October 2024

LAKE SHERWOOD

ANNUAL REPORT

PREPARED FOR:
LAKE SHERWOOD PROPERTY OWNERS
OAKLAND COUNTY, MI

PROGRESSIVE COMPANIES

TABLE OF CONTENTS

EXECUTIVE SUMMARY - 1
INTRODUCTION - 2
WATER QUALITY - 3
Lake Water Quality - 3
Temperature - 4
Dissolved Oxygen - 4
Chlorophyll-*a* - 5
Secchi Transparency - 5
E. coli - 7
pH and Total Alkalinity - 7
Chloride - 8
Total Suspended Solids - 8
Sampling Methods - 9
Sampling Results and Discussion - 9
PLANT CONTROL - 12
PLANT INVENTORY SURVEY - 15
DISCUSSION AND RECOMMENDATIONS - 16
2025 PROPOSED MANAGEMENT ACTIVITES - 17
REFERENCES - 18

APPENDICIES
Appendix A - Shoreland Management Guide
Appendix B - Biobase Maps (Depth Contours, Sediment Hardness, BioVolume)

TABLE OF CONTENTS

LIST OF TABLES

Table 1 Lake Classification Criteria

Table 2 pH and Alkalinity of Upper Midwest Lakes

Table 3 Lake Sherwood 2024 Deep Basin Water Quality Data

Table 4 Lake Sherwood 2024 Surface Water Quality Data

Table 5 Lake Sherwood 2024 Plant Control Activities

Table 6 Lake Sherwood 2024 Plant Inventory Data

Table 7 Lake Sherwood 2025 Proposed Management Activities

LIST OF FIGURES

Figure 1 Lake Sherwood location map

Figure 2 Lake classification

Figure 3 Seasonal thermal stratification cycles

Figure 4 Secchi Disk

Figure 5 Lake chloride levels

Figure 6 Chemocline graphic

Figure 7 Composite sampler

Figure 8 Lake Sherwood sampling location map

Figure 9 Natural shoreline graphic

Figure 10 Eurasian milfoil

Figure 11 Curly-leaf pondweed

Figure 12 Aquatic plant survey map

Figure 13 Aquatic plant groups

EXECUTIVE SUMMARY

In 2024, the Lake Sherwood Property Owners Association retained Progressive Companies to provide oversite and recommendations towards the lake's improvement. The following is a summary of project activities:

<u>Water Quality Sampling:</u> In 2024, samples were collected from Lake Sherwood in March and August. During the 2024 sampling period, phosphorus levels were elevated. Water clarity was moderate to poor in spring and summer, and algae growth was moderate to high during both sampling events. Overall, Lake Sherwood can be classified as eutrophic lake system.

<u>Nuisance Aquatic Plant Control:</u> In 2024, 208 acres infested by non-native milfoil, curly-leaf pondweed, and nuisance algae required treatment.

<u>Recommendations:</u> Lake Sherwood residents should use best shoreland management practices to reduce nutrient loading into the lake. In 2025, management activities should focus on nutrient reduction and invasive species control. Nutrient inactivation treatments in the canals are recommended to reduce total phosphorus concentrations. Eurasian milfoil should be treated with systemic herbicides and curly-leaf pondweed should be harvested when applicable. Native aquatic plant species should not be targeted for control in order to strengthen the current community.

INTRODUCTION

Lake Sherwood is located in Commerce Charter Township, Oakland County, Michigan (Figure 1). The lake is 269 acres in surface area with a maximum depth of 19 feet and a mean (average) depth of 7.9 feet. In 2024, the Lake Sherwood Homeowners Association retained Progressive Companies for the purposes of studying water quality, overseeing the aquatic plant control program, and providing education and recommendations. This report includes information on 2024 Lake Sherwood management activities.

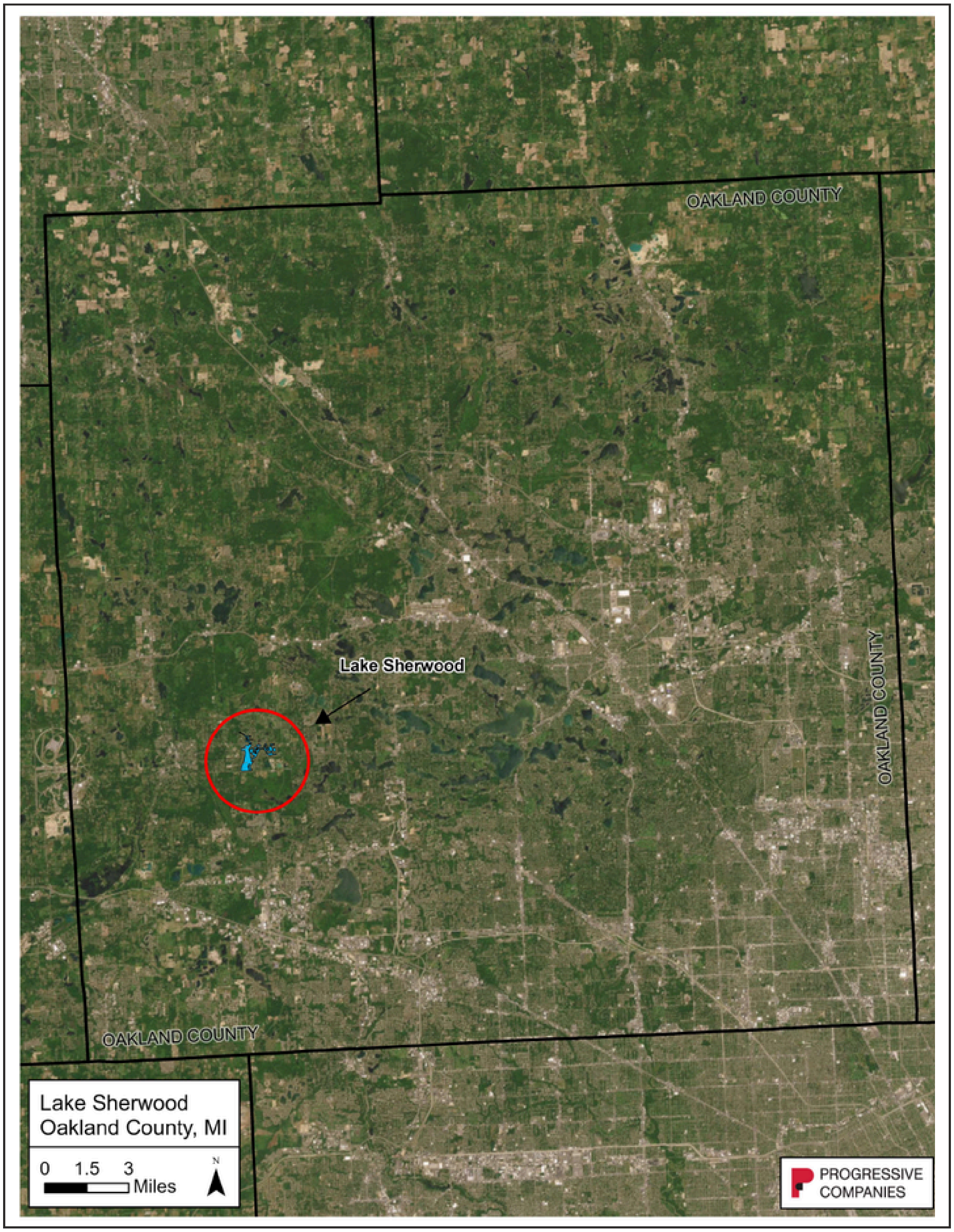

Figure 1. Lake Sherwood location map.

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.

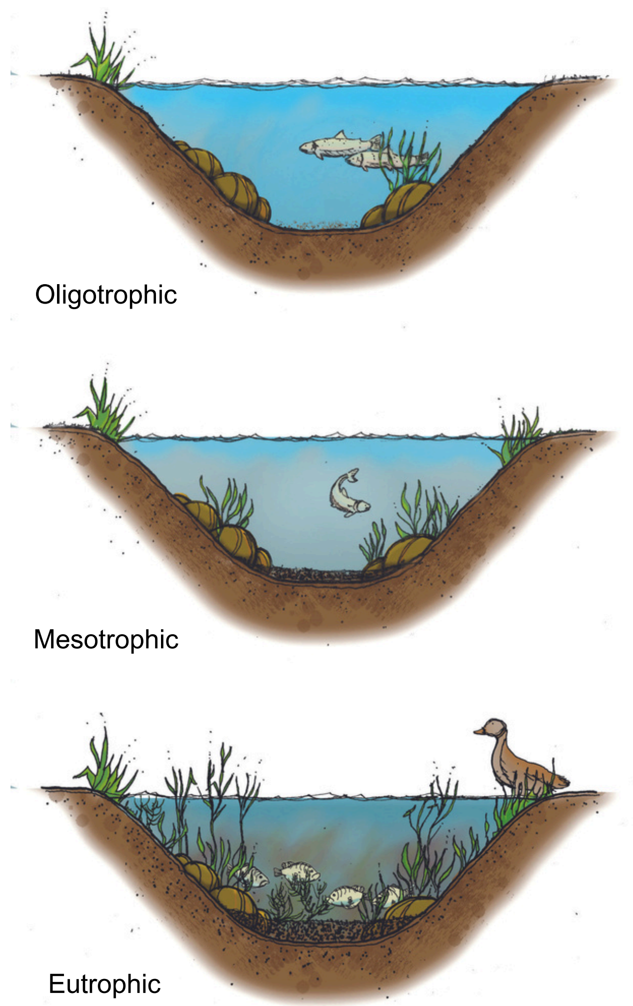

Figure 2. Lake classification.

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.

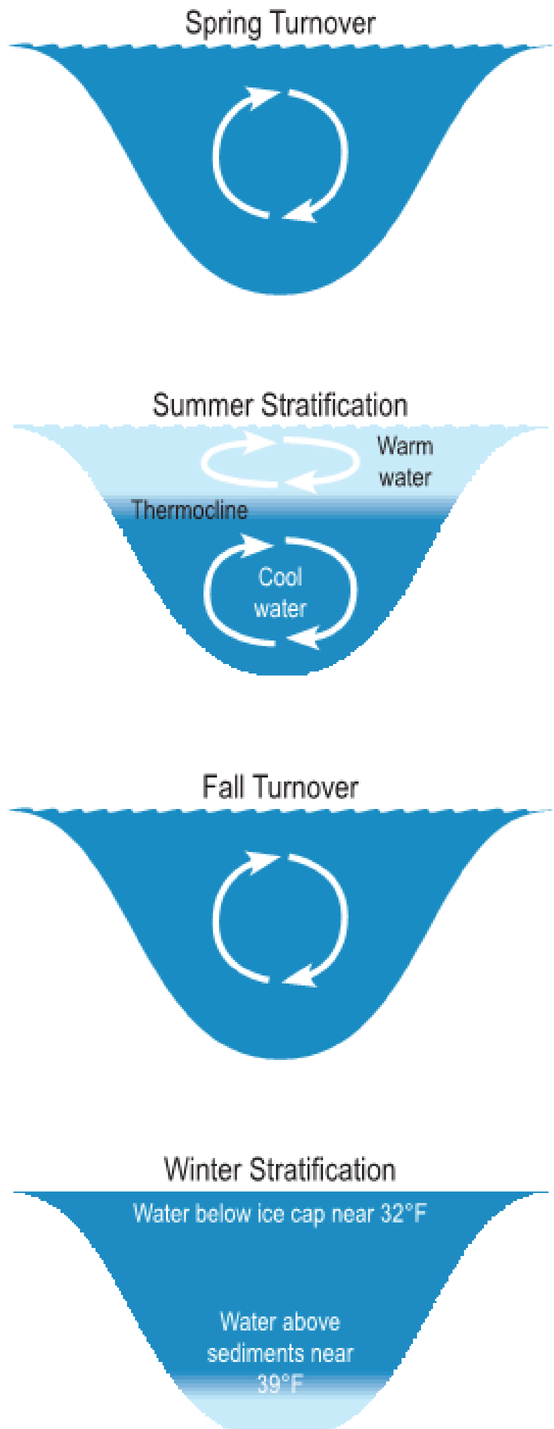

Figure 3. Seasonal thermal stratification cycles.

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 able to support abundant plant growth and are classified as nutrient-enriched or 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 (ug/L)[1]	Chlorophyll-*a* (ug/L)[1]	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

1 ug/L = micrograms per liter

WATER QUALITY

E. coli

Fecal coliform bacteria can present health risks when present at high levels. Michigan's water quality standards for total body contact and recreational activities sets the acceptable limit for *E. coli* bacteria at 300 colonies per 100 milliliters for any single occurrence. If *E. coli* levels meet or exceed this limit, it is advisable to avoid recreational activities.

pH and TOTAL ALKALINITY

pH is a measure of the amount of acid or base in the water. The pH scale ranges from 0 (acidic) to 14 (alkaline or basic) with neutrality at 7. The pH of most lakes in the Upper Midwest ranges from 6.5 to 9.0 (Michigan Department of Environmental Quality (MDEQ)* 2012; Table 2). In addition, according to the Michigan Department of Environment, Great Lakes, and Energy (EGLE 2021):

While there are natural variations in pH, many pH variations are due to human influences. Fossil fuel combustion products, especially automobile and coal-fired power plant emissions, contain nitrogen oxides and sulfur dioxide, which are converted to nitric acid and sulfuric acid in the atmosphere. When these acids combine with moisture in the atmosphere, they fall to earth as acid rain or acid snow. In some parts of the United States, especially the Northeast, acid rain has resulted in lakes and streams becoming acidic, resulting in conditions which are harmful to aquatic life. The problems associated with acid rain are lessened if limestone is present, since it is alkaline and neutralizes the acidity of the water.

Most aquatic plants and animals are adapted to a specific pH range, and natural populations may be harmed by water that is too acidic or alkaline. Immature stages of aquatic insects and young fish are extremely sensitive to pH values below 5. Even microorganisms which live in the bottom sediment and decompose organic debris cannot live in conditions which are too acidic. In very acidic waters, metals which are normally bound to organic matter and sediment are released into the water. Many of these metals can be toxic to fish and humans. Below a pH of about 4.5, fish are unable to survive.

The Michigan Water Quality Standard (Part 4 of Act 451) states that pH shall be maintained within the range of 6.5 to 9.0 in all waters of the state.

Alkalinity, also known as acid-neutralizing capacity or ANC, is the measure of the pH-buffering capacity of water in that it is the quantitative capacity of water to neutralize an acid. pH and alkalinity are closely linked and are greatly impacted by the geology and soil types that underlie a lake and its watershed. According to MDEQ (2012):

Michigan’s dominant limestone geology in the Lower Peninsula and the eastern Upper Peninsula contributes to the vast majority of Michigan lakes being carbonate-bicarbonate dominant [which increases alkalinity and moderates pH] and lakes in the western Upper Peninsula having lower alkalinity and thus lesser buffering capacity.

The alkalinity of most lakes in the Upper Midwest is within the range of 23 to 148 milligrams per liter, or parts per million, as calcium carbonate (MDEQ 2012; Table 2).

TABLE 2 - pH AND ALKALINITY OF UPPER MIDWEST LAKES

Measurement	Low	Moderate	High
pH (in standard units)	Less than 6.5	6.5 to 9.0	Greater than 9.0
Total Alkalinity or ANC (in mg/L as $CaCO_3$)*	Less than 23	23 to 148	Greater than 148

* MDEQ now the Michigan Department of Environment, Great Lakes, and Energy
* mg/L as $CaCO_3$ = milligrams per liter as calcium carbonate

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."

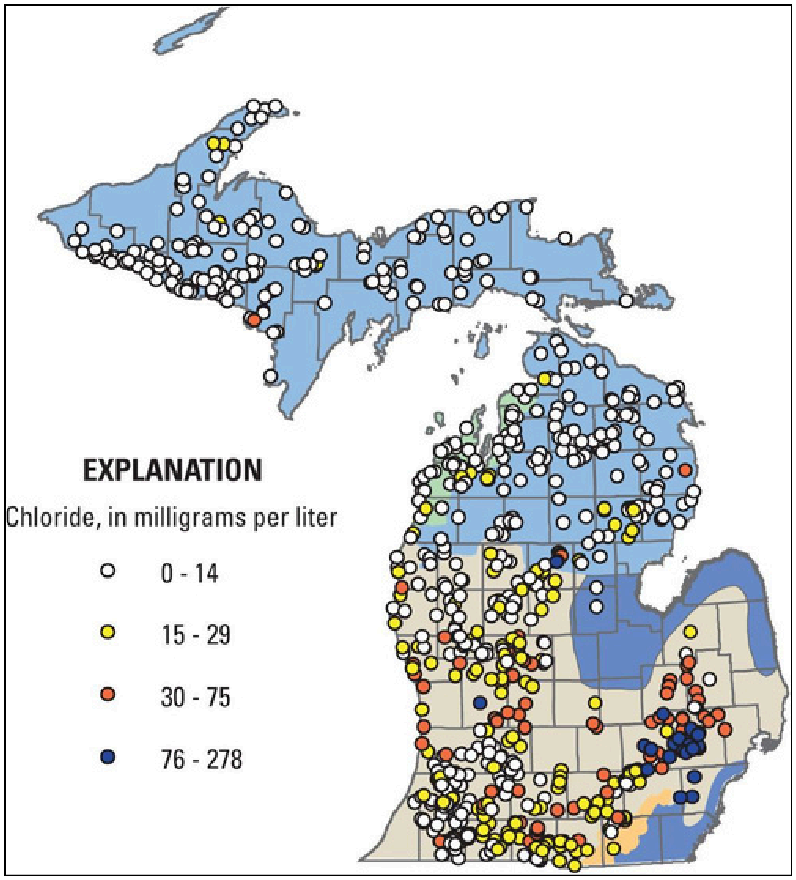

Figure 5. Lake chloride levels (2001–10) in USEPA ecoregions. Fuller and Taricska 2012.

TOTAL SUSPENDED SOLIDS
According to EGLE (2020):

Total suspended solids (TSS) include all particles suspended in water which will not pass through a filter. Most people consider water with a TSS concentration less than 20 mg/L to be clear. Water with TSS levels between 40 and 80 mg/L tends to appear cloudy, while water with concentrations over 150 mg/L usually appears dirty.

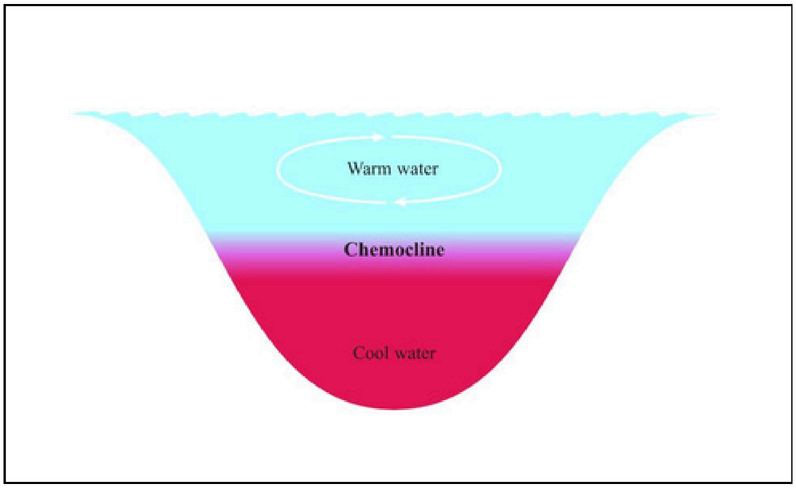

Figure 6. High chloride inputs can result in a chemocline, preventing lake mixing.

WATER QUALITY

SAMPLING METHODS

Water quality sampling was conducted in the spring and summer of 2024 at four locations within Lake Sherwood (Figure 8). Temperature and dissolved oxygen were measured using a YSI Prosolo ODO/T probe. Samples were collected at the surface, mid-depth, and just above the lake bottom over site one and at the surface and just above the bottom at sites 2, 3, and 4. Samples were collected with a Van Dorn bottle to be analyzed for pH, total alkalinity, total suspended solids, chloride, and total phosphorus. pH was measured in the field using a Hach Pocket Pro pH meter. Total alkalinity, total suspended solids, chloride, and total phosphorus samples were placed on ice and transported to Progressive Companies and to Summit Laboratory* for analysis. Total alkalinity was titrated at Progressive Companies using Standard Methods procedure 2320 B. Total phosphorus, chloride, and total suspended solids were analyzed at Summit Laboratory using Standard Methods procedure 4500-P E, EPA procedure 300.0, and SM4110B, respectively. In addition to the depth-interval samples at each 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. Additional samples were collected in August at random locations around the shoreline and analyzed for *E. coli* bacteria at Summit Laboratories.

SAMPLING RESULTS AND DISCUSSION

Sampling results are provided in Tables 3-5.

In March of 2024, sampling was conducted when water temperatures were cool and dissolved oxygen concentrations were high. Due to the shallow depths, Lake Sherwood was not stratified during the August sampling period; the lake was warm and well-oxygenated at the surface and near the bottom, except for site three, which was relatively cooler and had lower oxygen near the bottom. This is likely a result of decreased Secchi transparency from increased sediment suspension and cooler water flowing in from the Wildwood River. In 2024, total phosphorus concentrations were generally elevated. The elevated phosphorus concentrations are likely due to input from external sources from within the watershed. Secchi transparency decreased in summer months, this is most likely attributed to sediment suspension from heavy boating activity. pH was within the moderate range for Upper Midwest lakes while total alkalinity was high. Chloride concentrations were moderate for most inland lakes in Michigan. All *E. coli* samples collected in August were well below the max contamination limit of 300 colonies/ 100 mL as set by EGLE.

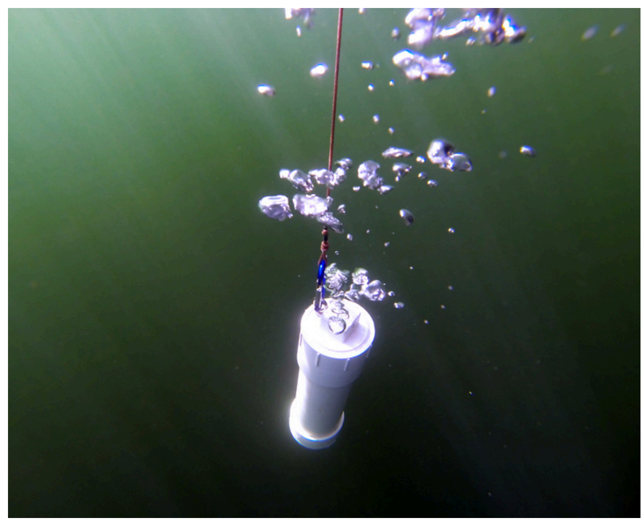

Figure 7. Composite sampler.

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

WATER QUALITY

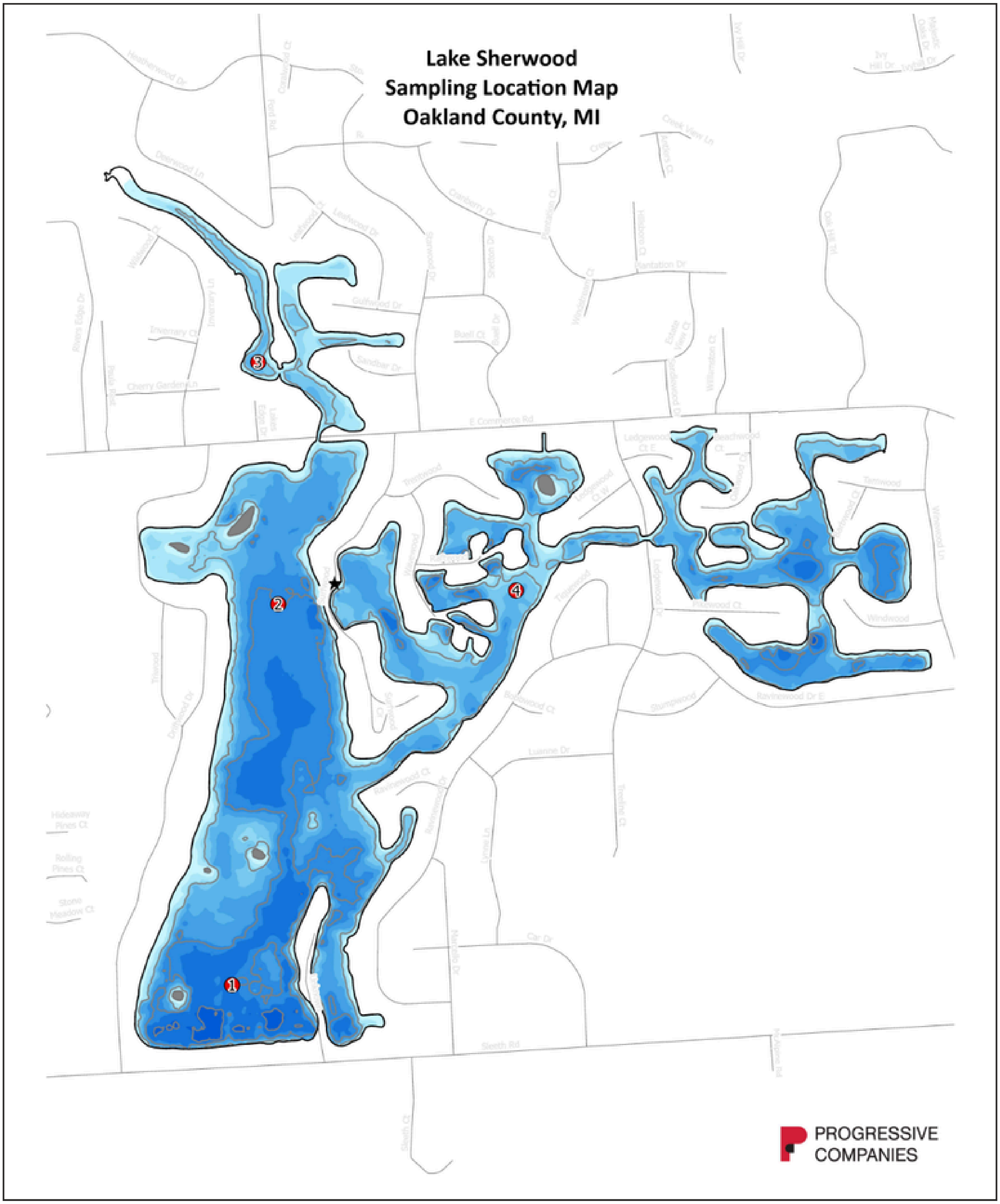

Figure 8. Lake Sherwood sampling location map.

WATER QUALITY

TABLE 3 - LAKE SHERWOOD 2024 DEEP BASIN WATER QUALITY DATA

Date	Site	Depth (feet)	Temp (F)	DO *(mg/L)	TP *(ug/L)	pH *(S.U.)	Total Alk. *(mg/L CaCO3)	Chloride *(mg/L)	TSS *(mg/L)
28-Mar-24	1	1	42	12.6	36	7.8	198	55	7.0
28-Mar-24	1	5	42	12.6	23	7.7	197	51	5.6
28-Mar-24	1	10	42	12.6	25	7.6	200	60	5.2
28-Mar-24	2	1	42	12.6	15	7.7	199	54	5.2
28-Mar-24	2	8	42	12.6	19	7.5	196	63	4.0
28-Mar-24	3	1	44	10.5	14	7.4	235	57	4.0
28-Mar-24	3	4	44	10.5	23	7.3	234	51	5.6
28-Mar-24	4	1	42	12.4	19	7.8	191	64	4.4
28-Mar-24	4	5.5	42	12.4	23	7.7	189	61	7.0
13-Aug-24	1	1	76	9.4	10	8.5	185	44	9.0
13-Aug-24	1	5	75	9.1	10	8.5	183	44	8.4
13-Aug-24	1	10	75	7.2	21	8.3	182	44	10.4
13-Aug-24	2	1	75	9.0	24	8.3	182	43	8.4
13-Aug-24	2	8	74	8.8	23	8.3	195	44	10.8
13-Aug-24	3	1	71	7.6	19	7.8	200	35	4.0
13-Aug-24	3	5	68	4.7	14	7.8	x	35	4.4
13-Aug-24	4	1	78	10.0	14	8.4	157	47	7.6
13-Aug-24	4	5	76	10.8	10	8.3	156	47	5.0

* mg/L = milligrams per liter = parts per million
* ug/L = micrograms per liter = parts per billion
* S.U. = standard units
* mg/L CaCO3 = milligrams per liter as calcium carbonate
x = bottle broke during transport

WATER QUALITY

TABLE 4 - LAKE SHERWOOD 2024 SURFACE WATER QUALITY DATA

Date	Station	Secchi Transparency (feet)	Chlorophyll-*a* *(ug/L)
28-Mar-24	1	4.5	ND
28-Mar-24	2	4.5	1
28-Mar-24	3	3.5	ND
28-Mar-24	4	4.5	1
13-Aug-24	1	3.0	7
13-Aug-24	2	3.0	6
13-Aug-24	3	3.5	2
13-Aug-24	4	5.0	6

* ug/L = micrograms per liter = parts per billion
ND = not detected

PLANT CONTROL

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 to the lake's ecosystem. It is important to maintain an active plant control program to reduce the introduction and spread of invasive species within Lake Sherwood. Plant control efforts in 2024 consisted of five aquatic herbicide and algaecide applications.

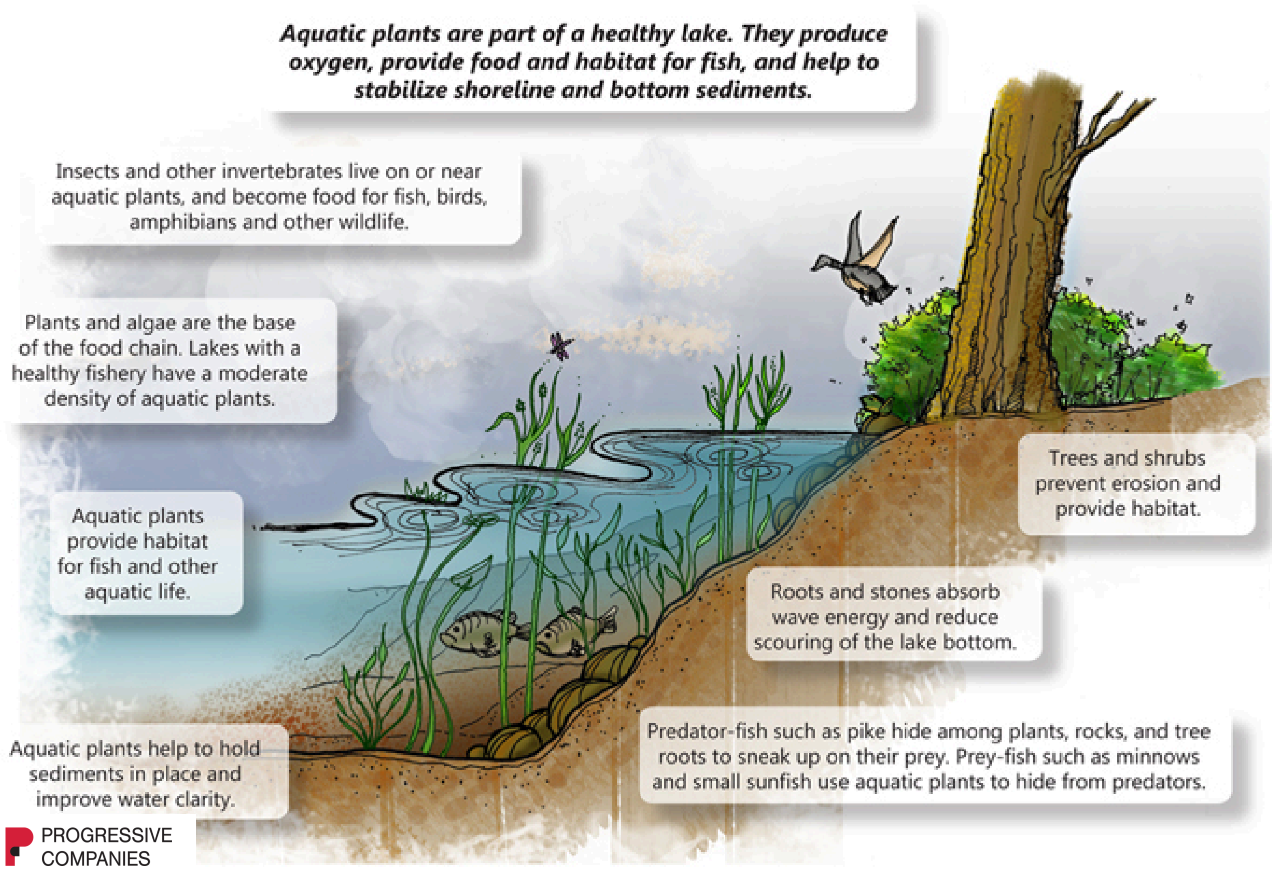

Figure 9. Natural shoreline graphic.

PLANT CONTROL

Plant control activities in 2024 were coordinated under the direction of an environmental consultant, Progressive Companies. Scientists from Progressive conducted GPS-guided surveys of the lake to identify problem areas, and georeferenced plant control maps were provided to the herbicide applicator. GPS reference points were established along the shoreline and off-shore grid of the lake. These waypoints were used to accurately identify the location of invasive and nuisance plant growth areas.

Figure 10. Eurasian milfoil
Myriophyllum spicatum

Figure 11. Curly-leaf pondweed
Potamogeton crispus

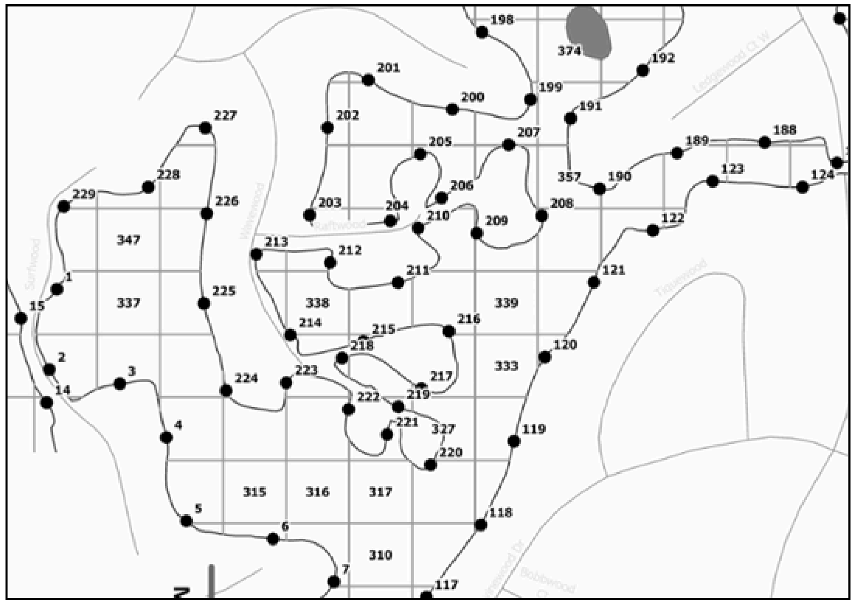

Figure 12. Aquatic plant survey map.

Primary plants targeted for control in Lake Sherwood included 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 5.

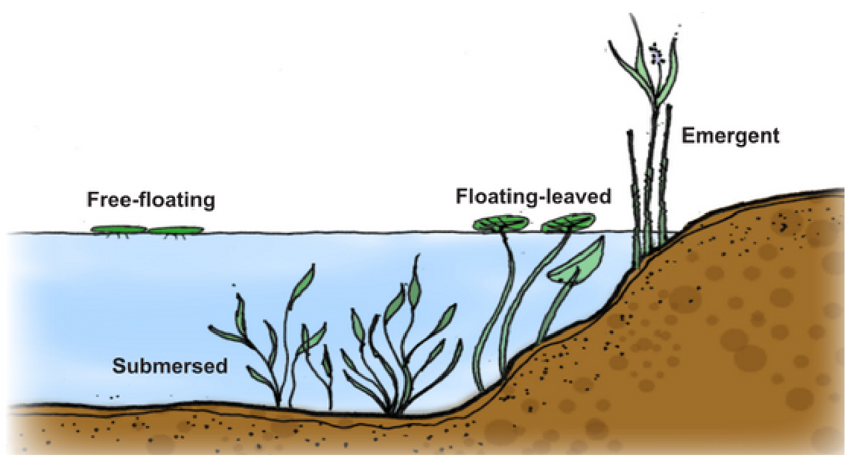

Figure 13. Aquatic plant groups.

PLANT CONTROL

TABLE 5. LAKE SHERWOOD 2024 PLANT CONTROL ACTIVITIES

Date	Plants Targeted	Acreage
May 8	E. milfoil, curly-leaf pondweed	59.50
May 20	Curly-leaf pondweed	15.00
June 19	E. milfoil	37.25
June 27	E. milfoil, algae	25.75
August 20	E. milfoil, algae	70.50
Total		**208.00**

In 2024, a total of 208 acres of Lake Sherwood was treated with aquatic herbicides. Eurasian milfoil was treated with systemic herbicides, ProcellaCOR and Triclopyr, for extended control. Large curly-leaf pondweed treatments occurred on May 8 and May 20 using contact herbicides which provided seasonal control of the invasive plant. Chronic nuisance algae growth was treated as necessary.

Planktonic algae blooms occurred throughout the growing season within the canals of Lake Sherwood. Most invasive growth around the lake was observed within the canals and southern portion of the lake. Overall, minimal plant growth was observed in the main body of the lake throughout the late summer months.

PLANT INVENTORY SURVEY

In addition to the surveys of the lake to identify invasive plant locations, a detailed vegetation survey of Lake Sherwood was conducted on August 14 to evaluate the type and abundance of all plants in the lake. The table below lists each plant species observed during the survey and the relative abundance of each. At the time of the survey, 10 submersed species, three floating-leaved species, and five emergent species were found in the lake. Lake Sherwood has moderate diversity of beneficial, native plant species, however, they are of poor abundance.

TABLE 6. LAKE SHERWOOD 2024 PLANT INVENTORY DATA

Common Name	Scientific Name	Group	Percentage of sites where present
Brittle-leaf naiad	*Najas minor*	Submersed	30
Thin-leaf pondweed	*Potamogeton* sp.	Submersed	17
Eurasian milfoil	*Myriophyllum spicatum*	Submersed	14
Wild celery	*Vallisneria americana*	Submersed	6
Slender naiad	*Najas flexilis*	Submersed	5
Curly-leaf pondweed	*Potamogeton crispus*	Submersed	3
Flat-stem pondweed	*Potamogeton zosteriformis*	Submersed	2
American pondweed	*Potamogeton americanus*	Submersed	1
Illinois pondweed	*Potamogeton illinoensis*	Submersed	1
Coontail	*Ceratophyllum demersum*	Submersed	1
White waterlily	*Nymphaea odorata*	Floating-leaved	7
Floating-leaf pondweed	*Potamogeton natans*	Floating-leaved	3
Yellow waterlily	*Nuphar* sp.	Floating-leaved	1
Cattail	*Typha* sp.	Emergent	8
Bulrush	*Schoenoplectus* sp.	Emergent	7
Purple loosestrife	*Lythrum salicaria*	Emergent	5
Phragmites	*Phragmites australis*	Emergent	3
Iris	*Iris* sp.	Emergent	1

Invasive exotic species

The majority of plant biomass in Lake Sherwood is attributed to invasive aquatic species. In the spring, curly-leaf pondweed is particularly abundant, while the summer months see significant growth of dense Eurasian milfoil. Additionally, brittle-leaf naiad was prevalent in the late summer, primarily within the eastern canal system.

DISCUSSION AND RECOMMENDATIONS

WATER QUALITY

Lake Sherwood is categorized as a eutrophic lake system, having high phosphorus levels in spring and elevated chlorophyll-*a* during summer, along with decreased water clarity in the warmer months. Total phosphorus declined from spring to summer. Notably, significant growth of planktonic algae occurs throughout the summer, likely consuming the excess phosphorus available in the water. Other contaminants examined, such as chloride and *E. coli*, are currently low and not concerning. The primary challenge facing Lake Sherwood's water quality is the heightened phosphorus concentrations, probably stemming from external sources. It is essential for residents to adopt best shoreland management practices to minimize nutrient runoff into the lake. Additionally, the drains leading to the lake should be evaluated for possible nutrient contributions from the watershed. Residents can find a guide to best management practices in Appendix A.

A treatment for phosphorus inactivation is proposed for 2025, aimed at binding phosphorus in the water column to the sediment at the lake's bottom. Products like Eutrosorb G and Phoslock are recommended for application in spring to help mitigate summer algal blooms. Total treatment size and projected cost can be found in Table 7.

PLANT CONTROL

Lake Sherwood currently has a limited presence of beneficial native plants, with only 5% of the littoral zone comprised of native aquatic species, while 10% is occupied by invasive plants. Plant growth areas over the growing season can be found in Appendix B. According to the Michigan Department of Natural Resources (DNR), inland lakes with 25-35% native plant coverage across their total surface area are known to support the healthiest fisheries (O'Neal and Soulliere 2006). Efforts to manage plant life in Lake Sherwood should concentrate solely on controlling invasive aquatic species to promote the flourishing of native plants. Systemic herbicides should specifically target Eurasian milfoil. As for curly-leaf pondweed, which grows early in the season and naturally dies off in warmer waters, it is advised to treat this species minimally. Additionally, harvesting as an alternative to herbicides for removing curly-leaf pondweed biomass from the lake in the spring should be considered. Cost projections for aquatic herbicides and harvesting can be found in Table 7.

2025 PROPOSED MANAGEMENT ACTIVITIES

TABLE 7. LAKE SHERWOOD 2025 PROPOSED MANAGEMENT ACTIVIES

Season	Activity	Projected Cost*
Spring 2025	**Water Quality Monitoring** • *Lake Sampling* • *Drain Assessment*	$10,000
	Nutrient Inactivation Treatment • *East and North Canal (50 acres)*	$30,000
	Mechanical Harvesting • *Curly-leaf pondweed (15-20 acres)*	$10,000-$15,000
Summer 2025	**Lake Management** • *Plant Control Oversight* • *Contractor Coordination* • *Water Quality Monitoring* • *Information and Education*	$13,000
	Aquatic Herbicide Applications • *Eurasian milfoil (30 acres)* • *Curly-leaf pondweed (20 acres)*	$10,000-$20,000
Total		**$73,000-$88,000**

*Costs are projected based on industry averages

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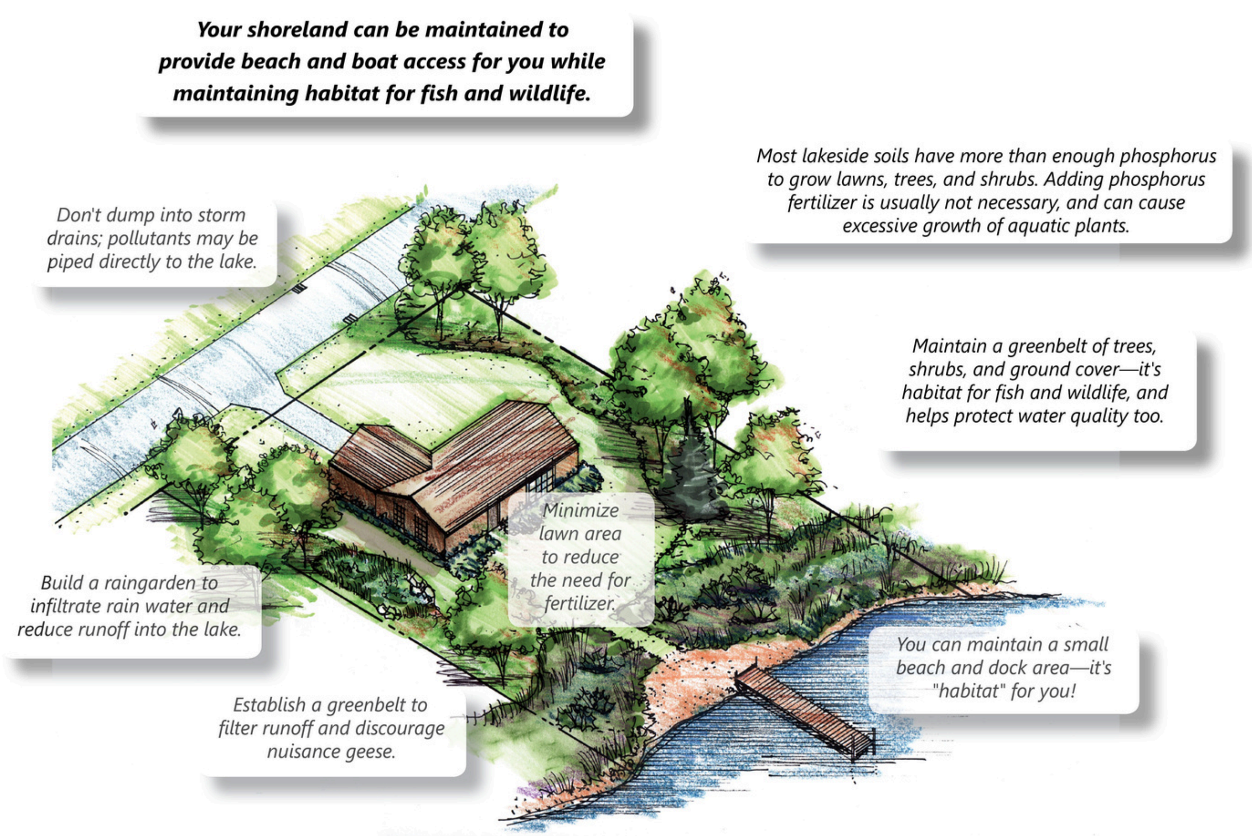
APPENDIX A
SHORELAND MANAGEMENT GUIDE

SHORELAND MANAGEMENT
A Guide for Lake Sherwood

Created by Progressive Companies - Water Resources Group

Natural shoreland areas around lakes help to reduce pollution runoff and provide valuable fish and wildlife habitat. As such, natural shorelands are essential to a healthy lake. In addition to providing important environmental benefits, natural shorelands can be beautiful. Recognizing the value of natural shorelands, several states including Minnesota, Wisconsin, Vermont, Maine, and New Hampshire have adopted state-wide shoreland protection regulations. Many lake communities have realized that restoring natural shorelands is a win-win-win scenario: a healthier lake with better water quality; improved fisheries; and better lake living.

Maintaining and preserving natural features of a shoreland will help to improve the quality of Lake Sherwood. Instead of installing seawalls or hard surfaces along the lake's edge, consider using native plantings and maintaining a buffer zone to reduce pollution run off from your lawn. A big contributor to excessive algae growth on Lake Sherwood is the presence of phosphorus. Lawn fertilizers can be a primary source of phosphorus. Michigan law prohibits the application of lawn fertilizers containing phosphorus unless a soil test documents a phosphorus deficiency or a new lawn is bein established. Another pollutant that can impact Lake Sherwood's water quality is chloride. Increased levels of chloride can become toxic to fish, macro invertebrates, and amphibians within Lake Sherwood. Chloride can come from road salting as well as water softener discharge and use. Following shoreline management best practices can help to reduce the input of chloride and phosphorus in Lake Sherwood.



PROGRESSIVE COMPANIES

Ways riparians can help protect Lake Sherwood:

Nutrient Reduction

- 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.
- Reduce fertilizer use when possible. Use the minimum amount of fertilizer as recommended on the label (or less).
- Water your lawn sparingly to avoid washing nutrients and sediments into the lake.
- Do not feed ducks and geese near the lake. Waterfowl droppings are high in nutrients.
- Do not burn leaves and grass clippings near the shoreline. Nutrients concentrate in the ash and can easily wash into the lake.
- Do not mow the water's edge. Instead, allow a strip of natural vegetation to become established along your waterfront. This natural buffer will trap pollutants and discourage nuisance geese from frequenting your property. Visit: www.shoreline.msu.edu
- Promote infiltration of stormwater into the ground. Building a rain garden helps to capture runoff from driveways and downspouts. Visit: www.raingardennetwork.com

Chloride Pollution

(Visit: https://dnr.mo.gov/water/hows-water/pollutants-sources/chloride)

- Determine the hardness of your water. Avoid softening water if it is at an acceptable level for drinking.
- Soften only the water that needs it, do not soften water for outdoor spickets or cold drinking water taps.
- Monitor softener settings. If it uses more than one bag of salt per month, consider ways to optimize efficiency.
- Upgrade your softener. Look for demand-initiated versions that are more salt efficient, operate based on how much water you use, and help reduce salt use.
- If you have a timer-based system, see if you can extend the time between cycles.
- Determine where your softener discharge/ backwash is going. Try considering using a dry well or hook up to the sewer system. Avoid discharging onto turf lawns or directly to lake.

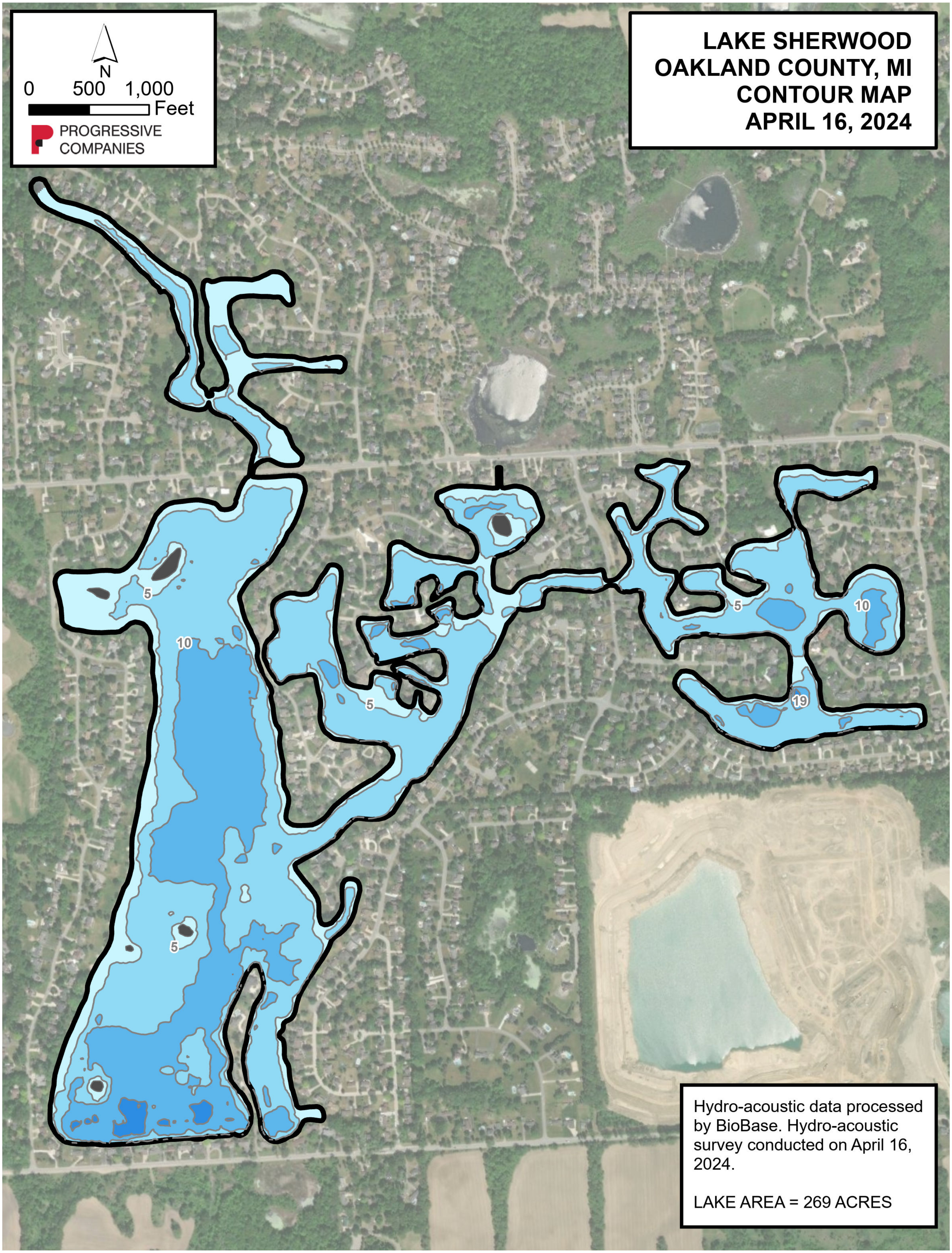
For more information regarding
Michigan's inland lakes, please
visit michiganlakeinfo.com

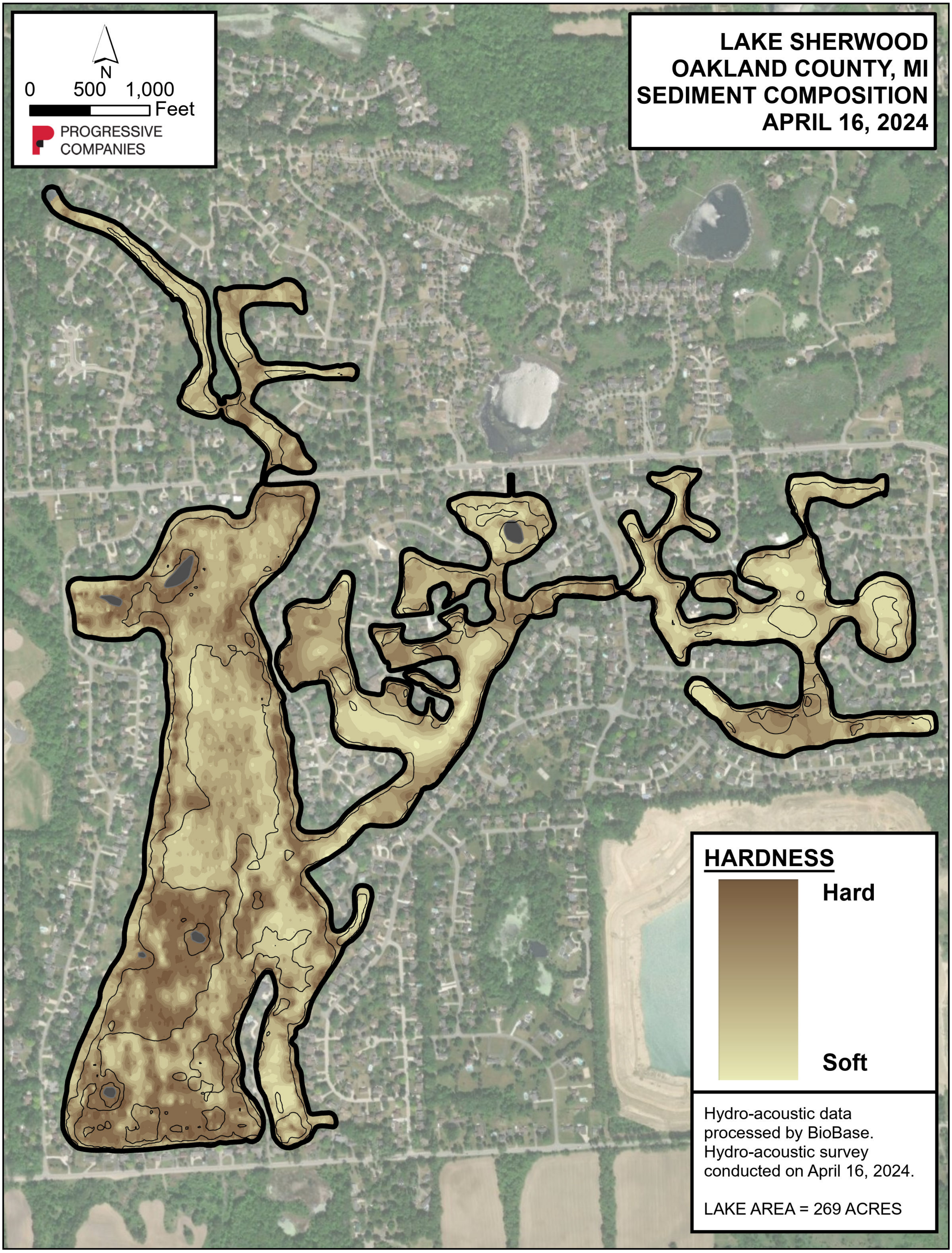
michiganlakeinfo
michiganlakeinfo.com

PROGRESSIVE
COMPANIES

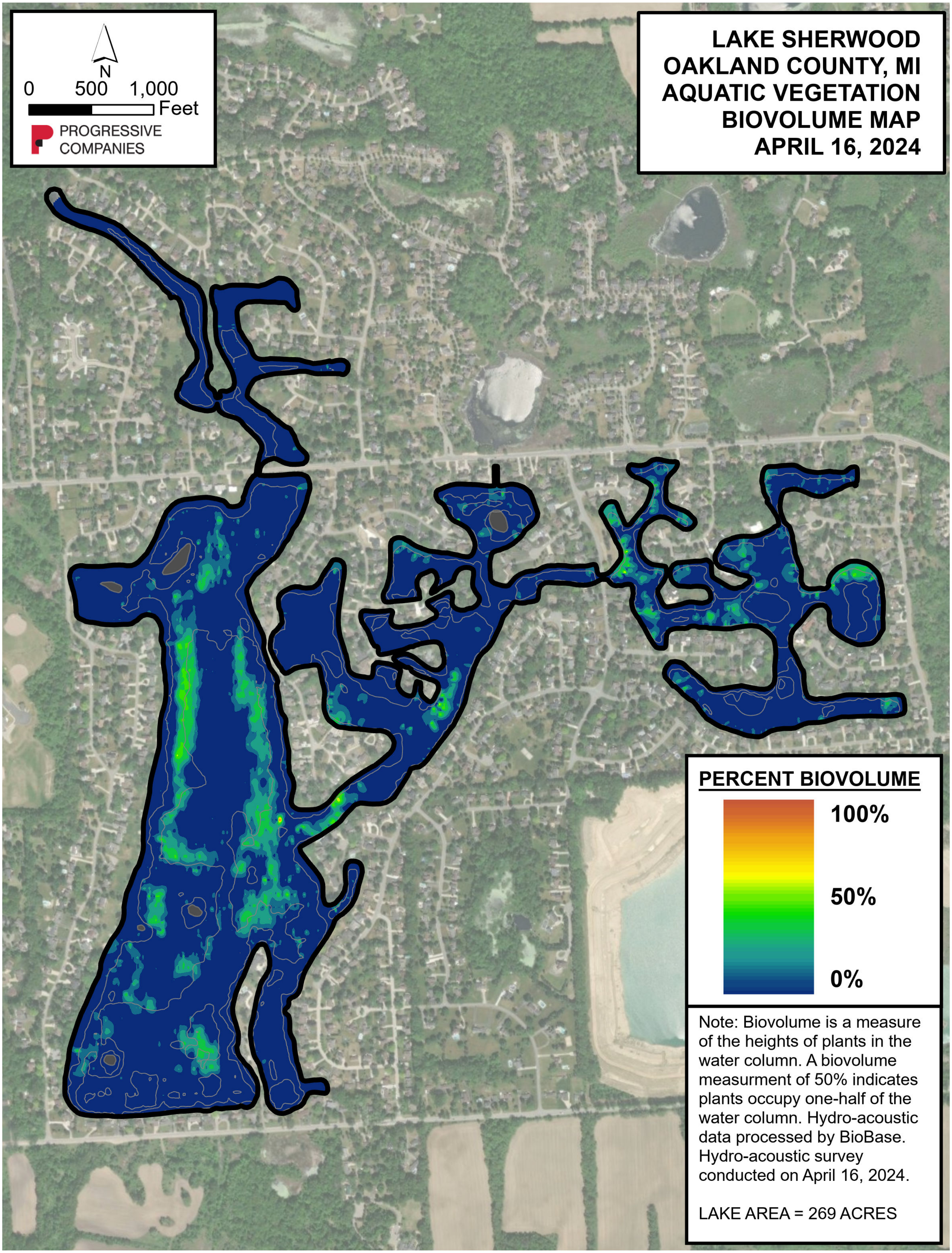
APPENDIX B

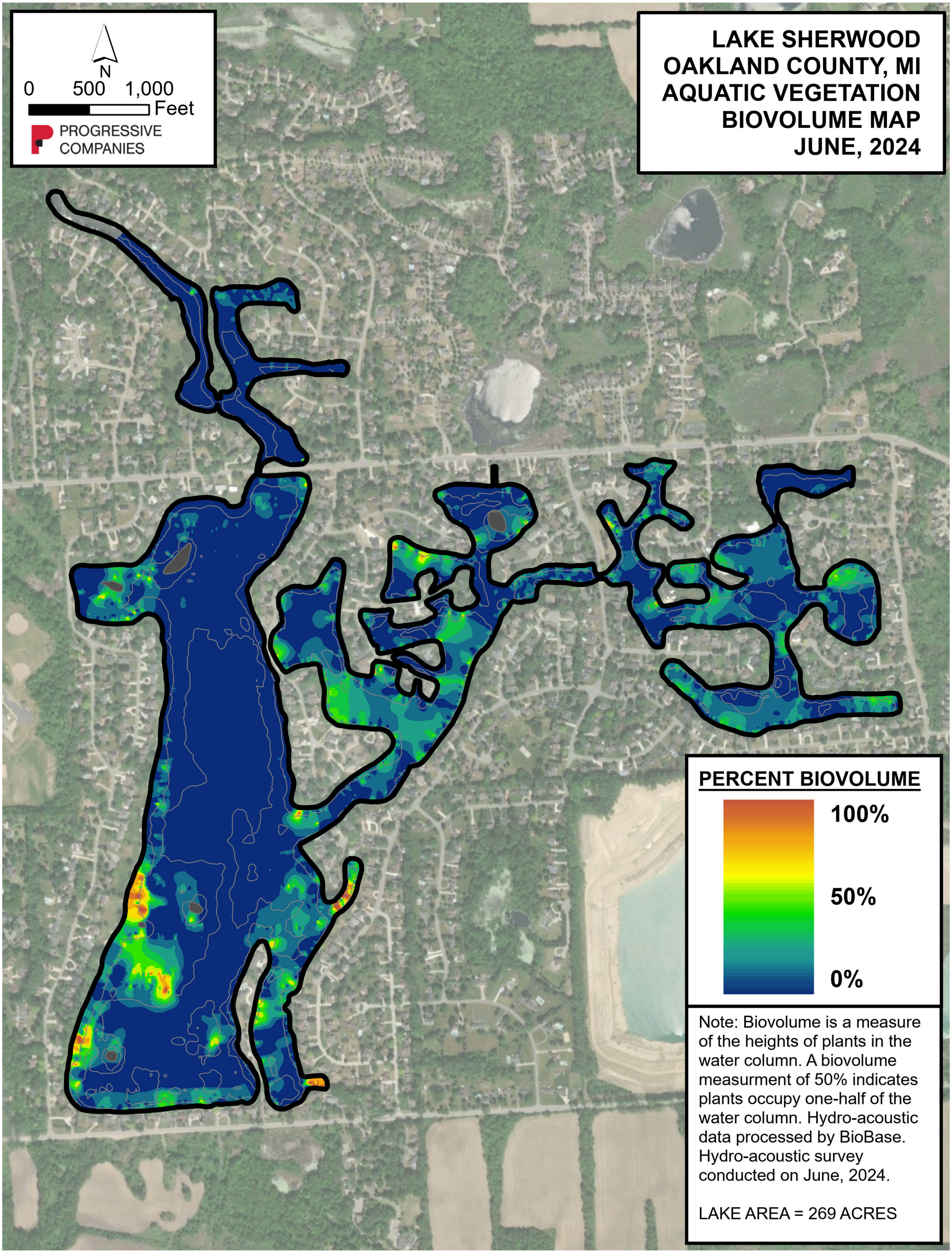
BIOBASE MAPS (DEPTH CONTOURS, SEDIMENT HARDNESS, BIOVOLUME)

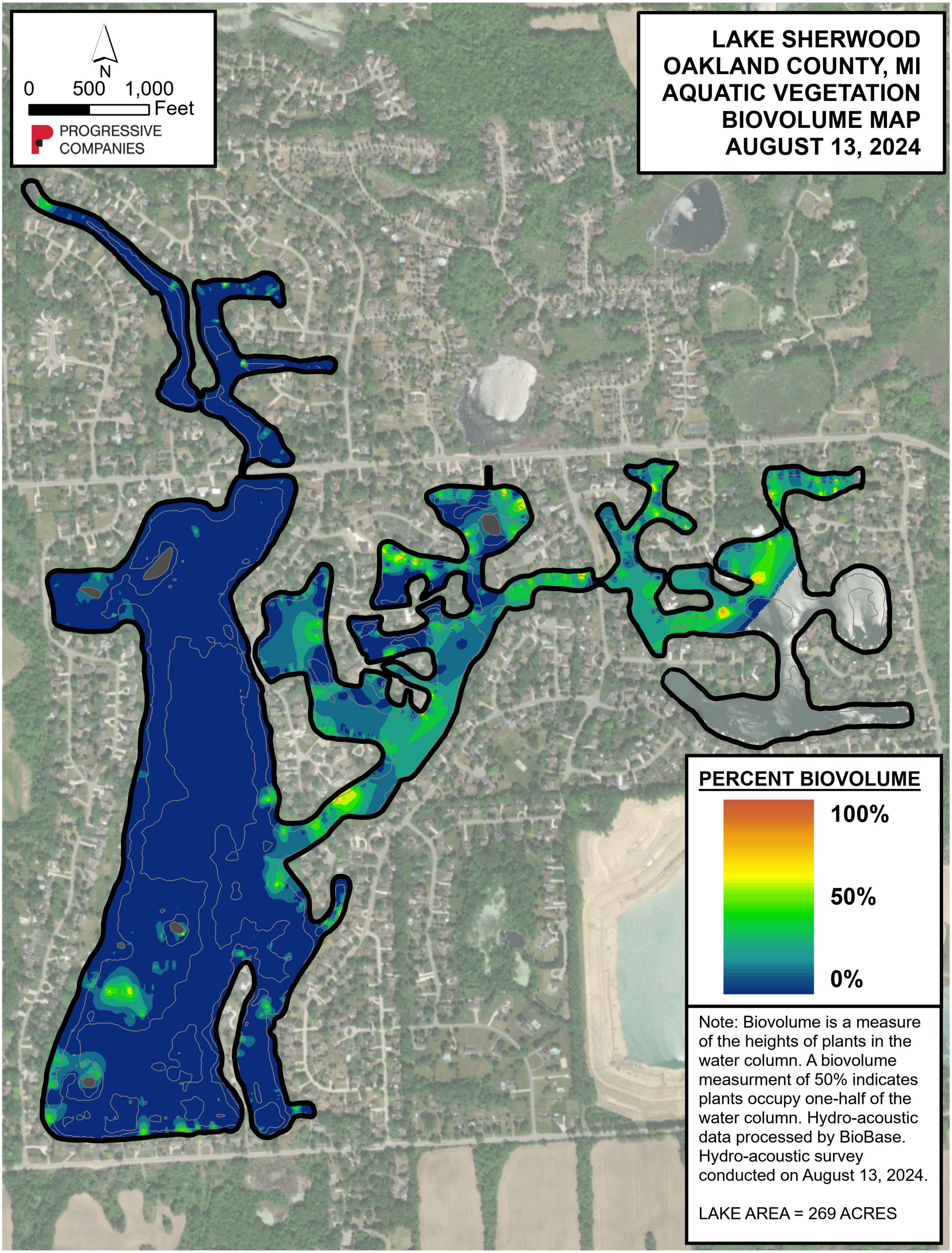

LAKE SHERWOOD
OAKLAND COUNTY, MI
CONTOUR MAP
APRIL 16, 2024
N
0
500
1,000
Feet
PROGRESSIVE
COMPANIES
5
10
19
Hydro-acoustic data processed by BioBase. Hydro-acoustic survey conducted on April 16, 2024.
LAKE AREA = 269 ACRES



LAKE SHERWOOD
OAKLAND COUNTY, MI
SEDIMENT COMPOSITION
APRIL 16, 2024
N
0 500 1,000
Feet
PROGRESSIVE
COMPANIES
HARDNESS
Hard
Soft
Hydro-acoustic data processed by BioBase.
Hydro-acoustic survey conducted on April 16, 2024.
LAKE AREA = 269 ACRES


LAKE SHERWOOD
OAKLAND COUNTY, MI
AQUATIC VEGETATION
BIOVOLUME MAP
APRIL 16, 2024
N
0
500
1,000
Feet
PROGRESSIVE
COMPANIES
PERCENT BIOVOLUME
100%
50%
0%
Note: Biovolume is a measure of the heights of plants in the water column. A biovolume measurment of 50% indicates plants occupy one-half of the water column. Hydro-acoustic data processed by BioBase. Hydro-acoustic survey conducted on April 16, 2024.
LAKE AREA = 269 ACRES


LAKE SHERWOOD
OAKLAND COUNTY, MI
AQUATIC VEGETATION
BIOVOLUME MAP
JUNE, 2024
N
0
500
1,000
Feet
PROGRESSIVE
COMPANIES
PERCENT BIOVOLUME
100%
50%
0%
Note: Biovolume is a measure of the heights of plants in the water column. A biovolume measurment of 50% indicates plants occupy one-half of the water column. Hydro-acoustic data processed by BioBase. Hydro-acoustic survey conducted on June, 2024.
LAKE AREA = 269 ACRES


LAKE SHERWOOD
OAKLAND COUNTY, MI
AQUATIC VEGETATION
BIOVOLUME MAP
AUGUST 13, 2024
N
0 500 1,000
Feet
PROGRESSIVE
COMPANIES
PERCENT BIOVOLUME
100%
50%
0%
Note: Biovolume is a measure of the heights of plants in the water column. A biovolume measurment of 50% indicates plants occupy one-half of the water column. Hydro-acoustic data processed by BioBase. Hydro-acoustic survey conducted on August 13, 2024.
LAKE AREA = 269 ACRES