

Water Quality Monitoring of Candlewood Lake & Squantz Pond 2025



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Ecology**

**For the Communities of Brookfield, Danbury, New Fairfield, New
Milford, and Sherman**

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All Raw Data is available from the Candlewood Lake Authority upon request to
science@candlewoodlakeauthority.org

Introduction

The Candlewood Lake Authority

Candlewood Lake is a pumped storage reservoir built in the late 1920's for the purposes of power generation. It has since become a premier destination for lake recreation in both Connecticut and the New York City tristate area and is a critical economic and environmental asset for local communities. The Candlewood Lake Authority (CLA) is an organization formed from ordinances by the municipal governments of Brookfield, Danbury, New Fairfield, New Milford, and Sherman pursuant Connecticut General Statute §7-151a, to enforce boating law on the water and to provide lake management to protect and conserve the environmental value of Candlewood Lake and Squantz Pond. Those five municipalities equally share a substantial amount of the responsibility for much of the CLA's operational budget. FirstLight Power, the owners and operators of Candlewood Lake and its hydropower generation have also historically made a voluntary contribution to the Candlewood Lake Authority's budget. Annual donations, grants, and fundraising projects constitute the final portion of the Lake Authority's budget.

Candlewood Lake Authority Mission Statement

The Candlewood Lake Authority provides lake, shoreline and watershed management to foster the preservation and enhancement of recreational, economic, scenic, public safety and environmental values of the Lake for the City of Danbury and the Towns of Brookfield, New Fairfield, New Milford and Sherman in cooperation with the State of Connecticut and the hydro power owner of the lake.

Lake and Watershed Characteristics

Candlewood Lake is Connecticut's largest, with a surface area of 5,064 acres. The Candlewood Lake & Squantz Pond shared watershed is approximately 25,907 acres and contained almost entirely in the Connecticut municipalities of Brookfield, Danbury, New Fairfield, New Milford, and Sherman. (Jacobs and O'Donnell 2002). New Fairfield and Sherman contain 73% of the watershed, while a small portion crosses the border into New York State (Table 1).

Town	Acres of Watershed	% Of watershed within municipal boundary	% Of municipality within watershed boundary
Brookfield	1,177	4	9
Danbury	2,726	10	10
New Fairfield	12,197	46	72
New Milford	2,629	10	6
Sherman	7,132	27	51
New York State	600	3	
Total	26,461		

Table 1: Percentages of the Candlewood Lake & Squantz Pond watershed contained within each bordering municipality, and the percentage of each municipality contained within the watershed.

Squantz Pond has a surface area of 270 acres, with a watershed of 3,662 acres contained entirely within the borders of Sherman and New Fairfield, making it a sub-basin of the Candlewood Lake watershed. A culvert below the Route 39 causeway in New Fairfield connects the two hydrologically, allowing free water flow between Candlewood Lake and Squantz Pond.

The Candlewood Lake watershed has changed dramatically over the course of the lake’s life, becoming more urbanized and losing forested and agricultural lands. Since 1970, the percentage of the watershed classified as urban has increased from 11.7% to 28.3% in 2007 (Table 2) (Kohli et al. 2017).

Year	Urban (%)	Agriculture (%)	Wooded (%)	Water (%)
1970	11.7	8.5	57.0	22.0
1977	19.5	2.1	57.0	22.2
1990	28.7	5.6	43.6	21.7
2007	28.3	1.9	47.1	22.7

Table 2: Candlewood Lake Watershed percent coverage of different land classifications (Table from Kohli et al. 2017).

The Candlewood Lake Monitoring Program

Long-term management of water resources requires consistent and standardized monitoring to make informed management decisions. By tracking critical water chemistry and biological metrics that are indicators of lake health, we can analyze how management activities are affecting the in-lake ecosystem, and what additional management activities may be necessary. To that end, the CLA began a monitoring program in 1983 to provide a scientifically standardized method of assessing Candlewood Lake & Squantz Ponds health and water quality over time to the surrounding communities.

Initially undertaken by researchers from Western Connecticut State University (WCSU) and later by Connecticut College (CC), the CLA has conducted this monitoring itself since 1998, with the exception of the years 2017-2019, when the monitoring was contracted to Aquatic Ecosystems Research (AER), a freshwater consulting organization specializing in in-lake chemical monitoring. Since 1999, all whole-water sample laboratory analyses have been performed at Hydro Technologies, Inc. at their CT Department of Health certified laboratory in New Milford, CT. In 2022, that laboratory analysis was changed and conducted at York Analytical Laboratories Inc. in Newtown, CT due to an ownership change at Hydro Technologies, Inc. In 2023 the decision was made to transfer analysis to the UCONN Center for Environmental Sciences and Engineering's nutrient and metals divisions.

2025 is the first year where we returned to once monthly sampling after 4 years of twice monthly sampling from May-October. This was done to give the CLA a more fine-grained view of the chemical monitoring results, allowing us to better understand trends over the course of a season, as well as being able to calculate representative averages of our key metrics more accurately. After analyzing the trends of the last 4 years and comparing them to the prior 35 years of monitoring, we found that the trends could be well understood using the once-monthly sampling protocol. For the sake of keeping this report a reasonable size, raw data has not been included as an appendix, but all raw data and lab results are available from the Candlewood Lake Authority upon request: science@candlewoodlakeauthority.org

Materials & Methods

The CLA began its water quality monitoring program in 1983 to provide the community with a scientifically rigorous and standardized method of assessing changes in Candlewood Lake and Squantz Pond over time. The program has continued largely uninterrupted since then, providing us with historical data for 38 years and counting.

More Specifically, The Candlewood Lake Authority has been conducting monthly monitoring from May – October of 4 sites on Candlewood Lake, and one site on Squantz Pond. From 1985-1987 sites in Lattins Cove, Pocono Point, and the southern end of the New Milford arm of the lake were sampled as well. From 1985-1990 an additional site in New Fairfield Bay was sampled. From 1988-1990 the New Fairfield Bay site was sampled instead of the standard New Fairfield site. In 1990 the New Fairfield site was re-established, and the New Fairfield Bay site was eliminated.

The monitoring has taken some different forms over the years, and different metrics have been added, eliminated, and transferred to new methods of measurement at various times over the course of the monitoring's history. However, the metrics being measured regularly at each monitoring location are:

At each location:

1. Secchi Depth (m)

At 1-meter intervals:

2. Depth (m)
3. Temperature (C°)
4. Dissolved Oxygen (mg/l)
5. pH
6. Standard Conductivity (µmhos/cm)
7. Relative Cyanobacteria (cells/mL)
8. Relative Chlorophyll-a (µg/L) - Started in 2019

At the Epi, Meta, and/or Hypolimnion:

9. Total Phosphorous (ppb)
10. Total Nitrogen (ppm)
11. Chlorophyll-a (µg/m³)
12. Ca⁺⁺ (mg/l) – Bi-monthly
13. Mg⁺⁺ (mg/l) – Bi-monthly
14. Na⁺ (mg/l) – Bi-monthly
15. K⁺ (mg/l) – Bi-monthly
16. Cl⁻ (mg/L) – Bi-monthly

Phaeophytin, phytoplankton diversity and cell counts (including Cyanobacteria cell counts), and Chlorophyll b and c have also been included in past years' monitoring, but have been monitored inconsistently, or monitoring has ceased. Phytoplankton diversity and cell counts were monitored from 1985-1998, at which point that monitoring was discontinued until 2017, and has been re-incorporated into monitoring from 2017 to 2020. In 2011, a Zebra Mussel Veliger Monitoring program was added in conjunction to the normal monthly monitoring but has been discontinued following the establishment of Zebra Mussels throughout the lake.

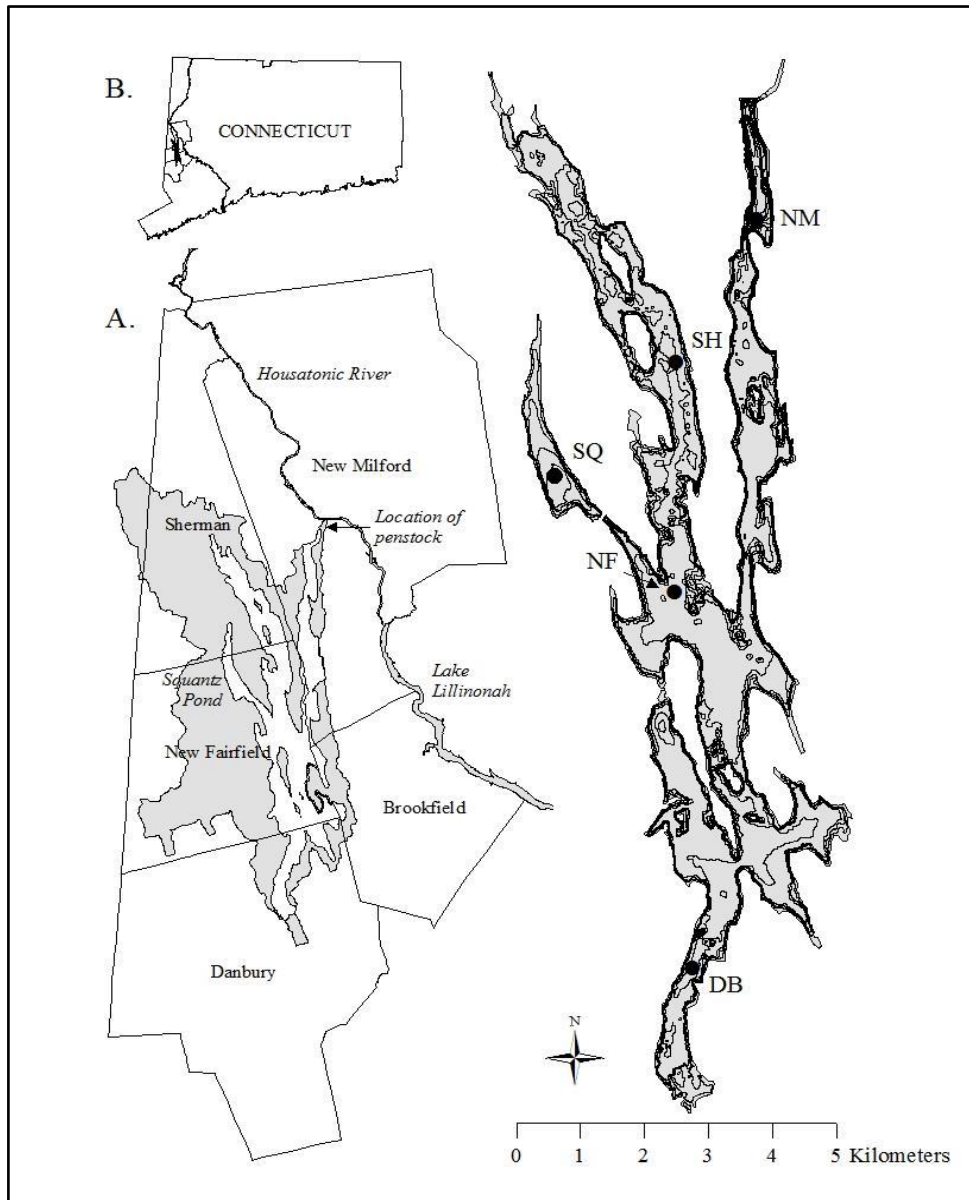


Figure 1: A) Relation of the Candlewood Lake Watershed to the five bordering municipalities. B) Location of watershed and municipalities in the state of Connecticut. C) Location of the five sampling sites on Candlewood Lake and Squantz Pond.

Results

Temperature and Dissolved Oxygen Profiles

Candlewood Lake is a dimictic lake, meaning that twice per year, the temperature difference between the surface water and the lake bottom is negligible. That remains true this year.

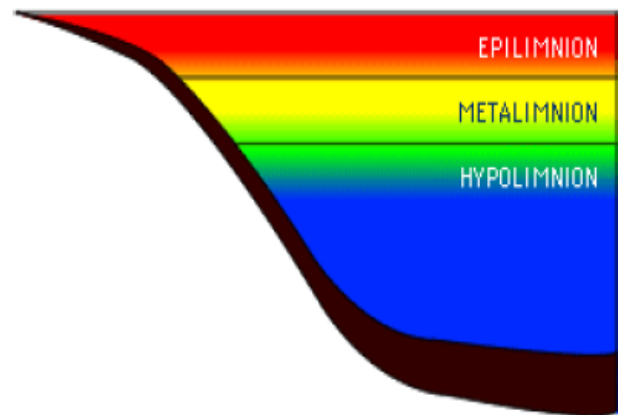
	Danbury		New Fairfield		New Milford		Sherman		Squantz	
	Metalim. Boundary (m)	Anoxic Layer (m)	Metalim. Boundary (m)	Anoxic Layer (m)	Metalim. Boundary (m)	Anoxic Layer (m)	Metalim. Boundary (m)	Anoxic Layer (m)	Metalim. Boundary (m)	Anoxic Layer (m)
12-May	8	N/A	8	N/A	7	N/A	7	N/A	8	N/A
23-Jun	5	9	7	10	6	22	7	11	None	None
14-Jul	6	7	7	7	7	19	7	7	5	7
5-Aug	8	8	7	7	10	18	7	7	7	7
8-Sep	9	9	10	9	9	9	9	9	9	N/A
6-Oct	N/A	10	10	11	11	10	N/A	10	N/A	9

Table 3: Stratification, mixing, and oxygen depletion characteristics at 4 locations on Candlewood Lake, and one location on Squantz Pond in 2025. The metalimnetic boundaries are presented as meters below the surface, and the anoxic layer is presented as the upper boundary of the anoxic zone, extending from that level to the bottom.

The tendencies of Candlewood Lake of top-to-bottom mixing, and strong mid-season stratification followed by a period of mixing are characteristic of deep lakes in the American northeast. The colder, denser, water “sinks” to the bottom of the water column, effectively preventing mixing with the shallower surface water – creating the anoxic layer in the lake bottom. These layers are shown in Figure 2. As surface waters begin to cool at the end of the season, the metalimnion (middle layer) recedes deeper into the water column until such time that the temperature of the column reaches a homogenous state, and the anoxic zone disappears, allowing for a consistent level of dissolved oxygen throughout the water column.

When we began our monitoring extra early in April, none of the five sites had a thermocline (the “barrier” of the largest temperature difference between the epilimnion and the hypolimnion, preventing mixing). And deep oxygen concentrations hadn’t begun to drop at that point, and so there was no anoxic zone (below 0.05 mg/L of oxygen). As the season continued, the drop in DO in the deeper water is due to respirating single-

Figure 2: Lake layers formed during stratification of the water column. (Source: UMN)



celled organisms utilizing that oxygen to digest sinking phytoplankton and other materials for energy. Stratification tended to be strongest at all 5 sites between the July and August sampling, by which point respiring bacteria had been able to establish significant anoxic zones at all 5 sites. Stratification is calculated by comparing temperature differences between meter intervals and calculating RTRM (relative thermal resistance to mixing). Temperature and oxygen profiles generally mirror one another due to their strong relationship with thermal resistance to mixing and lake stratification.

To help illustrate this, the graphs of the temperature and dissolved oxygen concentrations in August and October at the Danbury site have been included below:

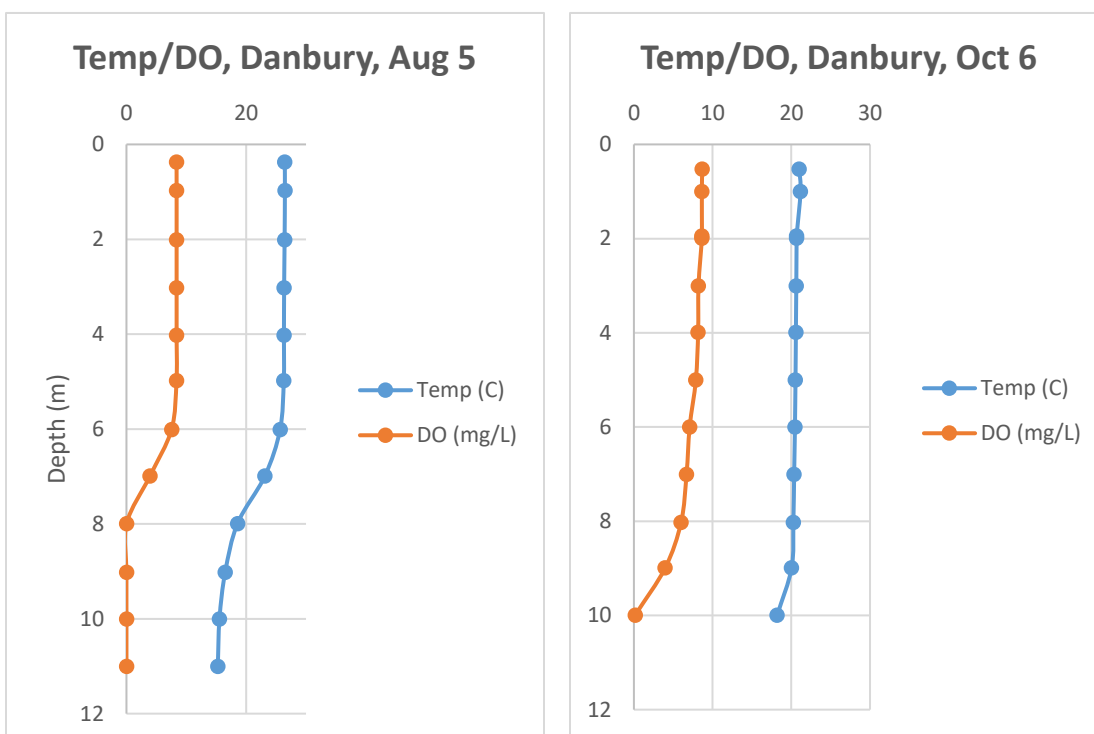


Figure 3: Temperature and dissolved oxygen concentrations, taken at 1m intervals at the Danbury location in 2025. Graphs meant to illustrate the difference between the lake at its most strongly stratified state and a well-mixed state.

The New Milford site shows a unique property of sometimes having two separate anoxic zones. With low levels of dissolved oxygen between the two zones. This is our deepest site, but the cause of this is somewhat unclear. It could indicate outgassing at a certain point in the deep lake’s geology or indicate layers of oxygen utilization by deep water respiring bacteria. 2023 was also the first year that FirstLight Power, the current owners of the lake, pumped water up into the lake from the Housatonic River at semi-regular intervals during the summer, which continued in 2025. While the impacts of this aren’t clear in the data, and pumping wasn’t occurring consistently, the pumping will likely increase the lake’s

ability to mix as relatively shallow, oxygenated water from the Housatonic River is pumped into the deeper layer of the lake. This tendency might also be strongest at the New Milford site, which is the closest to the input from the penstock. We hope to better understand the impact of this moving forward.

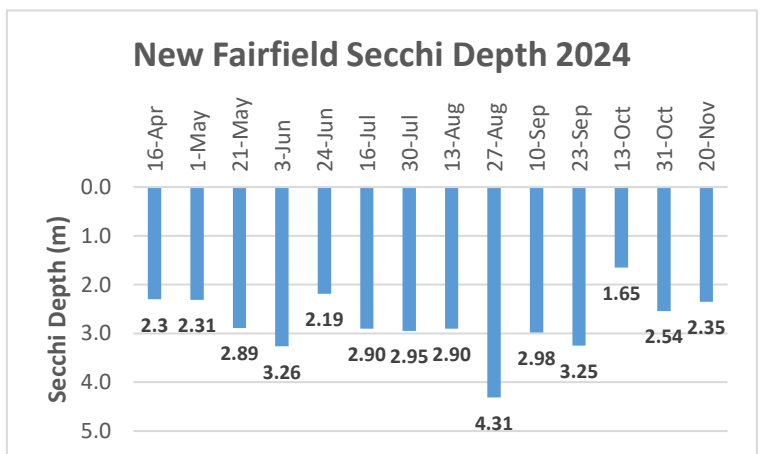
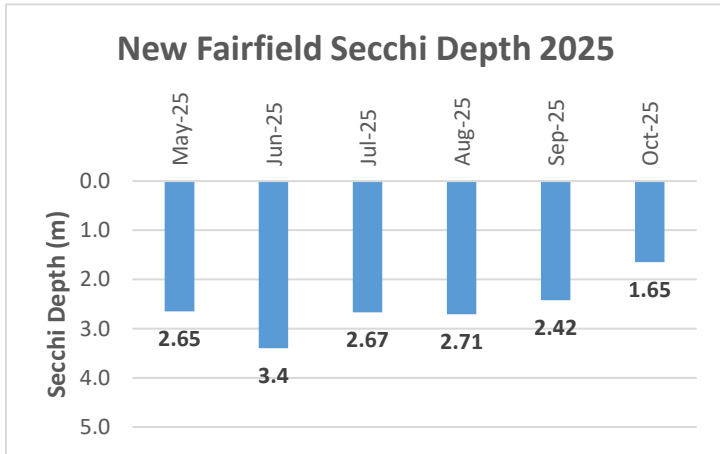
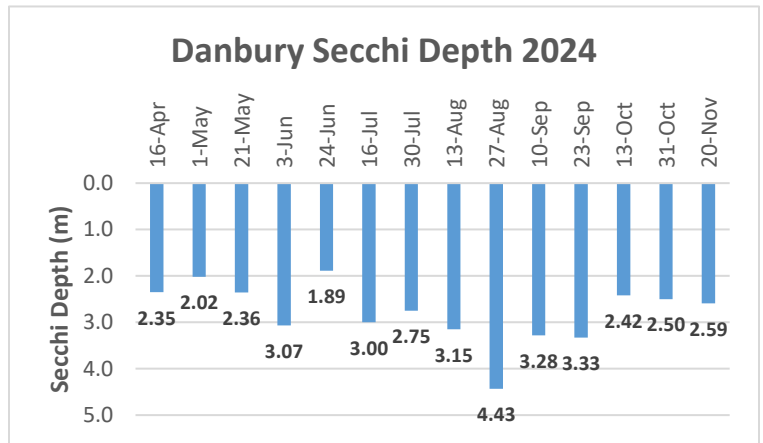
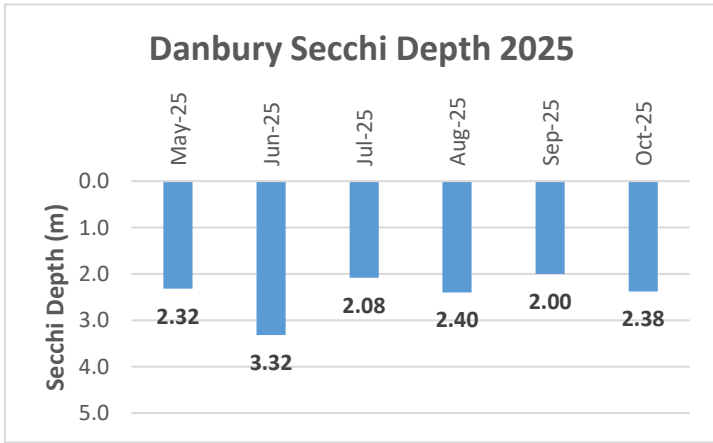
Anoxic zones in the hypolimnion require respirating bacteria to use anaerobic respiration, increasing nutrient release in the hypolimnion as compounds containing both nitrogen and phosphorus are broken down into forms usable by bacteria. This is known as “internal loading” and is a critical component of lake monitoring and management. Mixing allows for the hypolimnion to be refreshed with oxygen, allowing for aerobic respiration and a relative pause in nutrient release while the water column is homogenous. As temperatures continue to increase due to climate change, strong stratification can last for a longer period, increasing the potential for nutrient release in anoxic zones. This can and will accelerate eutrophication (lake “aging”) in the long term.

Secchi Transparency

In 2025 secchi transparency (water clarity) in Candlewood Lake ranged from a low of 1.65m in New Fairfield in October to a high of 4.08m in New Milford in June. The average reading across the whole of both Candlewood and Squantz was 2.63m, with the highest average being New Milford at 3.01m, and the lowest being Danbury at 2.42m.

	DB Secchi (m)	NF Secchi (m)	NM Secchi (m)	SH Secchi (m)	SQ Secchi (m)	Average
May-25	2.32	2.65	3.15	2.68	2.46	2.65
Jun-25	3.32	3.4	4.08	3.26	N/A	3.52
Jul-25	2.08	2.67	2.53	2.6	2.10	2.40
Aug-25	2.40	2.71	2.41	2.71	2.71	2.59
Sep-25	2.00	2.42	2.98	2.72	2.74	2.57
Oct-25	2.38	1.65	2.88	2.00	2.30	2.24
Average	2.42	2.58	3.01	2.66	2.46	2.63

Table 4: Secchi depths measured at each sampling location during the 2025 season.



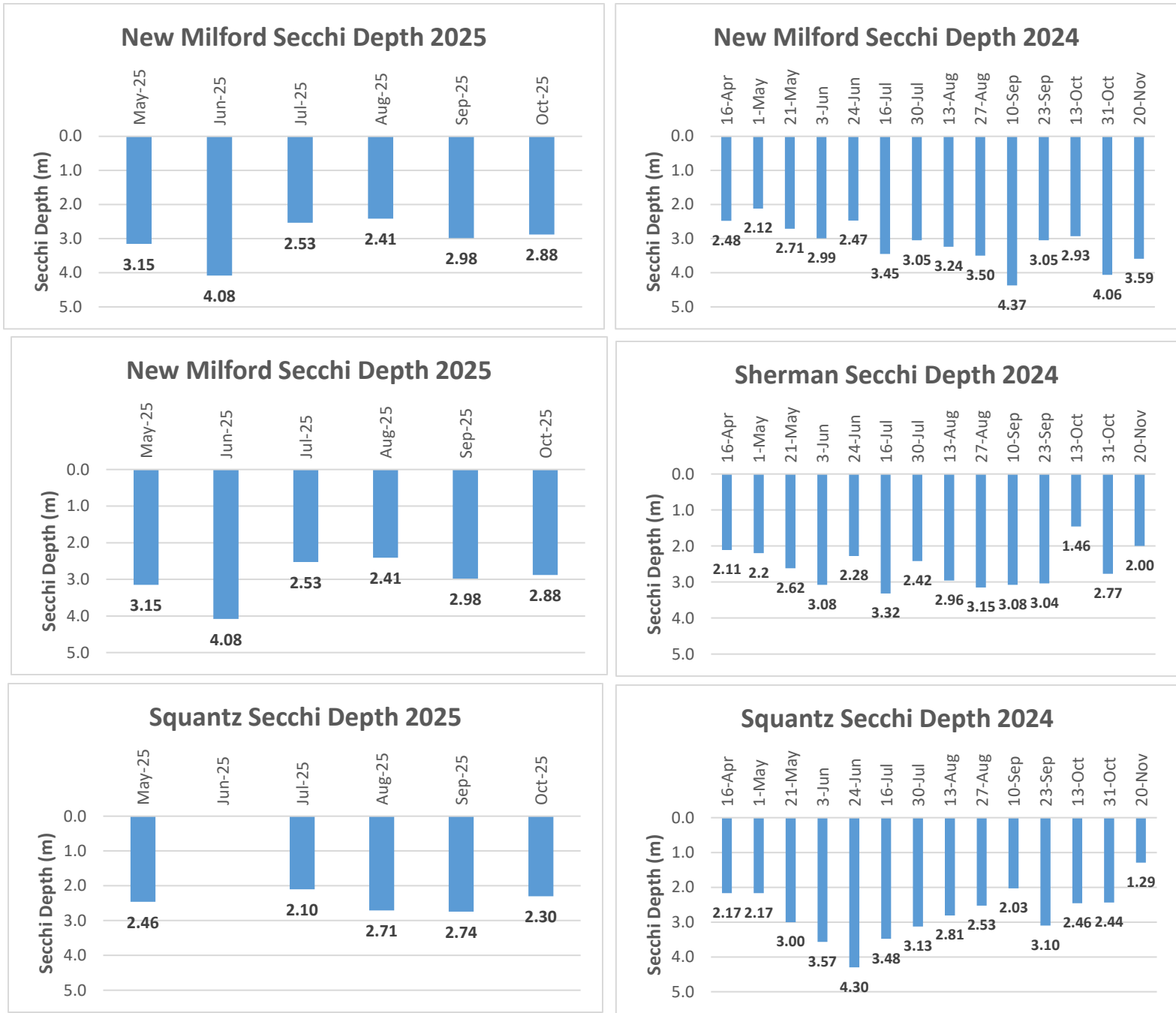
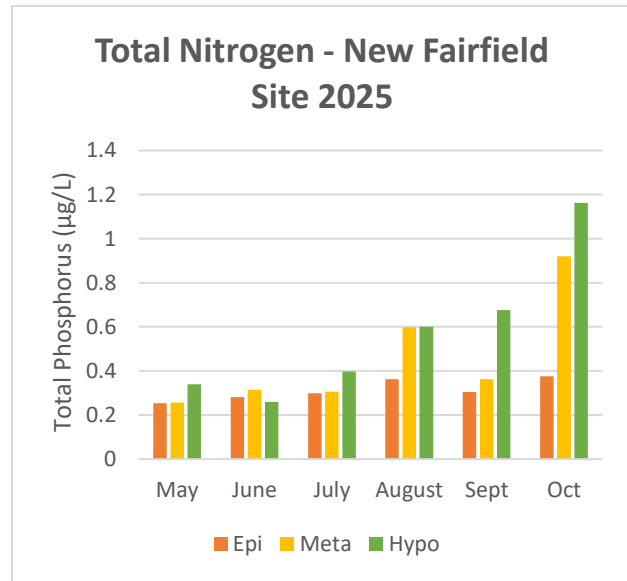
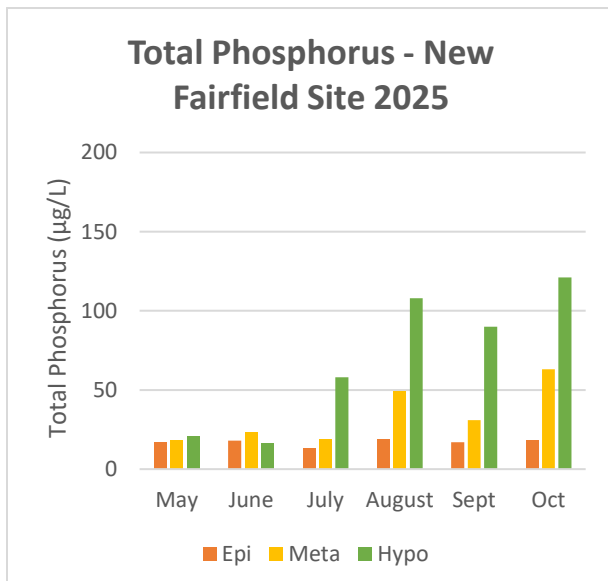
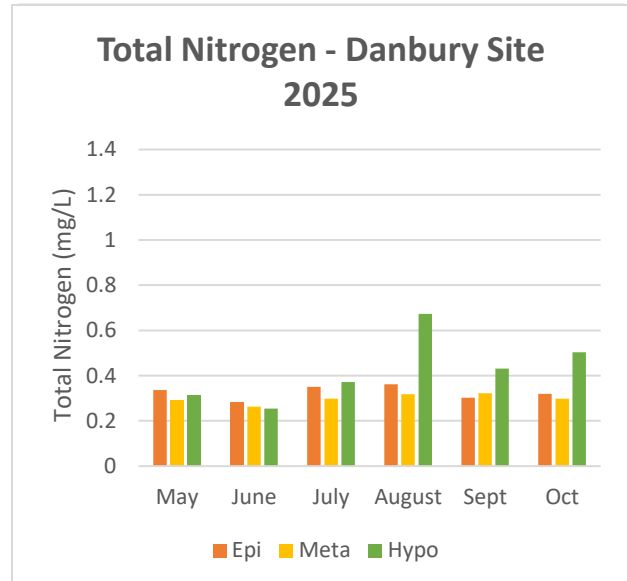
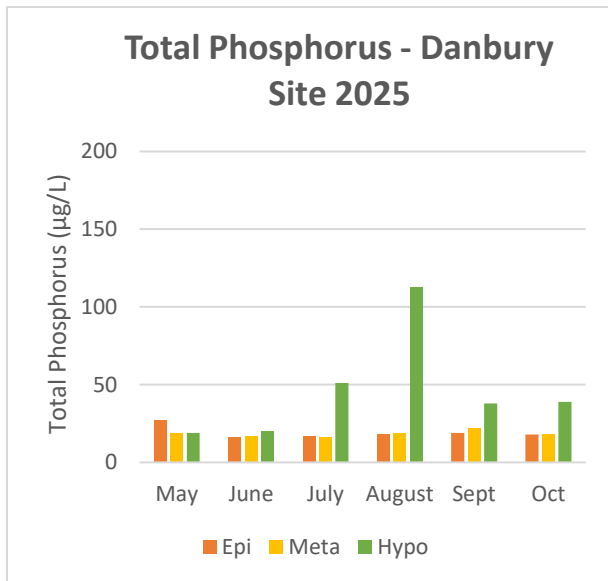


Figure 4: Measured Secchi Transparency in Candlewood and Squantz in 2024 & 2025.

2025 is the third year in a row of roughly similar average secchi transparencies, with 2.67, 2.85, and 2.65 in order. These are all good, and slightly better than Candlewood’s comprehensive average of 2.61. Thankfully we are not seeing higher chl-a values (discussed later in the report) or higher nutrient availability for algae as side-effects from the lack of plants in the lake over the past 3 years. We might see continued increases in secchi clarity thanks to the recent arrival of zebra mussels in the ecosystem.

Nutrient Levels

In 2025, nutrient measurements were taken 12 times at each site. This includes 3 samples at each location (Epilimnion, Metalimnion, and Hypolimnion samples) once per month. The past 4 years included twice-monthly sampling throughout the season to give us a better impression of nutrient dynamics in the water, and how that might impact blue-green and green algae growth in the water. This also allowed for a closer look at how nutrients are “locked” into the hypolimnion due to stratification and subsequent internal loading, and when those nutrients begin to mix with the rest of the water column. After that analysis, it became clear that while that information was valuable, it is consistent enough in Candlewood that twice-monthly sampling didn’t need to continue. At each location we sample total phosphorus, as well as four different forms of Nitrogen, but to visualize the nitrogen levels, we will use total nitrogen levels.



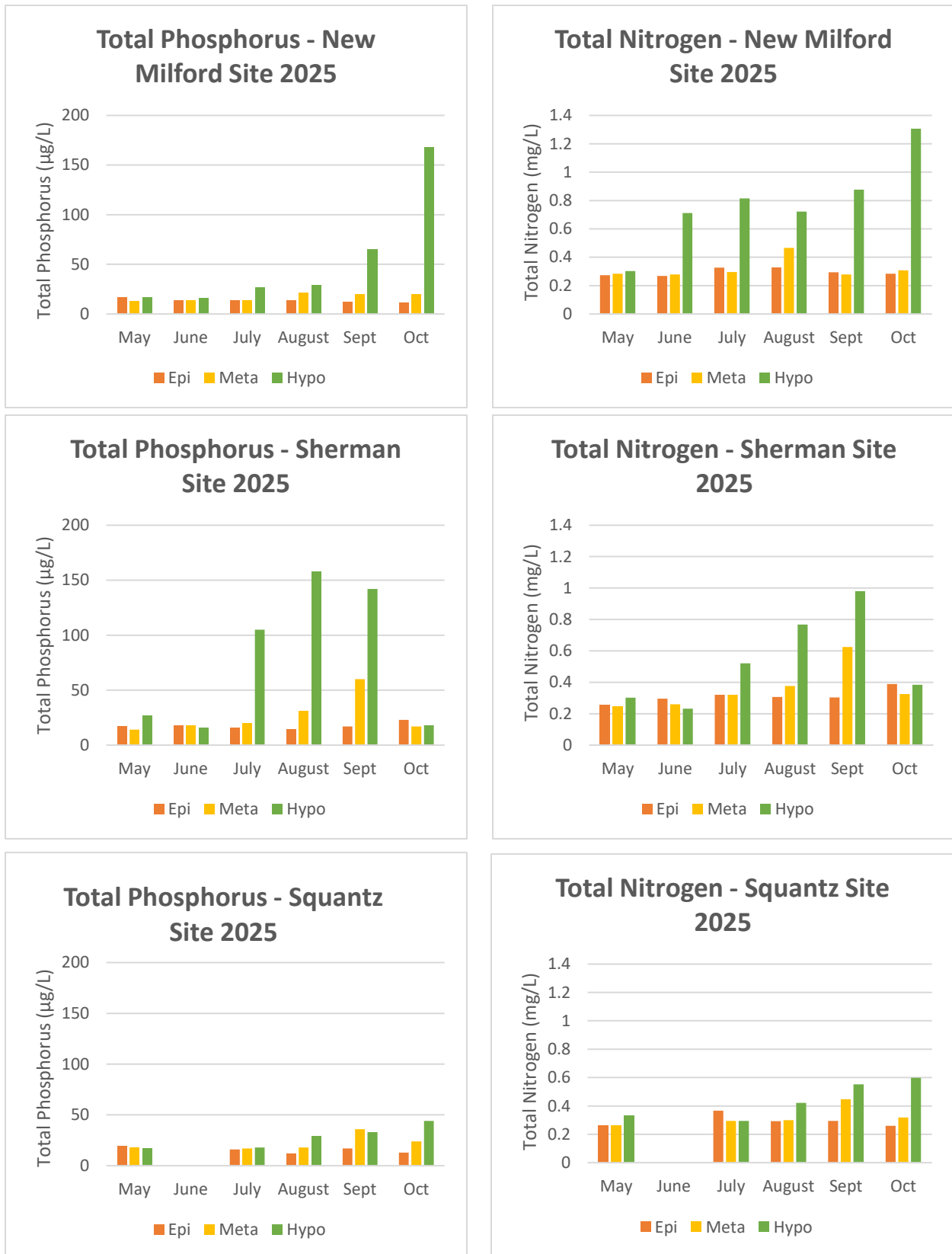


Figure 5: Measured Total Phosphorus and Nitrogen at 3 depths in 2025.

While there are different schools of thought about which of these two nutrients are more important in algae dynamics and eutrophication in freshwater systems, both are critical raw materials for algae blooms. Historically, Candlewood Lake has been considered phosphorus limited, and the blue-green algae community has been largely dominated by *Microcystis* cyanobacteria. To examine how the nutrient profile in Candlewood has changed over the course of the CLA's monitoring, it is useful to visualize epilimnion phosphorus levels, as those are the most relevant to algae growth, and thus the most likely to impact recreation during the boating season.

In 2025, the largest measurements for both nitrogen and phosphorus were generally found in the hypolimnion from July through September, and even through October at the deeper New Milford site. This is because the New Milford site had not yet been mixed completely. By October, every other monitoring site had oxygen mixed through the water column, with the exception of New Fairfield. New Fairfield was a little later to mix than the other sites, but in general early fall was warmer this year, and our sampling day in October was relatively early (October 6th). So, it's likely that all locations, except New Milford, would have been strongly mixed by the end of the month, which is supported by our twice-monthly sampling from the past 4 years. These measurements indicate strong internal loading in hypoxic conditions, a well-documented phenomenon in Candlewood Lake. Sediments at the lake bottom contribute nutrients to the system during the midsummer months, and those nutrients are incorporated into the rest of the water column after mixing.

This year continues a general improvement in phosphorus measurements at the epilimnion. There were no readings above 30 µg/L giving an average reading of 17.2 µg/L. For reference, 2023's average was 18.8 µg/L. 2024 was slightly better than this year at 16.5 µg/L. Hopefully this is signaling continued improvements thanks to public educational efforts and municipal stormwater management.

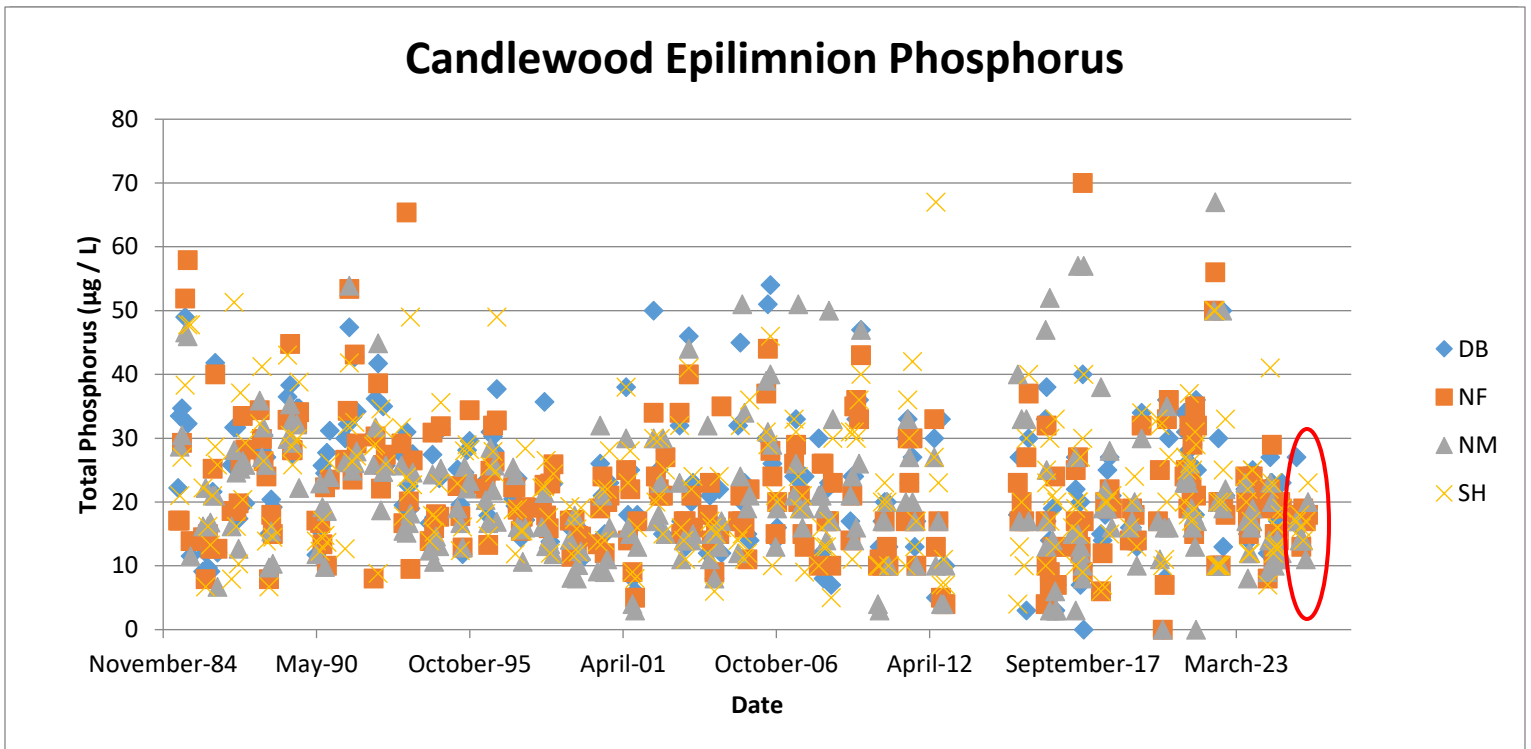


Figure 5: Epilimnion phosphorus measurements at all 4 Candlewood monitoring sites taken from 1985 to 2025. The 2025 measurements have been highlighted.

To help illustrate the trend over time of these measurements, we can look specifically at one sampling location, in this case we will look at Danbury:

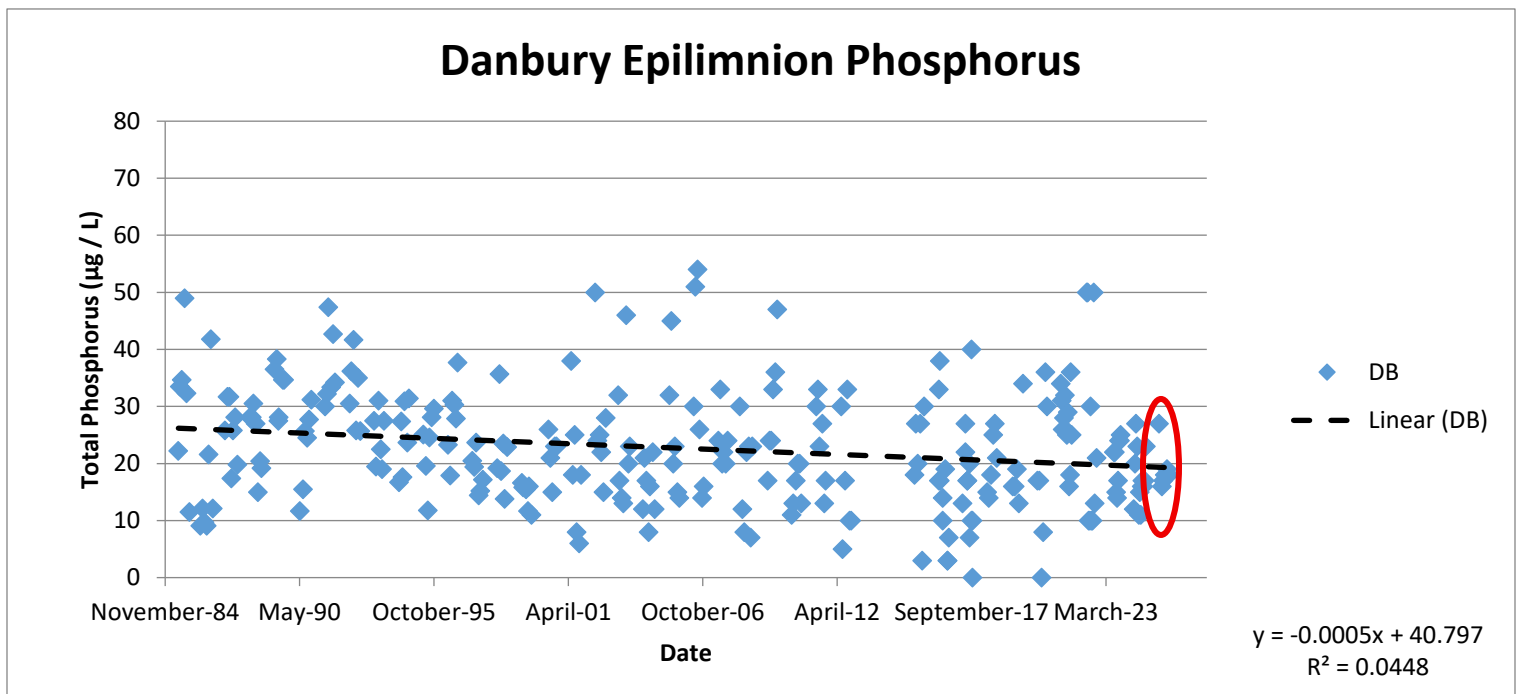


Figure 6: Danbury Epilimnion Phosphorus from 1985-2025. 2025 measurements highlighted.

While there is substantial variation in the data, (R^2 value of 0.0448) the negative slope of the line is encouraging, and we are also seeing a steady increase in this R^2 value. Based on all the above data from the Danbury site, a 95% confidence interval of the population mean of epilimnion of phosphorus was found to be 21.03 – 24.10 $\mu\text{g/L}$. Hopefully continued expanded sampling can help us determine a more accurate mean measurement in the coming years. This R^2 value decreased somewhat in 2022 due to detection limitations at the lab, but the lab servicer was switched in 2023 to UCONN who has been consistently accurate.

At this point, the slope representing the average epilimnion phosphorus levels is negative at all 4 sites on Candlewood. This means, over the past 40 years of monitoring, the average phosphorus concentrations at the surface of the lake have been going down. This is very encouraging news, since most lakes around the country are battling rapidly increasing nutrient levels due to increased human activity. This is a sign of increasing awareness of the problem, education of the public on nutrient pollution, and implementation of best practices at properties around the lake. All that said however, the slope of these lines is a maximum of -0.0005 at the Danbury site, with New Milford being the closest to zero. This represents a very small, modest decrease over a long period of time; a decrease that can be reversed very easily should nutrient pollution in the watershed increase.

Chlorophyll Concentrations

Chl-a	May	June	July	August	September	October	Average
DB	6.8	3.7	9.4	5	3	4.5	5.40
NF	5.9	5.2	6.6	5.1	4.9	9.9	6.27
NM	4.7	5.5	5.9	8.6	5.4	3.6	5.62
SH	5	7	4.1	3.3	5.5	8.3	5.53
SQ	5.8		10.7	3.9	4.3	2.5	5.44
Average	5.64	5.35	7.34	5.18	4.62	5.76	5.65

Table 5: *Chlorophyll-a as measured in the lab during the 2025 season ($\mu\text{g/L}$). Note that there was no chl-a sample for June in Squantz.*

One of the best ways to measure both eutrophication and potential recreational impact on a freshwater lake system is by measuring Chlorophyll-a. This measurement is effectively a measurement of the algal material in the lake by measuring the green pigment present in green algae and cyanobacteria. The largest measurement taken in 2025 was in Squantz in late July at $10.7 \mu\text{g/L}$, with July also being the highest average Chl-a month by a relatively wide margin.

The highest measurement in Candlewood was in late October at the New Fairfield location, coming in at $9.9 \mu\text{g/L}$, with the second highest in Danbury in July. This year was marked by generally average to somewhat low productivity, giving slightly lower average chlorophyll-a readings than in many past years. This is supported by a lack of large scale algae bloom events during the year, with the exception of some in the Danbury/Lattins Cove area in June. However, this year follows the pattern of average measurements tending to be elevated twice in the season: once at the peak of the season in July, and once in October. We also had a late-season large scale blooming event that was sampled for nutrients that will be discussed later in this report.

By plotting chlorophyll-against secchi depth, we can get a good idea of how the lake generally compares to other years. This is a useful way to track two critical measures of eutrophication, while also displaying important aspects of the recreational value of the lake compared to past years.

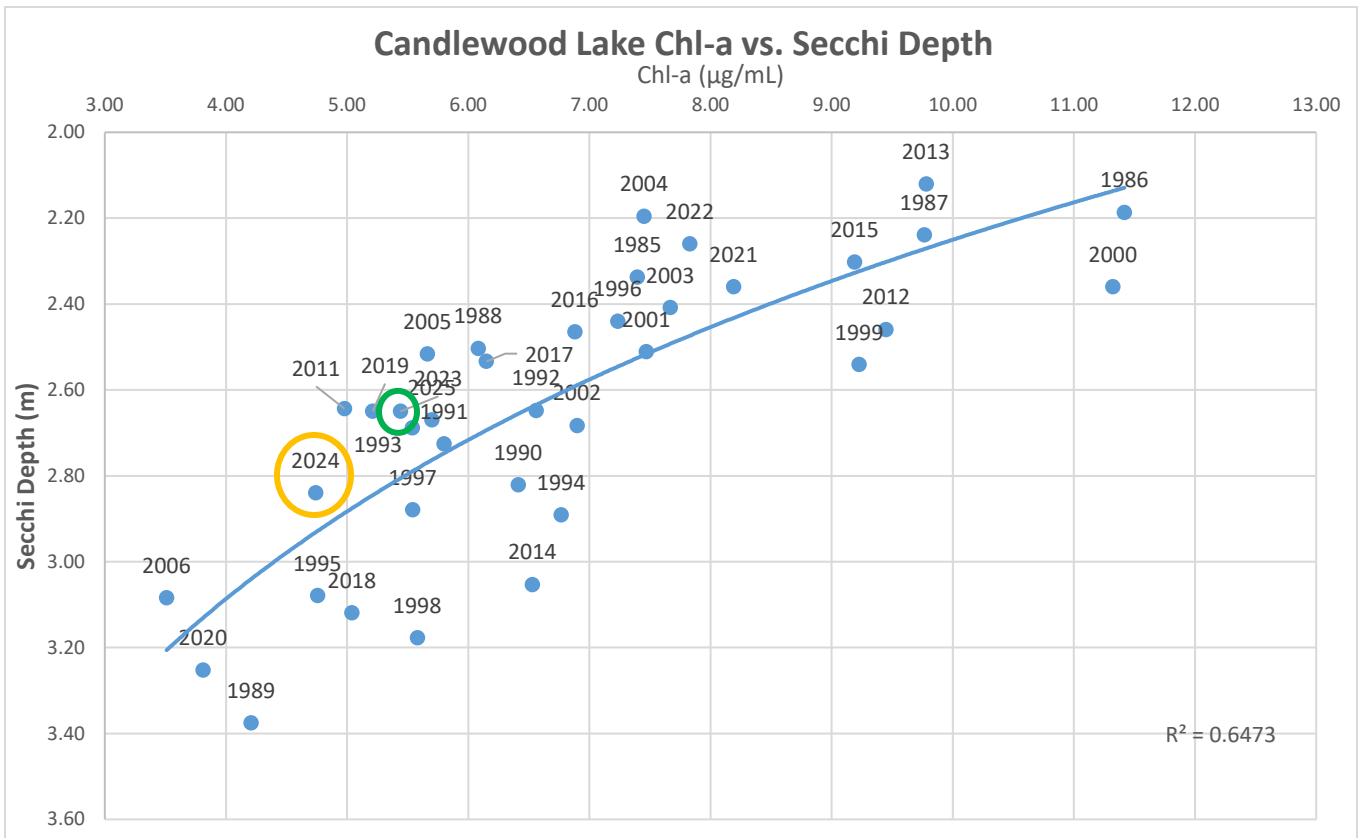


Figure 7: Chlorophyll-a plotted against Secchi Depth in Candlewood from 1985-2025. The years 2024 and 2025 have been highlighted (Note that this graph does not include Squantz Measurements).

The above figure is really useful in displaying the general productivity (that is, algae growth) of the lake, and comparing different years. The line shows the general (logarithmic) relationship between the two metrics. 2025 is a year where we saw slightly lower than average chl-a measurements, and relatively expected clarity measurements. You can see a numbers of measurements tend to bunch in the area where 2025's measurements are found. Based on the relationship, you could generally expect slightly clearer water based on the average chl-a measurements taken. 2025 ranks relatively well compared to past years in both secchi depth and chl-a. It is very similar to 2019, and 2023. 2025 is a year that was marked by light precipitation but somewhat heavy wind action, which might have prevented the effective proliferation of large algae colonies while in semi-drought conditions. While there is no clear trend to the relationship between chl-a and secchi clarity over time, the graph presents a useful method to comparing the "recreational usability" of the lake between years.

Conductivity

Conductivity is a measurement of how well the water can conduct an electric charge. This is a good analog for measuring the level of dissolved salts in the water, as these salts dissolve into charged ions, which increase the water’s ability to conduct an electric charge. This means that the higher the conductivity is, the higher the “saltiness” of the water. Over time, Candlewood has been accumulating more and more of these ions mostly through stormwater runoff and stormwater discharges that empty into the lake, precipitating a pretty clear increase in the water’s conductivity.

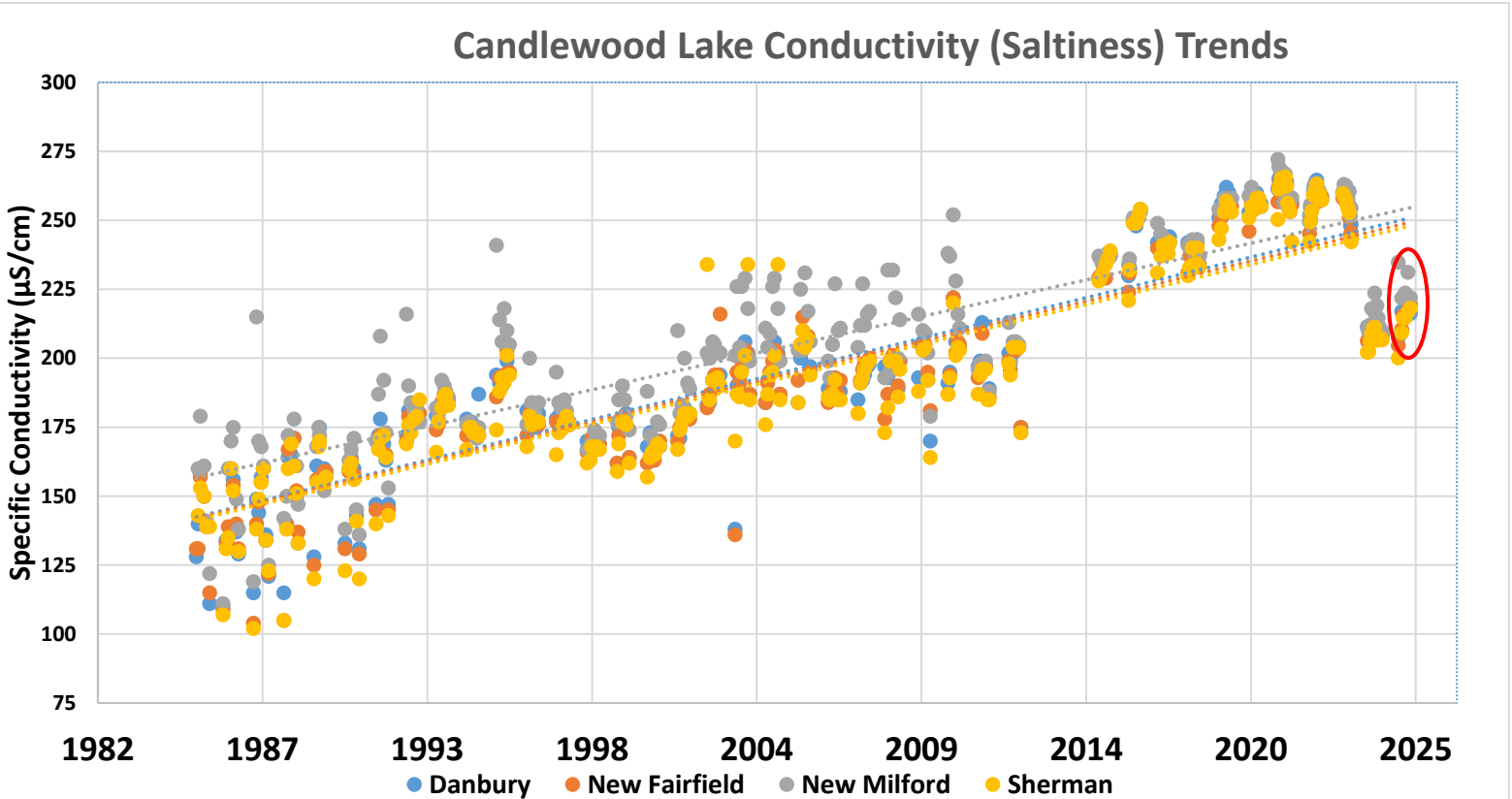


Figure 9: Candlewood Lake Conductivity from 1985-2025 measured at 1m depth. 2025 has been highlighted, and trend lines have been included to illustrate the clear increase over time.

2025 is now the second consecutive year where this concerning trend has changed a bit, where average numbers decreased. However, we are seeing a general increase from 2024. This drop is likely due to the arrival of zebra mussel, who integrate some of these charged ions into their shells when growing. This, however, is unlikely to limit the increase long term. To put these numbers in context, seawater has a conductivity of 50,000 µS/cm, and the limit of drinkable freshwater is around 3000 µS/cm, so while the lake is not in imminent danger of becoming a salt lake, there are species of fish and plankton that are more sensitive to these measurements, and eventually, we might begin to have impacts on the lake’s fishery and ecosystem.

Cations and Anions

As part of the measurement of salts in Candlewood Lake we test the water bimonthly for key positive and negatively charged ions that are parts of certain biological or ecological pathways. Those ions are calcium, magnesium, sodium, potassium, and chlorine. The measurement of these ions began in 1992 and has continued since

	Sodium (Na+)		Calcium (Ca++)		Chloride (Cl-)		Magnesium (Mg++)		Potassium (K+)	
Danbury	14.41	(15.02)	15.86	(16.91)	27.10	(25.30)	6.49	(6.13)	1.36	(1.36)
New Fairfield	13.85	(14.37)	16.24	(17.07)	26.13	(24.53)	6.55	(6.14)	1.32	(1.33)
New Milford	14.01	(13.96)	17.99	(17.73)	26.80	(24.03)	7.15	(6.50)	1.32	(1.30)
Sherman	13.67	(14.00)	15.61	(16.57)	25.70	(24.10)	6.47	(6.07)	1.33	(1.31)
Squantz	10.14	(9.52)	11.05	(9.61)	19.80	(16.03)	4.20	(3.70)	1.12	(1.07)

Table 6: 2024 (in parantheses) and 2025 average cation and anion concentrations measured at 1m depth (in mg/L).

Of particular interest are the calcium ion levels, as these are a critical raw material for zebra mussel shell formation, and there are well documented thresholds for effective zebra mussel infestation of waterbodies based on calcium levels.

Risk	pH	Calcium (mg/L)
Low	<7.4	<12.0
Medium	7.4 – 8.0	12.0 – 20.0
High	>8.0	>20.0

Table 7: Risk thresholds for Zebra Mussel Colonization (via: Murray et al. 1993, Biodrawiversity 2013).
Note: O'Neill 1996 classifies the range from 20-25mg/L as moderate risk.

In Candlewood, most readings have moved far below the high risk category of 20 mg/L. This is due, in large part, to the usage of calcium by the zebra mussels which have recently arrived and begun colonizing in Candlewood. Free calcium is being removed from the ecosystem and used for shell building. Notably, Squantz is below the low risk concentration, and Squantz has had no reported zebra mussel sightings yet. However, following the initial drop in calcium from the highs before the arrival of the zebra mussels, we are seeing some locations decrease, but some increasing – especially Squantz.

Other cations and anions are in a position of flux as well, which supports the changes in conductivity we're seeing. This is likely due in large part to the power company beginning to start pumping water into Candlewood in the summer time. In general though, we expect that the decreases are temporary as the ecosystem adjust to the summer pumping and arrival of the zebra mussels, and expect the slow upward trajectory to continue.

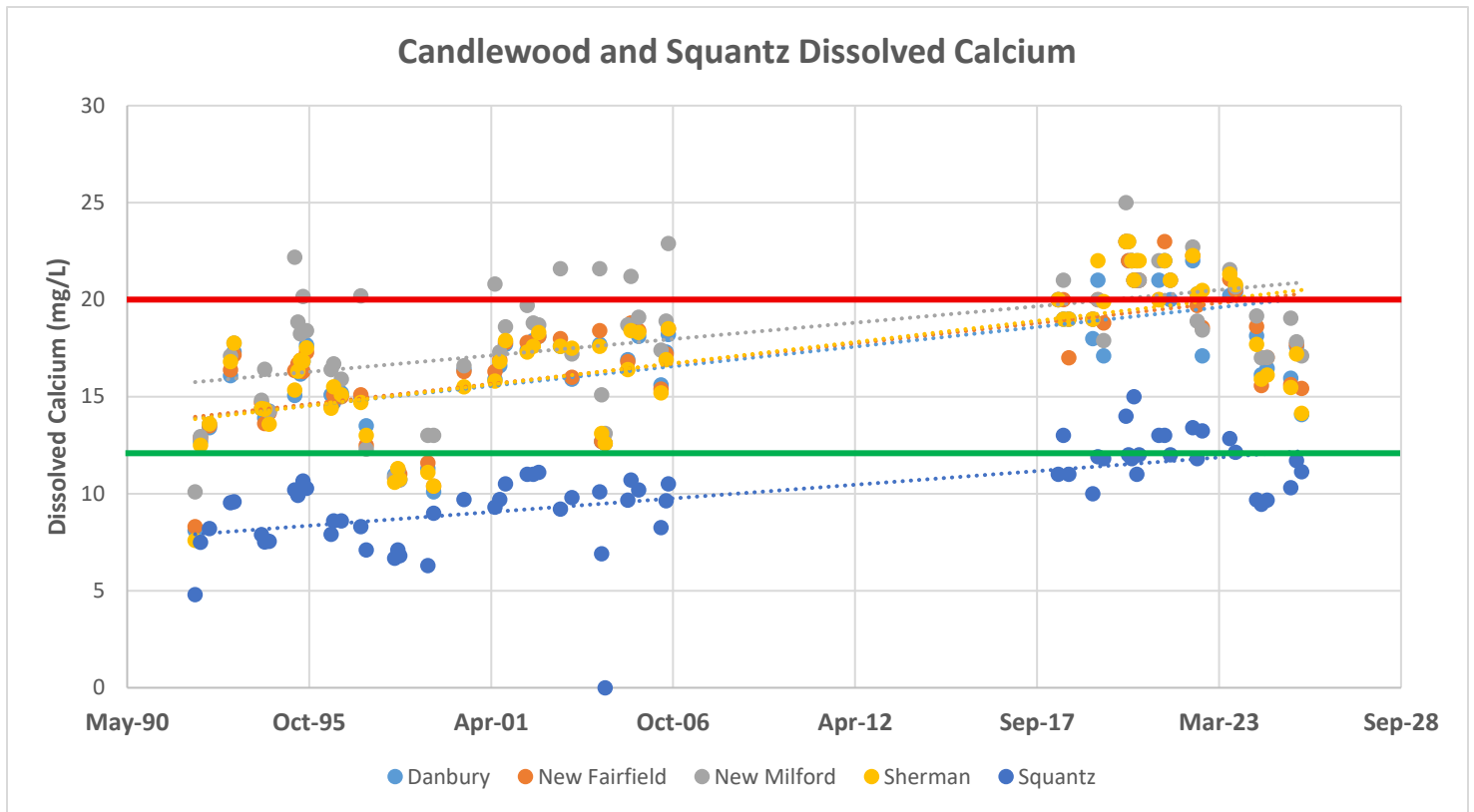


Figure 10: Calcium concentrations in Candlewood and Squantz since 1992. Note that collection between 2006 and 2018 was paused. The red line shows the “high” risk threshold for zebra mussel colonization, the green line shows “low” risk threshold

Tracking calcium in the coming years will be very interesting, as zebra mussels continue to use free calcium as their population in the lake expands. The annual winter-time drawdown will also continue to affect their numbers, particularly in shallow areas, and may help sequester some calcium in their shells, which take longer to decompose. Of particular interest is Squantz – which has now moved just below the “low” risk threshold. While the potential source of zebra mussels into Squantz is obvious, the low calcium concentrations there might explain why there have been no mussels found there yet.

This provides an interesting experimental opportunity to examine at exactly what calcium concentration colonization might be able to begin, as we expect calcium concentrations there to slowly continue rising.

Other Monitoring Projects

PFAS Baseline

In October of 2025, 3 samples were taken in the lake to better understand the baseline levels of PFAS or “Forever Chemicals” in the lake. These chemicals are becoming more heavily studied and understood to have potential long term health effects, particularly when ingested in drinking water. However, due to recent developments in the local area, including in the Housatonic River – we felt it important to establish a baseline level of these chemicals in a few locations in Candlewood so that we can better understand if it changes over time moving forward.

	Perfluorobutanesulfonic acid PFBS	Perfluorohexanoic acid PFHxA	HFPO-DA GenX	Perfluoroheptanoic acid PFHpA	Perfluorohexanesulfonic acid PFHxS	ADONA	Perfluorooctanoic acid PFOA	Perfluorononanoic acid PFNA	perfluorooctane sulfonic acid PFOS	9CI-PF3ONS	Perfluorodecanoic acid PFDA	NMeFOSAA	Perfluoroundecanoic acid PFUnA	NEFOSAA	11CL-PF3OUdS	Perfluorododecanoic acid PFDoA	Perfluorotridecanoic acid PFTrDA	Perfluorotetradecanoic acid PFTA
NM	ND	ND	ND	ND	1.34	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NF	ND	ND	ND	ND	1.33	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DB	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Control Report Limit	2.53	4.94	4.05	2.85	1.27	3.67	2.54	3.18	2.66	1.76	6.24	2.25	3.33	2.15	4.75	6.14	3.34	4.13

Table 8: PFAS Results for 2025 in PPT (parts per trillion). Note that the only result above the reporting limit was for PFHx. The two chemicals of highest concern have also been highlighted, although both were below the reporting threshold.

This analysis was not necessarily meant to draw any conclusions, but simply to give the CLA and the public an idea of the concentrations of these chemicals in the lake as a whole. Samples were taken at the surface, but in the main basins of the lake – meaning that while these are representative of the lake as a whole, they might not be representative of every small area of the lake, including local beaches.

That said, these results are encouraging in that virtually every result is under the very low concentration detection limit, especially the chemicals of particular concern (PFOA and PFOS). The only positive result was found for PFHx, which is a less studied chemical – but the EPA drinking water guideline is 10 ppt. Meaning that Candlewood, which is not a drinking water resource, is still well below this limit. It also is the only chemical found, meaning that the hazard index the EPA would establish for candlewood is zero. We may decide to do more analyses in the future, but sampling and analyzing is both difficult and expensive for these very low concentration contaminants.

Fall/Early Winter Bloom Sampling

The late fall and early winter in Candlewood Lake in 2025 was marked by a significant persistent and large scale bloom event that affected primarily the main basin of the lak in New Fairfield, and spread northward into the Sherman arm of the lake. Candlewood has had similar late-season bloom events before when weather conditions line up favorably with the “turnover” of the lake. This creates a system where internally loaded nutrients are delivered to the surface water after mixing concludes, and mild temperatures and low wind allow blue-green algae to continue reproducing.

In an effort to better understand these dynamics samples of blooming waters were taken to assess nutrient concentrations.



Figure 11: Photo of large-scale bloom in main basin of Candlewood in early November 2025.

FIELD #	Date	Date	NH ₃	NO _x	TN	ORG N	TKN	TP
CLA-NF	11/24/25	12/8/25	0.011	0.041	0.417	0.365	0.376	0.034
CLA-DB	11/24/25	12/8/25	0.033	0.052	0.362	0.276	0.310	0.019
CLA-EB	11/24/25	12/8/25	0.020	0.043	0.528	0.465	0.485	0.026
CLA-BR	11/24/25	12/8/25	0.013	0.041	0.382	0.328	0.341	0.031

Table 9: Nutrient concentrations of blooming waters. EB stands for “Echo Bay” and “BR” Stands for Brookfield.

As expected, these represented the highest nutrient concentrations taken all year for both nitrogen and phosphorus. Of particular notice is the elevated phosphorus, which is likely the limiting factor for blooms in Candlewood. Eventually these blooms subsided once temperatures sufficiently decreased to bring water temperature low enough to prevent blooming. In the future, for blooms like this, we will add chl-a analysis to sampling to help flesh out our understanding of bloom dynamics in the lake.

Similar large-scale blooms occurred in both 2013 and 2021, as well as before monitoring began. However, it’s difficult to predict their occurrence, as they seem very dependent on mild conditions in the fall and early winter.

Discussion

2025 was a unique year in that it marked an improvement in many water chemistry metrics, but continued changes in Candlewood’s Ecosystem. This marks the first year in which the CLA switched back to once-monthly sampling of our key metrics. By increasing our samples per month and year, we were able to get a more accurate idea of the actual state of Candlewood Lake. We plan to continue once-monthly sampling moving forward after understanding better the phases of chemistry changes in the lake thanks to the twice-monthly sampling. This allowed us to confirm our understanding about when changes in the lake more commonly occur, but that time can now be better used for other sampling projects like the PFAS project this year, and continued plant monitoring for hydrilla.

While the lake saw some improvements in nearly every metric, including ions and conductivity, the ecosystem is changing in other concerning ways. In particular, the rapidly increasing population of zebra mussels, and the continued lack of macrophyte plants. While the loss of plants is now pretty well understood in the context of the sterile grass carp and drawdown, work will continue to attempt to balance the plant community in the lake. We are encouraged that nutrient concentrations in the epilimnion continue their meager decrease over time – a trend likely attributable to public education efforts and better community engagement. However, this trend might be slowing in recent years, so careful watch of nutrient level average change will be critical. The lake still shows strong internal loading tendencies during stratification, which can lead to strong algae blooms at the end of the season when the water column mixes, and those nutrients become available for use by the algal community. For the first time we are beginning to see a potential decrease in salt levels over time in the lake. Hopefully we see that trend continue over the next few years, but we expect that decrease to be temporary.

Trophic Category	Total Phosphorus (µg / L)	Total Nitrogen (µg / L)	Summer Chlorophyll- <i>a</i> (µg / L)	Summer Secchi Disk Transparency (m)
Oligotrophic	0 - 10	0 - 200	0 - 2	>6
Early Mesotrophic	10 - 15	200 - 300	2 - 5	4 - 6
Mesotrophic	15 - 25	300 - 500	5 - 10	3 - 4
Late Mesotrophic	25 - 30	500 - 600	10 - 15	2 - 3
Eutrophic	30 - 50	600 - 1000	15 - 30	1 - 2
Highly Eutrophic	> 50	> 1000	> 30	0 - 1

Table 10: Eutrophication “report card” with 2025 average levels highlighted to illustrate the general eutrophic identity of the lake.

In most categories in 2025, Candlewood remained in a mesotrophic or early mesotrophic condition, after improving in recent years in some metrics from a late mesotrophic condition. While Candlewood Lake is not an old lake, it is substantially impacted by the surrounding human development, precipitating higher nutrient measurements, lower clarity, and greener water. By working to lower nutrient levels in the lake, ideally we might begin to see improvements in chlorophyll-a and secchi disk measurements as well.

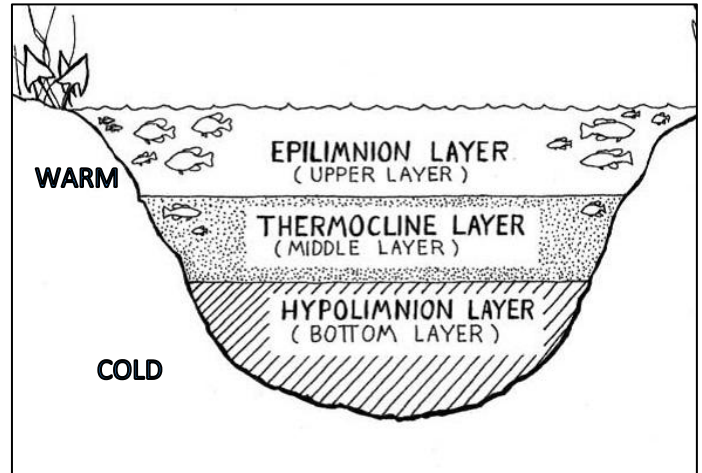
In 2026, the CLA will be continuing our Nutrient Budget analysis, pinpointing the primary sources of Phosphorus and Nitrogen in the lake, specifically focusing on ground water. Although we understand these sources now, this project will illustrate just how much impact each source is having, and the best course of action for potentially managing those sources. Work on hopefully achieving a balanced and healthy plant community will also continue as additional exclosures, native species planting, and additional carp removals if necessary are being evaluated.

The general recommendations for the coming years based on the 2025 results are as follows:

1. Continue developing a long-term nutrient mitigation strategy based on nutrient budget analysis to inform a Lake Management Plan.
2. Continue community education efforts surrounding phosphorus and nitrogen pollution to continue and strengthen downward trend.
3. Engage town public works and departments of transportation with a focus on efficient road salting to minimize lake impacts of road salt runoff with a hope of potentially creating a sustainable negative trend.
4. Expand additional monitoring and analysis efforts to include ecosystem aspects like the plant community and fisheries.
5. Expand active recreation management and education at the boat ramps to help stop invasive species threat both into and out of Candlewood Lake.

Glossary

Temperature: Often measured in Celsius, different layers (surface vs. very deep water) of the lake often have very different temperatures! A larger difference between the temperature of shallow and deep water can mean that those two layers are less likely to mix, since colder water is denser and sits at the bottom. A diagram of the various lake layers is illustrated below!



Dissolved Oxygen: This is measured in milligrams per liter (mg/L) and is a measure of how much oxygen the water has, which many fish species and other organisms rely on.

Total Phosphorus: This is measured in micrograms per liter ($\mu\text{g/L}$) which is the same as "parts per billion" (ppb). This measures the concentration of phosphorus in the water which can feed algae and aquatic plants.

Total Nitrogen: This is measured in the same way as total phosphorus, but instead measures nitrogen concentration, which can also feed algae and aquatic plants.

pH: This is a measure of how acidic or alkaline (basic) the water in the lake is by measuring hydrogen ions (H^+). This is measured on a scale from 0-14, where zero is the most acidic and 14 is the most basic. Neutral pH is 7, and this measure is of singular importance to organisms living in the water, many of which require a pH that is slightly basic (7-9). However, higher pH can also allow more phosphorus (and other compounds) to dissolve in the water; potentially increasing total phosphorus measurements.

Secchi Depth: This is a method used to measure how clear and transparent the lake water is. It is measured by dropping a circular black and white disk on a rope into the water, and the depth at which the disk can no longer be seen is recorded in meters (m). Higher measures mean the disk could be seen longer, and that the water is clearer. This is illustrated in the diagram below!

Chlorophyll-a: This is measured in micrograms per liter ($\mu\text{g/L}$) which is the same as "parts per billion" (ppb). Chlorophyll-a is the compound that makes plants green, and what they use for photosynthesis. This measure gives insight into how much green algae is in the water and can decrease transparency (and secchi depth).

Conductivity: A measure of the ability of water to pass an electrical current, increased by the presence of charged particles in the water.

Ions: Charged particles that increase conductivity. Often From salts that have dissolved in the water – which certain aquatic species are very sensitive to.