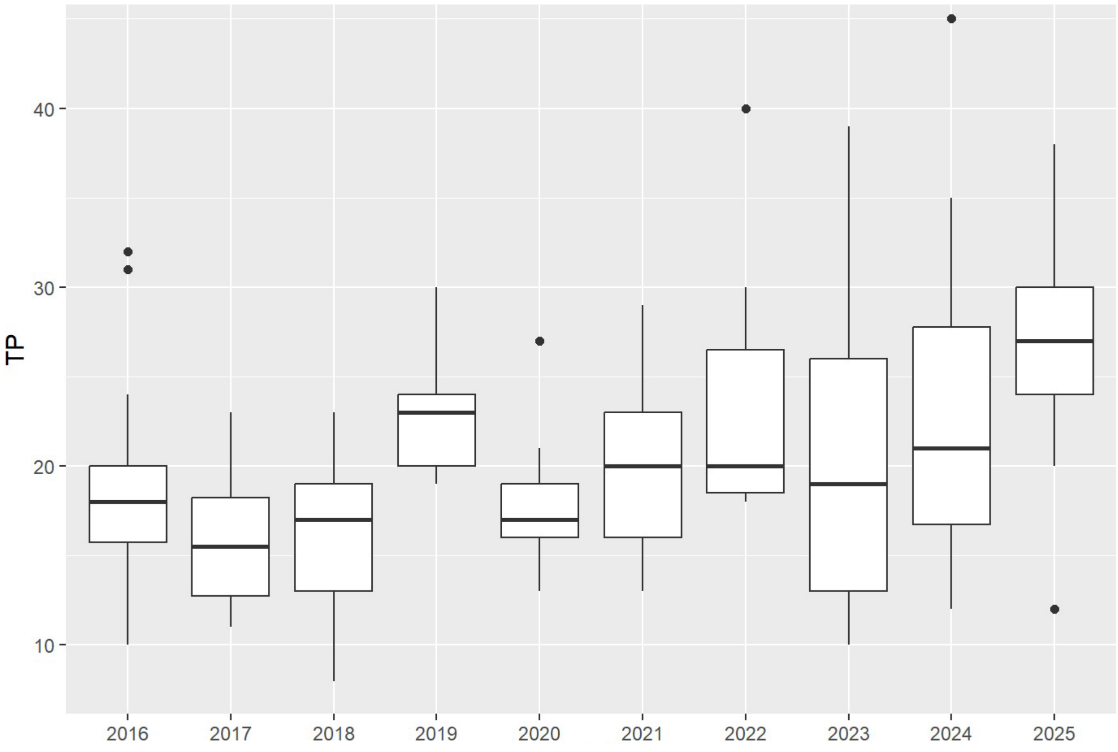
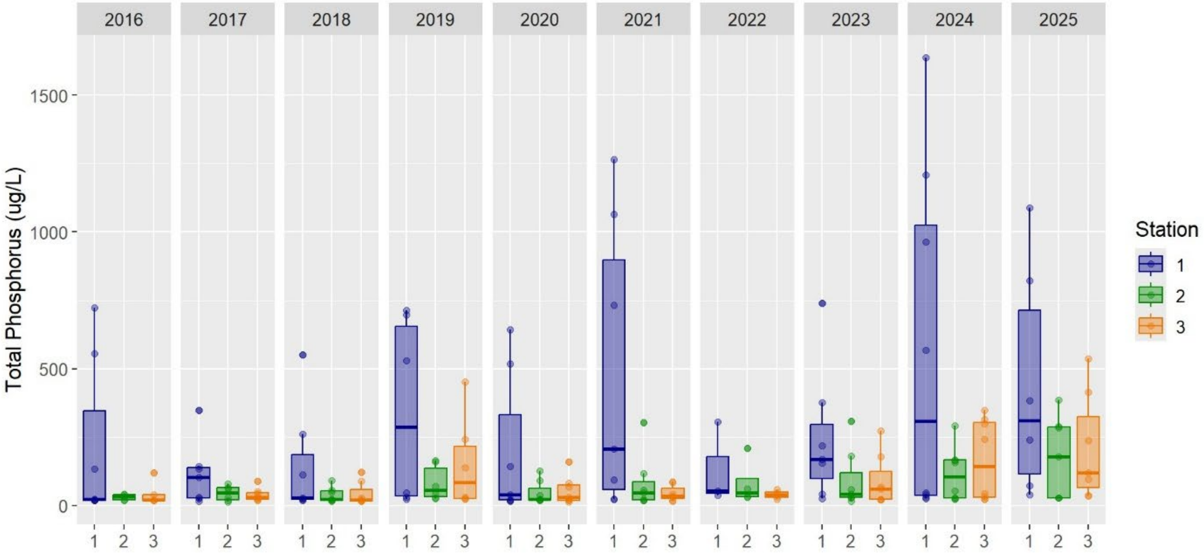


Figure 16. Bottom Water TP 2016-2025



Bottom-water TP reached high concentrations in late summer 2025, but remained in line with the elevated St1 bottom-water TP concentrations observed in previous years. St2 and St3 bottom TP were also elevated in summer, reflective of internal P loading. The data suggest that if internal P load treatments were pursued in the future, it would be wise to focus on higher dosages at the St1 and St3 sites, which appear to affect the more heavily used and public swimming beach areas at the south end of the lake. St3 had higher surface and bottom TP across nine of the last ten years.

Table 3. Nitrogen, Station 1 - 2025

Total Nitrogen (TN)								
Depth_m	3/31/2025	4/29/2025	5/30/2025	6/27/2025	7/29/2025	8/29/2025	10/2/2025	10/29/2025
1	440	*291*	*389*	*494*	*628*	*497*	*571*	*810*
4	341	285	374	570	491	527	558	809
6	391	300	452	500	3279	2193	548	889
~9.5-10.2	456	401	745	1578	3209	4162	4827	799
Total Ammonia Nitrogen (tNH3)								
Bottom		0	404	863	2496	NS	3605	264

Values in *italics* are averages of the field duplicate surface samples taken for lab QA/QC purposes. Duplicate sample TP and TN concentrations were within reasonable error ranges, with differences <10% between samples and most <5%. NS = Not Sampled.

The TN in surface waters was unusually high in summer to fall 2025 (Figure 16 and Figure 18). At this time, there is not a full explanation for this change, but it does appear to be related to a dramatic increase in bottom-water TN (Figure 17). The last time TN surface concentrations were this high was in 2012-13 and the early 2000s. In the following section of this report, AWS explores potential explanations for the excessive TN measured in 2025.

Figure 17. Surface TN (Station 1) Long-term Trend

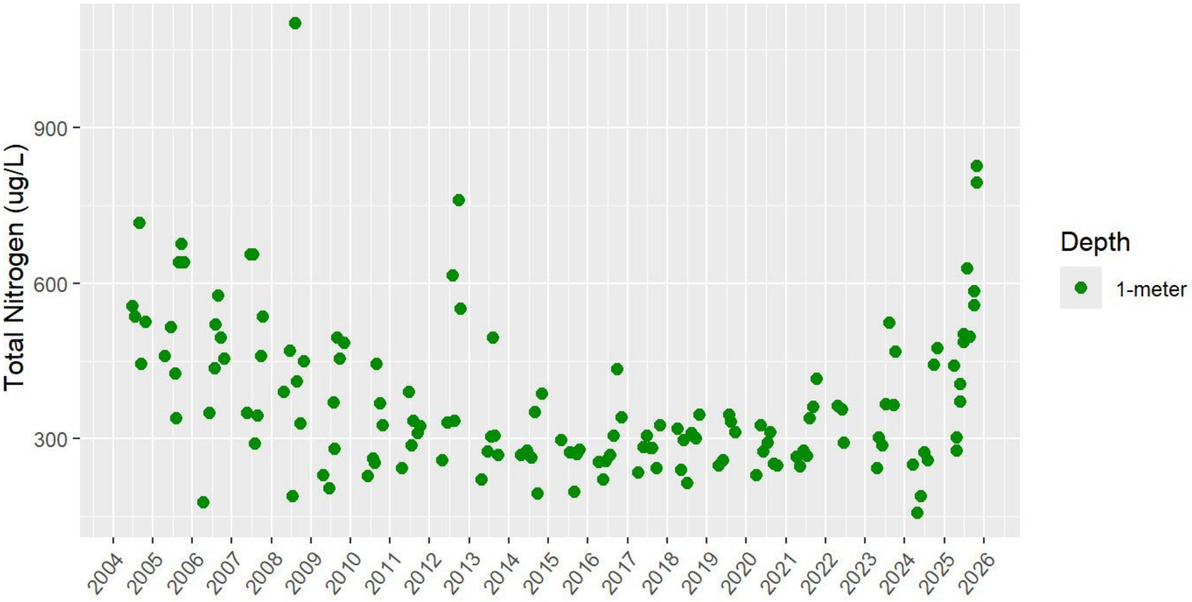
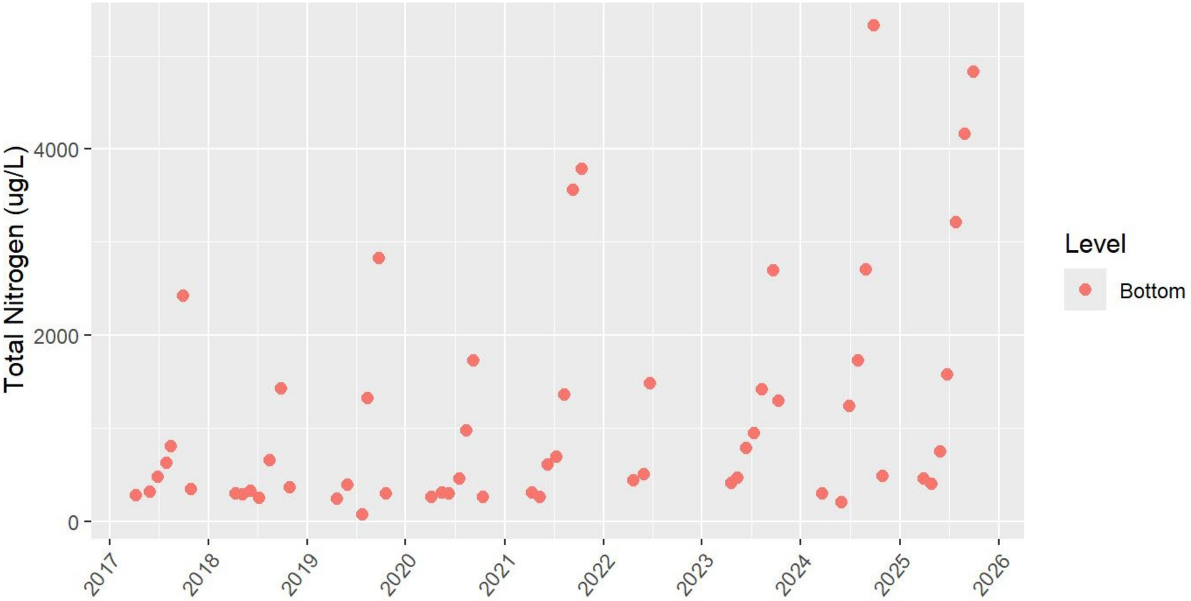
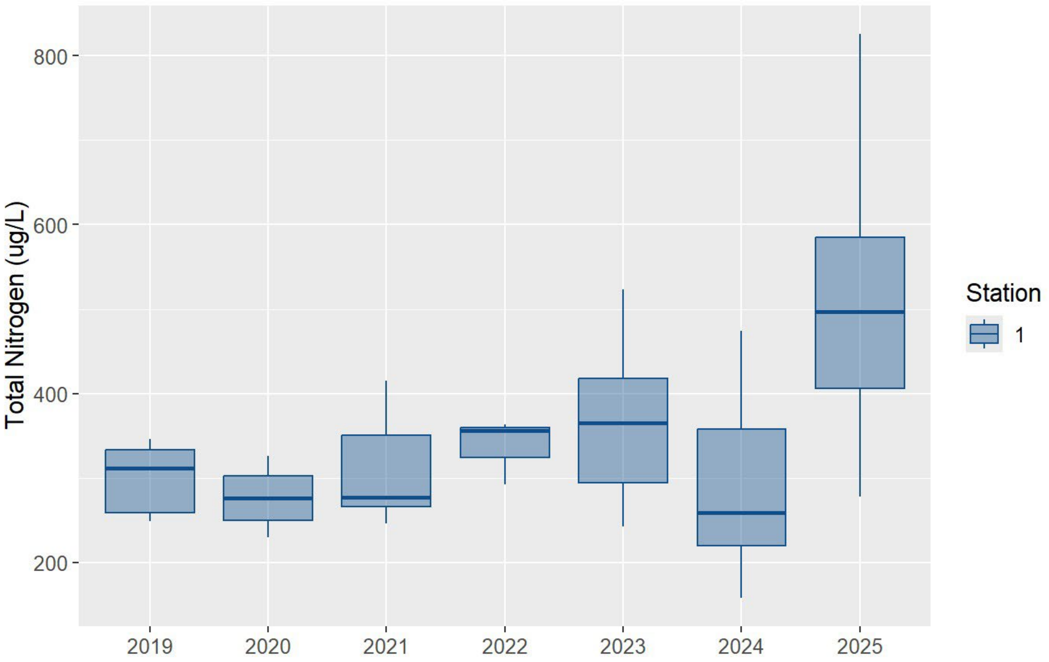


Figure 18. Bottom TN - 2017-2025 (only bottom NH3 monitored prior to 2017)



Total ammonia nitrogen (NH3) was also tested at the Station 1 bottom samples to confirm that the majority of the increase in bottom TN was a result of increasing ammonia nitrogen during periods of anoxia. Ammonia production in the bottom waters is a combined result of decomposing organic matter and a release of ammonia from bottom sediments. Bottom-water NOx (nitrate+nitrite nitrogen) samples were either below detection or near the detection limits for most samples, common for anoxic periods. The highest NOx recorded in bottom waters in 2025 was 56 µgN/L, following lake turnover.

Figure 19. Historical Comparison of Surface Total Nitrogen



Rainfall & Water Level – Water Quality Relationship

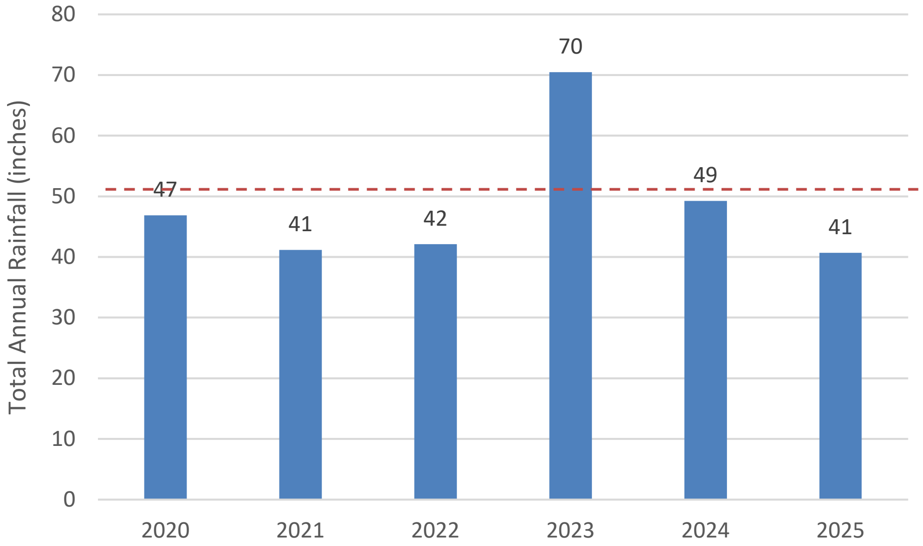
The substantial increase in surface TN in 2025, along with high seasonal TP in surface waters over the past few years, is concerning. AWS believes this increase is primarily due to the widespread reduction in aquatic plant growth resulting from grass carp predation and possibly related to greater sediment disturbance from mechanical harvesting in shallower water. There are also other confounding factors. It is unusual to have such a substantial increase in surface TN in 2025 compared to the previous 5+ years. The general long-term trend of N in the lake's surface waters has been decreasing since the early 2000s. The surface TN in 2025 is associated with dramatic increases in bottom-water TN, but the reason is not clear.

AWS hypothesizes that reduced littoral-zone N retention and substantially reduced plant growth are major contributing factors to the high open water TN in 2025. There is a known concern about N loading from shoreline septic systems and residential fertilizers used in the watershed and shoreline properties. N travels readily through aerated soils. Even properly functioning septic systems contribute substantial N load to the lake unless they are advanced treatment units (ATUs) designed to reduce nutrients. Typically, if TP remains low in the lake, N is not the limiting nutrient for phytoplankton growth in freshwaters; yet if TP is also high, cyanobacterial scum formation has been linked to TN concentrations, particularly through the availability of ammonia-N in the water column. High levels of anoxia in 2025, also likely contributed to high surface TN, with increased sediment ammonia-N releases.

The general rainfall patterns and seasonal (monthly and annual) total rainfall across the past five years are included in this 2025 monitoring report. Lake Oscawana has a flushing rate of about 1.2 years. This means that short-term changes in rainfall do not typically show clear correlations with monthly in-lake Secchi clarity or surface nutrients (TP & TN). The lake responds more to cumulative rainfall over longer periods (e.g., multiple months of heavy rainfall or prolonged dry summers). The lake's internal nutrient recycling from sediments is also substantial (~30%+ of annual P load from internal recycling of sediment P). Internal P and N loads are highly dependent on temperature and wind, and may also be impacted by mechanical harvesting and littoral sediment disturbance. These factors further complicate the relationship between open water quality and rainfall.

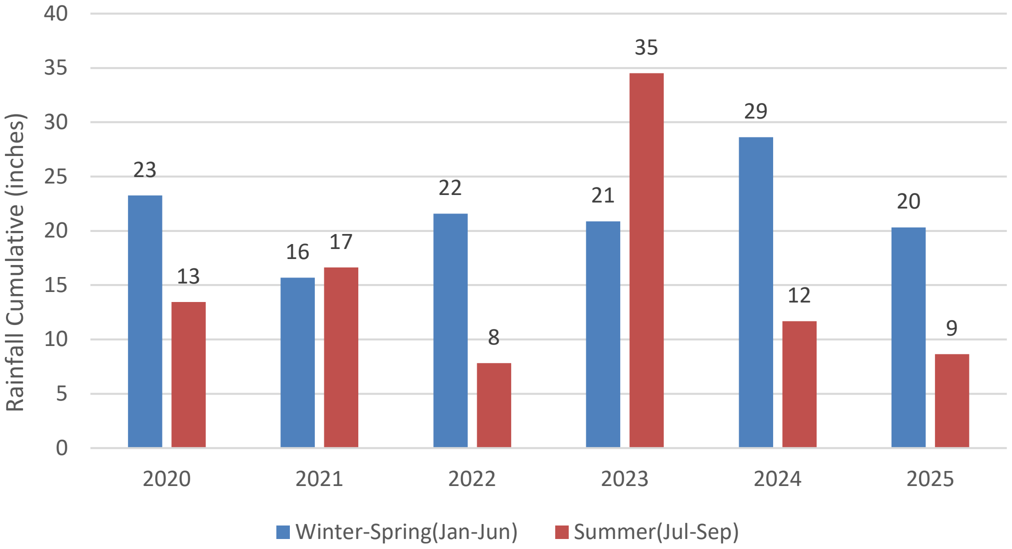
To rule out rainfall alone as a causative factor in the substantial increase in TN in 2025, AWS investigated several potential seasonal rainfall relationships with average clarity, TP, and TN. No statistically significant correlations between short-term rainfall vs. clarity or surface nutrients were found across the five-year timespan and data means. It is possible that expanding this analysis to include additional years of data or more detailed water level and volumes might refine a modeled relationship between rainfall and water quality parameters, but the relationship of rainfall to water quality at Oscawana is certainly less profound and more complicated than at waterbodies with more rapid flushing rates, or at waterbodies with lower internal and septic nutrient loads, or more natural plant coverages. Raw monthly rainfall totals are included in the raw data Appendix at the end of this report.

Figure 20. Total Annual Rainfall (inches) 2020-2025 (RainDrop Application, NOAA/NASA data)



(30-year average total annual rainfall shown in red dashed line, above).

Figure 21. Seasonal Cumulative Rainfall Patterns (RainDrop Application, NOAA/NASA data)



In addition to tracking rainfall patterns, the Lake Oscawana monitoring program now tracks water level, relative to the newly constructed Abele Park spillway height. Prior to 2025, the Town of Putnam Valley had no way to control the water level of Lake Oscawana. Updates to the lake's Abele outflow and pipe were constructed between late fall 2024 and spring 2025. The Town now has the ability to control water levels to minimize shoreline flooding during high spring water conditions.

There are no consistent historical water-level records prior to 2025, only sporadic water-level data relative to static shoreline docks. The water level in spring 2025 was slightly lower than normal, according to resident observations. AWS installed a water level gauge at the Abele Park boat ramp, adjusted relative to the elevation of the Abele spillway at the time of installation in April 2025. To prevent ice damage, the gauge was removed at the end of October 2025 and will be reinstalled in 2026. AWS encourages LOMAC to take regular visual readings of the gauge and report the data to AWS at weekly intervals; each water-level data point reported by LOMAC volunteers should be accompanied by a clear photo of the gauge to verify the reading. The following data represents only AWS observations in 2025.

Table 4. 2025 Water Level Readings - Abele Boat Ramp Gauge

Date	Gauge Level ft	Abele Full Pool (1" over spillway) Equivalent ft	Ft relative to full pool	Inches relative to full pool
03-31-2025	2.04*	2	+0.04	+0.5
04-29-2025	1.82	2	-0.18	-2.16
05-30-2025	1.76	2	-0.24	-2.88
6-27-2025	1.44	2	-0.56	-6.72
7-29-2025	1.26	2	-0.74	-8.88
10-02-2025	0.76	2	-1.24	-14.88
10-29-2-25	0.87	2	-1.13	-13.56

*Calculated based on water level measured at spillway before Abele gauge installed

Water level should ideally be about 1-2 inches above the Abele spillway elevation in spring. This is a standard water level goal for controlled elevations. The actual spillway elevation was not surveyed during engineering design or construction because it was unaltered from the original structure.

In March and April, AWS recommends that the Town and LOMAC aim to have the water level 1-2 inches above the spillway; this will ultimately require maintenance if large storms are predicted. Careful attention to weather is critical to prevent the water level from falling below the spillway depth before the end of April, whenever possible. The water level dropped by 12.72 inches from the end of April to the beginning of October 2025. While it is common for the Oscawana water level to fluctuate this amount seasonally, maintaining higher water levels by reducing outflows earlier in the season is good for lake water quality. Stagnant summer conditions generally increase the likelihood of cyanobacterial blooms in reservoirs, but that relationship is unclear at Oscawana without more consistent water-level data. Despite low water levels and no apparent surface water outflow through the outlet pipe from summer to fall 2025, AWS consistently observed groundwater seepage just downstream of the outlet, typically as very low flows. The photos below display the spring water levels in 2024 and 2025.

Records of opening and closing the outlet pipe should be kept in a spreadsheet and reported to LOMAC annually for long-term record-keeping. AWS recommends that the individual responsible for outlet pipe maintenance record the following in column format: Date, Time, Opening or Closing, # of turns (estimated to the quarter turn). If possible, we also recommend that the individual record the water level just prior to the time of pipe outlet management (based on the Abele Park boat ramp gauge). We also recommend installing a temporary continuous water level logger sensor for part of 2026. AWS will discuss potential options with LOMAC and the Town Supervisor.

Table 5. Spring 2024 vs. 2025 Abele outlet photos

4/29/2024

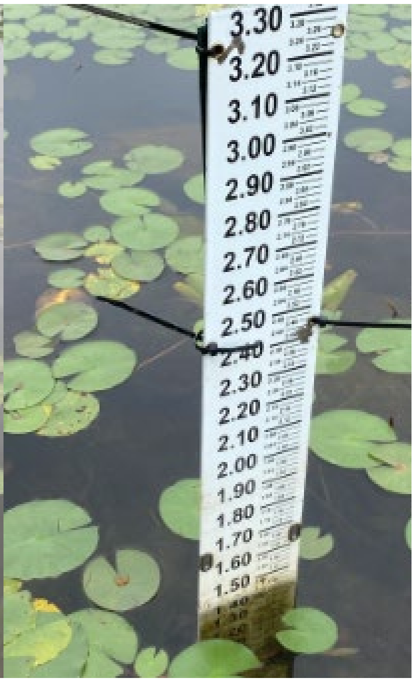
3/31/2025

Table 6. Water Level - Abele Gauge Photos 2025

04-29-2025

05-30-2025

6-27-2025



7-29-2025

10-02-2025

10-29-2-25

Inlets

AWS sampled baseflow at the inlets in April, May, and June. The August and October inlets samplings were around precipitation events. The raw concentration data from 2025 is shown in the table below.

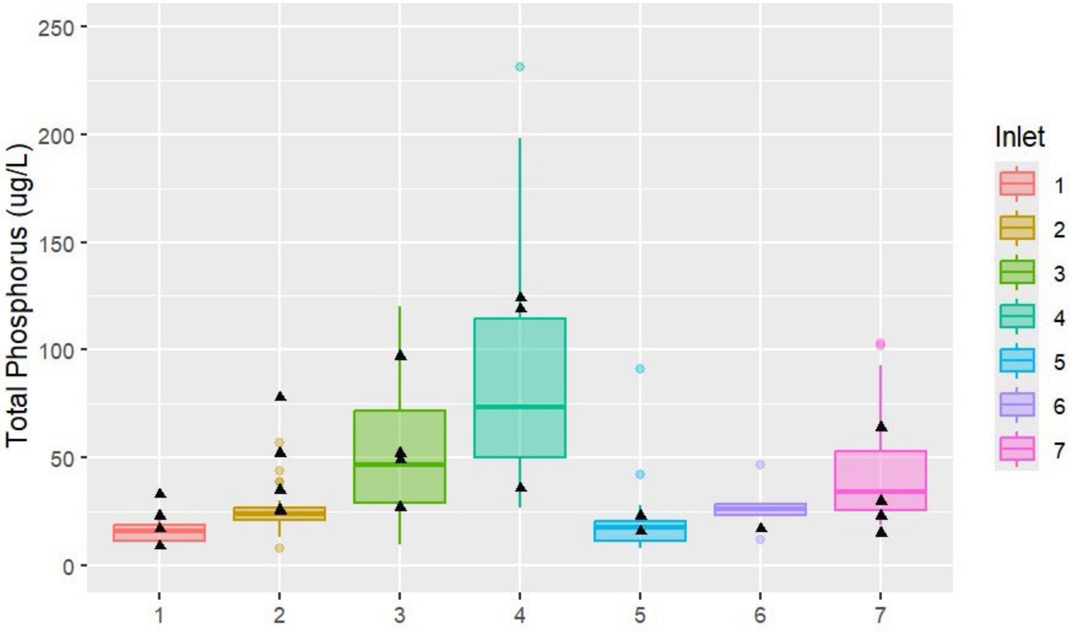
Historically, the concentration range at some of the inlets, mainly Inlets 4 and 7, have been very high. For the purposes of graphical comparison, the historical outliers where TP > 350 µg/L were removed from Figure 22. No outliers were removed from the TN comparison figure (Figure 23).

Table 7. Inlet Nutrient Concentrations, TP & TN 2025 (µg/L)

	Baseflow 4/29/2025		Baseflow 5/30/2025		Baseflow 6/27/2025		Day after rain 8/21/2025		Rainfall 10/30/2025	
	TP	**TN**	**TP**	**TN**	**TP**	**TN**	**TP**	**TN**	**TP**	**TN**
Inlet 1	9	200	NS	NS	17	397	23	869	33	392
Inlet 2	25	193	26	286	52	422	35	373	78	284
Inlet 3	27	459	NS	NS	49	954	52	862	97	323
Inlet 4	36	2096	NS	NS	119	1290	124	1143	1536	1492
Inlet 5	16	90	NS	NS	NF	NF	23	632	NS	NS
Inlet 6	17	ND	15	65	NF	NF	NS	NS	NS	NS
Inlet 7	23	658	30	788	NF	NF	64	489	885	1216

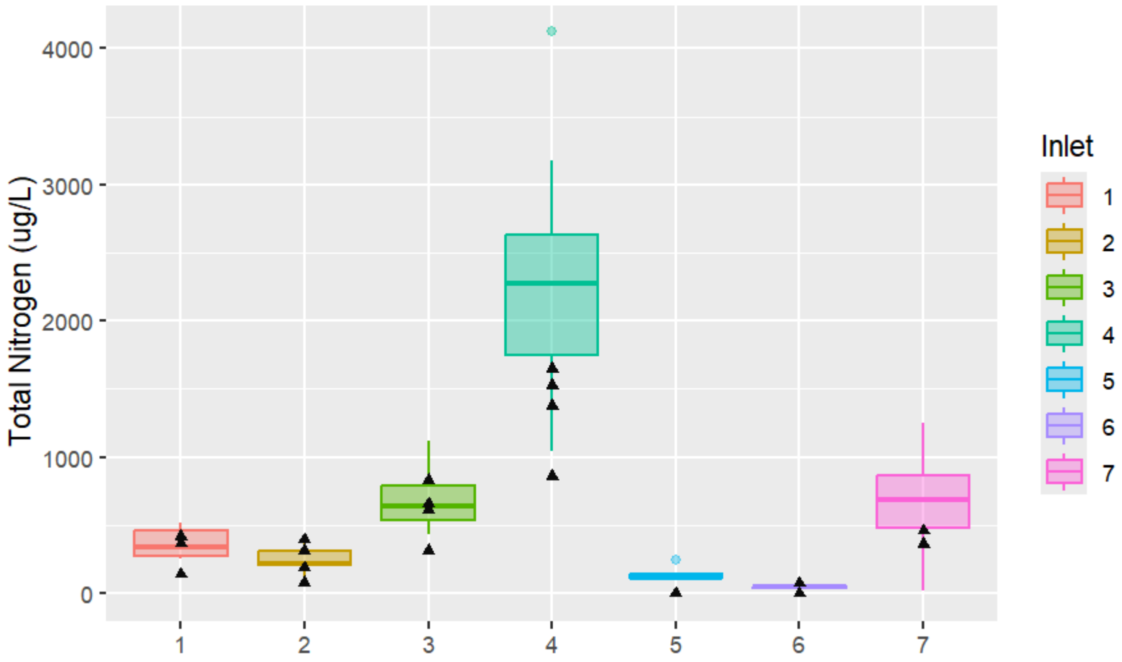
NF = Not flowing, ND = Not Detected (below limit of detection), NS = Not Sampled

Figure 22. Total Phosphorus Stream Data 2019-2024 (boxplots) compared to 2025 (black triangles), storm sampling outliers removed



Total Nitrogen (TN) 2019-2024 boxplot inlet comparisons are shown below. Inlet TN concentrations were all within the normal or low range for the past five years of data. Note that Inlets 5 and 6 are small streams that dry up for a large part of the summer. The extremely high TN in the lake in 2025 is not reflected in the inlet concentration data, further pointing to possible grass carp and/or internal loading-related N impairments in 2025.

Figure 23. 2019-2024 Total Nitrogen Stream Data Compared to 2025 (black triangles)



In 2024, post-storm E. coli bacteria samples were taken at Inlets 3 (upper and lower sites), 4, and 7 on April 3rd. In 2025, the samples were taken during active rainfall, within roughly the first hour of precipitation. Inlet 3 lower site is off of Lost River Road below the farm. The Inlet 4 E. coli sample was collected at the road as the stream goes under Lee Ave. The Inlet 7 E. coli test was taken at Lake Front Road, just north of the High Street intersection. Results are included in the table below for 2024 compared to 2025. The 2025 E. coli results during rainfall are high, but the true values are unknown because they exceeded the laboratory method limit of 2419.6 MPN/100mL. These three sites still clearly have nearby wastewater influence. E. coli data should be shared with the local health department to determine what needs proper follow-up at this time.

Table 8. Inlet E. coli Test Results, April 3, 2024-2025

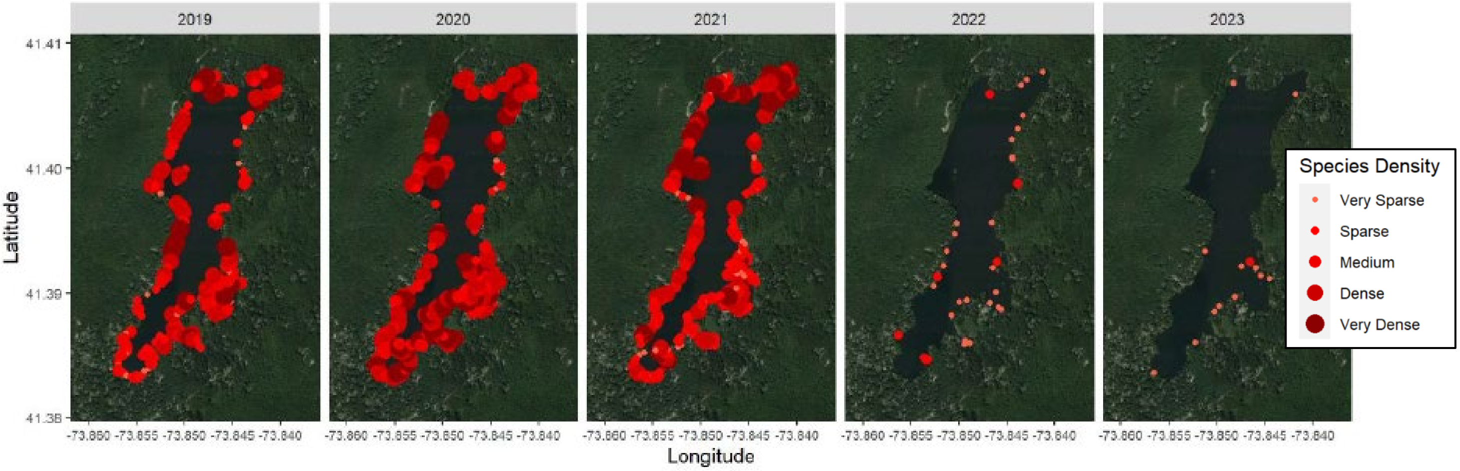
Sample ID	Date	Parameter	Result	Method
Oscawana Inlet 3 upper	04-03-2024	E. coli	71.7 MPN/100mL	SM9223B-2016
Oscawana Inlet 3 lower	04-03-2024	E. coli	34.5 MPN/100mL	SM9223B-2016
Oscawana Inlet 4	04-03-2024	E. coli	178.5 MPN/100mL	SM9223B-2016
Oscawana Inlet 7	04-03-2024	E. coli	52.1 MPN/100mL	SM9223B-2016
Oscawana Inlet 3 lower	10-30-2025	E. coli	432.2 MPN/100mL	SM9223B-2016
Oscawana Inlet 4	10-30-2025	E. coli	>2419.6 MPN/100mL	SM9223B-2016
Oscawana Inlet 7	10-30-2025	E. coli	>2419.6 MPN/100mL	SM9223B-2016

Aquatic Plants

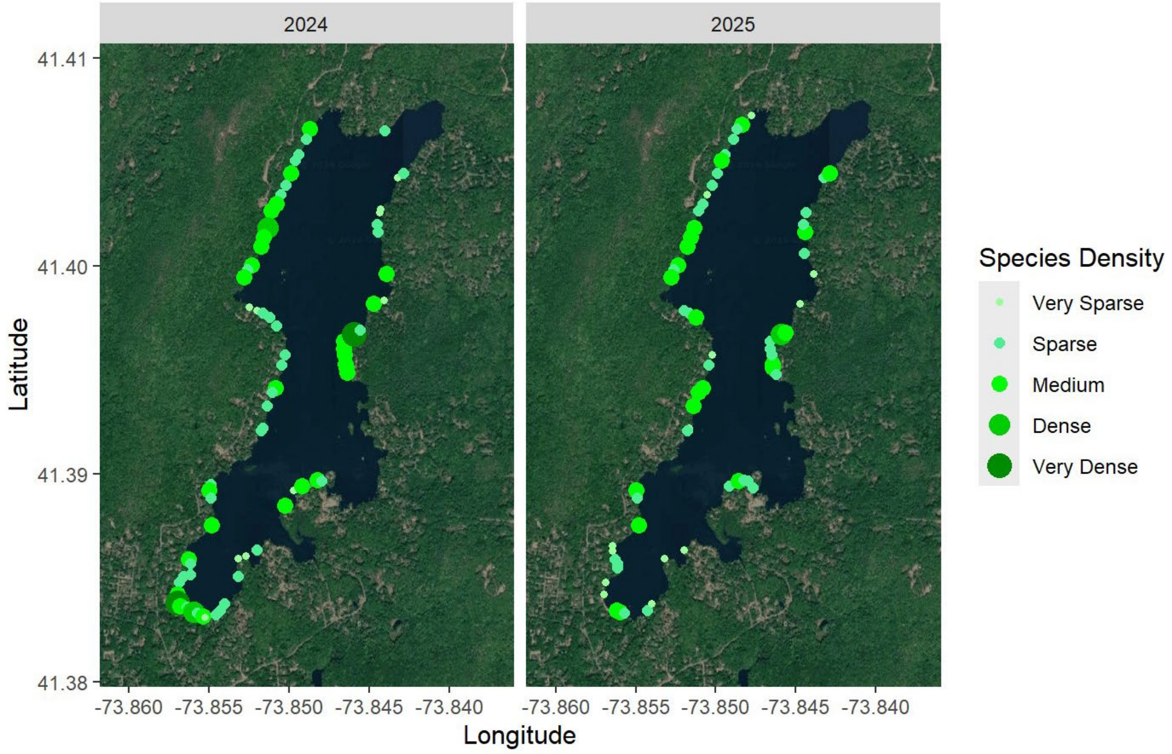
There was no invasive Eurasian milfoil found in the lake in 2024 or 2025. Map 2, below, demonstrates the dramatic reduction in invasive milfoil following a secondary grass carp stocking in 2021. From that point, it took grass carp three seasons to eradicate Eurasian milfoil from the lake. There has also been a considerable reduction in native plants throughout the lake. The most prominent native plant reductions since 2021 have been: Large-leaf pondweed (*Potamogeton amplifolius*), Robbins pondweed (*Potamogeton robbinsii*), and Coontail (*Ceratophyllum demersum*).

Native Tapegrass (*Vallisneria americana*) is still present throughout much of the shallow rocky shoreline zones of the lake (Map 3). The carp may have difficulty feeding in high wave-action shallow zones along open shores where this species remains. Native Waterlilies (primarily *Nymphaea odorata*) had reduced density in several areas in 2025, but it is challenging to determine if that change was directly related to grass carp or if it was a factor of mechanical harvesting or normal inter-annual variation. Benthic cyanobacteria mat was present in similar locations and fluctuating densities for the past four years. Fluctuation over the last four years is likely related to mechanical harvesting and changing dominance of cyanobacteria mats versus green filamentous algae, but there has been a distinct increase since 2019 in many areas of the lake, corresponding to early reduction in Robbins pondweed after the initial grass carp stocking in 2016. There was very little green filamentous algae recorded in 2025, only a few locations. Overall species diversity had been low at Oscawana for over a decade, even before the initial grass carp stocking – largely due to the takeover of invasive Eurasian milfoil; however, species diversity has been considerably diminished since 2021, with really only Tapegrass and White water lilies remaining dominant in the lake post grass carp.

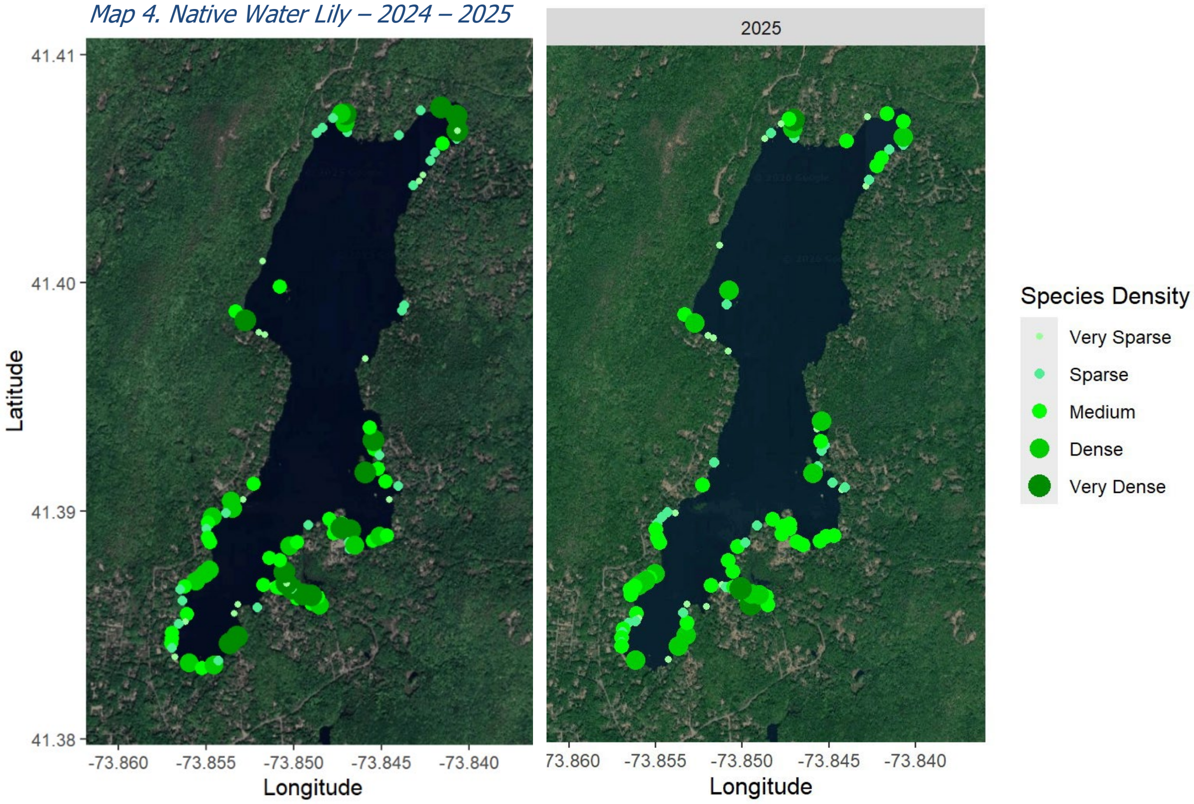
Map 2. Invasive Eurasian milfoil: 2019-2023 NEAR Maps



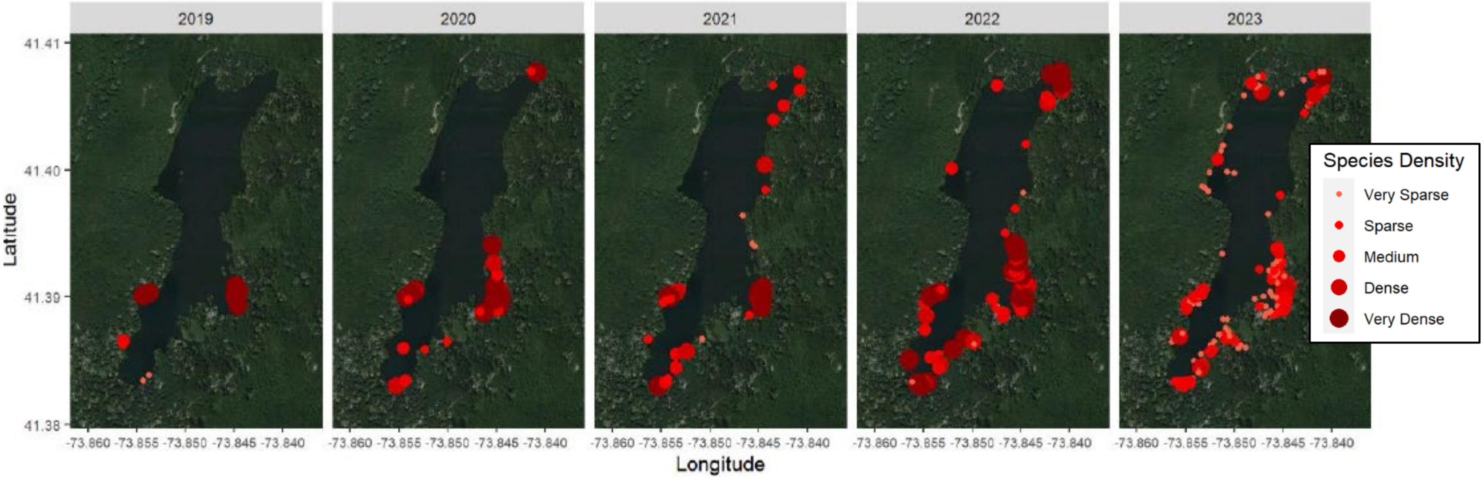
Map 3. Tapegrass (Vallisneria americana) 2024-2025



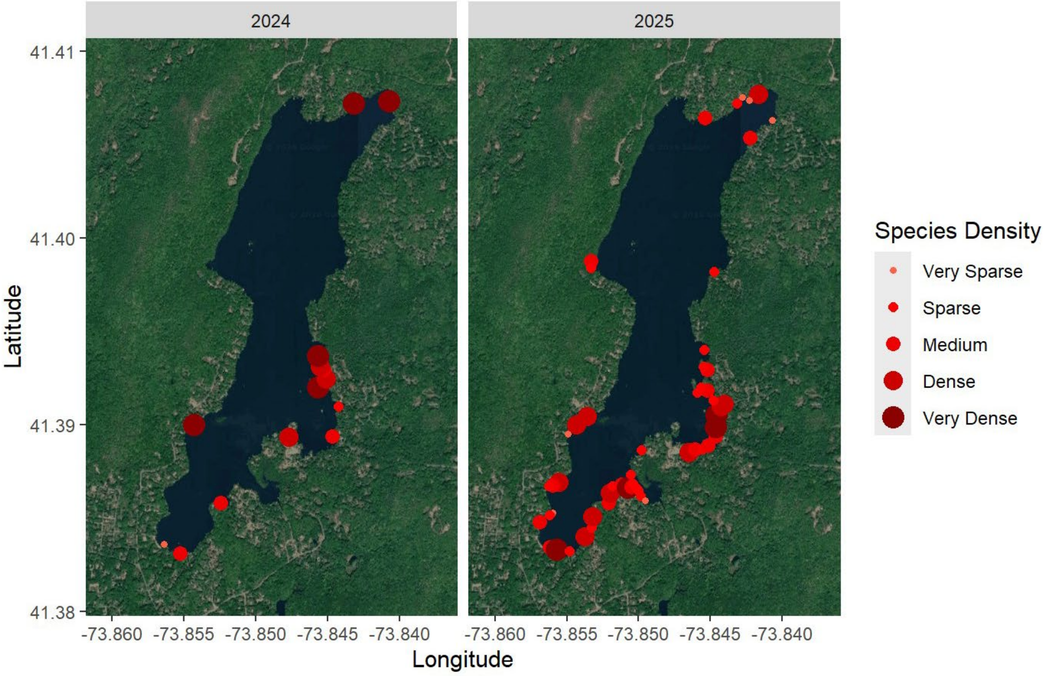
Map 4. Native Water Lily – 2024 – 2025



Map 5. Cyanobacteria mat: NEAR 2019-2023 Maps



Map 6. Benthic cyanobacteria mat 2024-2025



Discussion & Recommendations

Grass Carp Discussion & Plant Management

Based on the previous modeling of grass carp mortality, we estimate that there are likely around 230 remaining adult grass carp in the lake in 2026. That would be about 20% of the total grass carp stocked in 2016 and 2021. Since the native Tapegrass and native Waterlilies showed no considerable decline in 2025, AWS believes that the level of plant growth relative to the number of remaining grass carp may have leveled out as of 2025. Yet, a moderate strategic carp removal effort in 2026 and/or 2027 would likely benefit the lake overall. Removal of 50+ grass carp would reduce the number of years it will take for partial littoral zone recovery. As grass carp reach full size, the mortality rate also decreases, so carp that have survived thus far are more likely to survive, potentially veering from the earlier mortality rate assumptions.

Emphasis should be on maximizing the cost-efficiency of grass carp removal. With the relatively low number of lake-wide carp, the level of effort required to remove 50 carp is unknown at this time. It may be possible for LOMAC to obtain special harvesting permits for Lake Oscawana, so that anglers could remove some grass carp from the lake directly on scheduled special event days. Bowhunting is a common method. The first step would be to discuss this option with NYDEC fisheries biologists and regulators. AWS also recommends that the Town allocate funding for one to two days of electroshocking and carp removal, potentially in 2027, depending on the ability to obtain permits for and relative success of direct angler removal. A formal electroshocking carp removal effort would require two electroshocking boats to corral grass carp into an area where they could be netted and removed. This would also require permits from NYDEC.

The goal of grass carp removal would be to reduce the number of years it would take for a partial littoral zone partial recovery. Prolonged, widespread reduction in native plant coverage may have negative implications for the aquatic ecosystem; it would benefit the lake to reduce the number of seasons where plant coverage and species diversity are so low, as they have been in both 2024 and 2025. The table of grass carp mortality (assuming 20% annual mortality) is copied below for reference (Table 9). If grass carp are not removed, the lake will likely still recover some vegetation growth in the next three to four years, but limited carp removal would speed up that process by about two years.

Table 9. Grass Carp Population Modeling - 2020 permit application

20% mortality	Grass carp age																				Population size
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
2016	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600
2017	0	480	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	480
2018	0	0	384	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	384
2019	0	0	0	307	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	307
2020	0	0	0	0	246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	246
2021	443	0	0	0	0	197	0	0	0	0	0	0	0	0	0	0	0	0	0	0	640
2022	0	354		0	0	0	157	0	0	0	0	0	0	0	0	0	0	0	0	0	512
2023	0	0	284	0	0	0	0	126	0	0	0	0	0	0	0	0	0	0	0	0	409
2024	0	0	0	227	0	0	0	0	101	0	0	0	0	0	0	0	0	0	0	0	327
2025	0	0	0	0	181	0	0	0	0	81	0	0	0	0	0	0	0	0	0	0	262
2026	0	0	0	0	0	145	0	0	0	0	64	0	0	0	0	0	0	0	0	0	210
2027	0	0	0	0	0	0	116	0	0	0	0	52	0	0	0	0	0	0	0	0	168
2028	0	0	0	0	0	0	0	93	0	0	0	0	41	0	0	0	0	0	0	0	134
2029	0	0	0	0	0	0	0	0	74	0	0	0	0	33	0	0	0	0	0	0	107
2030	0	0	0	0	0	0	0	0	0	59	0	0	0	0	26	0	0	0	0	0	86
2031	0	0	0	0	0	0	0	0	0	0	48	0	0	0	0	21	0	0	0	0	69
2032	0	0	0	0	0	0	0	0	0	0	0	38	0	0	0	0	17	0	0	0	55
2033	0	0	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0	14	0	0	44
2034	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0	0	0	0	11	0	35

Mechanical Harvesting

Mechanical harvesting in 2025 primarily removed benthic cyanobacteria mats. The harvester is also used to maintain a laneway in Abele Cove and Wildwood Cove, where lilies are prevented from expanding over time. However, the harvester should not be used to remove well-established areas of water lilies adjacent to the DEC-designated wetland area in Abele Cove. Removal of peat is not authorized under existing LOMAC procedures. Harvesting established waterlilies requires wetlands permits, and there are no areas where that appears to be necessary at this time in Lake Oscawana.

AWS had previously recommended reducing the number of mechanical harvest hours at Lake Oscawana, as the plant growth in the lake has been considerably reduced. The harvester is also responsible for consistent sediment disturbances in shallow-water operation zones. The majority of that sediment will settle out quickly, but winds do carry fine particles over long distances and contribute to higher nutrient levels and greater turbidity in the water column. Ideally, harvesting time would be limited to maintaining the swimming beaches and most popular recreation and boat lane areas. Cyanobacteria mats should be removed if they come to the surface, but it is unnecessary for the harvester to disturb bottom-dwelling cyanobacteria outside of swim areas. The harvester also continues to remove native Tapegrass if it grows to extreme densities, particularly in Wildwood Cove.

Surface Water Quality Simplified Indexing

In the 2024 report, a simplified surface water quality index was introduced, producing an easily understandable annual score. The index uses surface Total Phosphorus (TP), surface Total Nitrogen (TN), water clarity (Secchi), and cyanobacteria cell counts and presence of shoreline scums that cause recreational beach advisories. Each of the four components counts equally towards this index. The TP and TN nutrient components consist of the possibility of each scoring 3 points based on: if the mean seasonal 1-meter concentration was lower than the 50th percentile (median) of all 1-meter values from the previous 5 years, if the 2025 means were lower than the target threshold to maintain relatively good water quality, and if the 2025 surface mean was below a critical threshold of *eutrophic* conditions. The respective threshold values are included in the table below. Values that meet the criteria receive 1 point each. If they do not meet the criteria, they receive 0 points.

The third component of the index is water clarity (Secchi transparency). If the 2025 mean is better than the 50th percentile of the past five years of values, 1 point is scored. The second criterion is if there was at least one value taken during the season that exceeds 4 meters, indicating that the lake maintains a clear-water phase, which typically occurs in late spring to early summer. The final point is awarded if the seasonal mean clarity exceeds the critical *eutrophic* threshold of 2m.

The final index component is based on the presence and quantity of cyanobacteria. If the seasonal maximum cyanobacteria cell count is less than 20,000 cells/ml, 1 point is scored. If the seasonal maximum cyanobacteria cell count is less than 100,000 cells/ml, another point is scored. If there are no cyanobacteria-related beach advisories or closures lasting more than one week, a third point is scored. The reasoning behind the 1-week criteria versus the complete absence of surface scums is the fact that even *oligotrophic* generally clear-water lakes can have occasional small and short-lived cyanobacteria shoreline scums. It is not possible to them avoid completely.

In total each component has 3 possible points, for a total of 12 possible points. For the 2024 season, Lake Oscawana scored 8 of the 12 points. For the 2025 season, the lake scored 4 points.

Table 10. Lake Oscawana Water Quality Index Scoring Sheet 2025

2020-2024 Summary Stats for TP (Top) 1m								< 50th percentile	< Target Threshold (20)	< Critical Threshold (30)	Sum
Station	Min	Q1	Median (Q2)	Q3	Max		2025 1m Mean	Score 1	Score 3	Score 4	
1	11	15	18	23	45		*26.0*	0	0	1	
2	11	15	19	24	40		*27.0*	0	0	1	
3	12	17	20	25	35		*27.0*	0	0	1	
AVG	*11*	*16*	*19*	*24*	*40*		27	0	0	1	**1**
2020-2024 Summary Stats for TN (Top) 1m								< 50th percentile	< Target Threshold (400)	< Critical Threshold (600)	
Station	Min	Q1	Median	Q3	Max		2025 1m Mean	Score	Score 3	Score 4	
1	167	256	293	362	523		*513*	0	0	1	**1**
2020-2024 Summary Stats for Secchi (m)								> 50th percentile	Any values >4m	> Critical Threshold (2m)	
Station	Min	Q1	Median (Q2)	Q3	Max	2025 Max	2025 Mean	Score	Score 3	Score 4	
1	1.4	2.2	2.9	3.6	4.1	2.8	*2.0*	0	0	0	
2	1.4	2.1	2.8	3.6	4.3	2.6	*2.0*	0	0	0	
3	1.4	2.1	2.9	3.5	4.5	2.6	*2.1*	0	0	1	
AVG	*1.4*	*2.1*	*2.9*	*3.6*	*4.3*		***2.0***	0	0	1	**1**
2025 Cyanobacteria Bloom Score							(Epi 3m-int)	Max > 20,000 cells/ml	Max > 100,000 cells/mL	Beach Closures >1 week	
								0	1	0	**1**
								Yes	No	Yes	
Overall 2025 Score		Points	MaxPoints								
		4	12								

While the 2025 open-water cyanobacteria cell counts did not exceed 20,000-100,000 cells/mL, there were visible shoreline scums along shore noted during July and August, and samples taken in these near-shore areas would have all likely exceeded this 100,000 cells/mL threshold (reducing the score by 1 point). Based on this index, the lake scored 3-4 points in 2025, a particularly poor score given that the index was developed to be reasonable and specific to Lake Oscawana water quality. A 12/12 score should be achievable in a given year if water quality is particularly better than average.

Water Quality Management

Internal Nutrient Recycling Load

As explained in previous monitoring reports, there are limited options for in-lake nutrient reductions. The shape of Lake Oscawana makes aeration/oxygen difficult, with a very large and sprawling anaerobic zone across multiple depth zones. If aeration or oxygenation were to be used at Oscawana in the future, AWS believes that phosphorus binding treatments would still be required, alongside aeration or oxygenation, to substantially reduce cyanobacteria blooms.

The 2024 annual monitoring report emphasized that every season, Oscawana maintains at least one month with excellent water clarity, but that was unfortunately not the case in 2025. The 2025 conditions were consistently poor throughout the season. AWS believes that despite high watershed nutrient sources to the lake, Oscawana would be a good candidate for in-lake phosphorus binding agents like buffered aluminum sulfate (Alum), poly-aluminum chloride (PAC), or lanthanum clay-based products like Phoslock and EutrosorbG. These products are highly effective in permanently binding and inactivating phosphorus in the water column and sediments. Several pilot projects in New York were completed in the last five years, but the NYDEC has yet to release a public report on its case study reviews. NYDEC has still not established a regular permitting pathway to use these products, despite decades of successful use in lakes and reservoirs of the northeastern US.

However, Lake Oscawana could be considered for another pilot study, given its long history of monitoring. AWS tested the lake sediment in spring 2026 in order to determine a range of potential appropriate dosages and treatment strategies. The blooms at Oscawana prior to 2025 were typically short-lived and very late in the season, sometimes past the swimming period, but 2025 saw more consistent and earlier blooms. These blooms also corresponded to various beach closures due to fecal bacteria. It will be important to consider the role of nitrogen in Oscawana's recent increase in cyanobacteria, as nitrogen would not be controlled via some phosphate-binding treatments. Certain products, such as zeolite aluminosilicate clays, can bind ammonia nitrogen as well as phosphate. Restoring plant growth to key littoral zone areas should reduce nitrogen in the water column as well.

Watershed Management

Stormwater improvement work in the watershed is ongoing, aided by several grant-funded projects to reduce runoff and nutrient pollution to the lake. LOMAC has also continued to advocate for responsible homeowner property management, minimizing fertilizer use in the whole watershed, but especially on lakefront properties. Homeowners are encouraged to trap stormwater runoff from their homes, driveways, and patios to minimize runoff onto the streets or directly flowing to the lake. Small rain gardens and increased infiltration are key to minimizing the impacts of phosphorus pollution from residential properties. Ongoing maintenance and watershed management is essential for the long-term health of Lake Oscawana.

LOMAC and the Town of Putnam Valley have been active in the enforcement of septic maintenance, inspection, and pump-outs under the Town ordinance but tracking this information should be done electronically in a more organized manner that can be used to create a map-database (GIS). LOMAC has also used sampling data collected from various inlets to aid the Department of Public Health in finding failing and short-circuiting systems in need of upgrades and considerable repairs. However, the multiple weeks of beach closures in 2025 due to fecal bacteria warrant increased pressure on residents to maintain and upgrade improperly functioning septic systems.

In 2026, AWS would like the Town to prioritize an organized compilation of all watershed septic system records so that we can create a formal GIS-tracking method for public-facing onsite wastewater maintenance. A public database is warranted at this time; it would increase the likelihood of the Town and residents being awarded septic system improvement grant funds in the future. Innovative and alternative nutrient-reduction systems exist, for both nitrogen and phosphorus removal. Use of these types of septic systems are encouraged in the Oscawana watershed and near-shore zones.

Appendix A

Table 1. 2025 Raw Lake Oscawana In-Lake Nutrients Data - Upstate Freshwater Institute Lab Analyses

Date	Station	Depth_m	Level	TP_ug/L	NH3_ug/L	TN_ug/L	NOX_ug/L	TDP_ug/L
3/31/2025	1	1	Top	24		440		
3/31/2025	2	4	Mid1	26		341		
3/31/2025	3	6	Mid2	34		391		
3/31/2025	1	9.7	Bottom	41		456		
3/31/2025	2	1	Top	27				
3/31/2025	2	7	Bottom	29				
3/31/2025	3	1	Top	24				
3/31/2025	3	7	Bottom	37				
4/29/2025	1	1	Top	21		278		
4/29/2025	1	1	Top	21		303		
4/29/2025	1	4	Mid1	25		285		
4/29/2025	1	6	Mid2	34		300		
4/29/2025	1	9.5	Bottom	74	0	401	0	
4/29/2025	2	1	Top	21				
4/29/2025	2	7.5	Bottom	29				
4/29/2025	3	1	Top	23				
4/29/2025	3	7.7	Bottom	35				
5/30/2025	1	1	Top	22		371		
5/30/2025	1	4	Mid1	37		374		
5/30/2025	1	6	Mid2	69		452		
5/30/2025	1	10	Bottom	240	404	745	11	219
5/30/2025	2	1	Top	26				
5/30/2025	2	7.6	Bottom	29				
5/30/2025	3	1	Top	28				
5/30/2025	3	7.6	Bottom	120				
5/30/2025	1	1	Top	30		406		
6/27/2025	1	1	Top	25		501		
6/27/2025	1	1	Top	25		487		
6/27/2025	1	4	Mid1	47		570		
6/27/2025	1	6	Mid2	55		500		
6/27/2025	1	9.2	Bottom	384	863	1578	0	369
6/27/2025	2	1	Top	28				
6/27/2025	2	7	Bottom	180				
6/27/2025	3	1	Top	24				
6/27/2025	3	7.1	Bottom	237				
7/29/2025	1	1	Top	28		628		
7/29/2025	1	4	Mid1	34		491		
7/29/2025	1	6	Mid2	57		3279		
7/29/2025	2	1	Top	34				
7/29/2025	2	7.5	Bottom	289				
7/29/2025	3	1	Top	28				

7/29/2025	3	6.7	Bottom	414			
8/29/2025	1	1	Top	12		497	
8/29/2025	1	4	Mid1	27		527	
8/29/2025	1	6	Mid2	250		2193	
8/29/2025	1	9.3	Bottom	1088		4162	
8/29/2025	2	1	Top	20			
8/29/2025	2	7	Bottom	387			
8/29/2025	3	1	Top	25			
8/29/2025	3	7	Bottom	536			
10/2/2025	1	1	Top	31	221.454	557	
10/2/2025	1	1	Top	32		585	
10/2/2025	1	4	Mid1	30		558	
10/2/2025	1	6	Mid2	35		548	
10/2/2025	1	9	Bottom	822	3605.21	4827	
10/2/2025	2	1	Top	29			
10/2/2025	2	7.5	Bottom	284			
10/2/2025	3	1	Top	32			
10/2/2025	3	7	Bottom	97			
10/29/2025	1	1	Top	34		826	
10/29/2025	1	1	Top	38		794	
10/29/2025	1	4	Mid1	31		809	
10/29/2025	1	6	Mid2	32		889	
10/29/2025	1	9	bottom	34	264	799	56
10/29/2025	2	1	Top	27			
10/29/2025	2	7.3	bottom	26			
10/29/2025	3	1	Top	33			
10/29/2025	3	6.5	bottom	32			

Table 2. Oscawana 2025 Profile Data

Date	Depth_m	Temp C	DO%	DO	SPC	pH	CHL ug/L	CHL RFU	PC ug/L	PC RFU
3/31/2025	0	8.6	115	13.4	189	8.3			0.61	1.16
3/31/2025	1	8.4	115	13.5	189	8.3			0.79	1.44
3/31/2025	2	8.4	115	13.5	190	8.2			0.76	1.54
3/31/2025	3	8.3	114	13.4	189	8.1			0.9	1.61
3/31/2025	4	8.3	112	13.26	190	8.0			0.94	1.68
3/31/2025	5	7.9	102.9	12.91	190	7.8			1.31	2.25
3/31/2025	6	7.4	101.6	12.2	191	7.6			1.43	2.48
3/31/2025	7	7.3	97.5	11.75	190	7.5			1.52	2.58
3/31/2025	8	7.2	93.7	11.32	191	7.4			1.69	2.84
3/31/2025	9	7.2	90.3	10.9	191	7.3			1.61	2.72
3/31/2025	10	7.2	87.4	10.56	191	7.2			1.65	2.77

3/31/2025	10.2	7.1	56.5	6.84	201	7.0			2.02	3.35
3/31/2025	0	9.1	104.6	12.07	187	8.3			0.32	0.72
3/31/2025	1	8.5	113.5	13.3	189	8.2			0.81	1.48
3/31/2025	2	8.4	113	13.2	187	8.1			0.91	1.63
3/31/2025	3	8.3	112	13.1	188	8.0			0.91	1.74
3/31/2025	4	8.3	111	13.1	190	7.9			1.02	1.8
3/31/2025	5	8	110	13	190	7.9			1.18	2.05
3/31/2025	6	7.6	107	12.8	187	7.7			1.3	2.25
3/31/2025	7	7.4	103	12.36	187	7.6			1.34	2.3
3/31/2025	8	7.2	98	11.8	191	7.5			1.51	2.56
3/31/2025	0	8.5	108	12.63	189	8.1			0.62	1.17
3/31/2025	1	8.3	108.9	12.8	190	8.0			0.83	1.5
3/31/2025	2	8.3	108.7	12.8	190	8.0			0.85	1.53
3/31/2025	3	8.1	107.4	12.7	190	7.8			1.06	1.86
3/31/2025	4	8	105.1	12.5	190	7.6			1.15	2
3/31/2025	5	7.6	101.2	12.1	190	7.4			1.86	3.1
3/31/2025	6	7.4	98.8	11.86	191	0.4			1.56	2.63
3/31/2025	7	7.3	95.2	11.47	190	7.3			1.33	2.29
3/31/2025	7.7	7.3	86.1	10.32	190	7.1			2.77	4.68
4/29/2025	0	14.7	101.2	10.55	194	7.8	1.2	0.73	0.1	0.17
4/29/2025	1	14.7	105.3	10.7	194	7.8	2.01	1.1	0.17	0.28
4/29/2025	2	14.7	105.3	10.7	194	7.8	3.2	1.7	0.21	0.34
4/29/2025	3	14.3	104	10.7	194	7.1	3.76	1.95	0.22	0.35
4/29/2025	4	13.1	100.9	10.6	192	7.6	4.1	2.12	0.31	0.5
4/29/2025	5	12.2	95.6	10.3	193	7.3	5.06	2.58	0.32	0.52
4/29/2025	6	11.2	81.3	8.92	194	7.1	3.85	2	0.33	0.53
4/29/2025	7	10.7	69.1	7.67	194	6.9	4.24	2.19	0.38	0.61
4/29/2025	8	10.4	55.9	6.25	195	6.7	4.76	2.43	0.43	0.67
4/29/2025	8.7	10.5	54.3	6.06	195	6.6	4.65	2.38	0.88	0.77
4/29/2025	0	15.3	103.4	10.4	194	7.2	0.99	0.62	0.05	0.09
4/29/2025	1	15.2	105.4	10.6	194	7.7	1.65	0.94	0.12	0.19
4/29/2025	2	14.9	105.7	10.7	194	7.7	2.95	1.56	0.23	0.37
4/29/2025	3	14.6	105.5	10.7	194	7.8	3.7	1.92	0.24	0.39
4/29/2025	4	12.1	95.3	10.2	195	7.5	4.72	2.42	0.33	0.53
4/29/2025	5	11.6	86	9.3	194	7.3	4.86	2.48	0.39	0.62
4/29/2025	6	10.69	66.9	7.4	195	7.1	4.42	2.27	0.35	0.56
4/29/2025	7	10.3	58	6.5	195	7.0	3.61	1.88	0.37	0.59
4/29/2025	8	10.2	49.3	5.6	196	6.9	4.37	2.25	0.43	0.69
4/29/2025	9	10.1	44.8	5.04	196	6.9	4.2	2.17	0.47	0.76
4/29/2025	10	10	39	4.4	197	6.9	3.62	1.89	0.54	0.86
4/29/2025	10.5	9.9	24.1	2.7	199	6.9	5.34	2.72	0.65	1.03
4/29/2025	0	14.9	104.7	10.6	194	7.6	1.13	0.69	0.06	0.1
4/29/2025	1	14.9	108.8	11	194	7.8	1.84	1.03	0.12	0.2

4/29/2025	2	14.8	109.2	11.1	194	7.8	3.11	1.64	0.19	0.3
4/29/2025	3	14.7	109.3	11.1	194	7.8	3.44	1.8	0.21	0.34
4/29/2025	4	14.1	107.9	11.1	193	7.8	4.06	2.1	0.24	0.39
4/29/2025	5	12.1	101	10.84	192	7.6	5.25	2.67	0.34	0.56
4/29/2025	6	10.9	88	9.7	194	7.3	5.79	2.93	0.34	0.55
4/29/2025	7	10.2	66.5	7.47	195	7.1	4.66	2.39	0.37	0.6
4/29/2025	8	10	46.3	5.2	196	6.9	5.01	2.56	0.52	0.83
4/29/2025	8.3	10	39.7	4.5	196	6.9	5.29	2.69	0.59	0.93
5/30/2025	0	17.9	110.5	10.5	197	8.4	4	1.07	0.11	0.45
5/30/2025	1	17.8	110.4	10.5	198	8.3	4.28	1.15	0.16	0.5
5/30/2025	2	17.6	108.6	10.4	196	8.1	5.36	1.42	0.18	0.51
5/30/2025	3	17.4	102.9	10.1	196	7.9	7.19	1.88	0.16	0.49
5/30/2025	4	16.8	98.7	9.6	197	7.6	9.15	2.38	0.32	0.67
5/30/2025	5	15.9	86.1	8.5	195	7.3	12.17	3.14	0.46	0.81
5/30/2025	6	14.5	47.7	4.85	198	6.9	5.9	1.56	0.41	0.76
5/30/2025	7	12.6	13	1.38	209	6.5	1.95	0.56	0.21	0.55
5/30/2025	8	12.1	6.2	0.66	212	6.6	1.86	0.54	0.15	0.49
5/30/2025	8.1	12.1	3.7	0.39	217	6.6	5.19	1.38	0.16	1.55
5/30/2025	0	18.2	113	10.6	198	8.4	3.44	0.94	0.11	0.44
5/30/2025	1	17.9	113	10.74	196	8.5	4.4	1.2	0.06	0.39
5/30/2025	2	17.7	113	10.7	196	8.3	6.7	1.76	0.19	0.53
5/30/2025	3	17.4	110	10.6	196	8.1	8.13	2.12	0.27	0.63
5/30/2025	4	16.7	95	9.23	198	7.7	8.28	2.16	0.29	0.64
5/30/2025	5	15.9	85.3	8.4	195	7.4	10.5	2.7	0.51	0.86
5/30/2025	6	13.9	43	4.45	201	6.8	5.93	1.56	0.51	0.87
5/30/2025	7	12.4	10.8	1.14	210	6.6	1.21	0.37	0.1	0.43
5/30/2025	8	12	6	0.64	213	6.6	1.1	0.35	0.11	0.45
5/30/2025	9	11.9	3.7	0.4	212	6.6	0.72	0.25	0.07	0.4
5/30/2025	10	11.5	2.6	0.28	224	6.7	1.1	0.35	0.08	0.42
5/30/2025	10.5	11	1.7	0.19	245	6.8	6.55	1.72	0.71	1.07
5/30/2025	0	18.6	113	10.6	196	8.5	0.74	2.67	0.08	0.25
5/30/2025	1	18.4	117	11	195	8.6	1.02	3.74	0.06	0.39
5/30/2025	2	17.9	116	11	194	8.4	1.46	5.53	0.15	0.48
5/30/2025	3	17.4	113	10.8	196	8.2	1.95	7.46	0.19	0.53
5/30/2025	4	16.3	103	10.1	196	7.8	2.89	11.2	0.43	0.78
5/30/2025	5	15.4	73.9	7.3	195	7.3	2.47	9.5	0.46	0.81
5/30/2025	6	14.2	30.1	3.09	197	7.8	0.56	2.03	0.92	0.92
5/30/2025	7	12.4	19.9	1.18	208	6.5	0.31	0.94	0.04	0.37
5/30/2025	8	11.9	5.8	0.51	211	6.6	0.23	0.64	0.02	0.35
7/29/2025	0	29.6	142	10.9	219	9.4	3.6	0.98	0.59	0.95
7/29/2025	1	28.6	145	11.2	219	9.5	7.56	1.97	1.15	1.52
7/29/2025	2	28	141	11	218	9.4	8.13	2.12	1.54	1.95
7/29/2025	3	26.2	97.4	7.86	210	9.1	5.2	1.4	1.5	1.9

7/29/2025	4	22.2	37.1	3.23	212	7.5	19.2	4.9	0.93	1.3
7/29/2025	5	20.3	29.1	2.63	203	7.5	4.7	1.26	0.4	0.75
7/29/2025	6	15.9	5.5	0.56	241	6.6	0.7	0.26	0.11	0.44
7/29/2025	7	13.8	3.7	0.38	252	6.6	0.5	0.2	0.2	0.54
7/29/2025	8	13	2.5	0.26	265	6.7	1.53	0.45	0.77	1.14
7/29/2025	9	12.5	1.9	0.2	269	6.6	1.98	0.57	0.77	1.13
7/29/2025	10	12.2	1.4	0.15	279	6.6	2.65	0.74	0.87	1.25
7/29/2025	10.5	12.1	0.9	0.1	284	6.6	7.06	1.85	2.29	2.73
7/29/2025	0	29.2	135	10.3	218	9.4	5.06	1.34	0.95	1.32
7/29/2025	1	27.9	139	10.7	218	9.4	7.69	2	1.46	1.86
7/29/2025	2	27.3	131	10.4	216	9.3	9.25	2.4	1.7	2.1
7/29/2025	3	26.5	109.9	8.8	213	8.6	7.25	1.89	1.85	2.27
7/29/2025	4	25.1	54.3	4.47	208	7.5	3.26	0.89	0.77	1.13
7/29/2025	5	19.7	10.7	0.98	208	6.6	3.3	0.9	0.2	0.57
7/29/2025	6	15.4	4	0.4	230	6.3	0.9	0.3	0.01	0.42
7/29/2025	7	13.7	2.4	0.3	251	6.1	0.46	0.2	0.17	0.52
7/29/2025	8	12.9	1.7	0.2	266	6.3	4.05	1.1	1.83	2.25
7/29/2025	0	29.7	148	11.2	220			6.65		1.11
7/29/2025	1	28.8	146	11.3	219			2		1.35
7/29/2025	2	27.4	137	10.8	216			2.1		2.35
7/29/2025	3	26.6	118	9.4	213			1.8		2.4
7/29/2025	4	25.1	58.7	4.8	209			0.76		1.02
7/29/2025	5	19.4	9.8	0.9	212			0.9		0.46
7/29/2025	6	15	4.2	0.42	240			0.2		0.4
7/29/2025	7	13.5	3	0.31	259			0.3		0.9
7/29/2025	7.2	13.3	2.2	0.2	263			0.8		1.6
10/29/2025	0	13.3	89	9.33	214	7.3	8.46	2.01	0.35	0.26
10/29/2025	1	13.2	88.3	9.24	214	7.3	7.8	1.84	0.39	0.3
10/29/2025	2	13.2	87.8	9.19	214	7.3	7.7	1.8	0.32	0.23
10/29/2025	3	13.2	87.4	9.16	214	7.3	6.73	1.57	0.38	0.29
10/29/2025	4	13.2	87.3	9.14	214	7.3	7.95	1.88	0.37	0.28
10/29/2025	5	13.2	87.1	9.12	214	7.3	7.66	1.81	0.39	0.3
10/29/2025	6	13.2	86.9	9.1	214	7.3	7.86	1.85	0.37	0.28
10/29/2025	7	13.2	86.5	9.08	214	7.3	7.51	1.77	0.3	0.21
10/29/2025	8	13.2	86	9.03	214	7.2	7.96	1.58	0.35	0.26
10/29/2025	9	13.1	85.7	9.02	214	7.2	7.22	1.68	0.34	0.24
10/29/2025	10	13	84.7	8.93	214	7.2	7.88	1.86	0.3	0.2
10/29/2025	10.1	13	45.7	4.78	229	6.8	25.14	6.17	5.46	5.75
10/29/2025	0	13.2	92.3	9.67	214	7.1	5.86	1.36	0.36	0.27
10/29/2025	1	13.2	89.7	9.39	214	7.2	7.61	1.79	0.36	0.27
10/29/2025	2	13.2	88.8	9.3	214	7.3	6.79	1.59	0.33	0.24
10/29/2025	3	13.2	88.2	9.25	214	7.3	6.7	1.56	0.35	0.26
10/29/2025	4	13.2	88	9.23	214	7.3	8.36	1.98	0.32	0.23

10/29/2025	5	13.2	87.7	9.2	214	7.2	6.82	1.6	0.32	0.23
10/29/2025	6	13.2	87.4	9.17	214	7.2	6.34	1.48	0.36	0.27
10/29/2025	7	13.1	87	9.14	214	7.2	6.5	1.52	0.3	0.21
10/29/2025	7.8	12.9	84.7	8.94	215	7.2	5.3	1.22	0.29	0.2
10/29/2025	0	13.2	93.5	9.79	214	7.2	7.84	1.85	0.47	0.39
10/29/2025	1	13.3	91.3	9.56	214	7.3	9.31	2.22	0.47	0.39
10/29/2025	2	13.2	90.7	9.5	214	7.3	8.28	1.96	0.43	0.34
10/29/2025	3	13.2	90	9.43	214	7.3	6.93	1.62	0.39	0.3
10/29/2025	4	13.2	89.2	9.35	214	7.3	8.42	2	0.39	0.3
10/29/2025	5	13.2	88.8	9.31	214	7.3	7.58	1.78	0.37	0.28
10/29/2025	6	13.2	88.4	9.27	214	7.3	7.94	1.88	0.38	0.29
10/29/2025	7	13	88.1	9.27	214	7.3	8.07	1.91	0.37	0.28
10/2/2025	0	20	86	7.82	208	7.4	3.9	0.86	0.31	0.22
10/2/2025	1	20	88.9	7.72	208	7.7	5.81	1.34	0.43	0.35
10/2/2025	2	19.9	84.2	7.67	208	7.6	7.4	1.74	0.54	0.46
10/2/2025	3	19.9	83.4	7.6	208	7.6	7.5	1.76	0.45	0.37
10/2/2025	4	19.9	82.8	7.6	208	7.5	8.9	2.1	0.55	0.47
10/2/2025	5	19.8	82.1	7.5	208	7.4	7.84	1.85	0.47	0.39
10/2/2025	6	19.6	81.7	7.5	209	7.4	7.9	1.87	0.43	0.34
10/2/2025	7	17.6	37.8	3.6	284	6.7	4.45	1	0.41	0.32
10/2/2025	8	16.3	7.4	0.7	315	6.7	4.86	1.1	0.71	0.64
10/2/2025	9	14.4	2.9	0.29	331	6.6	6.09	1.4	0.8	0.74
10/2/2025	10	13.4	2	0.21	355	6.5	12.05	2.9	1.95	1.98
10/2/2025	0	20.4	85.8	7.74	209	7.3	3.85	0.85	0.31	0.22
10/2/2025	1	20	81.7	7.43	209	7.2	7.4	1.75	0.49	0.41
10/2/2025	2	19.9	77.2	7.04	209	7.2	7.29	1.71	0.49	0.41
10/2/2025	3	19.8	74.6	6.8	209	7.1	8.02	1.91	0.41	0.32
10/2/2025	4	19.8	75.9	6.93	209	7.1	7.49	1.76	0.39	0.31
10/2/2025	5	19.7	76.5	7	209	7.1	7.2	1.69	0.4	0.31
10/2/2025	6	19.4	71.9	6.6	216	7.0	6.26	1.45	0.32	0.23
10/2/2025	7	18	26.2	2.48	283	6.6	4.85	1.1	0.49	0.41
10/2/2025	7.1	17.8	9.7	0.9	291	6.7	4.13	0.92	0.43	0.35
10/2/2025	8	16.2	4.7	0.5	318	6.7	5.06	1.16	0.82	0.76
10/2/2025	0	20.7	95.7	8.58	208	7.4	3.98	0.86	0.86	0.1
10/2/2025	1	20.5	96.6	8.7	208	7.5	7.59	1.79	1.79	0.4
10/2/2025	2	20.2	95.3	8.64	208	7.4	8.9	2.11	0.62	0.54
10/2/2025	3	20.1	90.5	8.22	208	7.3	8.87	2.11	0.52	0.44
10/2/2025	4	20	88.4	8.03	208	7.3	8.84	2.1	0.45	0.37
10/2/2025	5	20	86.9	7.9	208	7.2	8.25	1.95	0.45	0.37
10/2/2025	6	19.8	78.7	7.18	213	7.1	7.2	1.7	0.35	0.26
10/2/2025	7	17.8	34.8	3.3	289	6.7	3.76	0.83	0.37	0.28
10/2/2025	7.5	17.1	9.1	0.88	309	6.7	5.99	1.39	0.83	0.77
6/27/2025	0	26.3	108	8.71	211	8.0	4.26	1.14	0.19	0.53

6/27/2025	1	26.4	108	8.7	211	8.2	4.83	1.29	0.1	0.44
6/27/2025	2	26.3	108	8.7	211	8.2	4.27	1.15	0.11	0.44
6/27/2025	3	22.3	111	9.6	211	8.2	4.9	1.3	0.96	1.34
6/27/2025	4	20.5	104	9.3	206	7.7	7.99	2.08	1.36	1.76
6/27/2025	5	16.2	38	3.7	201	6.8	8.4	2.19	1.52	1.92
6/27/2025	6	14.2	9.3	0.95	216	6.3	2.6	0.72	0.22	0.56
6/27/2025	7	13.3	5.7	0.6	230	6.3	0.83	0.28	0.19	0.53
6/27/2025	7.6	12.9	4	0.4	234	6.4	0.84	0.28	0.3	0.65
6/27/2025	0	26	110	8.9	210	8.4	5.39	1.43	0.21	0.55
6/27/2025	1	26	112	9.1	210	8.5	6.06	1.6	0.16	0.5
6/27/2025	2	25.9	113	9.2	210	8.5	6.5	1.7	0.16	0.49
6/27/2025	3	22.5	113	9.7	208	8.5	4.71	1.26	0.93	1.31
6/27/2025	4	19.6	94.1	8.6	206	7.6	6.23	1.64	1.2	1.58
6/27/2025	5	16.4	21.1	2.07	199	6.6	5.38	1.42	1.77	2.19
6/27/2025	5.1	15.9	5.2	0.5	200	6.4				
6/27/2025	6	14.2	3.6	0.35	216	6.3	1.32	0.4	0.15	0.49
6/27/2025	7	13.2	1.9	0.2	228	6.5	0.45	0.18	0.13	0.46
6/27/2025	8	12.4	1.1	0.12	237	6.6	0.31	0.15	0.13	0.46
6/27/2025	9	12.2	0.8	0.09	241	6.6	0.63	0.23	0.11	0.44
6/27/2025	10	11.9	0.6	0.07	252	6.6	1.4	0.42	0.18	0.52
6/27/2025	10.2	11.6	0.5	0.05	260	6.6	2.15	0.61	0.39	0.74
6/27/2025	0	25.9	119	9.6	210	8.7	3.75	1.01	0.12	0.45
6/27/2025	1	25.9	119	9.7	210	8.7	6.45	1.69	0.19	0.52
6/27/2025	2	25.6	118	9.66	210	8.7	7.44	1.94	0.36	0.7
6/27/2025	3	22.8	118	10.2	207	8.7	8.2	2.14	0.97	1.34
6/27/2025	4	18.7	83.6	7.8	205	7.5	4.48	1.2	1.41	1.81
6/27/2025	5	16.4	24.8	2.42	196	6.8	5.82	1.5	2.82	3.28
6/27/2025	6	14.4	9.3	0.95	211	6.4	2.73	0.76	0.26	0.6
6/27/2025	7	13.2	5.4	0.57	227	6.5	0.3	0.14	-0.01	0.32
6/27/2025	8	12.4	3.7	0.39	239	6.6	0.51	0.2	0.18	0.52
8/29/2025	0.2	22.8	95.5	8.1	209	7.9		0.6		1.0
8/29/2025	1.0	22.8	95.1	8.1	210	8.0		0.8		1.3
8/29/2025	2.0	22.9	95.0	8.0	210	8.1		1.0		1.2
8/29/2025	3.0	22.9	92.8	7.9	209	8.1		1.0		1.2
8/29/2025	4.0	22.8	85.0	7.2	209	7.8		1.1		1.2
8/29/2025	4.0	22.8	85.0	7.2	207	7.4		1.2		0.8
8/29/2025	5.0	22.5	52.1	4.4	252	7.2		0.9		1.1
8/29/2025	6.0	17.3	1.6	0.2	275	7.1		3.8		1.1
8/29/2025	7.0	14.9	0.3	0.0	276	7.0		2.4		1.1
8/29/2025	8.0	14.2	0.0	0.0	282	7.0		2.4		2.1
8/29/2025	9.0	13.4	0.0	0.0	293	7.0		2.1		1.8
8/29/2025	10.0	12.9	0.1	0.0	312	6.9		2.1		2.1
8/29/2025	0.2	22.9	100.2	8.5	196	8.6		0.3		1.0

8/29/2025	1.0	22.9	99.7	8.4	196	8.7	0.5	1.2
8/29/2025	2.0	22.9	98.8	8.4	197	8.6	0.5	1.3
8/29/2025	3.0	22.9	97.7	8.3	199	8.4	0.6	1.2
8/29/2025	4.0	22.9	97.2	8.2	200	8.3	0.9	1.3
8/29/2025	5.0	22.9	93.5	7.9	201	8.0	1.1	1.4
8/29/2025	6.0	18.7	19.1	1.8	236	7.1	3.9	1.0
8/29/2025	6.0	18.1	9.0	0.8	239	7.1	2.4	0.9
8/29/2025	7.0	15.2	0.7	0.1	259	7.0	2.4	0.7
8/29/2025	0.2	23.4	97.2	8.1	182	7.9	0.0	0.9
8/29/2025	0.2	23.4	97.2	8.1	183	7.9	0.0	0.8
8/29/2025	0.9	23.1	96.3	8.1	183	8.1	0.0	1.1
8/29/2025	0.9	23.1	96.2	8.1	183	8.1	0.5	1.0
8/29/2025	2.0	23.0	95.6	8.1	188	8.1	0.8	1.2
8/29/2025	3.0	22.9	94.4	8.0	202	8.2	0.7	1.2
8/29/2025	4.0	22.8	94.7	8.0	203	8.4	0.9	1.4
8/29/2025	5.0	22.6	82.2	7.0	203	8.1	0.7	1.1
8/29/2025	6.0	18.7	1.5	0.1	238	7.1	3.7	1.2
8/29/2025	7.0	15.2	0.3	0.0	269	7.0	2.3	1.4
8/29/2025	7.6	14.6	0.1	0.0	275	7.0	2.4	2.2

Table 3. Raw Monthly Rainfall Totals 2020-2025 (RainDrop App)
[NOAA & NASA data with proprietary satellite data analysis & model]

Year	Month	Inches
2020	1	2.25
2020	2	4.13
2020	3	4.5
2020	4	5.2
2020	5	3.88
2020	6	3.3
2020	7	4.16
2020	8	5.39
2020	9	3.91
2020	10	4.13
2020	11	2.79
2020	12	3.24
2021	1	1.31
2021	2	3.57
2021	3	2.52
2021	4	2.3
2021	5	4.23
2021	6	1.76
2021	7	4.69
2021	8	5.27

2021	9	6.67
2021	10	5.69
2021	11	1.92
2021	12	1.24
2022	1	2.66
2022	2	2.84
2022	3	2.73
2022	4	4.47
2022	5	4.45
2022	6	4.44
2022	7	1.54
2022	8	1.37
2022	9	4.9
2022	10	3.49
2022	11	3.71
2022	12	5.51
2023	1	4.49
2023	2	1.26
2023	3	4.14
2023	4	5.7
2023	5	0.9
2023	6	4.39
2023	7	18.44
2023	8	5.51
2023	9	10.58
2023	10	4.36
2023	11	2.74
2023	12	7.98
2024	1	7.23
2024	2	2.56
2024	3	7.38
2024	4	4.08
2024	5	3.96
2024	6	3.41
2024	7	4.75
2024	8	6.2
2024	9	0.74
2024	10	0.1
2024	11	4.32
2024	12	4.53
2025	1	1.07
2025	2	2.52
2025	3	4.44
2025	4	3.47
2025	5	6.44

2025	6	2.39
2025	7	4.8
2025	8	2.13
2025	9	1.72
2025	10	5.29
2025	11	2.15
2025	12	4.26

Basic Lake Monitoring Parameters Descriptions

Lake measurements are typically taken at the deepest open-water location, but large or irregularly shaped lakes frequently require more than one sampling site to achieve representative data for lake management decision-making.

Water Clarity

A **Secchi disk**, an 8-inch circular black and white disk attached to a measuring tape, is commonly used to measure **water clarity**. The Secchi disk is lowered into the water on the shady side of the boat and is observed using a view scope to shade out light in one's peripheral vision. The depth at which the Secchi disk disappears from view is considered the water clarity measurement. This visual-based measurement is a simple yet effective method of assessing a basic parameter of water quality.

Secchi transparency is related to water column turbidity; it is a measure of light penetration. Factors like phytoplankton, suspended sediments, and microscopic organic matter influence light penetration and water turbidity. Clearer waterbodies possess higher Secchi transparency values. Open-water measurements above 6 meters (around 20ft) indicate very clear water, while measurements less than 2 meters (about 6 ft) suggest a high likelihood of impaired water quality and a higher likelihood of harmful cyanobacteria blooms. Water clarity and Secchi disk transparency are often lower in near-shore areas compared to central open-water monitoring sites, so you cannot directly compare the clarity at a shoreline dock to a measurement taken in open water. Secchi clarity fluctuates throughout the season, especially for larger waterbodies. These changes can be driven by variations in sediment and organic matter levels in the water, but clarity change is most often linked to nutrient increases that stimulate phytoplankton (microscopic algae) growth.

Monthly water clarity monitoring, ideally from April to October, is recommended. Secchi disk measurements are the simplest and most affordable method of tracking water quality and serve as the foundation for many volunteer monitoring programs. However, transparency measurements should be combined with more comprehensive monitoring to diagnose water quality issues or to assess the success of strategic lake management practices over time.

Lake Profile Measurements

Profile measurements involve taking multiple readings as conditions change from the top to the bottom of the water column. Ideally, profile measurements should be made at least one-meter increments from the lake surface to the bottom, on a monthly or biweekly basis. Alternatively, temperature profile data can be acquired by using relatively low-cost continuous data sensors set on a vertical buoy array in open water. Profile measurements are typically taken in the deepest location in the waterbody, but large or irregularly shaped lakes and reservoirs often require more than one location to adequately measure how the water column changes throughout a season or year over year.

Water temperature in lakes and ponds in the northeast follows a predictable seasonal pattern of warming and cooling. In early spring, following ice melt, lakes and ponds will exhibit a more or less uniform temperature from top to bottom. However, as the sun's rays penetrate the water column, profile measurements begin to change. The development and depth of a thermocline, a zone of rapid temperature change with depth, depends on the overall waterbody bathymetry (depth contours), lake surface area, climatic conditions, and water clarity. A **thermocline** indicates a strong temperature-driven density difference between the water above and below. Warmer surface water is less dense than cooler water at the bottom of the lake, which triggers a cascade of changes in other lake parameters during the "thermal stratification period."

In the northeast, lakes deeper than 20ft typically experience a thermal stratification period from late May to October. In the fall, as air temperatures drop, lake water temperature also drops, weakening the thermocline (stratification) and eventually leading to water "turnover." Lake turnover simply means that the temperature becomes uniform from top to bottom and that the thermocline disappears. Shallower lakes are more weather-dependent and may experience multiple thermal mixing events (partial turnover events) in a season. Very large and deep lakes often have more complex temperature dynamics. The temperature of a waterbody drives many other water quality parameters and lake conditions, including how plants and algae grow.

Dissolved oxygen (DO) is an essential parameter for aquatic life and plays a critical role in the health of a lake. DO levels vary throughout the year and are influenced by several factors, including temperature, plant and algae productivity, and aerobic respiration processes. In general, DO levels are highest in the spring and fall when the water is well-mixed and lowest at the bottom of the lake in summer when the lake is thermally stratified. The thermocline, a layer of water with a rapid temperature change with depth, acts as a barrier to oxygen transfer between the surface and bottom of the lake, leading to low DO levels in the hypolimnion, also known as the bottom layer of the lake. Lakes shallower than 20ft typically do not form a true hypolimnion layer, but they can still exhibit similar oxygen loss conditions at the bottom.

Lakes with very little decomposing material (muck/sediment) at the bottom, do not usually present a severe oxygen loss problem. More nutrient-rich lakes, however, can be completely depleted of oxygen in the bottom waters below the thermocline. This physical water column stratification and consumption of bottom-water DO during summer results in **anoxic** (<1mg/L) conditions in deeper waters of many lakes. Such conditions change the bottom nutrient chemistry of the lake. It is critical to track oxygen loss beneath the thermocline and/or the level of the **anoxic boundary** because DO loss has implications for surface water algae conditions. The anoxic boundary is defined as the depth of water at which dissolved oxygen is depleted in the summer. Anoxia worsens towards the end of summer, just before fall 'turn-over,' which will eventually replenish oxygen to the bottom, even in polluted northeastern lakes. Anoxia also tends to worsen over time, increasing incrementally for years and years. Anoxia can also form under winter ice in eutrophic waterbodies.

DO concentrations are typically reported in milligrams per liter (mg/L). A healthy lake should have DO levels of at least 6 mg/L throughout the water column. However, DO levels can vary significantly depending on the time of day, weather conditions, and the lake's biological activity. Each lake is unique and low DO levels are sometimes natural and not an immediate concern for certain waterbodies. However, low DO levels can hurt aquatic life and such conditions may stimulate algae blooms because of the way the sediment chemistry changes in the absence of oxygen (internal recycling of nutrients from muck to the water column). Certain fish and other organisms are more resilient to lower oxygen concentrations than others, which is why scientists often associate certain species with worsened water quality. Monitoring DO levels is an important part of lake management. By tracking DO levels over time, managers can identify potential problems and take corrective measures to protect the health of the lake.

Lake Nutrients Samples

Water **nutrients** samples should be ideally collected monthly from April to October in at least the deepest part of the lake. The most critical times for sampling are early spring, mid to late summer, and fall. Sampling depths usually incorporate top, middle, and bottom depths. Deeper lakes may need more samples arranged vertically in the water column. Shallower lakes may only need top and bottom samples. Water samples are typically analyzed for total phosphorus, total nitrogen, ammonia nitrogen, and nitrate nitrogen.

In baseline assessments, several additional parameters are also needed. **Phosphorus** and **Nitrogen** are the two principal plant nutrients that drive aquatic plant and algae growth. Due to lake temperature stratification, these nutrients are not usually present in the same quantities throughout the lake. Typically, the bottom of the lake has more phosphorus and nitrogen as the summer progresses because bottom sediments release nutrients when oxygen is depleted (internal loading). Just as anoxia increases over time, phosphorus and nitrogen also tend to increase over time as a waterbody becomes more eutrophic, or dominated by plants and algae.

Additional Important Measurements

The following parameters can be taken as profile measurements or as depth-specific measurements.

The **pH** of a lake is more or less a measure of its acidity or basicity, determined by the balance between hydrogen (H+) and hydroxide (OH-) ions in the water. A pH of 7 is neutral, while values below 7 indicate acidity and those above 7 signify alkaline conditions. The pH of a lake plays a pivotal role in its overall conditions, influencing the availability of nutrients for aquatic life and impacting the toxicity of various pollutants. Fluctuations of lake pH result from the underlying bedrock and soil composition, the extent of vegetation, and human activities. Typically, the pH of most lakes in the northeast falls between 6 and 8. pH generally decreases with depth in thermally stratified lakes, as a result of plant and algae photosynthetic consumption of dissolved CO2 in the surface waters. pH measurements require careful calibration of both in situ and laboratory probes. Not all methods of pH testing are accurate enough for lake monitoring purposes.

Specific conductance (conductivity) is a measure of the ability of water to conduct an electrical current. It is influenced by the concentration of dissolved ions in the water, such as salts, minerals, and organic matter. In a lake water column, conductivity typically increases slightly with depth as there are more dissolved ions in the deeper water. High conductivity can indicate that a lake is polluted with salts or other contaminants. High conductivity can often be traced to road salting practices or pollution from shoreline septic systems. Conversely, low conductivity can indicate that a lake is oligotrophic, or very low in nutrients. A conductivity meter measures the electrical resistance of a sample of water. The results are typically reported in units of microsiemens per centimeter (μS/cm).

Metals & other compounds: Other metals that are involved in the amount and availability of phosphorus (the key plant nutrient), are Iron, Manganese, and Aluminum.