

November

2025

WALNUT LAKE

LIMNOLOGICAL ASSESSMENT

PREPARED FOR:
LAKE SHORE RESIDENTS OF WALNUT LAKE, INC.
OAKLAND COUNTY, MI

TABLE OF CONTENTS

INTRODUCTION - 1

WATER QUALITY - 2

 Lake Water Quality - 2

 Temperature - 3

 Dissolved Oxygen - 3

 Phosphorus - 4

 Chlorophyll-a - 4

 Secchi Transparency - 4

 Lake Classification Criteria - 4

 Chloride - 5

 Sampling Methods - 6

 Sampling Results and Discussion - 6

PLANT COMMUNITY - 9

 Plant Control Review - 11

 Plant Inventory Survey - 12

 Biobase Mapping - 13

RECOMMENDATIONS - 14

APPENDICES

 Appendix A - Maps and Figures

 Appendix B - Guides and Fact Sheets

TABLE OF CONTENTS

LIST OF TABLES

- Table 1 Lake Classification Criteria
- Table 2 Walnut Lake 2025 Deep Basin Water Quality Data
- Table 3 Walnut Lake 2025 Surface Water Quality Data
- Table 4 Walnut Lake 2022-2024 Plant Control Activities
- Table 5 Walnut Lake 2025 Plant Inventory Data
- Table 6 Walnut Lake 2026-2031 Management Recommendations

LIST OF FIGURES

- Figure 1 Walnut Lake location map.
- Figure 2 Lake classification.
- Figure 3 Seasonal thermal stratification cycles.
- Figure 4 Secchi disk.
- Figure 5 Lake chloride levels.
- Figure 6 Chemocline.
- Figure 7 Composite sampler.
- Figure 8 Van Dorn bottle.
- Figure 9 Walnut Lake sampling location map.
- Figure 10 Natural shoreline graphic.
- Figure 11 Invasive species.
- Figure 12 Walnut Lake aquatic plant survey map.
- Figure 13 Walnut Lake biovolume map.

INTRODUCTION

Walnut Lake is located in West Bloomfield Township, Oakland County, Michigan (Figure 1). The lake is 252 acres in surface area with a maximum depth of approximately 101 feet and a mean (average) depth of 38 feet. Walnut Lake has an approximate total volume of 9,603 acre-feet or 3 billion gallons. The lake has 3.6 miles of shoreline with a shoreline development factor of 1.6, meaning the lake does not exhibit an overly convoluted shoreline that would allow excessive development for its overall surface area. Walnut Lake has a very long water residence time of 4.8 years. This means that it takes nearly five years (on average) to completely replace the volume of water within the lake. In 2025, the Lake Shore Residents of Walnut Lake, Inc. retained Progressive Companies to evaluate the lake's aquatic plant community and water quality, and provide management recommendations for Walnut Lake. This report contains information on Walnut Lake's 2025 limnological assessment.

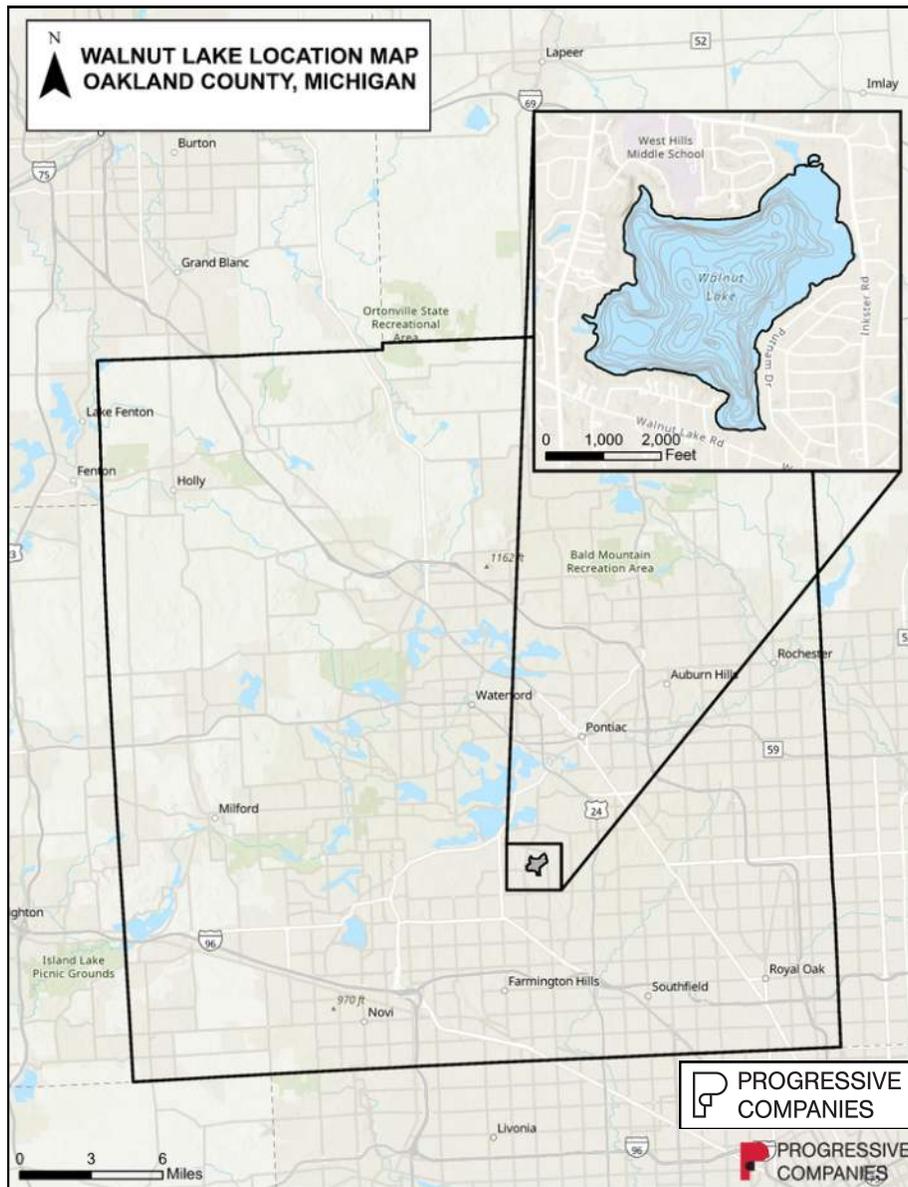


Figure 1. Walnut Lake location map.

WATER QUALITY

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 (Figure 2). 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. Thus, in developing a management plan, it is necessary to determine the limnological (i.e., the physical, chemical, and biological) condition of the lake and the physical characteristics of the watershed as well. Key parameters used to evaluate the limnological condition of a lake include temperature, dissolved oxygen, total phosphorus, pH and alkalinity, chlorophyll-*a*, and Secchi transparency.

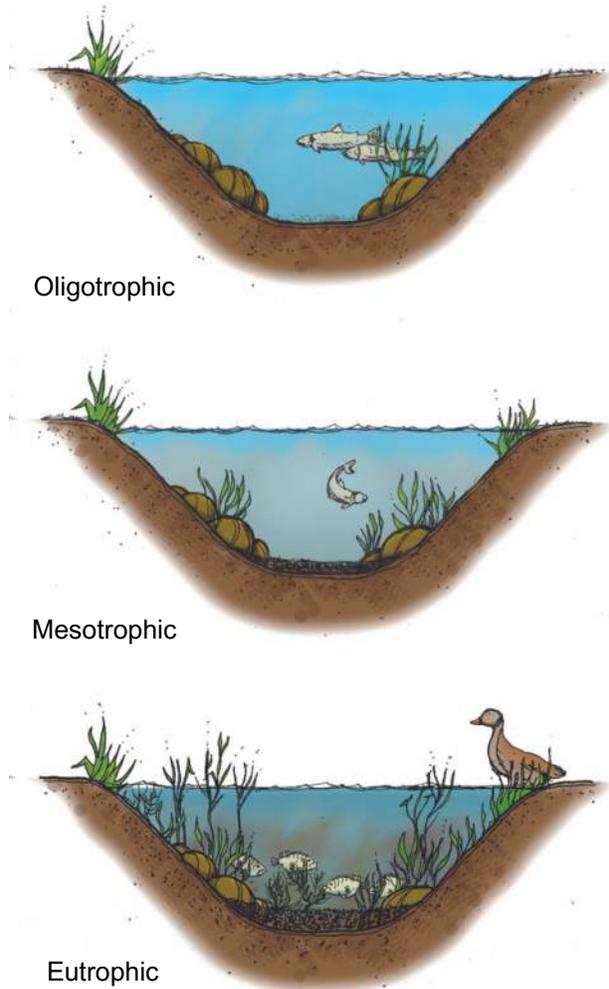


Figure 2. Lake classification.

WATER QUALITY

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 (Figure 3). 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.

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.

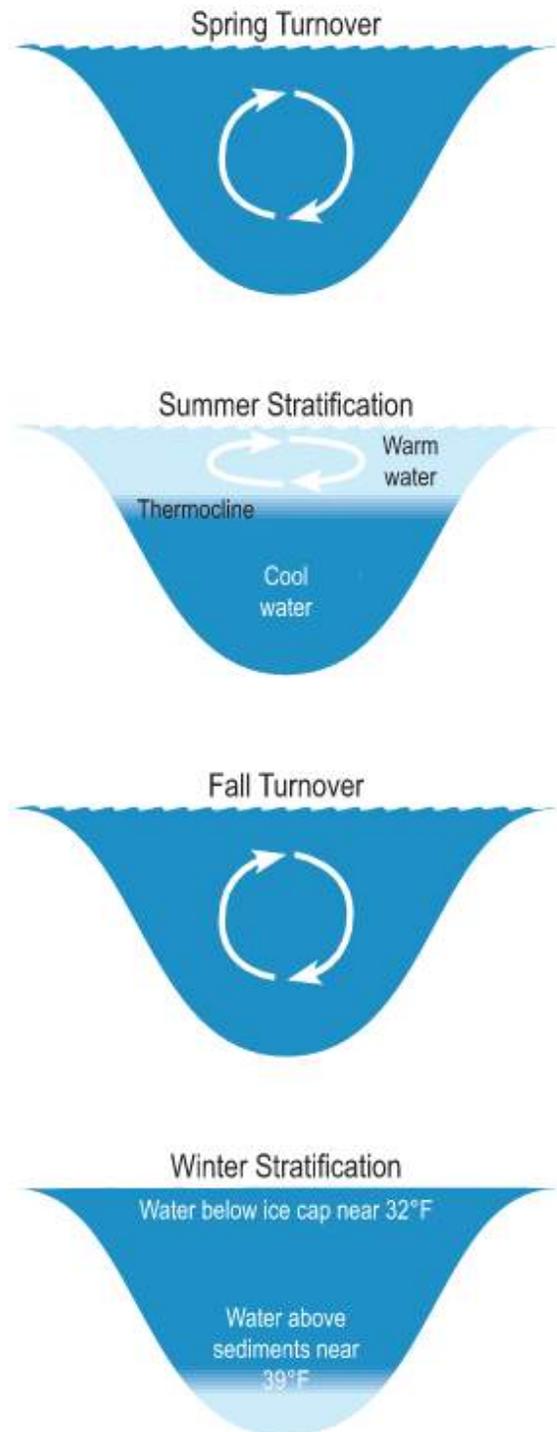


Figure 3. Seasonal thermal stratification cycles.

WATER QUALITY

PHOSPHORUS

The quantity of phosphorus present in the water column is especially important since phosphorus is the nutrient that most often controls aquatic plant growth and the rate at which a lake ages and becomes more eutrophic. By reducing the availability of phosphorus in a lake, it is often possible to control the amount of aquatic plant growth. In general, lakes with a phosphorus concentration of 20 µg/L (micrograms per liter, or parts per billion) or greater are can support abundant plant growth and are classified as eutrophic.

Phosphorus enters the lake either from the surrounding watershed, or from the sediments in the lake itself, or both. The input of phosphorus from the watershed is called "external loading," and from the sediments is called "internal loading." External loading occurs when phosphorus washes into the lake from sources such as fertilizers, septic systems, and eroding land. Internal loading occurs when bottom-water oxygen is depleted, resulting in a chemical change in the water near the sediments. The chemical change causes phosphorus to be released from the sediments into the lake where it becomes available as a nutrient for aquatic plants.

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 (Figure 4). 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 at least 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.



Figure 4. Secchi disk.

LAKE CLASSIFICATION CRITERIA

Ordinarily, 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 developed by the Michigan Department of Natural Resources 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

WATER QUALITY

CHLORIDE

Normally, chloride is a very minor component of freshwater systems and background concentrations are generally less than about 10 milligrams per liter (Wetzel 2001; Fuller and Taricska 2012, Figure 5). However, chloride pollution from sources such as road salting, industrial or municipal wastewater, water softeners, and septic systems can increase chloride levels in lakes. Increased chloride levels can reduce biological diversity and, because chloride increases the density of water, elevated chloride levels can prevent a lake from completely mixing during spring and fall. The U.S. Environmental Protection Agency's acute and chronic standards for protection of freshwater aquatic life are 860 and 230 milligrams per liter of chloride, respectively (USEPA 2021). EPA states that "[a]quatic life criteria for toxic chemicals are the highest concentration of specific pollutants or parameters in water that are not expected to pose a significant risk to the majority of species in a given environment or a narrative description of the desired conditions of a water body being 'free from' certain negative conditions." In contrast, EGLE has set a final chronic value (FCV) for protection of aquatic life at 150 mg/L.

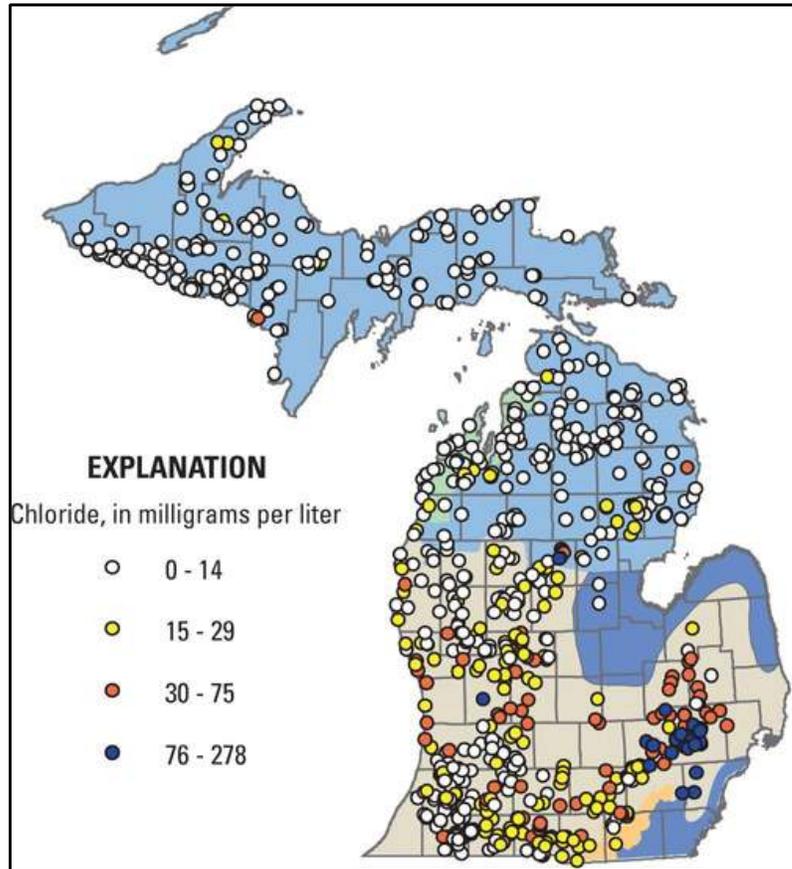


Figure 5. Lake chloride levels (2001–10) in USEPA ecoregions. Fuller and Taricska 2012.

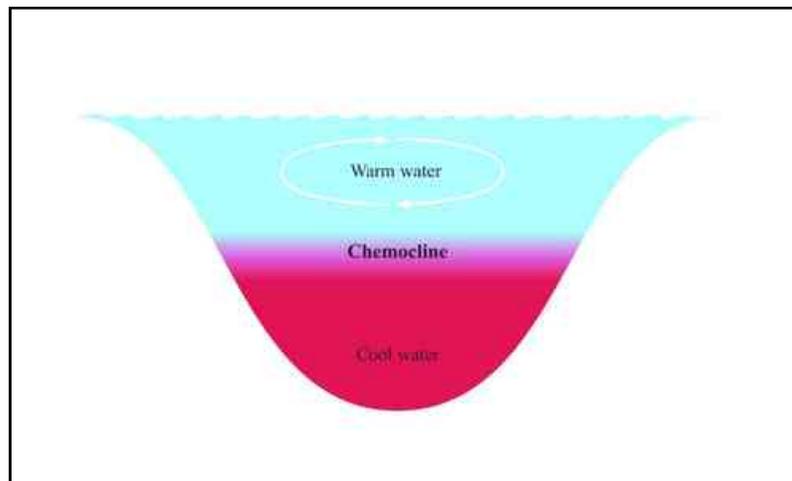


Figure 6. High chloride inputs can result in a chemocline, preventing lake mixing.

WATER QUALITY

SAMPLING METHODS

Water quality sampling was conducted in September of 2025 at the deepest basin within Walnut Lake (Figure 9). Temperature and dissolved oxygen were measured using a YSI ProSolo ODO/T probe. Samples were collected at 10 foot depth intervals and just above the lake bottom with a Van Dorn bottle to be analyzed for total phosphorus and chlorides. Total phosphorus and chloride samples were placed on ice and transported to Summit Laboratory*, for analysis, using Standard Methods procedure 4500-PE and 4500-Cl, respectively. 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 AND DISCUSSION

Sampling results are provided in Tables 2-3.

In September of 2025, Walnut Lake was thermally stratified; the lake was warm and well-oxygenated at the surface, and was cool with low oxygen near the bottom. The thermocline (where temperature decreases rapidly with depth) was established between 20 and 40 feet. Based on the temperature and dissolved oxygen profile collected, Walnut Lake can support a cold-water fishery. During the summer, the cold-water refuge (water temperatures less than 65 °F) contains sufficient oxygen for species such as trout, *Cisco*, Walnut Lake's notable Lake Whitefish (additional details on Lake Whitefish can be found on page 8). At the time of sampling, the cold water refuge was between 20 and 30 feet below the surface. Total phosphorus concentrations were low above the thermocline and elevated below the thermocline. The elevated phosphorus in the bottom waters is likely due to internal release of phosphorus from the lake sediments. When oxygen is depleted, phosphorus bound to iron within the sediment is released. Chloride concentrations throughout the water column are elevated compared to averages across the state. Chloride is just below EGLE's FCV of 150 mg/L, suggesting long term exposure at these concentrations could negatively impact aquatic life within Walnut Lake. The lake exhibited moderate clarity during sampling and chlorophyll-a concentrations were below detectable limits. This suggests that algal production was minimal at the time of sampling.



Figure 7. Composite sampler.

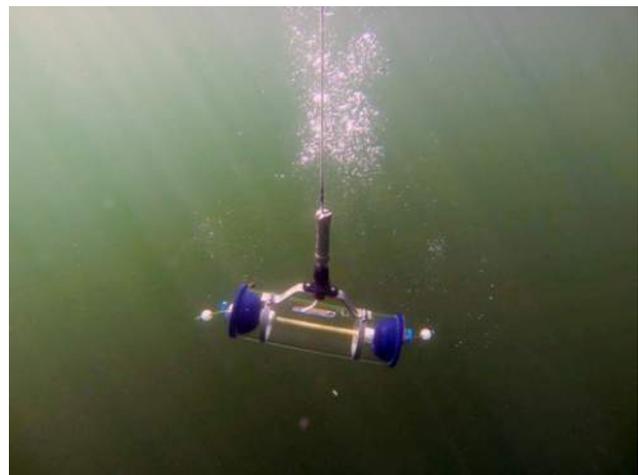


Figure 8. Van Dorn bottle.

* Summit Laboratory, 900 Godfrey Ave SW, Grand Rapids, MI 49503

* Prein and Newhof Laboratories, 3260 Evergreen Dr NE, Grand Rapids, MI 49525

WATER QUALITY

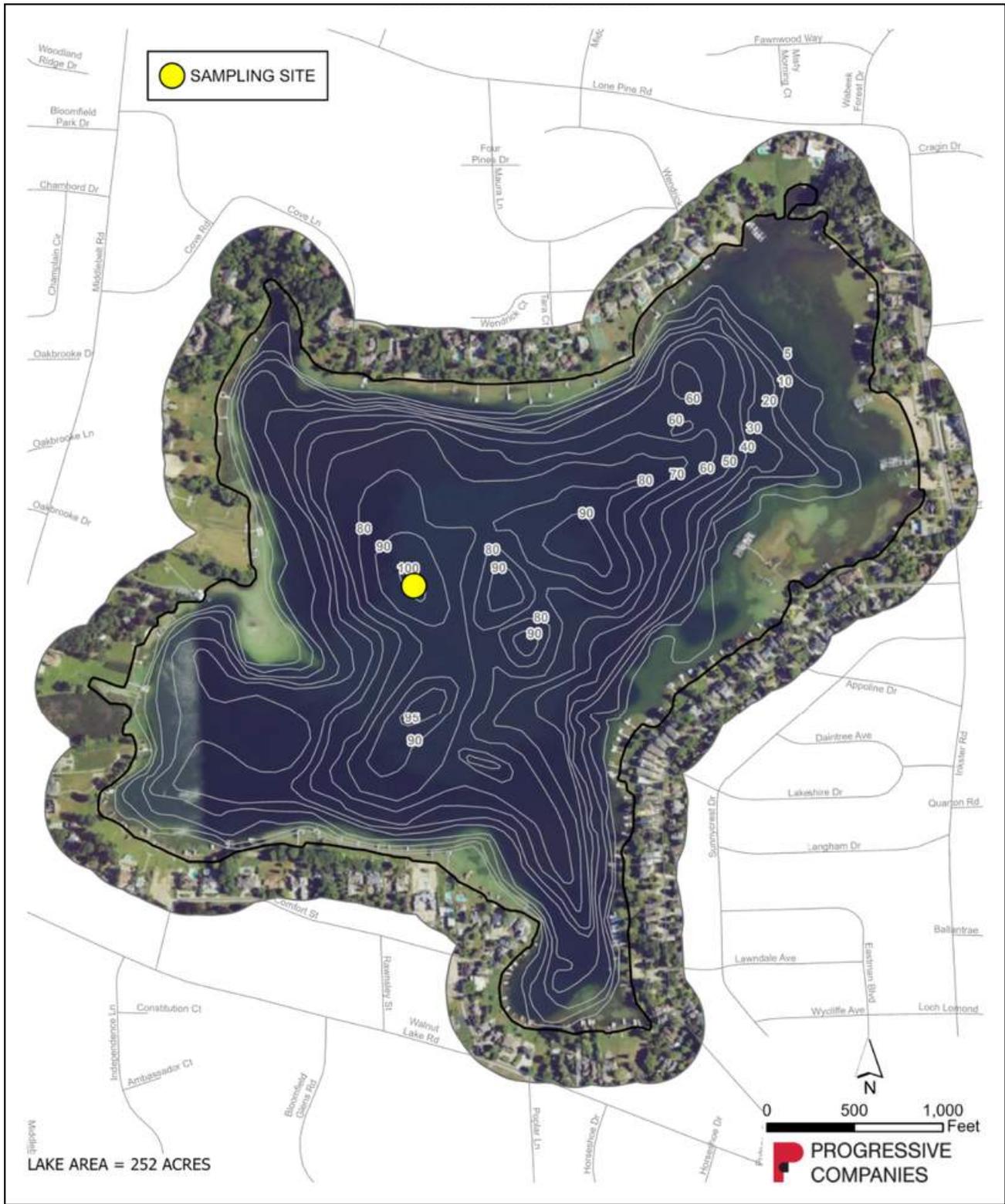


Figure 9. Walnut Lake sampling location map.

WATER QUALITY

TABLE 2 - WALNUT LAKE 2025 DEEP BASIN WATER QUALITY DATA

Date	Station	Sample Depth (feet)	Temperature (F)	Dissolved Oxygen (mg/L)*	Total Phosphorus (µg/L)*	Chloride (mg/L)*
22-Sep-25	1	1	70	8.6	10	146
22-Sep-25	1	10	70	8.4	10	149
22-Sep-25	1	20	65	6.8	10	133
22-Sep-25	1	30	51	3.2	10	124
22-Sep-25	1	40	47	2.1	10	126
22-Sep-25	1	50	44	0.6	10	130
22-Sep-25	1	60	44	0.2	36	124
22-Sep-25	1	70	44	0.1	52	117
22-Sep-25	1	80	44	0.1	66	119
22-Sep-25	1	90	44	0.1	56	123
22-Sep-25	1	95	44	0.2	92	135

TABLE 3 - WALNUT LAKE 2025 SURFACE WATER QUALITY DATA

Date	Station	Secchi Transparency (feet)	Chlorophyll-a (µg/L)*
22-Sep-25	1	10	ND*

WHITEFISH IN WALNUT LAKE

Walnut Lake possesses a well-documented historical record of its lake whitefish (*Coregonus clupeaformis*) population. The presence of lake whitefish in inland lakes is uncommon, particularly in systems comparable in size to Walnut Lake. Notably, Walnut Lake represents the only known southern inland lake in Michigan that supports a self-sustaining population of this species. Recent research indicates that lake whitefish exhibit a strong preference for very cold water temperatures (below 50°F) and demonstrate a notable tolerance for anoxic conditions, often selecting colder habitats over areas with higher dissolved oxygen concentrations. At the time of sampling, it is likely that the lake whitefish population in Walnut Lake could occupy depths of approximately 30 to 40 feet or greater.

* mg/L = milligrams per liter = parts per million

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

* ND = none detected

PLANT COMMUNITY

A nuisance aquatic plant control program has been ongoing on Walnut Lake with the use of aquatic herbicides. The primary objective of an effective plant control program should be to prevent the spread of invasive aquatic plants while preserving beneficial native plant species. This report contains an overview of the plant community and plant control activities on Walnut Lake.

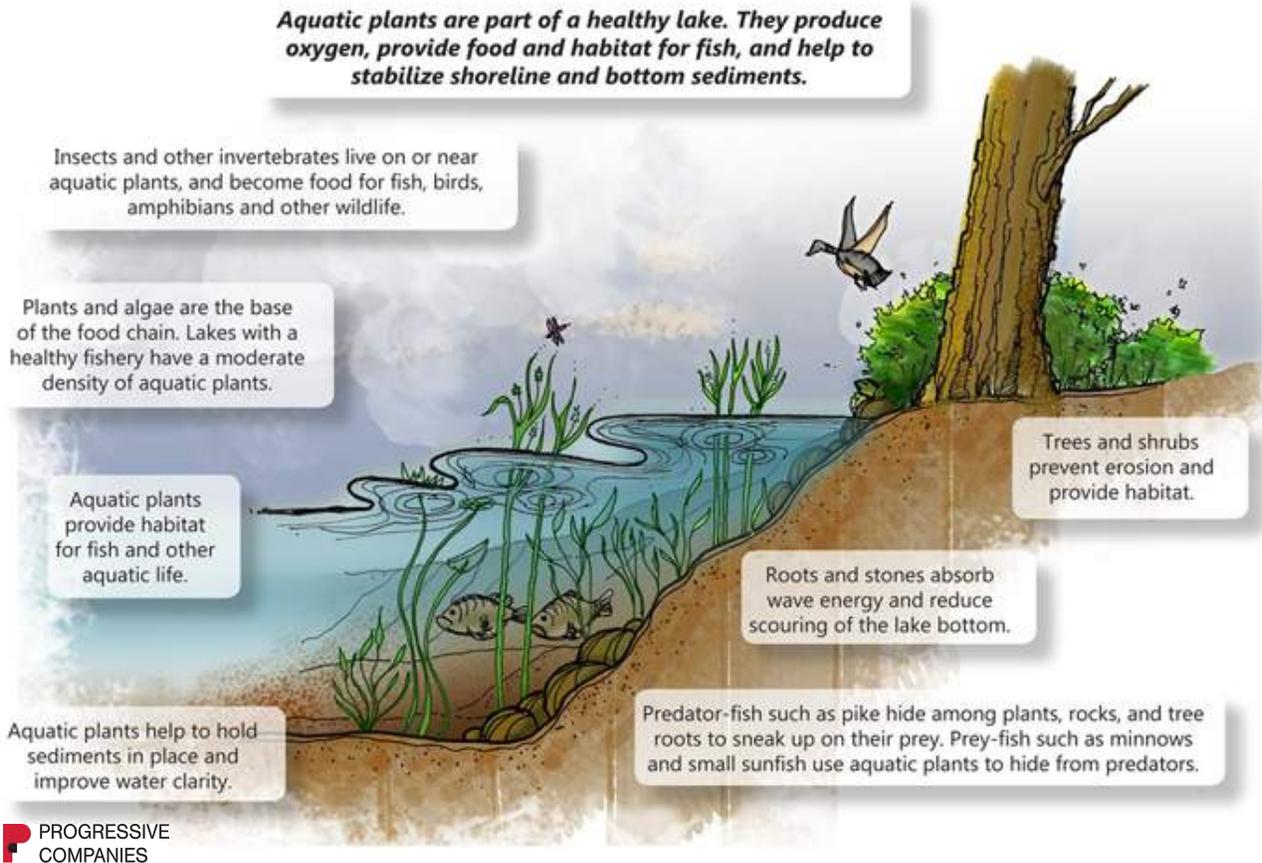


Figure 10. Natural shoreline graphic.

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 Walnut Lake.

PLANT COMMUNITY

Plant control activities are coordinated under the direction of the Lake Shore Residents of Walnut Lake, Inc. and Savin Lake Services. During the plant community assessment, scientists from Progressive conducted a GPS-guided survey of the lake to identify problem areas, and a georeferenced plant control map was generated (Appendix A). GPS reference points were established along the shoreline of the lake. These waypoints are used to accurately identify the location of invasive and nuisance plant growth areas (Figure 11).



Eurasian milfoil
Myriophyllum spicatum



Flowering Rush
Butomus umbellatus



Starry stonewort
Nitellopsis obtusa

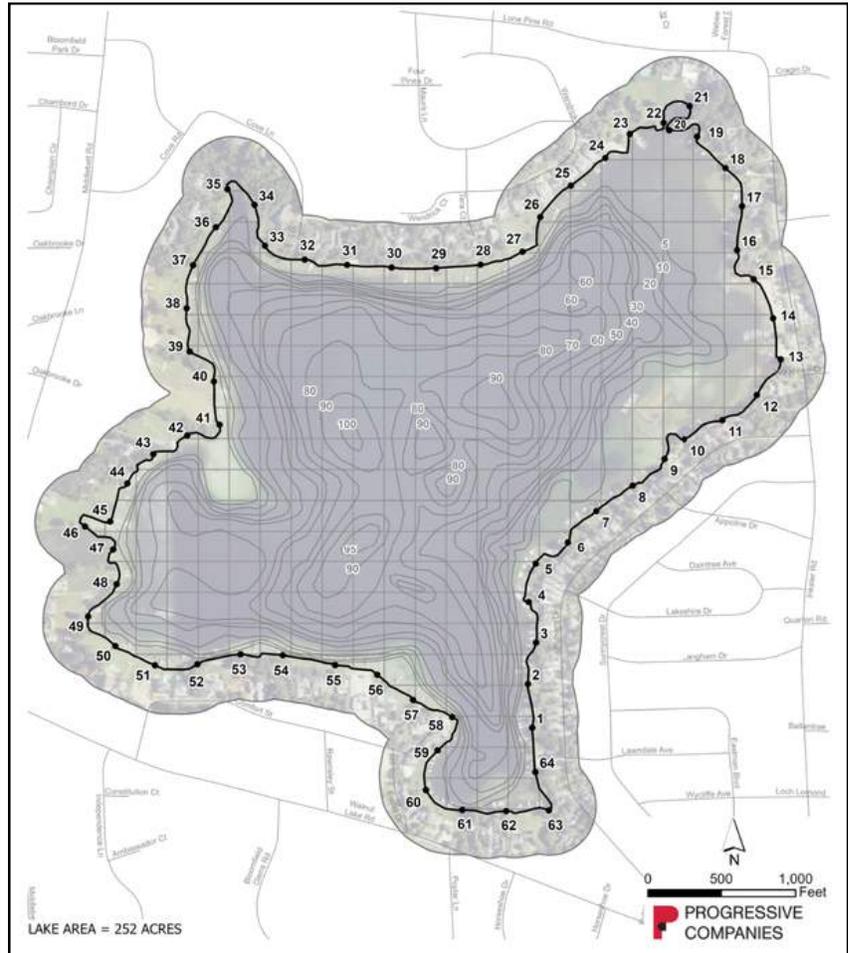


Figure 11. Walnut Lake aquatic plant survey map.

Primary invasive plants observed in Walnut Lake included Eurasian milfoil, flowering rush, and starry stonewort. These are non-native (exotic) species and have the potential to spread quickly if left unchecked. Plant control activities conducted on the lake between 2022-2024 are summarized in Table 4.

PLANT CONTROL REVIEW

TABLE 4. WALNUT LAKE 2022-2024 PLANT CONTROL ACTIVITIES

Date	Plants Targeted	Herbicide	Acreage
June 7, 2022	E. milfoil, curly-leaf	Florpyrauxifen-benzyl, diquat	13.50
July 21, 2022	E. milfoil, nuisance natives	Diquat, endothall	15.00
August 18, 2022	E. milfoil, algae	Florpyrauxifen-benzyl, diquat, copper	6.00
Total			34.50
May 23, 2023	E. milfoil , curly-leaf	Florpyrauxifen-benzyl, diquat	18.50
June 7, 2023	E. milfoil	Diquat	7.50
July 11, 2023	E. milfoil, nuisance natives	Diquat, endothall	15.00
August 17, 2023	E. milfoil, nuisance natives, starry, algae	Diquat, endothall, copper	7.50
Total			48.50
May 16, 2024	E. milfoil, curly-leaf	Florpyrauxifen-benzyl, diquat	12.50
July 8, 2024	E. milfoil, nuisance natives	Diquat, hydrothol	17.50
August 8, 2024	E. milfoil, nuisance natives, starry, algae	Diquat, endothall, hydrothol, copper	25.00
September 26, 2024	Water lillies	Glyphosate	0.18
Total			55.18

Since 2022, the total treatment area of the lake has increased by 60%. Although the systemic herbicide florpyrauxifen-benzyl has been applied annually and usually yields season-long control, large areas of Eurasian milfoil have been treated with contact herbicides, usually after the initial May treatment. This approach has led to seasonal regrowth, resulting in retreatment each year. In addition, large-scale management of native pondweeds have been conducted each July using a combination of broad-spectrum contact herbicides. Algae treatments have been minimal, limited primarily to larger areas infested with starry stonewort, an invasive macroalga. Treatments have been conducted monthly throughout the growing season year over year, often in the same locations around the lake.

PLANT INVENTORY SURVEY

In addition to the surveys of the lake to identify invasive plant locations, a detailed vegetation survey of Walnut Lake was conducted on September 22 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, 12 submersed species, one floating-leaved species, and five emergent species were found in the lake. Walnut Lake maintains a moderate diversity of beneficial native plant species.

TABLE 5. WALNUT LAKE 2025 PLANT INVENTORY DATA

Common Name	Scientific Name	Group	Percentage of sites where present
<i>Chara</i>	<i>Chara</i> sp.	Submersed	94
Wild celery	<i>Vallisneria americana</i>	Submersed	83
Illinois pondweed	<i>Potamogeton illinoensis</i>	Submersed	60
Variable pondweed	<i>Potamogeton gramineus</i>	Submersed	44
Slender naiad	<i>Najas flexilis</i>	Submersed	40
Large-leaf pondweed	<i>Potamogeton amplifolius</i>	Submersed	27
Eurasian milfoil	<i>Myriophyllum spicatum</i>	Submersed	21
American pondweed	<i>Potamogeton americanus</i>	Submersed	13
Starry stonewort	<i>Nitellopsis obtusa</i>	Submersed	13
Coontail	<i>Ceratophyllum demersum</i>	Submersed	6
Thin-leaf pondweed	<i>Potamogeton</i> sp.	Submersed	3
Flat-stem pondweed	<i>Potamogeton zosteriformis</i>	Submersed	2
White waterlily	<i>Nymphaea odorata</i>	Floating-leaved	49
Flowering rush	<i>Butomus umbellatus</i>	Emergent	33
Cattail	<i>Typha</i> sp.	Emergent	6
Swamp loosestrife	<i>Decodon verticillatus</i>	Emergent	6
Bulrush	<i>Schoenoplectus</i> sp.	Emergent	3
Lake sedge	<i>Carex lacustris</i>	Emergent	3

Exotic invasive species

BIOBASE MAPPING

In addition to determining plant type and abundance, hydro-acoustic soundings were collected during the survey on September 22 to measure plant bio-volume (i.e., the height of the plants in the water column). When plants grow to the surface, they occupy 100% of the water column, and those areas are shown in red on the map. When plants are not present, 0% of the water column contains plants, and those areas are shown in blue. When plants grow half-way to the surface, they occupy 50% of the water column, and are shown in yellow. Most of Walnut Lake's shoreline is shown in green indicating moderate growth at the time of the survey.

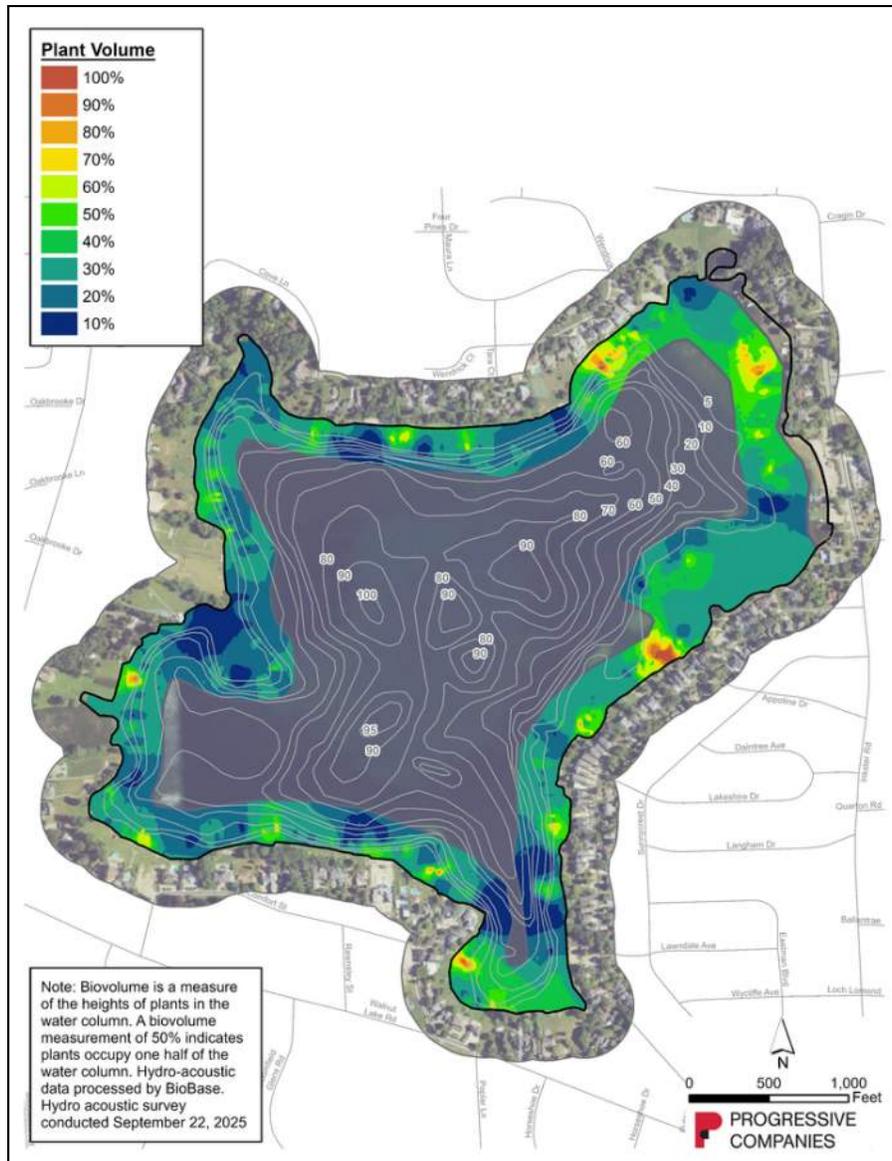


Figure 12. Walnut Lake Biovolume Map

RECOMMENDATIONS

Walnut Lake currently exhibits good water quality capable of supporting a cold-water fishery. Based on the samples collected and historical data, Walnut Lake would be classified as an Oligotrophic or borderline Mesotrophic system. General water quality monitoring should be conducted periodically (every 3–5 years), focusing on total phosphorus, chlorophyll-a, and chlorides. Additionally, summer temperature and dissolved oxygen profiles should be measured annually, particularly if stocking of cold-water species such as trout is being considered. Local residents can contribute valuable data through the Cooperative Lakes Monitoring Program (CLMP) by recording Secchi disk transparency readings on a bi-weekly basis. This will help build a more sufficient dataset and improve understanding of water clarity fluctuations in Walnut Lake. Residents are also encouraged to implement shoreland best management practices to minimize nutrient and pollutant inputs (see Appendix B for guidance).

Aquatic plant management should be limited to controlling exotic invasive species. Eurasian milfoil should be treated using selective systemic herbicides. Considering past treatment results and the September survey findings, alternative systemic products should be utilized to maintain effectiveness and prevent herbicide tolerance. Triclopyr is a suitable systemic option for milfoil control and should be considered for the 2026 season. Flowering rush should be managed early in the growing season to minimize impacts on native aquatic vegetation. The use of copper and Hydrothol products should be minimized and restricted to areas with stary stonewort and nuisance algae.

Walnut Lake is a unique high quality system that is the only documented whitefish lake in southern Michigan. Steps should be taken to preserve habitat for this species by limiting herbicide treatments and nutrient inputs and exploring the use of green infrastructure methods to better manage stormwater inputs (see Appendix B - Riparian stormwater article)

Finally, retaining a third party environmental consultant to oversee the plant management and water quality monitoring programs for Walnut Lake is strongly encouraged. Third-party oversight will help ensure that the program remains both cost-effective and environmentally responsible. Consultant responsibilities would include conducting aquatic plant surveys, developing treatment plans, contractor coordination, and providing administrative support for ongoing project management. A proposed management plan and associated cost estimates are provided below in Table 6.

TABLE 6. WALNUT LAKE 2026-2031 MANAGEMENT RECOMMENDATIONS

Year	Management	Estimated Cost
2026	Lake Management Consulting	\$9,500
	<ul style="list-style-type: none"> • Plant control oversight (contractor coordination, surveys, treatment plans) • Project administration (budget management, information and education) Aquatic Herbicide Treatments	\$45,000
2027-2030	Lake Management Consulting	\$9,500
	<ul style="list-style-type: none"> • Plant control oversight (contractor coordination, surveys, treatment plans) • Project administration (budget management, information and education) Aquatic Herbicide Treatments	\$45,000
2031	Lake Management Consulting	\$13,500
	<ul style="list-style-type: none"> • Plant control oversight (contractor coordination, surveys, treatment plans) • Water quality monitoring • Project administration (budget management, information and education) Aquatic Herbicide Treatments	\$45,000

APPENDIX A

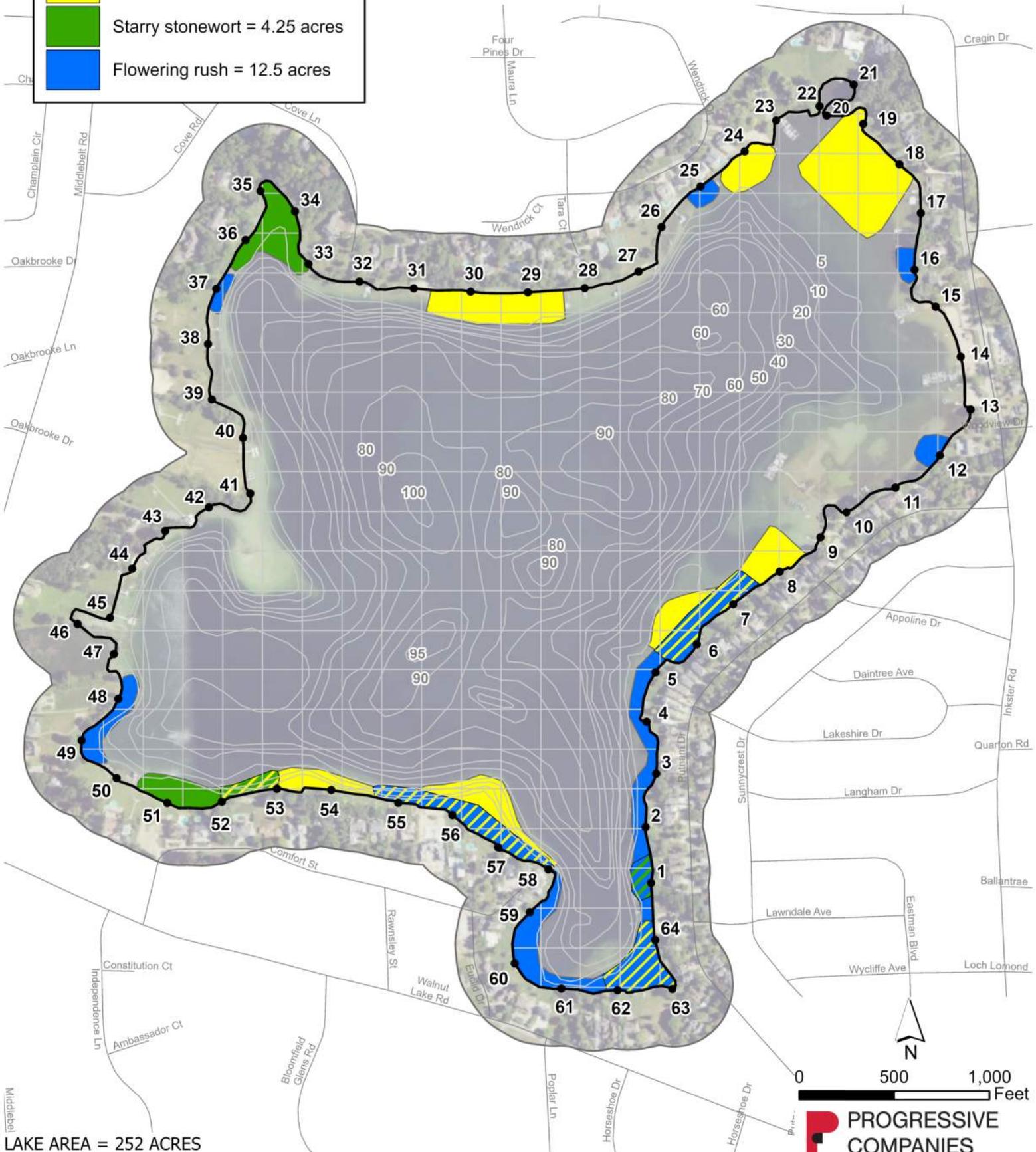
MAPS AND FIGURES

WALNUT LAKE OAKLAND COUNTY, MICHIGAN NON-NATIVE PLANT DISTRIBUTION MAP SURVEY DATE: SEPTEMBER 22, 2025

□ = 1 ACRE

Legend

- Non-native milfoil = 19.5 acres
- Starry stonewort = 4.25 acres
- Flowering rush = 12.5 acres

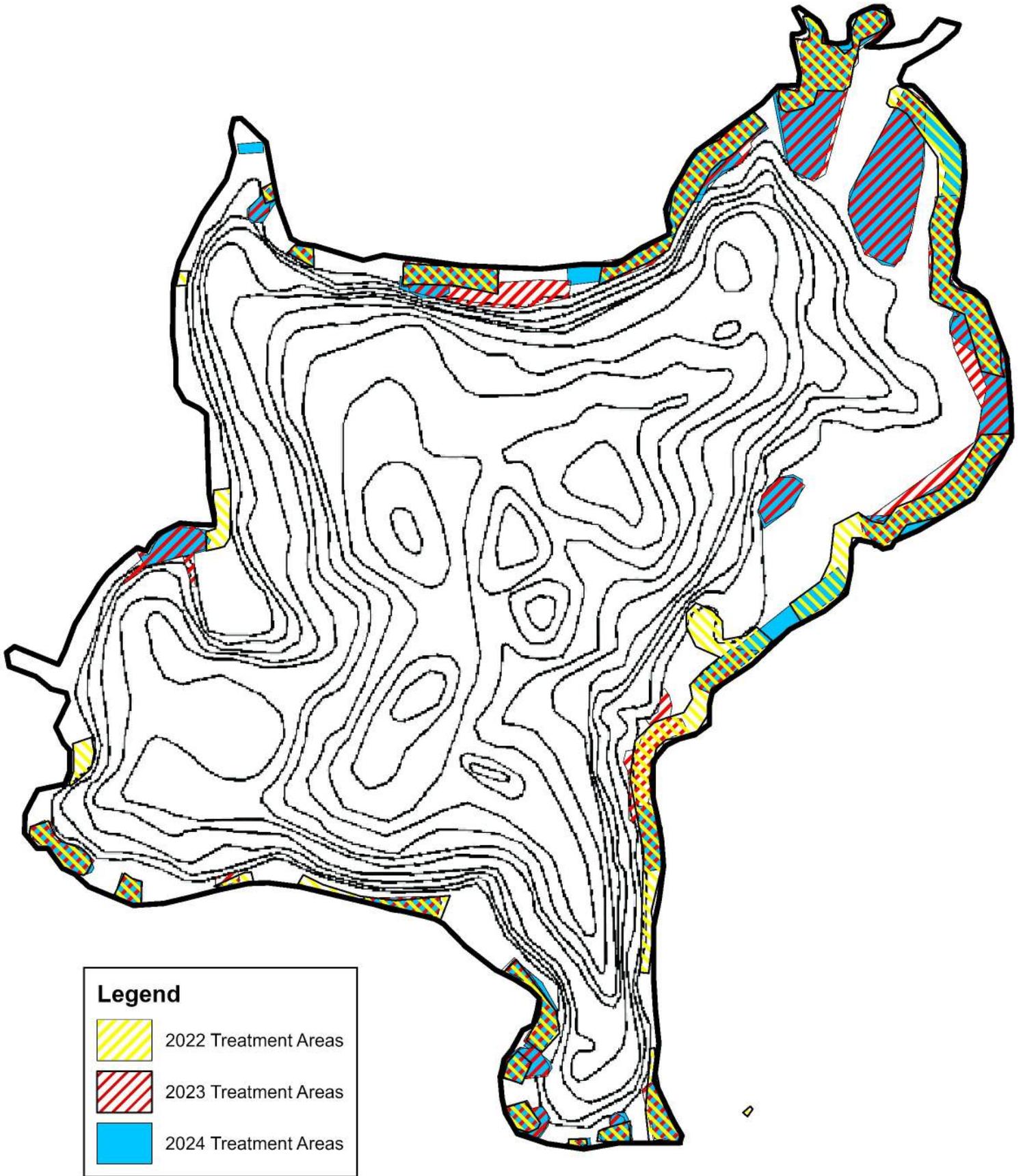


LAKE AREA = 252 ACRES

0 500 1,000
Feet

PROGRESSIVE COMPANIES

WALNUT LAKE
OAKLAND COUNTY, MICHIGAN
2022-2024 TREATMENT AREAS



Legend

-  2022 Treatment Areas
-  2023 Treatment Areas
-  2024 Treatment Areas

LAKE AREA = 252 ACRES

APPENDIX B

GUIDES AND FACT SHEETS



Shorelands Management

What lakefront property owners should know and do

By Progressive AE

Proper shoreland management is vital to protect both water quality and fisheries. During pre-settlement days, much of the shoreland around lakes was forested, wetlands, or grassland. Natural habitat was abundant. Over time, as shorelands were developed, much changed. Shoreland vegetation was removed, and natural areas that allowed rain waters to infiltrate were replaced by rooftops, roads, driveways, and other hard surfaces. Now, rather than infiltrating, storm water runs off these hard surfaces, often carrying fertilizer, oil, and other pollutants to the lake. Problems associated with excessive shoreland development include increased aquatic plant growth, diminished fisheries, and poor water quality. How we manage our shorelands can have a direct and profound impact on the quality of our lakes.

Protecting shorelands is straightforward: Maintain or restore as much natural shoreland as possible. That is not to say that you can't—or shouldn't—have an area to swim, moor boats, fish or lounge by the shore. However, manicured lawn to the water's edge and boundless seawalls are not conducive to healthy lakes, nor is large-scale removal of aquatic vegetation.

In addition to protecting or restoring natural shoreland, you should also be careful about the application of lawn fertilizers, especially fertilizers containing phosphorus. Phosphorus is the nutrient that most often stimulates excessive growth of aquatic plants and causes premature lake aging. Fertilizers should only be used sparingly near lakes, if at all. If you must use fertilizer, only use a phosphorus-free fertilizer. Once in the lake, a pound of phosphorus can generate hundreds of pounds of aquatic vegetation. This vegetation is most evident in the near-shore areas of the lake where we swim and recreate.

Take a look at the following illustrations. Then take a look at your shoreland and see what you can do to help preserve the natural features of your lake.



Look for the middle number!
A zero in the middle means phosphorus free!

Minimize lawn area. Less turf means less fertilizer, less pesticides—and less mowing! It's better for the lake and easier on you.



Establish a greenbelt along your waterfront. A greenbelt will trap pollutants, provide wildlife habitat, and help prevent shoreline erosion.

Caring for Your Shoreland

Your shoreland can be maintained to provide beach and boat access for you while maintaining habitat for fish and wildlife.

Don't dump into storm drains; pollutants may be piped directly to the lake.

Most lakeside soils have more than enough phosphorus to grow lawns, trees, and shrubs. Adding phosphorus fertilizer is usually not necessary, and can cause excessive growth of aquatic plants.

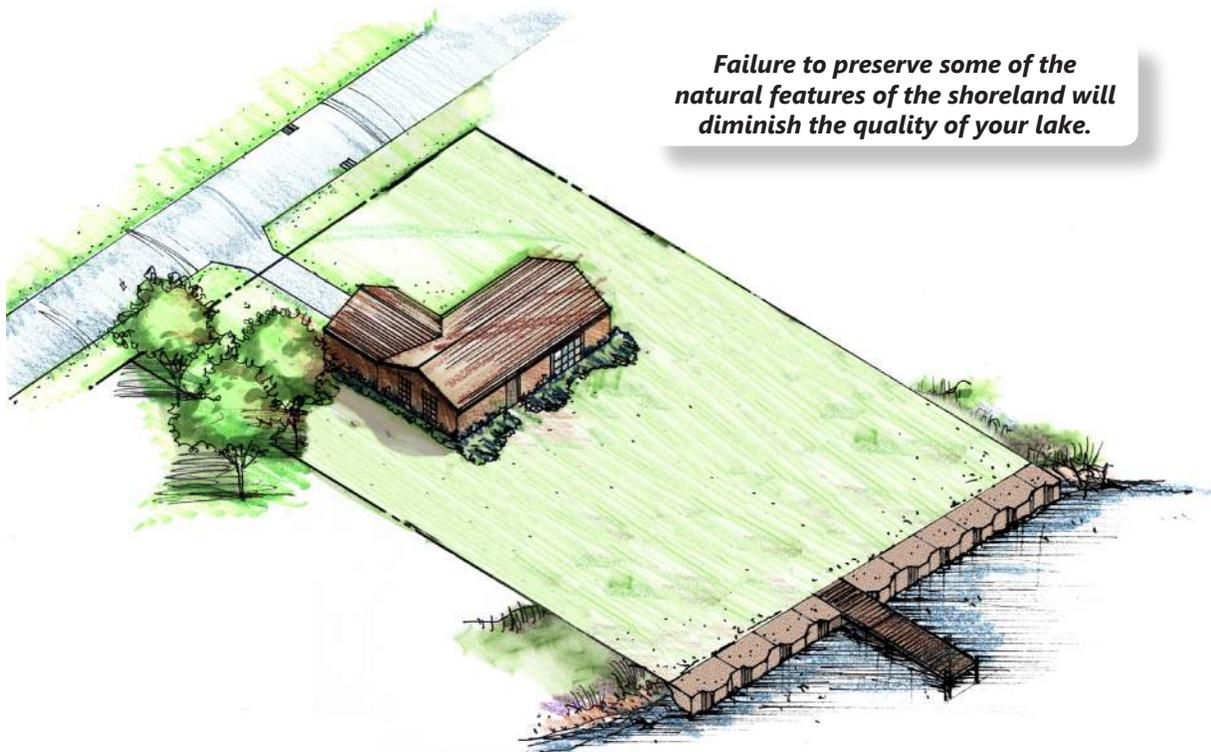
Maintain a greenbelt of trees, shrubs, and ground cover—it's habitat for fish and wildlife, and helps protect water quality too.

Build a raingarden to infiltrate rain water and reduce runoff into the lake. Visit www.raingardens.org.

Minimize lawn area to reduce the need for fertilizer.

Establish a greenbelt to filter runoff and discourage nuisance geese.

You can maintain a small beach and dock area—it's "habitat" for you!



Failure to preserve some of the natural features of the shoreland will diminish the quality of your lake.

Aquatic plants are part of a healthy lake. They produce oxygen, provide food and habitat for fish, and help to stabilize shoreline and bottom sediments.

Insects and other invertebrates live on or near aquatic plants, and become food for fish, birds, amphibians and other wildlife.

Plants and algae are the base of the food chain. Lakes with a healthy fishery have a moderate density of aquatic plants.

Aquatic plants provide habitat for fish and other aquatic life.

Aquatic plants help to hold sediments in place and improve water clarity.

Roots and stones absorb wave energy and reduce scouring of the lake bottom.

Predator-fish such as pike hide among plants, rocks, and tree roots to sneak up on their prey. Prey-fish such as minnows and small sunfish use aquatic plants to hide from predators.

Trees and shrubs prevent erosion and provide habitat.

progressive|ae

Seawalls deflect waves and cause scouring of the lake bottom.

Scouring of the lake bottom reduces water clarity.

The nuisance exotic plant Eurasian milfoil often invades disturbed lake bottoms, such as areas along seawalls.

Excessive plant control reduces habitat, impairs water quality and is not healthy for the lake.

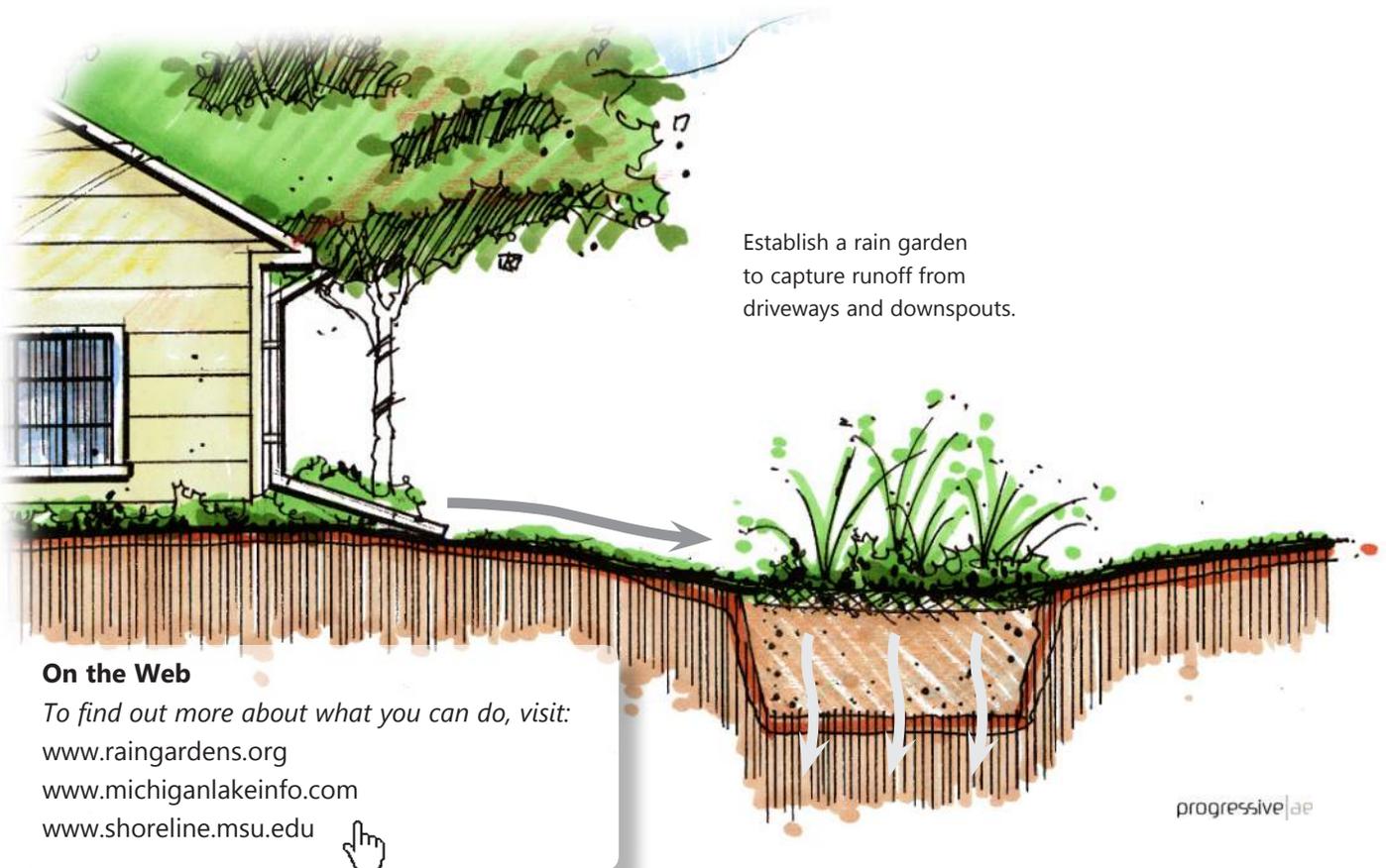
Seawalls do not provide habitat for fish or other aquatic life.

Seawalls prevent the migration of frogs and other amphibians to shore.

progressive|ae

10 Ways To Protect Your Lake

1. Don't use lawn fertilizer that contains phosphorus. If you use a professional lawn care service, insist upon a fertilizer that does not contain phosphorus.
2. Use the minimum amount of fertilizer recommended on the label — more is not necessarily better!
3. Water the lawn sparingly to avoid washing nutrients and sediments into the lake.
4. Don't feed ducks and geese near the lake. Waterfowl droppings are high in nutrients and may cause swimmer's itch.
5. Don't burn leaves and grass clippings near the shoreline. Nutrients concentrate in the ash and can easily wash into the lake.
6. Don't mow to the water's edge. Instead, allow a strip of natural vegetation (i.e., a greenbelt) to become established along your waterfront. A greenbelt will trap pollutants and discourage nuisance geese from frequenting your property.
7. Where possible, promote infiltration of stormwater into the ground. Build a rain garden to capture runoff from driveways and downspouts.
8. Don't dump anything in area wetlands. Wetlands are natural purifiers.
9. If you have a septic system, have your septic tank pumped every 2 to 3 years.
10. Don't be complacent — your collective actions will make or break the lake!



On the Web

To find out more about what you can do, visit:

www.raingardens.org

www.michiganlakeinfo.com

www.shoreline.msu.edu



AQUATIC HERBICIDES FACT SHEET

Created by Progressive Companies / Water Resources Group

Prevention is the first defense in exotic species control. However, once an exotic plant has colonized a lake, a rapid response should be taken to control its spread. One such response is the use of aquatic herbicides.

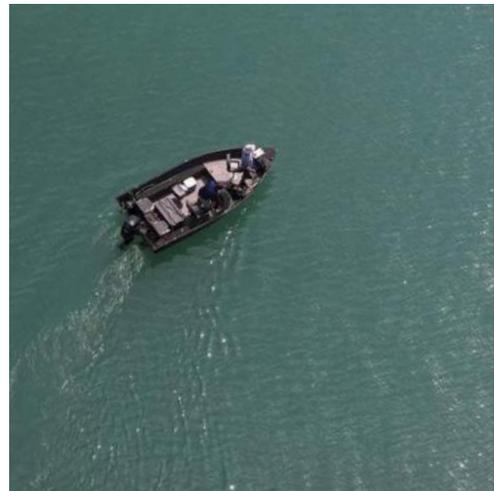
In Michigan, a permit is required from the Michigan Department of Environment, Great Lakes, and Energy (EGLE) to apply herbicides to lakes. The permit lists the herbicides that are approved for use, respective dose rates, use restrictions, and indicates specific areas of the lake where treatments are allowed. EGLE aquatic herbicide permitting information can be found at <https://www.michigan.gov/egle/about/organization/water-resources/aquatic-nuisance-control>.

Prior to being applied to Michigan's inland lakes, herbicides must be registered and approved by the Environmental Protection Agency (EPA). There are currently over 300 herbicides registered with the EPA. Of those, only about a dozen are approved for use in the aquatic environment. In addition to Michigan's permitting system, there are federal regulations that require herbicide applicators to acquire a pesticide general permit and to prepare and submit a pesticide discharge management plan. Herbicide applicators must also obtain a pesticide applicator certification through the Michigan Department of Agriculture and Rural Development (MDARD) prior to applying aquatic herbicides.

There are two basic types of herbicides: systemic and contact. Systemic herbicides are taken up by the plant and translocated to the root system killing the plant entirely. With systemic herbicides, it may take several weeks for the impacts to the treated plants to become apparent. Contact herbicides act quickly, impacting plants within a week after treatment, but only affect the portion of the plant that comes into contact with the herbicide, leaving the roots intact and viable. This allows the plants to reestablish more quickly, allowing them to potentially grow to nuisance levels again later in the season.



Eurasian milfoil (*Myriophyllum spicatum*).



Aquatic plant survey.

Unlike systemic herbicides that are selective in controlling invasive plants like Eurasian milfoil, contact herbicides can impact a broad spectrum of plant species, but timing and rate of application can be used to minimize non-target impacts. Deciding which herbicide to use in a particular situation will depend on the plant(s) being targeted, potential impacts to non-target species, cost, use restrictions, and other factors. In general, herbicide treatments should target nuisance exotic species such as Eurasian milfoil and starry stonewort and have minimal impacts on most native plant species.

If applied properly, herbicides have no direct impacts on fish or other aquatic animals. Herbicides approved for aquatic application disrupt a variety of plant-specific processes including cell growth, DNA synthesis, photosynthesis, and enzyme production. In general, lakes with a variety and moderate density of plants often support healthy fisheries. Targeting invasive exotic plants with herbicides aids in the preservation of valuable, native plants that provide habitat and cover for fish and other aquatic organisms.

The best approach or combination of approaches to control aquatic plants in a particular lake depends on local conditions and the expectations of lake residents. Once an exotic plant has been introduced in a lake, a complete eradication is unlikely and a sustained effort is often required to ensure control. Ask your lake management consultant about the best way to manage the aquatic plants in your lake.



Systemic herbicide.



Starry stonewort (*Nitellopsis obtusa*).

A reliable resource for information on Michigan's inland lakes.

ROAD SALT: IMPACTS ON LAKES FACT SHEET

Created by Progressive Companies / Water Resources Group

Each year approximately two million tons of road salt are applied to Michigan's ice-covered roads by public agencies.¹ Individual use of salt on driveways, sidewalks, and parking lots would likely inflate this number considerably, if quantified. While the extent of the environmental effects associated with the use of road salt come into focus, Michigan's waterways appear to be facing a growing problem.

The most commonly used form of road deicer is Sodium chloride (NaCl), the same compound as table salt, but in larger granules called rock salt. Concerns over the use of rock salt have been met with somewhat safer but considerably more costly alternatives such as Magnesium chloride (MgCl₂) and Calcium chloride (CaCl₂). Chlorides can have detrimental ecological effects to freshwater systems at high concentrations. In August 2019, the Michigan Department of Environment, Great Lakes, and Energy (EGLE) established water quality values (WQV) for chloride to describe the impacts to aquatic life at different concentrations. EGLE set the final chronic value (FCV) for chloride at 150 milligrams per liter (mg/L), stating that long-term exposure above this concentration can be harmful to aquatic life such as fish and invertebrates.²

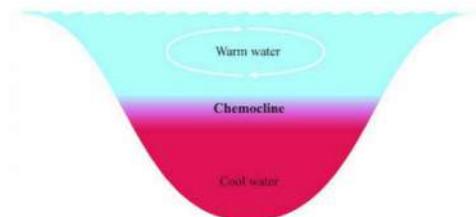
The adverse impacts to lakes as a result of road salt inputs extend beyond immediate biological concerns. Because water density increases with salinity, chloride can accumulate in a lake's bottom waters and increase to levels significantly higher than surface water concentrations. Lakes that receive higher inputs of chloride may form a chemocline, or chemical gradient, between the surface and deeper water. This strong barrier to mixing can prevent a lake from fully turning over in the spring and fall. In deeper lakes, mixing is essential for re-oxygenating the bottom waters prior to the thermal stratification that takes place in the summer and winter. If a lake is unable to turn over, the deep water will remain oxygen-depleted. As a result, phosphorus, the nutrient that most often regulates aquatic plant and algae growth, will be released from the sediments year-round. Further, cold water fish such as trout and whitefish are unable to survive without sufficiently oxygenated deep water.

Chloride levels can be monitored by collecting samples throughout the water column. If a lake's watershed contains roads that are regularly salted during the winter it is recommended to monitor chloride levels. Ask your lake management consultant about the threat chloride may pose to your lake.

References:

1 Cornwell, M. 2011. Michigan Road Salt: What is it costing Us? Michigan Science. 16.

2 EGLE. 2019. Chloride and Sulfate Water Quality Values Implementation Plan.



High chloride inputs can result in a chemocline, preventing lake mixing.



THE ROLE OF THE CONSULTANT IN LAKE MANAGEMENT



Progressive Companies / Water Resources Group

January 2025

No one knows or appreciates your lake more than you, but hiring a consultant might be just the ticket to go beyond simply loving your lake to properly managing it. Lake residents often have many questions about managing their lake. What should be done? What will it cost? What is a reasonable expectation of success? Who should be involved? How do we get there? Who pays? Who decides? What is the return on our investment? A consultant can help answer all of these questions.

The role of the consultant is to provide professional and unbiased advice regarding lakes and lake management. The consultant will often begin with a study to evaluate the characteristics of the lake and watershed, and the feasibility and costs of management alternatives. The study is important because it becomes the basis for decision-making and development of a lake management plan. A lake consultant should have a fundamental understanding of limnology (the study of the physical, chemical and biological characteristics of lakes), land use issues, environmental regulations, lake and watershed management techniques, contracting, public relations and, last but not least, municipal financing.

On some projects, engineering and legal expertise may be needed as well. Once the plan is defined, the consultant can assist with its implementation. Throughout development and implementation of the lake management plan, the consultant can:

- Identify management alternatives that will work and those that will not.
- Define expected outcomes of management alternatives and perhaps temper unrealistic expectations.
- Identify valid and effective sampling and monitoring protocols, perform appropriate analyses, and interpret technical data.
- Guide the decision-making process and help build consensus around environmentally-sound and cost-effective management alternatives.
- Perform cost-benefit analyses.



- Define regulatory hurdles and financing alternatives.
- Assist with the organization and financing aspects of the project.
- Prepare plans, specifications, and bidding documents for contract work.
- Coordinate and evaluate contract work.

A consultant is different from a contractor you may hire to perform a specific service on a lake, such as herbicide treatments, mechanical harvesting, weevil stocking, etc. A consultant will look at a number of alternatives, evaluate the pros and cons of each, and make a recommendation accordingly. To be truly objective, the consultant should be independent from the contractor and contract work. Beyond providing professional services, the consultant should have no financial interest in the management techniques being employed for the project.

A consultant can bring a wealth of knowledge and experience to the table and can help ensure that your lake management plan achieves its stated objectives. Lake residents tend to be very passionate about their lake. Developing and implementing a proper management plan may be the best investment you make in your lake. Retaining a consultant to assist with the lake management plan can help you get the most bang for the buck.



About the Authors:

For over 40 years, Progressive’s Water Resources Group has provided professional lake and watershed management services to communities across Michigan. The Water Resources Group created MichiganLakeInfo.com, a website for those interested in Michigan’s inland lakes. On the site you can find this article and information on topics such as lake water quality, lake and watershed management, aquatic biology, emerging issues, invasive species and more.

A reliable resource for information on Michigan's inland lakes.



michiganlakeinfo
michiganlakeinfo.com



STORMWATER AND LAKES

MANAGING THE RUNOFF IN A CHANGING REGIONAL CLIMATE



CARRIE RIVETTE, P.E. | PROGRESSIVE COMPANIES

PAUL HAUSLER | PROGRESSIVE COMPANIES

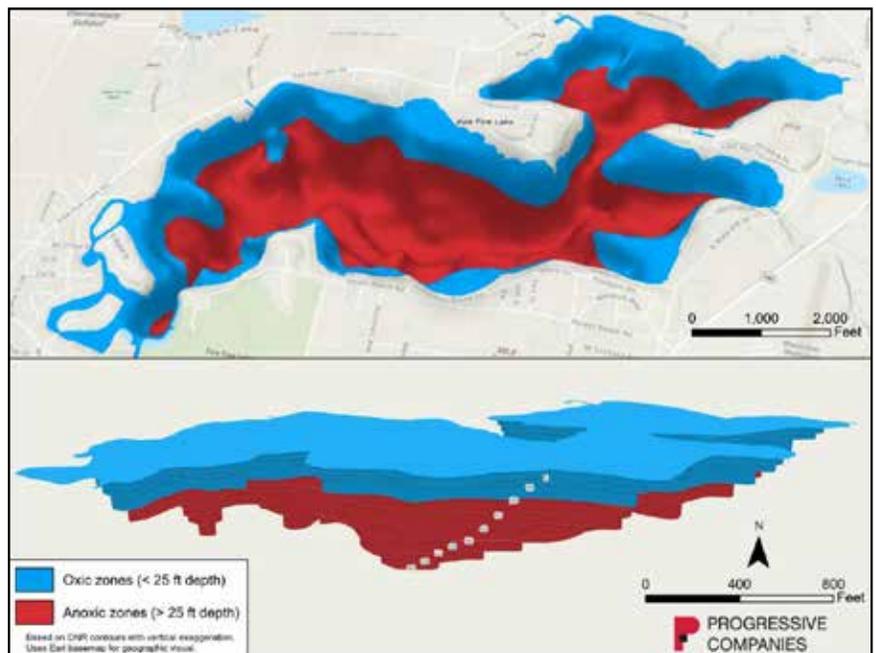
These days, most lakefront homeowners are aware that their actions can affect the water quality in their lakes. However, lakes connected to storm sewer discharges are facing additional issues that can't be resolved by lakefront homeowners' actions alone. Lakes in more urban areas are dealing with runoff from streets, parking lots, and yards carried by stormwater. Stormwater is typically one of the major sources of pollutants to lakes, second only to septic seepage which has already been addressed by many urban lakes by installing collection sewers. These collection sewers provide offsite treatment of wastewater. This article is intended to provide an update on sources of stormwater contaminants and their impacts on lakes, especially with rainfall frequency and intensity changing.

Precipitation comes in many forms: rain, snow, sleet, freezing rain, or hail, and is the primary source of atmospheric water that replenishes water bodies, groundwater, and soil. Infiltration is the process by which water on the unpaved ground soaks into the soil. The rate and extent of infiltration depend on factors like soil composition, vegetative cover, land slope, and existing soil moisture levels. For instance, coarse-textured soils with large, well-connected pore spaces tend to have higher infiltration rates than fine-textured soils. Runoff occurs when the rate of precipitation exceeds the soil's capacity to absorb water, leaving excess water to flow over the land surface. This surface runoff can travel over the ground and through channels and storm sewer pipes, eventually reaching streams, rivers, and lakes. Like infiltration, factors influencing runoff include soil saturation, land slope, and land use. Urban streams experience reduced infiltration and consequently, higher runoff, thanks to impervious surfaces like roads, sidewalks, parking lots, and buildings.

Runoff can often pick up and deliver contaminants to a waterbody (either directly to the lake or transported via a stream, stormwater outfall pipe, or tributary that empties into the lake). As runoff increases, it can transport a higher percentage of contaminants into the lake, potentially causing degradation through loss of habitat, loss of biodiversity, and an increase in surface water temperatures. In addition, the excess nutrients typically found in runoff can fuel the growth of nuisance and harmful algal blooms. Contaminants typically found in runoff include fertilizers, pet and avian waste (often containing *E. coli* bacteria), pesticides, household chemicals, road salt, sediment, oil and grease, and various cleaners/detergents.

Excessive nutrients and sediment in runoff can also lead to a decrease in oxygen in lakes due to an increased biological oxygen demand as bacteria consume oxygen while decomposing organic material in the lake. This

(CONTINUED ON PAGE 27)



depletion poses a threat to aquatic life that depends on sufficient dissolved oxygen levels for survival (USGS.gov). The diagram below illustrates the portion of Paw Paw Lake that experienced anoxia (the loss of oxygen in the deeper unmixed portions of a lake) in the summer of 2024. Anoxia, besides impacting organisms which require oxygen to live, can trigger chemical reactions that release nutrients, like phosphorus from sediments back into the water column, where it is available for algal growth. Additionally, anoxia can create a positive feedback loop, where the lack of oxygen leads to conditions that further deplete oxygen levels, exacerbating the problem over time.

According to the 2023 update of *Rainfall to Results: The Future of Stormwater* by the Water Environmental Foundation, “Stormwater is the only growing source of water pollution in many watersheds throughout North America. More than half the world’s population lives in cities, and urbanization is increasing. The combination of urbanization and climate change exacerbates stormwater pollution.... To put this issue in the context of environmental effects, in 1970, 85% of water quality impairments were associated with point-source pollution. The remaining 15% came from nonpoint sources such as agricultural and urban stormwater. Today, after significant advancements in wastewater treatment, these values have flipped—85% of impairments now stem from nonpoint and urban stormwater discharges (Brown, 2017).”

REGIONAL PRECIPITATION

According to a detailed report by the Great Lakes Integrated Sciences and Assessment Center (GLISA) entitled “Historical Climate and Climate Trends in the Midwestern USA,” overall mean temperatures have been gradually climbing since 1900 and the most recent period (1979– 2010) has shown an accelerated rise of 0.26 degrees Celsius per decade from the previous measured period (1950 – 1978) where it was 0.12 degrees Celsius, based on data obtained from the CRUTEM3 data set (Brohan et al., 2006). Also from this report, overall annual precipitation in Michigan has remained the same since 1981 but has increased by 0.04 inches per year during this time frame in winter and 0.033 inches per year during spring. This data suggests that episodic events have become more intense, and the frequency of intense precipitation has increased during these time frames (winter/spring). Warming temperatures during winter have resulted in more runoff and a reduction

in the annual coverage of Great Lakes ice. The increased precipitation during the winter months is likely correlated with the reduction in Great Lakes ice cover, allowing for more frequent and intense “lake effect” precipitation events.

MITIGATING RUNOFF

Constructed green infrastructure, or Low Impact Development (LID) practices help to manage runoff where it lands by increasing infiltration and filtration properties in an area. They generally slow the runoff down and provide it an opportunity to infiltrate into the ground, thus recharging the groundwater, cooling the water and allowing it to reach surface water bodies more slowly, reducing the erosion of sediment into the surface water. Many pollutants are also filtered out through the soil.

In addition, many green infrastructure practices utilize native plants. Native plants have long root structures that require less water and uptake more water during and immediately following precipitation events. They also slow the water further and filtrate pollutants as the water flows through them.

Standard green infrastructure practices are listed below:

- **RAIN GARDENS AND BIOSWALES**

Rain gardens and bioswales are areas where depressions are created in the ground and feature high porosity soils to allow the water to infiltrate. Most rain gardens also use native plantings to increase filtration and increase water uptake.

- **NATURAL SHORELINES AND FILTER STRIPS**

Natural shorelines typically consist of native plantings and do not utilize hard banks or seawalls. The plants assist in stabilizing the soil. In addition, if the plants are not mowed, they serve as a filter strip cleaning the runoff before it reaches the surface water. Finally, an unmowed vegetative filter strip will deter geese from occupying the area and reduce the potential for bacteria to enter the surface water from their feces.

- **DAYLIGHTING OUTFALLS AND BUFFER STRIPS**

Daylighting outfalls is the practice of opening up an enclosed storm sewer pipeline and creating a naturalized stream channel. Again, this slows the water down and allows it to infiltrate into the soils below. Like in rain gardens, native plantings are usually utilized to

STORMWATER AND LAKES

(CONTINUED FROM PAGE 27)

uptake additional water and filter/settle out pollutants. These daylighted streams are also beneficial to native wildlife and provide aesthetic appeal.

● PERMEABLE PAVEMENT

Permeable pavement can consist of asphalt, poured concrete, or concrete block. All of these permeable pavement types feature either pore space or spaces between the blocks which allow water to drain through. They are laid over a gravel base and sand subbase that will infiltrate the water. This reduces runoff and filters out pollutants. In addition, permeable pavement can reduce both icing in the winter and puddles in the warmer months. The blocks can also provide aesthetic appeal.

● LEACHING CATCH BASINS

Leaching catch basins or storm drains appear like a regular storm drain on the surface. Below the surface, however, the structure has a gravel bottom and holes on the sides, surrounded by gravel. Again, in areas of porous soils, this will slow the water, filter pollutants, and allow for infiltration.

● MECHANICAL FILTERS

Mechanical filters are offered in a variety of styles. They are typically underground vaults that use baffles or a swirling effect to settle out sediment and keep floatables (petroleum or plastics) on top where they can be skimmed off or bypassed, improving water quality before it's discharged.

FUNDING SOURCES

In Michigan, several funding sources are available to address stormwater management, supporting projects aimed at improving water quality, reducing flooding, and implementing green infrastructure solutions. Here are some key funding sources:

1. STATE REVOLVING FUND (SRF) PROGRAMS

- **Clean Water State Revolving Fund (CWSRF)**
This fund provides low-interest loans to municipalities, counties, and other public entities for stormwater management and water quality improvement projects. The CWSRF is typically used for infrastructure projects related to water pollution control.
- **Drinking Water State Revolving Fund (DWSRF)**
While primarily for drinking water projects, this fund can sometimes be used for stormwater treatment systems that protect water supplies.

- **Stormwater Management Fund (under CWSRF)**
This fund is specifically targeted at stormwater infrastructure, helping communities address runoff, flooding, and water quality.

2. MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY (MDEQ) GRANTS

- The Michigan Department of Environment, Great Lakes, and Energy (EGLE) offers various grants, such as the **Nonpoint Source Program** which funds stormwater management projects that address pollution runoff from nonpoint sources.
- EGLE also administers competitive **stormwater management grants** through various programs, particularly those related to Great Lakes protection, reducing runoff, and enhancing water quality.

3. GREAT LAKES RESTORATION INITIATIVE (GLRI)

- Funded by the U.S. Environmental Protection Agency (EPA), the GLRI supports projects that improve water quality and protect the Great Lakes. It often funds projects aimed at controlling stormwater runoff and reducing pollution in the watershed areas of the Great Lakes.

4. MICHIGAN NATURAL RESOURCES TRUST FUND (MNRTF)

- This fund primarily supports land acquisition, recreation, and conservation projects but can be used for stormwater management efforts, particularly those that focus on green infrastructure, wetlands restoration, or watershed protection.

5. MICHIGAN COASTAL MANAGEMENT PROGRAM (MCMP)

- Focused on projects along Michigan's coastal areas, MCMP supports stormwater management projects that reduce pollution runoff into lakes, rivers, and streams, particularly projects tied to coastal ecosystems.

6. LOCAL STORMWATER UTILITY FEES AND BONDING

- Several Michigan communities have implemented stormwater utility fees to fund local stormwater management systems. These fees can be used to by the utility to address infrastructure needs and are often complemented by bonding or other forms of local financing for larger projects. The utilities may also

(CONTINUED ON PAGE 29)

incentivize the use of green infrastructure through reduced fees and rebates. If you pay a stormwater fee, check to see if your local stormwater utility offers incentives for green infrastructure.

7. EPA AND OTHER FEDERAL GRANTS

- In addition to the GLRI, the U.S. Environmental Protection Agency (EPA) offers various federal grants for stormwater and water quality management. Some are available to states, municipalities, or non-profit organizations working on stormwater solutions.

8. REGIONAL AND LOCAL SOURCES

- **Regional Planning Commissions**
Some Michigan regions offer funding or assisting in securing grants for stormwater projects.
- **Non-Profit Organizations**
Organizations like The Nature Conservancy provide grants and other forms of support for projects that focus on stormwater management and water quality improvements.

9. PRIVATE SECTOR FUNDING

- Local utilities or corporations may offer rebates, grants, or incentives for stormwater management practices, particularly for projects related to green infrastructure or water conservation.

By combining various state, federal, and local funding sources, municipalities and other entities in Michigan can leverage multiple opportunities to address stormwater challenges effectively. Engaging with a stormwater consultant can provide a strategic and guided plan utilizing available technology and green infrastructure concepts to best meet the specific needs, goals, and resources of a given lakeshore community.

REFERENCES:

Andresen, et al. 2012. Historical Climate and Climate Trends in the Midwestern USA. Great Lakes Integrated Sciences and Assessment Center. Michigan State University, East Lansing, Michigan.

Stormwater Institute. 2023. Rainfall to Results, the Future of Stormwater. Water Environment Foundation. Alexandria, Virginia. R

YOUR ONE CALL for everything lake & pond



STONEY CREEK

FISHERIES &
EQUIPMENT, INC.

Visit our
Fish Farm & Store

11073 Peach Ave.
Grant, MI 49327
Just 6 miles east of Grant

Open 8am-5pm M-F
Open Saturdays April-June
Closed Sundays
and Holidays

Live Fish for Stocking

Liner • Fountains • Water Treatments
Aeration Systems • Underwater Lighting
Windmill Aeration • Solar Aeration
Water Gardening and more!

800-448-3873

www.stoneycreekequip.com

info@stoneycreekequip.com

Find us on Facebook!

Call, drop by the fish farm or visit our website
for a free full color catalog

