2024

RYERSON LAKE

WATER QUALITY & PLANT CONTROL SUMMARY

PREPARED FOR:
RYERSON LAKE IMPROVEMENT BOARD
NEWAYGO COUNTY, MI

PROGRESSIVE
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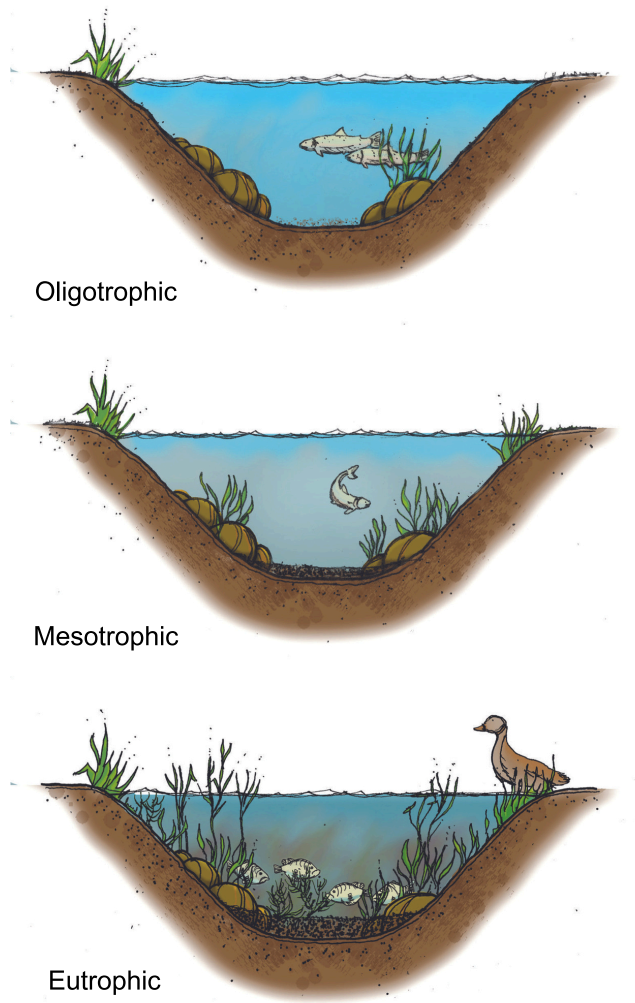
LAKE WATER QUALITY

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* 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.

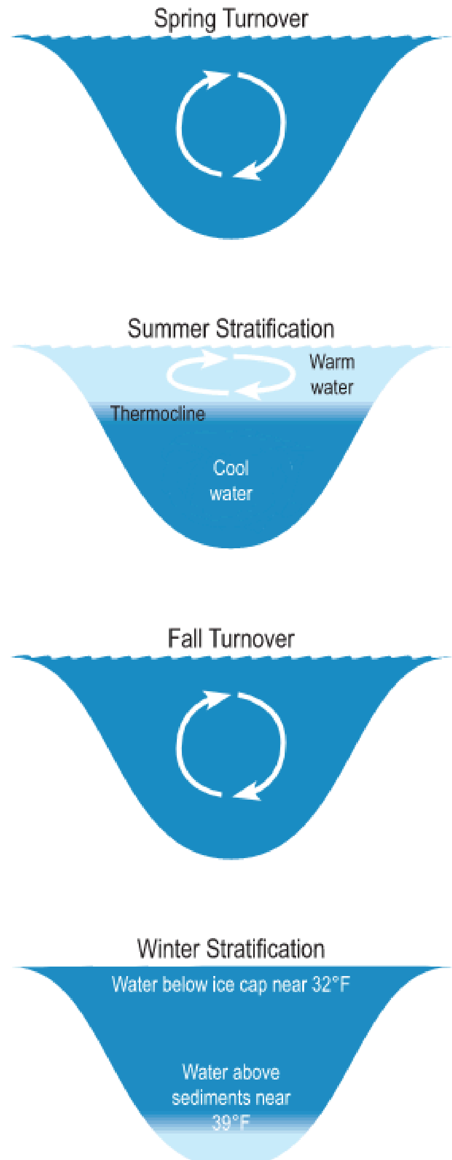
TABLE 1 - LAKE CLASSIFICATION CRITERIA

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.



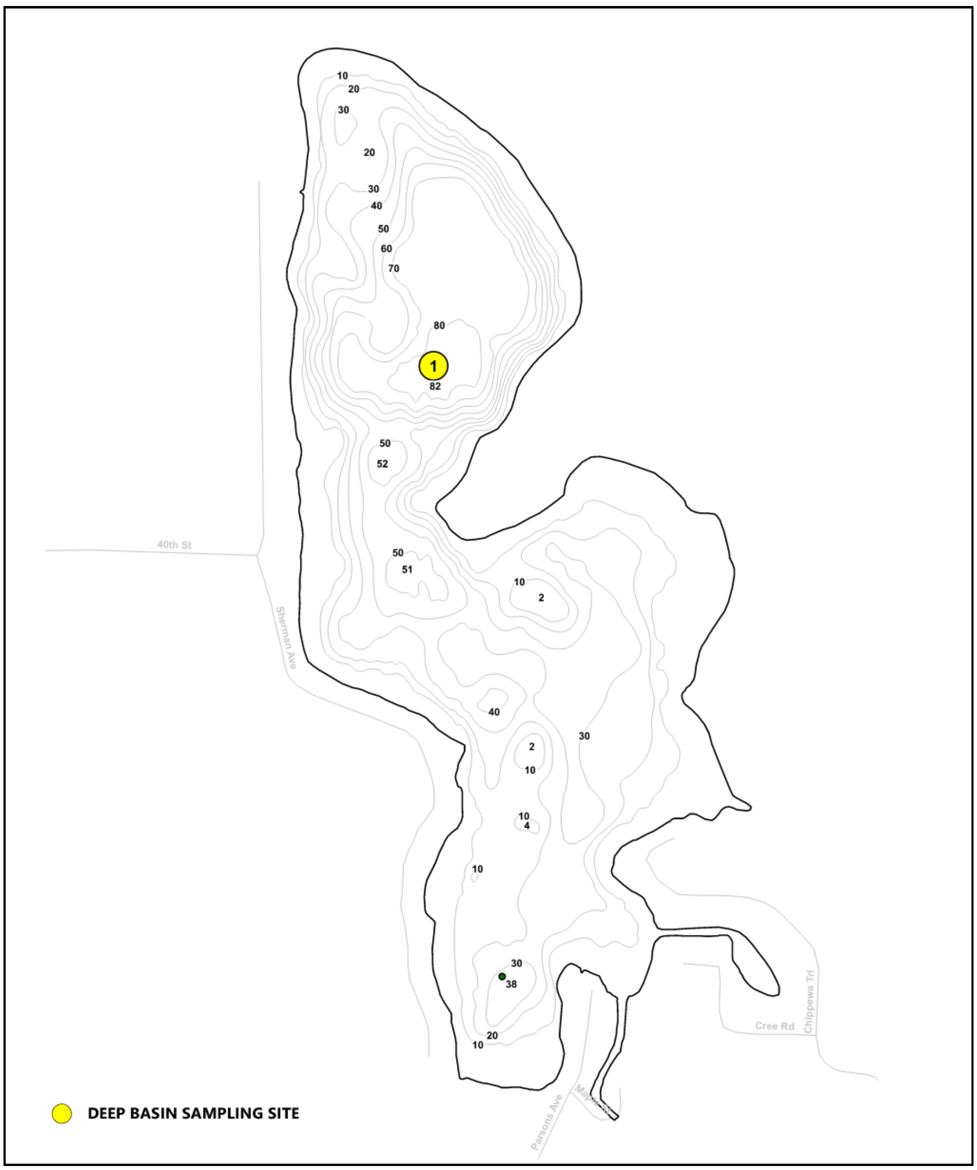
Seasonal thermal stratification cycles.

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 2024, sampling was conducted during spring turnover when water temperatures were cool and dissolved oxygen concentrations were high throughout the water column. 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 2024, total phosphorus concentrations were elevated in the spring and even more so in the summer below the thermocline. The elevated phosphorus is due in-part to internal release of phosphorus from the lake sediments under anoxic conditions in the deeper portions of the lake. Chlorophyll-*a* levels were very high and Secchi transparency was low during the April sampling event. This indicates that there was abundant algae growth at the time of sampling. During the August sampling, chlorophyll-*a* was moderate and Secchi transparency was good.



Ryerson Lake Sampling Location Map.

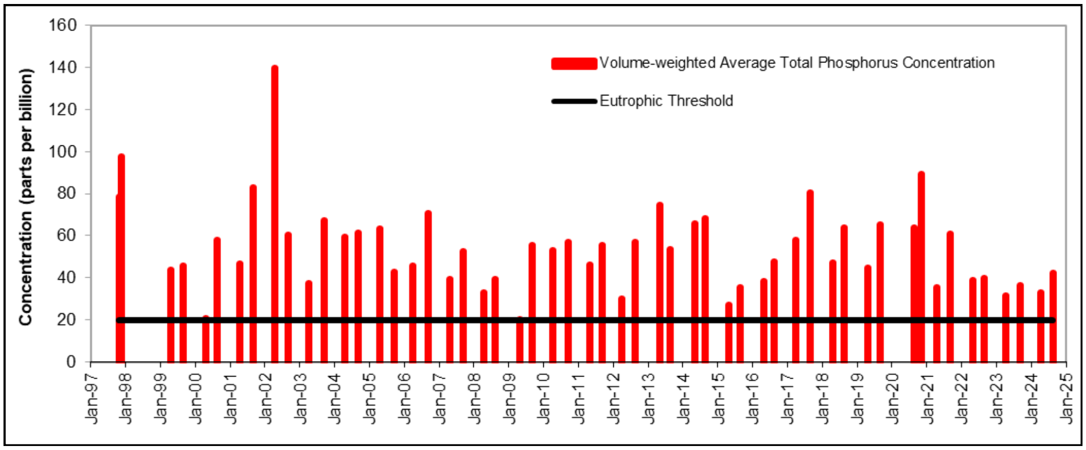
TABLE 2 - RYERSON LAKE 2024 DEEP BASIN WATER QUALITY DATA

Date	Station	Sample Depth (feet)	Temperature (°F)	Dissolved Oxygen (mg/L)*	Total Phosphorus (μg/L)*
9-Apr-24	1	1	46	14.2	24
9-Apr-24	1	10	45	13.7	40
9-Apr-24	1	20	44	13.5	40
9-Apr-24	1	30	44	13.2	26
9-Apr-24	1	40	42	11.9	29
9-Apr-24	1	50	42	11.8	31
9-Apr-24	1	60	42	11.5	32
9-Apr-24	1	70	42	11.1	34
9-Apr-24	1	81	42	10.5	43
13-Aug-24	1	1	77	7.4	<10
13-Aug-24	1	10	75	7.3	10
13-Aug-24	1	20	64	2.4	10
13-Aug-24	1	30	49	0.2	20
13-Aug-24	1	40	46	0.1	84
13-Aug-24	1	50	45	0.0	122
13-Aug-24	1	60	43	0.0	173
13-Aug-24	1	70	43	0.0	267
13-Aug-24	1	80	42	0.0	439

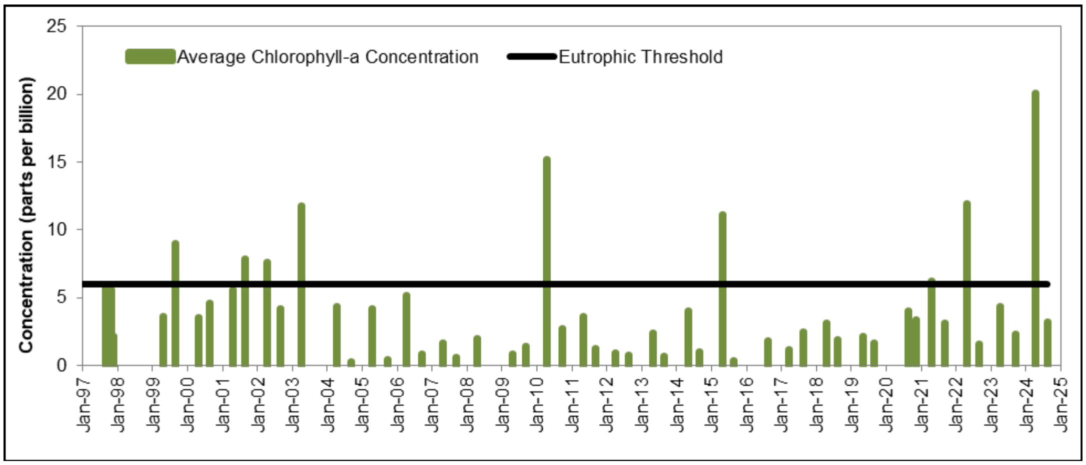
TABLE 3 - RYERSON LAKE 2024 SURFACE WATER QUALITY DATA

Date	Station	Secchi Transparency (feet)	Chlorophyll-*a* (μg/L)*
9-Apr-24	1	5.0	20
13-Aug-24	1	13.0	3

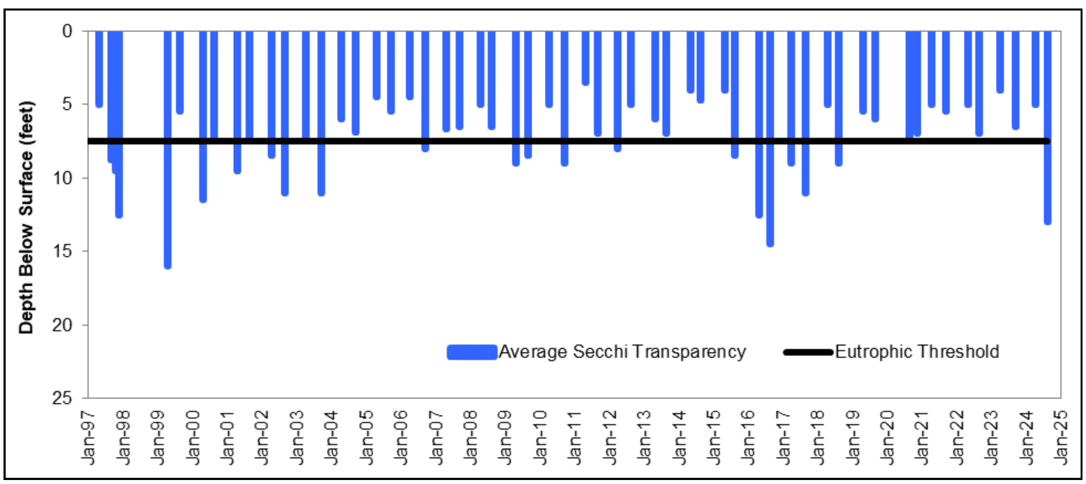
* mg/L = milligrams per liter = parts per million
* μg/L = micrograms per liter = parts per billion



Volume-weighted average total phsophorus concentrations, 1997 - 2024.



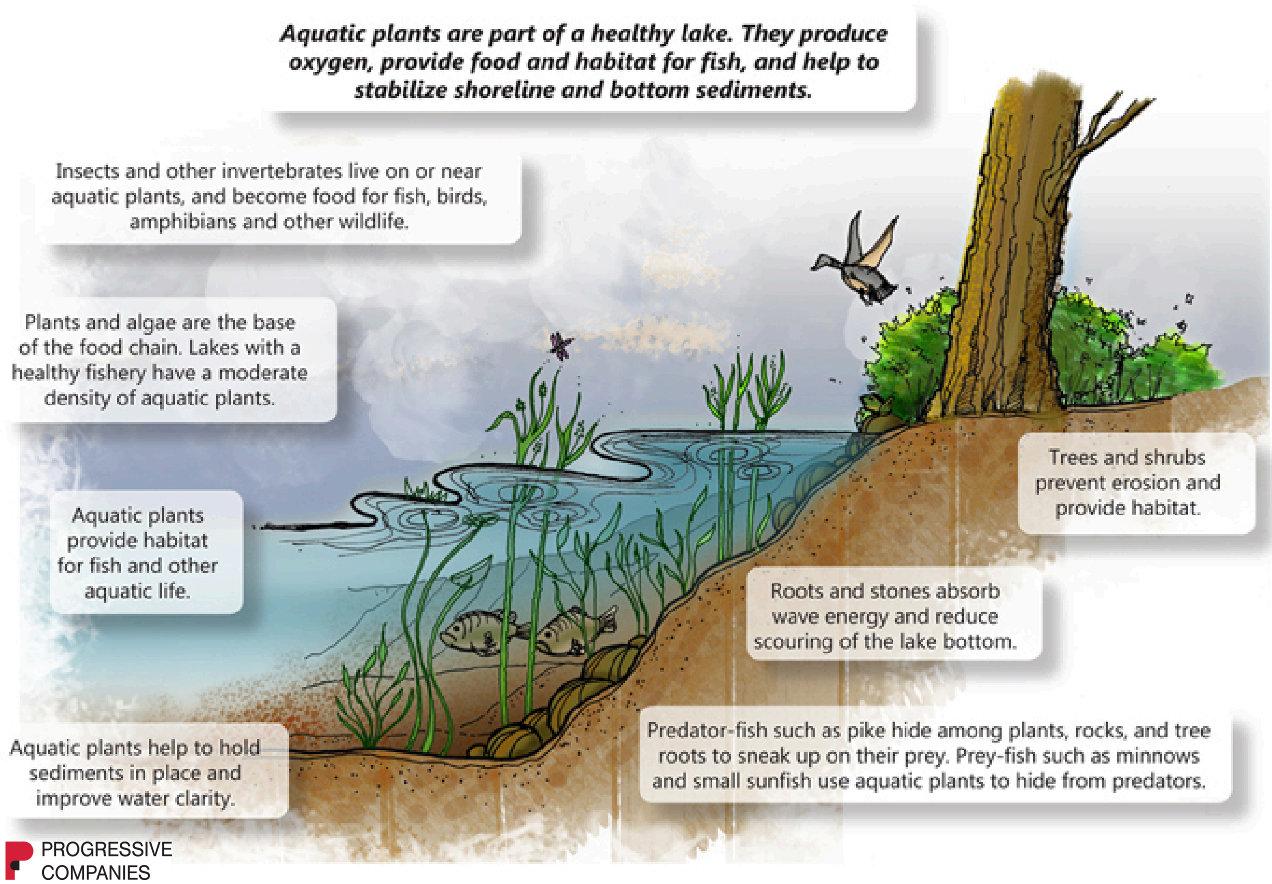
Average Chlorophyll-*a* concentrations, 1997 - 2024.



Average Secchi transparency measurements, 1997 - 2024.

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 2024.

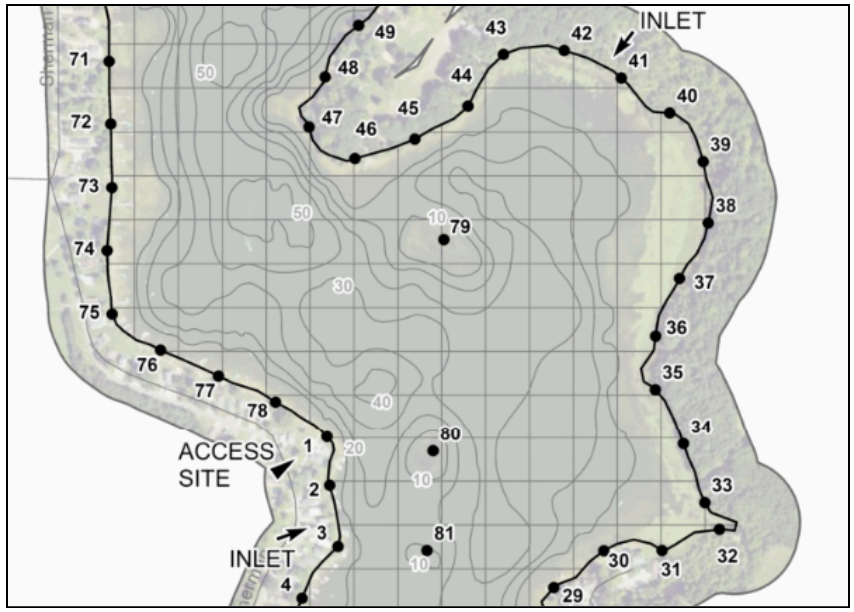


Aquatic plants are an important component of lakes. They produce oxygen during photosynthesis, provide food, habitat and cover for fish, and help stabilize shoreline and bottom sediments. There are four main aquatic plant groups: submersed, floating-leaved, free-floating, and emergent. Each plant group 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 2024 consisted of three aquatic herbicide treatments and two Phoslock treatments of Chippewa Bay to inactivate phosphorus, the nutrient that drives aquatic plant and algae growth.

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 of the lake and on the submerged islands. These waypoints are used to accurately identify the location of invasive and nuisance plant growth areas.

Eurasian milfoil
Myriophyllum spicatum



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 2024 are summarized in Table 4.

Curly-leaf pondweed
Potamogeton crispus

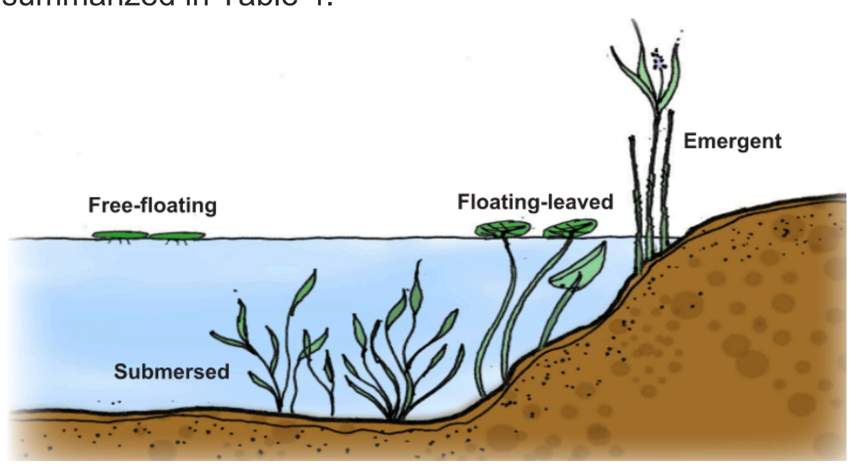


TABLE 4 - RYERSON LAKE 2024 PLANT CONTROL ACTIVITIES

Date	Plants Targeted	Acreage
April 30	Algae	2.00
May 23	E. milfoil, curly-leaf, algae	50.50
June 27	Nuisance natives, algae	12.25
July 31	E. milfoil, nuisance natives, algae	10.50
Total		**75.25**

In 2024, 75.25 acres of Ryerson Lake were treated with aquatic herbicides throughout the growing season. In May, Eurasian milfoil was treated with the systemic herbicide, ProcellaCOR, providing season-long control. Curly-leaf pondweed was also treated in May with the contact herbicide diquat dibromide. Dense wild celery growth was treated with copper products to suppress growth where it was impacting navigation in June and July. During the July treatment, two small Eurasian milfoil patches were targeted with 2,4-D along the northeastern shoreline. Plant growth was abundant in 2024. This is due to a combination of factors, including but not limited to, an abundance of available phosphorus, an extended growing season, and the preceding light winter.

Phoslock was applied to Chippewa Bay, a two-acre manmade bay connected to Ryerson Lake, on April 30 and August 7 of 2024. Chippewa Bay is susceptible to chronic algae blooms due to abundant nutrients and lack of water movement. Phoslock contains lanthanum-modified bentonite and when applied to a waterbody, the lanthanum chemically binds with phosphorus, creating lanthanum phosphate which settles to the lake bottom, reducing the amount of phosphorus available to support algae growth. While Phoslock is not an herbicide as it does not directly kill algae, it is used as a growth suppressant by reducing the fuel that algae needs to bloom. Results of the Phoslock treatments were positive, though based on anecdotal evidence rather than data-driven analysis.

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 13 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, two floating-leaved species, and six emergent species were found in the lake. Ryerson Lake maintains a good diversity of beneficial, native plant species.

TABLE 5 - RYERSON LAKE 2024 PLANT INVENTORY DATA

Common Name	Scientific Name	Group	Percentage of sites where present
Wild celery	*Vallisneria americana*	Submersed	90
Chara	*Chara* sp.	Submersed	77
Coontail	*Ceratophyllum demersum*	Submersed	30
Illinois pondweed	*Potamogeton illinoensis*	Submersed	28
Large-leaf pondweed	*Potamogeton amplifolius*	Submersed	25
Sago pondweed	*Stuckenia pectinata*	Submersed	23
Flat-stem pondweed	*Potamogeton zosteriformis*	Submersed	14
Slender naiad	*Najas flexilis*	Submersed	13
Water stargrass	*Heteranthera dubia*	Submersed	8
Thin-leaf pondweed	*Potamogeton* sp.	Submersed	5
Curly-leaf pondweed	*Potamogeton crispus*	Submersed	3
Eurasian milfoil	*Myriophyllum spicatum*	Submersed	3
Variable pondweed	*Potamogeton gramineus*	Submersed	1
White waterlily	*Nymphaea odorata*	Floating-leaved	57
Yellow waterlily	*Nuphar* sp.	Floating-leaved	6
Bulrush	*Schoenoplectus* sp.	Emergent	22
Purple loosestrife	*Lythrum salicaria*	Emergent	16
Swamp loosestrife	*Decodon verticillatus*	Emergent	15
Cattail	*Typha* sp.	Emergent	14
Lake sedge	*Carex lacustris*	Emergent	11
Pickerelweed	*Pontederia cordata*	Emergent	3

Exotic invasive species