Lily Lake
Clare County, Michigan
Aquatic Plant Control Report

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Table of Contents

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

Lily Lake is located in Sections 33 and 34 of Greenwood Township and Section 3 of Lincoln Township in Clare County, Michigan (T18-19N, R5W; Figure 1). In June of 2018, Progressive AE was retained to assist with the establishment of a statutory lake board to administer an aquatic plant control program on Lily Lake that, for many years, has been administered by Greenwood Township. As part of the evaluation, Progressive AE reviewed past aquatic plant control activities, assessed the physical characteristics of Lily Lake, conducted an aquatic plant survey to determine the type and abundance of vegetation in the lake, evaluated alternatives to control nuisance plant growth, developed a proposed budget, and described a method to finance a plant control program for Lily Lake. This report contains a summary of study findings, conclusions and recommendations.

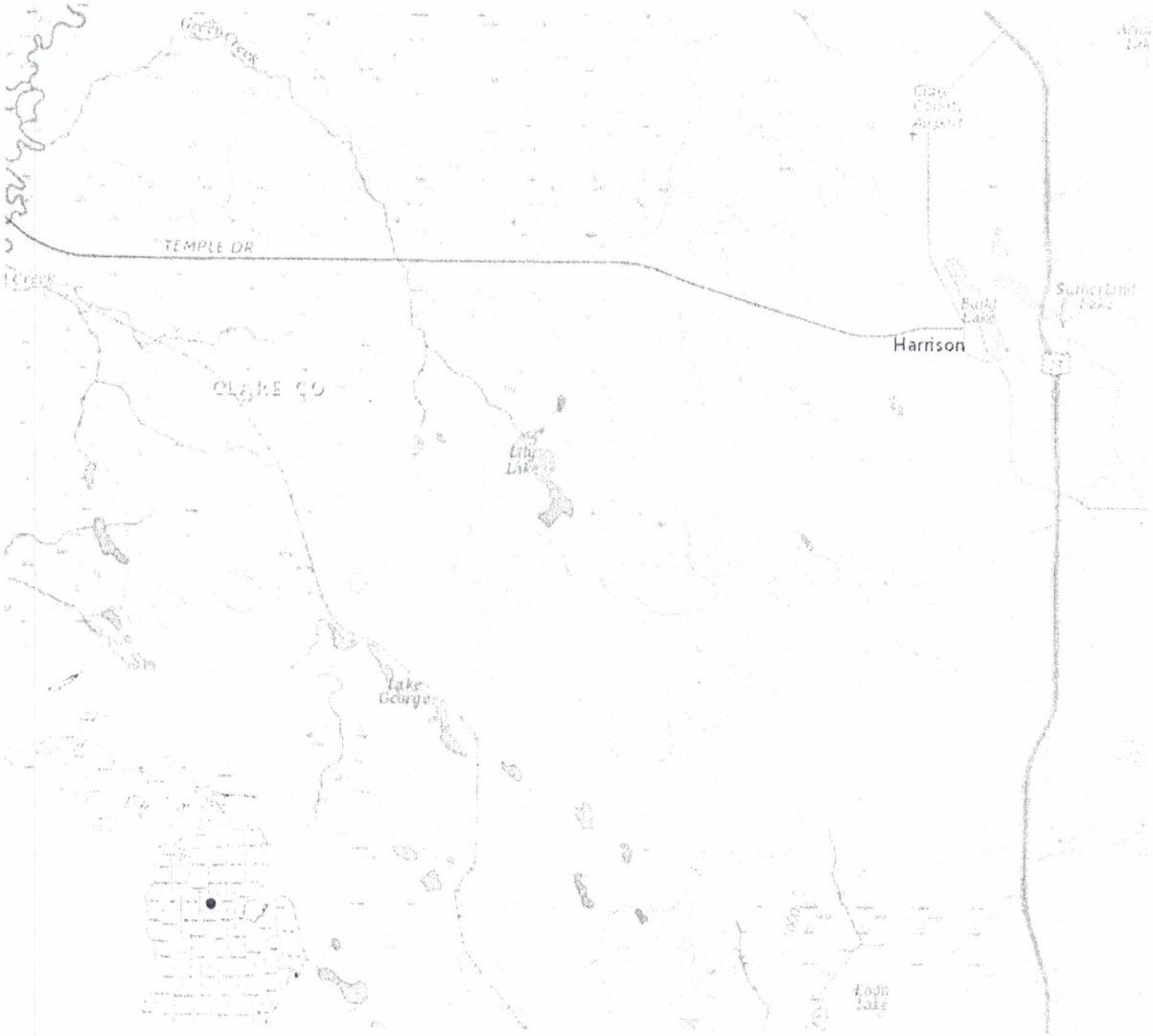

Figure 1. Lily Lake location map.

Findings

LAKE PHYSICAL CHARACTERISTICS

Lily Lake was mapped by the Michigan Department of Conservation (MDC) in 1937. Figure 2 shows the depth contours mapped by the MDC. The MDC map shows the lake has a surface area of 161 acres and a maximum depth of 9 feet. However, more recent mapping from the State of Michigan indicates the lake area is 190 acres and the shoreline length is 4.9 miles. The Lily Lake shoreline development factor is 2.5. The shoreline development factor indicates the degree of irregularity in the shape of the shoreline. That is, compared to a perfectly round lake with the same surface area as Lily Lake (i.e., 190 acres), the shoreline of Lily Lake is over twice as long because of its irregular shape.

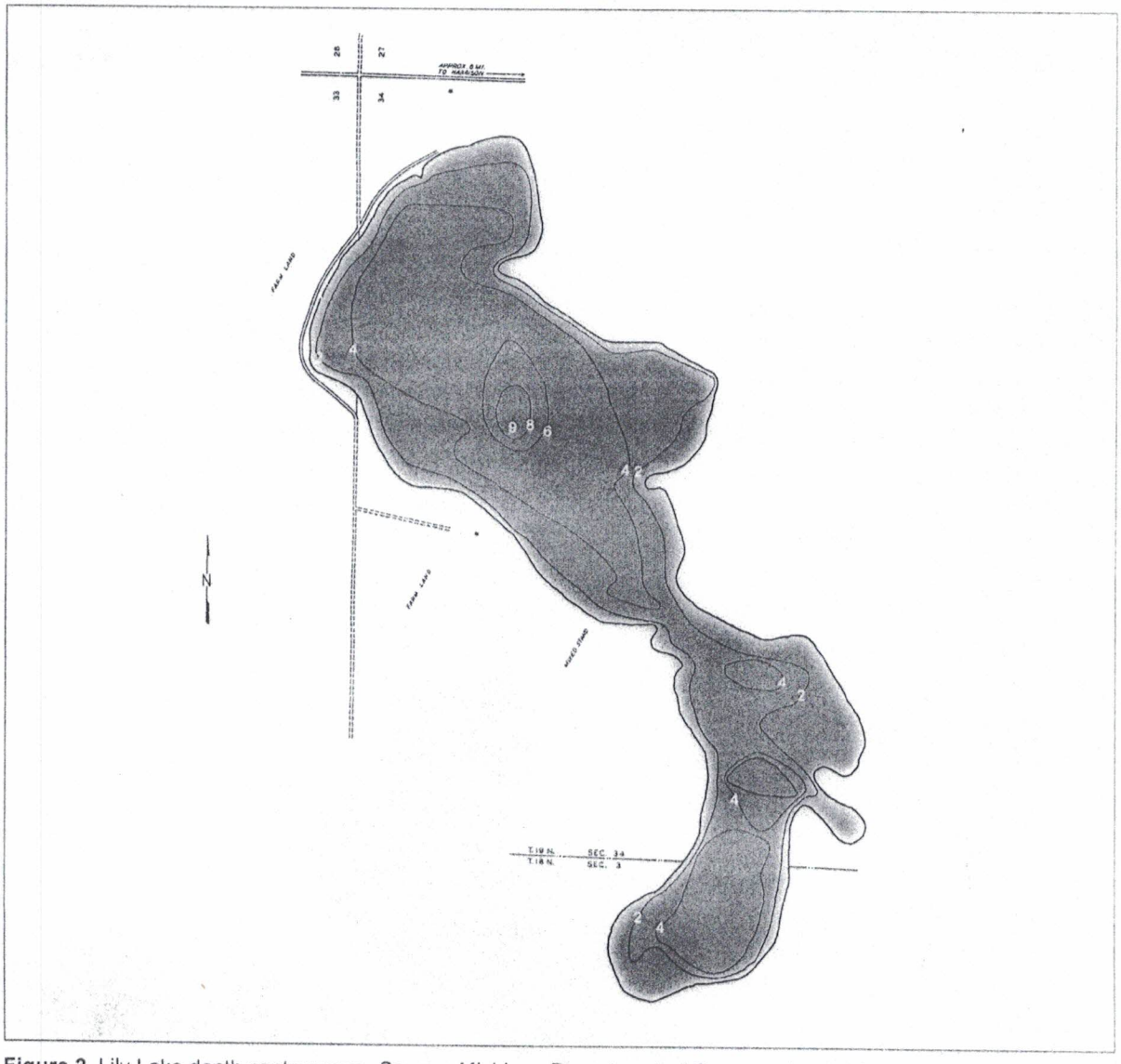

Figure 2. Lily Lake depth contour map. Source: Michigan Department of Conservation (1936-37).

FINDINGS

LILY LAKE AQUATIC PLANTS

On July 18, 2018, biologists from Progressive AE conducted an aquatic vegetation survey of Lily Lake in which aquatic plants were observed at 59 sites in the lake. At each site, the type and relative abundance of all plants observed were recorded. Results of the aquatic plant survey are summarized in Table 1. At the time of the plant survey, Lily Lake contained thirteen submersed plant species, three floating-leaved species, and three emergent species.

TABLE 1
LILY LAKE AQUATIC PLANTS
July 18, 2018

Common Name	Scientific Name	Group	Percent of Sites Where Present
Robbins pondweed	*Potamogeton robbinsii*	Submersed	31
Large-leaf pondweed	*Potamogeton amplifolius*	Submersed	22
Richardson's pondweed	*Potamogeton richardsonii*	Submersed	20
Eurasian milfoil	*Myriophyllum spicatum*	Submersed	20
Submersed bulrush	*Schoenoplectus subterminalis*	Submersed	17
Bladderwort	*Utricularia vulgaris*	Submersed	12
Variable pondweed	*Potamogeton gramineus*	Submersed	12
Chara	*Chara* sp.	Submersed	10
Wild celery	*Vallisneria americana*	Submersed	10
Illinois pondweed	*Potamogeton illinoensis*	Submersed	8
Slender naiad	*Najas flexilis*	Submersed	7
Spikerush	*Eleocharis acicularis*	Submersed	3
Northern milfoil	*Myriophyllum sibiricum*	Submersed	3
White waterlily	*Nymphaea odorata*	Floating-leaved	61
Water shield	*Brasenia schreberi*	Floating-leaved	24
Yellow waterlily	*Nuphar* sp.	Floating-leaved	2
Bulrush	*Scirpus* sp.	Emergent	14
Pickerelweed	*Pontederia cordata*	Emergent	8
Cattail	*Typha* sp.	Emergent	8

Discussion

In evaluating aquatic plant growth and plant control alternatives, it is important to remember that aquatic plants are an important ecological component of lakes. They produce oxygen from photosynthesis, provide food and habitat for fish, and help stabilize shoreline and bottom sediments (Figure 3).

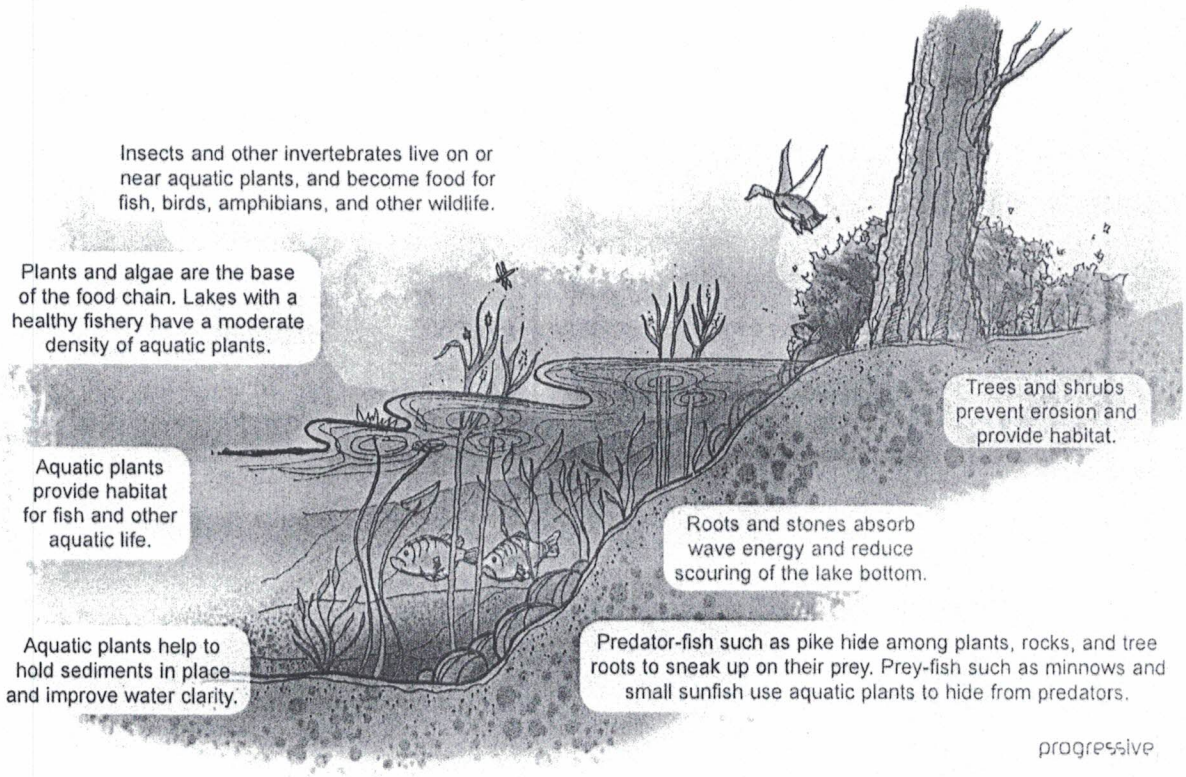

Figure 3. Benefits of aquatic plants.

The distribution and abundance of aquatic plants are dependent on several variables, including light penetration, bottom type, temperature, water levels, and the availability of plant nutrients. The term "aquatic plants" includes both the algae and the larger aquatic plants or macrophytes. The macrophytes can be categorized into four groups: the emergent, the floating-leaved, the submersed, and the free-floating (Figure 4). Each plant group provides unique habitat essential for a healthy lake.

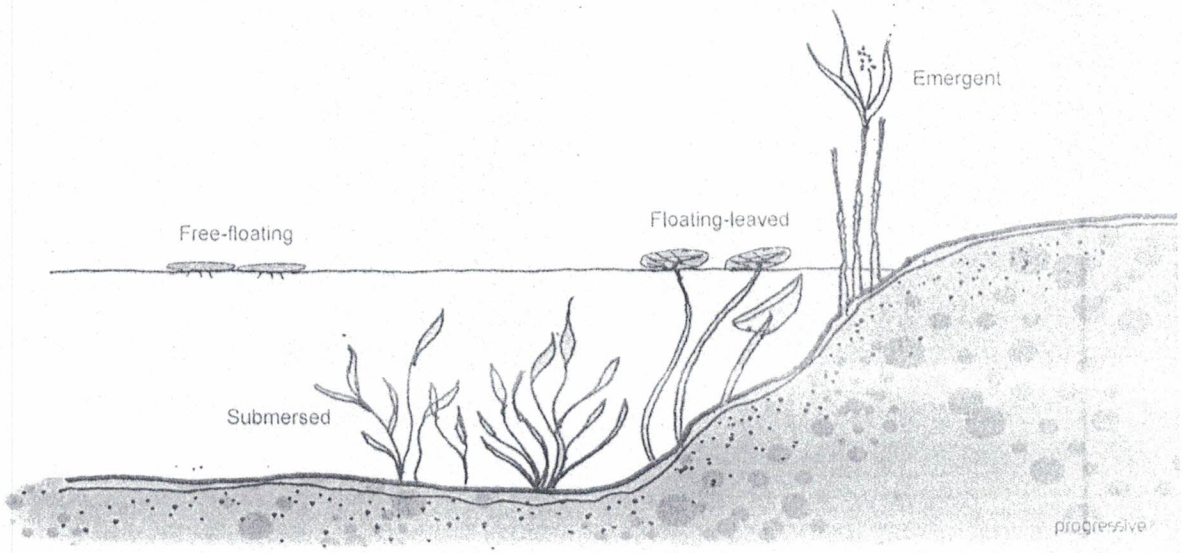

Figure 4. Aquatic plant groups.

However, while most aquatic plants are beneficial, aquatic plant growth can be considered a nuisance when it severely interferes with recreational use or when exotic species are present, both of which occur in Lily Lake. An exotic species is one that is found outside of its natural range. Exotic aquatic plants often have aggressive and invasive growth tendencies. They can quickly out-compete native plants and gain dominance in a lake. During the aquatic plant survey, the exotic species, Eurasian milfoil (*Myriophyllum spicatum*, Figure 5) was found in Lily Lake. Another invasive plant that is a cause for concern is starry stonewort (*Nitellopsis obtusa*). This plant has recently invaded many Michigan lakes, but was not found during the survey of Lily Lake. Given the propensity for this plant to spread quickly if introduced, control measures should be implemented immediately if this plant is found in Lily Lake.

Figure 5. Eurasian milfoil (*Myriophyllum spicatum*).

Figure 6. Starry stonewort (*Nitellopsis obtusa*).

EURASIAN MILFOIL

Getsinger et al. (2005) described problems associated with Eurasian milfoil as follows:

> Problems associated with this species include its aggressive displacement of native vegetation, and alteration of fish and wildlife habitat by formation of impenetrable mats with dense upper canopies that reduce light and decrease water flow. These significant changes in habitat quality quickly affect fish, wildlife, and other aquatic organisms.
>
> Over time, Eurasian watermilfoil will out-compete or eliminate more beneficial native aquatic plants, severely reducing natural plant diversity within a lake. Eurasian watermilfoil is rarely used for food by wildlife, and can displace many aquatic plants that are valuable food sources for waterfowl, fish, and insects. Dense stands of Eurasian watermilfoil provide habitat for mosquitoes and may increase populations of some species of these insects.
>
> Fish populations may initially experience a favorable increase when Eurasian watermilfoil first invades a site. However, the abundant and aggressive growth of this weed will counteract any short term benefits. It's typically dense growth habit make Eurasian watermilfoil beds poor spawning areas for fish and may lead to populations of small-sized specimens. Loss of oxygen and light caused by the dense mats can also affect the characteristics of fish populations. At high densities, Eurasian watermilfoil's foliage supports a lower abundance and diversity of invertebrates to serve as fish food. While dense cover does allow high survival rates of young fish, larger predator fish lose foraging space and are less efficient at obtaining their prey. Thus dense Eurasian watermilfoil stands are reported to reduce expansion and vigor of warm-water fisheries.
>
> The growth and senescence of dense Eurasian watermilfoil colonies also reduce water quality and water circulation, and cause lower levels of dissolved oxygen.

Eurasian milfoil is not the only type of milfoil found in Michigan. There are several native milfoil species, such as northern milfoil (*Myriophyllum sibiricum*). Some native species closely resemble Eurasian milfoil and are commonly mistaken for it. However, the native milfoils rarely form dense, impenetrable plant beds like Eurasian milfoil often does. In some lakes, hybridization between exotic Eurasian milfoil (*M. spicatum*) and native northern milfoil (*M. sibiricum*) is occurring. Genetic testing has found milfoil hybrids to be widely dispersed across the northern portion of the United States and hybrid milfoil appears to be widespread in Michigan (Sturtevant et al. 2009, Moody and Les 2007). The presence of hybrid milfoil is important because hybridity in plants is often linked to invasive traits. In fact, hybrid milfoil may be more invasive than Eurasian milfoil (LaRue et al. 2012). There is concern in the scientific community that hybrids could have a competitive advantage over, and ultimately displace both northern milfoil and Eurasian milfoil (LaRue et al. 2012). Recent research indicates that hybrid milfoils may exhibit increased tolerance to some herbicides (LaRue et al. 2012, Thum et al. 2012).

Given the problems caused by Eurasian milfoil infestations, considerable effort and funds are spent in Michigan and nationwide to control the plant. The most common method of milfoil control is the application of aquatic herbicides. Other alternatives to control nuisance aquatic plants include mechanical harvesting and diver-assisted suction harvesting. Because Eurasian milfoil can spread by vegetative propagation, it is generally ill-advised to control Eurasian milfoil by mechanical harvesting. Diver-assisted suction harvesting shows some promise for small milfoil infestations of a few acres or less. However, given the size of the Lily Lake milfoil infestation, this option is cost-prohibitive. In recent years, a native aquatic insect called the milfoil weevil (*Euhrychiopsis lecontei*) has also been used in an attempt to control milfoil. However, these attempts have been largely unsuccessful, and milfoil weevils are no longer commercially available.

DISCUSSION

Most often, excessive milfoil growth is controlled with herbicides. There are two types of herbicides: systemic and contact. Systemic herbicides are taken up by the plant and translocated to the roots, resulting in more complete control. Contact herbicides only impact the portions of the plant that come into contact with the herbicide. They also tend to be broad-spectrum; they kill both milfoil and desirable native plants. By contrast, systemic herbicides kill milfoil with little or no impact to native plants. Contact herbicides work relatively quickly while systemic herbicides generally take several weeks to kill the targeted plant. However, control with contact herbicides is usually short-lived and milfoil can re-grow within a few weeks. In Michigan, aquatic herbicide use is regulated under Part 33, Aquatic Nuisance Control, of the Natural Resources and Environmental Protection Act, PA 451 of 1994. Prior to herbicide treatments, a permit must be acquired from the Michigan Department of Environmental Quality (MDEQ). MDEQ regulates which herbicides can be applied, dose rates, and areas of the lake where treatments are allowed.

STARRY STONEWORT

Starry stonewort (*Nitellopsis obtusa*) looks like a rooted plant but it is actually an algae. The plant is native to Europe and Asia and was first discovered in the St. Lawrence River in 1978 (Schloesser et al. 1978). In 1983, it was found in the Detroit River near Belle Isle (Nichols et al. 1988) and is now found in over 30 counties in Michigan (Midwest Invasive Species Information Network 2017).

Starry stonewort resembles the native aquatic plant Chara. Starry stonewort has tiny, star-shaped, tan-colored reproductive structures called "bulbils" that are firm to the touch when compared to its soft branches. The presence of bulbils is one way to distinguish between starry stonewort and Chara. Unlike Chara, which is generally considered to be a beneficial plant, starry stonewort has several nuisance characteristics. Starry stonewort has a tendency to colonize deeper waters and can form dense mats several feet thick. In many infested lakes, starry stonewort impedes navigation, limits growth of beneficial plants, and covers valuable fish habitat and spawning areas.

Both herbicides and mechanical harvesting are somewhat effective in controlling starry stonewort. Because it lacks roots, starry stonewort can be dislodged from the bottom without much difficulty.

PAST PLANT CONTROL ACTIVITIES

Historical plant control activities in Lily Lake have focused primarily on the use of herbicides to control nuisance plant growth and periodic mechanical harvesting of nuisance plants to open boat lanes and facilitate navigation. Herbicide treatments have focused mainly on exotic species such as Eurasian milfoil. In addition to spot-treatments with herbicides, several whole-lake treatments with the aquatic herbicide fluridone (trade name Sonar®) have been conducted over the years to control Eurasian milfoil infestations.

Conclusions and Recommendations

It is recommended that the Lily Lake Improvement Board consider the continuation of an aquatic plant control program on Lily Lake as has been conducted historically by Greenwood Township. Primary objectives of the program would include controlling nuisance growth of invasive plants while preserving beneficial native plant species.

Plant control activities in Lily Lake would be conducted by contractors retained through a competitive bidding process. The herbicide applicator would be responsible for acquiring a permit from the MDEQ, applying herbicides in a timely, safe, and effective manner, and complying with all MDEQ permit requirements. Mechanical harvesting of plants does not require a MDEQ permit.

Costs associated with the recommended plant control program are provided in Table 2.

TABLE 2
LILY LAKE AQUATIC PLANT CONTROL PROGRAM (2019 – 2023)
ESTIMATE OF PROBABLE COSTS

Work Item	Annual Cost
Aquatic Plant Control	$19,000
Administration and Contingencies (10%)	$2,000
Total	$21,000

The plant control program on Lily Lake is proposed to be financed through special assessment of benefitting properties in accordance with Part 309 (Inland Lake Improvements) of Michigan's Natural Resources and Environmental Protection Act, PA 451 of 1995, as amended. Under this Act, the newly-stablished lake improvement board would administer the project. By statute, the Lily Lake Improvement Board includes the following:

- A waterfront property owner
- Two representatives of Greenwood Township
- A Clare County Commissioner
- The Clare County Drain Commissioner, or his designee

The special assessment district previously established by Greenwood Township to finance the plant control project is proposed to be utilized on this project. Under this plan, all lots in Greenwood Township bordering Lily Lake are proposed to be included within the special assessment district, and an assessment is proposed to be levied against each lot in the district. Based on this criterion, there are approximately 122 assessment units within the special assessment district, and the approximate annual assessment for the project would be $172. In the first year of the project, an additional $9,000 would need to be assessed to cover the cost of the lake evaluation and special assessment administrative proceedings. Thus, the first year unit assessment would be approximately $246.

References

Getsinger, K., M.D. Moore, E. Dibble, E. Kafcas, M. Maceina, V. Mudrak, C. Lembi, J. Madsen, R.M. Stewart, L. Anderson, W. Haller, C. Layne, A. Cofrancesco, R. Newman, F. Nibling, K. Engelhardt. 2005. Aquatic plant management: Best management practices in support of fish and wildlife habitat. Aquatic Ecosystem Restoration Foundation, Lansing, MI.

LaRue E.A., M.P. Zuellig, M.D. Netherland, M.A. Heilman, and R.A. Thum. 2012. Hybrid watermilfoil lineages are more invasive and less sensitive to a commonly used herbicide than their exotic parent (Eurasian watermilfoil). Evolutionary Applications 6:462-471.

Midwest Invasive Species Information Network. 2017. Starry stonewort, accessed July 24, 2017, http://www.misin.msu.edu/browse/.

Moody, M. L., and D.H. Les. 2007. Geographic distribution and genotypic composition of invasive hybrid watermilfoil (Myriophyllum spicatum x M. sibiricum) populations in North America. Biological Invasions 9:559–570.

Nichols, S.J., D.W. Schloesser, and J.W. Geis. 1988. Seasonal growth of the exotic submerged macrophyte *Nitellopsis obtusa* in the Detroit River of the Great Lakes. Canadian Journal of Botany. 66: 116-118.

Schloesser D.W., P.L. Hudson, and J. Nichols. 1986. Distribution and habitat of *Nitellopsis obtusa* (Characeae) in the Laurentian Great Lakes. Hydrobiologia 133: 91-96.

Sturtevant, A.P., N. Hatley, G.D. Pullman, R. Sheick, D. Shorez, A. Bordine, R. Mausolf, A. Lewis, R. Sutter, A. Mortimer. 2009. Molecular characterization of Eurasian watermilfoil, northern milfoil, and the invasive interspecific hybrid in Michigan lakes. Journal of Aquatic Plant Management 47:128-135.

Thum R.A., M.A. Heilman, P.J. Hausler, L.E. Huberty, P.J. Tyning, D.J. Wcisel, M.P. Zuellig, S.T. Berger, L.M. Glomski, and M.D. Netherland. 2012. Field and laboratory documentation of reduced fluridone sensitivity of a hybrid watermilfoil biotype (*Myriophyllum spicatum* x *Myriophyllum sibiricum*). Journal of Aquatic Plant Management 50:141-146.