Annual Report

Houghton Lake
2013 Annual Report

Prepared for:

Houghton Lake Improvement Board
P.O. Box 843
Houghton Lake, MI 48629

Prepared by:
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Grand Rapids, MI 49525-2442
616/361-2664

September 2013

Project No: 55520101

progressive | ae

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Introduction

Houghton Lake is Michigan's largest inland lake at 20,044 acres, but it is also shallow with an average depth of less than 10 feet (Figure 1). Aquatic plants have been abundant and diverse in Houghton Lake for many years. By the late 1990's, the nuisance exotic plant, Eurasian milfoil (*Myriophyllum spicatum*, Figure 2), had spread to approximately 11,000 acres of the lake and was crowding out beneficial native plant species. The Houghton Lake Improvement Board was formed in 2000 under the provisions of Part 309 of Act 451 of 1994 (the Natural Resources and Environmental Protection Act). The lake board commissioned a management feasibility study of Houghton Lake that was completed in January of 2002 (Smith et al. 2002). To address the widespread milfoil problem, a whole-lake treatment with the aquatic herbicide fluridone (trade name Sonar®) was conducted in the spring of 2002 as part of a five-year management plan. Public hearings were held in 2006 and 2011 pursuant to statute and the project was approved to be continued through 2016. Key components of the management plan include aquatic plant control, water quality and vegetation monitoring, information and education, and watershed management. This report contains a status of the project through 2013.

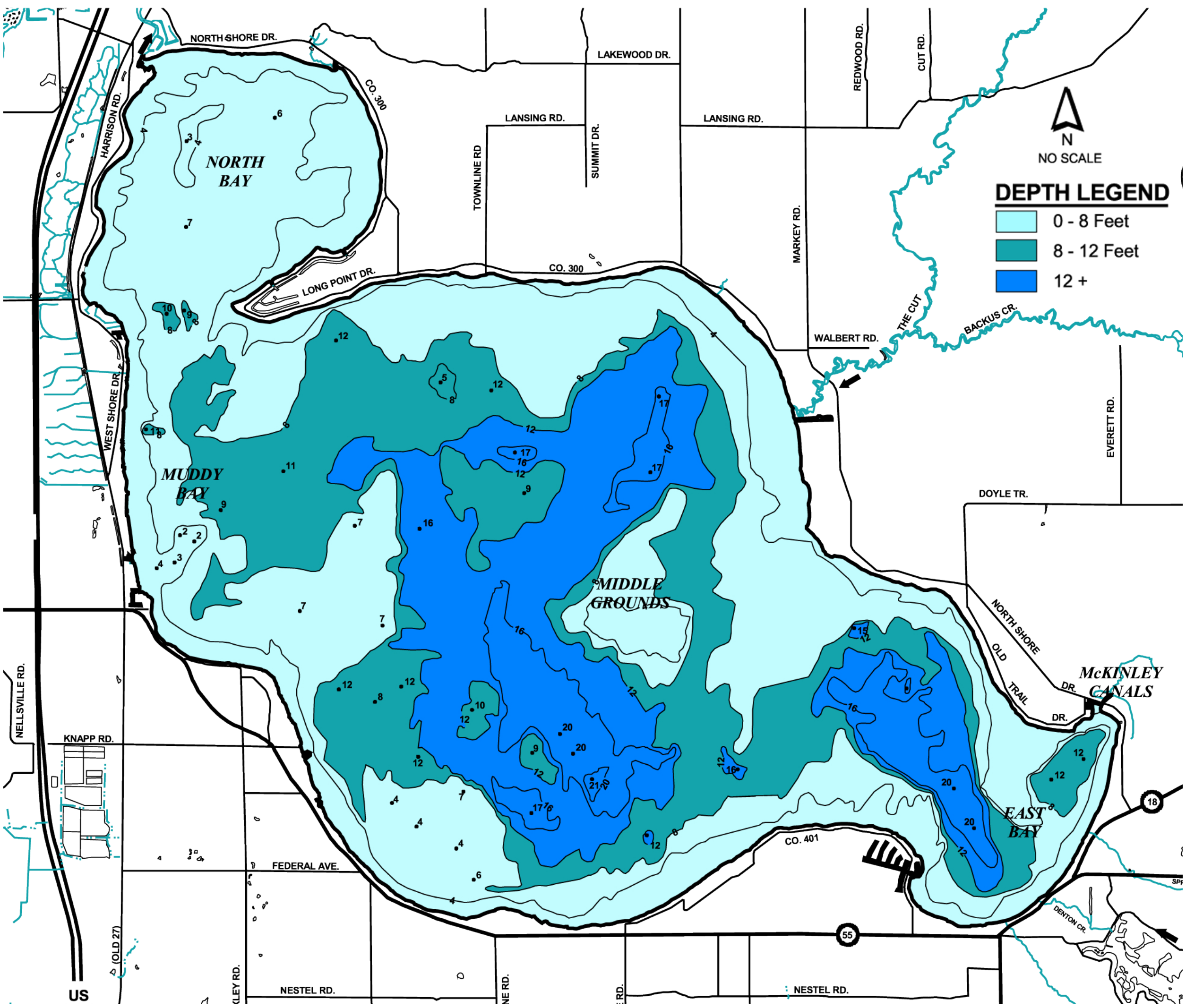

Figure 1. Houghton Lake depth contour map.

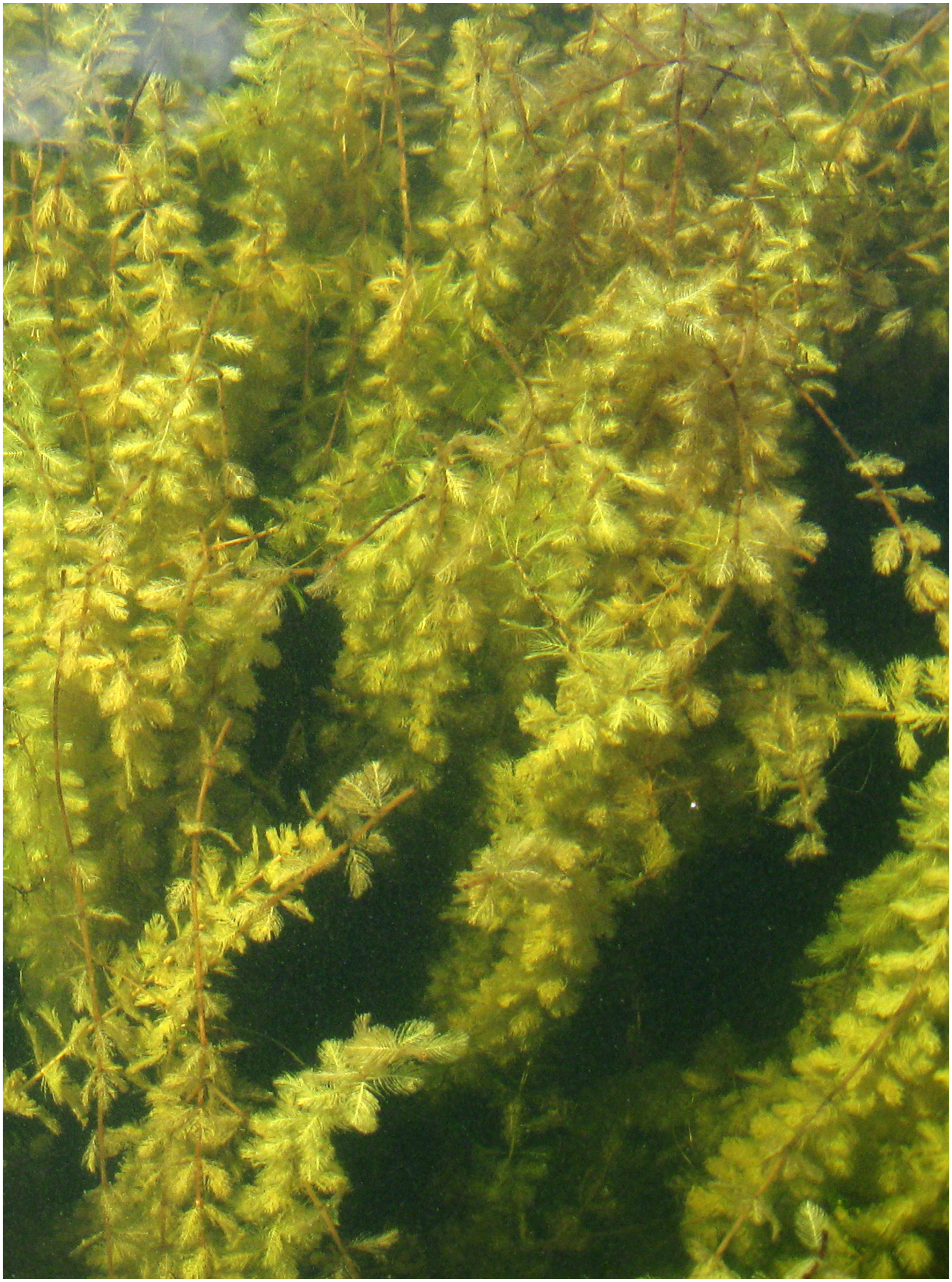

Figure 2. Eurasian milfoil.

Aquatic Plants

SURVEY METHODS AND RESULTS

In 2013, aquatic plant surveys of Houghton Lake were conducted on June 11 and 12 and from August 8 through 14 using the point-intercept method (Madsen 1999). Sampling locations were established at grid-points with a global positioning system (GPS). At each sampling location, a double-sided thatch rake attached to a line was dragged for approximately 15 feet in two rake tosses, one on each side of the boat.

The June survey was used to identify the location of Eurasian milfoil beds in the lake by sampling grid points spaced at 500-foot intervals in locations where nuisance Eurasian milfoil growth had occurred historically (Figure 3).

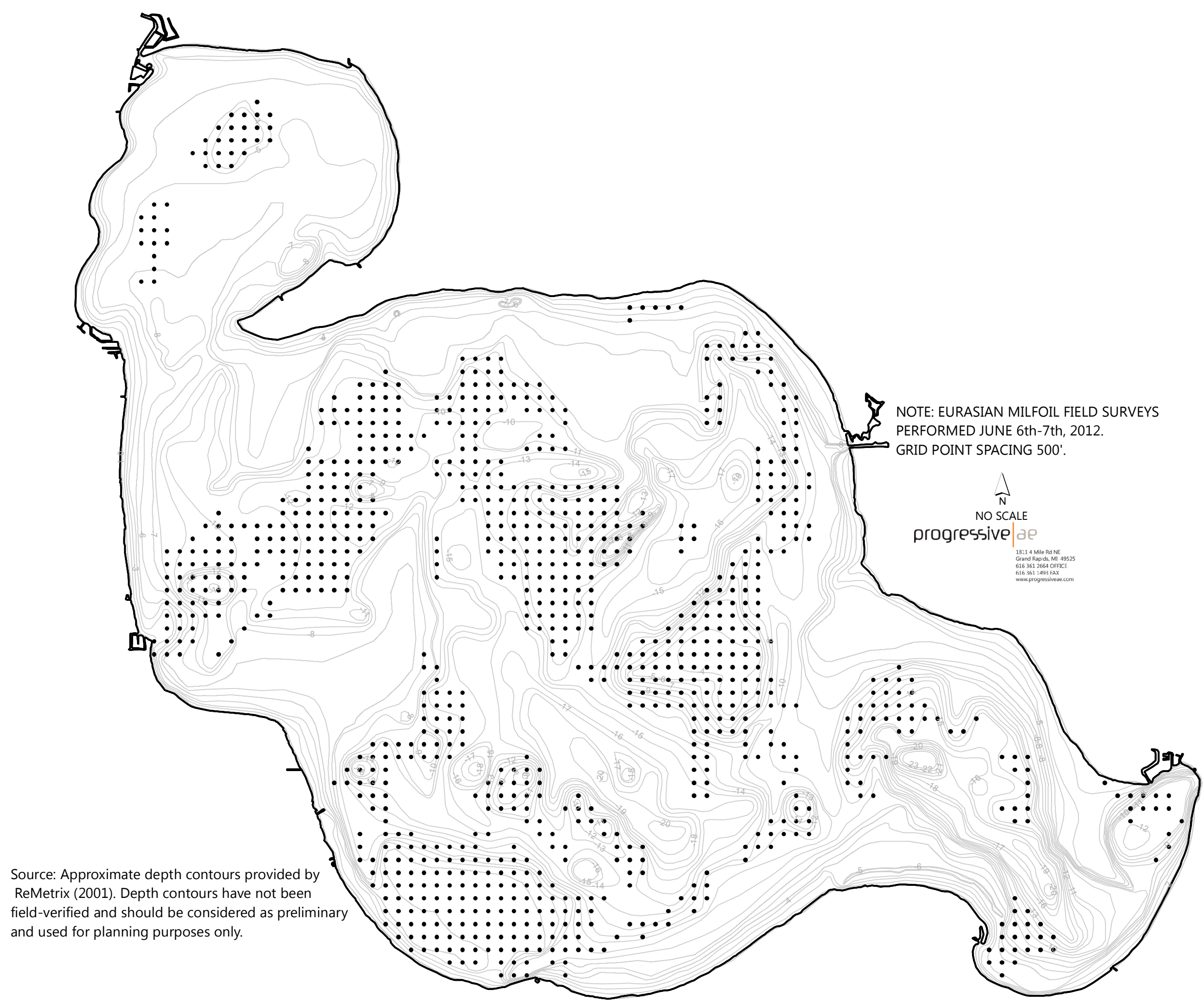

Figure 3. Aquatic plant survey sampling locations, June 11-12, 2013.

In August, plant samples were collected at 300-meter intervals for a total of 912 points at the same locations that have been sampled annually since 2001 (Figure 4). The August survey is conducted to evaluate the composition of all plants species in the lake (Table 1).

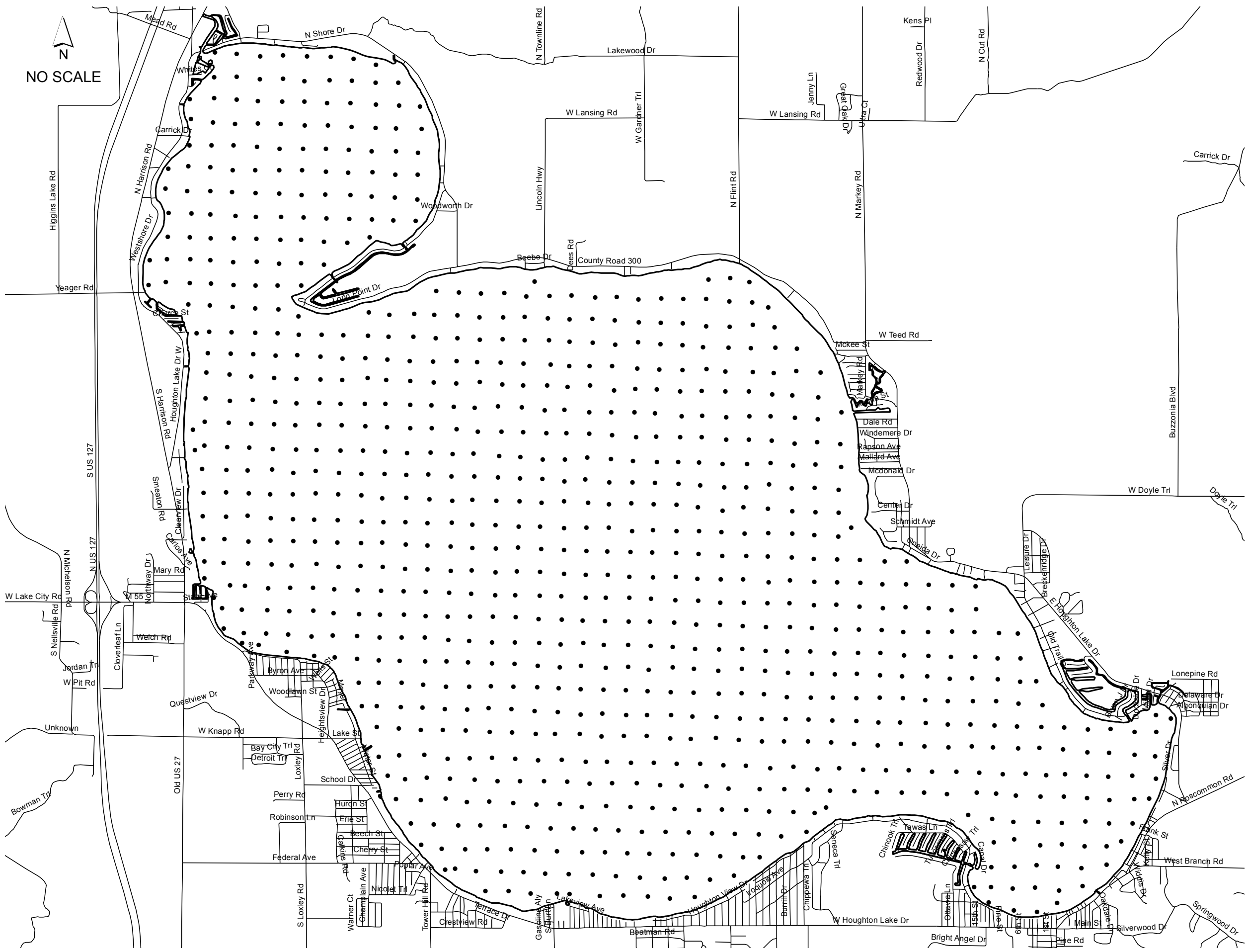

Figure 4. Aquatic plant survey sampling locations, August 8-14, 2013.

TABLE 1
HOUGHTON LAKE AQUATIC PLANTS
August 2013

Common Name	Scientific Name	Number of Sites Where Present
Chara	*Chara* sp.	327
Elodea	*Elodea canadensis*	158
Whitestem pondweed	*Potamogeton praelongus*	129
Eurasian milfoil	*Myriophyllum spicatum*	118
Naiad	*Najas* sp.	109
Variable pondweed	*Potamogeton gramineus*	88
Richardson's pondweed	*Potamogeton richardsonii*	88
Starry stonewort	*Nitellopsis obtusa*	65
Wild celery	*Vallisneria americana*	31
Illinois pondweed	*Potamogeton illinoensis*	23
Water marigold	*Megalodonta beckii*	19
Flat-stem pondweed	*Potamogeton zosteriformis*	12
Water stargrass	*Heteranthera dubia*	8
Robbins pondweed	*Potamogeton robbinsii*	6
Large-leaf pondweed	*Potamogeton amplifolius*	6
Coontail	*Ceratophyllum demersum*	5
Small pondweed	*Potamogeton pusillus*	4
Bladderwort	*Utricularia vulgaris*	3
Thin-leaf pondweed	*Potamogeton* sp.	2
Bulrush	*Scirpus* sp.	2
Curly-leaf pondweed	*Potamogeton crispus*	1
Wild rice	*Zizania aquatica*	1
Yellow waterlily	*Nuphar* sp.	1
Variable-leaf pondweed	*Potamogeton diversifolius*	1
Nitella	*Nitella* sp.	1

Houghton Lake has an abundant and diverse aquatic plant population. In August of 2013, there were 25 species of aquatic plants found in 554 of the 912 points in Houghton Lake. Thus, about sixty percent of Houghton Lake supports aquatic plant growth. With a surface area of 20,044 acres, this equates to nearly 12,000 acres of vegetation in Houghton Lake. Of the species observed in 2013, Chara was the most abundant followed by Elodea and whitestem pondweed. Of the 118 sites where Eurasian milfoil was observed in the lake, dense milfoil growth was observed at only five locations. Thus, during the August survey, Eurasian milfoil growth was dense in less than 1% of the lake. Another plant that was observed and needs to be monitored closely in Houghton Lake is starry stonewort. This plant is similar in appearance to Chara but tends to grow much more aggressively. Unlike Chara which is generally considered to be a beneficial plant, starry stonewort is an invasive exotic species that has become a nuisance in many Michigan lakes. Starry stonewort should be closely monitored in Houghton Lake to ensure it does not gain dominance.

PLANT CONTROL IN HOUGHTON LAKE, 2002 - 2013

A summary of plant control in Houghton Lake since 2002 is presented in Table 2. Eurasian milfoil infested about 11,000 acres (approximately 54 percent of the lake area) in 2001 before the Sonar® treatment; in July of 2013, about nine percent of the lake was treated (Figure 5).

TABLE 2
HOUGHTON LAKE PLANT CONTROL HISTORY

	Herbicides (acres treated)			Acres	Milfoil Weevils
	Sonar®	Contacts	Systemic	Harvested	(# Stocked)
2002	20,044	17			
2003			32		
2004			44	81	5,000
2005		50	395	84	28,000
2006		59	444	105	
2007		106	660		30,000
2008		20	1,310	35	
2009		40	1,751		
2010		39	558		
2011		42	1,747		
2012		84	1,237		
2013		49	1,902		

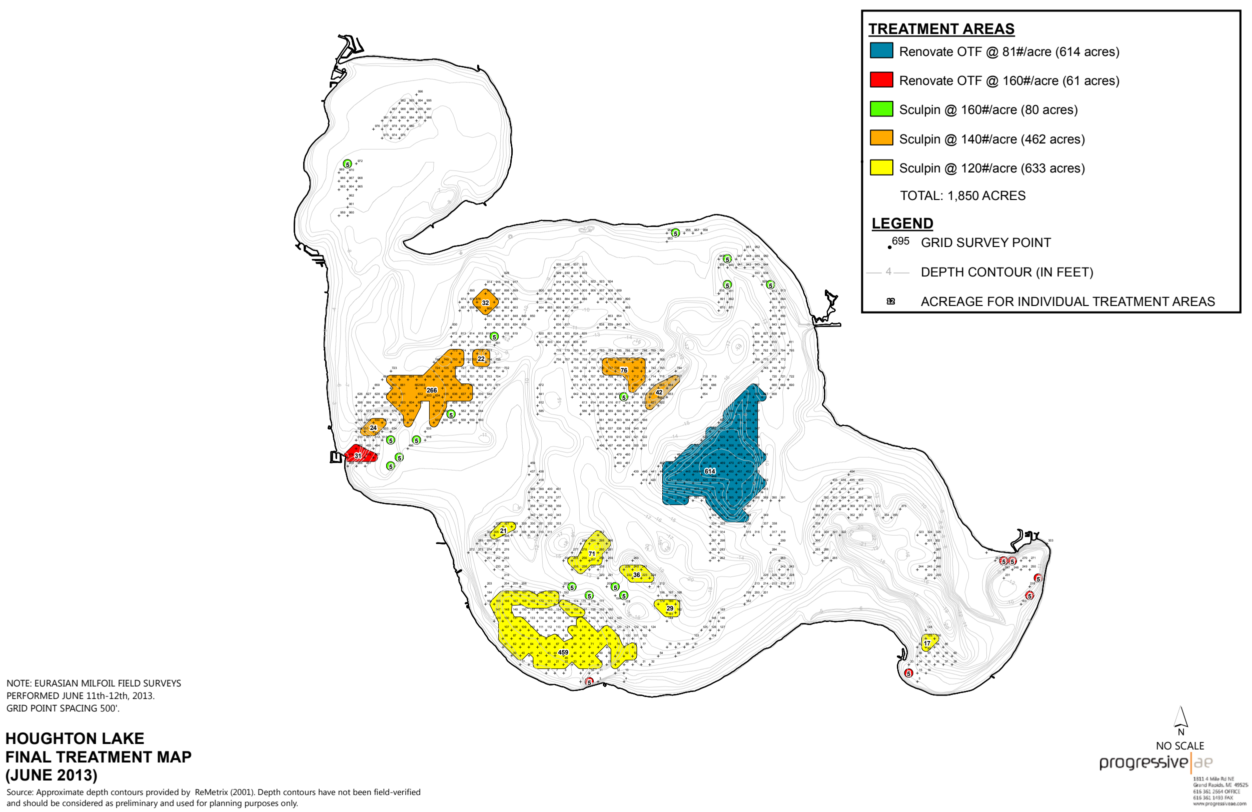

Figure 5. Eurasian milfoil treatment areas in Houghton Lake in 2013. In addition to herbicide treatments in the main body of the lake, several of the canal areas were treated in 2013 to control Eurasian milfoil.

To minimize potential impacts to wild rice, the permit issued by the Michigan Department of Environmental Quality for the 2013 treatment required that low doses of the systemic herbicide triclopyr be used for Eurasian milfoil control in areas known or suspected to contain wild rice, i.e., the Middle Grounds and North Bay. The low-dose protocol was used throughout the Middle Grounds treatment area. As in the previous two years, no herbicides were used in North Bay in order to address concerns raised by the Houghton Lake, Lake Association. During the August 2013 survey, Eurasian milfoil was growing at common to dense levels in about 150 acres of North Bay, and no wild rice was observed.

Results of recent genetic testing show hybrid milfoil plants are growing in a number of Michigan lakes. The hybrid milfoil is a cross between the invasive, exotic species Eurasian milfoil (*Myriophyllum spicatum*) and the native northern milfoil (*Myriophyllum sibiricum*). Because the hybrid milfoil combines traits of the native and exotic milfoils, there is concern in the scientific community that the hybrid milfoil will be more aggressive than the Eurasian milfoil. Some variants of the hybrid milfoil also appear to be tolerant to certain herbicides. To address this potential issue in Houghton Lake, milfoil samples were collected from 18 locations in the lake where milfoil was observed at common to dense levels during the August 2012 grid survey and were analyzed by Grand Valley State University. Ten of the 18 samples were identified as hybrid milfoil and the remainder (8 samples) were Eurasian milfoil. Although hybrid milfoil is present in Houghton Lake, the efficacy of the 2013 herbicide treatments did not appear to be diminished.

Monitoring will be required on an ongoing basis to minimize the spread of Eurasian milfoil in Houghton Lake. Surveys and treatments in 2014 should be conducted similarly to those in 2013. That is, in June, plants will be collected at grid points spaced at 500-foot intervals in areas where nuisance milfoil growth has occurred historically in Houghton Lake and, in August, the 912-point survey will be conducted across the entire lake. The June survey would identify Eurasian milfoil beds and facilitate early-season treatment of areas infested with Eurasian milfoil. The August survey would evaluate the efficacy of early-season control efforts, and the distribution of all plants in the lake. The August grid survey would use the same protocol detailed in the Houghton Lake Management Feasibility Study (Smith et al. 2002) in which presence or absence of all species present and an estimate of species density are conducted. This protocol has been replicated annually since the Sonar® treatment and has been periodically integrated with hydroacoustic vegetation assessments performed by ReMetrix LLC.

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 6). 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 warm water fish such as bass and pike. Lakes that fall between these two extremes are called mesotrophic lakes.

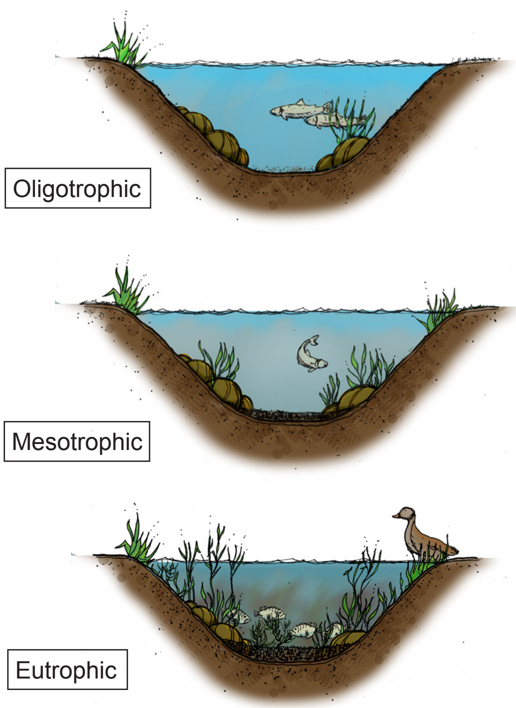

Figure 6. Lake classification.

Under natural conditions, most lakes will ultimately evolve to a eutrophic state as they gradually fill with sediment and organic matter transported to the lake from the surrounding watershed. As the lake becomes shallower, the process accelerates. When aquatic plants become abundant, the lake slowly begins to fill in as sediment and decaying plant matter accumulate on the lake bottom. Eventually, terrestrial plants become established and the lake is transformed to a marshland. The aging process in lakes is called "eutrophication" and may take anywhere from a few hundred to several thousand years, generally depending on the size of the lake and its watershed. The natural lake aging process can be greatly accelerated if excessive amounts of sediment and nutrients (which stimulate aquatic plant growth) enter the lake from the surrounding watershed. Because these added inputs are usually associated with human activity, this accelerated lake aging process is often referred to as "cultural eutrophication." The problem of cultural eutrophication can be managed by identifying sources of sediment and nutrient loading (i.e., inputs) to the lake and developing strategies to halt or slow the inputs. 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, chlorophyll-*a*, and Secchi transparency. A brief description of these water quality measurements is provided as an introduction for the reader. Particular attention should be given to the interrelationship of these water quality measurements.

TEMPERATURE

Temperature is important in determining the type of organisms that may live in a lake. For example, trout prefer temperatures below 68°F. Temperature also determines how water mixes in a lake. As the ice cover breaks up on a lake in the spring, the water temperature becomes uniform from the surface to the bottom. This period is referred to as "spring turnover" because water mixes throughout the entire water column.

As the surface waters warm, they are underlain by a colder, more dense strata of water. This process is called thermal stratification. Once thermal stratification occurs, there is little mixing of the warm surface waters with the cooler bottom waters. The transition layer that separates these layers is referred to as the "thermocline." The thermocline is characterized as the zone where temperature drops rapidly with depth. As fall approaches, the warm surface waters begin to cool and become more dense. Eventually, the surface temperature drops to a point that allows the lake to undergo complete mixing. This period is referred to as "fall turnover." As the season progresses and ice begins to form on the lake, the lake may stratify again. However, during winter stratification, the surface waters (at or near 32°F) are underlain by slightly warmer water (about 39°F). This is sometimes referred to as "inverse stratification" and occurs because water is most dense at a temperature of about 39°F. As the lake ice melts in the spring, these stratification cycles are repeated (Figure 7). Shallow lakes do not stratify. Lakes that are 15 to 30 feet deep may stratify and destratify with storm events several times during the year.

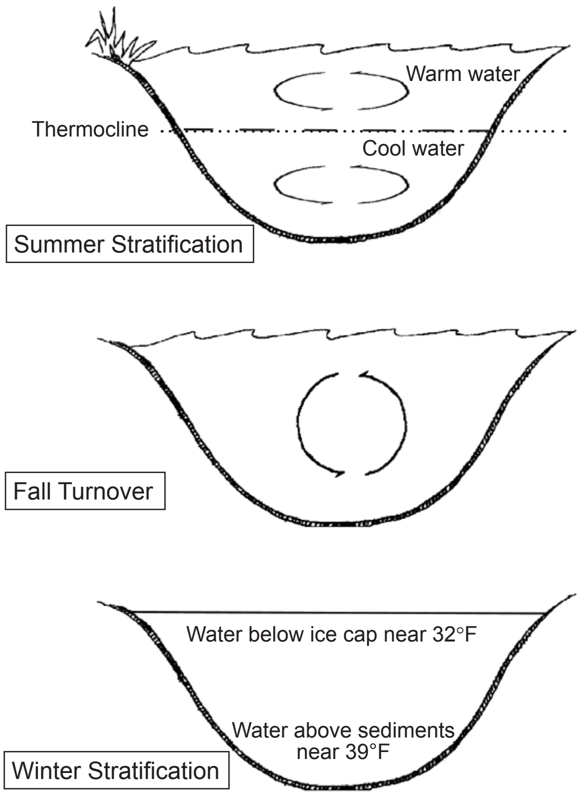

Figure 7. Lake stratification and turnover.

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 warm water 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 deep water is cut off from plant photosynthesis and the atmosphere, and oxygen is consumed 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 cold water fish because the cool, deep water (that the fish require to live) does not contain sufficient oxygen.

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. In the presence of oxygen, lake sediments act as a phosphorus trap, retaining phosphorus and, thus, making it unavailable for aquatic plant growth. However, if bottom-water oxygen is depleted, phosphorus will be released from the sediments and may be available to promote aquatic plant growth. In some lakes, the internal release of phosphorus from the bottom sediments is the primary source of phosphorus loading (or input).

By reducing the amount of phosphorus in a lake, it may be possible to control the amount of aquatic plant growth. In general, lakes with a phosphorus concentration greater than 20 μg/L (micrograms per liter, or parts per billion) are able to support abundant plant growth and are classified as nutrient-enriched or eutrophic.

CHLOROPHYLL-*a*

Chlorophyll-*a* is a pigment that imparts the green color to plants and algae. A rough estimate of the quantity of algae present in lake water can be made by measuring the amount of chlorophyll-*a* in the water column. A chlorophyll-*a* concentration greater than 6 μg/L is considered characteristic of a eutrophic condition.

SECCHI TRANSPARENCY

A Secchi disk is often used to estimate water clarity. The measurement is made by fastening a round, black and white, 8-inch disk to a calibrated line (Figure 8). The disk is lowered over the deepest point of the lake until it is no longer visible, and the depth is noted. The disk is then raised until it reappears. The average between these two depths is the Secchi transparency. Generally, it has been found that aquatic plants can grow at a depth of approximately twice the Secchi transparency measurement. In eutrophic lakes, water clarity is often reduced by algae growth in the water column, and Secchi disk readings of 7.5 feet or less are common.

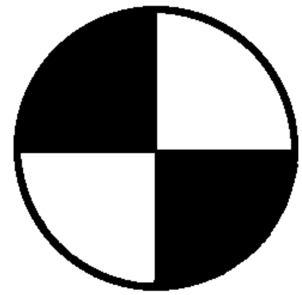

Figure 8. Secchi disk.

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 Environmental Quality is shown in Table 3.

TABLE 3
LAKE CLASSIFICATION CRITERIA

Lake Classification	Total Phosphorus (μg/L)[1]	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

SAMPLING METHODS

Water quality samples were collected in the spring and summer of 2013 from five locations within Houghton Lake (Figure 9). Temperature was measured using a YSI Model 550A probe. Samples were collected at the surface and just above the lake bottom with a Kemmerer bottle to be analyzed for dissolved oxygen, pH, total alkalinity, and total phosphorus. Dissolved oxygen samples were fixed in the field and were analyzed at Progressive AE using the modified Winkler method (Standard Methods Procedure 4500-O C). pH was measured in the field using a Hach pH Pal. Total alkalinity and total phosphorus samples were placed on ice and transported to Progressive AE and to Prein and Newhof[2], respectively, for analysis. Total alkalinity was titrated at Progressive AE using Standard Methods Procedure 2320.B, and total phosphorus was analyzed at Prein and Newhof using Standard Methods Procedure 4500P-E. Also at each of the five sampling locations, 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 using Standard Methods Procedure 10200H.

1 μg/L = micrograms per liter = parts per billion.
2 Prein and Newhof, 3260 Evergreen Drive, NE, Grand Rapids, MI 49525.

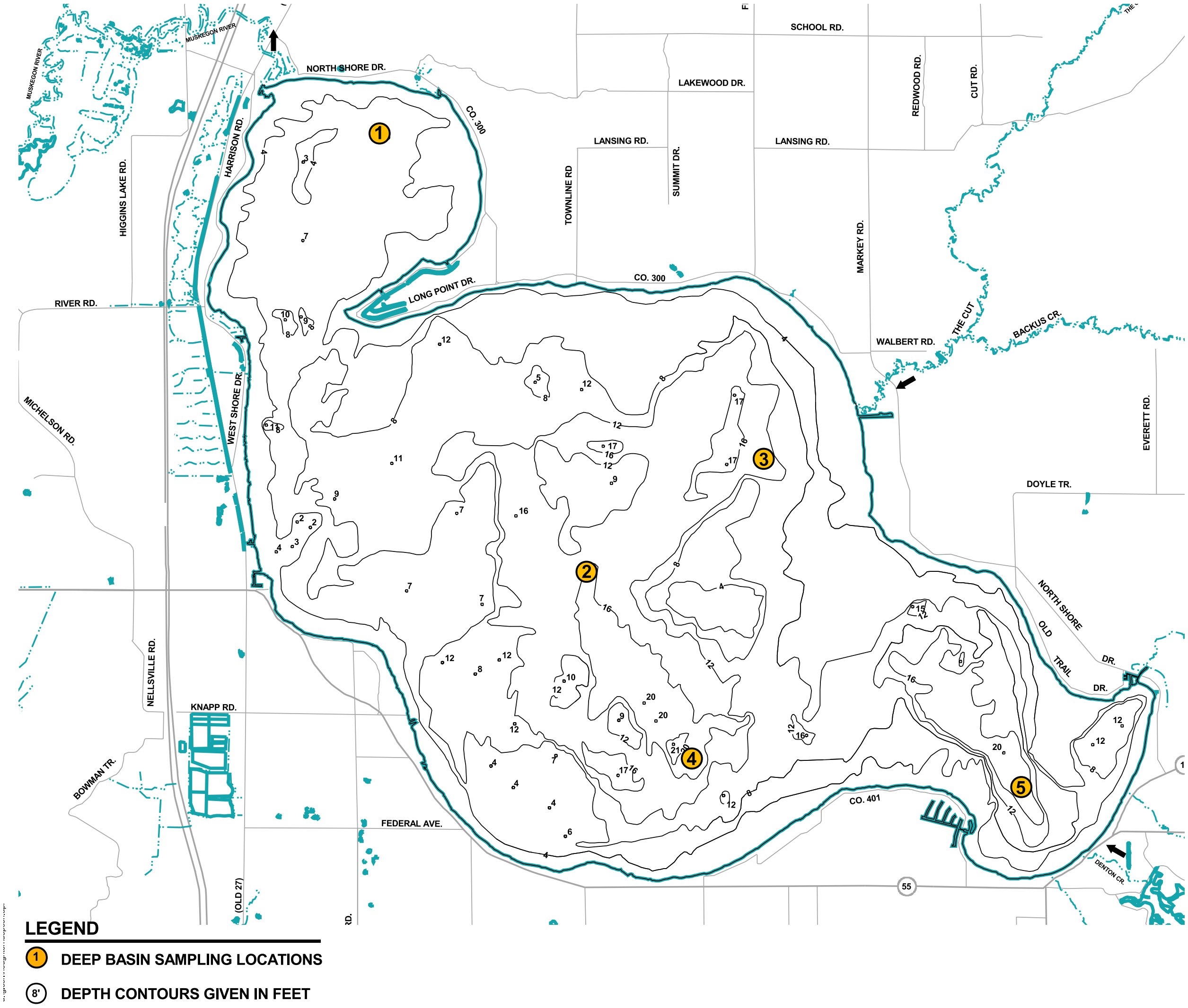

Figure 9. Houghton Lake sampling location map.

SAMPLING RESULTS AND DISCUSSION

Lake water quality data is provided in Tables 4 and 5. In-lake summary statistics are included in Table 6.

TABLE 4
HOUGHTON LAKE
2013 DEPTH PROFILE WATER QUALITY DATA

Date	Station	Sample Depth (feet)	Temp-erature (°F)	Dissolved Oxygen (mg/L)[1]	Total Phosphorus (µg/L)[2]	pH (S.U.)[3]	Total Alkalinity (mg/L as $CaCO_3$)[4]
29-Apr-13	1	1	52	11.3	9	8.4	84
29-Apr-13	1	6	50	10.8	<5	8.3	86
29-Apr-13	2	1	48	11.2	<5	8.4	84
29-Apr-13	2	14	46	12.1	<5	8.5	83
29-Apr-13	3	1	48	9.5	<5	8.4	96
29-Apr-13	3	16	45	11.2	<5	8.4	91
29-Apr-13	4	1	47	10.0	<5	8.4	87
29-Apr-13	4	20	45	7.3	<5	8.3	86
29-Apr-13	5	1	49	11.0	<5	8.4	83
29-Apr-13	5	18	46	10.1	<5	8.3	84
14-Aug-13	1	1	65	8.0	<5	9.1	84
14-Aug-13	1	4	63	8.6	<5	9.1	82
14-Aug-13	2	1	66	6.0	9	8.8	78
14-Aug-13	2	14	66	6.7	<5	8.7	82
14-Aug-13	3	1	67	7.6	<5	8.7	87
14-Aug-13	3	13	67	7.2	<5	8.7	89
14-Aug-13	4	1	65	9.9	18	8.5	87
14-Aug-13	4	19	64	10.0	14	8.6	87
14-Aug-13	5	1	66	9.1		8.6	89
14-Aug-13	5	20	65	9.2	10	8.6	86

1 mg/L = micrograms per liter = parts per billion.
2 µg/L = micrograms per liter = parts per billion.
3 S.U. = standard units.
4 mg/L as $CaCO_3$ = milligrams per liter as calcium carbonate.

TABLE 5
HOUGHTON LAKE
2013 SURFACE WATER QUALITY DATA

Date	Station	Secchi Transparency (feet)	Chlorophyll-*a* (µg/L)[1]
29-Apr-13	1	7.0	1
29-Apr-13	2	8.0	2
29-Apr-13	3	7.0	2
29-Apr-13	4	8.0	2
29-Apr-13	5	7.0	2
14-Aug-13	1	4.5	1
14-Aug-13	2	3.0	3
14-Aug-13	3	3.0	0
14-Aug-13	4	3.0	2
14-Aug-13	5	3.0	1

TABLE 6
HOUGHTON LAKE IN-LAKE SUMMARY STATISTICS
2003-2013

	Total Phosphorus (µg/L)[1]	Secchi Transparency (feet)	Chlorophyll-*a* (µg/L)[1]
Average	29	5.4	1.1
Standard deviation	29	1.3	1.3
Median	20	5.4	0.9
Minimum	<5	2.5	0.0
Maximum	256	9.0	8.2
Number of samples	277	137	137

1 µg/L = micrograms per liter = parts per billion.

The shallow depths in Houghton Lake cause the lake to mix constantly from spring to fall and as such, water temperature and chemistry are fairly uniform from top to bottom. Temperatures were cool in spring and warm in summer. The water was well oxygenated from the surface to bottom during both the spring and summer sampling periods in 2013, and were well above the concentration needed to sustain a warmwater fishery. Although dissolved oxygen concentrations are adequate, water temperatures in Houghton Lake are too warm to sustain a coldwater fishery.

In 2013, total phosphorus concentrations were low in spring and summer. Phosphorus data collected in recent years indicates that phosphorus levels in Houghton Lake can vary considerably both season-to-season and year-to-year (Table 4; Figure 10). This variability in phosphorus levels may be related to wind action that periodically stirs unconsolidated bottom sediments into the water column. The median phosphorus concentration of all in-lake phosphorus data collected since 2003 is 20 ppb, a level that is at the eutrophic threshold.

Algal growth was low in 2013, as indicated by the chlorophyll-*a* concentrations that were 3 ppb or less. The low chlorophyll-*a* levels suggest that most of the phosphorus in Houghton Lake is used by rooted plants rather than algae. Secchi transparency measurements were generally low in 2013. Given the low chlorophyll-*a* concentrations, it is unlikely the poor clarity is related to algae growth. Instead, turbidity in the water column caused by wind-mixing of bottom sediments probably reduces water clarity. Similar Secchi transparency measurements were reported by Pecor et al. (1973); therefore, reduced clarity is not a new phenomenon in Houghton Lake.

pH is a measure of the amount of acid or base in water. The pH scale ranges from 0 (acidic) to 14 (alkaline or basic) with neutrality at 7. The pH of most lakes generally ranges from 6 to 9 (Wetzel 1983). During 2013, the pH in Houghton Lake ranged from 8.3 to 9.1.

Alkalinity is the measure of the pH-buffering capacity of water in that it is the quantitative capacity of water to neutralize an acid. Often lakes with high alkalinity (such as Houghton Lake) receive substantial water inputs via groundwater springs. Houghton Lake is well buffered and therefore not susceptible to the effects of acid rain.

Based on the data collected and presented herein, Houghton Lake is meso-eutrophic in that the lake exhibits moderately elevated phosphorus levels, low chlorophyll-*a*, and low transparency (Figures 10 through 12).

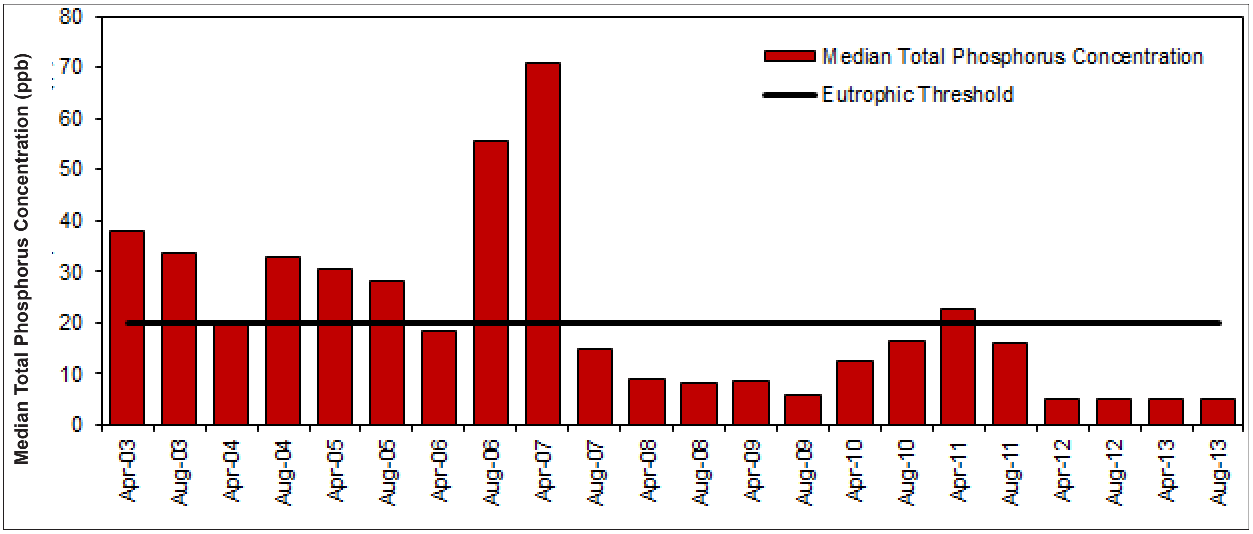

Figure 10. Houghton Lake median total phosphorus concentrations, 2003 - 2013.

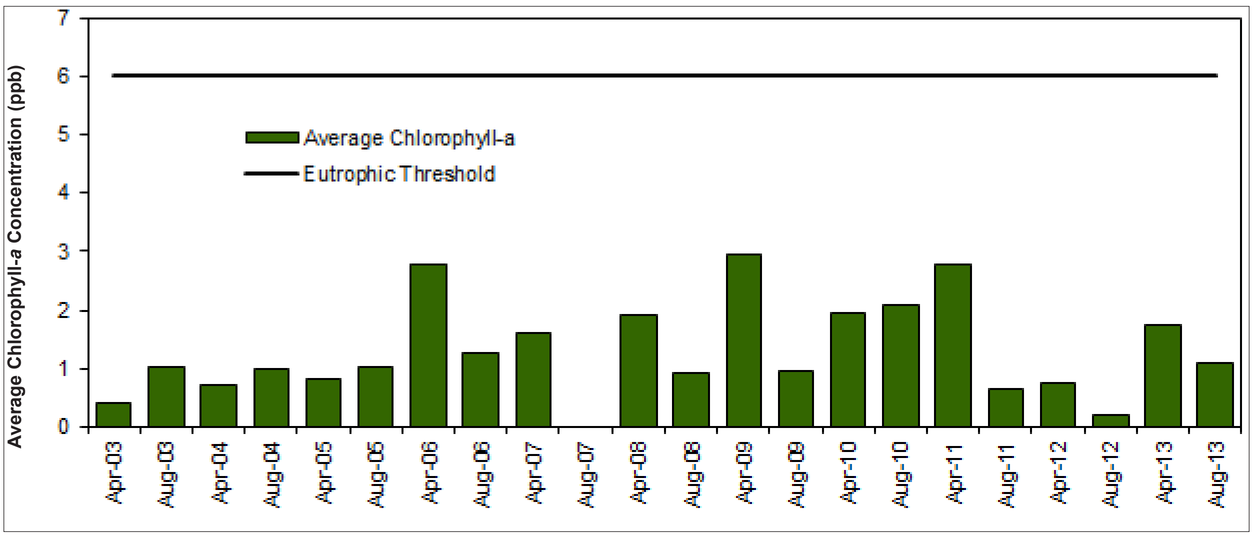

Figure 11. Houghton Lake average chlorophyll-*a* concentrations, 2003 - 2013.

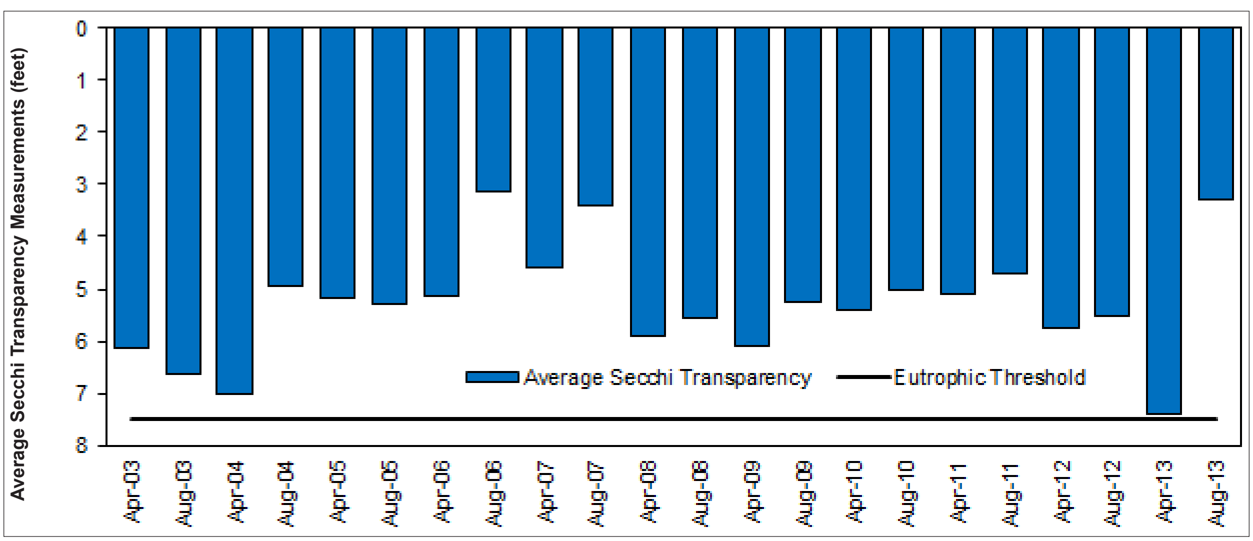

Figure 12. Houghton Lake average Secchi transparency measurements, 2003 - 2013.

Information and Education

This year, property owners around Houghton Lake were provided information via the lake board's website at houghtonlakeboard.org (Figure 13). The web site includes a discussion of the history surrounding Houghton Lake; facts about the lake, the watershed, aquatic plants, and the fishery; reports from various sources regarding Houghton Lake; and includes a posting of lake board meeting dates. For 2013, the website was updated to include the 2012 annual report, a 2013 newsletter, and a recently completed fishery report from the Michigan Department of Natural Resources.

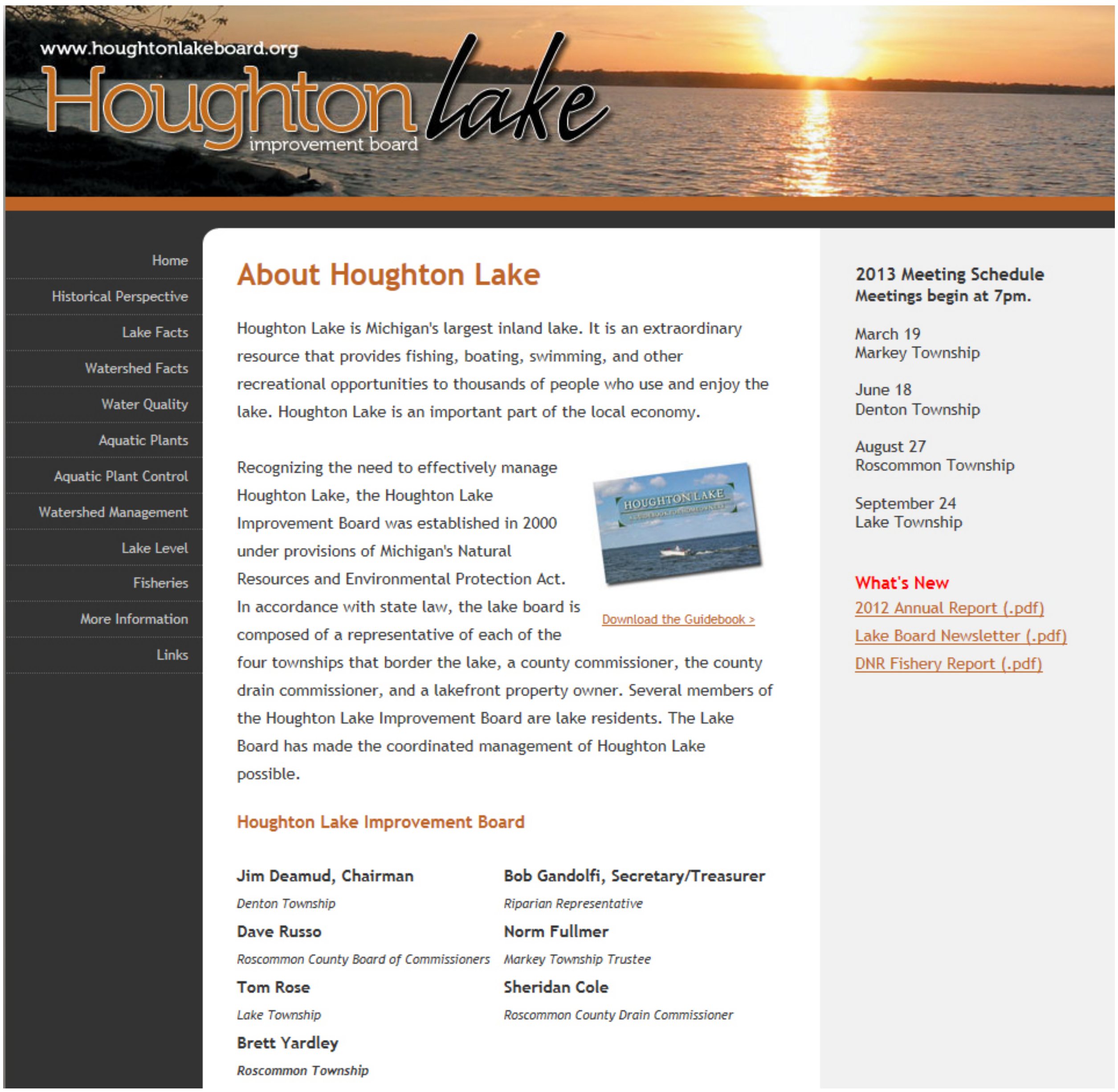

Figure 13. Houghton Lake Improvement Board web site.

Watershed Management

The land area surrounding a lake that drains to the lake is called its watershed or drainage basin. The Houghton Lake watershed is 172 square miles in area, a land area over five times greater than the lake itself (Figure 14). Houghton Lake receives drainage from Higgins Lake via the Cut River and four major tributaries: Knappen Creek, Denton Creek, Spring Brook, and Backus Creek. The Houghton Lake watershed encompasses all or part of 13 townships.

Figure 14. Houghton Lake watershed map.

WATERSHED MANAGEMENT

Over the long term, Houghton Lake's water quality will be influenced by land use activities in its watershed. Fortunately, much of the watershed is state-owned land and consists of forested areas or wetlands. By filtering and absorbing runoff, forests and wetlands in the watershed help to preserve water quality. With the construction of a sanitary sewer system around Houghton Lake in the 1970's, a primary source of pollution input to the lake was eliminated. However, much of the land adjacent to the lake has been urbanized and stormwater and fertilizer runoff are a concern.

To address this concern, watershed management elements to date have included the following:

- The watershed was mapped in detail to identify land use, soil types and drainage characteristics.
- The shoreline was surveyed and all stormwater outfalls to the lake were identified and mapped.
- Watershed management guidelines for lakeside landscaping, fertilizer use, and stormwater management were provided to all area homeowners.
- An ordinance that restricted the use of phosphorus fertilizers was drafted by the lake board and adopted by Roscommon County and all four townships bordering Houghton Lake.
- Roscommon County has adopted county-wide stormwater management guidelines.
- Information about low impact development and shoreline development ordinances has been provided to local government officials.

In 2011, the Muskegon River Watershed Assembly (MRWA) began work on the preparation of a watershed management plan for the Upper Muskegon River Watershed, which includes Houghton Lake. Key partners in the project include Grand Valley State University's Annis Water Resources Institute (AWRI) and the Central Michigan District Health Department. In addition, a Steering Committee has been established composed of representatives from throughout the watershed, including a Houghton Lake Improvement Board member.

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