Ecosystem Consulting Service
A Division of GZA

GEOTECHNICAL
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November 11, 2025
Project No. 05.0046838.04

Mr. Scott Soderberg
Gardner Lake Authority
240 Hartford Road
Salem, CT 06420

Re: Gardner Lake 2025 Monitoring Report
Gardner Lake, Salem, CT

Dear Mr. Soderberg

GZA GeoEnvironmental, Inc. (GZA) is pleased to provide this update to the Gardner Lake Authority (GLA) summarizing our observations and findings related to water quality on Gardner Lake in 2025. This report and its findings and recommendations are subject to the Limitations attached as **Appendix A**.

BACKGROUND

Gardner Lake is an approximately 550-acre waterbody located in the Towns of Salem, Bozrah, and Montville, Connecticut. It has been monitored by GZA (formerly Ecosystem Consulting Service) since 1996, under the direction of the GLA. The long-term monitoring program was originally established to assess trophic state conditions, track oxygen dynamics in the lake's deep basin, and evaluate nutrient trends in support of proactive watershed and in-lake management. Over nearly three decades, the program has provided a continuous record of physical, chemical, and biological data that constitute one of the most complete long-term limnological datasets in the State of Connecticut.

The lake's bathymetry and hydrology play a defining role in its limnological behavior, which GZA has identified as a key natural feature. Gardner Lake has a maximum depth of approximately 42–45 feet (ft) (~13.7 meters (m)) and a mean depth near 13.7 ft (~4.2 m). Although its total volume is about 7,500 acre-feet, less than 2% of this volume occurs below 24 feet (7.3 m), and only 33% occurs below 12 ft (3.7 m). However, roughly 55% of the lake bottom lies deeper than 12 ft (3.7 m), forming a broad mid-depth plateau between 12 ft (3.7 m) and 24 ft (7.3 m). This morphology makes the system particularly sensitive to internal nutrient loading when bottom waters become anoxic (oxygen-depleted, defined as dissolved oxygen < 1.0 milligrams per liter (mg/L)). The small deep basin north of Minnie Island—commonly referred to as the "deep hole"—is the focal point for monitoring because it provides a representative sample of the entire water column and it represents the most vulnerable area to oxygen depletion (anoxia) and nutrient loading from sediments (**Figure 1**).

Since the initial 1996 baseline study, Gardner Lake has generally maintained mesotrophic characteristics: moderate nutrient levels, good transparency, and episodic late-summer oxygen depletion confined primarily to the deep basin. Routine measurements of Secchi depth, thermal stratification, dissolved oxygen, and nutrient concentrations have allowed GZA to assess year-to-year variability and to distinguish between internal processes and watershed influences.

Management goals established in the late 1990s remain consistent today:

- Maintain total phosphorus (TP) below 20 micrograms per liter (µg/L; preferably <15 µg/L);
- Maintain dissolved oxygen (DO) above 1 mg/L at 6 m depth at all times;
- Maintain water clarity with Secchi transparency >3 m during summer months; and,
- Prevent development of “nuisance” aquatic invasive plant communities.

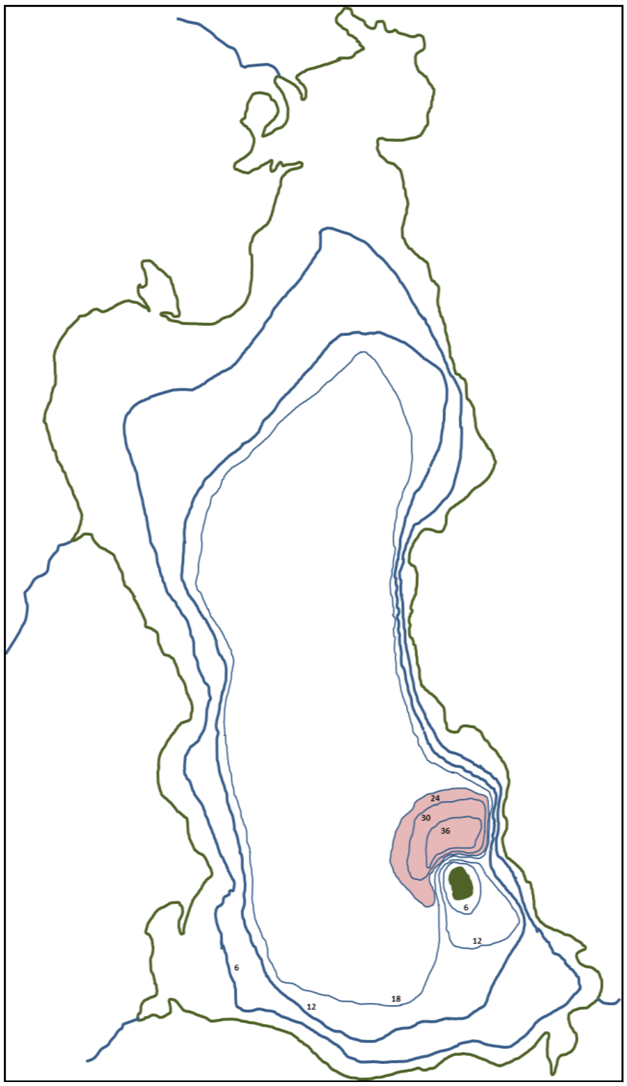

FIGURE 1. **Gardner Lake, with 6-ft contour bathymetry. The deepest area is sampled (area marked in pink), North of Minnie Island (pink).**

These goals have guided decades of assessment and management, emphasizing the prevention of “anoxic ascent”—the upward migration of the anoxic, or oxygen deficient zone—beyond the boundaries of the deep hole, which would increase internal phosphorus loading rates by an order of magnitude and degrade water quality.

The 2025 monitoring year continues the long-term cooperative assessment between GZA and the GLA. Building upon the 2024 findings—which documented stable water quality, but persistent anoxia and deep cyanobacteria density—this year’s program aimed to track any shifts in oxygen dynamics, transparency, and nutrient behavior under variable climate conditions.

Monitoring efforts at Gardner Lake have been especially important in recent years as regional trends show increasing frequency of thermal stratification intensity, extended duration of anoxia, and increasing hypolimnetic phosphorus accumulation in similar Connecticut lakes. These trends are often linked to climate-driven factors such as warmer summer surface temperatures, reduced wind mixing, and increased stormwater nutrient pulses related to watershed development.

In 2025, monitoring took on an additional focus due to 2024’s initial discovery and identification of the invasive aquatic plant *Hydrilla verticillata* (Hydrilla; **Figure 2**). During the annual macrophyte inspection on July 17, 2024, GZA staff identified rooted Hydrilla along multiple sections of the shoreline, including the dam outlet cove, eastern shoreline, and the beach and boat ramp areas. Genetic confirmation by the Connecticut Agricultural Experiment Station (CAES) reported that this strain matches the *Hydrilla verticillata* subsp. *lithuanica* Clade C previously documented in the Connecticut River and Lake Pocotopaug, and not the monoecious strain more common to northern lakes. This finding marks a significant ecological event for Gardner Lake and underscores the importance of continued vigilance in both invasive species management and nutrient control. 2025's macrophyte inspection focused on documenting the spread and extent of Hydrilla coverage. With this recent change along with other environmental pressures, upholding the original management goals of Gardner Lake has become more important than ever.

FIGURE 2. Sample of *Hydrilla verticillata* subsp. *lithuanica* Clade C.

MONITORING

Gardner Lake's 2025 monitoring involved a cooperative field effort between GZA staff and GLA volunteers. Gardner Lake was sampled 5 times (1 by GZA and 4 by GLA) in 2025, with monitoring occurring from late-May to early-September. Field staff performed vertical water column tests in meter increments to assess the lake's physical and chemical composition.

FIGURE 3. Example of a datalogging buoy, though instrumentation and depths vary. In Gardner, the top of the buoy remained submerged, was anchored at 12 m depth, and had three miniDOTs at 10, 6, and 2 m deep.

For more detailed chemical analyses, water samples were collected at 1 m, 5 m, and 10 m below the surface of the lake using a van-Dorn water sampler. When GZA sampled, a 5-meter sampling straw was used to collect phytoplankton samples which were preserved with Lugol's solution and shipped to a taxonomist for enumeration. A set of 3 miniDOTs were deployed early in the season in May at the routine sampling location and subsequently collected/removed in October (**Figure 3**). These miniDOTs recorded hourly snapshots of temperature and dissolved oxygen concentrations. Instruments were spot-checked, and data were collected during GZA's August field visit to confirm instrument function and performance. A complete hourly dataset from the three depths was recovered for 2025.

RESULTS

Climactic variability in rainfall and air temperature influence lake ecosystems in a variety of ways. For instance, **increased rainfall** results in elevated watershed connectivity, which could mean external inputs of nutrients or organic material. The Gardner Lake area experienced slightly above-average rainfall during the 2025 spring season, with the heaviest single rainfall event occurring in late-May (**Figure 4**), but the summer and fall seasons (from July onwards) were dry with little precipitation in the area of Gardner Lake and more regionally across Connecticut.

Air temperature can be assessed by cumulative density degree days (DDD; **Figure 5**) calculated by subtracting the temperature at which water is densest (4 °C or roughly 40 °F) from mean daily air temperature. The residual, which is cumulative through time, is the DDD. This is similar in concept to growing degree days (GDD), often used for agricultural purposes. 2025 DDD indicates a relatively average temperature year (in comparison to recent years), cool compared to 2024 but warmer than 2023. Compared to recent years, early spring temperatures were relatively warm, though fall temperatures (from September onwards) were cool.

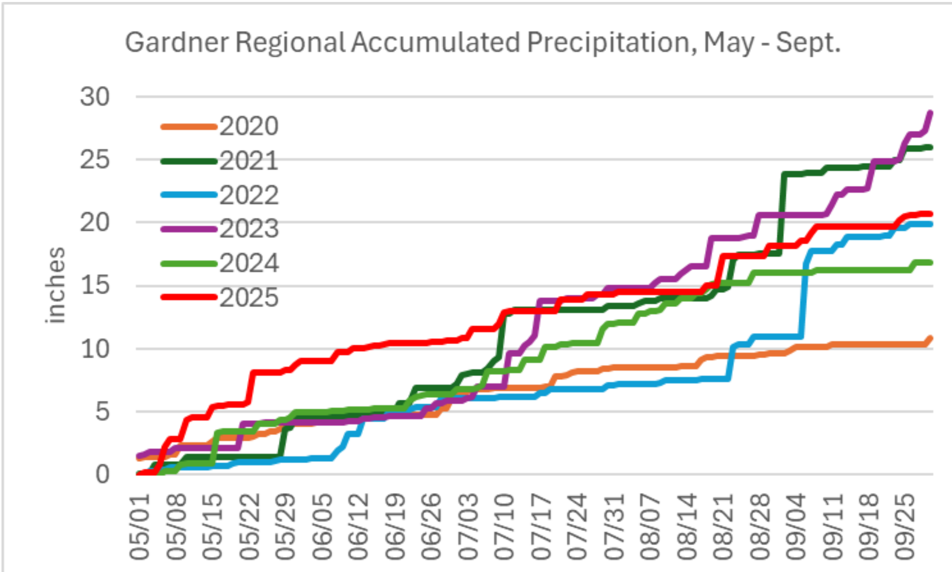

FIGURE 4. Gardner Lake accumulated precipitation.

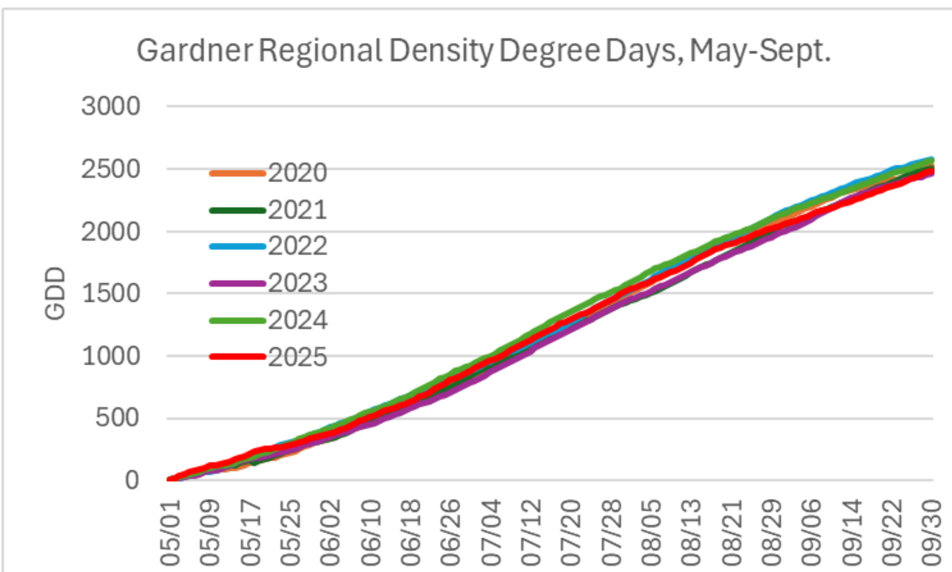

FIGURE 5. Gardner Lake heat accumulation (recorded as density degree days, DDD).

In mid-May, the temperature at the surface of the water column was 18 ˚C and 13 ˚C over bottom, and though briefly interrupted in late May, this temperature gradient intensified through summer (**Figure 6**). **Thermal stratification**, where warm water is located at the surface, and colder, denser water is located deep, began in Gardner starting in May, though stabilized in June (**Figure 7**). Stratification is measured by relative thermal resistance to mixing (RTRM), which is a unitless ratio. RTRM below 30-50 at any given depth, or below 100 when summed across the water column, is considered weak. Stratification in Gardner Lake was relatively weak in 2025, peaking in July at 6 m (136 RTRM, or 348 summed across the whole water column). The thermocline remained at approximately 6 m through July, though MiniDOT data loggers suggested it deepened in August and September. By October, it weakened substantially with minimum RTRM indicating fall turnover and mixed lake conditions.

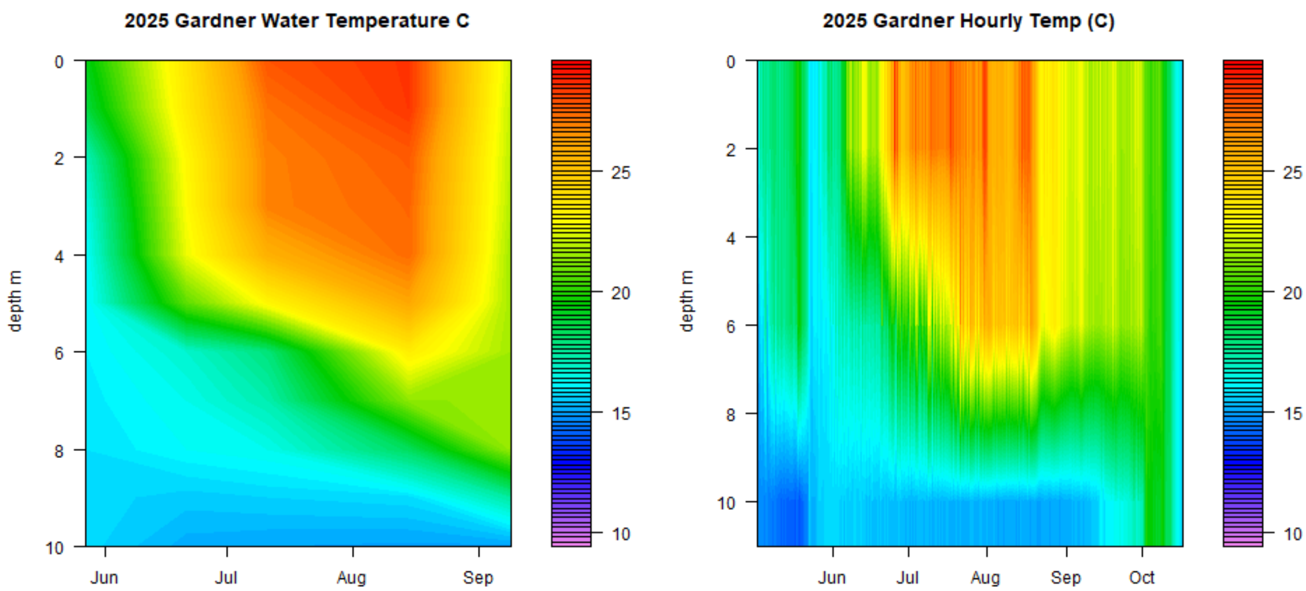

FIGURE 6. Gardner Lake monthly (left) and hourly (right) temperature profiles.

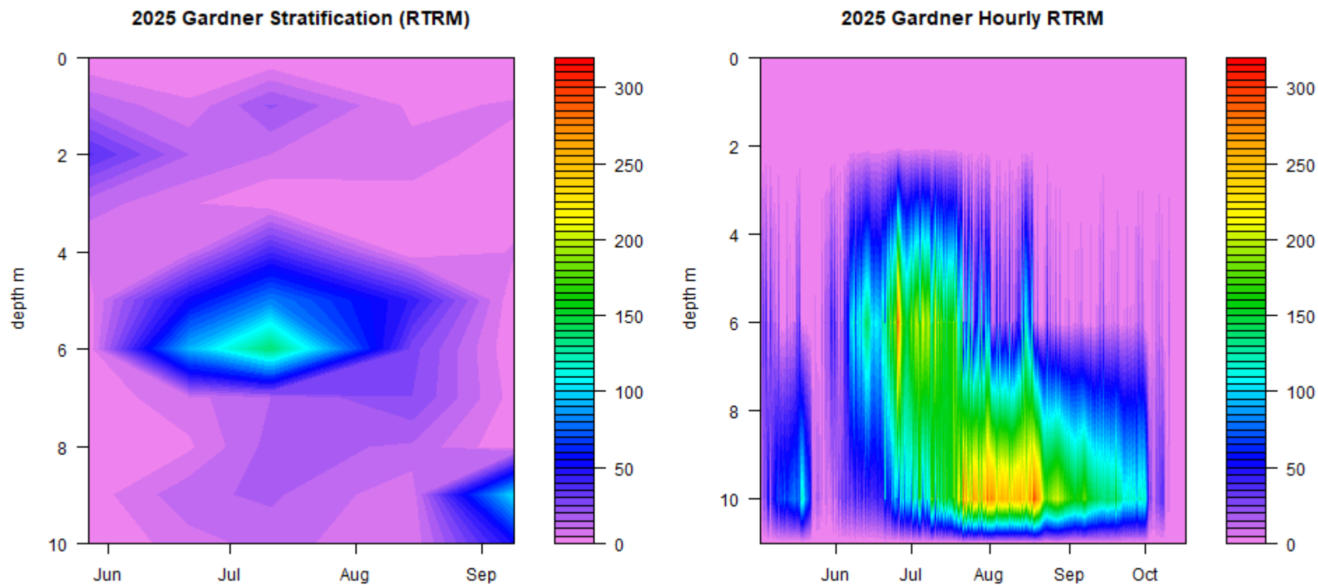

FIGURE 7. Gardner Lake monthly (left) and hourly (right) stratification profiles (measured as relative thermal resistance to mixing, RTRM).

Dissolved oxygen (DO) is critical for lakes as it allows organisms to conduct aerobic respiration and can maintain good water quality in recreational water sources. DO is diffused across the lake's surface from the atmosphere or produced by plants and phytoplankton within the lake. After lakes experience stratification, DO in the deepest hypolimnetic layer can become exhausted by biological processes (mainly, microbial respiration). This leads to anoxia (defined here as DO < 1.0 mg/L) and, often, chemically reduced conditions (low oxidation-reduction potential (**ORP**)). Such conditions increase the rate of release and transport of problematic nutrients and constituents such as TP, iron (Fe), and manganese (Mn) from the lake sediments into the water column. TP and Fe are critical nutrients for cyanobacteria growth, while Mn can be a concern in source water reservoirs. Hence, the water at the bottom of the lake during the summer may not only be cold and dense (which is not problematic in and of itself), but if anoxic and chemically reduced, it may also be very nutrient and metal rich (which can have negative implications).

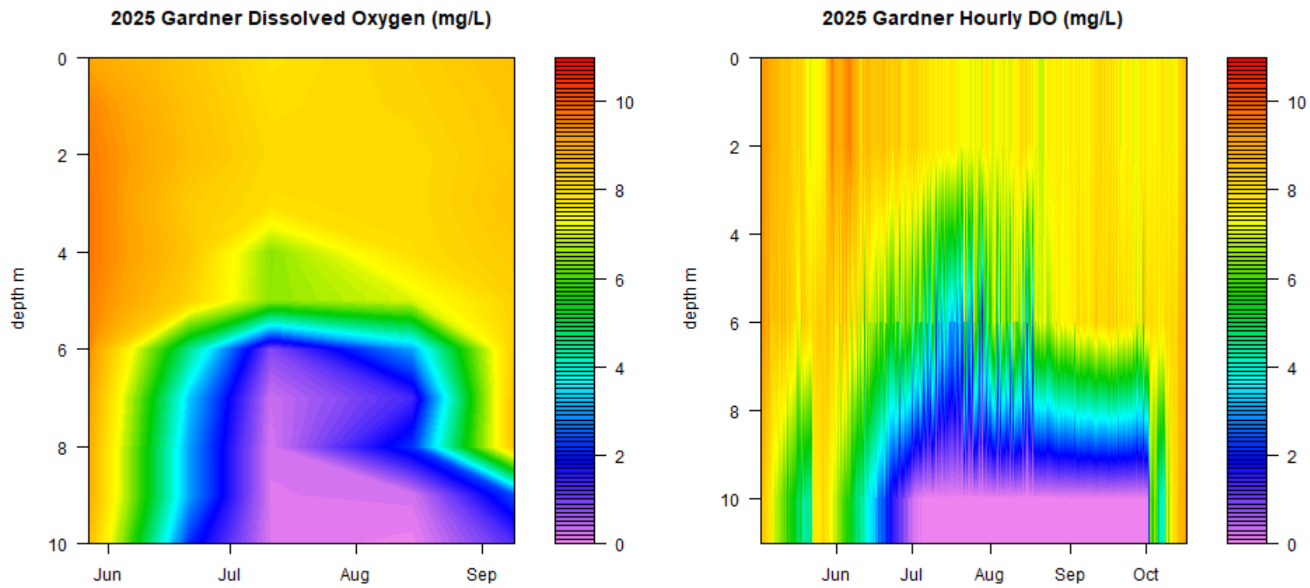

FIGURE 8. Gardner Lake monthly (left) and hourly (right) dissolved oxygen (DO) profiles.

Gardner Lake was relatively aerobic through the 2025 season, with DO concentrations remaining mostly above 1 mg/L (the threshold for anoxia). Anoxia occurred from 6 m down to over-bottom depths early in July but was otherwise contained at or below 8 m through September (**Figure 8**). These conditions are favorable, as in recent years (including 2024) anoxia ascended high into the water column and remained at 6 m (the edge of the deep hole). **DO saturation** is a related, but slightly different metric to DO concentration (**Figure 9**). It can indicate supersaturation (DO > 100% saturation) of the water column which may correspond to high rates of photosynthetic productivity. Mainly, this can be an indicator of phytoplankton growth and reproduction leading into or during bloom conditions. Mild supersaturation (≤ 110%) was observed at the surface throughout the season but did not clearly indicate elevated phytoplankton productivity.

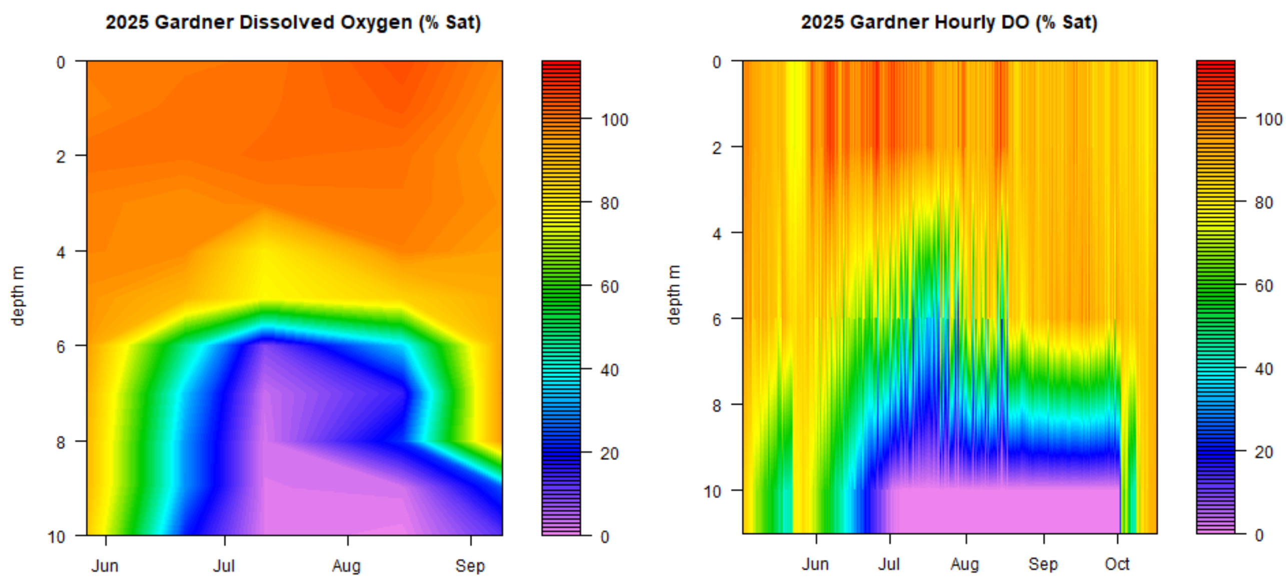

FIGURE 9. Gardner Lake monthly (left) and hourly (right) dissolved oxygen (% saturation) profiles.

In the reduced oxygen conditions (anoxia), **Fe and Mn** can become reduced and mobilized from sediments into the water column by anaerobic microbial respiration, which requires 'scavenging' for these constituents for use as electron acceptors in lieu of oxygen. When anoxia occurs for a duration of time, Fe and Mn can accumulate to high concentrations in over-bottom water. Chemistry analyses suggested that anaerobic respiration byproducts, such as Fe, accumulated over bottom through the season, starting in July and peaking above 3 mg/L in August (**Figure 10**). Mn followed the same trend, though peaking in September at approximately 2.4 mg/L. Compared to 2024, which had more intense anoxia, 2025 deep Fe and Mn accumulation initiated later in the season, and Fe was reduced (compared to 7 mg/L) though Mn was higher (compared to 1.4 mg/L).

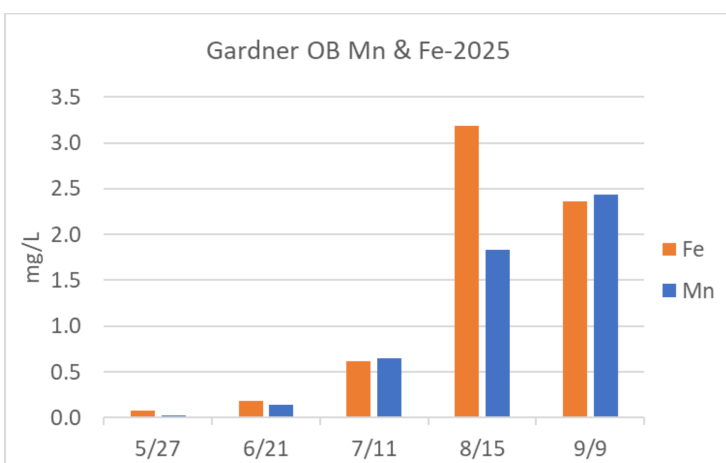

FIGURE 10. Gardner Lake over bottom manganese (Mn) and iron (Fe).

Total Phosphorus (TP) is a key nutrient for biological productivity in lakes in the northeast. Typically, we prefer to see TP at the top of a lake or reservoir (where there is sunlight exposure) no higher than 20 µg/L. TP in the 15 – 20 µg/L range can initiate and sustain some types of cyanobacteria at high cell densities if other conditions are favorable (such as temperature, sunlight, micronutrients, etc.). Thus, a threshold of 20 µg/L TP indicates favorable nutrient conditions for cyanobacteria, at which blooms can initiate and be sustained in fresh waterbodies. Gardner Lake is a moderate TP system, though 2025 was favorable with regards to TP. 2024 mean TP was around 17 µg/L and 2025 mean TP was 14.5 µg/L (**Figure 11**). Over bottom TP is typically moderately enriched due to internal loading, averaging 23 µg/L and peaking at 58 µg/L in August 2025.

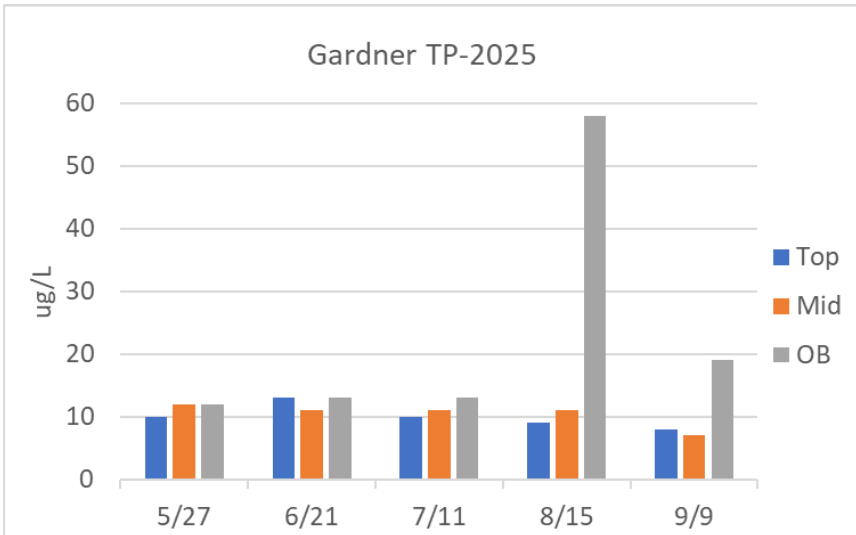

FIGURE 11. Gardner Lake total phosphorus (TP).

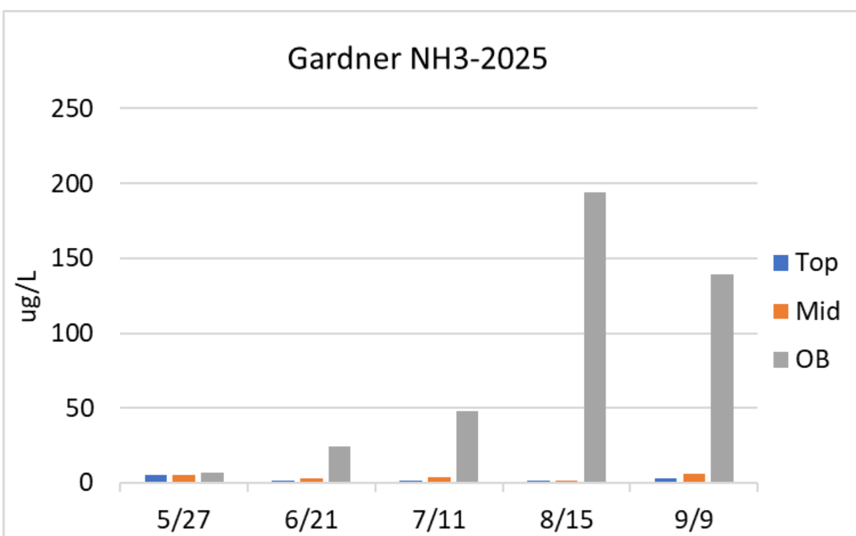

FIGURE 12. Gardner Lake ammonia (NH3).

Ammonia is an important source of inorganic nitrogen to cyanobacteria and typically accumulates near the bottom of lakes and reservoirs resulting from organic decomposition during anoxia. This was observed at Gardner Lake, with the only 'moderately high' concentrations occurring over bottom, peaking in August at almost 200 µg/L; **Figure 12**. This was lower than 2024's peak concentration (533 µg/L), and ammonia was low at all other depths.

Nitrate is an important nutrient for eukaryotic phytoplankton such as diatoms and chrysophytes, which can readily compete with cyanobacteria when conditions are favorable. Typically, early season waterbodies are enriched with nitrate following ice off, snow melt, and spring rains. Spring diatom blooms often track nitrate availability, and "bust" when nitrate is exhausted in the upper water column. Following nitrate exhaustion, lakes and reservoirs may experience a 'clear-water phase,' where diatoms senesce and settle to the bottom of the lake. When nitrate becomes unavailable in surface waters, N-fixing cyanobacteria can gain a competitive advantage over eukaryotic algae. Gardner's nitrate availability tracked this typical seasonal trend both in the upper and lower portions of the water column (**Figure 13**). Peak concentrations in the upper water column occurred in May at approximately 30 µg/L (it was likely higher in April, but those data are not available). In Gardner, nitrate tends to become exhausted, first at the top of the lake by June, and then at the bottom of the lake by July; this year deep nitrate persisted until August.

Silica is an important nutrient for certain eukaryotic phytoplankton taxa, such as diatoms and chrysophytes. Diatom frustules, which are their unique cellular wall structures, are composed of silica and can be quite intricate (with geometric, and even snowflake-like shapes). Similar to nitrate, silica can follow seasonal dynamics of spring enrichment and depletion as senesced diatoms settle out of the water column by early summer. Also, like nitrate, silica is a nutrient that can determine how well diatoms and chrysophytes compete with cyanobacteria, so it is important to measure to understand phytoplankton community and is part of GZA's standard nutrient chemistry suite. Silica in Gardner Lake is moderately low, as indicated by 2025 surface water samples (**Figure 14**), though it does follow typical seasonal trends of spring (in this case, from May onwards, but it is usually enriched in April) and fall enrichment (September data are not available at the time of this report, but are forthcoming).

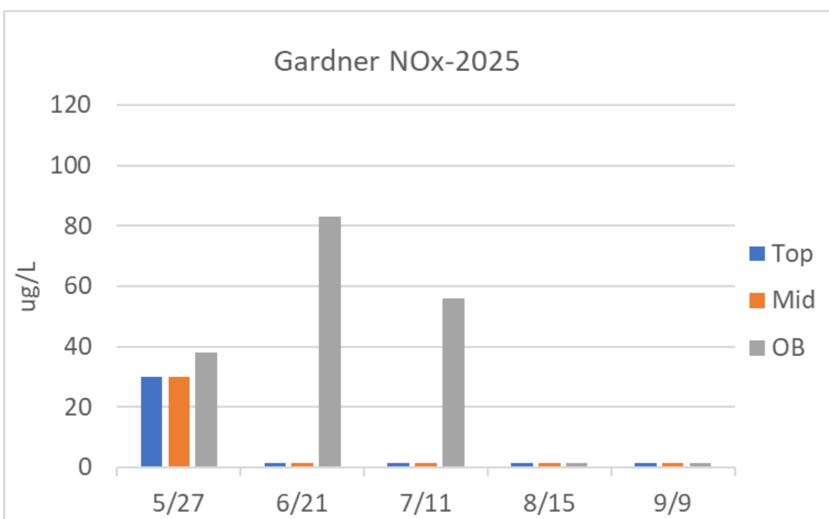

FIGURE 13. Gardner Lake nitrate (NO3).

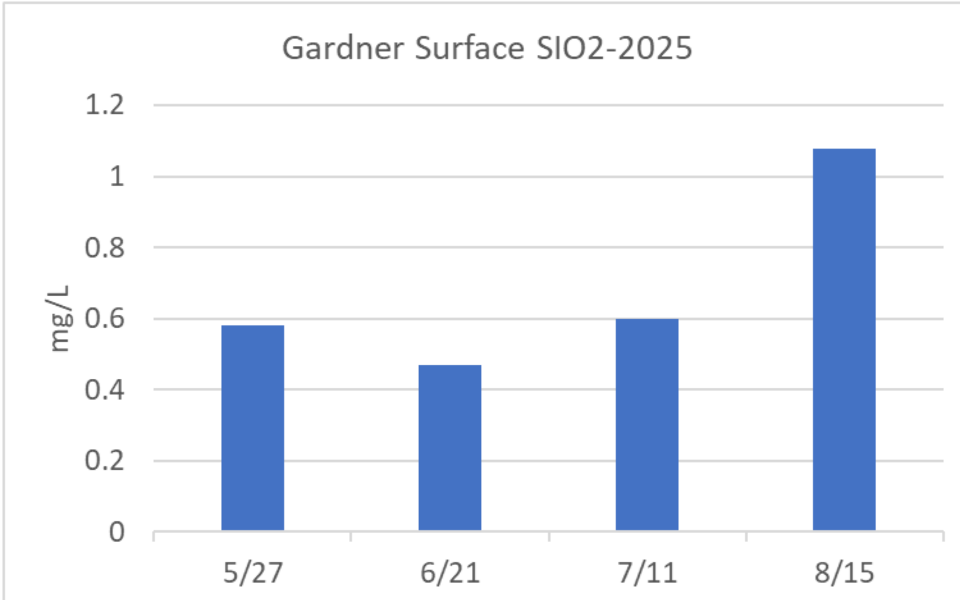

FIGURE 14. Gardner Lake silica oxide (SiO_2). September data were not available at the time of this report but are forthcoming.

Water clarity is aesthetically and ecologically important and determines the depth that sunlight can penetrate through the water column. Clarity is affected by physical, chemical, and biological factors such as suspended particulates, turbidity, and phytoplankton. Decreased water clarity can be an indicator of compromised water quality and greater water clarity usually indicates favorable water quality conditions. Water clarity is assessed by Secchi disk, which is a black and white disk that is lowered through the water column until it is no longer visible. The depth at which it disappears from view is recorded as the **Secchi disk depth**. Greater Secchi disk depths indicate clearer conditions. In 2025, Gardner Lake exhibited water clarity that varied between 3.7 and 5.5 m, exceeding 2024's water clarity, as well as Gardner's water clarity goals (**Figure 15**). Peak summer (August) exhibited the greatest water clarity, which may be associated with low nutrient conditions in the upper water column at that time. Also shown on **Figure 15** is the estimated **euphotic zone**, that is, depth of the water column that receives enough light to support photosynthetic productivity. In Gardner, the deepest euphotic zone extent, near 10 m from the lake's surface, occurred in August; most of the time it averaged around 7 m.

Gardner Lake phytoplankton is collected once a season by GZA. We collect a standard 0-5 m integrated water sample that is representative of the upper water column (**Figure 16**), and a deep, depth discrete sample (from 7 m – 10 m) which is now standard based on observations in recent years of high cyanobacteria density occurring at those depths (**Figure 17**). Cyanobacteria were dominant in both the upper water column and deep phytoplankton assemblages, though occurred at much higher densities at depth (approximately 1,000 vs. 182,000 cells/mL) as is typical for Gardner Lake. A group of 'nannoplankton' was also abundant at the surface, though these are tiny cells that are not easily identifiable but could consist of diatoms and cyanobacteria. Identifiable cyanobacteria at the surface mostly consisted of very small-sized, buoyant *Aphanocapsa*, which is not a known toxin producer, and *Microcystis*, which is (but not necessarily at the recorded densities of 311 cells/mL; **Figure 18**).

Conversely, cyanobacteria at depth were mostly *Planktothrix*, which is historically consistent at Gardner and is a cold, low-light tolerant group that can produce toxins (**Figure 19**). Luckily, at 8 m deep and contained in the 'deep hole' location, these cyanobacteria were out of contact with normal recreational lake users. Still, there is some concern of these cyanobacteria becoming entrained at the surface during a storm mix-down event or fall turnover; Gardner Lake residents should remain vigilant of this dynamic in future years.

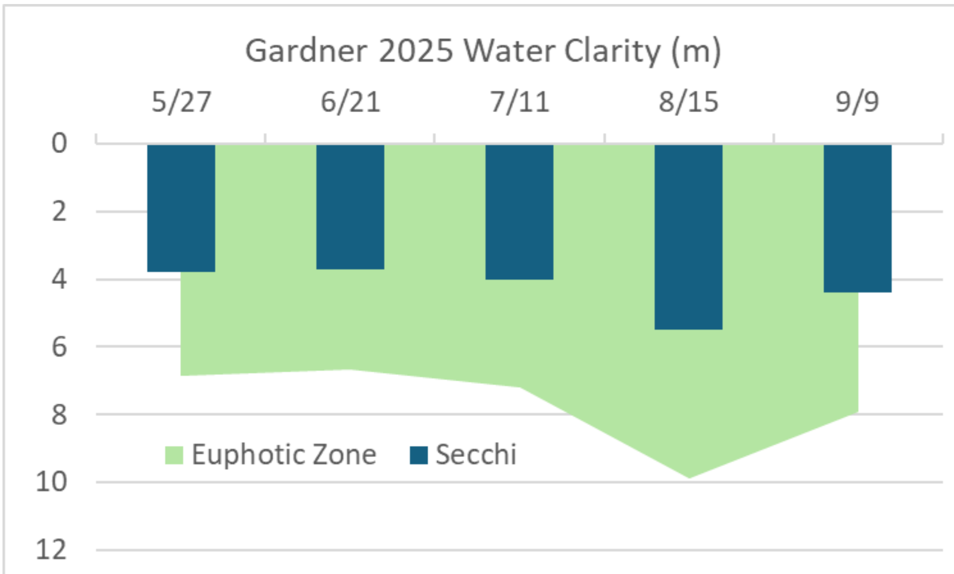

FIGURE 15. Gardner Lake water clarity (blue) and euphotic zone (green).

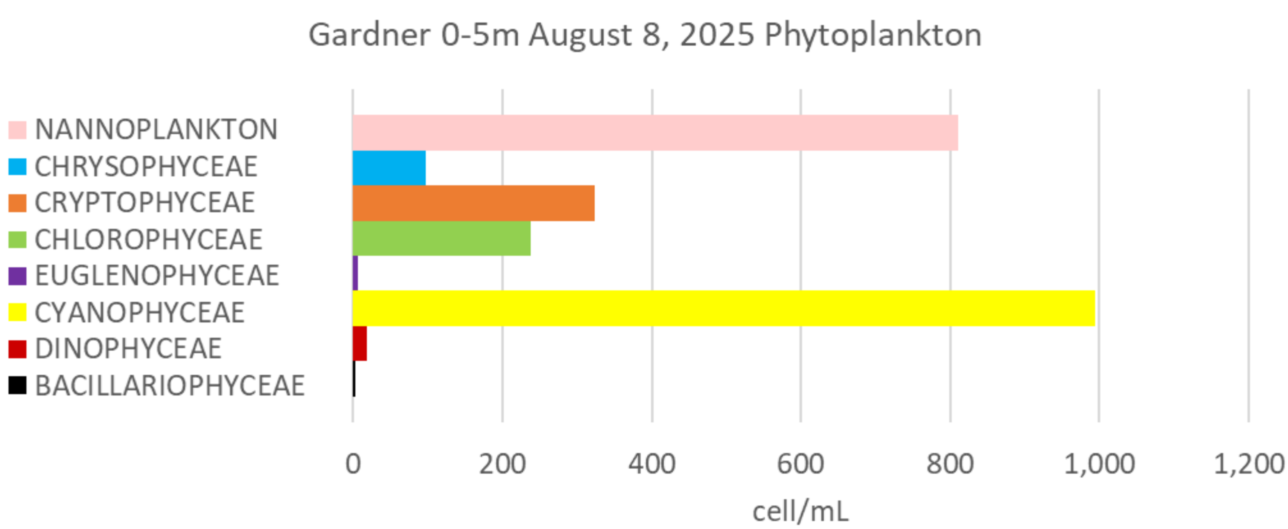

FIGURE 16. Gardner Lake surface (0 – 5 m) phytoplankton enumeration.

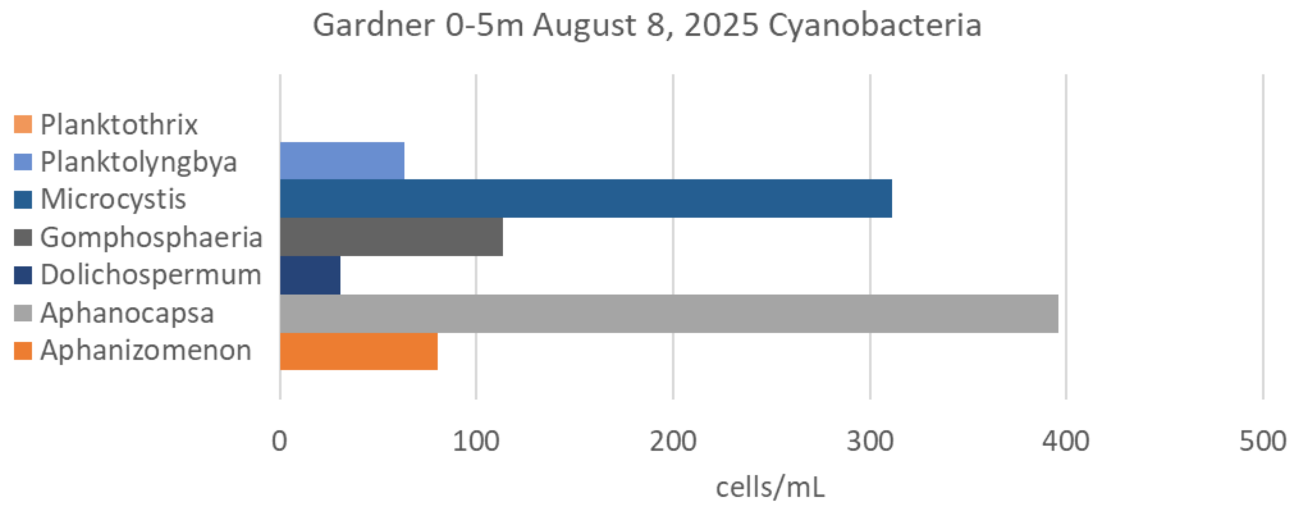

FIGURE 17. Gardner Lake deep (6.5 m) phytoplankton enumeration.

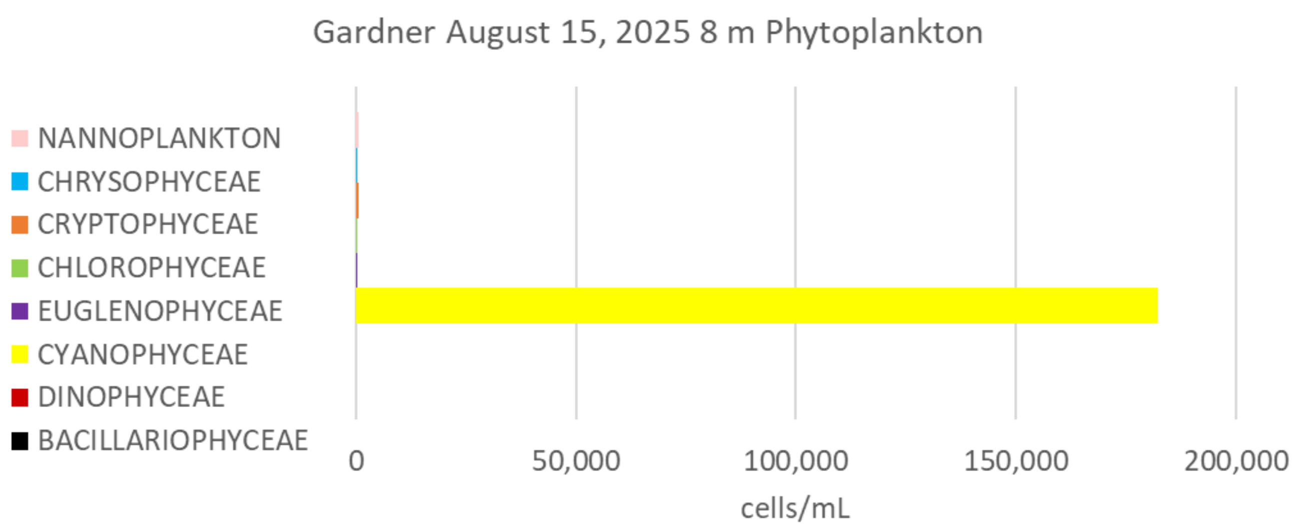

FIGURE 18. Gardner Lake surface (0 – 5 m) cyanobacteria enumeration and identification.

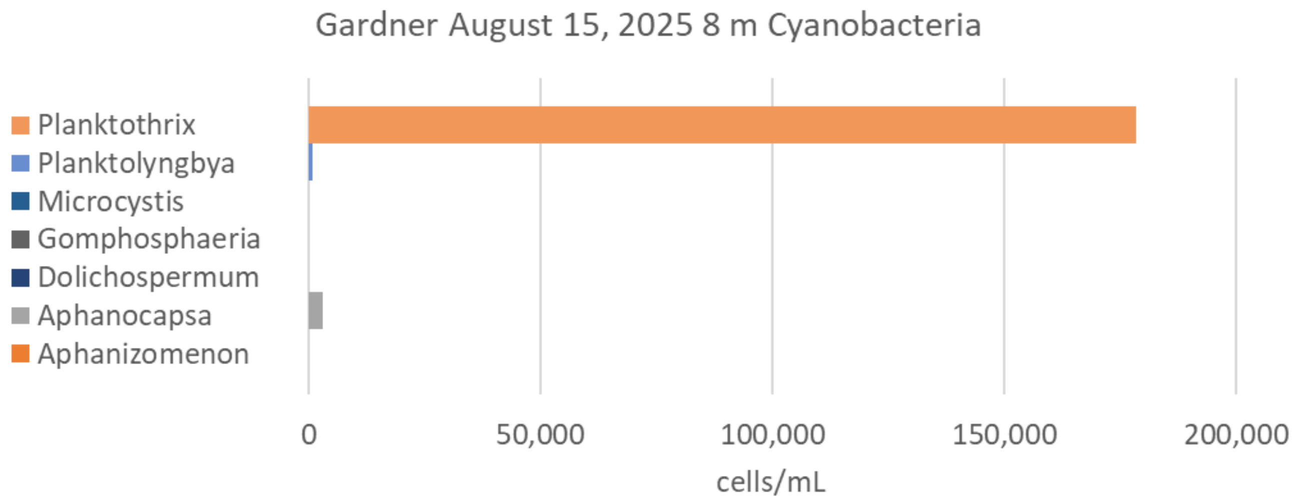

FIGURE 19. Gardner Lake deep (8 m) cyanobacteria enumeration and identification.

GZA staff (Dr. Benjamin Burpee and Sarah Gerhardt) performed a meandering littoral plant survey on August 15th to characterize the Gardner Lake plant community, density, and changes over the past few years. To conduct the survey, GZA utilized a grapple hook technique that consisted of tosses thrown from a slowly trolling boat. Aquatic plants collected from each toss were identified visually using Crow and Hellquist (2000), Padgett (2021), and Padgett (2022). Each species was logged according to a relative abundance scale of 1 – 5, with 1 being the lowest value and 5 being the highest (if a species was absent, the species was automatically assigned a value of 0). Field data were logged as an attribute table in the survey grids. Each sample point was populated with a series of data, which included latitude, longitude, and all the species detected during the survey. Species data were logged in that attribute table with the relative abundance.

Most plant density and species richness occurred in the north end of the lake in the cove areas adjacent to wetlands (though there was also a good amount of plant density and richness on the southern and western shores; **Figure 20**). A known Gardner Lake invasive, Fanwort (**Figure 21**) was concentrated to the northern areas, with limited occurrence on the southern and western shore, consistent with historical observations. Conversely, another invasive, Variable Leaf Milfoil (**Figure 22**), was reduced compared to previous years and only observed in the north end of the lake (last year, it was only observed in the southern end of the lake). Phragmites (**Figure 23**) was observed only in locations where it was previously known to be established. Hydrilla was a new invasive observed in 2024, with a single colony observed in the north of the lake, floating fragments on the eastern shore, and larger, more established colonies in the southern portion of the lake and surrounding the boat landing area. This year our observations suggest this invasive is unfortunately established throughout the lake (**Figure 24**). Such rapid colonization is both worrying and consistent with Hydrilla's life history strategy and establishment in other systems. Even so, GZA was still surprised to see its overall abundance and distribution. Other, common native species were observed at comparable densities and locations to previous years (Largeleaf Pondweed, **Figure 25**; Robbins' Pondweed, **Figure 26**; and Tape Grass, **Figure 27**), though Largeleaf Pondweed in Gardner and elsewhere is known for annual establishment in new areas of the lake. Native Water Nymph (**Figure 28**), was also observed at some abundance in the western area of the lake.

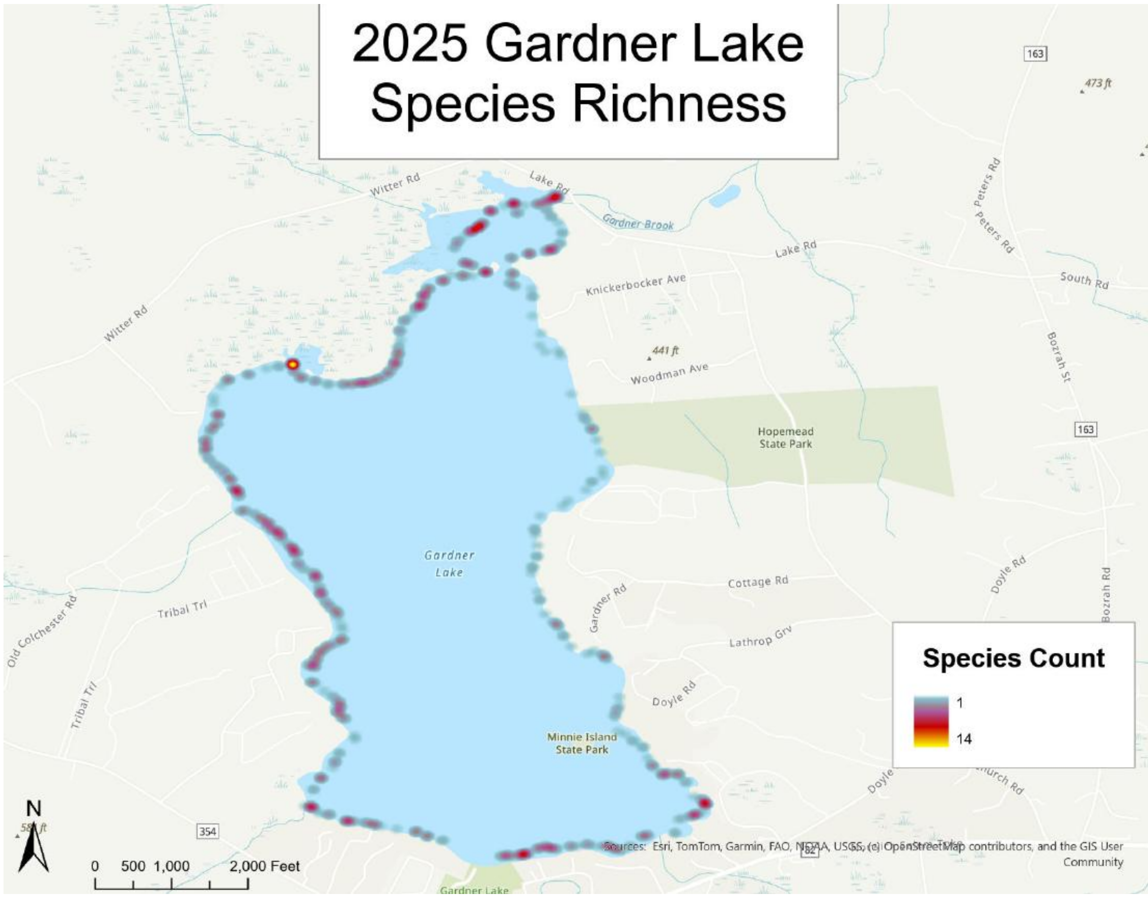

FIGURE 20. Gardner Lake meandering littoral plant survey, indicating species richness.

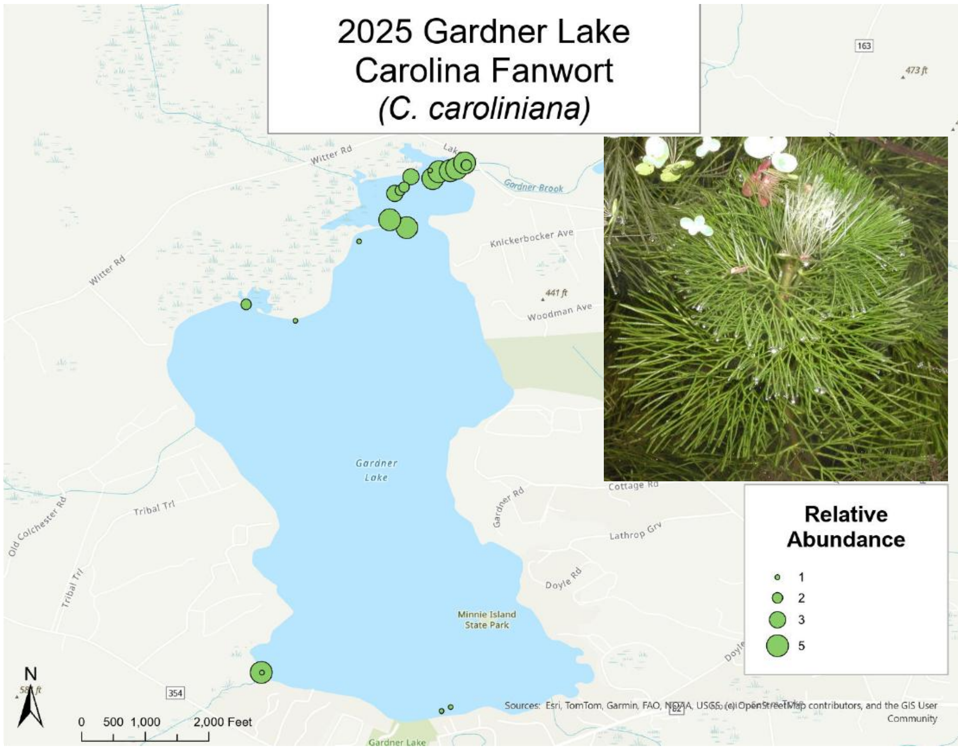

FIGURE 21. Gardner Lake Cabomba caroliniana (Fanwort).

FIGURE 22. Gardner Lake Myriophyllum heterophyllum (Variable Leaf Watermilfoil).

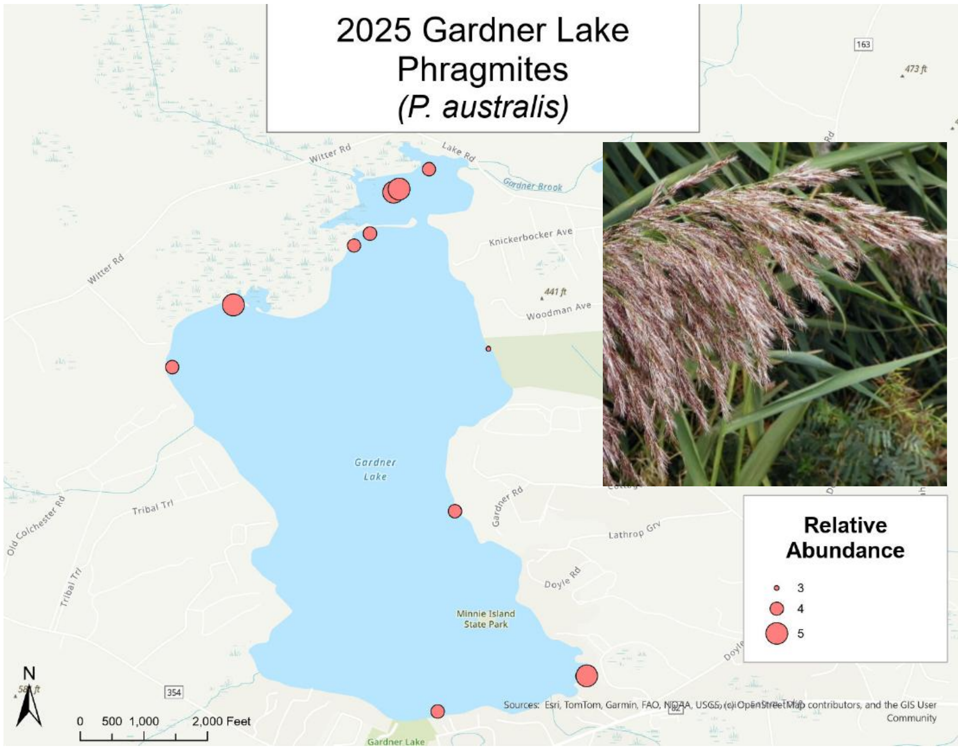

FIGURE 23. Gardner Lake Phragmites australis (Phragmites).

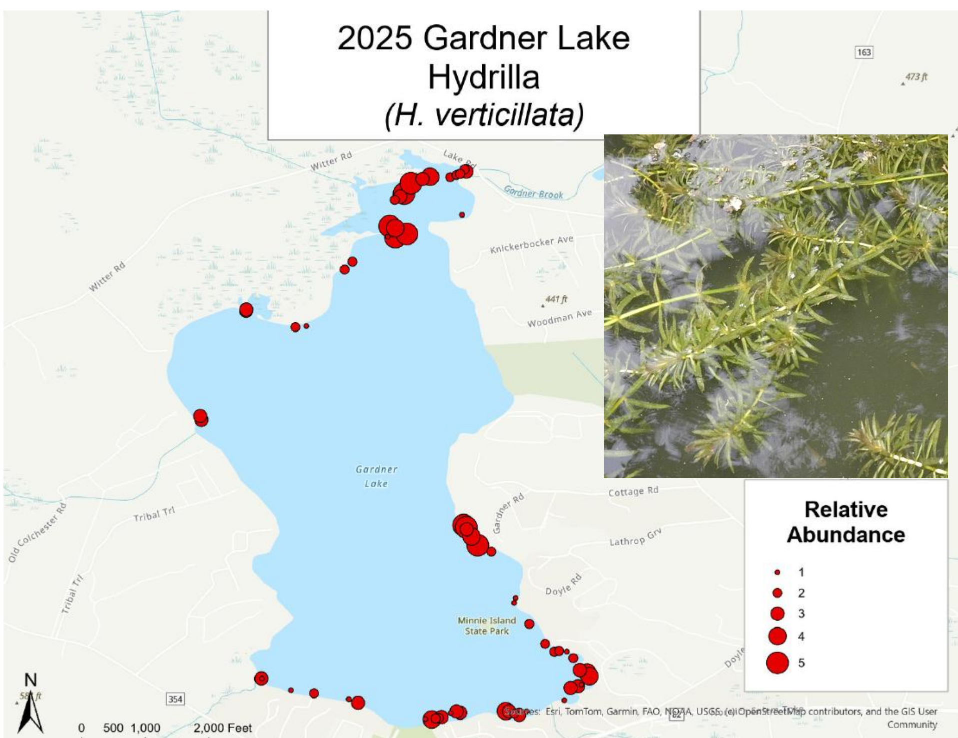

FIGURE 24. Gardner Lake Hydrilla verticillata ssp. lithuanica (Hydrilla).

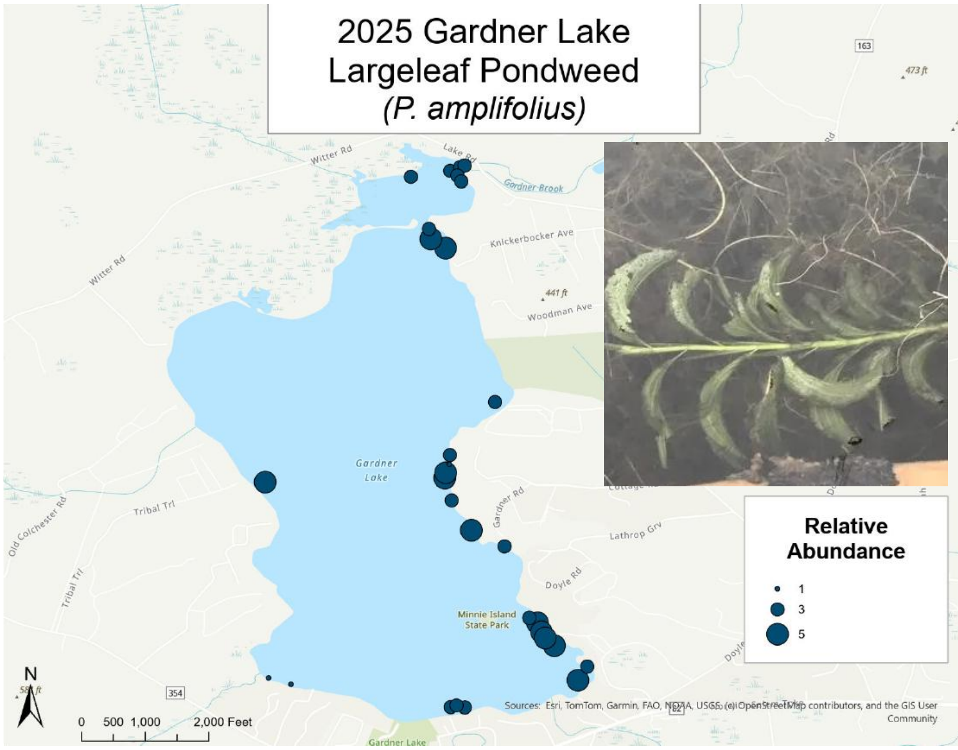

FIGURE 25. Gardner Lake Potamogeton amplifolius (Largeleaf Pondweed).

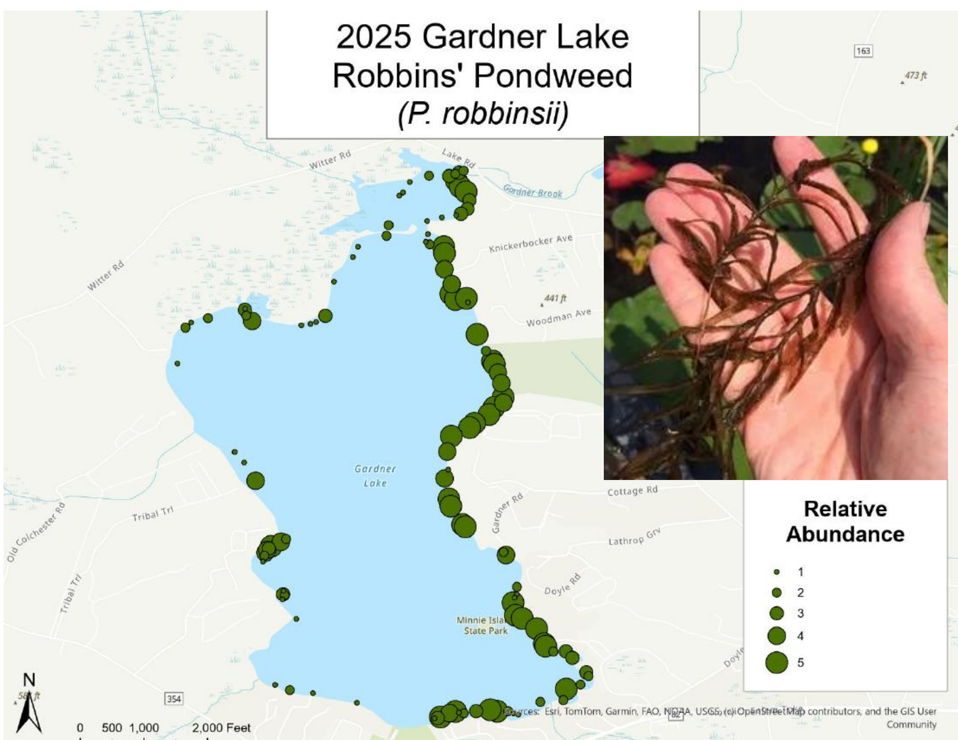

FIGURE 26. Gardner Lake Potamogeton robbinsii (Robbins' Pondweed).

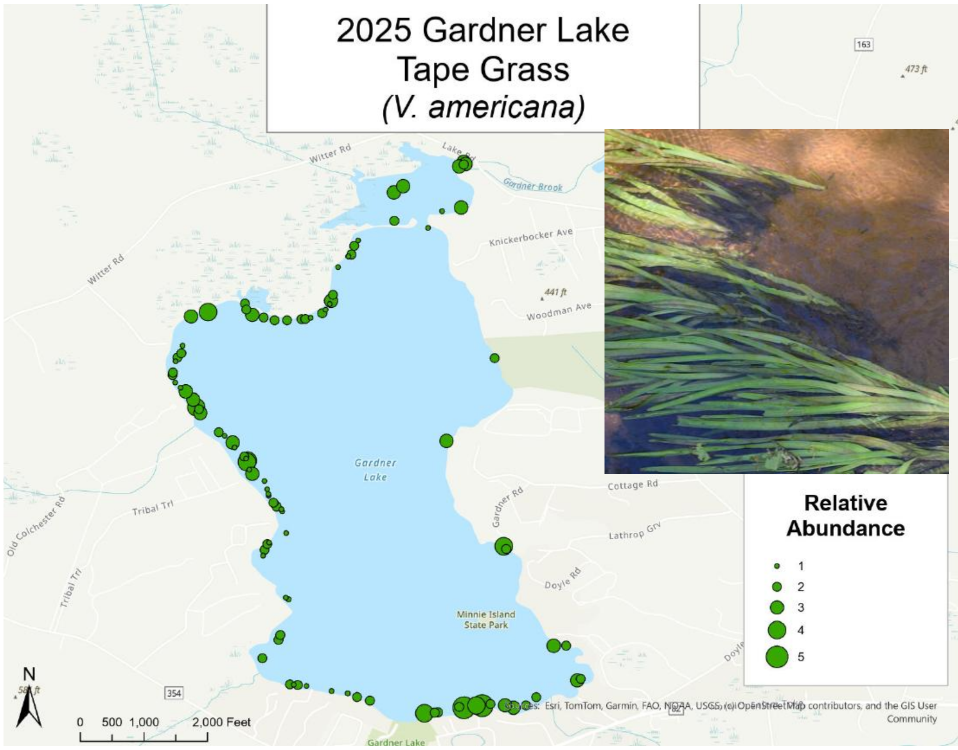

FIGURE 27. Gardner Lake Vallisneria americana (Tape Grass).

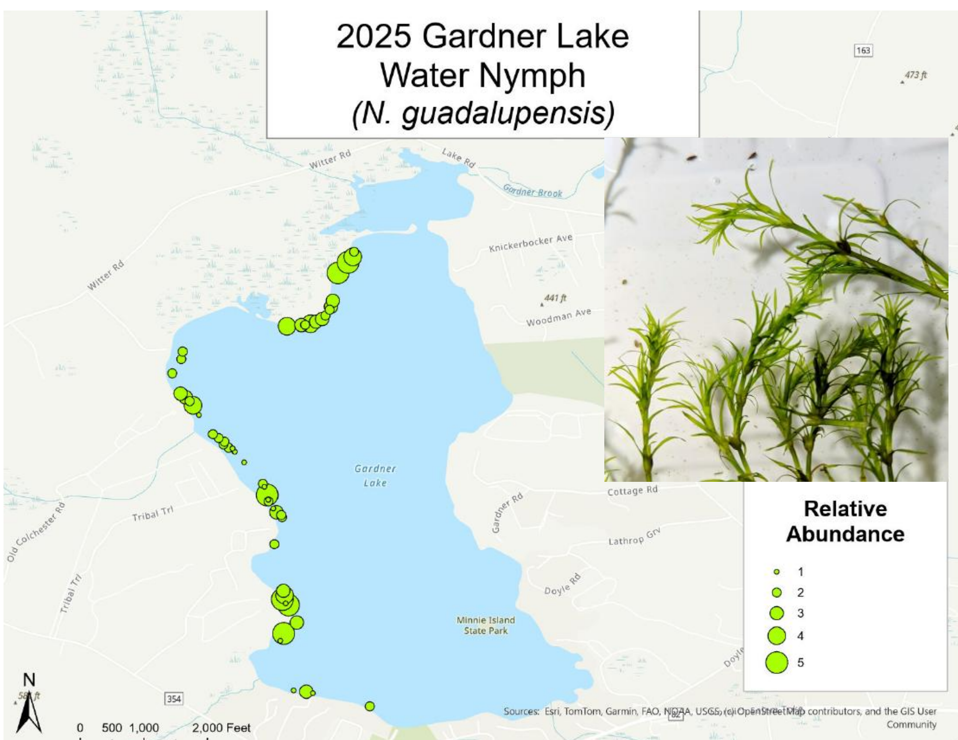

FIGURE 28. Gardner Lake Najas guadalupensis (Water Nymph).

DISCUSSION AND RECOMMENDATIONS

In summary, 2025 was a good water quality year, though Hydrilla colonization is a looming management concern that may prove to be a real nuisance for Gardner Lake and its community in the near future. Besides invasive Hydrilla establishment, Lake conditions were otherwise favorable, meeting other long-term goals outlined for Gardner Lake. Total phosphorus was maintained well below 20 µg/L at the surface of the lake. The only exception to this threshold occurred late in the summer in deep areas of the water column and was not of immediate concern. DO was greater than 1 mg/L above 6 m at all times, and anoxia (which this year remained close to the bottom) was contained within the deep hole feature of Gardner Lake. Secchi disk depths were greater than 3 m throughout the summer (minimum was 3.7 m), which likely served to maintain an oxygenated water column and contain the anoxic boundary ascent. Clear water may have allowed high densities of cyanobacteria access sunlight and grow deep in the Gardner water column (8 m) this past summer, but cyanobacteria were sparse in the upper water column. 'Nuisance plant conditions' (meaning high densities of plants that would impede navigation or operation of boats in areas where boat traffic would normally occur) were not observed within recreational areas of the lake, and historical invasive species were contained to known areas within the basin and shoreline. Hydrilla spread significantly compared to its 2024 distribution but was still largely contained to cove areas and did not occur at nuisance densities at the boat launch; the ultimate spread and extent of 'nuisance conditions' that this species may create for residents of Gardner Lake remains to be seen. For future seasons, GZA recommends continued monitoring in collaboration with the GLA, and an annual macrophyte survey to monitor Hydrilla colonization. In addition, GZA recommends the deployment of high-frequency remote data logging instruments to monitor anoxia throughout the Gardner Lake water column. The GLA may also wish to consider addition of phytoplankton sampling to their sampling routine to acquire monthly phytoplankton data.

GZA appreciates the opportunity to provide these services to the GLA, and we look forward to continuing to serve you in the future. If you have any questions regarding the information presented, please feel free to contact Benjamin Burpee directly at 207-887-0358.

Very truly yours,

GZA, GeoEnvironmental, Inc.

Benjamin Burpee, PhD, CLM
Project Limnologist

Benjamin Rach, LMA
Senior Project Manager

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Associate Principal

Attachments: Attachment A – Limnology Report Limitation

USE OF REPORT

1. GZA GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of our Client for the stated purpose(s) and location(s) identified in the Proposal for Services and/or Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not expressly identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

STANDARD OF CARE

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in the Proposal for Services and/or Report and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. Conditions other than described in this report may be found at the subject location(s).

3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made. Additionally, GZA makes no warranty that any response action or recommended action will achieve all of its objectives or that the findings of this study will be upheld by a local, state or federal agency.

4. In conducting our work, GZA relied upon certain information made available by public agencies, Client and/or others. GZA did not attempt to independently verify the accuracy or completeness of that information. Inconsistencies in this information which we have noted, if any, are discussed in the Report.

COMPLIANCE WITH CODES AND REGULATIONS

5. We used reasonable care in identifying and interpreting applicable codes and regulations necessary to execute our scope of work. These codes and regulations are subject to various, and possibly contradictory, interpretations. Interpretations and compliance with codes and regulations by other parties is beyond our control.

6. The standard of care for projects like this is that the proposed apparatus/equipment is 'exempt by right' from permits and no permits were requested or obtained as part of this project. If a permit is ultimately required and if Client retains GZA to assist Client or any other party with applying for any license, permit, certificate or other authorization, Consultant does not guarantee that it will be able to obtain such license, permit, certificate or other authorization, only that it will assist Client in the application for such license, permit, certificate or other authorization in accordance with the standard of care.

SCREENING AND ANALYTICAL TESTING

7. GZA may have collected samples at the locations identified in the Report. These samples were analyzed for the specific parameters identified in the report. Additional constituents, for which analyses were not conducted, may be present in soil, groundwater, surface water, sediment and/or air. Future Site activities and uses may result in a requirement for additional testing.

8. Our interpretation of field screening and laboratory data is presented in the Report. Unless otherwise noted, we relied upon the laboratory's QA/QC program to validate these data.

9. Variations in the types and concentrations of constituents observed at a given location or time may occur due to release mechanisms, changes in flow paths, and/or the influence of various physical, chemical, biological or radiological processes. Subsequently observed concentrations may be other than indicated in the Report.

INTERPRETATION OF DATA

10. Our opinions are based on available information as described in the Report, and on our professional judgment. Additional observations made over time, and/or space, may not support the opinions provided in the Report.

ADDITIONAL SERVICES

11. GZA recommends that we be retained to provide services during any future investigations, design, and/or implementation activities at the Site. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.

NUMERICAL MODELS

12. Actual conditions are likely more complex than indicated in this Report. If a mathematical model is refenced in this report, it is by its very nature, a simplification of actual conditions. Except as noted in the report, we did not validate the code used in the model. In constructing the model, point specific data was generalized and extrapolated across the study area. In addition, in areas where field data was not available, we used professional judgment, based on experience and regional information, to construct the model. Model assumptions are provided in this report**.** Actual flow patterns, etc. may be other than simulated. As additional field data becomes available our numerical model can be modified to better reflect conditions of possible interest.

COST ESTIMATES

13. Unless otherwise stated, our cost estimates are only for comparative and general planning purposes. These estimates may involve approximate quantity evaluations. Note that these quantity estimates are not intended to be sufficiently accurate to develop construction bids, or to predict the actual cost of work addressed in this Report. Further, since we may have no control over either when the work will take place or the labor and material costs required to plan and execute the anticipated work, our cost estimates were made by relying on our experience, the experience of others, and other sources of readily available information. Actual costs may vary over time and could be significantly more, or less, than stated in the Report.

APPARATUS/EQUIPMENT INSTALLATIONS

14. GZA will not be responsible for damage to installed equipment or apparatus as a result of Acts of God such as extreme weather events or events not within our reasonsible control.

15. GZA will not be responsible for damage to installed equipment or apparatus as a result of actions by others. Certain types of installed apparatus/equipment are designed to be fully submerged, while other apparatus/equipment may have portions of the units partially exposed above the water surface during normal operations.

16. GZA will not be responsible for damage to installed apparatus/equipment due to improper start up or operation by others. Any usage that is not consistent with GZA's recommendations would be considered improper operation and has the potential to damage the installed apparatus/equipment.

17. GZA will not be responsible for damage to installed apparatus/equipment if the installed apparatus/equipment is changed or altered by anyone other than GZA or our subcontractor(s).

18. GZA will not be responsible for damage to installed apparatus/equipment if the apparatus/equipment is moved or relocated by anyone other than GZA or our subcontractor(s).