

Pickerel Lake Water Quality Update 2025

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Prairie Coteau Watershed Improvement and Protection Project

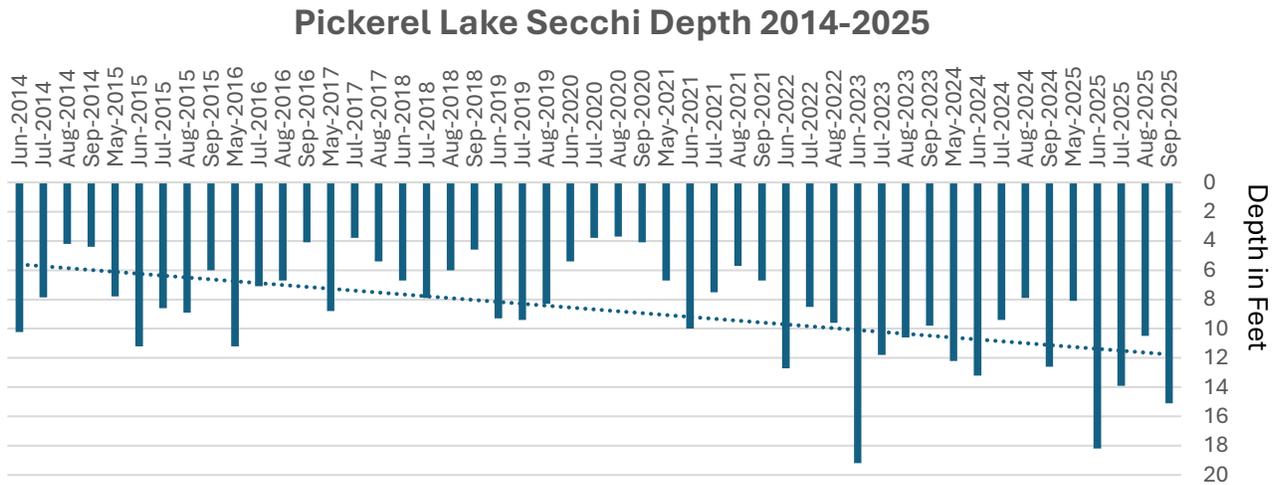
Composite surface and bottom water samples were collected during the months of May, June, July, August, and September 2025 from three sites for the following parameters: total phosphorus, nitrate-nitrogen, total kjeldahl nitrogen, ammonia-nitrogen, total suspended solids, and chlorophyll *a*. Field parameters taken by Prairie Coteau personnel include pH, dissolved oxygen, and Secchi depth. RMB Laboratories located in Detroit Lakes, Minnesota conducted analysis of the water samples collected.

Secchi Depth

Secchi depth is a measure of water clarity. A Secchi disk is an 8 inch or larger plastic, or metal disk alternately painted black and white. The disk, attached to a measuring tape, is lowered into the water until it is no longer visible from the surface. The depth measured where the disk is no longer visible is called the Secchi depth. Low Secchi depth measurements are typically due to algae blooms or suspended sediments. Secchi depth usually decreases in eutrophic lakes like Pickerel as the summer season progresses due to increases in algae growth. Water clarity is one water quality parameter many people believe improves with heavy infestations of zebra mussels due to their ability to filter large amounts of lake water in a single day, removing algae and suspended solids.

Secchi depth continued to be greater than average in 2025. Watershed Project personnel recorded a record average Secchi disk reading for the month of September at 15.1 feet. Figure 1 shows the overall trend of Secchi depth readings increasing. This summer's greater depths are due to a decrease in algae which is likely caused by the lake's phosphorus being utilized by rooted aquatic plants and filamentous algae growing along the lake's shoreline. Due to the increase in water clarity, aquatic macrophytes are now able to grow at deeper depths due to sunlight penetrating further into the lake's water column. The lake showed an increased percentage of the littoral zone having aquatic plant growth, although Curly Leaf Pondweed seemed to have decreased. Other native aquatic plants are taking place such as coontail, muskgrass, northern watermilfoil, and filamentous algae.

Figure 1



Dissolved Oxygen (DO)

Oxygen is essential for the survival of aquatic life. The diffusion of atmospheric oxygen into lakes occurs naturally and is enhanced by the agitation of the lakes surface by wind. Wind will mix oxygen vertically within the lake. Oxygen is also produced by algae and rooted aquatic plants called macrophytes where sunlight is available for photosynthesis. In the deeper areas of the lake where sunlight does not reach (called the profundal zone) oxygen levels depend on mixing by the wind. During periods of calm, warm, sunny days during the summer months, the lake may stratify with lighter warmer water on the surface and heavier colder water near the bottom. The difference in density of the lighter and heavier water prevents mixing, and the bottom water may become depleted of oxygen (hypoxic) which then causes a chemical reaction that releases phosphorus from the lake's sediment. High winds and cooler surface temperatures weaken the stratification allowing the lake to mix. This mixes the dissolved phosphorus from the bottom to the surface where it is available for algae to use.

Pickerel was stratified at Site 1 and 2 on July 8, 2025, with oxygen levels below 1 mg/l at 21 feet deep at Site 1 (Figure 2) and Site 2 (Figure 3). The August and September sampling dates did not show signs of stratification and overall, the lake was well mixed. Calm winds and warmer temperatures the week before July 8th created the conditions to set up for the stratification event.

The overall increase in water clarity on Pickerel Lake has no doubt increased the depth to which sunlight can penetrate, decreasing the depth of the aphotic zone. In Figure 2 and 3, the aphotic zone is clearly defined on July 8 by the rapid decrease in temperature and oxygen levels at 21 feet.

Figure 2

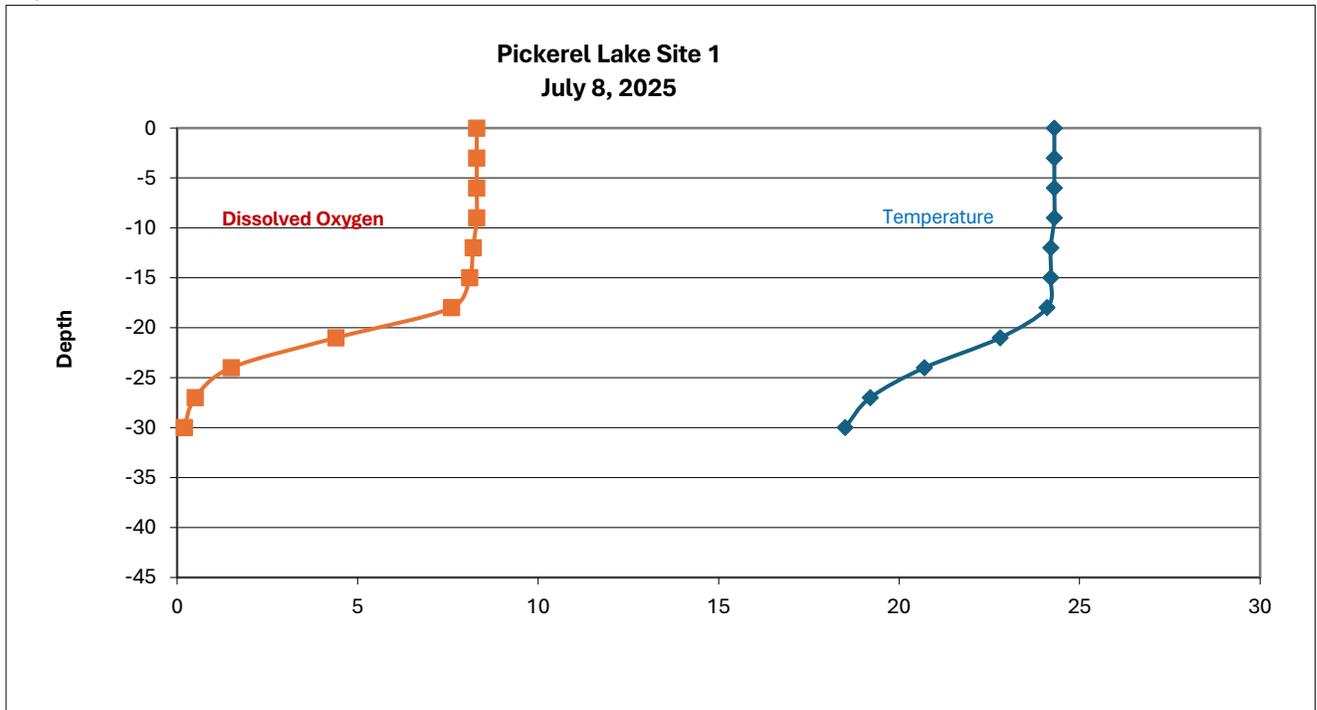
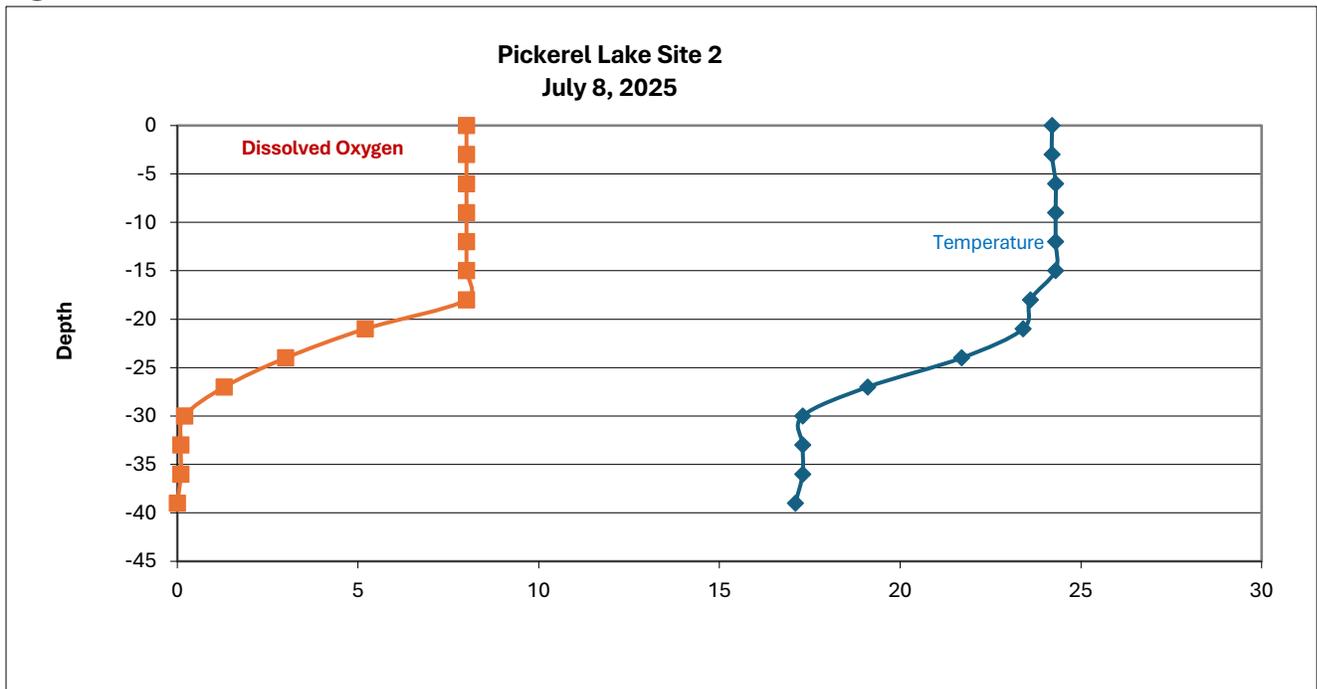


Figure 3



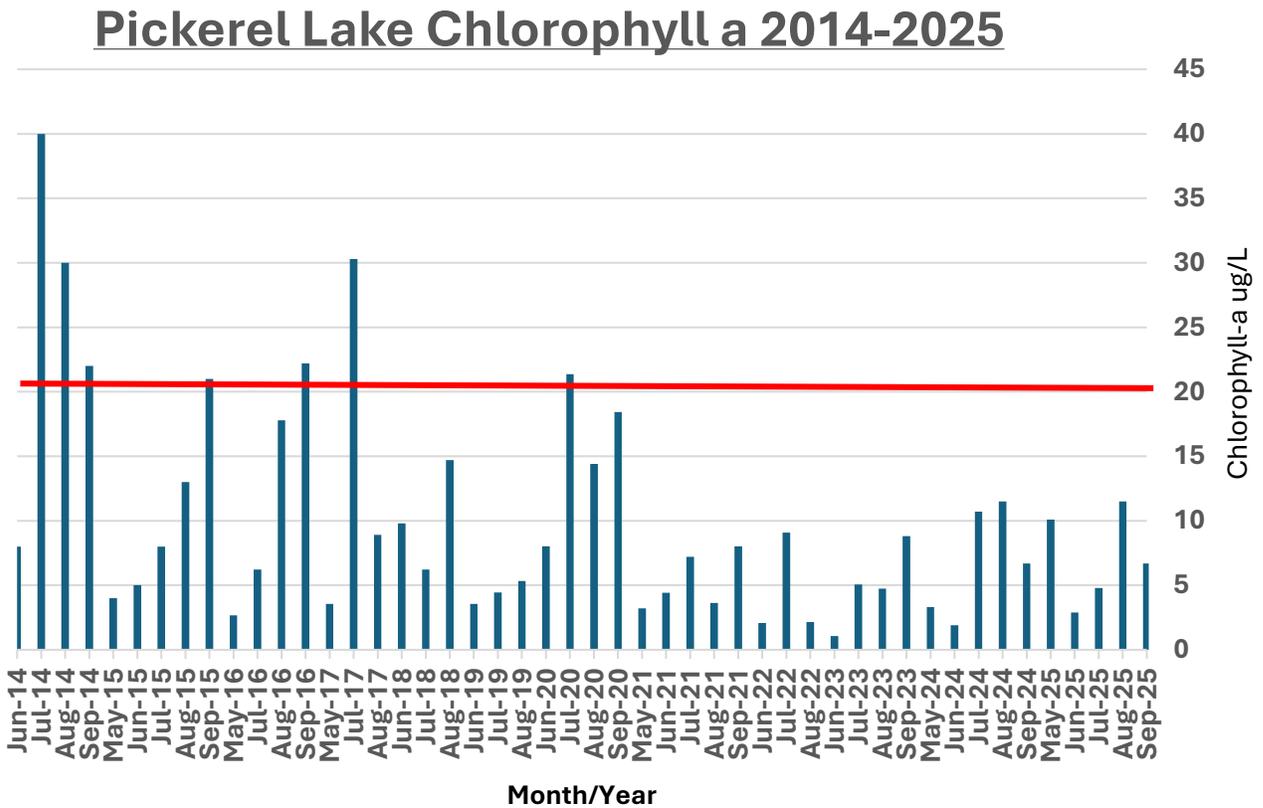
Chlorophyll a

Chlorophyll is the green pigment in algae that can be extracted and measured giving a year-to-year comparison of algal biomass in a lake. Higher chlorophyll measurements indicate higher algal biomass. Chlorophyll measurements over 20 ug/l (micrograms per liter) usually indicate a

nuisance bloom of blue-green algae (above the red line shown in Figure 4). Due to the ability of zebra mussels to filter large amounts of water, chlorophyll *a* levels in the lake decrease as green algae and diatoms are consumed by these mussels. This however is not necessarily a good thing as these phytoplankton are an important part of the food chain, unlike blue-green algae which cannot be eaten by zooplankton and are disliked by zebra mussels.

Due to the decrease in algae growth on Pickerel Lake, Chlorophyll *a* levels have not exceeded the State water quality standard of 20 ug/L (red line) since July 2020. Lower chlorophyll measurements are probably due to several factors including; the introduction and rapid spread of curly leaf pondweed, a rooted aquatic plant that is probably utilizing a good portion of the lake’s dissolved phosphorus for growth; and the redistribution of phosphorus by zebra mussels to the littoral zone where it is being utilized by *Cladophora* filamentous algae and native species of aquatic plants.

Figure 4



Total Phosphorus (TP)

Total phosphorus is the total amount of phosphorus found in plant and animal fragments (mainly plankton) within the water column, and ortho-phosphate or dissolved phosphorus is available for plant growth. Eutrophic lakes, like Pickerel, have an overabundance of phosphorus available for algae growth, especially from internal loadings from sediments that periodically are released when

the lake's bottom becomes anoxic (depleted of oxygen) when the lake stratifies. Both surface and bottom samples from Pickerel Lake are tested for total phosphorus.

Surface total phosphorus (Figure 5) levels continue to trend downward. This indicates external sources of phosphorus from the lake's watershed have been reduced. Although the Total Phosphorus is decreasing, the Total Dissolved Phosphorus (TDP) seems to be trending upward (Figure 6). The Total Dissolved Phosphorus refers to the filterable fraction of phosphorus that is directly available for aquatic plants and algae to uptake. The increase is most likely due to zebra mussels and somewhat to internal loadings during stratification events. When zebra mussels are filter feeding, they digest and excrete waste, introducing and allowing more phosphorus to be available as dissolved phosphorus for uptake by the aquatic plants and algae.

Figure 5

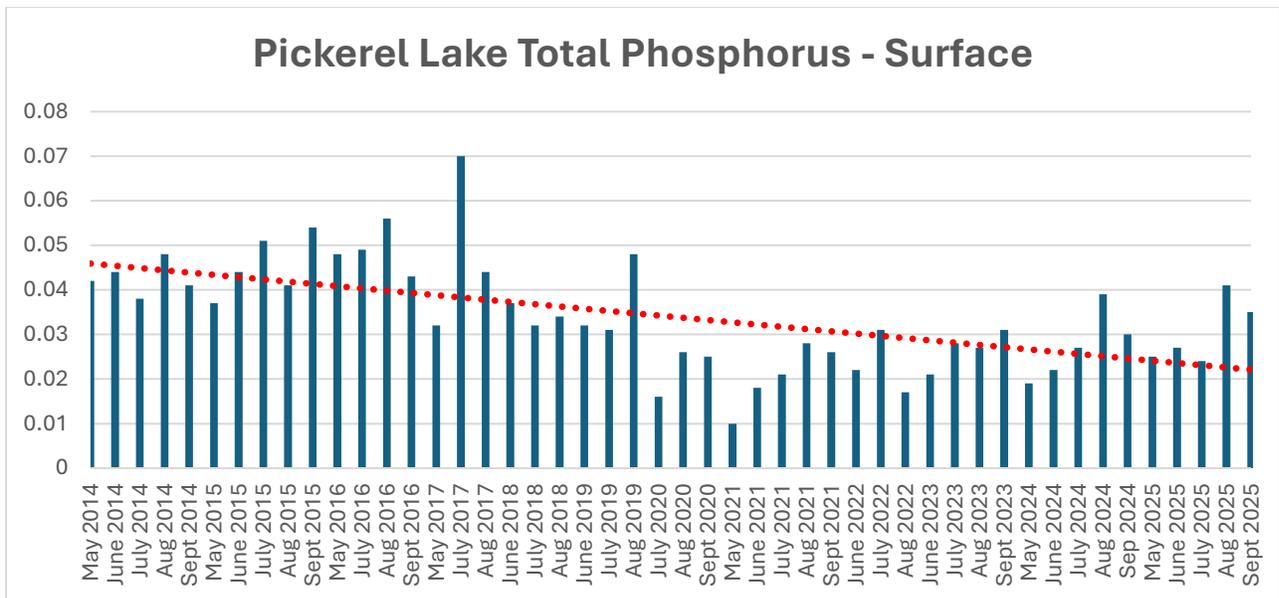
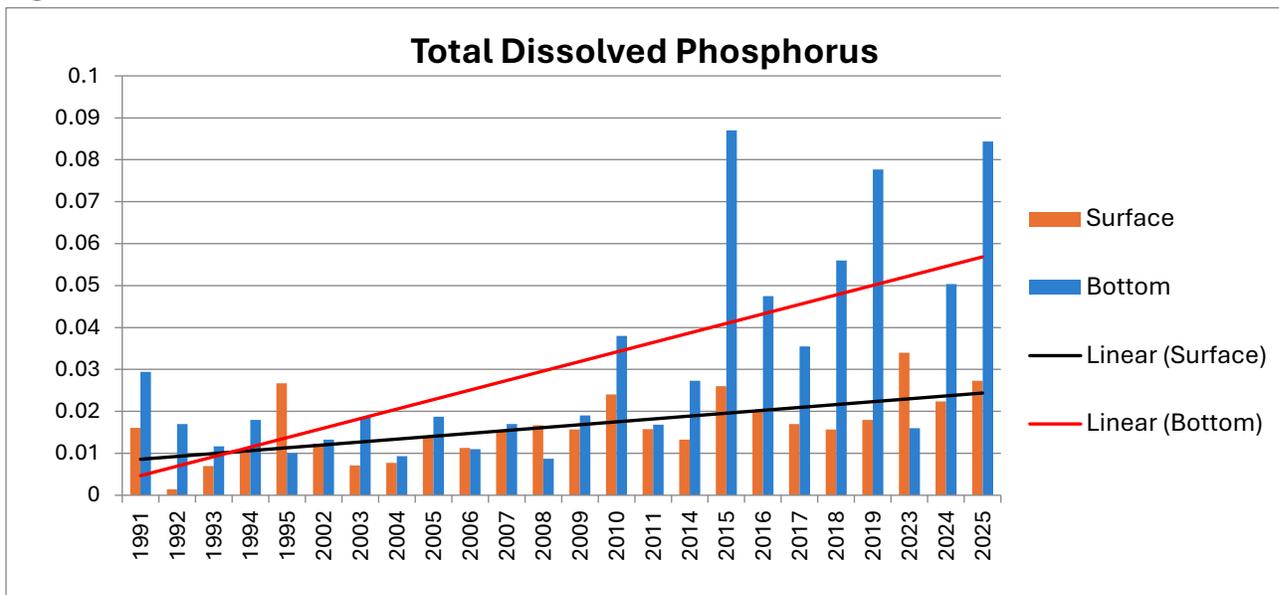


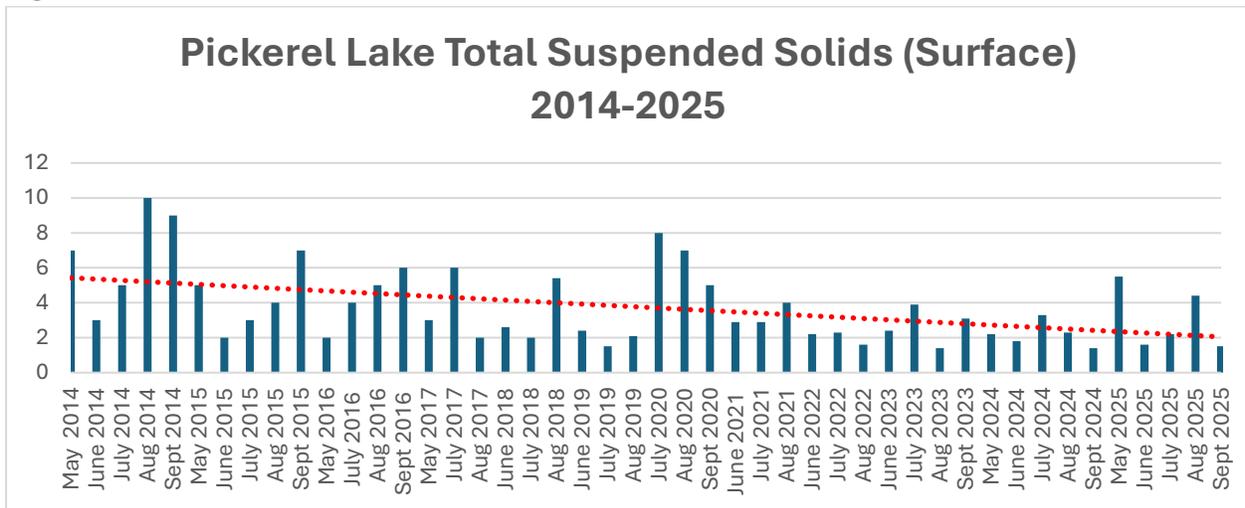
Figure 6



Total Suspended Solids (TSS)

Total Suspended Solids (TSS) include a wide variety of materials, that include algae, silt, decaying plant and animal matter. These solids are suspended in the water column and captured by filtering a sample of lake water. While many suspended solids occur naturally in a lake like plankton, soil and organic material from shoreline and cropland erosion in a lake's watershed can increase suspended solids. In shallow lakes, wave action from wind and boats can stir up bottom sediments making the lake very turbid. In Pickerel Lake, higher TSS measurements typically are due to algae blooms, which as previously discussed, have been greatly reduced since the introduction of curly leaf pondweed and zebra mussels to the lake. Total suspended solids levels for the lake are shown in Figure 7.

Figure 7



Conclusion

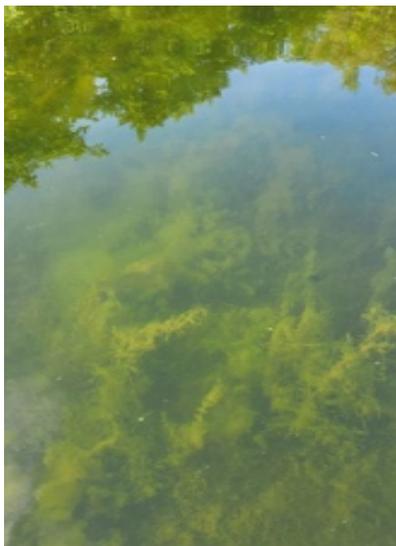


Figure 8

The summer of 2025 witnessed a significant increase in the growth of aquatic plants and filamentous algae across the lake, primarily attributed to enhanced water clarity. (Figure 8.) This clarity, however, is misleadingly credited to zebra mussels, which, while filtering water, do not remove pollutants like phosphorus—the main nutrient driving lake eutrophication (aging). The introduction of these invasive species is actively altering the nutrient cycle, evidenced by increased Total Dissolved Phosphorus measurements.

Compounding this, heavy rainfall in June and July may have contributed additional external nutrients and sediment, maintaining higher-than-average lake levels. The dramatic change in clarity and plant growth, however, is mainly driven by the presence of both zebra mussels and Curlyleaf pondweed.

The improved water clarity, a direct result of the invasive species, has expanded the lake's photic zone. This allows aquatic macrophytes to grow at greater depth due to increased sunlight penetration and higher phosphorus availability—as this nutrient is no longer being fully consumed by the reduced algae population. The unchecked growth of these submerged plants, or macrophytes, now poses a nuisance, as observed on Pickerel Lake. While certain water quality data might appear to show improvement, it presents a deceptive picture if the comprehensive negative effects of these aquatic invasive species on the lake's ecosystem and nutrient cycling are not fully acknowledged and addressed.

To mitigate the current issues and improve recreational use, lake residents may want to consider the mechanical removal of aquatic plants within their shoreline area. This strategy may offer the benefit of reducing overall lake phosphorus levels, as the removal prevents the decomposition of plants that release stored phosphorus back into the water for future reuse. Additionally, lakeshore owners and users can employ general water quality improvement practices such as installing shoreline restorations, practicing safe boating by avoiding wakes in shallow areas to prevent sediment disturbance, and following the "clean, drain, and dry" protocol for all watercraft to prevent the further spread of invasive species.