December

2025

RYERSON LAKE

WATER QUALITY & PLANT CONTROL SUMMARY

PREPARED FOR:
RYERSON LAKE IMPROVEMENT BOARD
NEWAYGO COUNTY, MI

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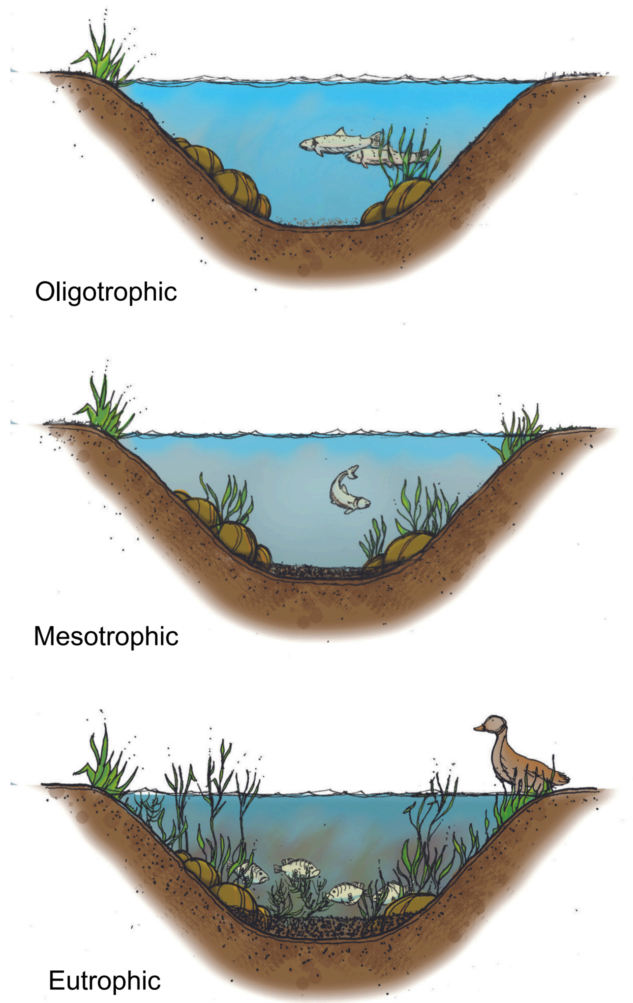
LAKE WATER QUALITY

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.



Lake classification.

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.

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 (micrograms per liter or parts per billion) 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.

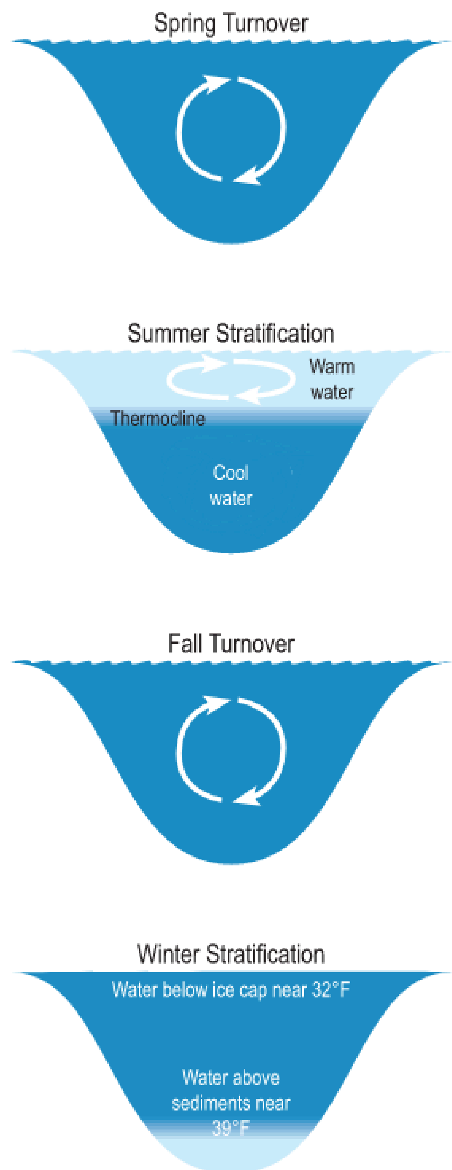
TABLE 1 - LAKE CLASSIFICATION CRITERIA

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 METHODS

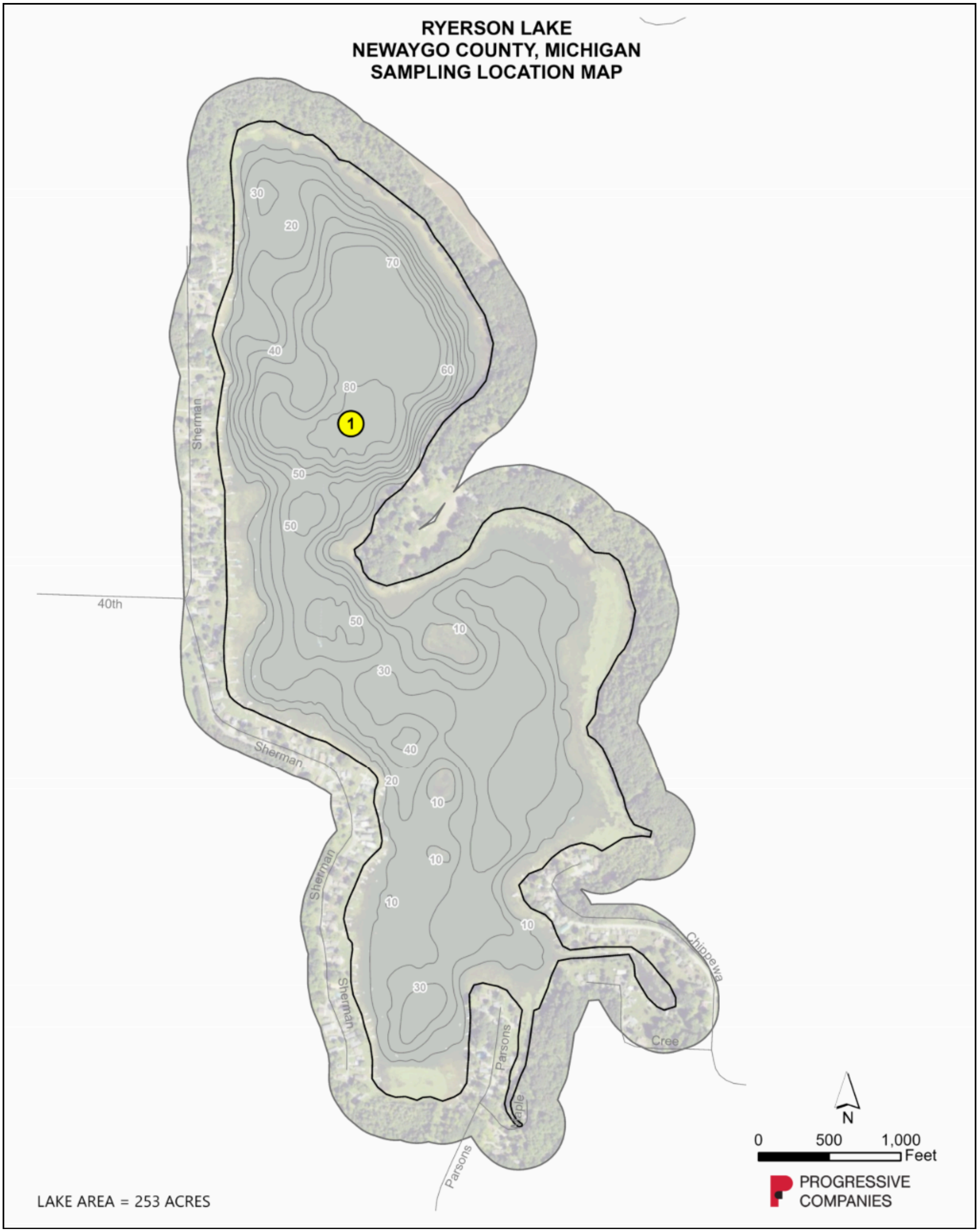
Water quality sampling was conducted in the spring and summer of 2025 at the deep basin within Ryerson Lake. Temperature and dissolved oxygen were measured using a YSI Prosolo ODO/T probe. Samples were collected at 10-foot intervals from the surface to just above the lake bottom with a Van Dorn bottle to be analyzed for total phosphorus. Total phosphorus samples were placed on ice, transported to Summit Laboratory*, and analyzed using Standard Methods procedures 4500-PE. In addition to the depth-interval samples at the deep basin, Secchi transparency was measured and composite chlorophyll-*a* samples were collected from the surface to a depth equal to twice the Secchi transparency. Chlorophyll-*a* samples were analyzed by Prein and Newhof Laboratories* using Standard Methods procedure 10200 H.

SAMPLING RESULTS

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, Ryerson Lake was thermally stratified; the lake was warm and well-oxygenated at the surface, and was cool with low oxygen near the bottom. In 2025, total phosphorus concentrations were generally moderate, with the exception of the deepest samples in late summer which were high. The elevated bottom-water phosphorus is likely due to internal release of phosphorus from the lake sediments.

Water clarity was in the eutrophic range during both sampling periods. Chlorophyll-*a* levels were high in spring and low in summer, indicating that algae growth in April was likely a factor contributing to the reduced water clarity.

* Summit Laboratory, 900 Godfrey Ave SW, Grand Rapids, MI 49503
* Prein and Newhof Laboratories, 3260 Evergreen Dr NE, Grand Rapids, MI 49525



RYERSON LAKE
NEWAYGO COUNTY, MICHIGAN
SAMPLING LOCATION MAP
30
20
70
40
60
80
1
50
50
40th
50
10
30
40
20
10
10
10
10
30
Sherman
Sherman
Sherman
Sherman
Parsons
Parsons
Maple
Chippewa
Cree
N
0 500 1,000
Feet
PROGRESSIVE COMPANIES
LAKE AREA = 253 ACRES

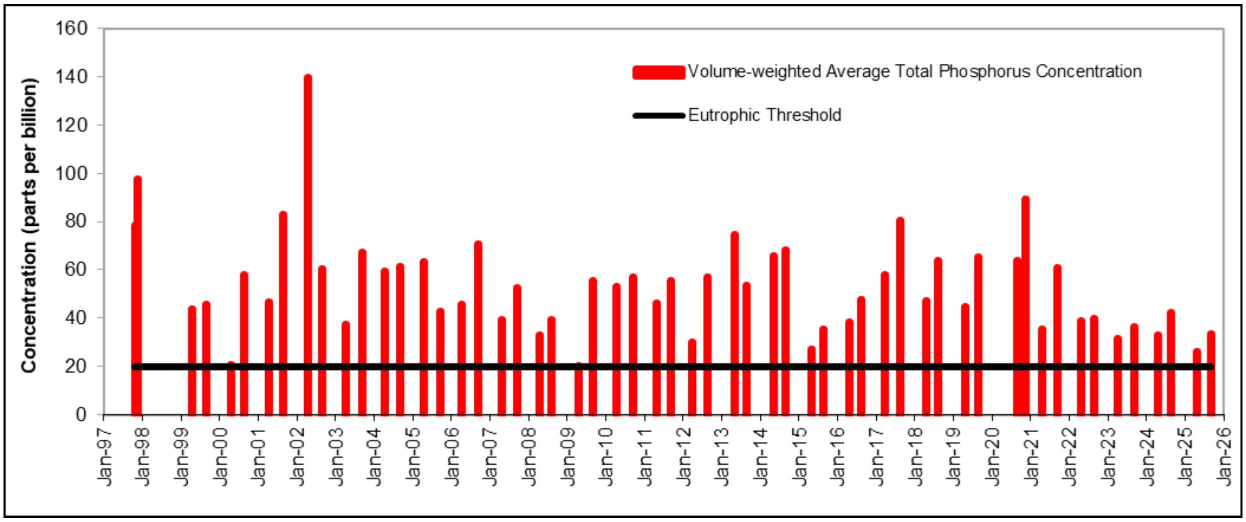
TABLE 2 - RYERSON LAKE 2025 DEEP BASIN WATER QUALITY DATA

Date	Station	Sample Depth (feet)	Temperature (F)	Dissolved Oxygen (mg/L)*	Total Phosphorus (µg/L)*
15-Apr-25	1	1	45	13.6	25
15-Apr-25	1	10	45	13.6	28
15-Apr-25	1	20	45	13.4	35
15-Apr-25	1	30	44	13.0	30
15-Apr-25	1	40	43	12.0	18
15-Apr-25	1	50	42	11.8	13
15-Apr-25	1	60	42	11.6	11
15-Apr-25	1	70	42	11.3	21
15-Apr-25	1	81	42	10.9	19
25-Aug-25	1	1	75	7.5	<10
25-Aug-25	1	10	75	7.5	<10
25-Aug-25	1	20	60	2.5	<10
25-Aug-25	1	30	48	0.1	15
25-Aug-25	1	40	46	0.0	78
25-Aug-25	1	50	44	0.0	62
25-Aug-25	1	60	43	0.0	91
25-Aug-25	1	70	43	0.0	249
25-Aug-25	1	80	42	0.0	455

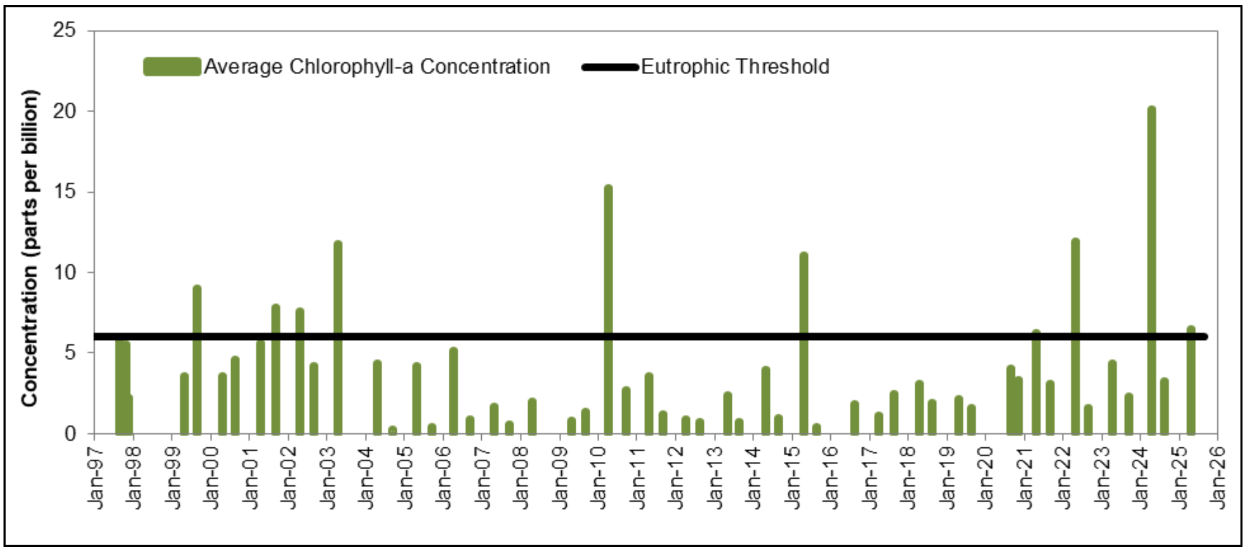
TABLE 3 - RYERSON LAKE 2025 SURFACE WATER QUALITY DATA

Date	Station	Secchi Transparency (feet)	Chlorophyll-*a* (µg/L)*
15-Apr-25	1	4.5	7
25-Aug-25	1	7.0	ND*

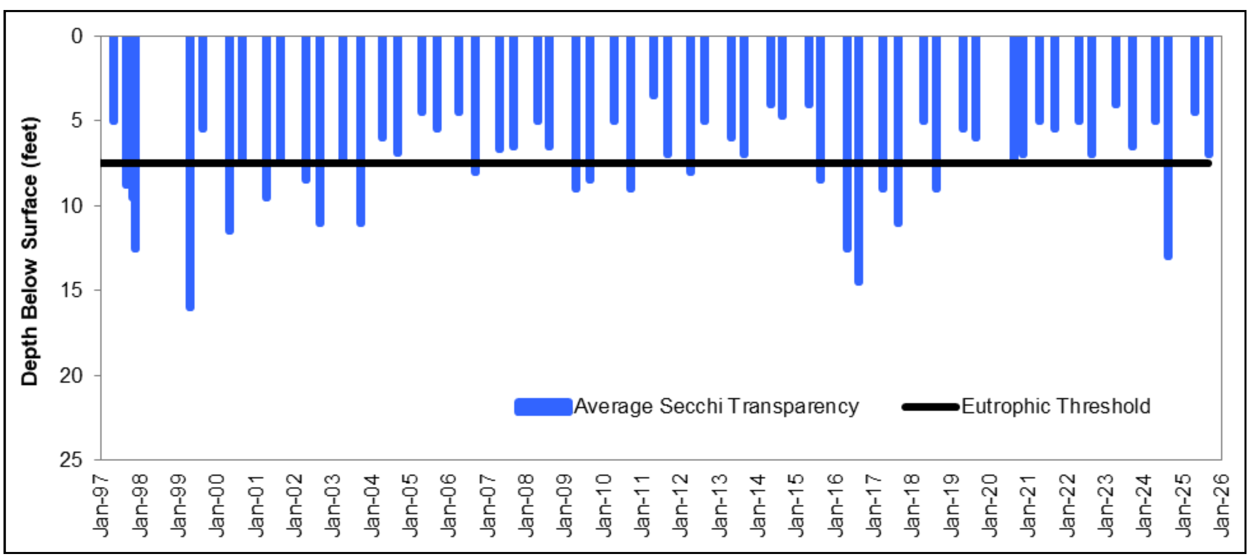
* mg/L = milligrams per liter = parts per million
* µg/L = micrograms per liter = parts per billion
* ND = None detected



Volume-weighted average total phsophorus concentrations, 1997 - 2025.



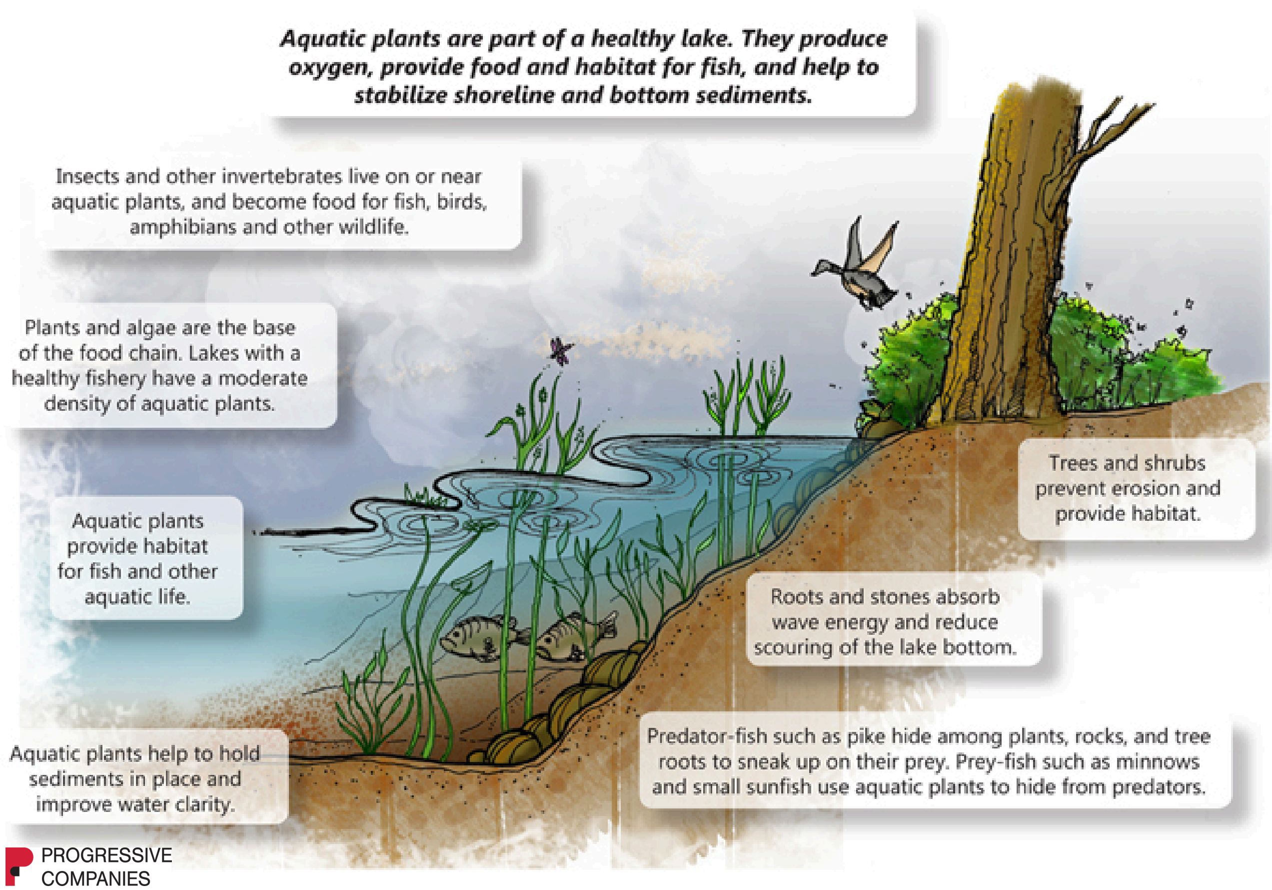
Average Chlorophyll-*a* concentrations, 1997 - 2025.



Average Secchi transparency measurements, 1997 - 2025.

PLANT CONTROL PROGRAM SUMMARY

A nuisance aquatic plant control program has been ongoing on Ryerson 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 Ryerson Lake in 2025.

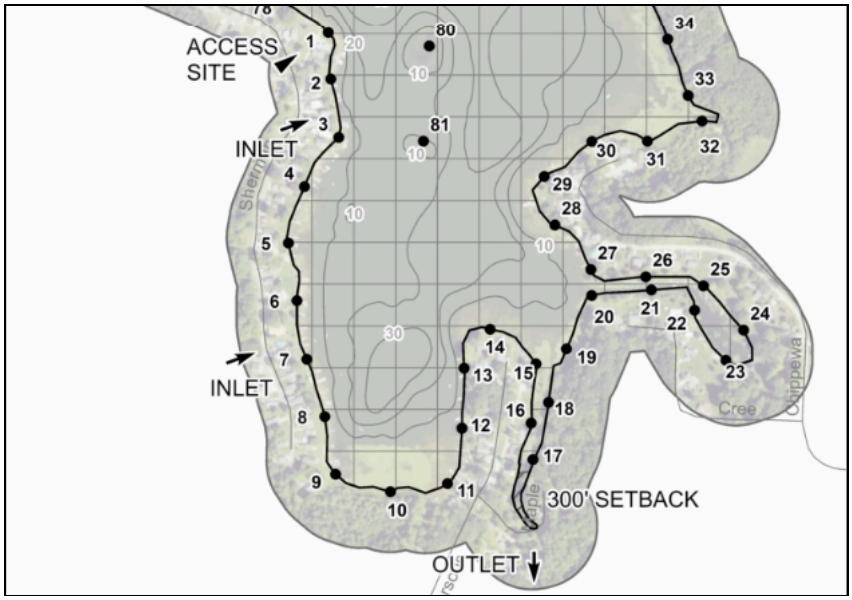


Aquatic plants are an important component of lakes. They produce oxygen during photosynthesis, provide food, habitat and cover for fish, and help stabilize shoreline and bottom sediments. There are four main aquatic plant groups: submersed, floating-leaved, free-floating, and emergent. Each plant group 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 Ryerson Lake. Plant control efforts in 2025 consisted of four aquatic plant surveys, two herbicide applications, and one phosphorus inactivation treatment of Chippewa Bay.

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 contractor. GPS reference points are established along the shoreline and shallow offshore areas within 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 Ryerson Lake include Eurasian milfoil and curly-leaf pondweed. 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 4.

In Michigan, an Aquatic Nuisance Control (ANC) permit must be acquired from the Department of Environment, Great Lakes, and Energy (EGLE) before herbicides are applied to inland lakes. The permit lists the herbicides that are approved for use, maximum dose rates, use restrictions, and indicates specific areas of the lake where herbicides may be applied. Permit requirements are designed to protect public health and the environment. The contracted herbicide applicator on Ryerson Lake, Savin Lake Services, holds the ANC permit for the lake.

TABLE 4 - RYERSON LAKE 2025 PLANT CONTROL ACTIVITIES

Date	Plants Targeted	Acreage
April 30	algae	2.0
May 29	E. milfoil, curly-leaf pondweed	29.0
July 30	E. milfoil, wild celery, algae	10.5
Total		**41.5**

In 2025, 41.5 acres of Ryerson Lake were treated with aquatic herbicides throughout the season. Eurasian milfoil and curly-leaf pondweed were treated using a combination of systemic herbicides and contact herbicides in May. This initial treatment was successful in controlling both species for most of the summer. Eurasian milfoil regrowth was minimal throughout the lake until fall. Algae and wild celery (*Valisneria americana*) were treated with copper products. Wild celery is difficult to control because of its robust root system, allowing regrowth even after leaves are damaged by herbicides.

In order to address chronic algae growth in Chippewa Bay, a lanthanum-modified bentonite clay (Phoslock) treatment was applied in late April, consistent with applications conducted over the past two years. Lanthanum, a naturally occurring element, chemically binds with phosphorus, making it unavailable to fuel algae growth. Visual observations suggest that the Phoslock treatments reduced the average amount of algae growth throughout the summer in Chippewa Bay. Phoslock treatments paired with homeowners applying best management practices to their shorelands will continue to improve the water quality of Chippewa Bay.

PLANT INVENTORY SURVEY

In addition to the surveys of the lake to identify invasive plant locations, a detailed vegetation survey of Ryerson Lake was conducted on August 25 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, 10 submersed species, one free-floating species, two floating-leaved species, and seven emergent species were found in the lake. Wild celery and *Chara* were the dominant plant species observed in Ryerson Lake, consistent with 2024 survey results.

TABLE 5 - RYERSON LAKE 2025 PLANT INVENTORY DATA

Common Name	Scientific Name	Group	Percentage of sites where present
Wild celery	*Vallisneria americana*	Submersed	96
Chara	*Chara* sp.	Submersed	73
Water stargrass	*Heteranthera dubia*	Submersed	30
Sago pondweed	*Stuckenia pectinata*	Submersed	25
Illinois pondweed	*Potamogeton illinoensis*	Submersed	18
Eurasian milfoil	*Myriophyllum spicatum*	Submersed	16
Large-leaf pondweed	*Potamogeton amplifolius*	Submersed	10
Coontail	*Ceratophyllum demersum*	Submersed	8
Curly-leaf pondweed	*Potamogeton crispus*	Submersed	5
Thin-leaf pondweed	*Potamogeton* sp.	Submersed	4
Duckweed	*Lemna minor*	Free-floating	1
White waterlily	*Nymphaea odorata*	Floating-leaved	71
Yellow waterlily	*Nuphar* sp.	Floating-leaved	5
Cattail	*Typha* sp.	Emergent	29
Bulrush	*Schoenoplectus* sp.	Emergent	29
Purple loosestrife	*Lythrum salicaria*	Emergent	29
Swamp loosestrife	*Decodon verticillatus*	Emergent	22
Lake sedge	*Carex lacustris*	Emergent	20
Pickerelweed	*Pontederia cordata*	Emergent	4
Phragmites	*Phragmites australis*	Emergent	1

Exotic invasive species