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A new perspective on Lake and Pond management

School Section Lake, Mecosta Co. 2022 Year End Report

Morton Township, Mecosta Co.

126 Surface Acres

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Midland, MI 48640

Main Phone: 989-967-3600
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2022 School Section Lake Year-End Report:

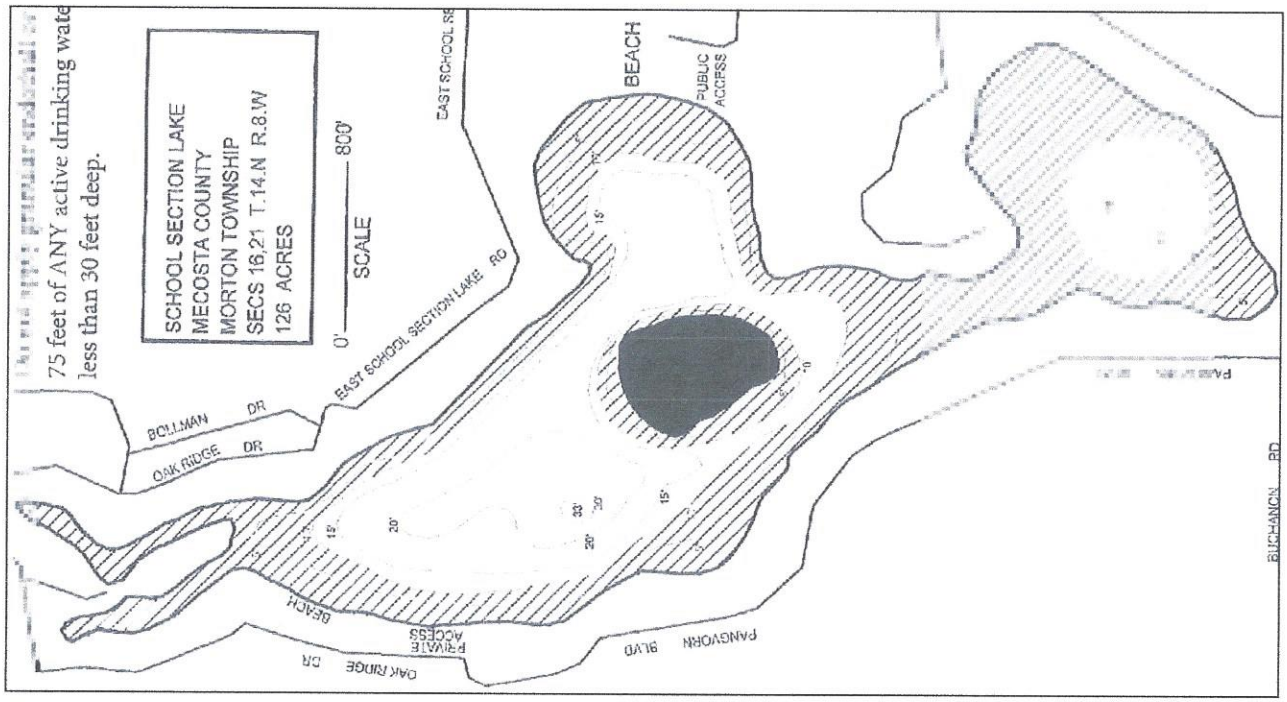
Background information:

Lake Size - 126 S/A

Max Depth – TBD

Mean Depth – TBD

Primary Uses: School Section Lake is classified as an all sports lake, recreational boating, water skiing and fishing are common. The lake is highly developed with single family residences.



Bathymetric map of School Section Lake

Lake Management: In the past, various chemical methods have been used to control Curly-Leaf Pondweed and Eurasian Milfoil, invasive species found in many lakes throughout the United States. The current focus of management is to maintain minimal populations of invasive species while promoting native species to create bio-diversity. We also continue to monitor for any new exotic plant infestations, harmful Algal Blooms or water quality issues on the lake.

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School Section Lake Water Quality Report:

ALKALINITY:

In a surface water body, such as a lake, the alkalinity in the water comes mostly from the rocks and land surrounding the lake. Precipitation falls in the watershed surrounding the lake and most of the water entering the lake comes from runoff over the landscape. If the landscape is in an area containing rocks such as limestone then the runoff picks up chemicals such as calcium carbonate (CaCO3), which raises the pH and alkalinity of the water. In areas where the geology contains large amounts of granite, for instance, lakes will have a lower alkalinity. But, a pond in an suburban area, even in a granite-heavy area, could have a high alkalinity due to runoff from home lawns where limestone have been applied (used to raise the soil's pH to better grow lawns).

Water alkalinity and hardness are primarily a function of 1) the geology of the area where the surface or groundwater is located and 2) the dissolution of carbon dioxide (CO2) from the atmosphere. The ions responsible for alkalinity and hardness originate from the dissolution of geological minerals into rain and groundwater. Rainwater is naturally acidic, which tends to solubilize some minerals more easily. Surface and groundwater sources in areas with limestone formations are especially likely to have high hardness and alkalinity due to the dissolution of bicarbonates and carbonates.

Date	Site #1 (Deep Hole)
6-29-22	99 mg / L CaCO3
10-4-22	106 mg / L CaCO3

Classification	$CaCO_3$ equivalent (mg/L)
Soft	<75
Moderately hard	75–150
Hard	150–300
Very hard	>300

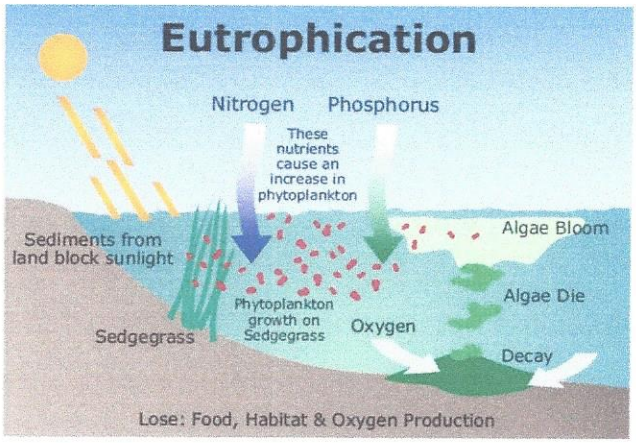
Source: US Environmental Protection Agency

Total Phosphorus:

Phosphorus is an essential nutrient for plant growth. However, concentrations exceeding 100 ppb can impair the water and results in nuisance vegetation growth. In water, phosphorus is present in three forms. Total Phosphorous tests for all three forms, including inorganic, bio-available and organic, bound molecules.

Eutrophication affects rivers, lakes and coastal areas. In addition, eutrophication can lead to a disruption of the structure of planktonic stands. For example, the proliferation of **unwanted algae** such as Dinophyceae and Cyanobacteria, some species of which can produce toxins. Deoxygenation can promote the release of sediment-associated pollutants (metals, micropollutants). Not to mention the economic impacts on bathing areas (toxic algae) and drinking water production (obstruction of pumping filters, establishment of parasitic fauna in networks, development of tastes and odors incompatible with the notion of consumption, etc.).

During the biosynthesis process, algae need carbon (C), nitrogen (N) and phosphorus (P). Algae growth is conditioned by the ratio in which they remove nutrients **(Redfield ratio** C: N: P = 106:16:1). This ratio refers to the molar elemental composition of carbon, nitrogen and phosphorus in an algal cell. If these elements are present in these ratios in the aquatic environment there is no growth limitation. If one of these elements is missing, it is called an algal growth **limiting factor** (nitrogen or phosphorus limitation for example).



Oligotrophic (Least Productive)	Mesotrophic	Eutrophic	Hypereutrophic (Most Productive)
5-10 ppb	10-30 ppb	30-100 ppb	>100 ppb

Date	Site #1 (Deep Hole)
6-29-22	10 ppb
10-4-22	22 ppb

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School Section Lake Water Quality Report:

Nitrogen / Nitrate: Measured in the parts per billion range, has traditionally been considered by lake scientists to be a limiting nutrient. The experts felt any concentration below 200 parts per billion was excellent in terms of lake water quality. Nitrogen is effected mainly in 2 ways. First, plants and algae growing in lakes as water warms can remove nitrates from the water column. And second, bacterial denitrification (where nitrates are converted to nitrogen gas by bacteria) also occurs at a much faster rate in summer when the water is warmer. Generally limnologists feel optimal nitrate nitrogen concentrations (which encourage maximum plant and algal growth) are about 10-20 times higher than phosphorus concentrations. The reason more nitrogen than phosphorus is needed is because nitrogen is one of the chemicals used in the production of plant proteins, while phosphorus is used in the transfer of energy, but is not used to create plant material. If the nitrate concentration is less than 10-20 times the phosphorus concentration, the lake is considered nitrogen limited. If the nitrate concentration is higher than 10-20 times the phosphorus concentration, the lake is considered phosphorus limited.

Date	Site #1 (Deep Hole)
6-29-22	<100 ppb
10-4-22	<100 ppb

Total Dissolved Solids: A measure of conductivity, detects the capacity of a water to conduct an electric current. More importantly however, it measures the amount of materials dissolved in the water (salts), since only dissolved materials will permit an electric current to flow. Theoretically, pure water will not conduct an electric current. It is the perception of the experts that poor quality water has more dissolved materials than good quality water.

Date	Site #1 (Deep Hole)
6-29-22	56 mg / L
10-4-22	180 mg / L

Level of TDS (milligrams per litre)	Rating
Less than 300	Excellent
300 - 600	Good
600 - 900	Fair
900 - 1,200	Poor
Above 1,200	Unacceptable

Ph: is a measure of the amount of hydrogen ions (H+) present in a substance such as water.

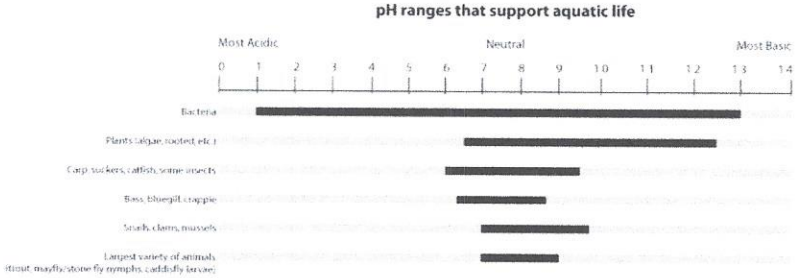
The pH scale ranges from 0 (most acidic) to 14 (most basic), with the value of 7 representing neutral solutions. As we go down the pH scale, each unit of pH value represents a tenfold increase in how much hydrogen is present. (For example, water with a pH of 7.5 is 10 times more acidic than water with a pH of 8.5.)

Most natural waters in the United States have pH values between 6.5 and 8.5. Rain usually has a pH of between 5.0 and 6.0, but the "acid rain" that we hear about has pH values that average around 4.3.

The pH level of the water in rivers, lakes, and wetlands is important to plant and animal life. Most animal species cannot survive if the water is too acidic (generally below 5.0), or too basic (above 9.0). Optimal pH for many species is between 7.0 and 9.0. pH levels can often indicate the types of animals found in a particular habitat. For example, bass and bluegill might be found at pH 8.5, but trout and mayflies will not be found in the same area. On the other hand, bass, bluegill, trout, and mayflies might be found in a habitat with a neutral pH of 7.0.

Source: Michigan Sea Grant

Date	Site #1 (Deep Hole)
6-29-22	8.00
10-4-22	7.85



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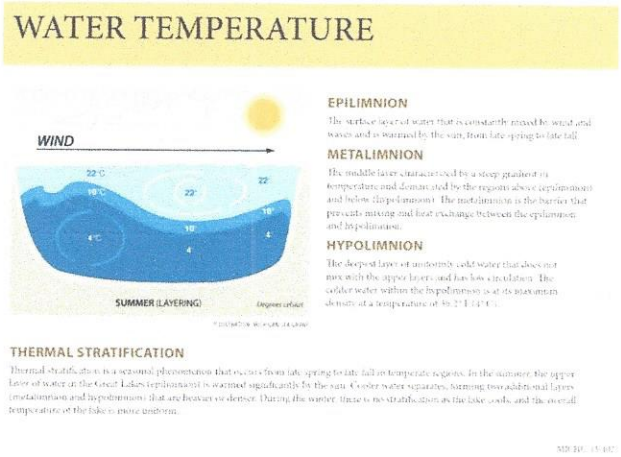
School Section Lake Water Quality Report:

Temperature: From late spring through early fall, some lakes in temperate climates experience **thermal stratification,** a phenomenon wherein lakes separate into three distinct thermal layers (Figure 1). The warming of the surface of the water by the sun causes water density variations and initiates thermal stratification. Cooler, denser water settles to the bottom of the lake forming the **hypolimnion.** A layer of warmer water, called the **epilimnion,** floats on top. A thin middle layer called the **metalimnion (or thermocline)** separates the top and bottom layers and is characterized by a rapid change in water temperature. This separation often is strong enough to resist mixing of the layers by the wind.

The most extreme thermal stratification occurs within lakes during the warm summer months. During fall **turnover**, the epilimnion cools, sinks and falls below the thermocline, resulting in mixing. Thermal stratification of a lake depends on the lake's depth, shape and size. Some small, shallow lakes may not experience seasonal thermal stratification because the wind mixes the entire lake. Other lakes, such as Lake Erie, have a combination of geographic location and water depth that regularly produces thermal stratification.

Date 10-4-22	Site #1 (Deep Hole)
Surface	63.8° F
3 feet	62.3° F
6 feet	61.2° F
9 feet	61° F
12 feet	60.7° F
15 feet	60.4° F
18 feet	60.4° F
Lake Bed	60.1° F



Source: Michigan Sea Grant

Dissolved Oxygen:

Oxygen can enter a lake via three different routes. The main mechanism is **atmospheric diffusion** where oxygen in the air is absorbed by surface water due to a difference in oxygen concentrations. Second, aquatic plants photosynthesize and release oxygen into the water. Finally, rivers and streams bring oxygenated water into the lake. In stratified lakes, the hypolimnion receives little oxygen from atmospheric diffusion and is too dark to support oxygen-producing plant life.

Lakes can be described by their **productivity.** This refers to the amount of nutrients available in a lake and the primary production, or plant and algal growth, they support. Defining **trophic** (nutrient or growth) status is a means of classifying lakes in terms of their productivity levels. Identified tropic levels are:

- Oligotrophic (olig-oh-trof-ik) – has low nutrient concentrations and low plant growth (e.g., Lake Superior). It is usually considered to have low productivity.
- Eutrophic (yoo-trof-ik) – A eutrophic lake has high nutrient concentrations and high plant growth. (e.g., Lake Erie). It is considered to have high productivity.
- Mesotrophic (meso-trof-ik) – Mesotrophic lakes fall somewhere in between eutrophic and oligotrophic lakes. They are considered to have average productivity.

In eutrophic lakes, large blooms of algae grow at the surface during the summer. The algae need large amounts of nutrients in order to form these blooms. As the algae die, the bloom sinks to the bottom and is decomposed by bacteria. **Decomposition** by bacteria, or the biological separation of a substance into simpler elements, requires oxygen. Oxygen consumption and low oxygen input in the hypolimnion combine to create extremely low oxygen levels during thermal stratification. Oxygen levels > 6 mg/L are considered ideal.

Date 10-4-22	Site #1 (Deep Hole)
Surface	6.42 mg / L
3 feet	6.40 mg / L
6 feet	6.35 mg / L
9 feet	6.26 mg / L
12 feet	6.01 mg / L
15 feet	5.73 mg / L
18 feet	5.47 mg / L
Lake Bed	5.61 mg / L

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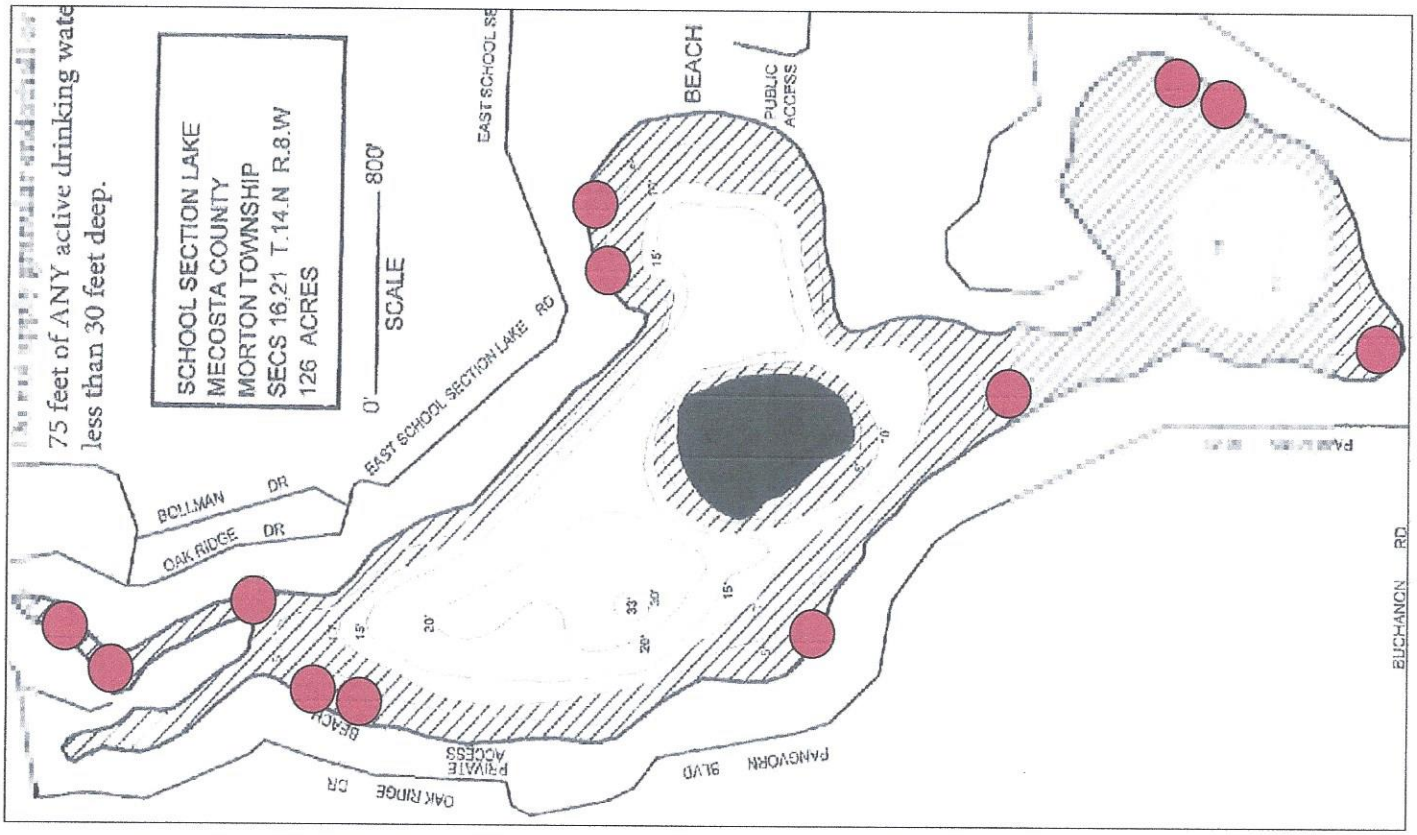
2022 School Section Lake Year-End Report:

2022 Invasive species Location map:



Invasive Species Locations:

- Starry Stonewort
- Eurasian Milfoil
- Purple Loosestrife
- Curly-Leaf Pondweed
- Flowering Rush
- Phragmites
- Observed Blue-Green Algae Blooms

Details of invasive species on pages 9-12

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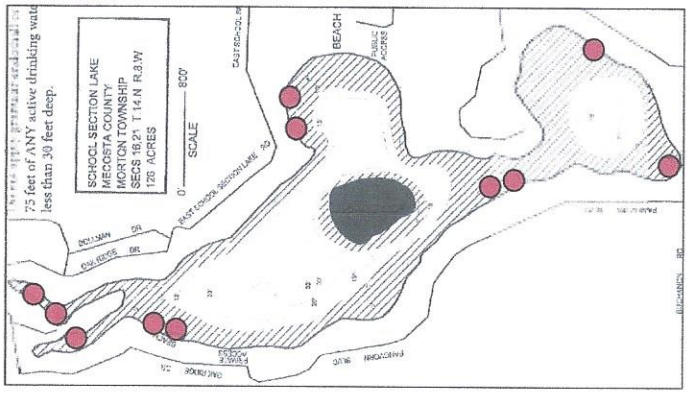
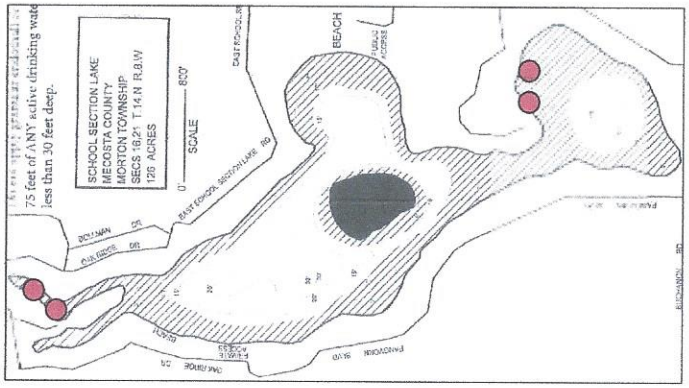
2022 School Section Lake Year-End Report:

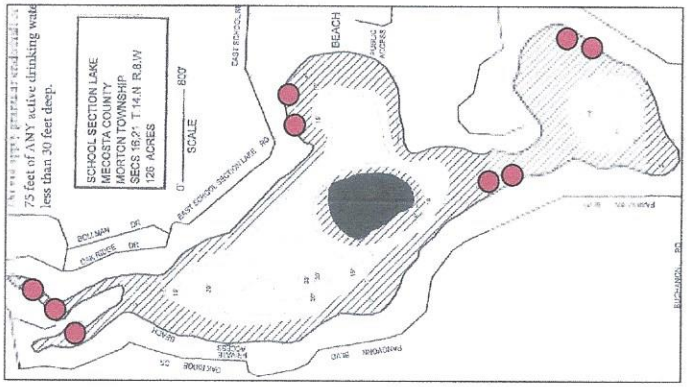
Historic Invasive species Location maps:



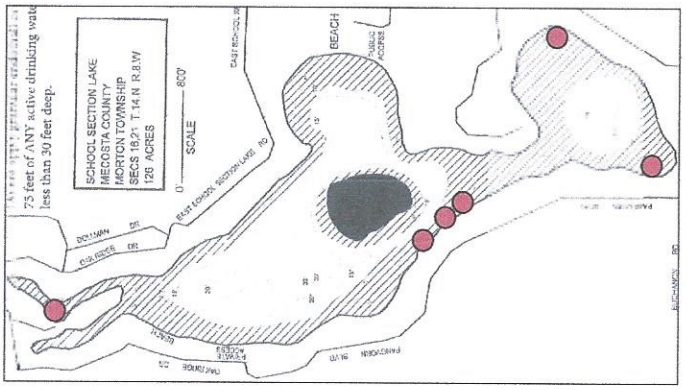
2021



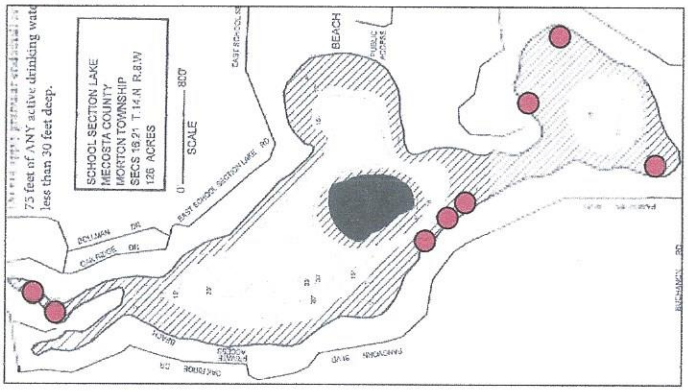
2019



2020



2017



2018

Invasive Species Locations:

- Starry Stonewort
- Eurasian Milfoil
- Purple Loosestrife
- Curly-Leaf Pondweed
- Flowering Rush
- Phragmites
- Observed Blue-Green Algae Blooms

Details of invasive species on pages 9-12

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2022 School Section Lake Year-End Report:

Management Recommendations for 2023:

School Section Lake currently contains known invasive species that are actively under management. With a combined effort between the lake manager and various homeowners, we have been able to identify and contain these problem species. Going forward the lake residents should consider the following:

- Continued monitoring and active management of invasive species.
- Education of homeowners / visitors to identify invasive species and how to prevent further infestation.
- Recommendations to lake owners on proper fertilizer usage / other nutrient abatement strategies.
- Monitoring of water quality issues.

Please find in the following pages some identification information of invasive plants. We also have information at our website www.helpmylake.com

If you have any questions or would like to inquire about other services we provide please contact us anytime at 989-967-3600.

Michigan Lakefront Solutions is a Michigan owned business that specializes in aquatic weed and algae control in lakes, ponds, canals and marinas in central and northern Michigan.

We have 40 years of combined experience in the Lake and Pond Management industry. With backgrounds in both large and small operations, we can combine the best of both worlds. We aim to deliver a diverse array of services, yet maintaining a focus on the one on one connection with our customers and the waterbody they value. As part of our dedication to maintain healthy aquatic environments we offer the following services:

- Water testing to ensure a proper balance of nutrients
- Aeration systems to maintain oxygen levels and improve fish health
- Fountains for an aesthetically pleasing addition to any pond
- Lake management plans to give a detailed view of your lake
- Bactria / enzymes for excess muck and nutrient reduction

Michigan Lakefront Solutions is a member and active in the following organizations:

- Midwest Aquatic Plant Managers Association
- Michigan Lakes and Streams Association
- Aquatic Eco Restoration Foundation
- Michigan Chapter North American Lake Management Society
- North American Lake Management Society

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Invasive Species Reference

Eurasian Watermilfoil is an exotic, aggressive growing plant in Michigan lakes and ponds. Its origin has been traced to the Hudson Bay area during the 1940's.

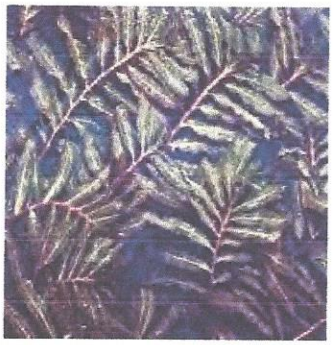
Because it is not native to Michigan waters, there are no natural controls to prevent growth. Milfoil can reproduce by seed or by fragmentation. A small piece or fragment of the plant can form roots and develop into a new plant. In fact, a single wisp can multiply into dense mats that can restrict boating, fishing and swimming.

Eurasian Watermilfoil

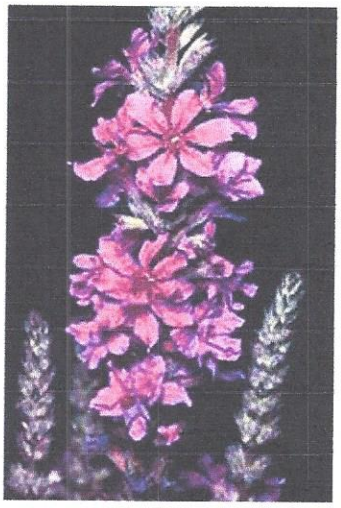
Curly-leaf pondweed was introduced into North America sometime in the late 1800's, and has now spread throughout many parts of the U.S. and Canada. This species usually emerges early each spring, flowers and sets seed in the late spring and early summer, then collapses sometime in July. In some cases re-growth communities can be found through August.

These plants are capable of surviving under the ice during the winter. Curly leaf can be a severe nuisance during the early part of the peak recreational use season. Early control of this species is recommended to reduce oxygen stress within the water body.

Curly Leaf Pondweed



Purple loosestrife grows most abundantly in parts of Canada, the northeastern United States, the Midwest, and in scattered locations in the West. Although this species tolerates a wide variety of soil conditions, its typical habitat includes cattail marshes, sedge meadows, and bogs. It also occurs along ditch, stream, and riverbanks, lake shores, and other wet areas. In such habitats, purple loosestrife forms dense, monospecific stands that can grow to thousands of acres in size, displacing native, sometimes rare, plant species and eliminating open water habitat. The loss of native species and habitat diversity is a significant threat to wildlife, including birds, amphibians, and butterflies, that depend on wetlands for food and shelter.



Purple loosestrife monocultures also cause agricultural loss of wetland pastures and hay meadows by replacing more palatable native grasses and sedges (Mal et al. 1992; Thompson et al. 1987).

Purple Loosestrife

Flowering rush is a rhizomatous, perennial monocot. It has narrow, linear leaves that arise from a stout rhizome). The leaves may be emergent, floating, or submersed. The emergent leaves are fleshy and triangular. The submersed and floating leaves are long and ribbon-like resembling those of wild celery (Eel Grass). The flower stalk rises above the leaves with a terminal cluster of many flowers. The flowers have 3 petals and 3 sepals. The flowers are most often pink but can be white.

Flowering rush most frequently grows as an emergent in shallow water along the shorelines of lakes, ponds, rivers and shallow marshes. The submersed growth form is found in deeper waters. Flowering rush will grow in a variety of sediments and water depths. Flowering occurs in late June to mid August and fruit is set by late summer.

Flowering Rush

Phragmites (Common reed) is a tall, coarse perennial with stout rhizomes. The stems are stout up to 4 m tall and 5-15 mm thick. The leaves are flat, stiff, 1-6 cm broad and to 6 dm long, serrate, tapering to long tips.

Plants grow in marshes, shores, often in tidal waters, along streams, lakes and estuaries. The invasive *Phragmites* is more likely to be found in disturbed sites such as roadsides, construction areas, agricultural fields, or along developed shorelines. Colonies of the introduced species tend to be denser than those of the native subspecies. Plants can form extensive colonies from rhizomes. Spread is by wind or waterborne seeds or vegetatively through rhizomes or rhizome fragments.

Phragmites

Invasive Species Alert

Courtesy of Michigan.gov

Starry Stonewort

(*Nitellopsis obtusa*)

Established in Michigan

Identification:

- Whorls of 4-6 branchlets/leaves with blunt tips
- Star-shaped bulbils are produced at the nodes, generally 3-6 mm wide
- Can reach up to 33 inches

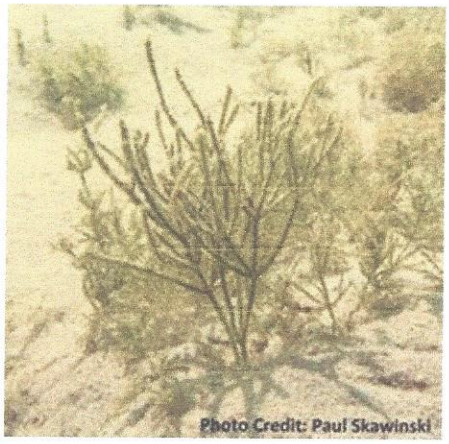


Photo Credit: Paul Skawinski

Habitat: This submerged annual macroalga invades lakes, ponds, reservoirs, and slow moving rivers. It will inhabit freshwater habitats ranging from 3 feet to 95 feet in depth.

Native Range: Europe and western Asia

U.S. Distribution: Michigan, northern Indiana, southeastern Wisconsin, Minnesota, and the northeast United States


Starry stonewort Photo by Paul Skawinski


Starry stonewort Photo by Paul Skawinski

Local Concern: Starry stonewort forms dense mats in lakes and can significantly reduce the diversity of other aquatic plants. Dense mats of vegetation can also impede movement of fish, spawning activity, water flow, and recreational activities.

Distribution map courtesy of Midwest Invasive Species Network:

Animal Safety Alert

Cyanobacterial blooms can be deadly for pets and livestock.

When in doubt, keep animals out!

Cyanobacteria (also called blue-green algae) are microscopic organisms that can be found naturally in all types of water. Sometimes cyanobacteria rapidly grow out of control, or bloom. Cyanobacterial blooms are most commonly found in fresh water, such as lakes, rivers, and streams.

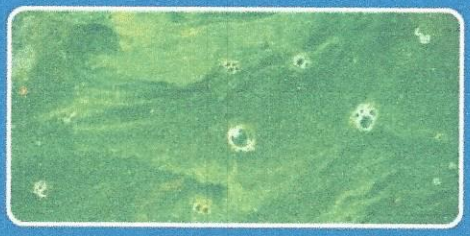
Cyanobacterial blooms can make toxins (poisons) that are deadly for animals.

- Pets and livestock can get very sick and die within hours to days after swallowing cyanobacterial toxins.
- The toxins can be in the cyanobacteria or in the water.

Signs of a cyanobacterial bloom

Foam, scum, mats, or paint-like streaks on the water's surface

Different colors like green, blue, red, or brown



As the bloom dies off, it may **smell like rotting plants.**

Cyanobacteria **bloom more often in summer and fall,** but can bloom anytime.

You cannot tell if a cyanobacterial bloom is toxic or not just by looking at it.

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

CS 319451-E