October

2025

TOWNLINE LAKE

PLANT CONTROL & WATER QUALITY SUMMARY

PREPARED FOR:
TOWNLINE LAKE IMPROVEMENT BOARD
MONTCALM COUNTY, MI

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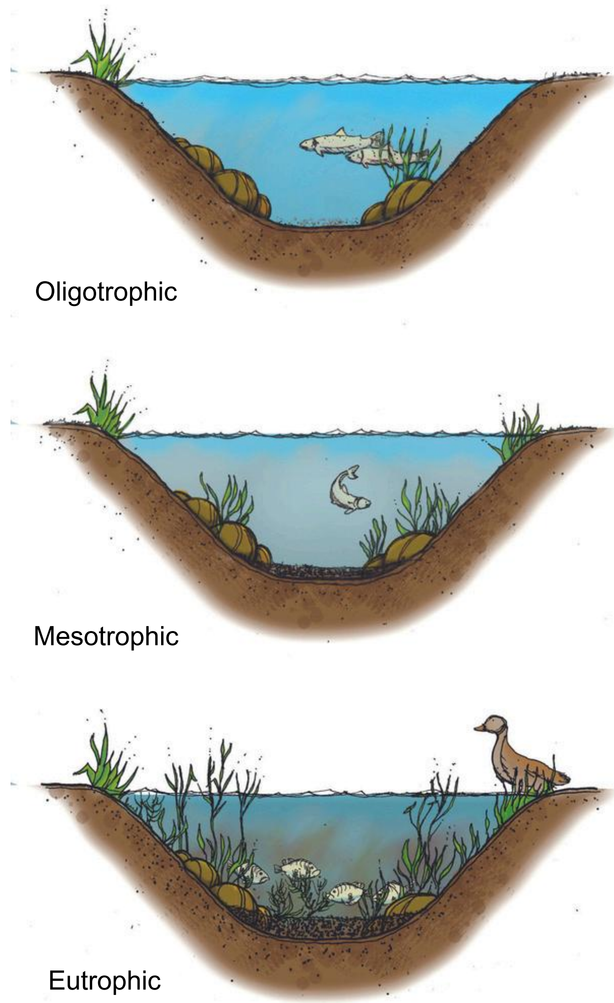
LAKE WATER QUALITY

Lake water quality is determined by a unique combination of processes that occur both within and outside of the lake. In order to make sound management decisions, it is necessary to have an understanding of the current physical, chemical, and biological condition of the lake, and the potential impact of drainage from the surrounding watershed.

Lakes are commonly classified as oligotrophic, mesotrophic, or eutrophic. Oligotrophic lakes are generally deep and clear with little aquatic plant growth. These lakes maintain sufficient dissolved oxygen in the cool, deep bottom waters during late summer to support cold-water fish such as trout and whitefish. By contrast, eutrophic lakes are generally shallow, turbid, and support abundant aquatic plant growth. In deep eutrophic lakes, the cool bottom waters usually contain little or no dissolved oxygen. Therefore, these lakes can only support warmwater fish such as bass and pike. Lakes that fall between these two extremes are called mesotrophic lakes.

Under natural conditions, most lakes will ultimately evolve to a eutrophic state as they gradually fill with sediment and organic matter transported to the lake from the surrounding watershed. As the lake becomes shallower, the process accelerates. When aquatic plants become abundant, the lake slowly begins to fill in as sediment and decaying plant matter accumulate on the lake bottom. Eventually, terrestrial plants become established and the lake is transformed to a marshland. The aging process in lakes is called "eutrophication" and may take anywhere from a few hundred to several thousand years, generally depending on the size of the lake and its watershed. The natural lake aging process can be greatly accelerated if excessive amounts of sediment and nutrients (which stimulate aquatic plant growth) enter the lake from the surrounding watershed. Because these added inputs are usually associated with human activity, this accelerated lake aging process is often referred to as "cultural eutrophication." The problem of cultural eutrophication can be managed by identifying sources of sediment and nutrient loading (i.e., inputs) to the lake and developing strategies to halt or slow the inputs. Key parameters used to evaluate a lake's productivity or trophic state include total phosphorus, chlorophyll-*a*, and Secchi transparency.



Lake classification.

PHOSPHORUS

Phosphorus is the nutrient that most often controls aquatic plant growth and the rate at which a lake ages and becomes more eutrophic. In the presence of oxygen, lake sediments act as a phosphorus trap, making it unavailable for aquatic plant and algae growth. If bottom-water oxygen is depleted, phosphorus will be released from the sediments and may be available to promote aquatic plant and algae growth. In some lakes, the internal release of phosphorus from the bottom sediments is the primary source of phosphorus loading.

By reducing the amount of phosphorus in a lake, it may be possible to limit the amount of aquatic plant and algae growth. In general, lakes with a phosphorus concentration greater than 20 µg/L (micrograms per liter, or parts per billion) are able to support abundant growth and are classified as nutrient-enriched or eutrophic.

CHLOROPHYLL-*a*

Chlorophyll-*a* is a pigment that imparts the green color to plants and algae. A rough estimate of the quantity of algae present in lake water can be made by measuring the amount of chlorophyll-*a* in the water column. A chlorophyll-*a* concentration greater than 6 µg/L* is considered characteristic of a eutrophic condition.

SECCHI TRANSPARENCY

A Secchi disk is often used to estimate water clarity. The measurement is made by fastening a round, black and white, 8-inch disk to a calibrated line. The disk is lowered over the deepest point of the lake until it is no longer visible, and the depth is noted. The disk is then raised until it reappears. The average between these two depths is the Secchi transparency. Generally, it has been found that aquatic plants can grow at a depth of approximately twice the Secchi transparency measurement. In eutrophic lakes, water clarity is often reduced by algae growth in the water column, and Secchi disk readings of 7.5 feet or less are common.

Generally, as phosphorus inputs (both internal and external) to a lake increase, the amount of algae the lake can support will also increase. Thus, the lake will exhibit increased chlorophyll-*a* levels and decreased transparency. A summary of lake classification criteria is shown in Table 1.

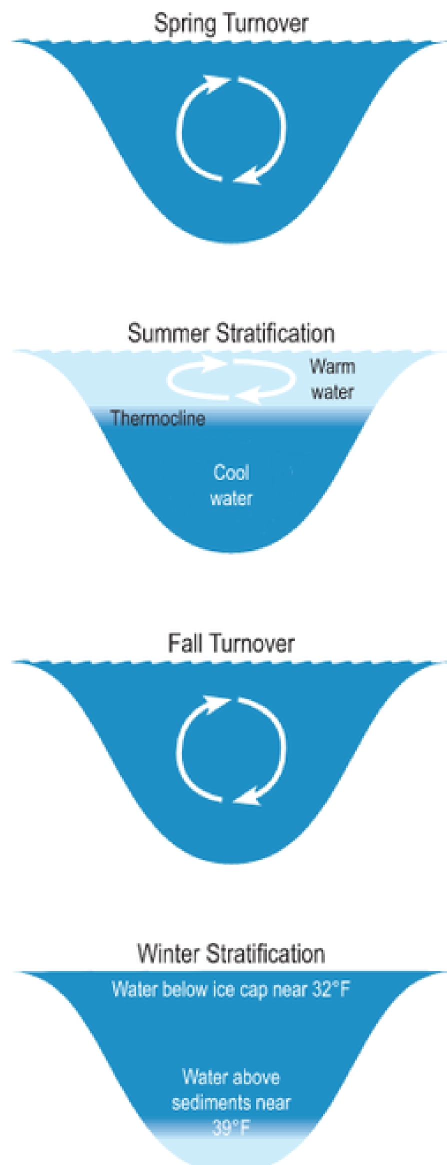
TABLE 1 - LAKE CLASSIFICATION CRITERIA

Lake Classification	Total Phosphorus (µg/L)*	Chlorophyll-*a* (µg/L)*	Secchi Transparency (feet)
Oligotrophic	Less than 10	Less than 2.2	Greater than 15.0
Mesotrophic	10 to 20	2.2 to 6.0	7.5 to 15.0
Eutrophic	Greater than 20	Greater than 6.0	Less than 7.5

* µg/L = micrograms per liter = parts per billion

TEMPERATURE

Temperature is important in determining the type of organisms which may live in a lake. For example, trout prefer temperatures below 68°F. Temperature also determines how water mixes in a lake. As the ice cover breaks up on a lake in the spring, the water temperature becomes uniform from the surface to the bottom. This period is referred to as "spring turnover" because water mixes throughout the entire water column. As the surface waters warm, they are underlain by a colder, more dense strata of water. This process is called thermal stratification. Once thermal stratification occurs, there is little mixing of the warm surface waters with the cooler bottom waters. The transition layer that separates these layers is referred to as the "thermocline." The thermocline is characterized as the zone where temperature drops rapidly with depth. As fall approaches, the warm surface waters begin to cool and become more dense. Eventually, the surface temperature drops to a point that allows the lake to undergo complete mixing. This period is referred to as "fall turnover." As the season progresses and ice begins to form on the lake, the lake may stratify again. However, during winter stratification, the surface waters (at or near 32°F) are underlain by slightly warmer water (about 39°F). This is sometimes referred to as "inverse stratification" and occurs because water is most dense at a temperature of about 39°F. As the lake ice melts in the spring, these stratification cycles are repeated.



Seasonal thermal stratification cycles.

DISSOLVED OXYGEN

An important factor influencing lake water quality is the quantity of dissolved oxygen in the water column. The major inputs of dissolved oxygen to lakes are the atmosphere and photosynthetic activity by aquatic plants. An oxygen level of about 5 mg/L (milligrams per liter, or parts per million) is required to support warmwater fish. In lakes deep enough to exhibit thermal stratification, oxygen levels are often reduced or depleted below the thermocline once the lake has stratified. This is because the oxygen has been consumed, in large part, by bacteria that use oxygen as they decompose organic matter (plant and animal remains) at the bottom of the lake. Bottom-water oxygen depletion is a common occurrence in eutrophic and some mesotrophic lakes. Thus, eutrophic and most mesotrophic lakes cannot support coldwater fish because the cool, deep water (that the fish require to live) does not contain sufficient oxygen.

SAMPLING RESULTS AND DISCUSSION

Sampling results are provided in Tables 2 and 3. In April of 2025, sampling was conducted during spring turnover when water temperatures were cool and dissolved oxygen concentrations were high. During the August sampling period, Townline Lake was thermally stratified; the lake was warm and well-oxygenated at the surface, and was cool with low oxygen beneath the thermocline which set up at around 24 feet. In 2025, total phosphorus concentrations were generally low, with the exception of the samples taken in the oxygen-depleted bottom water in late summer which were high. The elevated phosphorus in the deep basin is due to internal release of phosphorus from the lake sediments.

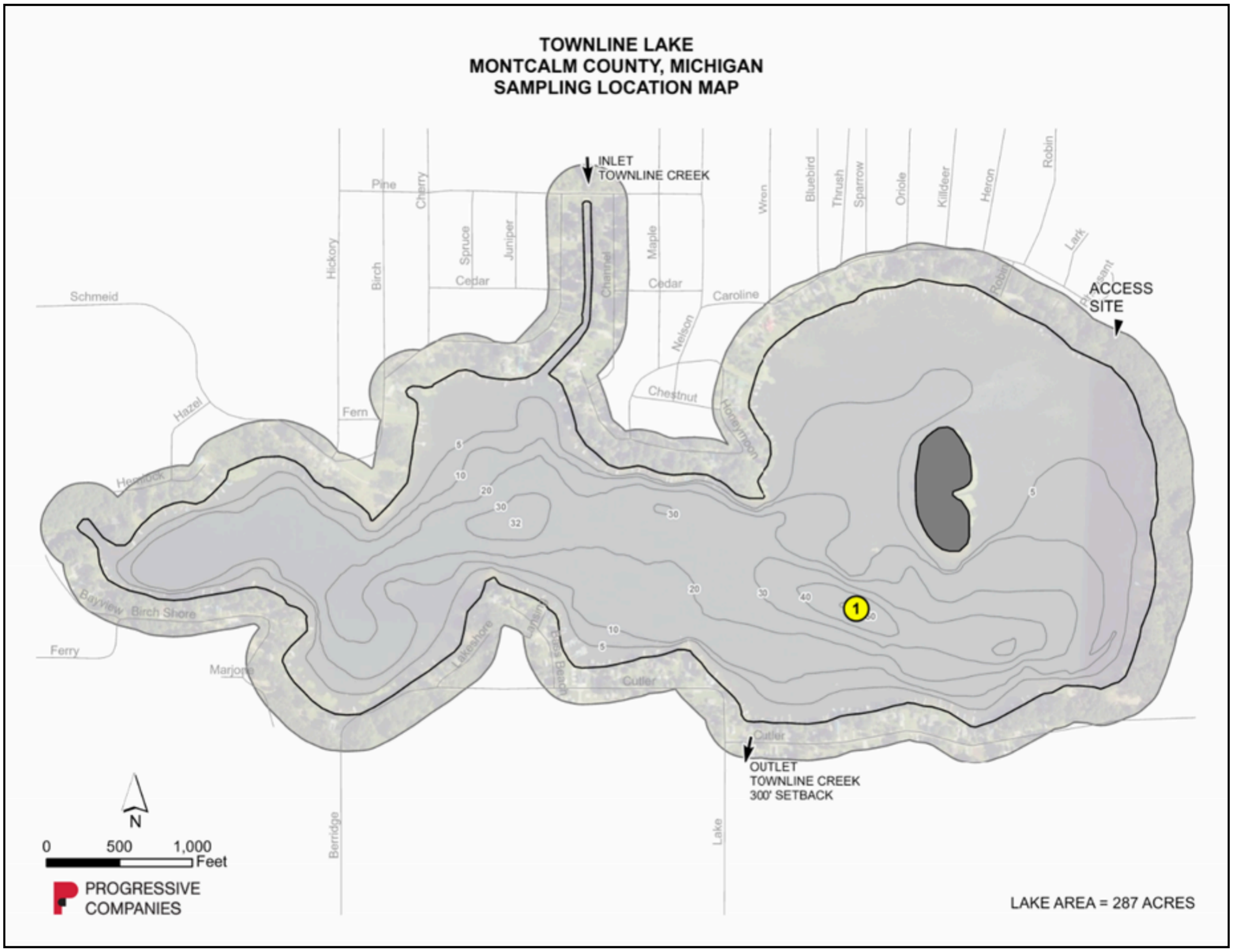


TABLE 2 - TOWNLINE LAKE 2025 DEEP BASIN WATER QUALITY DATA

Date	Station	Sample Depth (feet)	Temperature (F)	Dissolved Oxygen (mg/L)*	Total Phosphorus (µg/L)*
1-Apr-25	1	1	42.5	10.8	<10
1-Apr-25	1	10	42.5	10.8	<10
1-Apr-25	1	20	42.3	10.8	<10
1-Apr-25	1	30	42.3	10.8	<10
1-Apr-25	1	40	42.3	10.8	<10
1-Apr-25	1	45	42.3	10.7	<10
26-Aug-25	1	1	73.3	7.4	<10
26-Aug-25	1	10	73.1	7.4	<10
26-Aug-25	1	20	72.8	7.5	11
26-Aug-25	1	30	54.4	0.2	93
26-Aug-25	1	40	53.4	0.2	272
26-Aug-25	1	46	53.5	0.3	355

TABLE 3 - TOWNLINE LAKE 2025 SURFACE WATER QUALITY DATA

Date	Station	Secchi Transparency (feet)	Chlorophyll-*a* (µg/L)*
1-Apr-25	1	13.0	1
26-Aug-25	1	8.5	2

* mg/L = milligrams per liter = parts per million
* µg/L = micrograms per liter = parts per billion

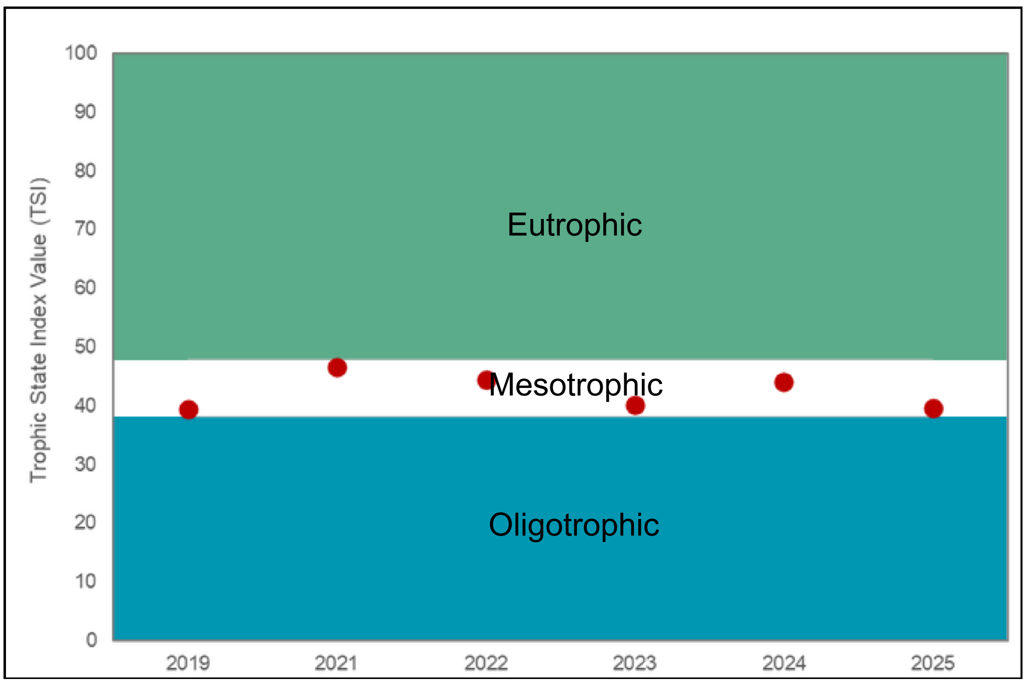
TOWNLINE LAKE TROPHIC STATE

Carlson's Trophic State Index (TSI) was developed from mathematical relationships that allowed phosphorus, chlorophyll-*a*, and Secchi transparency readings to be converted to a numerical scale from 0 to 100, with increasing numbers indicating more productive lakes. Table 4 shows how the TSI can be used to rate the trophic state of Michigan lakes.

TABLE 4 - TSI INDEX FOR MICHIGAN

Trophic State	TSI Value
Oligotrophic Mesotrophic Eutrophic	Less than 38 38 to 48 Greater than 48

The average TSI values for Townline Lake based on spring phosphorus and summer chlorophyll-*a* and Secchi transparency data collected between 2019 and 2025 are shown in the graph below.

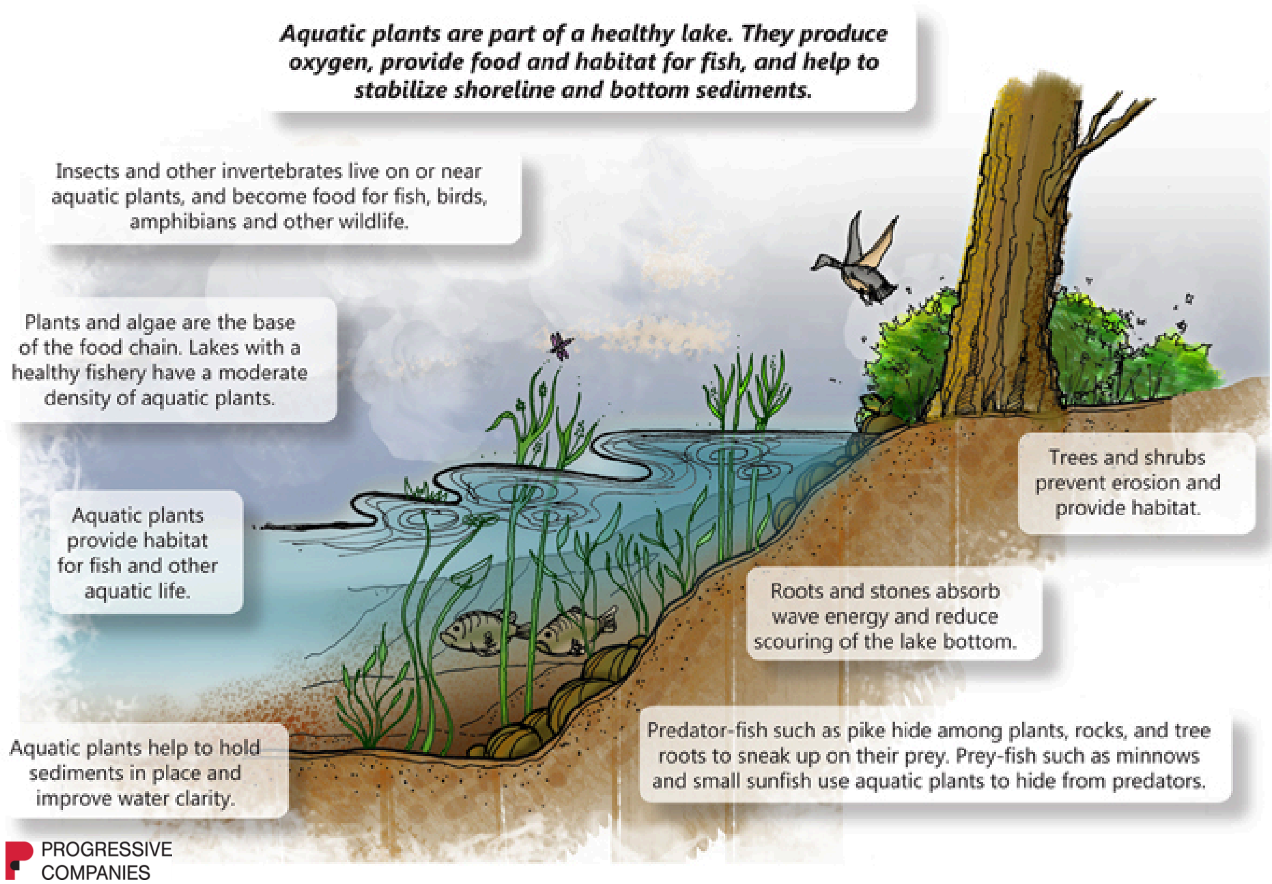


Based on water quality data collected from 2019 to 2025, Townline Lake is mesotrophic. Average phosphorus, chlorophyll-*a*, and Secchi readings in Townline Lake fall within the moderate range (Table 1).

Spring sampling was not conducted in 2020 due to pandemic restrictions, therefore, TSI could not be calculated.

PLANT CONTROL PROGRAM SUMMARY

A nuisance aquatic plant control program has been ongoing on Townline Lake for many years. The primary objective of the program is to prevent the spread of invasive aquatic plants while preserving beneficial native plant species. This report contains an overview of plant control activities conducted on Townline Lake in 2025.

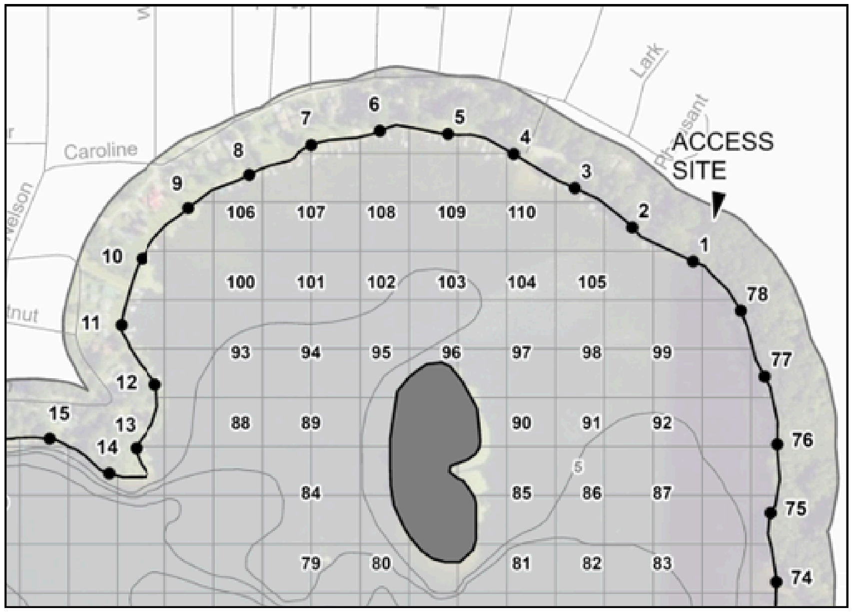


Aquatic plants are an important component of lakes. They produce oxygen during photosynthesis, provide food, habitat and cover for fish, and help stabilize shoreline and bottom sediments. There are four main aquatic plant groups: submersed, floating-leaved, free-floating, and emergent. Each plant group provides important ecological functions. Maintaining a diversity of native aquatic plants is important to sustaining a healthy fishery and a healthy lake. Invasive aquatic plant species have negative impacts on the lake's ecosystem. It is important to maintain an active plant control program to reduce the establishment and spread of invasive species within Townline Lake. Plant control efforts in 2025 consisted of five aquatic plant surveys, three herbicide treatments, and one mechanical harvesting event.

PLANT CONTROL

Plant control activities are coordinated under the direction of an environmental consultant, Progressive Companies. Scientists from Progressive conduct GPS-guided surveys of the lake to identify problem areas, and georeferenced plant control maps are provided to the plant control contractors. GPS reference points are established along the shoreline and across shallow portions of the lake. These waypoints are used to accurately identify the location of invasive and nuisance plant growth areas.

Eurasian milfoil
Myriophyllum spicatum



Curly-leaf pondweed
Potamogeton crispus

Primary plants targeted for control in Townline Lake include hybrid milfoil, curly-leaf pondweed, and starry stonewort. These plants are non-native (exotic) species that tend to be highly invasive and have the potential to spread quickly if left unchecked. Plant control activities conducted on the lake in 2025 are summarized in Table 5.

Starry stonewort
Nitellopsis obtusa

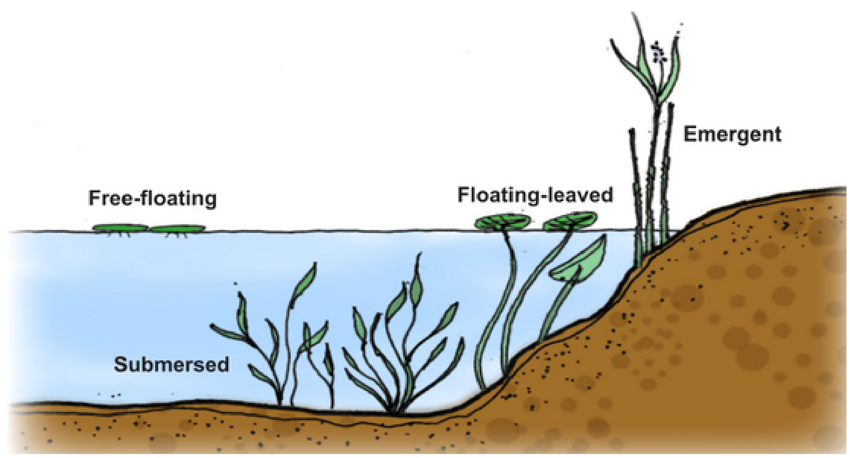


TABLE 5 - TOWNLINE LAKE 2025 PLANT CONTROL ACTIVITIES

Date	Plants Targeted	Acreage
May 21	hybrid milfoil, curly-leaf, nuisance natives	61.25
June 25	hybrid milfoil, starry stonewort, nuisance natives	22.25
July 30	hyrbid milfoil, starry stonewort	34.00
August 4	harvesting - nuisance natives	16.00
Total		**132.75**

In 2025, 117.5 acres of Townline Lake were treated with aquatic herbicides throughout the season. Primary plants targeted for control were hybrid milfoil, curly-leaf pondweed, starry stonewort, and nuisance native plants. A total of 16 acres of mechanical harvesting was performed on the lake. Harvesting addressed nuisance native growth areas along the southern shoreline and in shallow off-shore areas near the island.

PLANT INVENTORY SURVEY

In addition to the surveys of the lake to identify invasive plant locations, a detailed vegetation survey of Townline Lake was conducted on August 26th to evaluate the type and abundance of all plants in the lake. The table below lists each plant species observed during the survey and the relative abundance of each. At the time of the survey, 13 submersed species, one free-floating species, two floating-leaved species, and seven emergent species were found in the lake. Townline Lake maintains a good diversity of beneficial, native plant species.

TABLE 6 - TOWNLINE LAKE 2025 PLANT INVENTORY DATA

Common Name	Scientific Name	Group	Percentage of sites where present
Wild celery	*Vallisneria americana*	Submersed	82
Chara	*Chara* sp.	Submersed	54
Elodea	*Elodea canadensis*	Submersed	51
Large-leaf pondweed	*Potamogeton amplifolius*	Submersed	43
Coontail	*Ceratophyllum demersum*	Submersed	13
Hybrid milfoil	*Myriophyllum* sp.	Submersed	13
Illinois pondweed	*Potamogeton illinoensis*	Submersed	9
Thin-leaf pondweed	*Potamogeton* sp.	Submersed	8
Water stargrass	*Heteranthera dubia*	Submersed	5
Slender naiad	*Najas flexilis*	Submersed	4
Sago pondweed	*Stuckenia pectinata*	Submersed	2
Starry stonewort	*Nitellopsis obtusa*	Submersed	2
Robbins pondweed	*Potamogeton robbinsii*	Submersed	1
Duckweed	*Lemna minor*	Free-floating	1
White waterlily	*Nymphaea odorata*	Floating-leaved	37
Yellow waterlily	*Nuphar* sp.	Floating-leaved	16
Swamp loosestrife	*Decodon verticillatus*	Emergent	15
Cattail	*Typha* sp.	Emergent	10
Bulrush	*Schoenoplectus* sp.	Emergent	6
Purple loosestrife	*Lythrum salicaria*	Emergent	6
Arrowhead	*Sagittaria latifolia*	Emergent	4
Lake sedge	*Carex lacustris*	Emergent	4
Pickerelweed	*Pontederia cordata*	Emergent	2

Exotic invasive species