George Lake Aquatic Plant Management Plan Update

Prepared for:
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Jan. 2020

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INTRODUCTION

Every five years, George Lake Rehabilitation District (GLRD) is required to submit an aquatic plant management plan as part of its aquatic plant management program following plan specifications outlined under NR109.9 (March 2011). This allows GLRD to assess the progress or lack of progress on maintaining the integrity of the native plant population and control of invasive species populations. Historically and currently, management efforts have focused on curly-leaf pondweed *(Potamogeton crispus*) and Eurasian watermilfoil (*Myriophyllum spicatum*) and more recently its hybrid whose populations exhibit resistance to the pesticide 2,4-D.

George Lake is located within the Village of Bristol in Kenosha County, Wisconsin, and is a valuable resource in the area as it provides significant natural recreational opportunities. The lake is negatively impacted by invasive aquatic vegetation, primarily the hybrid Eurasian watermilfoil *(Myriophyllum spicatum x sibiricum)* and curly-leaf pondweed. The community of Bristol desires to work to improve George Lake, enhancing the long-term potential of the lake.

This updated aquatic plant management plan presents an inventory of the plant assemblages in George Lake and outlines the various options for long-term management of aquatic plants in the lake. The updated plan is funded by the GLRD as required by the Wisconsin Department of Natural Resources (WDNR) as part of the overall management plan of the lake.

Public Interaction

The GLRD holds quarterly meetings, which are open to public participation. On average the meetings have an audience of 10 to 12 residents; some live within the area covered by GLRD and others do not. Many of the concerns voiced by residents in 2019 were in regard to the presence of curly-leaf pondweed due to the nuisance levels this species reached in 2018 and again in 2019. The GLRD reached out to a pesticide consultant in August 2018 who proposed three options:

1.) Do nothing.
2.) Large scale management requiring a multi-year commitment of large-scale whole-lake treatments.
3.) Treating/managing small areas of dense growth to provide nuisance relief for boating/navigation/swimming. Targeting areas/lanes only, leaving the rest of the curly-leaf pondweed alone. This could be accomplished by mechanical harvesting or herbicide treatments.

The GLRD board proposed a fourth option: Harvesting the curly-leaf pondweed, accepting that this would be a long-term process and not expecting complete control in the first year of harvesting. A consultant would be contracted to perform the harvest. GLRD chose this route in order to remove nutrients, reproductive organelles (turions), and plant material. Pesticide treatment would result in the decay of a large amount of plant biomass and the production of algae blooms due to the amount of phosphorus trapped within the plant tissue.

The option of doing nothing was not an acceptable option for residents and riparian owners, who were frustrated by their inability to access the lake during this time frame.

Discussions were held regarding the capture of future outbreaks before they become problematic. To address this issue, GLRD recommended that the management plan include two monitoring periods: one in early spring and one in late summer to early fall. This will ensure a complete snapshot of the aquatic vegetation in George Lake.

A few residents expressed concern regarding the spread of white waterlily *(Nymphaea tuberosa*), asking whether it is permissible to manage populations near their shorelines. GLRD was advised about statute NR109.06.2 (2) that pertains to management of aquatic plant species by riparian owners. It was recommended that GLRD post this information on its website so that residents will know what is allowable in terms of control of their frontage for access and recreation purposes.

In addition, residents were curious about other options for control of white waterlily. The GLRD board explained that harvesting/cutting white waterlilies is a possibility, but this would provide only temporary relief as the cut stems would continue to grow. Digging is another method; however, the expanse of rhizome biomass makes digging difficult. Chemical control is possible and will give a few years of control of spread, but the white waterlily will come back—especially in shallow areas that are not frequently used for lake access. Harvesting will reduce the population but is a form of cutting, so areas that are harvested need to be used frequently to maintain access lanes.

There are cases where the abundance of white waterlily has hindered the ability of shoreline homeowners to recreate at their docks and access the lake. White waterlily does provide habitat for a variety of aquatic organisms, so it is favorable to allow this plant to thrive in certain areas of the lake; however, the GLRD is interested in exploring spot treatments of areas dominated by white waterlily where it is restricting lake access and shoreline recreation. GLRD is additionally concerned that if it does not manage the spread of white waterlily into these areas, homeowners will take it upon themselves, possibly causing injury to desirable native vegetation. Some of this activity was noted during the 2019 spring and fall aquatic plant surveys and is evident in Google Earth historical aerials: a.) June 2015 and b.) July 2018 (below).

George Lake has experienced algal blooms in past years—in 2014 post treatment and again in 2018. GLRD has initiated a nutrient reduction program partially funded by a WDNR grant. The GLRD is working towards an aquatic plant management plan that reduces the incidence of algal blooms resulting from die back of large quantities of plants through monitoring and harvesting of biomass from curly-leaf pondweed, which promoted the 2018 bloom. Algae is a beneficial component of lake health; it is when it gets out of balance and blooms occur that algae become problematic.

a. Aerial of George Lake, June 2015

b. Aerial of George Lake, July 2018

The GLRD intends to use this plan to guide future plant management decisions and to educate the residents of Bristol on the merits of the issues addressed in the plan.

Goals and Objectives

George Lake has multiple needs that must be balanced. Sometimes these needs conflict. Aquatic plants are necessary for good water quality, fish and wildlife habitat, and the overall aesthetics of the lake. Although good water quality is necessary for recreation on the lake, activities such as boating and swimming require that the aquatic vegetation in the lake not become overgrown: it is important that the aquatic vegetation in the lake not become a nuisance, thereby limiting recreation activities.

The GLRD's goal is to preserve and enhance the aquatic systems within the George Lake watershed as it affects the water quality, fish and wildlife habitat, and recreational uses. The five-year management plan is a tool that the district can use to guide decisions regarding the management of the lake. The plan includes water quality monitoring, community surveys, aquatic vegetation surveys, and wetland inventories.

The District's objectives:

- Preserve native species within George Lake and its watershed.
- Protect sensitive areas.
- Manage invasive exotic and nuisance plant species.
- Protect and improve fish and wildlife habitat.
- Improve recreational opportunities.
- Reduce the negative ecological impacts of aquatic plant management while providing nuisance relief.
- Identify local educational efforts that the District may undertake to improve the public's understanding of lake issues.
- Remediate nutrient pollution entering the lake from the watershed.

BACKGROUND

Physical Description

George Lake is located within a rural watershed within the Village of Bristol, Kenosha County, Wisconsin (latitude 42.524429 N; longitude 88.0364781 W). The general morphology of George Lake is reported in Table 1. Figure A-I of the Appendix shows how the surface area was calculated, as there may be differences reported in past reports. The lake is nearly circular in shape. In the early 1900s, a three-foot head dam was constructed at the George Lake outlet, stabilizing the water level. The dam is located on the northeast end of the lake. The lake drains to the Dutch Gap Canal and is part of the Des Plaines River watershed. The area draining to the lake is approximately 2,108 acres. The George Lake watershed area to lake area ratio is approximately 30 to 1. Lakes with high watershed area to lake surface area ratios tend to be more susceptible to nonpoint source pollution. However, the watershed to George Lake has a large percentage of wetland areas, which reduces the potential for problems from development. Wetland protection should continue to be a priority for the GLRD.

Table 1. Hydrography and Morphology of George Lake, Kenosha County, Wisconsin, 2019
Area = 73.13 acres
Mean depth = 6.4. feet
Maximum depth = 16 feet
Lake volume = 389.4-acre feet
Watershed area = 2,108 acres
Ratio of watershed area to lake area = 30:1

Sources: WDNR, Paap 2019

Most of the George Lake watershed lies to the west of the lake (Aron & Associates,2008). Land uses within the watershed are primarily rural and urban with a significant area of wetlands. Most of the shoreline of George Lake is developed with single-family homes. The majority of the watershed falls within the Township of Bristol, sections 19, 20, 29, and 30. A small portion lies within the Township of Salem, sections 24 and 25. Watershed boundaries include Highway V to the south and west, 98th Street to the north, and George Lake to the east.

There are four tributaries entering the lake; however, most of the water enters from the watershed through two tributaries. One of those tributaries enters from the southwest corner near 106th Street and US Highway 45 and encompasses the Paasch Lake watershed. The other enters near 196th Avenue and 104th Street; it receives runoff from agricultural lands west of US Highway 45 that flows through wetlands before discharging into the inlet. There are three other inlets to the lake: (1) one enters from the south and drains a small area of farmed lands and open space and a residential area, (2) another enters between 101st and 102nd Streets on the northwest side of the lake, draining areas north and east of US Highway 45, and (3) a culvert enters near the northwest corner of the lake from a small drainage receiving surface runoff from a farmed land to the north. Two of the inlets are the subject of projects aimed at reducing nutrient pollution into the lake. These inlets are near 104th Street and the inlet between 101st and 102nd Streets. These projects are supported by grant monies through the WDNR.

Water Quality

Water quality may change over time. The lake may experience fluctuations in its trophic status. Annual water quality monitoring data provides the information necessary to determine rehabilitation activities that should be a priority and to gauge the effectiveness of any activities that are undertaken.

George Lake is considered eutrophic with high levels of nutrients, decreased clarity, algae blooms, and excessive aquatic plants. This means that the lake is highly productive with poor water quality and supports large amounts of vegetation and fish.

Historical phosphorus concentrations have ranged from a low of 15 ug/l on August 16, 1995, to a high of 122 ug/l on October 4, 1993.

Nutrients, sediments, and other materials entering the lake can severely impact the plants, fish, and wildlife. Some of the negative results can produce lower oxygen levels, fish kills, and sediment filling in spawning beds and macroinvertebrate habitat. Public and property owner education should focus on activities to minimize their impact on the lake. These educational activities may include proper disposal of pet wastes and auto fluids away from the lake, minimizing use of salt and fertilizer, maintenance of vegetation cover, and erosion control.

A long-term, ongoing program of water quality monitoring should be a priority of the GLRD. The information obtained from this program is crucial to developing and evaluating any lake management activities that are implemented. The GLRD has plans to make improvements to two tributaries entering George Lake from the west and develop a project that focuses on dredging sediments from the main channel that is located on the west side of the lake. These projects are funded through grant monies from the WDNR.

Recently, there has been limited water quality data collected from George Lake. A resident has volunteered to collect Secchi depths on George Lake beginning April/May 2020. GLRD should request that phosphorus and chlorophyll A be collected once again, as GLRD is implementing projects designed to improve the phosphorus concentrations and decrease algal blooms within the lake. Monitoring can provide data demonstrating whether Best Management Practices are working.

During aquatic plant sampling on May 14, 2019, and August 21, 2019, a Secchi depth measurement was collected. In both instances, the Secchi disk reading was 3 feet. Water clarity on George Lake has varied over the years, from a low of 1 foot on November 1, 1993, to a high of 8 feet on June 25, 1995.

Fish and Wildlife

George Lake maintains a warm water fishery. The lake contains northern pike, largemouth bass, and panfish. A past fish survey conducted found grass pickerel and carp (Aron & Associates). Native plants provide higher quality habitat for native macroinvertebrates and spawning fish than do exotic plant species. Dense Eurasian watermilfoil and curly-leaf pondweed stands promote stunted fish populations when small fish can hide from their predators. Native plants have a more “open” structure allowing for predator fish to graze on small fish. Efforts should be made by the GLRD to improve the native plant community; this will consequently improve the habitat for the fisheries.

Detailed surveys of the fisheries are valuable tools for assessing the health of the George Lake fishery. The GLRD should continue to work with WDNR fisheries to ensure regular surveys take place to protect the quality of the fisheries.

The natural shoreline on the south and west is valuable to fish and wildlife, although the density of Eurasian watermilfoil reduces its quality. The large wetland complexes adjacent to George Lake increase the value of the lake to wildlife and improve water quality.

The lake may be used by ducks, geese, and other waterfowl primarily during migration. Shorelines that are highly developed, especially those with retaining walls, create barriers for frogs and turtles that need access to land. Retaining walls have few, if any, spaces and cavities in which small creatures can hide. This can impact the food source for fish.

A problem facing many lakes in southeast Wisconsin is the non-migratory Canada goose. These geese are an entirely different species than the migratory goose and cause significant problems. The non-migratory geese remain in an area year-round. They especially like mowed lawns and open water, making lakeshore areas prime targets. People often enjoy watching these geese, but problems arise as the numbers increase. These problems include overgrazed lawns, droppings on lawns and beaches, and polluted water. GLRD has worked with the US Department of Agriculture on managing goose populations on the lake, and these management activities will resume when the goose populations become too abundant. Another problem for some lakes is the proliferation of seagulls. This is especially true when the lake is near a landfill. Seagull populations are minimal on George Lake at this point.

Lake Use

George Lake is used for various purposes: motorboating, jet skiing, sportfishing, kayaking, paddle boarding, and swimming during summer months; and ice fishing, ice skating, ATV riding, and snowmobiling during winter months. There seems to be more kayak, canoe, and paddleboard activity in recent years than in the past. During the fall, duck hunters use the wetland area on the southwest corner to hunt waterfowl. In general, usage is higher during the weekends and holidays than during the week.

Two swimming beaches on George Lake are used by residents. Since 2018, the beaches are tested weekly for E. coli contamination. The results of the samplings are posted on the George Lake website and on the Kenosha County website at http://www.co.kenosha.wi.us/348/Beach-Conditions. On July 3, 2019, George Lake was under caution. The following standards apply:

- If the E. coli count is greater than 1000 MPN/100 mL, the beach is closed.
- If the E. coli count is greater than 235 MPN/100 mL but less than 1000 MPN/100 mL, an advisory is issued.
- If the E. coli count is under 235 MPN/100 mL, the beach has no advisories or warnings issued.

Access Locations

There is an access and launch on the south end of George Lake. Parking is available for up to five vehicles.

In 2013 GLRD implemented a parking fee to limit the number of vehicles in the parking area at the launch. Although there are five spaces designated for parking at the launch, there were times in the past that the number of vehicles in the space designated for parking surpassed 10 vehicles. The parking fee goes toward lake and launch improvements. The Bristol Police Department has agreed to assist in enforcing parking laws and fees. Parking is free for GLRD residents and military service personnel.

Boating Ordinance

State Boating Statutes apply on George Lake. A local ordinance allows all water sports (water skiing, tubing, jet skiing, etc.) between the hours of 12:00 noon and 6:00 pm but prohibits water sports at all other times.

Shoreline Development and Aesthetic Features

Most of the George Lake watershed area is wetland and, therefore, not highly developed. The lake's very circular shoreline means that there are no quiet bays to provide refuge for fish and wildlife or humans seeking an area for quiet reflection. Most of the lake shoreline is developed and is single-family residential; however, a large wetland complex on the south side of the lake provides a natural vista and habitat and a degree of water quality protection much like the undeveloped areas in the George Lake watershed.

Aquatic Plant Management Activities

Historically the GLRD has participated in an aquatic plant management program. They have used a harvester to harvest weeds and have has used pesticides to control invasive weed populations. This report emphasizes the past five years of aquatic plant management, the results of that activity, and recommendations on how to move forward for the next five years.

In past years, spot treatments curtailed the spread of curly-leaf pondweed. At this time, the curly-leaf pondweed population has exploded while all eyes were watching control of hybrid Eurasian watermilfoil. Curly-leaf pondweed's growth cycle differs from many of our perennial native plants as it is able to actively grow during the winter months, even after ice on, and its peak growth occurs from mid/late May through early July when it dies back and distributes its turions into the seed bank for future growth. Curly-leaf pondweed is best detected during late spring surveys, and these have not been conducted since 2013. There was likely some control benefit from the whole-lake treatment conducted in 2015 using a mixture of 2,4-D and Aquathol K (endothall), as endothall is effective in controlling curly-leaf pondweed.

Prior to the September survey conducted by Wisconsin Lake and Pond, curly-leaf pondweed was observed growing within the littoral zone. There was no quantitative spring aquatic plant survey conducted during the time when curly-leaf pondweed is prevalent (between May and July). At the time of the September survey, it was found at 1% of the points sampled. A chi-square test on the data collected between September 2016 and September 2017 indicated there was a significant increase ($p<0.001$) in the occurrence of curly-leaf pondweed. At the end of May 2018 post-fluridone treatment, it was observed throughout the lake at nuisance levels.

In 2013 it was discovered that George Lake contained hybrid Eurasian watermilfoil. The hybrid has become is more resistant to the action of 2,4-D, likely occurring due to hybrid vigor as well as repetitive exposure to the herbicide over multiple years. This is not unique to George Lake as many lakes across southeast Wisconsin are wrestling with the same problem. The GLRD has given considerable thought to the different management practices affective on Eurasian watermilfoil. In 2015, a change of management strategy and pesticide consultant was imposed, and since that time the GLRD has been successful in managing Eurasian watermilfoil populations while reducing the number of pesticide applications necessary for control. The GLRD has gone from two treatments plus a copper chelate treatment for algae in 2014 to treating for Eurasian watermilfoil minimally every other year.

For many years, GLRD participated in the release of purple loosestrife beetles (*Garucella* spp.). This was met with limited success. The beetle fed on the flowers and some leaves, preventing further spread by seed production; however, the adult plants survived. Purple loosestrife (*Lythrum salicaria*) populations are increasing in and around the lake.

Treatments

2014 – DMA-4 IVM (2,4-D) treatments; Cutrine plus (chelated copper)

In 2014, pond contractor Marine Biochemist conducted a spot treatment to 26.75 acres of Eurasian watermilfoil with DMA-4 IVM (2 ppm), with an additional 4 acres treated with a mix of DMA-4IVM (2 ppm) and Aquathol K (1 ppm) as a test plot.

An algicide was applied to 20 acres with Cutrine plus (chelated copper) to address a severe algae bloom. Prior to the treatment, the GLRD harvested the algae along with some coontail. Because of poor results from the May herbicide treatment, an additional 12.5 acres was treated with DMA-4 IVM (2 ppm) to control Eurasian watermilfoil.

2015 – DMA-4 (liquid 2,4-D) at 0.300 PPM and Aquathol K (liquid endothall) at 0.750 PPM

In May 2015, a whole-lake treatment was conducted using a mixture of DMA-4 (liquid 2,4-D) and Aquathol K (liquid endothall) at the rates specified above. This was in response to the lack of control of Eurasian watermilfoil from the 2014 treatments.

2016 – None

In October 2016, GLRD relied on a report from Wisconsin Land and Pond to assess the necessity for conducting a pesticide treatment in 2017. Following a significant increase (25%) in Eurasian watermilfoil from August 2015 to September 2016, a decision was made to treat George Lake for hybrid Eurasian watermilfoil in 2017.

2017 – Sonar One (fluridone)

Three fluridone applications were made in 2017. The initial treatment took place on May 18 - 4.0 PPB SonarOne (granular fluridone); the first bump occurred on July 27 - 4.0 PPB fluridone as 2.0 PPB SonarOne and 2.0 PPB Sonar Genesis (liquid fluridone), and the third bump occurred on September 7 - 2.0 PPB SonarOne. In the final analysis, the treatment was successful. It was a slow process for the Eurasian watermilfoil dieback; however, the slow die-off likely prevented an algal bloom such as the one witnessed in 2014.

2018 – None

2019 – Harvesting

In 2019 GLRD harvested curly-leaf pondweed and hybrid watermilfoil (where present). Heavy rains in the Midwest delayed the start date by more than a week. Harvesting took place for 10 days beginning June 11 and ending June 21.

Results

2014 – DMA-4 IVM (2,4-D) treatments; 1 chelated copper treatment for algae

The results of the treatment were not satisfactory. There are two factors that may have contributed to the lack of control. First, the optimal temperature for control using 2,4-D is near 58 degrees Fahrenheit. In addition, it was recognized that 2,4-D alone is not an effective control on Eurasian watermilfoil as the plants were exhibiting resistance to the pesticide. Recently, the WDNR has issued a statewide ban on the use of 2,4-D as a mid/late season (after July 1 or so) treatment except in instances where a "material hazard to navigation" exists.

2015 – 2,4-D and Endothall

Wisconsin Lake and Pond conducted a post-treatment survey on August 24, 2015. Table 2 summarizes the changes in the plant community from 2013 until August 2015; the treatment was determined successful as no Eurasian watermilfoil was detected during the time of the survey. There were 10 native species detected. Filamentous algae were present throughout the lake littoral zone. Coontail (*Ceratophyllum demersum*), muskgrass (*Chara* spp.), and sago pondweed (*Stuckenia pectinata*) exhibited significant decreases in the frequency at which they were found.

Table 2. Chi-square analysis of plant assemblage (2013 vs 2015)					
2013 survey total points	58				
2015 survey total points	126				
	2013	2015	p	Significance	+/-
Eurasian watermilfoil	25	0	2.23E-15	***	-
Curly-leaf pondweed	2	0	0.036096	*	-
Coontail	25	10	1.63E-08	***	-
Muskgrass	12	12	0.036666	*	-
Common waterweed	1	3	0.776527	n.s.	+
Small duckweed	3	8	0.754421	n.s.	+
Bushy pondweed	0	2	0.334668	n.s.	+
Spatterdock	1	1	0.571703	n.s.	-
White waterlily	16	20	0.062771	n.s.	-
Illinois pondweed	1	1	0.571703	n.s.	-
Small pondweed	0	0	0	n.s.	no change
Large duckweed	0	0	0	n.s.	no change
Sago pondweed	8	7	0.057799	n.s.	-
Common watermeal	0	8	0.049748	*	+
Filamentous algae	0	43	3.73E-07	***	+

2016 – No management

A decision was made not to conduct a pesticide treatment after considering results from the 2015 fall vegetation survey conducted by Wisconsin Lake and Pond. The results from a survey conducted on September 14, 2016, (Table 3) indicated that there was a significant increase in the frequency of occurrence of Eurasian watermilfoil—from no plants detected in August 2015 to occurrences at 23 of the sites in 2016. Therefore, it was determined that a 2017 treatment for Eurasian watermilfoil would be necessary. The Wisconsin Pond and Lake annual report stated that curly-leaf pondweed appeared to be controlled; there was an increase noted, but at that time it was not a significant increase. In discussions for choosing an herbicide with which to treat the lake, there was hesitance by Wisconsin Lake and Pond (the consultant) and by the WDNR to treat using a mix with 2,4-D because of the poor results being reported in lakes around the state using 2,4-D. Fluridone was mentioned as an option. After many discussions, it was decided that a fluridone treatment should be applied. Fluridone is known as an effective control on Eurasian watermilfoil but not on curly-leaf pondweed. The manufacturer of the product was involved in discussions and advised that control of curly-leaf pondweed was possible; however, reestablishment of plants by turions meant it would only be controlled during the year of treatment. Many of the native plant species were exhibiting significant increases in their abundance. During the discussions, GLRD was informed that there would likely be a reduction in abundance by native plant species as many are sensitive to fluridone.

Table 3. Chi-square analysis on plant assemblage (2015 vs 2016)					
2015 survey total points	126				
2016 survey total points	125				
	2015	2016	p	Significance	+/-
Eurasian watermilfoil	0	23	4.37E-07	***	+
Curly-leaf pondweed	0	1	0.314417	n.s.	+
Coontail	10	21	0.032845	*	+
Muskgrass	12	23	0.042382	*	+
Common waterweed	3	15	0.003145	**	+
Small duckweed	8	11	0.462983	n.s.	+
Bushy pondweed	2	0	0.157293	n.s.	-
Spatterdock	1	1	0.995486	n.s.	+
White waterlily	20	24	0.488226	n.s.	+
Illinois pondweed	1	3	0.309579	n.s.	+
Small pondweed	0	5	0.023348	*	+
Large duckweed	0	1	0.314417	n.s.	+
Sago pondweed	7	50	7.38E-11	***	+
Common watermeal	8	12	0.341643	n.s.	+
Filamentous algae	43	2	1.85E-11	***	-

2017 – Sonar 1 (fluridone)

It was discovered during discussions involving fluridone treatment that Eurasian watermilfoil and curly-leaf pondweed were observed to be present in equal abundances in early 2016. The control of Eurasian watermilfoil was slow; although sickened and dying, it persisted through much of the summer. Filamentous algae were prevalent within the dying plant materials (Table 4). An aquatic plant survey on September 26, 2017, indicated that there was successful control of Eurasian watermilfoil as the occurrence of this species was reduced significantly ($p<0.001$) from a frequency of 23% to a frequency of 5%. Table 4 shows that at the same time there was a significant increase in the frequency of curly-leaf pondweed ($p<0.001$). Where it was found at 1% in 2016 it was found in 2017 at a frequency of 25%. Somehow there was an oversight, and there is no documentation showing that this information was forwarded on to GLRD from the consultant. The consultant advised that there was no treatment necessary in 2018.

Table 4. Chi-square on plant assemblage (2016 vs 2017)					
2016 survey total points	125				
2017 survey total points	154				
	2016	2017	p	Significance	+/-
Eurasian watermilfoil	23	5	2.80223E-05	***	-
Curly-leaf pondweed	1	25	1.03352E-05	***	+
Coontail	21	34	0.270468848	n.s.	+
Muskgrass	23	2	6.57642E-07	***	-
Common waterweed	15	0	9.90321E-06	***	-
Small duckweed	11	9	0.341211295	n.s.	-
Bushy pondweed	0	0	0	0	no change
Spatterdock	1	2	0.687945011	n.s.	+

Table 4. Chi-square on plant assemblage (2016 vs 2017)					
2016 survey total points	125				
2017 survey total points	154				
	2016	2017	p	Significance	+/-
White waterlily	24	39	0.22369718	n.s.	+
Illinois pondweed	3	2	0.490480666	n.s.	-
Small pondweed	5	0	0.012263232	*	-
Large duckweed	1	1	0.882082111	n.s.	-
Sago pondweed	50	2	1.51629E-16	***	-
Common watermeal	12	28	0.041943624	*	+
Filamentous algae	2	21	0.00027776	***	+

Following the fluridone treatment, there was a significant decline in muskgrass, common waterweed (*Elodea canadensis*), small pondweed *(Potamogeton pusillus*), and sago pondweed. These species are known to be impacted by fluridone. GLRD awaited results from the 2018 survey to see if these species recovered.

2018 – No management

In mid-May 2018, while Eurasian watermilfoil remained controlled, curly-leaf pondweed was observed in nuisance abundance (Table 5). There were mats upon mats of curly-leaf pondweed in almost all areas of George Lake. On June 6, 2018, representatives of Wisconsin Lake and Pond toured the lake with a resident to observe the curly-leaf pondweed, and they provided the resident with three options: (1) large-scale treatment for many years, (2) spot treatments for allowing navigation and lake access, and (3) no management. Upon the die-off of curly-leaf pondweed, the lake experienced an algal bloom. The GLRD investigated how to best approach control of both invasive species. The GLRD decided to employ a harvester for approximately two weeks to remove as much plant material (nutrients) and turions (reproductive organelles) as possible, realizing this would be an ongoing process for numerous years, or until most or all the turion seedbank was exhausted. On years that Eurasian watermilfoil required treatment, a treatment would be implemented to control both Eurasian watermilfoil and curly-leaf pondweed. Similarly, in years when herbicide treatment was not required to manage Eurasian watermilfoil populations, it would be removed with curly-leaf pondweed if present.

Table 5. Chi-square analysis on plant assemblage (2017 vs 2018)					
2017 survey total points	154				
2018 survey total points	121				
	2017	2018	p	Significance	+/-
Eurasian watermilfoil	5	2	0.404836	n.s.	-
Curly-leaf pondweed	25	48	1.25E-05	***	+
Coontail	34	27	0.962686	n.s.	+
Muskgrass	2	22	8.47E-07	***	+
Common waterweed	0	3	0.049442	*	+
Small duckweed	9	29	1.54E-05	***	+
Bushy pondweed	0	2	0.109315	n.s.	+
Stonewort	2	3	0.466985	n.s.	+
Spatterdock	2	0	0.208338	n.s.	-
White waterlily	39	38	0.264971	n.s.	+

Table 5. Chi-square analysis on plant assemblage (2017 vs 2018)					
2017 survey total points	154				
2018 survey total points	121				
	2017	2018	p	Significance	+/-
Illinois pondweed	2	4	0.258087	n.s.	+
Small / leafy pondweed	0	5	0.0109	*	+
Large duckweed	1	16	1.72E-05	***	+
Sago pondweed	2	51	1.53E-17	***	+
Common watermeal	28	29	0.240072	n.s.	+
Filamentous algae	21	0	2.37E-05	***	-

The species that showed significant decline in 2017 showed recovery in September 2018. There was a significant decline in the sampling of filamentous algae present during the survey. Stonewort (*Nitella* spp.) was reported to be sampled at the time of the survey. This is the first occurrence of this species.

2019 – Harvesting

0ne hundred and seven loads (500#/load) were harvested from the lake, equating to approximately 53,500 pounds (107 loads at approx. 500#/load) of wet aquatic plant material. A plant survey conducted pre-survey indicated that the dominant plant species was curly-leaf pondweed. Because of the density of curly-leaf pondweed, prioritization was placed on the harvesting of mats so that shoreline owners would have access to the lake.

In 2019 aquatic plant surveys were conducted using an 85-point sampling grid overlaid on aerial imagery (Figure A-2). The point intercept method was utilized throughout the lake littoral zone. A rake was lowered into the water at each sample point and scored on a scale of 1 to 5. Samples were taken at each point until such depth that plants were no longer encountered. In order to analyze the data, a Braun-Blanquet cover-abundance scale was used to convert rake densities to an estimated density of aquatic vegetation (Table 6). The midpoint was used during the analysis for estimating the density of each species. Average Density, Relative Density, Frequency, and Relative Frequency and Importance were calculated from the data after the transformation. Importance is the sum of relative density and relative frequency and is used to establish dominance. The dominant species are the top 50% of the Importance.

Table 6. Braun-Blanquet Cover-Abundance Scale		
Cover Class	Range of Cover	Class Midpoints
5	75-100	87.5
4	50-75	62.5
3	25-50	37.5
2	5-25	15.0
1	1-5	2.5

A pre-harvest sampling took place on May 13. This allowed GLRD to determine the success of the treatment. The field data is presented in Table A-I. Table 7 presents the results of the analysis. Curly-leaf pondweed was dominant, occurring at 76.67% of the sites sampled with an average density of 45.98% (Table 7). During the time of this survey it was becoming difficult to navigate through the littoral zone. Eurasian watermilfoil was detected at 15% of the sample sites with an average density of 1.34%. There were three other plants detected during the time of the May survey: coontail, common duckweed (*Lemna minor*), and white waterlily. White water crowfoot (*Ranunculus longirostris*) and spatterdock (*Nuphar variegata*) were observed but not captured in the sample. Because of the early timing of the sampling, many of the native plant species were not actively growing and therefore not captured during the time of this survey.

Heat maps were generated during the time of the pre-harvesting sample (Figure A-3) and again post-harvest (Figure A-4) at the beginning of July. The heat maps allowed GLRD to assess the success of the harvesting operation. No survey was conducted during the July survey. Success was determined through the reduction of red occurring on the map at that time.

On August 17, a fall plant survey was conducted using the same methods as those used during the pre-harvest sampling. Field data collected on August 17 is presented in Table 2 of the Appendix. Eurasian watermilfoil, white waterlily, and coontail were co-dominants. There was a significant decrease in the occurrence of curly-leaf pondweed captured during the May and August 2019 sampling events (Table 8). The significant decrease in curly-leaf pondweed was likely the result of the species being in its dormant state at the time of the August survey. The fact that curly-leaf pondweed was encountered at 21.54% of the sample sites remains concerning. The good news is that there was a significant decrease in its occurrence between September 2018 and August 2019. The results of the Spring 2020 survey will be more indicative of any impact that harvesting had on curly-leaf pondweed in 2019. It will take time before abundances of curly-leaf pondweed are evident at levels that were present pre-2016.

Eurasian watermilfoil also exhibited a decrease in abundance that was likely due to the harvesting operation. However, it was found at 44.62% of the littoral zone (Table 9) and, when compared to its occurrence in 2018, its population exhibited a significant increase (Table 10).

Since 2015 white waterlily has increased, and during the period of 2018 to 2019 there was a significant increase in the number of times this species was detected. It has experienced an increase in abundance between 2015 and the present, with significant increases reported in 2016 (Table 3) and 2019 (Table 10).

Table 7. Results of May 2019 aquatic plant survey

Common Name	Scientific Epithet	Average Density	Frequency	Importance
Curly-leaf pondweed	*Potamogeton crispus*	45.98	76.67	136.94
White waterlily	*Nymphaea tuberosa*	7.13	28.33	33.72
Eurasian watermilfoil	*Myriophyllum spicatum*	1.34	15.00	13.69
Small duckweed	*Lemna minor*	0.15	5.00	4.05
Muskgrass	*Chara*	3.19	5.00	9.26
Coontail	*Ceratophyllum demersum*	0.63	1.67	2.34

Table 8. Chi-square analysis of plant assemblage (May 2019 vs Aug 2019)					
2013 survey total points	60				
2017 survey total points	65				
			p	Significance	+/-
Eurasian watermilfoil	17	14	0.379473	n.s.	-
White waterlily	3	29	3.97E-07	***	+
Coontail	9	24	0.005469	**	+
Small duckweed	3	13	0.012146	*	+
Curly-leaf pondweed	46	1	4.57E-18	***	-
Chara	1	1	0.954488	n.s.	-

Table 9. Results of August 2019 aquatic plant survey				
Common Name	Scientific Epithet	Average Density	Frequency	Importance
Eurasian watermilfoil	*Myriophyllum spicatum*	17.20	44.62	47.86
White waterlily	*Nymphaea tuberosa*	14.63	43.08	42.95
Coontail	*Ceratophyllum demersum*	13.82	36.92	38.93
Small duckweed	*Lemna minor*	2.64	20.00	13.08
Sago pondweed	*Stuckenia pectinata*	1.89	21.54	12.52
Curly-leaf pondweed	*Potamogeton crispus*	1.02	21.54	11.07
Common watermeal	*Wolffia columbiana*	2.38	12.31	9.31
Small/leafy pondweed	*Potamogeton pusillus*	2.68	9.23	8.45
Spatterdock	*Nuphar variegata*	2.69	3.08	5.79
Large duckweed	*Spirodela polyrhiza*	0.23	7.69	3.74
Forked duckweed	*Lemna trisulca*	0.37	6.15	3.29
Illinois pondweed	*Potamogeton illinoensis*	0.96	1.54	2.26
Muskgrass	*Chara*	0.05	1.54	0.75

Table 10. Chi-square analysis on plant assemblage (Sept 2018 vs Aug 2019)					
2018 survey total points	121				
2019 survey total points	65				Increase/Decrease
			p	Significance	+/-
Eurasian watermilfoil	2	14	3.99E-06	***	+
Curly-leaf pondweed	48	1	1.81E-08	***	-
Coontail	27	24	0.033214	*	+
Muskgrass	22	1	0.00101	**	-
Common waterweed	3	0	0.200602	n.s.	-
Small duckweed	29	13	0.537262	n.s.	-
Bushy pondweed	2	0	0.297346	n.s.	-
Nitella	3	0	0.200602	n.s.	-
Spatterdock	0	5	0.001983	**	+
White waterlily	38	29	0.073548	n.s.	+

Table 10. Chi-square analysis on plant assemblage (Sept 2018 vs Aug 2019)					
2018 survey total points	121				
2019 survey total points	65				Increase/Decrease
			p	Significance	+/-
Illinois pondweed	4	4	0.361321	n.s.	+
Small / leafy pondweed	5	2	0.718408	n.s.	-
Large duckweed	16	8	0.859058	n.s.	-
Sago pondweed	51	28	0.902818	n.s.	+
Common watermeal	29	14	0.707977	n.s.	-
Forked duckweed	0	6	0.000681	***	+

It does not take long for populations of invasive species to become a nuisance as a result of the exponential growth that is characteristic of invasive species. For instance, in the past five years the curly-leaf pondweed went from representing an average density of <1% and a frequency of 6% to an average cover and frequency of 40% and 54%, respectively, during a pre-harvesting survey conducted in May 2019. Curly-leaf pondweed was observed at nuisance levels during a pre-treatment subjective survey (2016) when It was noted at that time to be at an abundance equal to hybrid Eurasian watermilfoil, which was the species being targeted during the 2017 fluridone treatment. The observations of the abundance of curly-leaf pondweed were discussed during strategy sessions between Wisconsin Lake and Pond, the WDNR, and GLRD board members. The consultant from Wisconsin Lake and Pond advised that curly-leaf pondweed may be affected somewhat by the fluridone treatment, but this chemical was not meant to control curly-leaf pondweed. In 2015 Wisconsin Pond and Water did not view curly-leaf pondweed as a threat in its assessment of invasive species populations. However, in retrospect, even detecting it at a 1% frequency during the fall 2015 survey chi-square analysis indicated a significant increase in its abundance ($p<0.001$). This should have provoked a response to monitor the curly-leaf pondweed population in May 2016, but it did not.

GLRD is willing to provide management of the spread of white waterlily populations and excess growth in areas where lake access is impeded, maintaining populations in areas where populations do not impact user ability to recreate on the lake. Riparian owners can cut and pull aquatic plants within a 30-foot maximum width lane as measured along the shoreline per NR109.06. Harvesting can be used to cut access lanes; this practice requires the shoreline residents to regularly access the lake using access lanes. The treatment areas will vary as will the years when maintenance is required based upon monitoring surveys and other information such as aerial imagery and photos taken by land or boat. Areas of treatment and management method will be identified during request for permit. The areas that will be maintained for growth are identified in Figure A-5.

Coontail (*Ceratophyllum demersum*) is another species that is known to achieve abundances that cause problems with lake access, so its population should be watched. It is known to be aggressive and can colonize areas opened by management of other species.

Native species populations have fluctuated over time regardless of management type. Table 10 is a summary of the species as they have been encountered over the years. Exhibit A-1 shows the results of a floristic quality assessment on those aquatic plant species detected in 2019 using the Universal Floristic Quality Program at www.universalfqa.org. The resulting Floristic Quality Index (FQI) was 16.2. An analysis was conducted on the floristic quality on the 2018 and 2019 aquatic plant species following the methodology used by Wisconsin Lake and Pond between 2015 and 2017 and is presented in Table 11. The resulting FQI scores were 16.44 and 18.76 for 2018 and 2019 species, respectively. There are obvious differences in the indices. The Universal FQA program includes non-native species such as curly-leaf pondweed and Eurasian watermilfoil, but it does not account for macroalgal species such as muskgrass or nitella. A calculated Simpson Diversity Index of 0.88 has remained constant since 2018. This is likely due to the number of sites being sampled, as there were some species not detected in the 2019 sampling; in addition, the abundance of curly-leaf pondweed found in George Lake during 2018 and again in 2019 could be suppressing the growth of native species. Two native species found in 2018 and not in 2019 were bushy pondweed and common waterweed.

Table 11. Summary of species encountered during sample events from 2011 through 2019

	Sept 2011	Aug 2013	Aug 2015	Sept 2016	Sept 2017	July 2018	May 2019	Aug 2019
Number of points sampled	50	58	126	125	154	121	46	48
Eurasian watermilfoil	28	25	0	23	5	2	46	14
Curly-leaf pondweed	3	2	0	1	25	48	46	1
Coontail	11	25	10	21	34	27	17	24
Muskgrass	9	12	12	23	2	22	9	1
Common waterweed	3	1	3	15	0	3	0	0
Small duckweed	16	3	8	11	9	29	3	13
Bushy pondweed	2	0	2	0	0	2	0	0
Nitella	0	0	0	0	0	3	0	0
Spatterdock	1	1	1	1	2	0	0	5
White waterlily	8	16	20	24	39	38	3	29
Illinois pondweed	0	1	1	3	2	4	0	4
Small / leafy pondweed	2	0	0	5	0	5	0	2
Large duckweed	2	0	0	1	1	16	0	8
Sago pondweed	6	8	7	50	2	51	0	28
Common watermeal	0	0	8	12	28	29	0	14
Filamentous algae	0	0	43	2	21	0	0	0
Forked duckweed	0	0	0	0	0	0	0	6

Table 12. Floristic Quality of George Lake, 2015–2019

	2015	2016	2017	2018	2019
N	10	11	9	10	12
mean C	4.9	5	5	5.2	5.4
FQI	15.49	16.58	15.00	16.44	18.76
Simpsons Diversity Index	0.84	0.86	0.81	0.88	0.88

CITATION:

Nichols, SA. 1999. Floristic Quality Assessment of Wisconsin Lake Plant Communities with Example Applications. Journal of Lake and Reservoir Management, 15(2):133-141.

University of Wisconsin-Madison, 2001. Wisconsin Floristic Quality Assessment (WFQA). Retrieved October 27, 2009 from: http://www.botany.wisc.edu/WFQA.asp

Recommendations

Aquatic Plant Surveys

GLRD should have point-intercept aquatic plant surveys conducted using the 85-point map grid twice annually—May/June and August/September—to monitor the native aquatic plant community and invasive species control. This gives a more accurate assessment of the overall plant community as some species are more evident early or later in the season, depending on their life cycles. During the next Aquatic Plant Management Plan (APMP) update, the greater number of sampling points following the aquatic plant management protocol should be used. In 2014, the APMP coordinator approved the plant grid used during the 2014 and 2019 APMP updates.

No Management

No management means GLRD would do nothing to reduce abundance of curly-leaf pondweed. One of the options presented regarding curly-leaf pondweed was to do nothing, as the life cycle of this species is such that its peak growth occurs in early spring and dieback begins by early summer. This was not an acceptable option for residents and riparian owners, however, who were frustrated by their inability to access the lake during this time frame.

Mechanical Control

Harvesting is an acceptable method for control of species such as curly-leaf pondweed, white waterlily, and other weedy plant species; however, care needs to be taken so that the harvesting does not become injurious to the lake ecology. Harvesting of plants should not occur in less than 3 feet of water. This practice scours the lake bottom, causing a disturbance that can lead to future colonization by invasive species. Harvesting is a good way to remove nutrients from the lake through removal of plant material, especially when harvesting involves invasive and weedy plant species that form dense beds such as curly-leaf pondweed. Harvesting access lanes through white waterlily beds can provide habitat for fish and other aquatic organisms that require cover from predators. Caution needs to be applied as the harvesting of plants is somewhat non-selective. For instance, harvesting of curly-leaf pondweed, if done early in the season, early- to mid-May, can reduce the accidental harvesting of desirable plant species such as white water crowfoot, whose population early in the season is expanding in areas where curly-leaf pondweed and white waterlily have colonized.

During years of harvesting for curly-leaf pondweed, Eurasian watermilfoil will likely be incidentally harvested due to its early emergence, so some control of the species should take place as a result of this practice. However, it is not the most effective management tool for controlling Eurasian watermilfoil; fragmentation occurs, and fragments re-root.

Mechanical harvesting of lanes during management activities focused around white waterlily populations during curly-leaf pondweed control can provide lake access for shoreline owners in areas where white waterlily populations have made access to the lake or recreation along properties difficult if not impossible. When this is completed, it is necessary for the lanes to be utilized; otherwise, the expansive rhizomes will send off blades and flowers that will recolonize areas cleared for access. Caution needs to be taken not to harvest in areas where water depths are less than or equal to 3 feet.

Chemical Control

2,4-D and Endothall

In years when Eurasian watermilfoil growth exhibits abundances that require control, chemical control is a good option. Recently Eurasian watermilfoil has exhibited resistance to 2,4-D (a systemic herbicide known to be an effective control on Eurasian watermilfoil) applications across lakes in Wisconsin. However, when combined with endothall the Eurasian watermilfoil population was controlled for three seasons, not requiring treatment until 2017. Endothall is a contact pesticide that is effective at controlling curly-leaf pondweed and should provide relief of nuisance abundances colonizing the lake in years when chemical treatment is necessary to control Eurasian watermilfoil populations. It is recommended that the chemical application take place early in the season, by around mid-May or as soon as the water temperature is favorable for control and plants are actively growing (58˚F/≈14˚C). This will allow for control of targeted species and lessen the impact on native plants as endothall is known to affect many native aquatic plant species. In addition, controlling early—before curly-leaf pondweed forms mats—will provide a more successful treatment.

These chemicals will likely impact any actively growing white waterlilies during years when treatments are performed on Eurasian watermilfoil and curly-leaf pondweed, as 2,4-D is a broadleaf systemic pesticide and endothall is an effective broad-spectrum contact herbicide.

Triclopyr

Triclopyr is effective on dicots and can be selective when applied with care on floating leaf and emergent plant species such as white waterlily and purple loosestrife. It does not require any recreation restrictions and has low toxicity to aquatic organisms. There is a dosage restriction of 2.5 ppm per season on its usage, so its ability to be applied multiple times per season is limited.

Fluridone

Fluridone is another chemical treatment that is effective on Eurasian watermilfoil. However, it does require multiple bumps to maintain a target concentration to be effective, which can have negative effects on native plant populations. Plants decompose slowly, and Fluridone limits low dissolved oxygen concentrations that can accompany quick dieback of dense beds of vegetation. It is also nontoxic to aquatic animals. However, because George Lake has a mediocre biodiversity of aquatic plant species, this is a treatment that should be applied perhaps only once every 8–10 years.

Glysophate (Rodeo)

This broad-spectrum systemic herbicide can be used selectively if care is taken when applied. Glysophate is not effective on submersed species. It is nontoxic to most aquatic animals at recommended doses and can provide control for 1–5 years. Because this treatment is not effective on submersed species, it may be beneficial for control of white waterlily.

Grants

Grants are available for management of established aquatic invasive species (AIS). The deadline for application is February 1. However, you need to work with a DNR agent up to six months prior to the granting period. Applications need to be submitted two months prior to the deadline. Application deadlines for 2021 is November 1, 2020. It is highly recommended that control of curly-leaf pondweed and Eurasian watermilfoil grants be sought by GLRD.

Copper Compounds

Copper compounds control filamentous and planktonic algae. Wisconsin only allows small-scale treatment. These compounds reduce algal growth and improve water clarity; however, elemental copper accumulates in sediments and is toxic to invertebrates and some fish species. The improved water clarity and lack of competition by algae to plants may increase plant growth.

Biological Control

Eurhychiopsis lecontei (weevil)

Using a native weevil (*Eurhychiopsis lecontei*) to control Eurasian watermilfoil populations may be an option; however, the weevil needs places to overwinter, such as areas with leaf litter that are associated with undeveloped shorelines around the lake. Although there are developed shorelines that contain trees, there may not be an adequate amount of natural material settling in the lake bottom. In addition, George Lake has a healthy panfish (bluegill, crappie, etc.) population that would feed on the weevil, thereby requiring frequent reintroductions.

Garucella spp.

This beetle is native to Europe. The length of time required for effective biocontrol typically ranges from one to several years, depending on such factors as site size and loosestrife density. Though loosestrife elimination is rare, this process offers effective and environmentally sound control of the plant without herbicides.

Non–Point Source Nutrient Reduction

GLRD has taken a proactive stance by improving areas within tributaries to control non–point source nutrients entering George Lake. These nutrient control projects are being funded in part by WDNR grants. Dredging within the main channel to remove accumulated sediments and nutrients and to improve lake access for the shoreline owners along the channel is being initiated in fall/winter 2019–2020.

Education and Outreach AIS

GLRD should consider educating the community on the importance of plants in the lake and perhaps host an aquatic plant identification workshop. This could invoke an appreciation of the native plant population in George Lake but would also provide an opportunity to educate users of the lake about potential new invaders for which they should be watching. This could include faunal as well as floral invasive species. The GLRD should post the following link to the WDNR http://dnr.wi.gov/topic/Invasives/report.html so that lake users will know what to do if they suspect they have encountered a new invader. The e-mail address of the invasive species program specialist at the WDNR is invasive.species@wisconsin.gov.

New Invaders

In the case of a new invasion it is critical to rapidly respond to a new introduction. Therefore, it is important to identify populations while they are small and manageable. Below are WDNR guidelines that can be followed if a lake user believes they may have encountered a new invasive plant species colonizing their lake.

For plants:

- Take a digital photo(s) of the plant in the setting where it was found. Using a camera or smartphone, try to capture details such as flowers, leaf shape, leaf and stem arrangement, and fruits. Include a common object in the photo such as a dollar bill, coin, or pencil for a size scale, or stand next to tall plants.
- If possible, collect 5–10 intact specimens to ensure precise identification. Try to get the root system and all leaves, as well as seed heads and flowers when present. Place in a Ziplock bag with a damp paper towel. Place on ice and store in a refrigerator as soon as possible.
- Note the location of the plant you found. If you do not have a GPS device, you can visit www.google.com/maps to find the precise location on the online map. Click on the location and view the text box at the bottom of the screen to find the coordinates. If using a GPS device, please note the datum being used, for example, WGS 84 (preferred), UTM, WI Transverse Mercator, etc.
- It is best to fill out form 3200-125 – Aquatic Invasive Plant Incident Report and deliver it, your photo(s), and specimens to your Regional DNR Aquatic Invasive Species Coordinator. Please do this as soon as possible—no later than four days after you discover the plant if you have plant specimens.
- Report your suspected species, even if you have no photos or specimens! Such reports will take more time to confirm species ID but are still valuable. Include your name, address, phone number, suspected species name, and its location as exactly as you can. Try hard to include photos if possible (digital photos can be sent via email).

If it is an animal other than a fish:

- If possible, take a digital photo of the animal in the setting where it was found. Using a camera or smartphone, try to capture as much detail as you can.
- Collect up to five specimens. Place in a jar with water. Place on ice and transport to refrigerator. Transfer specimens to a jar filled with rubbing alcohol (except for jellyfish, which should be left in water).
- Note the location of the animal you found. If you do not have a GPS device, you can visit www.google.com/maps [exit DNR] to find the precise location on the online map. Click on the location and view the text box at the bottom of the screen to find the coordinates. If using a GPS device, please note the datum being used, for example, WGS 84, UTM, WI Transverse Mercator, etc.
- Fill out form 3200-126 – Aquatic Invasive Animal Incident Report.
- Deliver the specimens, report, and photo to your Regional DNR Aquatic Invasive Species Coordinator. Please do this as soon as possible—no later than four days after you discover the animal.

If it is a fish, contact your local fish biologist.

If you think you have caught a diseased fish, follow these steps.

If the invasive species is already known to occur in the waterbody, or you know it has been reported in the wetland, thanks for keeping an eye out for our lakes, streams, and wetlands! No incident report is needed at this time. (If you think recent changes in the species warrant special concern, such as a drastic increase in area infested, increased threat to rare species, sensitive areas, etc., please call your Regional Coordinator.)

Consideration should be given to native plant species that might be introduced to colonize open space left vacant due to control by Eurasian watermilfoil. These introductions could be beneficial for establishing species that have not lived in George Lake historically, thereby increasing the biodiversity of plants in the lake, or by introducing new population of species within the lake. New species that may do well include eel grass (*Vallisneria Americana*), large-leaf pondweed (*Potomogeton ampliflorus*), and water stargrass (*Heteranthera dubia*). Regardless of what plant species are chosen, decisions should be made with WDNR input. The WDNR should be able to guide not only species selection but also provide a list of reputable suppliers. This would better ensure against accidental introduction of aquatic hitchhikers.

Tentative Aquatic Plant Management Schedule

The GLRD board, seeming to have a good strategy in place for managing Eurasian watermilfoil populations, has implemented a long-term plan for managing both curly-leaf pondweed and Eurasian watermilfoil populations. It is proposing to treat for Eurasian watermilfoil and curly-leaf pondweed in 2020, followed by the harvest of curly-leaf pondweed and Eurasian watermilfoil beginning in 2021 for two weeks during the period between May 16 and May 31, as this is the time that curly-leaf pondweed begins active growth and turion development. Harvesting shall continue annually for two years or until the abundance of Eurasian watermilfoil is such that chemical treatment is required based upon annual plant surveys. The goal of this strategy is to remove as much curly-leaf pondweed biomass and reproductive material as possible during that time to reduce the amount of nutrients released during its dieback and to exhaust the seedbank. In years when Eurasian watermilfoil requires management, a pesticide treatment will be implemented that controls both curly-leaf pondweed and Eurasian watermilfoil. It is the desire of the GLRD board that the treatments occur as the active growth of these species begins or when water temperatures are near 58 degrees Fahrenheit. The GLRD board will work closely with the WDNR and its consultant on the exact timing of the treatments.

Table 13 presents a tentative management schedule. The schedule should be considered tentative pending the results of surveys indicating a change in strategy or timing of activities. The results of these surveys will be presented by November 1 of the survey year. The details of these surveys will be presented in aquatic plant management permits submitted to the WDNR for management activities.

Table 13. Proposed management schedule 2020–2024

	2020	2021	2022	2023	2024
Approval of aquatic plant management plan (WDNR)	January	X	X	X	December 2024
Pesticide/Harvester consultant quotes	January	January	January	January	January
Grant application (whole-lake pesticide)	February 1	X	X	February 1*	February 1
Pesticide permit	March	March	March	March	March
Late spring plant survey	May 1–8	May 1–8	May 1–8	May 1–8	May 1–8
Pesticide application	May 9–16 (temperature dependent)	X	X	May 9–16* (temperature dependent)	X
Harvesting of plants	X	May 16–31	May 16–31	X	May 16–31
Late summer plant survey	August	August	August	August	August

Table 13. Proposed management schedule 2020–2024					
	2020	2021	2022	2023	2024
Results of surveys	November	November	November	November	November
*Schedule subject to change due to results of bi-annual plant surveys.					

APPENDIX

Table A-1. Field data from aquatic plant survey May 2019 (ND – site not sampled due to inaccessibility)

Sample Point	Depth (feet)	Overall Rake Density	*Potamogeton crispus*	*Myriophyllum spicata*	*Ceratophyllum demersum*	*Lemna minor*	*Nymphaea tuberosa*	*Chara*
1	ND	ND	ND	ND	ND	ND	ND	ND
2	1.5	5	1	2	4	0	0	0
3	3	5	5	1	0	1	0	0
4	3.6	5	3	3	2	0	0	0
5	3.3	5	3	0	1	0	0	3
6	2.4	5	4	2	0	1	2	0
7	3.5	5	5	0	0	0	0	0
8	3.6	5	5	0	0	0	0	0
9	3.6	5	4	3	0	0	0	0
10	3.6	5	4	1	0	0	0	0
11	2.8	5	5	0	0	0	0	0
12	1.2	3	3	0	0	0	0	0
13	3	5	4	3	0	1	0	0
14	5	5	5	0	0	0	0	0
15	7.3	5	5	0	0	0	0	0
16	5	1	1	0	0	0	0	0
17	3	0	0	0	0	0	0	0
18	3.6	5	5	0	0	0	0	0
19	3.7	5	5	0	0	0	0	0
20	2.6	2	2	0	0	0	0	0
21	3	5	5	0	0	0	2	0
22	5.5	5	5	0	0	0	0	0
23	7.8	3	3	0	0	0	0	0

Table A-1. Field data from aquatic plant survey May 2019 (ND – site not sampled due to inaccessibility)

Sample Point	Depth (feet)	Overall Rake Density	*Potamogeton crispus*	*Myriophyllum spicata*	*Ceratophyllum demersum*	*Lemna minor*	*Nymphaea tuberosa*	*Chara*
24	9.3	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0
26	4.1	0	0	0	0	0	0	0
27	6.2	5	5	0	0	0	0	0
28	7.2	5	5	0	0	0	0	0
29	3.4	0	0	0	0	0	0	0
30	3.1	5	5	0	0	0	1	0
31	6.5	5	5	0	0	0	0	0
32	10.5	0	0	0	0	0	0	0
33	12.3	0	0	0	0	0	0	0
34	12	0	0	0	0	0	0	0
35	13.3	0	0	0	0	0	0	0
36	11.3	0	0	0	0	0	0	0
37	7.2	0	0	0	0	0	0	0
38	6.7	0	0	0	0	0	0	0
39	4.3	5	5	1	0	0	0	0
40	2.4	0	0	0	0	0	0	0
41	2.5	5	4	4	0	0	2	0
42	7.2	2	2	0	0	0	0	0
43	13	0	0	0	0	0	0	0
44	14.7	0	0	0	0	0	0	0
45	15	0	0	0	0	0	0	0
46	13.6	0	0	0	0	0	0	0

Table A-1. Field data from aquatic plant survey May 2019 (ND – site not sampled due to inaccessibility)

Sample Point	Depth (feet)	Overall Rake Density	*Potamogeton crispus*	*Myriophyllum spicata*	*Ceratophyllum demersum*	*Lemna minor*	*Nymphaea tuberosa*	*Chara*
47	0	0	0	0	0	0	0	0
48	12	0	0	0	0	0	0	0
49	10	0	0	0	0	0	0	0
50	7.5	3	3	0	0	0	0	0
51	4.7	5	5	0	0	0	0	0
52	1.8	0	0	0	0	0	0	0
53	3.7	5	4	2	0	0	0	0
54	8.7	1	1	0	0	0	0	0
55	13.6	0	0	0	0	0	0	0
56	15	0	0	0	0	0	0	0
57	15	0	0	0	0	0	0	0
58	14.1	0	0	0	0	0	0	0
59	15	0	0	0	0	0	0	0
60	11	0	0	0	0	0	0	0
61	7.5	0	0	0	0	0	0	0
62	7.5	2	2	0	0	0	0	0
63	3	0	0	0	0	0	0	0
64	2.6	4	4	0	0	0	1	0
65	0	0	0	0	0	0	0	0
66	11	0	0	0	0	0	0	0
67	10.3	0	0	0	0	0	0	0
68	5.9	0	0	0	0	0	0	0
69	5.5	0	0	0	0	0	0	0

Table A-1. Field data from aquatic plant survey May 2019 (ND – site not sampled due to inaccessibility)								
Sample Point	Depth (feet)	Overall Rake Density	*Potamogeton crispus*	*Myriophyllum spicata*	*Ceratophyllum demersum*	*Lemna minor*	*Nymphaea tuberosa*	*Chara*
70	7.6	0	0	0	0	0	0	0
71	7.2	3	3	0	0	0	0	0
72	4.5	4	4	0	0	0	0	0
73	3.3	0	0	0	0	0	0	0
74	3	1	1	1	0	0	0	0
75	1.6	5	4	0	0	0	4	0
76	2.7	5	4	2	0	0	3	0
77	3.4	5	5	2	0	0	0	0
78	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0
80	1.9	5	5	3	0	0	0	0
81	3	2	2	1	0	0	0	0
82	3	5	5	0	0	0	0	0
83	2.9	5	4	4	0	0	1	0
84	2.7	2	2	0	0	0	0	0
85	1.8	5	4	4	0	0	3	0

Table A-2. Field data from aquatic plant survey September 2019 (ND – site not sampled due to inaccessibility)

Sample Point	Depth	Overall Rake Density	*Potamogeton crispus*	*Myriophyllum spicatum*	*Ceratophyllum demersum*	*Lemna minor*	*Nymphaea tuberosa*	*Chara*	*Stuckenia pectinata*	*Nuphar variegata*	*Spirodela polyrhiza*	*Wolffia columbiana*	*Potamogeton pusillus*	*Lemna trisulca*	*Potamogeton illinoensis*
1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2	1.5	5	0	1	5	1	5	0	0	0	0	1	0	0	0
3	3	5	0	1	5	1	4	0	0	0	1	1	0	1	0
4	3.6	5	0	2	5	1	4	0	0	0	1	1	0	2	0
5	1.5	5	0	0	2	5	2	0	0	0	0	5	0	0	0
6	2.4	5	0	1	5	1	4	0	0	0	0	1	0	0	0
7	3.5	5	0	5	0	1	2	0	0	0	0	0	0	1	0
8	3.6	5	0	5	2	0	0	0	1	0	0	0	0	0	0
9	2	5	0	1	0	0	1	0	0	0	0	0	5	0	0
10	3.6	4	1	1	0	0	1	0	1	0	0	0	0	0	0
11	2.8	5	1	5	0	0	1	0	0	0	0	0	0	0	0
12	3	5	0	4	4	2	4	0	0	0	0	2	0	0	0
13	1.3	5	1	5	0	0	1	0	0	0	0	0	0	0	0
14	2.5	5	0	1	5	0	2	0	0	0	0	0	1	0	0
15	5	1	0	0	1	0	0	0	0	0	0	0	0	0	0
16	2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	2.5	2	2	0	0	0	0	0	1	0	0	0	0	0	0
18	3.2	5	0	5	0	0	0	0	0	0	0	0	0	0	0
19	3	2	2	2	0	0	0	0	0	0	0	0	0	0	0
20	2.9	1	1	1	0	0	1	0	0	0	0	0	1	0	0
21	3	1	1	1	1	0	1	0	1	0	0	0	0	0	0
22	3	2	0	2	1	0	0	0	1	0	0	0	0	0	0
23	4.1	5	0	0	5	0	0	0	0	0	0	0	0	0	0
24	9.3	0	0	0	0	0	0	0	0	0	0	1	0	0	0
25	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0
26	4.1	1	0	0	1	0	0	0	0	0	0	0	0	0	0
27	6.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A-2. Field data from aquatic plant survey September 2019 (ND – site not sampled due to inaccessibility)

Sample Point	Depth	Overall Rake Density	*Potamogeton crispus*	*Myriophyllum spicatum*	*Ceratophyllum demersum*	*Lemna minor*	*Nymphaea tuberosa*	*Chara*	*Stuckenia pectinata*	*Nuphar variegata*	*Spirodela polyrhiza*	*Wolffia columbiana*	*Potamogeton pusillus*	*Lemna trisulca*	*Potamogeton illinoensis*
28	7.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	2.9	1	1	1	1	0	0	0	1	0	0	0	0	0	0
30	3.1	1	0	0	0	2	1	0	1	0	0	0	0	0	0
31	3.3	1	0	0	0	0	1	0	0	0	0	0	0	0	0
32	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	12.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	13.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	11.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	7.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	5.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	3.5	1	0	1	1	0	0	0	0	0	0	0	0	0	0
40	2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	3.1	1	0	0	0	0	1	0	1	0	0	0	0	0	0
42	8	1	0	0	1	0	0	0	0	0	0	0	0	0	0
43	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	13.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	13.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	3	1	1	1	2	0	0	0	0	0	0	0	0	0	0
52	1.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	3.6	4	0	0	1	0	2	0	0	0	0	0	0	0	0
54	9.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A-2. Field data from aquatic plant survey September 2019 (ND – site not sampled due to inaccessibility)

Sample Point	Depth	Overall Rake Density	*Potamogeton crispus*	*Myriophyllum spicatum*	*Ceratophyllum demersum*	*Lemna minor*	*Nymphaea tuberosa*	*Chara*	*Stuckenia pectinata*	*Nuphar variegata*	*Spirodela polyrhiza*	*Wolffia columbiana*	*Potamogeton pusillus*	*Lemna trisulca*	*Potamogeton illinoensis*
55	13.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	14.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	5	1	1	1	0	1	0	0	0	0	0	0	0	0	0
63	2.5	4	0	0	0	0	1	0	0	0	0	0	4	0	0
64	2.6	5	1	0	2	1	0	0	0	5	1	0	0	0	0
65	10.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	5.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	5.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	5.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	4	1	0	1	1	0	0	0	0	0	0	0	0	0	0
73	3	2	1	2	0	0	0	0	0	0	0	0	0	0	0
74	2	5	0	0	0	0	2	0	2	0	0	0	2	0	4
75	1.6	4	0	0	1	2	1	0	1	0	1	0	0	0	0
76	2.7	4	0	0	1	2	1	0	0	0	1	0	0	0	0
77	2.6	1	0	0	0	0	0	1	1	0	0	0	0	0	0
78	4.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	2.2	1	1	1	2	0	1	0	1	0	0	0	0	0	0
80	2.5	4	0	1	0	0	4	0	0	0	0	0	0	0	0
81	2	2	0	0	0	0	2	0	0	0	0	0	0	0	0

Table A-2. Field data from aquatic plant survey September 2019 (ND – site not sampled due to inaccessibility)

Sample Point	Depth	Overall Rake Density	*Potamogeton crispus*	*Myriophyllum spicatum*	*Ceratophyllum demersum*	*Lemna minor*	*Nymphaea tuberosa*	*Chara*	*Stuckenia pectinata*	*Nuphar variegata*	*Spirodela polyrhiza*	*Wolffia columbiana*	*Potamogeton pusillus*	*Lemna trisulca*	*Potamogeton illinoensis*
82	2.2	1	0	1	0	0	1	0	1	0	0	0	0	0	0
83	2.5	5	0	5	0	0	0	0	0	0	0	0	0	0	0
84	2.7	5	0	4	0	0	4	0	1	0	0	1	0	0	0
85	1.4	5	0	2	0	1	5	0	0	5	0	0	1	1	0

Figure A-1. Surface area of George Lake (73.13 acres).

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Bristol WI 53104

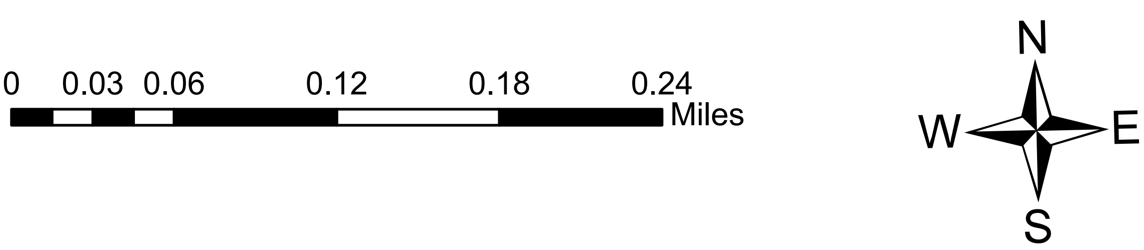
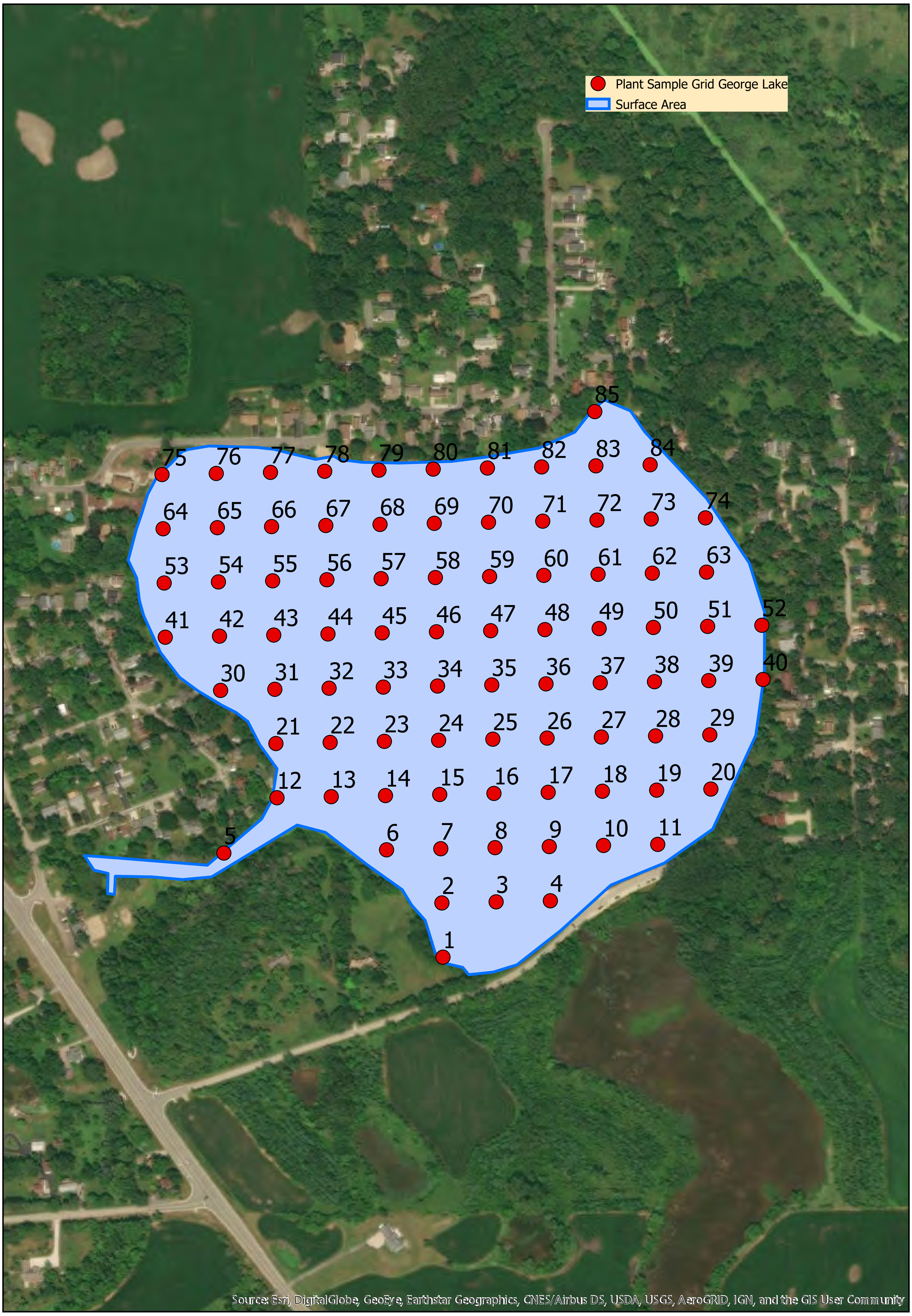


Figure A-5. George Lake plant grid.



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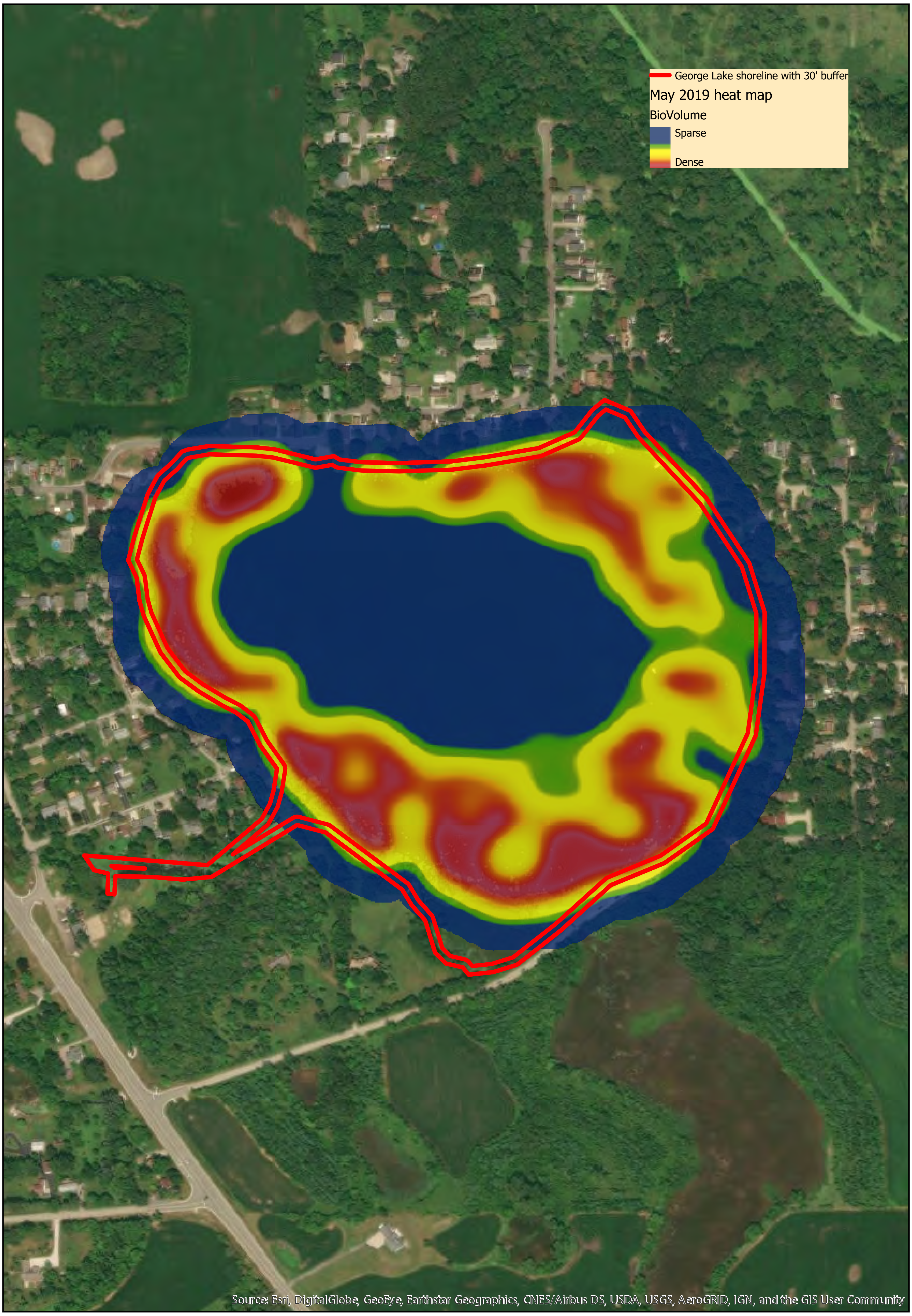
0 0.03 0.06 0.12 0.18 0.24 Miles

N
W E
S

Figure A-3. May 2019 heat map pre-harvest vegetation (curly leaf pondweed dominant).



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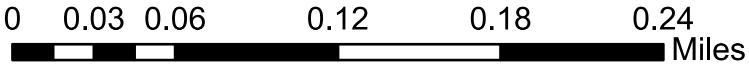

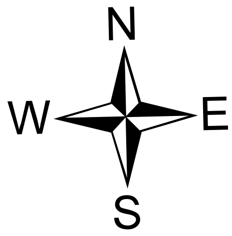

Figure A-3. July 2019 heat map post-harvest vegetation.

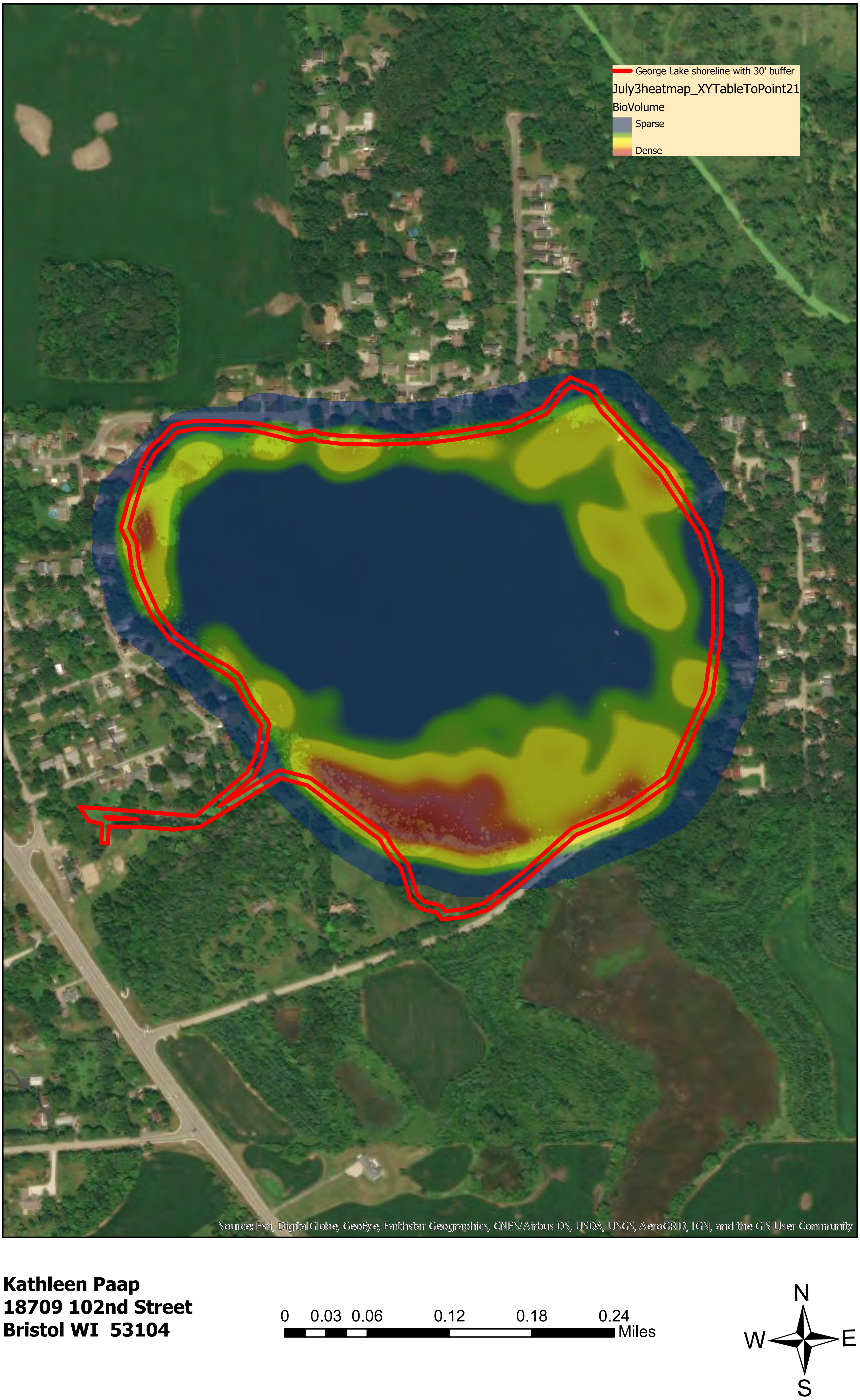

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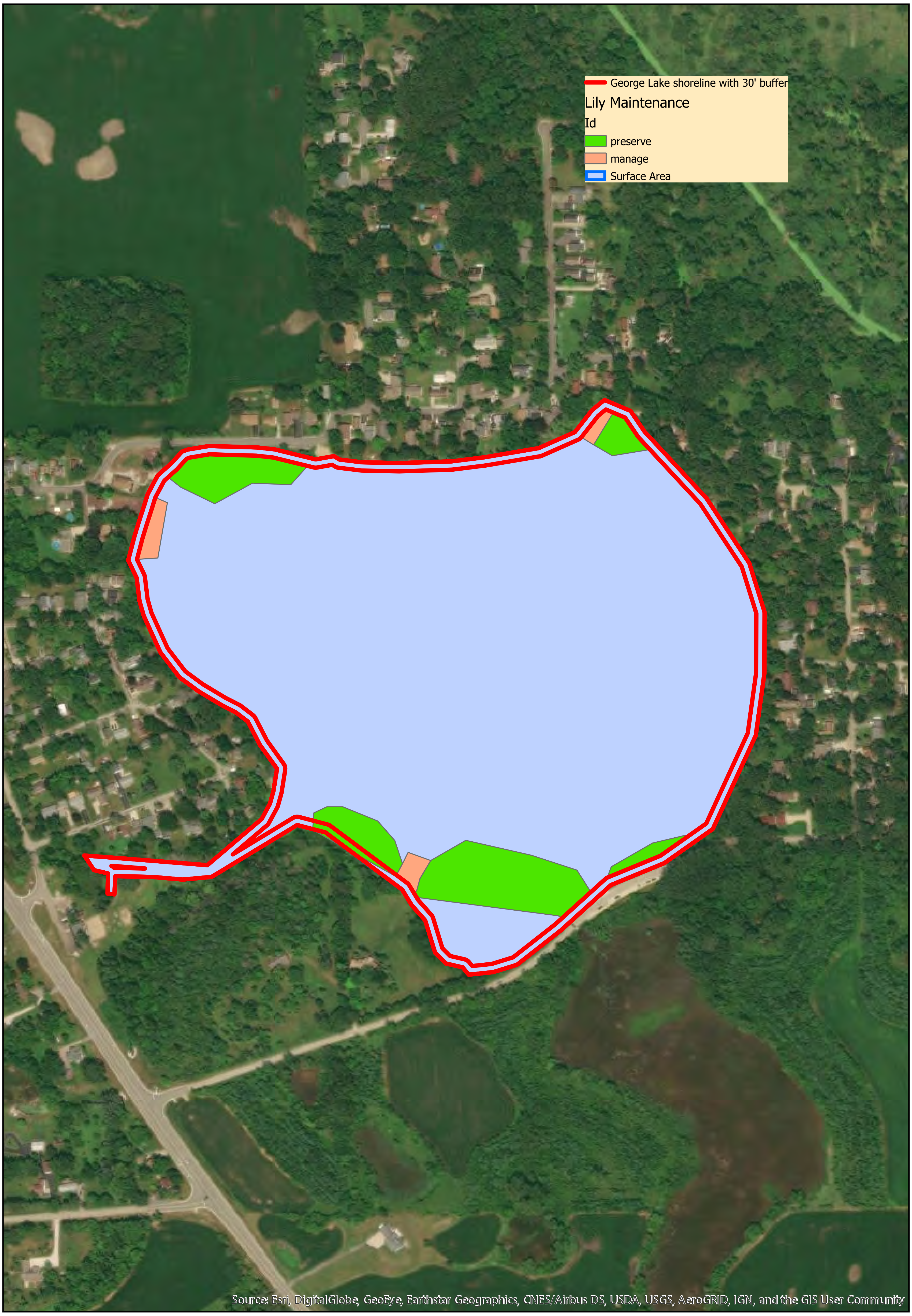
Figure A-5. Proposed areas of white-water lily maintenance and preservation.



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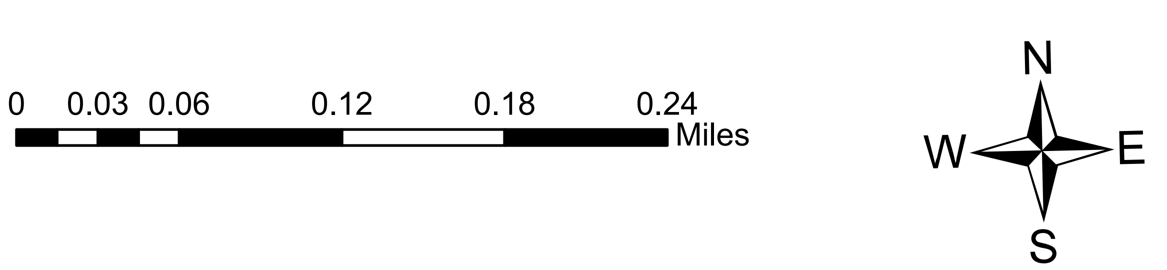

x

Exhibit A-1 Floristic Quality Index

Conservatism-Based Metrics:			
Total Mean C:		4.5	
Native Mean C:		5.3	
Total FQI:		16.2	
Native FQI:		17.6	
Adjusted FQI:		48.8	
% C value 0:		15.4	
% C value 1-3:		15.4	
% C value 4-6:		61.5	
% C value 7-10:		7.7	
Native Tree Mean C:	n/a		
Native Shrub Mean C:	n/a		
Native Herbaceous Mean C:		5.3	
Species Richness:			
Total Species:		13	
Native Species:		11	84.60%
Non-native Species:		2	15.40%
Species Wetness:			
Mean Wetness:		-4.6	
Native Mean Wetness:		-4.5	
Physiognomy Metrics:			
Tree:		0	0%
Shrub:		0	0%
Vine:		0	0%
Forb:		13	100%
Grass:		0	0%
Sedge:		0	0%

Rush:	0	0%
Fern:	0	0%
Bryophyte:	0	0%

Duration Metrics:

Annual:	0	0%
Perennial:	13	100%
Biennial:	0	0%
Native Annual:	0	0%
Native Perennial:	11	84.60%
Native Biennial:	0	0%

Species:

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Ceratophyllum demersum	Ceratophyllaceae	CERDEM	native	3	-5	forb	perennial	coons-tail
Lemna minor	Araceae	LEMMIN	native	4	-5	forb	perennial	common duckweed
Lemna trisulca	Araceae	LEMTRI	native	6	-5	forb	perennial	forked duckweed
Myriophyllum spicatum	Haloragaceae	MYRSPI	non-native	0	-5	forb	perennial	eurasian water-milfoil
Nuphar variegata	Nymphaeaceae	NUPVAR	native	6	-5	forb	perennial	bull-head pond-lily
Nymphaea odorata ssp. tuberosa	Nymphaeaceae	NYMODOST	native	6	n/a	forb	perennial	american white water-lily
Potamogeton crispus	Potamogetonaceae	POTCRI	non-native	0	-5	forb	perennial	curled pondweed
Potamogeton foliosus	Potamogetonaceae	POTFOL	native	6	-5	forb	perennial	leafy pondweed
Potamogeton illinoensis	Potamogetonaceae	POTILL	native	6	-5	forb	perennial	illinois pondweed
Ranunculus longirostris	Ranunculaceae	RANLON	native	8	-5	forb	perennial	long beak buttercup
Spirodela polyrrhiza	Araceae	SPIPOL	native	5	-5	forb	perennial	giant duckweed
Stuckenia pectinata	Potamogetonaceae	STUPEC	native	3	-5	forb	perennial	comb pondweed
Wolffia columbiana	Araceae	WOLCOL	native	5	-5	forb	perennial	common water-meal