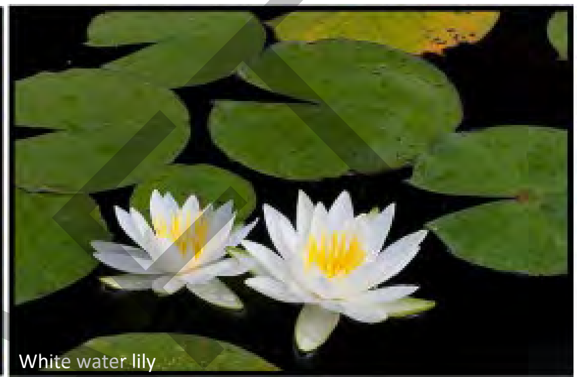
Long Lake

Aquatic Plant Management Plan

2024-2029


Pickerelweed


White water lily


Large-leaf pondweed

Plan Approved

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Long Lake Preservation Association
To preserve and protect Long Lake, its watershed and its ecosystems

Northwest Regional Planning Commission
NWRPC
keeping your future as our focus

Acknowledgements

The LLPA Board of Directors would like to acknowledge the efforts of many LLPA members for their participation in collecting the data used in the Comprehensive Lake Management Plan, without which, this plan would likely not have been completed. In addition, we also want to extend our great appreciation to the Northwest Regional Planning Commission whose support made the creation of this plan possible. Their Water Resources Specialist, Megan Mader, BS, MS, has served as the Long Lake Consultant. With her expertise in Aquatic Biology, she directed the efforts of those noted above, advised the Board of Directors on how to prepare to preserve and protect Long Lake and its watershed, and developed this Aquatic Plant Management Plan.

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Executive Summary

Long Lake is renowned for its natural beauty and recreational opportunities. Its expansive undeveloped shoreline due to the presence of the Tomahawk Boy Scout Camp, exceptional fishery, relatively clear waters, and large size attract wildlife viewers, fishermen, boaters, and recreators of all kinds. Between the calling of the lake's several pairs of loons and the revelry of children enjoying the lake, Long Lake is celebrated for its diverse range of recreation offerings and experiences. Appreciating the natural beauty and outdoor recreation opportunities provided by Long Lake is an integral aspect of the identity of the people who live and recreate there.

Long Lake (WBIC: 2106800) is located in southeast Washburn County, Wisconsin. The lake has several known aquatic invasive species (AIS), including curly-leaf pondweed (CLP), for which there has been previous management. Currently, CLP appears to have assimilated into the aquatic plant community. Other AIS, like yellow flag iris and Japanese knotweed, are also present around the lake and management activities for control of these and others are included in this plan.

Notably, the 2022 warm water point intercept survey for Long Lake did not find evidence of Eurasian watermilfoil (EWM). As such, watercraft inspection at lake access sites, AIS monitoring, and education are essential tools to prevent the introduction of EWM and other AIS. With EWM present in many surrounding lakes, the Long Lake Preservation Association (LLPA) decided to take proactive measures to prevent the introduction of this and other aquatic invasive species and to develop a Rapid Response Plan.

In a 2023 survey of Long Lake users and residents[1], issues related to native and non-native plant species were identified as significant problems. Of the 273 respondents, 205 (75.1%) indicated that 'excessive aquatic plant growth' was at least 'sometimes' an issue. However, 115 respondents (42.1%) were 'undecided' as to whether this was a threat to the health of Long Lake. This may indicate the need for action as well as education related to aquatic plant management and their ecological importance.

The goals of this Long Lake Aquatic Plant Management Plan are:

1. Protect, preserve, and enhance the native aquatic plant community while simultaneously maintaining lake access and recreation opportunities for the general public and riparian landowners.
2. Monitor and manage curly-leaf pondweed, yellow flag iris, Japanese knotweed, and other AIS in and around the lake and its watershed; and prevent the introduction of additional AIS.
3. Educate and inform the lake community about the importance of aquatic plants in the lake ecosystem, management alternatives, and appropriate management actions.
4. Develop a Rapid Response Plan to ensure that the appropriate measures are in place if a new AIS is detected in the lake.

[1] https://longlakellpa.org/resources/

The purpose of this plan is to guide the effective management and protection of aquatic plants in Long Lake through integrated pest management. This plan is intended to be a living document which will be modified to ensure goals and community expectations are being met. Minor changes and adaptations are expected and may be made annually, but any major change in activities or management philosophy will be presented to the Wisconsin Department of Natural Resources (WDNR) for approval.

Lake Management Concerns

The Long Lake Preservation Association (LLPA) has a long history of active engagement in preserving and protecting Long Lake and its watershed. Several lake and watershed planning projects have been completed in the last fifty years. The most recent project – the *2024-2034 Long Lake Comprehensive Lake Management Plan*[2] – identified the need to update the aquatic plant management plan (APMP) for Long Lake in order to address concerns related to dense stands of native plant species that impede navigation, management and monitoring of non-native species, the need for a rapid response plan in case new AIS are introduced, and the need for education related to AIS and the value of native plant species.

Public Participation and Input

The goals of this plan were created as a direct result of the 2023 survey[3] where Long Lake residents identified key areas of aquatic plant management areas for future management consideration.

Survey respondents were asked about their perceptions of different aspects of Long Lake. In response to their perceptions of "issues," excessive plant growth was identified as an issue particularly in the south basin and the north basin. Because this issue is somewhat subjective, the survey report and the *2024-2034 Long Lake Comprehensive Lake Management Plan* recommended updating Long Lake Aquatic Plant Management Plan to address areas of dense native plant growth and educate riparian landowners on their ecological value.

In addition to the survey, the public comment period of the *2024-2034 Long Lake Comprehensive Lake Management Plan* yielded several public opinions of aquatic plant management. Of the 41 total comments that were received, 6 related to dense native vegetation and AIS. These comments indicated a desire to improve navigation through dense native vegetation and reduce the risk of AIS (primarily Eurasian Watermilfoil) entering the lake.

Plan distribution, public comment period.

[2] https://longlakellpa.org/resources/
[3] https://longlakellpa.org/resources/

Waterbody Information

Lake Description

Long Lake (WBIC: 2106800) is a 3,290 acre, stratified, eutrophic, drainage lake located in southeastern Washburn County, Wisconsin in the Towns of Birchwood, Long Lake, and Madge (T37N R10/11W). Long Lake is at the headwaters of the Brill River that flows into the Red Cedar River (Figure 1). This large lake is irregularly shaped and consists of numerous bays and basins. The lake has a hydraulic residence time of two years and a volume of 86,967 acre feet. Long Lake provides exceptional recreational opportunities and possesses outstanding fish, wildlife, and water quality resources. As such, it is listed as an Outstanding Water Resource by the WDNR.[4]

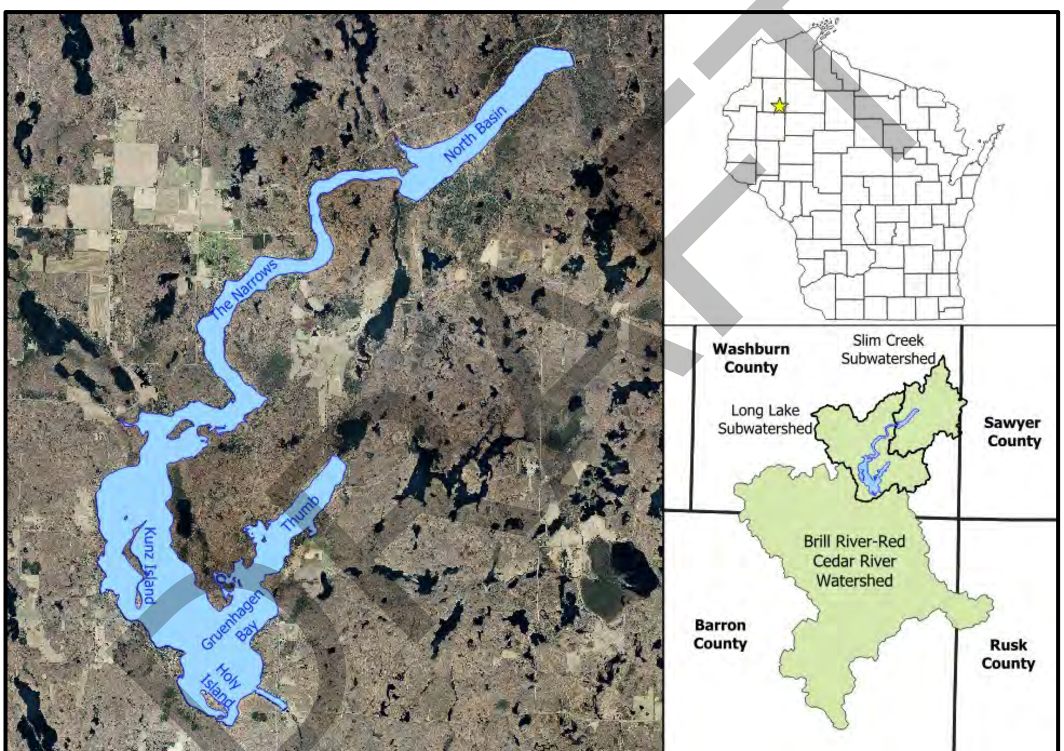


FIGURE 1. LONG LAKE LOCATION

[4] https://apps.dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2106800

Lake Depth and Substrate

The lake reaches a maximum depth of 74ft in the northeast thumb and has an average depth of 26ft (Figure 2). Only five percent of the lake surface area is less than 3 feet deep, but 63 percent of the lake has depths of over 20 feet (WDNR, 1978). The bottom substrate is predominantly organic muck in sheltered bays and a mixture of sand, rock, and sandy muck along the majority of the rest of the shoreline (Figure 2; Berg, 2022). Away from the immediate shoreline, the lake’s many bars, humps and sunken inlands are dominated by gravel and sand, while many shallow flats tend to have a thin layer of muck over these firmer substrates (Berg 2022).

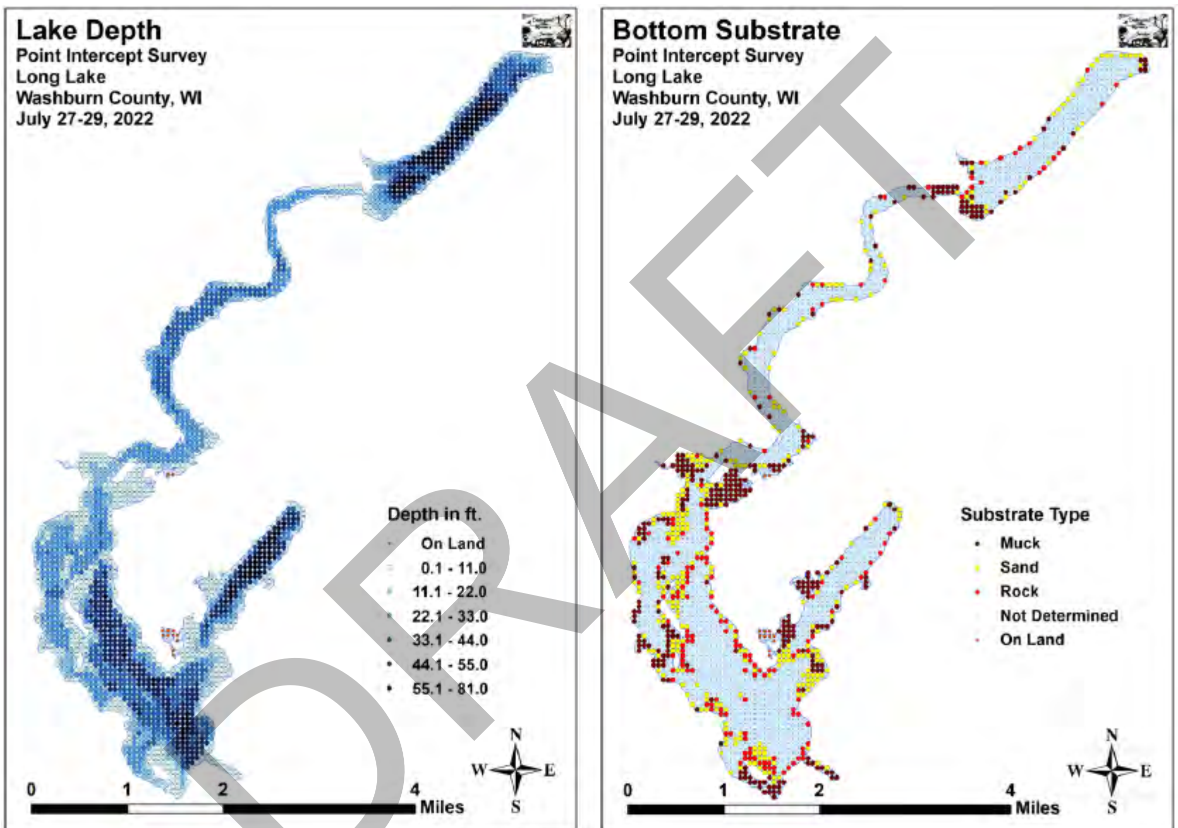


FIGURE 2. LONG LAKE DEPTH AND BOTTOM SUBSTRATE (BERG, 2022)

WDNR Lakes Classification

The WDNR uses four levels of classifications to delineate waterbodies based on water quality:

- Excellent – Waters are considered to be fully supporting their assessed designated uses.
- Good or Fair – Waters are considered to be supporting their assessed designated uses.
- Poor – Waters may not support assessed designated use(s) but have insufficient information for a decision at the impairment assessment level.

Listing thresholds and detailed methodology for assessment and analysis are included in WisCALM (Wisconsin Consolidated and Assessment Listing Methodology). Based on this methodology, the WDNR publishes a list of waters considered impaired, as required by the federal Clean Water Act, every two years. Impaired waters are those that do not meet water quality standards and may not support fishing, swimming, recreating, or public health and welfare. A water body is considered healthy when it supports: healthy aquatic animal and plant communities, safe human recreation like swimming, and safe fish consumption. If any of these are not supported, then the water is considered impaired (WDNR, 2021). The WDNR establishes standards for various lake types. Further, there are standards set for Fish and Aquatic Life (FAL) and for Recreational Use.

Long Lake was placed on the impaired waters list for total phosphorus in 2014. The 2018 assessment showed continued impairment by phosphorus; total phosphorus sample data overwhelmingly exceeded the 2018 WisCALM listing thresholds for the Recreational Use and FAL use. Chlorophyll-a sample data only exceeded the FAL use threshold.

Long Lake is a two-story drainage lake classified as impaired due to high levels of phosphorus and eutrophication. WisCALM lists FAL as Poor, Recreation as Poor, and Fish Consumption as Excellent (Figure 3).

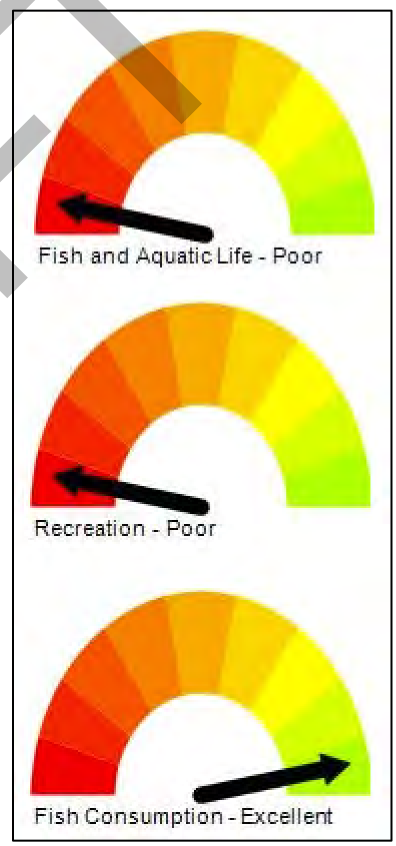


FIGURE 3. LONG LAKE WISCALM LISTING

Water Quality

Long Lake has five water quality monitoring sites to capture the variability of the morphologically diverse lake (Figure 4). Site A is located in the relatively productive North Basin. Site F is in the Narrows where there is some level of current flowing from the North Basin to the southern portion of the lake. Site C captures water quality near Kunz Island. Site D is centrally located in the South Basin. Site E is in Gruenhagen Bay ("the Thumb") at the deepest point in the lake (74 feet)

Volunteers have been collecting water quality data on Long Lake through the Citizen Lake Monitoring Program (CLMP) since 1991.

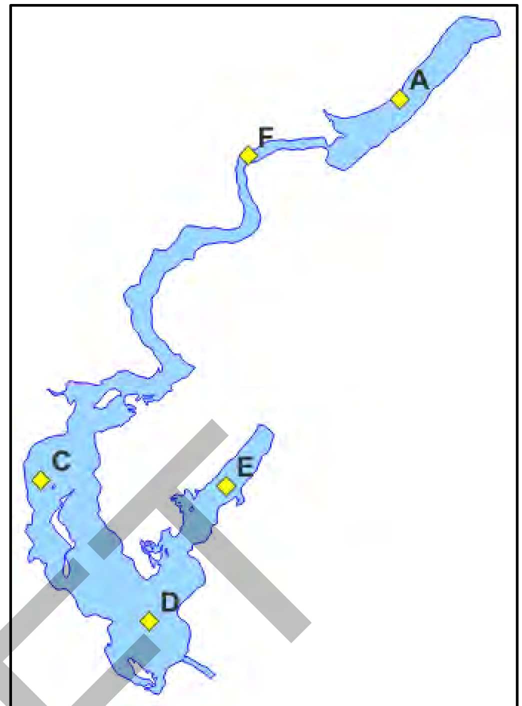


FIGURE 4. LONG LAKE WATER QUALITY MONITORING SITES

Trophic State

The trophic state index (TSI) score places a lake into a category of oligotrophic, mesotrophic, eutrophic, or hypereutrophic based on three measurements: chlorophyll-*a* (a measure of algal biomass), total phosphorus (a vital nutrient for algal growth), and secchi depth (a measure of water clarity). Lakes naturally occur in each of the first three categories, but hypereutrophic lakes are within that category because of human-caused nutrient enrichment (Table 1).

Oligotrophic lakes are generally very clear, deep, and cold. The lake substrate is typically firm and sandy. Nutrient levels are low, so the lake generally does not support large populations of aquatic plants, animals, or algae. The fish that occur in oligotrophic lakes are often low in abundance, but large in size. Many oligotrophic lakes divide into two layers in the summer, a condition known as stratification.

Mesotrophic lakes contain moderate amounts of nutrients, and contain healthy, diverse populations of aquatic plants, algae, and fish. Occasional algae blooms may occur. If the lake is deep enough to stratify, the hypolimnion often becomes low in oxygen by the end of summer and may result in some phosphorus release from the sediments.

Eutrophic lakes are high in nutrients and contain large populations of aquatic plants, algae, and fish. The lake substrate is typically soft and mucky. The aquatic plants and algae often grow to nuisance levels, and the fish species are generally tolerant of warm temperatures and low oxygen conditions. Common fish species include carp, bullheads, and bluegills. If the lake is deep enough to stratify, the hypolimnion is usually very low in oxygen by mid-summer. This results in a release of phosphorus from the sediments, which can fuel algae blooms.

TABLE-1. TSI CLASSIFICATION CHARACTERISTICS AND DESCRIPTIONS

TSI	Chlorophyll-a (µg/L)	Secchi Depth (ft)	Total Phosphorus (µg/L)	Classification	Attributes	Fisheries and Recreation
<30	<0.95	>26	<6	ULTRAOLIGOTROPHIC	clear water, many algal species, oxygen throughout the year in bottom water, cold water	oxygen-sensitive species, cold water fish species in deep lakes
30-40	0.95 - 2.6	13 - 26	6 - 12	OLIGOTROPHIC	clear water, many algal species, oxygen throughout the year in bottom water except possibly in shallow lakes, cold water	oxygen-sensitive species, cold water fish species in deep lakes only
40-50	2.6 - 7.3	6.5 - 13	12 - 24	MESOTROPHIC	water moderately clear, but increasing change of low dissolved oxygen in deep water during summer	walleye may dominate
50-60	7.3 - 20.0	3.0 - 6.5	24 - 48	EUTROPHIC	decreased clarity, fewer algal species, oxygen-depleted bottom waters during summer, plant overgrowth evident	warm-water fisheries (pike, perch, bass, sunfish, etc.)
60-70	20 - 56	1.5 - 3.0	48 - 96	EUTROPHIC	blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible	thick aquatic vegetation and algal scums may discourage swimming and boating
70-80	56 - 155	0.75 - 1.5	96 - 192	HYPEREUTROPHIC	heavy algal blooms possible throughout summer, dense plant beds, but extent limited by light penetration (blue-green algae block sunlight)	summer fish kills possible, rough fish (sucker, redhorse, bullhead, carp, etc.) dominant
>80	>155	<0.75	192 - 384	HYPEREUTROPHIC	Algal scums, few plants	

Using water quality data from Long Lake, the TSI can be determined at each sampling site and for the lake as a whole (Figure 5). Using data from 1991-2023, it is apparent that Long Lake is consistently borderline eutrophic to mesotrophic (Figure 5).

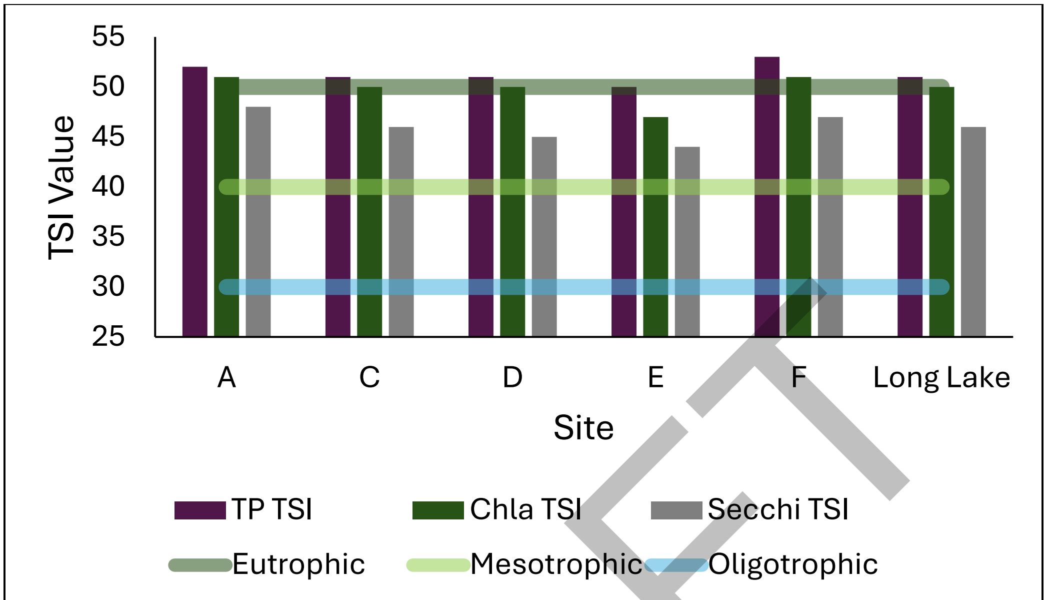


FIGURE 5. TSI VALUES FOR LONG LAKE AND MONITORING STATIONS: 1991-2023

The average summer trophic state for 2018-2023 determined by chlorophyll data was 55 (eutrophic). This is considered 'poor' for a two-story lake. However, when considering the average summer trophic state for 2018-2023 for total phosphorus and secchi depth, the TSI for total phosphorus is 45 (mesotrophic) and the TSI for secchi depth is 45 (mesotrophic). The combined TSI for all three metrics from 2018-2023 is 47 (mesotrophic). However, chlorophyll – which measures algal biomass – is the most visible and prominent indicator of trophic state.

Lake Stratification

Dissolved oxygen (DO) and temperature profiles are regularly completed at Long Lake's water quality monitoring stations[5]. Depths greater than 50 feet regularly become anoxic (DO< 1mg/L) as early as July. With low oxygen levels, lake sediments tend to release phosphorus, a phenomenon known as internal loading. The temperature profile indicates the lake is stratified, which confines phosphorus that is released from the sediment to the lower levels of the water column (hypolimnion). When fall turnover occurs, that phosphorus becomes available throughout the water column.

[5] https://apps.dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2106800&page=waterquality

Outstanding Resource Water Designation

Long Lake is designated as an Outstanding Resource Water (ORW)[6]. Waters designated as ORW or ERW (Exceptional Resource Waters) are surface waters which provide outstanding recreational opportunities, support valuable fisheries and wildlife habitat, have good water quality, and are not significantly impacted by human activities. Less than 1% of Wisconsin's 15,000 lakes and impoundments are designated as ORW. The state of Wisconsin assigns ORW and ERW status to waters that warrant additional protection from the effects of pollution. These designations are intended to meet federal Clean Water Act obligations requiring Wisconsin to adopt an "antidegradation" policy that is designed to prevent any lowering of water quality – especially in those waters having significant ecological or cultural value.

ORWs typically do not have any point sources discharging pollutants directly to the water (e.g., industrial sources or municipal sewage treatment plants), though they may receive runoff from nonpoint sources (e.g., agricultural runoff, residential runoff).

[6] https://dnr.wisconsin.gov/topic/SurfaceWater/orwerw.html

Public Use

Long Lake has four public boat launches[7] (Figure 6). The boat launches are owned and maintained by surrounding townships (Table 2). All the launches are relatively small (less than 15 vehicle stalls), and none have ADA (Americans with Disabilities Act). Several of the landings are monitored by volunteers through the Clean Boats, Clean Waters program.

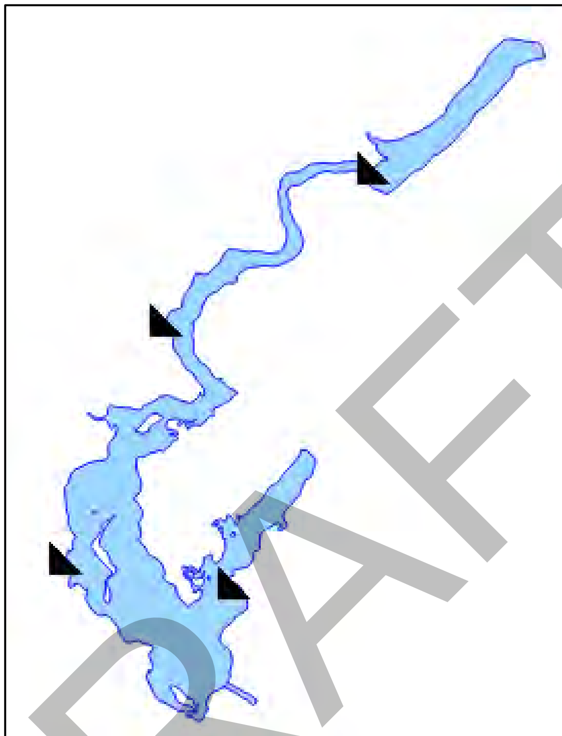


Figure 6. Long Lake Public Boat Launches

Landing Name	Access	Vehicle Stalls	ADA Accessible	Ownership	CBCW
Hank's Landing	Todd Rd	6 to 10	No	Town of Madge	Yes
Long Lake Access	End of Blackhawk Rd	6 to 10	No	Town of Birchwood	Yes
Long Lake Access	Off County Hwy M	11 to 15	No	Town of Long Lake	Yes
Long Lake Access	End of Sunset Bay Rd	1 to 5	No	Town of Long Lake	No

Table-2. Long Lake Boat Landing Summary Information

[7] https://apps.dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2106800&page=boating

Sensitive Areas

Sensitive Areas of Lakes (Areas of Special Natural Resource Interest) are designated as Critical Habitat Areas in Wisconsin. These areas have been identified by the WDNR as offering critical or unique fish and wildlife habitat, including seasonal or life stage requirements, or offering water quality or erosion control benefits to the body of water. Wisconsin law mandates special protections for these critical habitats[8].

Long Lake has 32 designated Sensitive Areas[9] (Figure 7). The sensitive areas total 456.19 acres – 13% of Long Lake's surface area. These areas were designated by the WDNR because they provide quality habitat for spawning, nurseries, wildlife habitat, and shoreline protection. Knowing the location of these areas provides insight into management decisions and the possible implications of management activities. For more information on Long Lake's individual sensitive areas, please review the Long Lake Sensitive Area Survey Report and Management Guidelines[10] (1998) document.

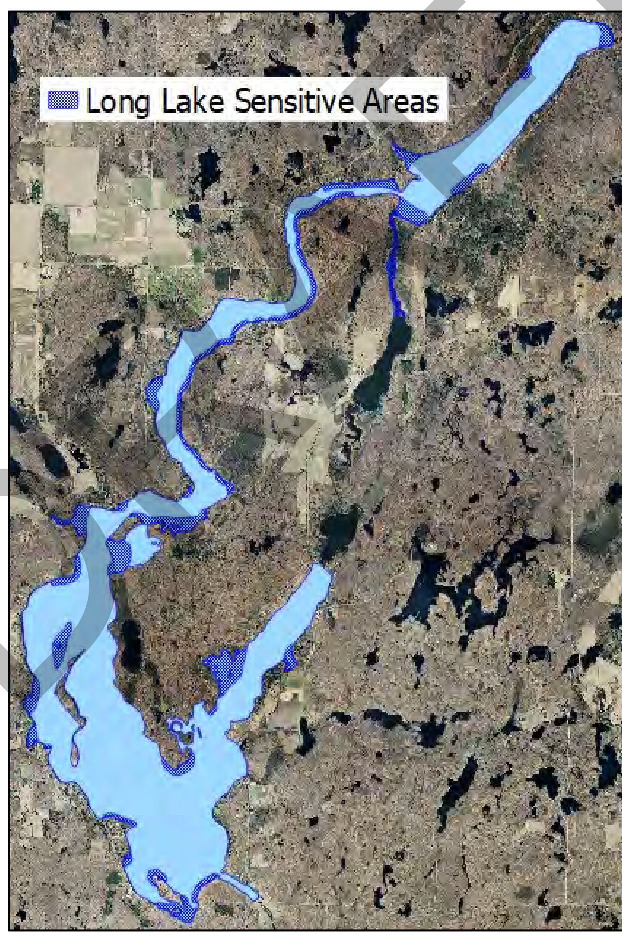


FIGURE 7. LONG LAKE SENSITIVE AREAS

[8] https://dnr.wisconsin.gov/topic/lakes/criticalhabitat
[9] https://apps.dnr.wi.gov/lakes/criticalhabitat/Project.aspx?project=10419350
[10] https://longlakellpa.org/resources/

Watershed

A watershed is an area of land that drains rainfall and snowmelt to a body of water. Slim Creek Watershed (20,625.77 acres) and Long Lake Watershed (33,545.14 acres) make up the land area that drains directly to Long Lake (Figure 8). The Slim Creek Watershed contributes to the North Basin through Slim Creek, and the Long Lake Watershed contributes to the lower portion of the lake. The Long Lake watershed areas are part of the larger Brill River-Red Cedar River Watershed[11].

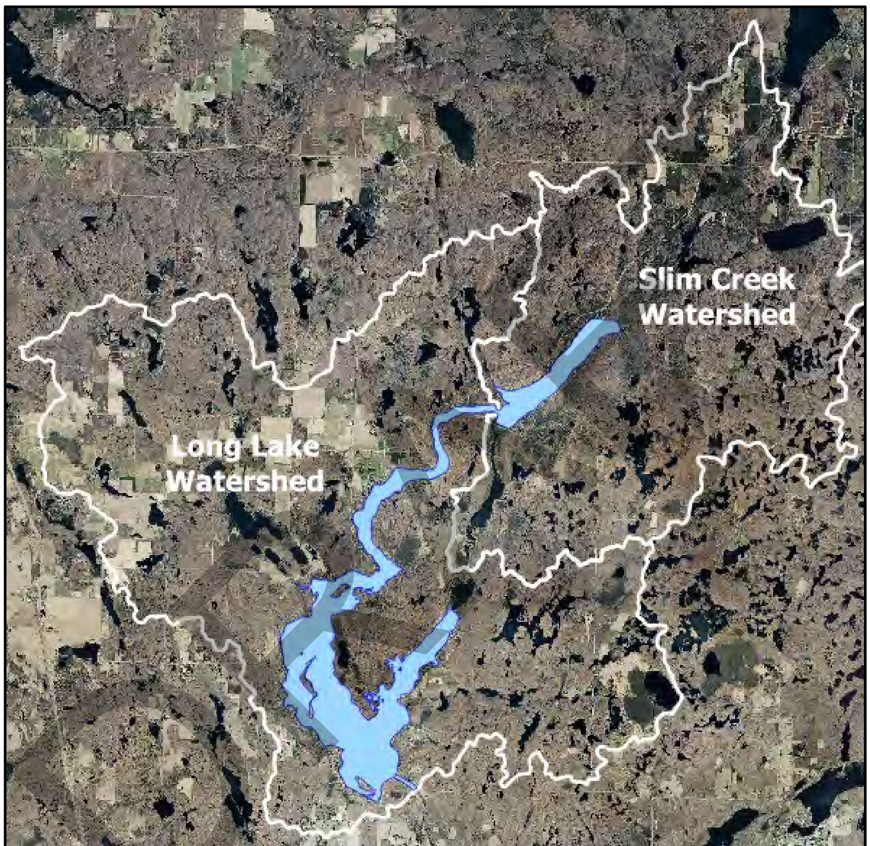


FIGURE 8. LONG LAKE WATERSHEDS

[11] https://apps.dnr.wi.gov/water/waterDetail.aspx?key=15992

Land Cover

The U.S. Geological Survey (USGS) has developed a National Land Cover Database (NLCD) that provides spatially explicit and reliable information on land cover[12]. This publicly accessible dataset makes it possible to accurately map land cover[13]. The NLCD 2019 database was used to map the land cover of Long Lake's watershed area.

The watershed has very little development and is largely dominated by forest cover (Figure 9; Table 3; Figure 10). Deciduous forests alone make up 54.08% of the watershed (Table 3). What little development there is in the watershed (3.77%) is mostly related to roadways and resort areas around Long Lake (Figure 9). Agriculture (Cultivated Crops + Pasture/Hay) makes up 9.43% of the watershed (Figure 9; Table 3; Figure 10). Wetlands (Woody Wetlands + Emergent Herbaceous Wetlands) make up 12.64% of the watershed, and open water (lakes, ponds, rivers, etc.) make up 11.58% of the watershed (Table 3; Figure 10).

Understanding the land cover of a watershed is an important piece to understanding the impacts of human actions on the landscape like agriculture, logging, developing, etc. It is also valuable for understanding potential sources of pollution (i.e., nutrients and sediment) that can negatively affect a waterbody. A natural watershed, like the Long Lake watershed area, is a critical piece of protecting the lake and limiting negative landscape-scale impacts.

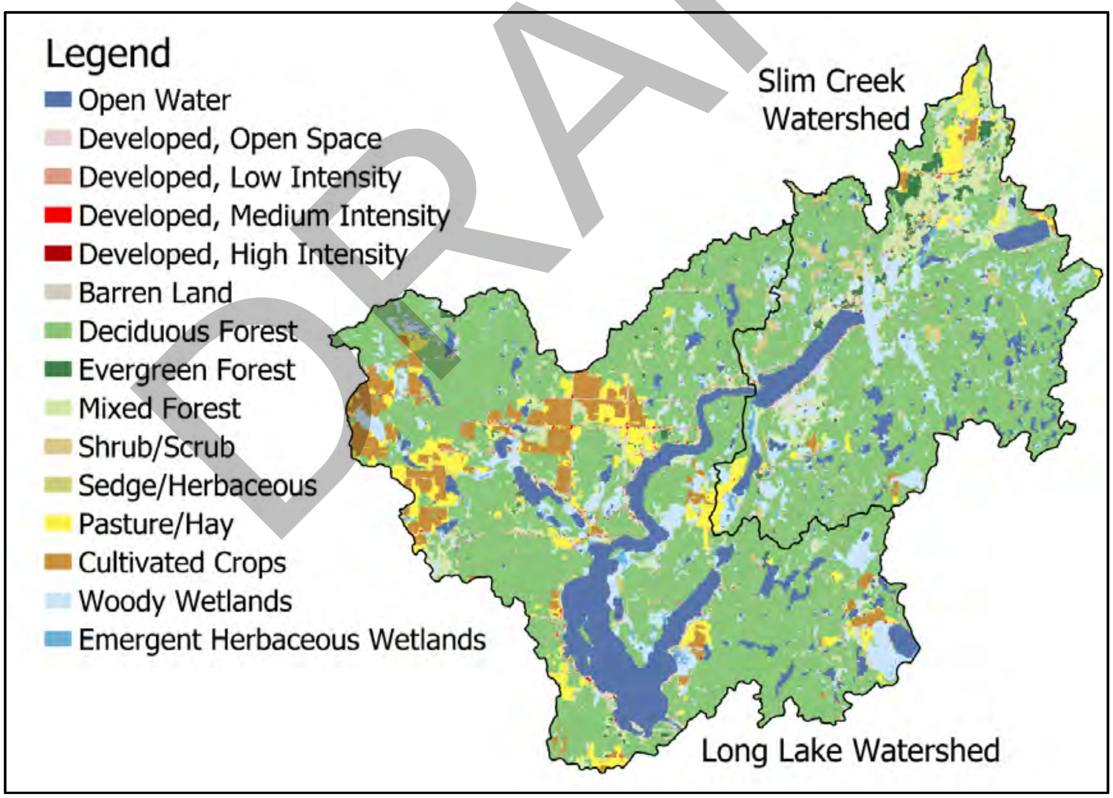


FIGURE 9. LONG LAKE WATERSHED AREA LAND COVER (NLCD, 2019)

[12] https://www.mrlc.gov/data/nlcd-2021-land-cover-conus

[13] For more information on NLCD Land Cover Classifications: https://www.mrlc.gov/data/legends/national-land-cover-database-class-legend-and-description

TABLE-3. LONG LAKE WATERSHED AREA LAND COVER (NLCD, 2019)

NLCD Classification	Acres	Percent of Total
Open Water	6,272.50	11.58%
Developed, Open Space	1,444.87	2.67%
Developed, Low Intensity	424.98	0.78%
Developed, Medium Intensity	143.21	0.26%
Developed, High Intensity	29.27	0.05%
Barren Land	17.28	0.03%
Deciduous Forest	28,203.60	52.08%
Evergreen Forest	668.93	1.24%
Mixed Forest	3,871.79	7.15%
Shrub/Scrub	434.16	0.80%
Sedge/Herbaceous	690.25	1.27%
Pasture/Hay	2,688.20	4.96%
Cultivated Crops	2,418.23	4.47%
Woody Wetlands	6,224.73	11.50%
Emergent Herbaceous Wetlands	618.26	1.14%
Total	**54,150.26**	**100.00%**

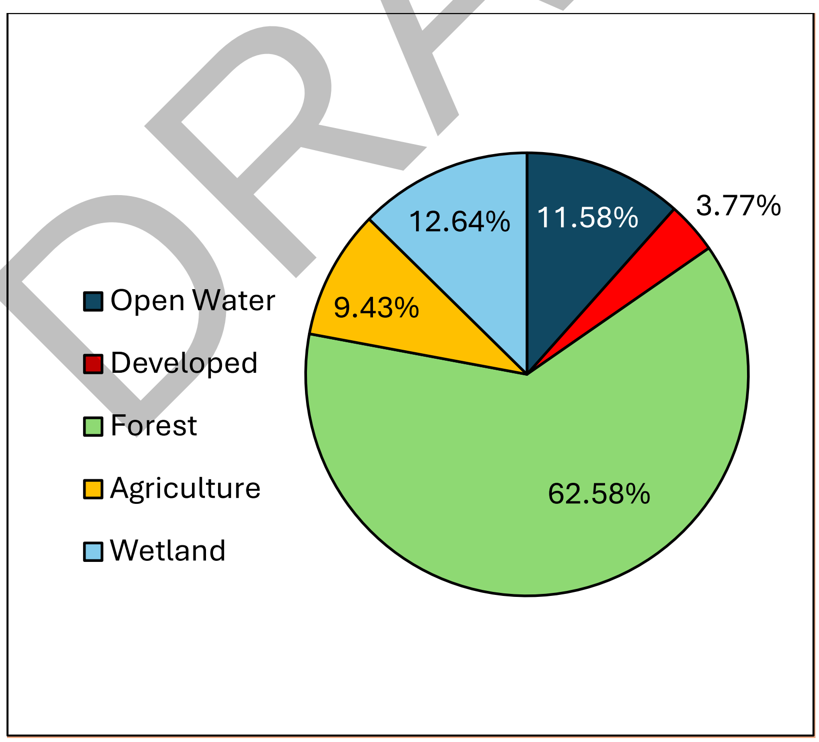


FIGURE 10. SIMPLIFIED LONG LAKE WATERSHED AREA LAND COVER (NLCD, 2019)

Fishery

Long Lake is a complex-two story lake with a popular multi-species fishery. In 2022, Long Lake was surveyed by the WDNR using several techniques to evaluate the status of the fishery – walleye, northern pike, largemouth bass, smallmouth bass, and panfish were assessed[14]. A population estimate for walleye was conducted and the catch rates for northern pike, largemouth bass and panfish species were indexed. General population characteristics, size structure and growth of all species were assessed and compared to previous years. Recent fisheries management activities have been focused on stocking, regulation changes, public outreach and education.

Stocking History

Walleye are the only species to have been stocked in Long Lake. Stocking activities have occurred since 1998 and have been supported by a variety of sources – private, WDNR, tribal, and Walleye Wagon (Roberts, 2023). Since 2014, Long Lake has received only large fingerling walleye as part of the Wisconsin Walleye Initiative (average length 6.9 inches; Roberts, 2023). More information can be found at the WDNR stocking database[15].

2022 Fishery Survey Results Summary

Walleye

There is some natural reproduction of walleye occurring in Long Lake, but stocking is still an important tool in promoting recruitment. Natural reproduction of walleye based on fall age-0 surveys has been poor since 2010 (10 fish/mile; Roberts, 2023). Low catch rates of naturally reproduced age-0 walleye were observed in fall surveys, but they are still contributing comparatively high numbers to the adult walleye population of Long Lake (Roberts, 2023). This level of higher natural contribution may be for a few reasons: 1) natural juvenile walleye survive better into adulthood than stocked fish, 2) natural juvenile walleye are not as susceptible to fall sampling methods or 3) possible fin generation has altered our results (Roberts, 2023). Supplementing the walleye population with stocking will continue to maintain the fishery, but natural reproduction – even at low levels – is an essential factor for Long Lake's walleye (Roberts, 2023).

The Long Lake walleye population has remained relatively stable for the last 30 years, with some variation between surveys. Currently, the adult walleye population has a density of 1.9 fish/acre, which is consistent with the long-term average density (Roberts, 2023). Since 2015, the population of adult walleye has declined slightly but is still above 1.5 fish/acre, which is a target for many stocked fisheries. Despite the decline in adult fish, the overall size structure has increased since 2015, and over 52% of sampled are walleye at or above the minimum size limit of 18 inches (Roberts, 2023). The larger stocked year classes are not yet sexually mature,

[14] https://dnr.wisconsin.gov/sites/default/files/topic/Fishing/WashburnLong2022CompSurvey%20.pdf
[15] https://apps.dnr.wi.gov/fisheriesmanagement/Public/Summary/Index

which may explain why the adult population appears lower (Roberts, 2023). The population density may increase when these immature fish enter the adult population (Roberts, 2023).

In Long Lake, walleye grow relatively quickly and reach 18 inches in 4-6 years (Roberts, 2023). The 18-inch minimum length limit and a daily bag limit of 3 walleye regulation protects mature fish and increases the chances for successful natural reproduction (Roberts, 2023). At this time, the WDNR does not recommend any changes for the minimum length limit for Long Lake due to these reasons (Roberts, 2023).

Northern Pike

The northern pike population in Long Lake has increased in abundance and average size since the last survey, and their population is stable (Roberts, 2023). Additionally, the catch rates are high when compared to other Wisconsin Complex-Two Story lakes (Roberts, 2023). The abundance of northern pike may be slightly underestimated based on survey methods.

Largemouth and Smallmouth Bass

Populations of largemouth and smallmouth bass appear stable and healthy (Roberts, 2023). Average size and growth has improved for largemouth bass, suggesting that anglers are continuing to harvest smaller bass which helps improve the growth rates for the other bass (Roberts, 2023). In this survey, all bass were observed for signs of disease (lesions or dead fish) due to an unknown disease observed in 2021; no bass were observed with signs of active disease (Roberts, 2023). Only two of the 126 largemouth and smallmouth bass collected electrofishing had healed lesions (1.6%) (Roberts, 2023). These results suggest the disease had run its course and these fish were likely surviving after the infection (Roberts, 2023).

Panfish

The bluegill population was similar to 2015 (Roberts, 2023). Bluegill size structure was good when compared to other Two-Story lakes in Wisconsin (Roberts, 2023). However, the 2015 creel survey also found good numbers of bluegill harvested at 7-8 inches, which may suggest sampling was not as effective for bluegill in Long Lake (Roberts, 2023). The black crappie population appears to be healthy in Long Lake with a good catch rate and size structure and was comparable to the last survey (Roberts, 2023). Black crappie continue to provide a popular fishery with anglers (Roberts, 2023).

Fishery Concerns Related to Plant Management

Fisheries management often intersects with aquatic plant management due to the critical role aquatic plants play in freshwater ecosystems.

1. **Habitat Alteration:** Removal or alteration of aquatic plants can disrupt fish habitat, affecting spawning, nursery areas, and food sources. Fish species rely on aquatic plants for shelter, foraging, and reproduction.

2. **Water Quality:** Aquatic plants contribute to water quality by oxygenating the water and absorbing nutrients. Their removal can lead to decreased water clarity, increased algae growth, and changes in nutrient dynamics, which can impact fish populations.

3. **Fish Population Dynamics:** Changes in aquatic plant communities can influence fish populations. For example, the loss of submerged vegetation can reduce prey availability for certain fish species, leading to changes in fish abundance and diversity.

4. **Invasive Species Management:** Aquatic plant management often involves controlling invasive plant species. These invasive plants can outcompete native vegetation, alter habitat structure, and disrupt food webs, impacting fish populations and overall ecosystem health.

5. **Ecosystem Function:** Aquatic plants play a crucial role in ecosystem function by providing habitat, stabilizing sediments, and cycling nutrients. Alterations to plant communities can have cascading effects on other organisms, including fish, and the overall functioning of the ecosystem.

6. **Integrated Pest Management:** Effective aquatic plant management requires an integrated approach that considers ecological principles and minimizes impacts on fish populations. Strategies such as mechanical harvesting, herbicide application, and biological control methods should be carefully evaluated to balance plant control with fish habitat preservation.

7. **Community Engagement:** Engaging stakeholders, including anglers, conservation groups, and local communities, in aquatic plant management decisions is essential for achieving sustainable outcomes. Collaborative efforts can help prioritize management goals, address concerns, and implement effective strategies while minimizing negative impacts on fish populations.

Overall, fisheries management and aquatic plant management are interconnected aspects of freshwater ecosystem management, requiring careful consideration of ecological interactions and stakeholder input to maintain healthy fish populations and ecosystem integrity.

Native Aquatic Plants Function and Value

Long Lake's native aquatic plants provide many beneficial functions. They provide habitat for a diverse range of species, support fisheries, help protect shorelines, and even help improve water quality.

Aquatic plants are essentially a first line of defense against many variables that can threaten a lake's health. Plants absorb nutrients that would otherwise fuel algal blooms. They also help keep sediments from re-suspending and reducing water clarity by slowing the movement of water and trapping sediment with their root structures. Floating and emergent species like water lilies and bullrushes can help protect shorelines from erosion by buffering waves before they reach shore.

Aquatic plants are an essential part of aquatic ecosystems because of the food and shelter they supply. Adult fish can use beds of aquatic plants for spawning habitat. Young fish use the plants for protection, and adult fish use them to ambush their prey. They also support the bacteria and plankton at the bottom of the food chain by providing structure for them to grow on; these species are then preyed on by juvenile fish and aquatic invertebrates like dragonfly larvae.

Native aquatic plants also help protect against invasive plant species like Eurasian water milfoil (EWM) and curly leaf pondweed (CLP). If there are lots of native plants and no available 'real estate', invasive plant species have no room to move in.

Benefits of a diverse native plant community include:

1. **Habitat Provision:** Native aquatic plants provide habitat for a diverse range of aquatic organisms, including fish, invertebrates, amphibians, and waterfowl. They offer shelter, spawning sites, and food sources, supporting the life cycles of many species.

2. **Biodiversity Support:** Native aquatic plants contribute to biodiversity by creating complex and diverse habitats. Diverse native plant communities can limit the intrusion of aquatic invasive plant species by not allowing room for invasive species to take hold.

3. **Erosion Control and Sediment Stabilization:** Aquatic plants help stabilize sediments along shorelines and in shallow water areas, reducing erosion and sedimentation. Their root systems anchor sediments, preventing soil loss and maintaining water clarity.

4. **Nutrient Cycling:** Native aquatic plants play a crucial role in nutrient cycling within freshwater ecosystems. They absorb nutrients such as nitrogen and phosphorus from the water column and sediments, helping to regulate nutrient levels and prevent eutrophication.

5. **Oxygenation:** Through photosynthesis, aquatic plants release oxygen into the water, contributing to oxygenation of aquatic habitats. Oxygen produced by aquatic plants supports aerobic respiration in aquatic organisms and helps maintain water quality.

6. **Water Filtration and Purification:** Native aquatic plants act as natural filters, removing pollutants, sediment, and excess nutrients from the water column. They help improve water clarity, reduce turbidity, and enhance overall water quality.

7. **Carbon Sequestration:** Aquatic plants capture and store carbon dioxide through photosynthesis, contributing to carbon sequestration and climate regulation.

8. **Recreational and Aesthetic Value:** Native aquatic plants enhance the recreational and aesthetic value of freshwater environments. They provide opportunities for activities such as fishing, boating, birdwatching, and photography, while also contributing to the scenic beauty.

9. **Economic Importance:** Native aquatic plants support various economic activities, including recreational fishing, tourism, and ecosystem services such as water purification and flood control. They contribute to local economies and livelihoods through their ecological functions and values.

Overall, native aquatic plant species are integral components of freshwater ecosystems, providing essential functions and values that support ecosystem health, biodiversity, and human well-being. Protecting and conserving native aquatic plants while balancing human use and access is crucial for maintaining the ecological integrity and resilience of freshwater environments.

2022 Point Intercept Survey

In 2022, the LLPA authorized a full point-intercept aquatic macrophyte survey to determine if Eurasian watermilfoil or any other new exotic plant had invaded the lake, and to compare data from the 2011 and 2016 surveys with the 2022 data to identify any significant changes in the lake's vegetation over time.

The following results extracted from the 2022 Long Lake Warm Water PI Macrophyte Survey Report (Berg, 2022) summarize the results of the 2022 survey and the comparisons to 2011 and 2016. For the extensive tables and maps, see Appendix A.

Native Plant Community

During the 2011 survey, Flat-stem pondweed, Coontail, Muskgrass, and Wild celery were the most common macrophyte species found. Present at 42.64%, 40.24%, 33.22%, and 31.34% of survey points with vegetation respectively, they accounted for 37.91% of the total relative frequency. Fries' pondweed (7.35%), Northern water-milfoil (6.25%), Slender naiad (5.15%), Common waterweed (5.06%), and Small pondweed (4.54%) also had relative frequencies over 4.00%.

The August 2016 survey identified Northern water milfoil, Coontail, Flat-stem pondweed, and Muskgrass as the most common species. These species were found at 39.24%, 38.02%, 37.50%, and 29.69% of sites with vegetation, and, collectively, they accounted for 39.83% of the total relative frequency. Wild celery (6.65%), Slender naiad (5.98%), Small pondweed (5.94%), Common waterweed (4.64%), and Fries' pondweed (4.02%) also had relative frequencies over 4.00% (Maps for all plants found in 2016 can be found in the project folder).

Lakewide, 12 species saw significant changes in distribution from 2011 to 2016. Northern water-milfoil enjoyed a highly significant increase ($p<0.001$), and Southern naiad saw a moderately significant increase ($p=0.009$). Conversely, Fries' pondweed and Stiff pondweed suffered highly significant declines ($p<0.001$); Wild celery ($p=0.002$), Needle spikerush ($p=0.004$), Northern wild rice ($p=0.004$), and Blunt-leaf pondweed ($p=0.002$) underwent moderately significant declines; and Flat-stem pondweed ($p=0.02$), Sago pondweed ($p=0.01$), Nitella ($p=0.01$), and Small bladderwort ($p=0.04$) saw significant declines.

The July 2022 survey identified Coontail (45.83% of points with vegetation), Flat-stem pondweed (44.83%), Small pondweed (33.00%), and Northern water-milfoil (27.50%) as the most common species with a combined relative frequency of 41.32%. Muskgrass (6.56%), Fries' pondweed (6.29%), Wild celery (5.28%), Slender naiad (4.24%), and Illinois pondweed (4.19%) also had relative frequencies over 4.00%.

From 2016 to 2022, eight species experienced significant changes in distribution (Figure 8). Filamentous algae, Coontail, Flat-stem pondweed, Small pondweed, and Fries' pondweed all saw highly significant increases ($p<0.001$); and Common bladderwort ($p=0.03$) and aquatic moss (p=0.03) both had significant increases. Northern water-milfoil was the only species that showed a statistically significant decline, and it was moderately significant (p=0.003).

Flat-stem pondweed was the most common species during the initial 2011 survey when it was present at 249 sites with a mean rake fullness of 1.82. During the 2016 survey, it had undergone a significant decline (p=0.02) in distribution to 216 sites and a highly significant decline (p<0.001) in density to a mean rake fullness of 1.42. Visual analysis of the maps showed these pullbacks were essentially a lakewide phenomenon; however, despite these losses, it remained the third most common species on the lake. In 2022, there was a highly significant increase (p<0.001) in distribution (269 sites), and a significant increase (p=0.01) in density (mean rake fullness of 1.54) as it climbed to the second ranked species in the community.

Coontail was the second most common species during both the 2011 and 2016 surveys. Over this time, it underwent a non-significant decline (p=0.16) in distribution from 235 sites in 2011 to 219 sites in 2016. It also saw a moderately significant decline (p=0.005) in mean rake fullness from 1.91 in 2011 to 1.44 in 2016. The 2022 survey found it at 275 sites, and it was the most common macrophyte in the community. Although this was a highly significant increase (p<0.001) in distribution, it underwent a nearly significant decline (p=0.07) in density to a mean rake fullness of 1.36.

Northern water-milfoil was just the sixth most common species in 2011 (142 sites) before jumping to become the most common species in 2016 (226 sites). This highly significant increase (p<0.001) in distribution was accompanied by a moderately significant increase (p<0.01) in density from a mean rake fullness of 1.46 in 2011 to 1.63 in 2016. This trend had reversed in 2022 as it suffered a moderately significant decline (p=0.003) in distribution (165 sites) and a significant decline (p=0.03) in density (mean rake fullness of 1.50). It also fell to the fourth ranked plant in the overall community. A species known for boom/bust population cycles, its lakewide expansion and subsequent contraction may explain some of the other significant changes in density and/or distribution we observed in species that prefer the same sandy muck habitat such as Muskgrass, Slender naiad, Fries pondweed, Stiff pondweed, and Wild celery.

For maps comparing plant distributions in 2011, 2016, and 2022, see Appendix A.

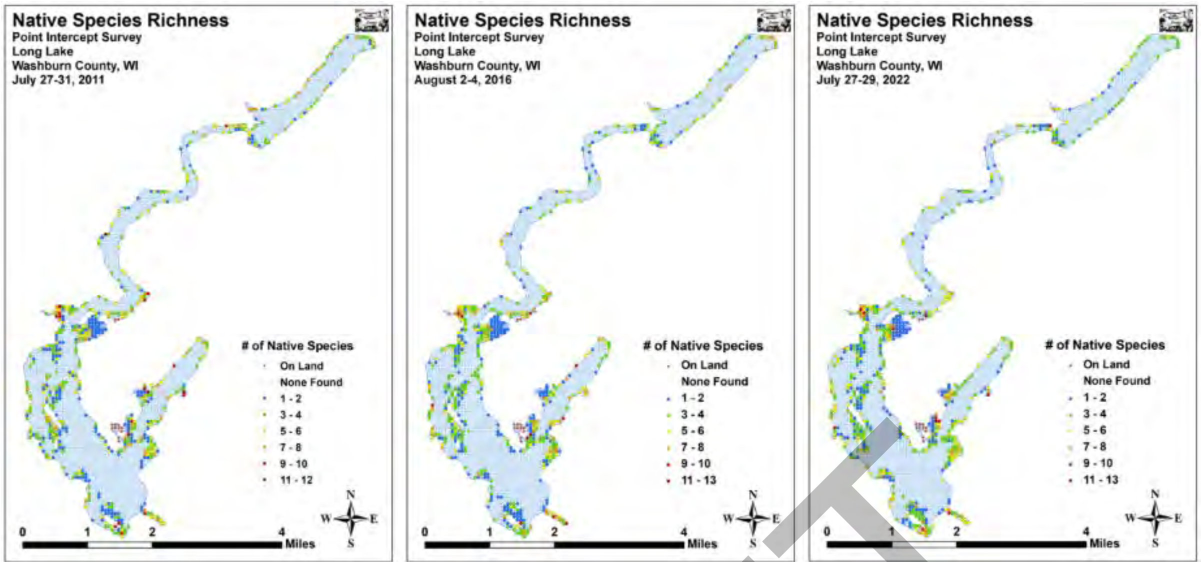


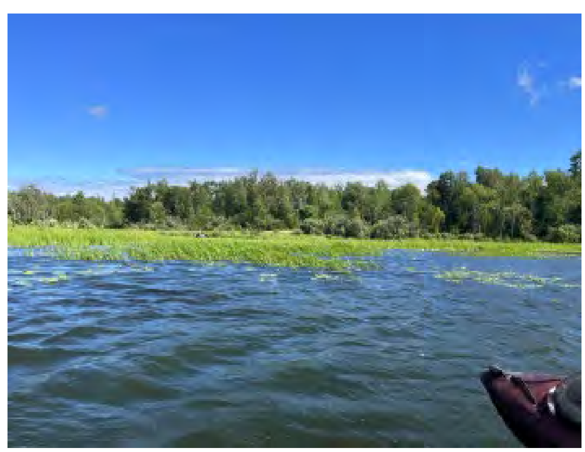
FIGURE 11. 2011, 2016, 2022 SPECIES RICHNESS (BERG, 2022)

Wild Rice

In 2011, Northern wild rice was widely scattered throughout Long Lake. Rice plants were growing in creek and seep inlets as well as in sheltered muck-bottomed bays; especially those that had stump fields. Lake wide, it was present in the rake at 20 points with six additional visual sightings. Of these, none had a rake fullness value of 3, eight were a 2, and twelve were a 1. This produced a mean rake fullness of 1.40 and suggested 0.4% of the lake had a significant amount of rice (rake fullness of 2 or 3). Most of the rice observed during the original survey was extremely patchy and not fit for human harvest.

During the 2016 survey, rice was recorded at six points with ten additional visual sightings. This moderately significant decline ($p = 0.004$) in total distribution and rake fullness 2 ($p = 0.004$) was accompanied by a moderately significant decline ($p = 0.001$) in density as all samples were a rake fullness of 1. Consequently, in 2016, there were no areas that even approached having human harvest potential.

The 2022 survey found rice at ten points with ten additional visual sightings. None had a rake fullness of 3, two were a 2, and the remaining eight were a 1 for a mean rake fullness of 1.20 (Figure 13). This increase in distribution compared to 2016 was not significant ($p = 0.26$). Similarly, none of the changes in rake fullness were significant, although mean density was nearly so ($p = 0.08$). As in the past, none of the rice beds offered significant human harvest potential. The densest areas occurred in the far northeast bay, but the rice only occurred at moderate density over a small area.



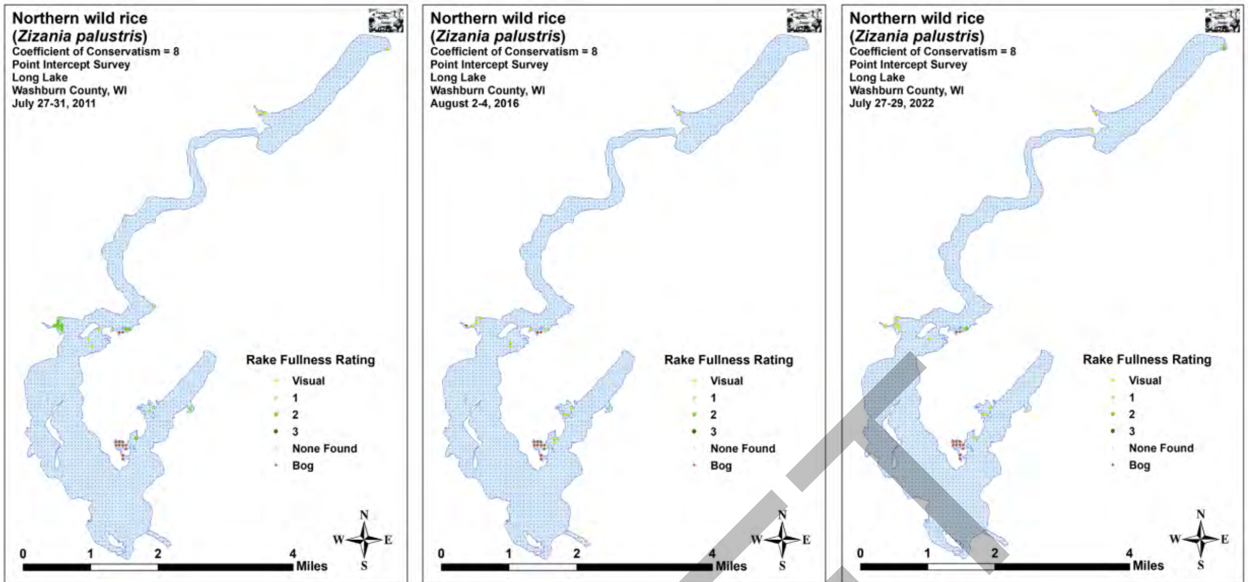


FIGURE 12. 2011, 2016, 2022 NORTHERN WILD RICE DISTRIBUTION (BERG, 2022)

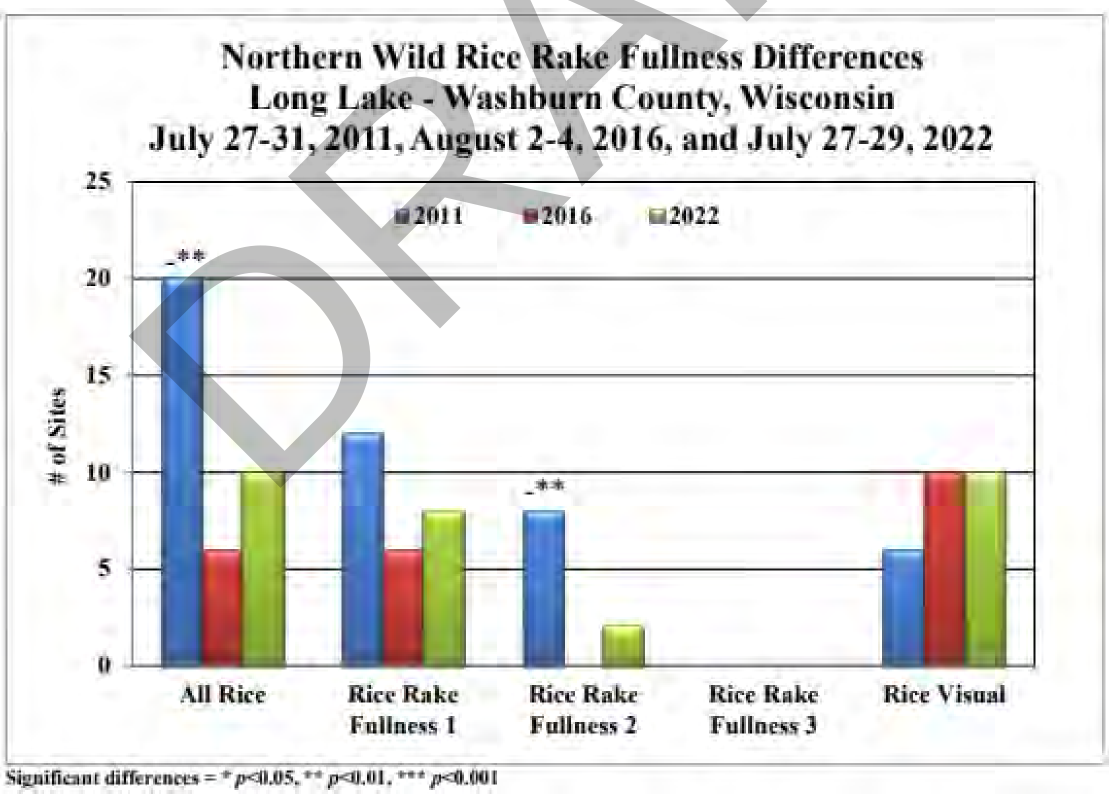


FIGURE 13. WILD RICE RAKE FULLNESS COMPARISONS (BERG, 2022)

Floristic Quality Index

The Floristic Quality Index is a tool used to assess the ecological integrity of a waterbody based on the composition of its plant community (Nichols, 1999). Some species only occur in high quality habitat, and some thrive in low quality conditions. The presence of these species can indicate the health of the lake.

In 2011, 51 native index species were identified with a mean Coefficient of Conservatism[16] of 6.3 and a Floristic Quality Index[17] of 44.9. The 2016 point-intercept survey identified a total of 49 native index plants with a mean Coefficient of Conservatism of 6.1 and a Floristic Quality Index of 42.9. The 2022 point-intercept survey found a total of 49 native index plants with a mean Coefficient of Conservatism of 6.2 and a Floristic Quality Index of 43.7. An average score for the North Central Hardwood Forests Region is 5.6, putting Long Lake well above average for this part of the state. The FQI was also more than double the median FQI of 20.9 for the North Central Hardwood Forests (Nichols, 1999).

TABLE-4. 2011, 2016, 2022 COMPARISON OF FQI (BERG, 2022)

Year	N	Mean C	FQI
2011	51	6.3	44.9
2016	49	6.1	42.9
2022	49	6.2	43.7

[16] Coefficients of Conservatism values (C values) range from 0 to 10 and rate an individual plant species based on its ability (or lack thereof) to tolerate human-caused disturbance to its habitat.
[17] The Floristic Quality Index (FQI) adds a weighted measure of species richness by multiplying the Mean C by the square root of the total number of native species. Higher Mean C and FQI numbers indicate higher floristic integrity and a lower level of disturbance impacts.

Filamentous Algae

Filamentous algae are normally associated with excessive nutrients in the water column from such things as agricultural and residential runoff, internal nutrient recycling, and failed septic systems. In 2011, these algae were located at 107 sites with a mean rake fullness of 1.54. The 2016 survey documented them at 88 points with a mean rake fullness of 1.17 – a nearly significant decline in distribution ($p=0.08$), and a highly significant decline ($p<0.001$) in density. In 2022, there was a sharp reversal in algal levels, as there were highly significant increases ($p<0.001$) in both distribution (135 sites) and density (mean rake fullness of 1.43). Visual analysis of the map showed these expansions appeared to be lake wide.

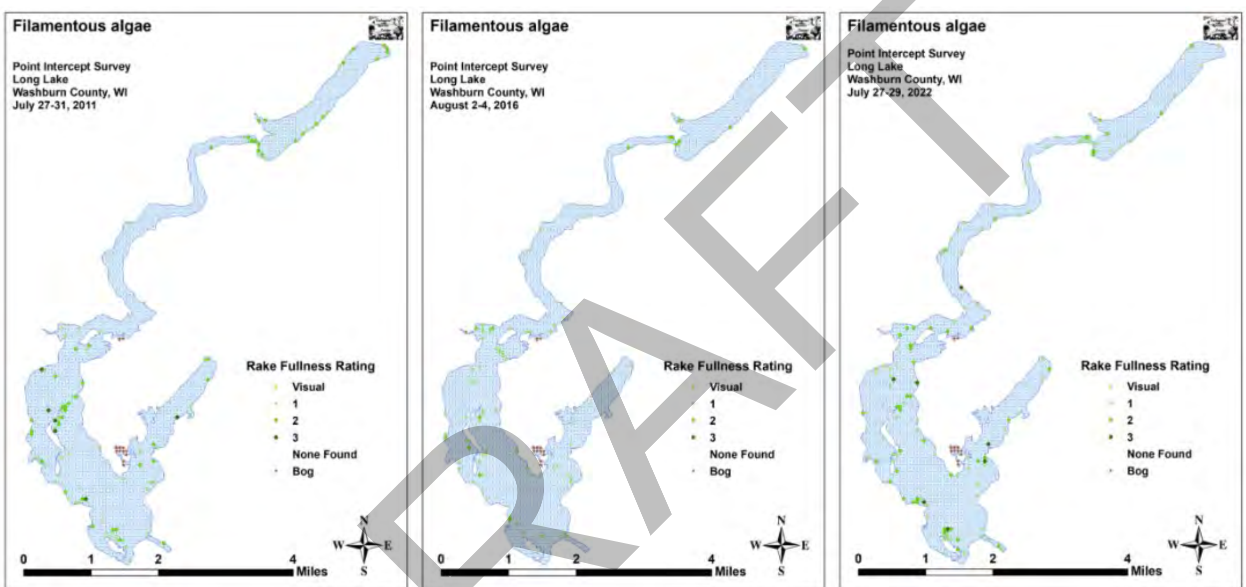


FIGURE 14. 2011, 2016, 2022 COMPARISON OF FILAMENTOUS ALGAE (BERG, 2022)

Curly-Leaf Pondweed

Curly-Leaf pondweed (CLP) is an aquatic invasive plant species. It thrives early in the growing season and can crowd out native plant species. It was first identified in Long Lake in 2005. The leaves are reddish-green, oblong, and about 3 inches long, with distinct wavy edges that are finely toothed. The stem of the plant is flat, reddish-brown and grows from 1 to 3 feet long. The density of curly-leaf pondweed early on prompted the first Long Lake Aquatic Plant Management Plan that is now expired. However, its density has drastically reduced since its initial introduction and is not a major concern at this time.

During the 2011 survey, Curly-leaf pondweed was present at four sites, all of which had a rake fullness of 1. In 2016, CLP was found at three points with one additional visual sighting (all points again had a rake fullness of 1). The July 2022 survey documented a single CLP plant in the rake at a single point. Because CLP normally completes its annual life cycle by late June and most plants have set turions and senesced by early July, this midsummer survey tells little about the current distribution and density of this potentially invasive exotic species.

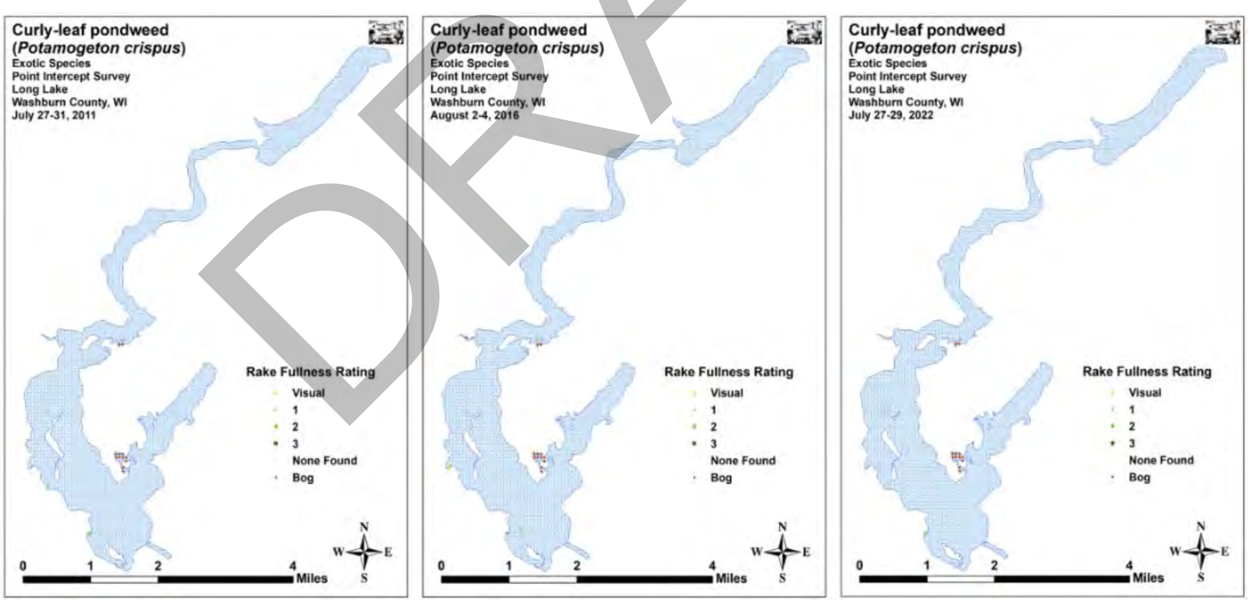
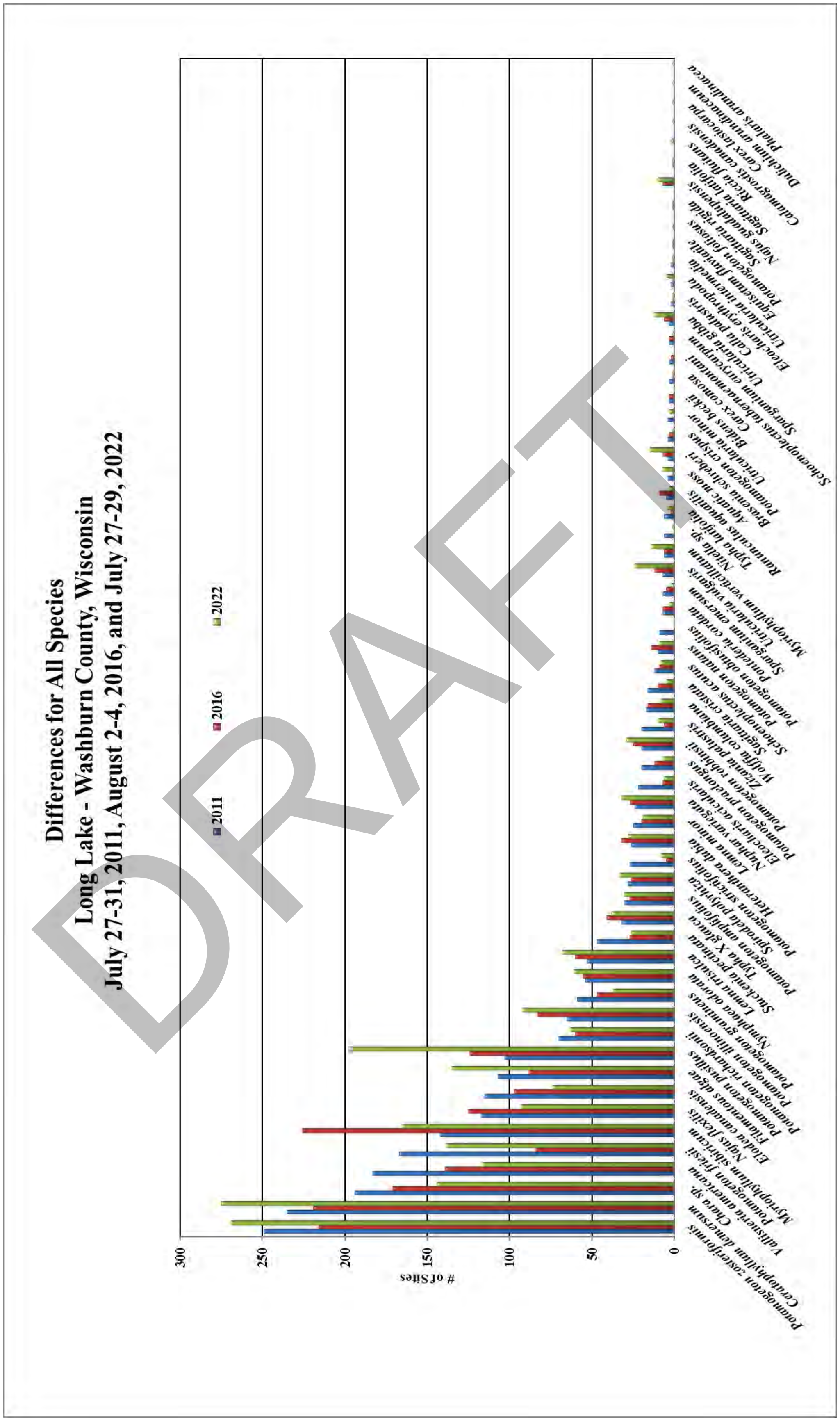


FIGURE 15. 2011, 2016, 2022 COMPARISON OF MIDSUMMER CLP (BERG, 2022)


Differences for All Species
Long Lake - Washburn County, Wisconsin
July 27-31, 2011, August 2-4, 2016, and July 27-29, 2022
2011
2016
2022
# of Sites
0
50
100
150
200
250
300

Other Aquatic Invasive Species

There was no evidence of Eurasian water-milfoil – a highly invasive species – in Long Lake during the 2022 survey. However, in addition to Curly-leaf pondweed, four other exotic species were documented growing in and around the lake: Yellow iris, Common forget-me-not, Reed canary grass, and Hybrid cattail.

Yellow iris was restricted to the northeast bay, but it appeared to be spreading rapidly as we noticed clusters of plants were peppered along much of the northern shoreline. Common forget-me-nots were less common, and there were a few around cold-water seeps. In contrast, Reed canary grass was regularly encountered in disturbed shoreline areas throughout the system.

Narrow-leaved cattail (*Typha angustifolia*) - a species native to southern but not northern Wisconsin that, along with its hybrids with Broad-leaved cattail (*Typha latifolia*) tends to be invasive - continues to expand on the lake. In 2011, Hybrid cattail (*Typha X glauca*) was found at 32 sites with a mean rake fullness of 2.84. This species formed dense stands east and south of Rice Island and in the bays on the north shoreline of the "Thumb". By 2016, these beds had expanded to cover 41 sites all of which had a rake fullness of 3. The 2022 survey found them at 38 points all of which again had a rake fullness of 3.

In 2016, several Purple loosestrife (*Lythrum salicaria*) plants were found in the Narrows. Despite rechecking these areas in 2022, there was no further evidence of this species.

Other AIS include Banded Mystery Snail and Chinese Mystery Snail, both verified in 2005[18].

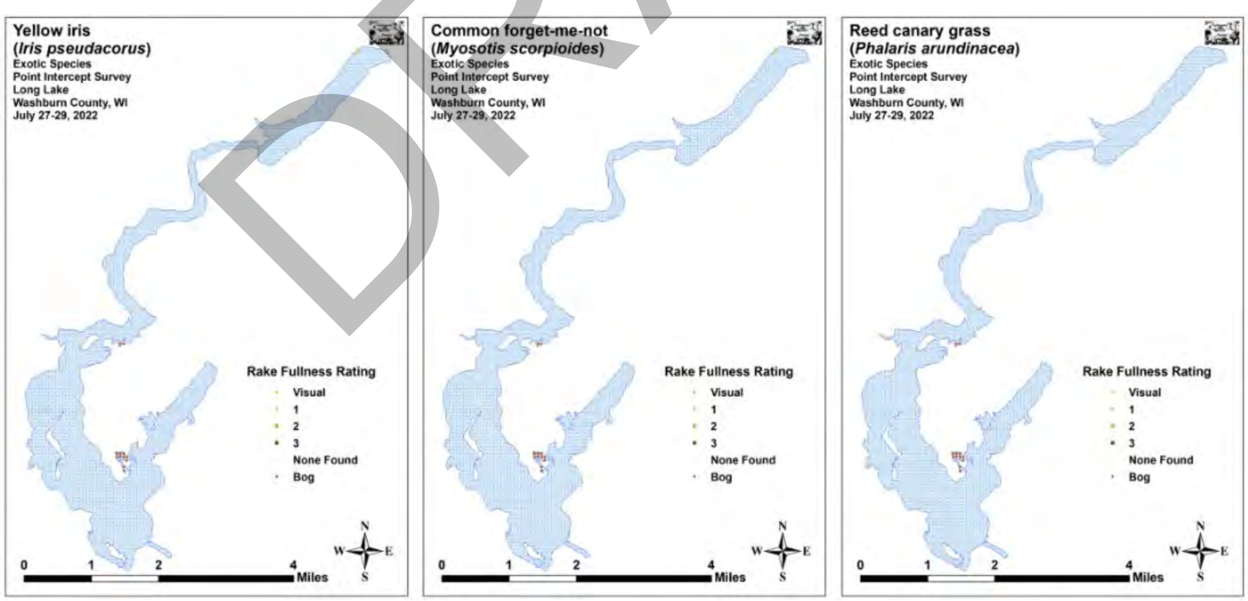


FIGURE 16. OTHER AIS 2022 DENSITY AND DISTRIBUTION (BERG, 2022)

[18] https://apps.dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2106800&page=invasive

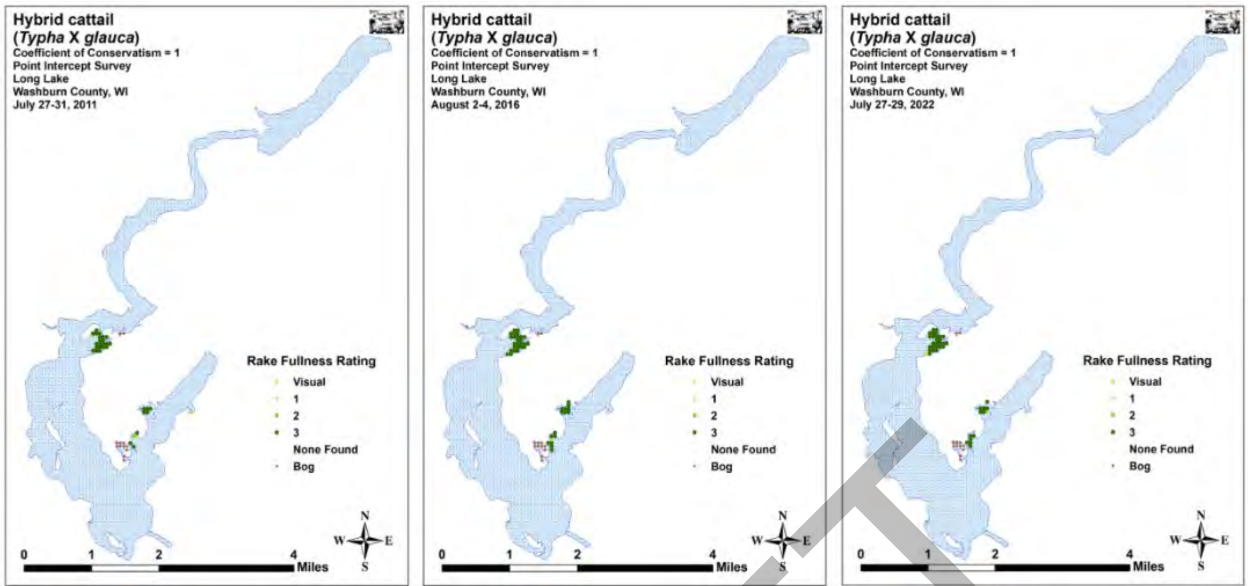


FIGURE 17. 2011, 2016, 2022 HYBRID CATTAIL COMPARISON (BERG, 2022)

AIS Management Recommendations

Curly-leaf pondweed should continue to be monitored through regular AIS monitoring protocol to observe its relationship to the native plant community. It currently appears to have assimilated with the native plant community and does not pose a significant threat to habitat or navigation.

Yellow iris appears to be spreading rapidly in the northeast bays of the lake. Because no biological control agents currently exist for this species, it is strongly recommended to residents to watch for and eliminate plants on their property before a minor problem becomes a significant one. Plants should be bagged to prevent seed dispersal and disposed of well away from the lake. June is the best time to look for this iris as the bright yellow “fleur-de-lis” are most common at this time. At other times of the year when it is not in bloom, its leaves could be confused with Northern blue flag (*Iris versicolor*) – a native and non-invasive species.

Purple loosestrife wasn’t seen anywhere during the July 2022 survey, but it is unlikely that the plant has been eliminated from the system. Because of this, residents should be on the lookout for Purple loosestrife in August and September when the bright fuchsia candle-shaped flower spikes are most easily seen. Plants should be bagged and disposed of well away from any wetland. Also, because the plants have an extensive root system, care should be taken to remove the entire plant as even small root fragments can survive and produce new plants the following year.

All of Wisconsin’s cattails have wildlife value as many bird species nest in them, and muskrats and a variety of insects use them as food. Because Narrow-leaved cattail and its hybrids can be invasive along the shoreline to the point that they interfere with lake access, property owners may want to remove pioneering individuals before they become a bed. However, unless they are interfering with human activity, removing previously established stands is probably unnecessary and unlikely to be ecologically beneficial. Because cattail seeds are transported by the wind, the continued expansion of this species in northern Wisconsin is likely inevitable.

Below are identifying characteristics of AIS in Long Lake curtesy of the WDNR Aquatic and Wetland Invasive Species Identification Guide.[19]

Curly leaf pondweed - CLP (*Potamogeton crispus*)

Photos: Frank Koshere, Paul Skawinski

Leaves: Submersed and alternate; attached directly to stem; oblong leaves (1.2-9 cm [0.5-3.5 in] long, 4-10 mm [0.16-0.4 in] wide) have distinctly wavy edges with finely serrated teeth and 3-5 veins. Sheaths (stipules) up to 0.5 cm (0.2 in) long are free of the leaf base and disintegrate with age.
Flowers: Tiny, with 4 petal-like lobes; in terminal spikes (1-3 cm; 0.4-1.2 in) on stalks up to 7 cm (2.75 in) above the water surface.
Fruits & seeds: Seed-like achene (4-6mm; 0.16-0.24 in) including 2-3 mm [0.08-0.12 in] beak, back ridged).
Roots: Fibrous, from slender rhizomes.
Similar species: There are many native pondweed (*Potamogeton*) species found in Wisconsin. They vary considerably in leaf width, shape, and overall size, although none of them have a visibly serrated leaf margin or produce a similar pine-cone like turion. Curly-leaf pondweed emerges early in the growing season and typically dies back by mid-summer, although in cold water systems (such as spring fed trout streams) it can persist year-round.

Eurasian water-milfoil - EWM (*Myriophyllum spicatum*)

Photo: Paul Skawinski

Leaves: Feather-like; leaves with 12 or more pairs of leaflets; typically arranged in whorls of 4 leaves around the stem; leaves fall limp when pulled out of water; whorls of leaves spaced 1-3 cm (0.4-1.2 in) apart on stem.
Flowers: Small, yellow or reddish, 4-parted on a spike that projects 5-10 cm (2-4 in) above the water surface.
Fruits & seeds: A hard, segmented capsule containing four seeds.
Roots: Fibrous, often developing on plant fragments.
Similar species: There are several native water-milfoils (*Myriophyllum* spp.) which may be confused with EWM, however these milfoils generally have fewer than 12 pairs of leaf segments, whereas Eurasian water-milfoil leaves have 12 or more. *M. spicatum* can cross with native *M. sibiricum*, forming a viable hybrid with intermediate characteristics. Non-native parrot feather (*M. aquaticum*) often produces more than 4 leaves in a whorl and has emergent leaves. Native coontail (*Ceratophyllum demersum*) has leaves that are forked like a wishbone (not feather-like) and toothed, giving the plant a rough feel when pulled through the hand.

Zebra Mussel - ZM (*Dreissena polymorpha*) & Quagga Mussel – QM (*Dreissena bugensis*)

Photo: Myriah Rieherson

Zebra mussels have a yellowish or brownish D-shaped shell, usually with alternating dark- and light-colored stripes. They can be up to 5 cm (2 inches) long, but most are under 2.5 cm (1 inch). The ventral (bottom side) of the shell is flat, allowing the mussel to sit flat on a surface.

Quagga mussels have black narrow stripes or blotchy lines on white to light tan shells. Unlike the zebra mussel, the quagga mussel shell has a rounded ventral side, and will not sit upright if placed on a flat surface. The quagga is no bigger than an adult's thumbnail.

[19] https://dnr.wisconsin.gov/topic/Lakes/AIS/Monitoring.html

Yellow flag iris (*Iris pseudacorus*)

Photo: Granberg

Leaves & stems: Broad, sword-shaped leaves grow upright, tall and stiff; green with a slight blue-grey tint.
Flowers: Showy and variable in color from pale to dark yellow; need flowers to know ID, but should still take pictures of plant is suspected. 7.5-10 cm (3-4 in) wide and on a stem which can be 1.0-1.2 m (3-4 ft) tall; blooms from April to June; three upright petals are less showy than the larger three downward pointing sepals, which may have brown to purple colored streaks.
Fruits & seeds: Fruits are 6-angled capsules, 5-10 cm (2-4 in) long; each fruit may have over 100 seeds that start pale before turning dark brown; each seed has a hard outer casing with a small air space underneath, which allows the seeds to float.
Roots: Thick, fleshy pink-colored rhizomes spread extensively in good conditions, forming thick mats that can float on the surface of water.
Similar species: When not flowering, yellow flag iris could be easily confused with native blue flag irises (*I. versicolor* and *I. virginica*) as well as other ornamental iris that are not invasive. Blue flag irises are usually smaller and do not tend to form dense monocultures. Yellow flag iris which is not in flower may also be confused with other emergent plants such as cattails (*Typha* spp.), sweet flag (*Acorus* spp.), or bur-reeds (*Sparganium* spp.).

Purple loosestrife – PL (*Lythrum salicaria*)

Leaves: Simple, lance-shaped and attached directly to the stem; usually opposite and rotated 90° from those below, but are sometimes whorled.
Flowers: Closely attached to the stem with 5-6 purple-pink colored petals; blooms from the bottom of the flower spike to the top from late June to September; plants can bloom the first year after seeds germinate.
Fruits & seeds: Capsules burst open when mature in late July-September.
Roots: Large woody taproot and many side roots; plants intertwine to form dense clumps.
Stems: Green, sometimes tinged purple, stiff, erect, and generally 4-sided (older stems, 5 or 6 sided).
Similar species: Garden loosestrife (*Lysimachia vulgaris*) is a non-native, wetland garden escapee with yellow flowers. Smaller, native winged loosestrife (*L. alatum*) is found in moist prairies and wet meadows, has winged, square stems, solitary flowers in separated leaf axils, paired lower leaves and alternate upper leaves. Swamp loosestrife (*Decodon verticillatus*) arches out from shorelines, has mostly whorled leaves, and flowers in well-separated leaf axils.

Chinese mystery snails - CMS (*Cipangopaludina chinensis malleata*)

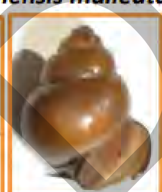
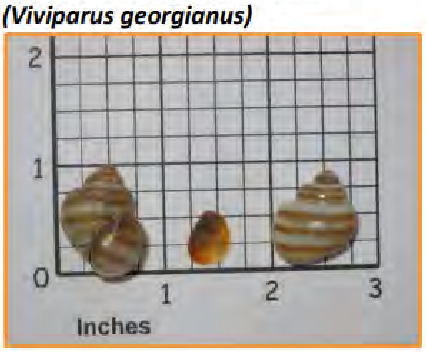



Photo: Paul Skawinski, ???

Adult snails are often greater than 1.5 inches in length.
They have a width to height ratio of 0.74–0.82, the shell has 6–7 whorls.
Operculum (trap door) present
Shell is typically light to dark olive green
Uniform coloring on the shell (no banding)

Chinese mystery snail is often wider than the native brown mystery snail.

Banded mystery snails - BMS (*Viviparus georgianus*)



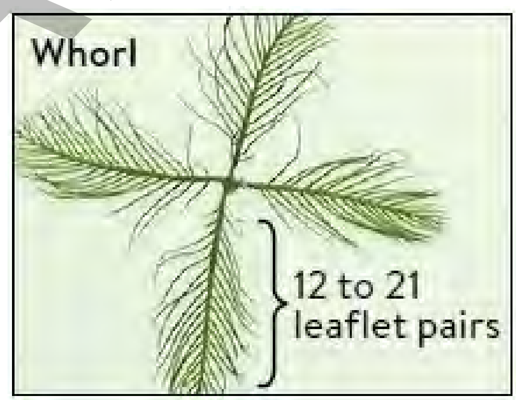
Often smaller than Chinese mystery snails
Adult snails can get up to 1.5 inches in length
Operculum (trap door) present
Shells have distinct reddish-brown bands circling the shell. This feature is obvious in empty shells, but more subtle on living snails.

Threat of Eurasian Watermilfoil

Eurasian watermilfoil (Myriophyllum spicatum) is an aquatic plant species native to Europe, Asia, and northern Africa. Eurasian watermilfoil (EWM) has become widely distributed outside of its native range due to human activities, including accidental introductions via boats and watercraft. Although it is present in almost every county in Wisconsin, it has only been verified in less than 10 percent of waterbodies statewide. While Eurasian watermilfoil can grow to nuisance levels in some waterbodies, recent studies have found that most Wisconsin lakes currently have populations at low frequencies, with relatively few lakes exhibiting very dense growth.[20]

Description

1. **Appearance:** Eurasian watermilfoil typically has long, slender stems that can grow up to several meters in length. The stems are densely covered with feathery, whorled leaves arranged in groups of 12 to 21 along the stem. The leaves are finely divided into thread-like segments, giving the plant a delicate appearance.



2. **Reproduction:** Eurasian watermilfoil reproduces through both sexual and vegetative means. It produces small, inconspicuous flowers that emerge above the water surface in summer. These flowers are typically arranged in whorls along the stems. Eurasian watermilfoil also spreads vegetatively through fragmentation, where broken stem fragments can take root and form new plants.

3. **Habitat:** Eurasian watermilfoil is commonly found in shallow, nutrient-rich freshwater habitats such as lakes, ponds, reservoirs, rivers, and streams. It can tolerate a wide range of environmental conditions but thrives in areas with moderate water depths and ample sunlight.

4. **Invasive Characteristics:** Eurasian watermilfoil is considered an invasive species in many parts of the world, including North America. It can form dense mats of vegetation that crowd out native aquatic plants, reduce biodiversity, and alter ecosystem structure and function. Its ability to spread rapidly through fragmentation and establish dense populations makes it difficult to control once established.

[20] https://dnr.wisconsin.gov/topic/Invasives/fact/EurasianWatermilfoil

Ecological Impacts

When Eurasian watermilfoil is introduced to a lake, it can have several negative impacts on the aquatic ecosystem and surrounding environment.

1. **Ecological Disruption:** Eurasian watermilfoil can outcompete native aquatic plant species, forming dense mats that shade out native vegetation. This can lead to a loss of biodiversity and alter the structure and function of aquatic habitats.

2. **Habitat Alteration:** Dense Eurasian watermilfoil mats can alter habitat structure and reduce available space for other aquatic organisms, including fish, invertebrates, and amphibians. This can disrupt food webs and decrease habitat diversity, impacting overall ecosystem health.

3. **Water Quality Degradation:** Eurasian watermilfoil can contribute to water quality degradation by trapping sediments and organic matter in its dense mats. This can increase turbidity, reduce water clarity, and degrade water quality parameters such as dissolved oxygen levels and nutrient concentrations.

4. **Recreational Impacts:** Dense mats of Eurasian watermilfoil can impede recreational activities such as swimming, boating, and fishing. Mats of tangled vegetation can entangle boat propellers, obstruct navigation channels, and make shoreline access difficult, negatively impacting user experience and local economies dependent on tourism and recreation.

5. **Economic Costs:** Eurasian watermilfoil infestations can impose significant economic costs on communities and lake groups. Costs may include expenses related to control and management efforts, property devaluation, and lost revenue from decreased recreational use of affected water bodies.

6. **Spread to New Areas:** Eurasian watermilfoil can spread rapidly within and between water bodies through fragmentation and dispersal of plant fragments by water currents, boats, and wildlife. Once established in a lake, it can be challenging and costly to control and prevent its spread to new areas.

7. **Habitat Degradation for Wildlife:** Dense Eurasian watermilfoil mats can create unsuitable habitat conditions for some wildlife species, particularly those that rely on open water or native vegetation for feeding, breeding, or shelter. This can lead to declines in populations of certain species and disrupt ecological interactions within the aquatic community.

The introduction of Eurasian watermilfoil to a lake can have significant negative impacts on ecosystem structure and function, water quality, recreational opportunities, and economic well-being by decreasing shoreline property values. Early detection, rapid response, and integrated management approaches are essential for effectively controlling Eurasian watermilfoil infestations and mitigating their impacts on freshwater ecosystems.

Waterbodies with Eurasian Watermilfoil

Long Lake is one of few large waterbodies remaining without Eurasian Watermilfoil (EWM). Preventing its introduction is an important aspect of management in Long Lake (see the Long Lake Comprehensive Lake Management Plan[21]). Several nearby waterbodies have verified occurrences of EWM or Hybrid Watermilfoil (HWM)[22]. There may be additional waterbodies nearby with EWM or HWM that have not yet been verified by the WDNR.

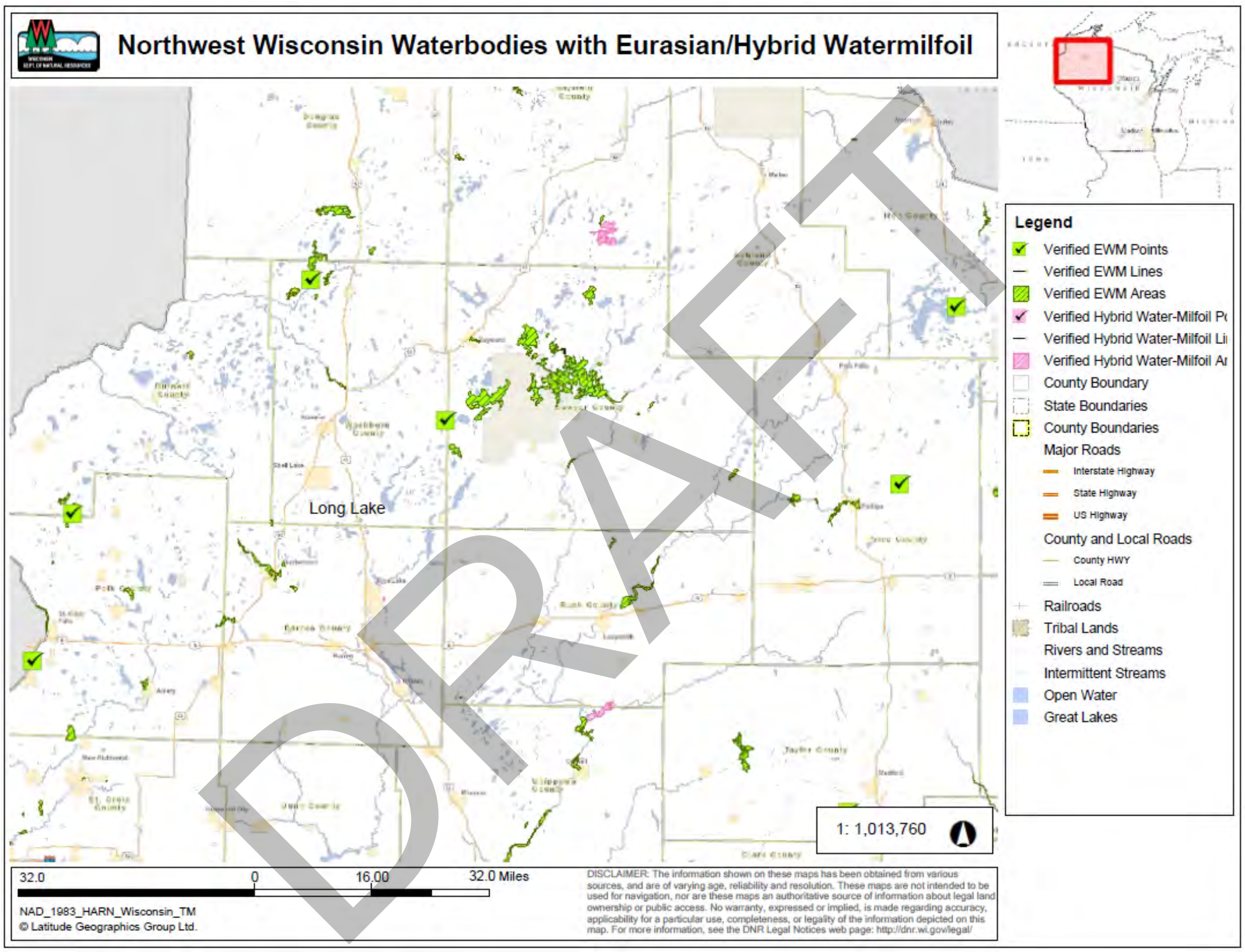


FIGURE 18. MAP OF NORTHWEST WISCONSIN VERIFIED OCCURRENCES OF EWM AND HWM

[21] https://longlakellpa.org/resources/

[22] https://dnrmaps.wi.gov/H5/?viewer=Lakes_AIS_Viewer

Aquatic Plant Management History

Curly-Leaf Pondweed

Curly-leaf pondweed (CLP) is widely scattered throughout much of the littoral zone of Long Lake. Despite being an exotic species, CLP is generally not invasive in Long Lake, and has largely assimilated into the native plant community. To date, there have only been three herbicide treatments to manage CLP that have treated an average of 3.4 acres each year.

TABLE-5. PAST CLP MANAGEMENT IN LONG LAKE

Year	Acres	Herbicide
2013	3.3	Aquathol Super K
2014	4.4	Aquathol Super K Granular Herbicide
2015	2.4	Aquathol K Aquatic Herbicide

Yellow Flag Iris

Yellow flag iris is widely distributed along the shoreline of Long Lake. Volunteers currently work to document, map, and clip the seed pods of this invasive species, but a regular monitoring schedule and procedure would be beneficial.

Zebra Mussels

The LLPA uses six zebra mussel monitoring structures to regularly check if zebra mussels have entered the waterbody. The LLPA also notifies members to check their docks and other structures for zebra mussels at the end of summer and early fall when these structures are removed. There have been no reports of zebra mussels in Long Lake; monitoring will continue.

Other AIS

Of the other aquatic invasive plant species identified in the 2022 point-intercept survey – Common forget-me-not, Reed canary grass, and Hybrid cattail – there has been no history of management. Continued monitoring of these species is recommended. Within the Long Lake watershed near the waterbody, the LLPA worked with the Washburn County Land and Water Conservation Department and a landowner to remove a large stand of Japanese knotweed in 2023. Future AIS projects and partnerships have been identified in the *2024-2034 Long Lake Comprehensive Lake Management Plan* to continue partnerships with Washburn County Land and Water Conservation Department, Hunt Hill Audubon Society, and the Tomahawk Scout Camp.

AIS Prevention

The Long Lake Preservation Association (LLPA) uses several strategies to prevent the introduction of AIS: communication with residents and membership (annual meeting presentations, spring and fall newsletters, email list of nearly 900 members, LLPA website, a decontamination station, and signs at boat landings. The group also participates in Clean Boats, Clean Waters to educate boaters on EWM and other AIS entering and leaving the lake.

Impairments to Beneficial Use

Water bodies in Wisconsin, like Long Lake, serve a multitude of beneficial uses that are essential for supporting ecosystems, providing recreational opportunities, sustaining economies, and meeting human needs. Some of the key beneficial uses of water bodies in Wisconsin include drinking water, recreation, aquatic habitat, agriculture and irrigation, hydropower generation, industrial and commercial uses, flood control, and ecosystem services. Long Lake provides:

1. **Recreation:** Long Lake offers abundant recreational opportunities, including swimming, boating, fishing, kayaking, canoeing, and paddleboarding. These activities contribute to the quality of life for residents and attract tourists, supporting local economies and businesses.

2. **Aquatic Habitat:** Long Lake serves as crucial habitats for a diverse array of aquatic plants and animals. It provides breeding grounds, spawning areas, and food sources for fish, amphibians, waterfowl, and other wildlife species, contributing to biodiversity and ecosystem health.

3. **Flood Control:** Long Lake's outlet dam can be used to manipulate water levels to mitigate downstream flooding.

4. **Ecosystem Services:** Long Lake provides valuable ecosystem services such as water filtration, nutrient cycling, and carbon sequestration.

These uses can become impaired by dense stands of aquatic invasive species and native vegetation. While native aquatic vegetation provides numerous ecological benefits, dense growth can sometimes impair certain beneficial uses of water bodies.

On Long Lake, dense native aquatic vegetation has been shown to:

1. **Impair Navigation:** Dense growth of native vegetation, such as submerged aquatic plants or emergent vegetation, can obstruct navigation channels, making it difficult for boats, kayaks, and other watercraft to navigate and access the lake from various bays and other areas (Figure 12).

2. **Fishing Interference:** Dense aquatic vegetation can hinder fishing activities by tangling fishing lines and limiting access to preferred fishing spots. Anglers find it challenging to cast their lines or retrieve hooked fish, reducing the quality of fishing experiences and impacting recreational fishing opportunities.

3. **Swimming:** Thick mats of aquatic vegetation near shorelines can pose safety hazards for swimmers or simply make the experience unpleasant.

4. **Water-Based Recreation:** Dense native vegetation can limit opportunities for water-based recreational activities such as water skiing, tubing, and jet skiing. Thick mats of vegetation

interfere with watercraft propulsion systems, reduce speed and maneuverability, and diminish the overall enjoyment of recreational boating.

5. **Visual Aesthetics:** Excessive growth of native vegetation can detract from the visual aesthetics of the lake, particularly in recreational areas and waterfront properties. Dense mats of vegetation may be perceived as unsightly or unkempt, diminishing the scenic beauty of natural landscapes and recreational destinations.

6. **Water Quality Impacts:** While native aquatic vegetation plays a crucial role in improving water quality by absorbing nutrients and stabilizing sediments, excessive growth can lead to unintended consequences. Decomposing plant material can contribute to nutrient recycling and oxygen depletion, potentially leading to water quality degradation and algal blooms.

7. **Habitat Fragmentation:** Dense vegetation can fragment aquatic habitats, reducing connectivity between different habitat types and limiting movement of aquatic organisms. This can disrupt ecological processes such as migration, dispersal, and foraging, affecting the health and resilience of aquatic ecosystems.

Overall, while native aquatic vegetation provides valuable ecosystem services, excessive growth in Long Lake can sometimes impair beneficial uses, highlighting the importance of balanced adaptive integrated management strategies to promote both ecological integrity and human enjoyment of aquatic environments.

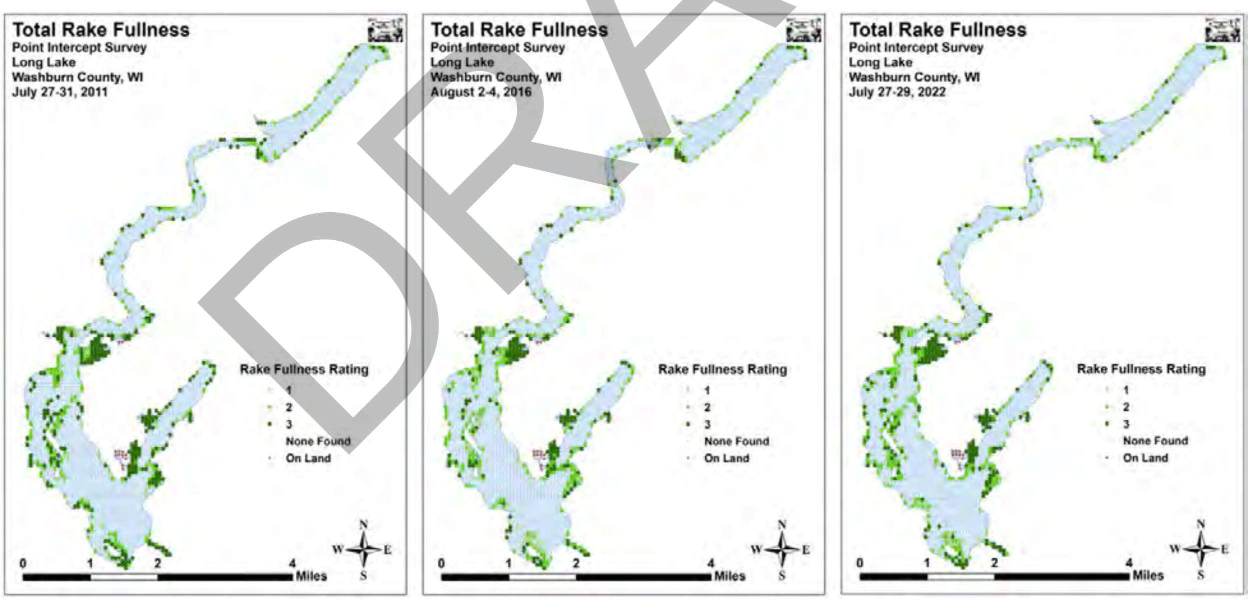


FIGURE 19. TOTAL RAKE FULLNESS (DENSITY) OF AQUATIC VEGETATION IN LONG LAKE (BERG, 2022)

Aquatic Plant Management Tools

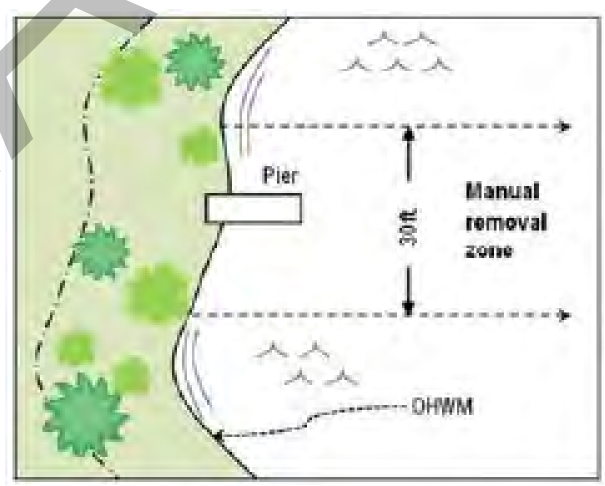
No Active Management

An often overlooked management strategy is to employ no management tool at all. As part of an adaptive management approach, sometimes it is best to simply observe the system for a given amount of time before trying to artificially manipulate the lake using a management tool that may cause more harm than good. Lakes are complex and influenced by many variables, so allowing enough time to understand the issue and potential conflicts before acting is critical. Likewise, allowing enough time after the implementation of a management tool to study its effects is an important part of adaptive management and should be incorporated into future plans.

No manipulation of the aquatic plant community is sometimes the most cost-effective and most successful aquatic plant management alternative, even for non-native invasive species like curly-leaf pondweed. Avoiding active management of aquatic plants in Long Lake is recommended in areas where: excess aquatic plant growth does not impact lake uses, the benefit of management is far outweighed by the cost of management, water quality or other lake characteristics limit nuisance growth conditions, and where highly valued native plants or habitat would be negatively impacted (e.g. sensitive areas and areas with wild rice).

Physical Removal

Aquatic plants can be manually removed through a variety of techniques. Plants can be manually removed by hand or rake, by scuba divers or snorkels, or through diver assisted suction harvesting (DASH). Shoreline property owners can remove vegetation by hand up to a maximum width of 30 feet (see NR 109, Wis. Adm. Code for more information[23]). Larger areas can be managed by snorkelers or DASH (extraction of plants using a diver, suction tube, a unique set of pumps mounted on a boat and a bagging or filtration system). However, WDNR permits will be required, and these methods are typically used on invasive species.



Manually removing vegetation around docks, boat lifts, and swim rafts may be a management tool that individual landowners wish to explore. Individuals should contact the local aquatic plant management coordinator before engaging in any aquatic plant management activities.[24]

[23] https://docs.legis.wisconsin.gov/code/admin_code/nr/100/109
[24] https://dnr.wisconsin.gov/topic/lakes/plants

Mechanical Harvesting

Aquatic plant harvesting can be an effective tool to manage dense, nuisance aquatic vegetation or aquatic invasive species like Curly-leaf pondweed (present in low levels in Long Lake). Harvesting aquatic plants can be done using large, floating machines that cut the vegetation. Harvesting is a temporary solution; however, it can be a useful tool to improve navigation.

Mechanical harvesting could be a management tool that could be used in Long Lake. This could be a useful tool in some of the densely vegetated bays and other areas in Long Lake where lake access or navigation is severely impacted by the vegetation. It may also be considered in the future if the Curly-leaf pondweed in the lake begins to form dense, expansive beds.

Biologic Controls

Biologic control refers to the use of animals, fungi, or diseases to control populations of invasive species. Control organisms typically come from the same place as the invasive species where they are a natural predator and less likely to target native species. Biologic control does not usually result in the total eradication of an invasive species, but it can be effective. For example, the *Galerucella* beetle (shown on the right) can be used to control invasive Purple loosestrife (present in very low levels around Long Lake). Another aquatic invasive species where biologic control (using the *Euhrychiopsis* weevil) can be used is Eurasian watermilfoil (not present in Long Lake). Currently, there is no need to explore biological control options in Long Lake. However, these options may become useful in the future.

Chemical Control

Aquatic herbicides are chemicals specifically formulated for use in water to kill plants or reduce plant growth. A WDNR permit is required to use chemical herbicides in aquatic environments and a certified pesticide applicator is required for application on most lakes. The advantages of using chemical herbicides for control of aquatic plant growth are the speed, ease and convenience of application, and the ability to control plant species with certain herbicides. Disadvantages of using chemical herbicides include possible toxicity to aquatic animals or humans, oxygen depletion after plants die and decompose which can cause fishkills, an increase of algal blooms as nutrients are released into the water by the decaying plants, adverse effects on desirable aquatic plants, loss of fish habitat and food sources, water use restrictions, and a need to repeat treatments due to existing seed/turion banks and plant fragments. Chemical herbicide use can also create conditions favorable for non-native aquatic invasive species to outcompete native plants (for example, areas of stressed native plants or devoid of plants).

When properly applied, the possible negative impacts of chemical herbicide use can be minimized. Early spring to early summer applications is preferred because exotic species are actively growing and many native plants are dormant, thus limiting the loss of desirable plant species; plant biomass is relatively low minimizing the impacts of deoxygenation and contribution of organic matter to the sediments; fish spawning has ceased; and recreational use is generally low limiting human contact. The concentration and volume of herbicides can be reduced because colder water temperatures enhance the herbicidal effects. Selectivity of herbicides can be increased with careful selection of application rates and seasonal timing. Chemical herbicides are not currently recommended in Long Lake and not permitted for use on native aquatic vegetation.

Physical Habitat Alteration

Dredging

Dredging is usually performed to restore lakes that have been filled in with sediments, have excess nutrients, have inadequate pelagic and hypolimnetic zones, need deepening for navigation, or require removal of toxic substances. A WDNR permit is required to perform any dredging in a waterbody or wetland. Using dredging to manage aquatic plants can be largely detrimental to desired plants, as all macrophytes would be prevented from growing for many years. This high level of disturbance may also create favorable conditions for the invasion of other invasive species. Dredging is not recommended for aquatic plant management in Long Lake.

Benthic Barriers

Benthic barriers or other bottom-covering approaches are another physical management technique that has been in use for many years. The plants are covered over with a layer of material meant to shade out and smother the plants. WDNR approval is required and screens must be removed each fall and reinstalled in the spring to be effective over the long term. This management is not recommended for use in Long Lake.

Water Level Manipulation (Drawdown)

Lowering the lake level to allow for the desiccation, aeration, and freezing of lake sediments has been shown to be an effective aquatic plant management technique. For control of certain aquatic plants, such as Eurasian watermilfoil, repeated winter drawdown lasting 4 to 6 months that include a freezing period are the most effective. Control of aquatic plants in these cases can last several years. Lowered lake levels may negatively affect native plants, provide an opportunity for invasive species, reduce the recreational value of a waterbody, and can impact the fishery if spawning areas are affected. This management strategy is not recommended for use in Long Lake due to the known negative impacts of winter drawdowns.

Long Lake Native Plant Management

Management Decision Making

Management of native aquatic plants should only be implemented when plant density reaches nuisance levels or impedes riparian property owners' access to open water. Physical removal will be implemented by individual property owners following guidelines in NR109, and mechanical harvesting to maintain navigation and open water access channels may be executed by the LLPA under appropriate conditions as approved by the WDNR. Navigation and open water access channels will be identified and approved by the WDNR through a mechanical harvesting permit completed annually by the LLPA. The LLPA will actively strive to follow and incorporate the aquatic plant management strategies for the Northern Region in their management decision making processes (WDNR, 2007; Appendix B).

Physical Removal

Physical, or manual removal, is the most appropriate management tool for controlling aquatic plant growth around docks and in areas where the water depth is shallower than 3 feet. Physical removal of aquatic plants is allowed without a permit within an area up to 30 feet wide near a dock or along a shoreline used for recreational activities, provided the parts of the plant cut or pulled are removed completely from the water and disposed of properly. Native plant removal will be limited only to the amount needed to access open water areas or provide navigation and access lanes. Education will be provided to riparian property owners on how to remove and dispose of vegetation.

Mechanical Harvesting

Long Lake's primary aquatic vegetation issue is that areas of dense plants impede navigation and lake access. As such, the primary recommended management tool is mechanical harvesting. Herbicides are not permitted for use on native vegetation and are not a recommended management tool for Long Lake. Shoreline property owners are encouraged to remove vegetation by hand up to a maximum width of 30 feet pending conversations with the local WDNR biologist (see NR 109, Wis. Adm. Code for more information[25]), but in some areas, this is not sufficient to create lake access for riparian owners or the general public.

In areas where relief from nuisance aquatic plant growth for navigation purposes is needed, a harvesting plan will be created annually and will be included in the aquatic plant harvesting permit application required by the WDNR. Harvesting plans will be designed to enhance both the ecological balance and recreational uses of the lake.

Navigation channels will be limited to 45 feet wide and must be at a depth between 5 to 10 feet. Once harvested, these areas should be kept open through regular use of watercraft. If the navigation channels or access lanes fill in again, they can be re-cut under the same harvesting permit that allowed their initial cutting. Riparian landowners can access these lanes by hand pulling their 30 feet areas and maintaining open channels through regular boar use.

[25] https://docs.legis.wisconsin.gov/code/admin_code/nr/100/109

It is recommended that GPS units capable of tracking the movements of the harvester be installed on or, at a minimum, carried with the operator whenever harvesting is occurring. A tracking log should be downloaded from the GPS unit and stored digitally in a shareable format. Daily log sheets that include the following harvesting information: estimated total daily tonnage, number of loads, surface acres covered, plant ID list, and plant bed density information will be kept for all harvesting actions. At off-loading sites, the operator will attempt to return fish, turtles, and other wildlife back to the water.

Clear-cutting of aquatic vegetation adjacent to riparian shoreline for the purpose of creating 'weed free' areas for swimming or other recreational purposes is not an acceptable use of the mechanical harvester and is **not** a recommended action in this plan. Landowners, however, are not prohibited from physically removing aquatic vegetation in these areas and will be encouraged to do so provided guidelines presented in NR 109 are followed.

The harvesting plan will be assessed annually to determine if changes should be made. Areas designated for harvesting each year can be repeatedly harvested as needed within that same year to maintain their function without additional WDNR permitting or fees. Larger changes in the harvesting plan may be necessary due to variability in water levels, changes in lake use patterns, or with the introduction of a new aquatic invasive species.

Mechanical harvesting is recommended for management of dense native vegetation in areas that meet the following requirements:

1. Water depth is 5-10 feet.
2. Density (rake fullness from 2022 point intercept survey) is at least a 2.
3. Areas are not in a designated Sensitive Area.
4. There is a demand for access.
5. There is no documented presence of northern wild rice (*Zizania palustris*)

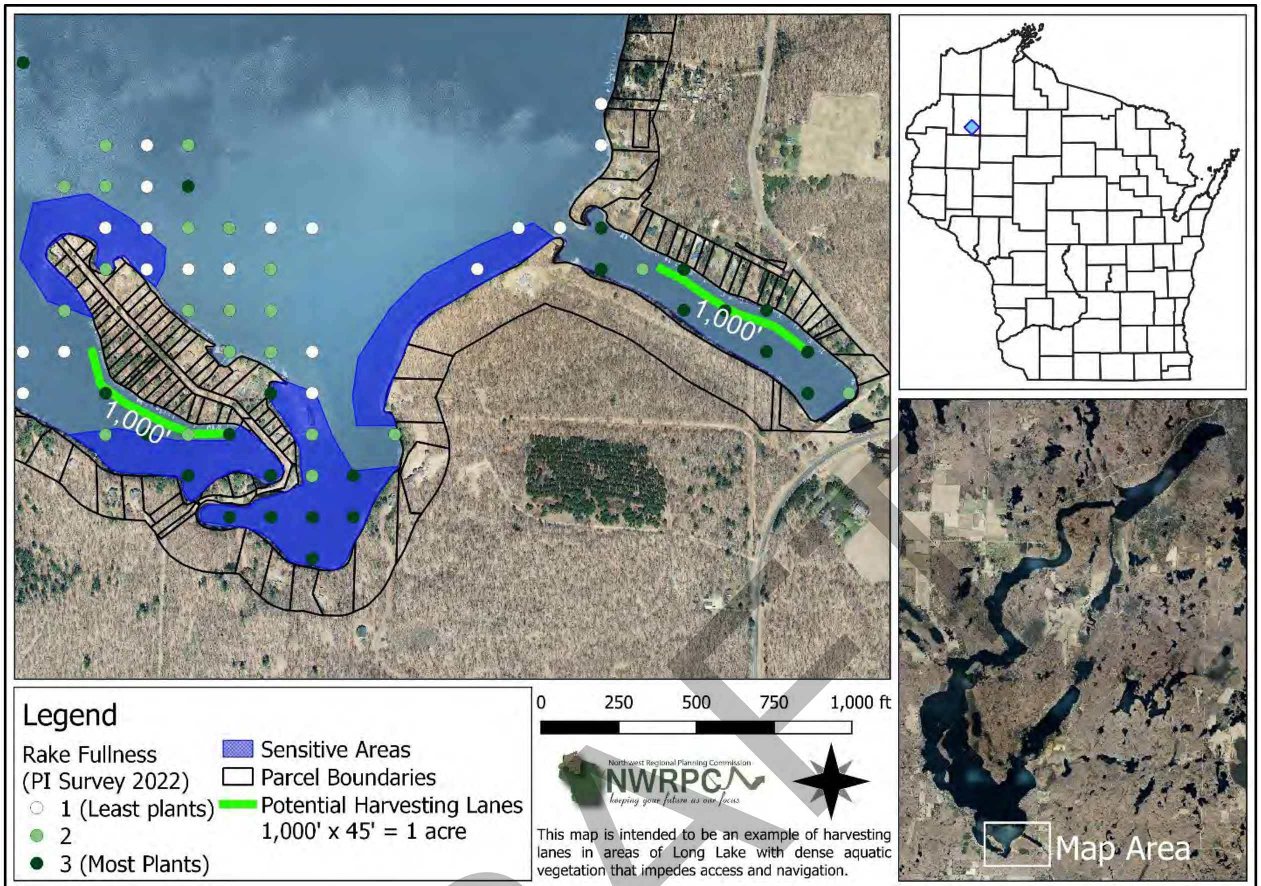


FIGURE 20. EXAMPLE OF HARVESTING LANES IN AREAS OF DENSE AQUATIC VEGETATION

Goals, Objectives, and Actions

The purpose of this plan is to guide the effective management and protection of aquatic plants in Long Lake through adaptive management. This plan is intended to be a living document which can be modified to ensure goals and community expectations are being met. Minor changes and adaptations are expected and may be made annually, but any major change in activities or management philosophy will be presented to the WDNR for approval.

Long Lake aquatic plant management activities are guided by the best available science and adaptive management strategies. Adaptive management is a systematic approach for improving resource management by learning from management outcomes. Adaptive management uses results of monitoring, evaluation of project activities, and updated information to modify and guide future project implementation.

The Long Lake Preservation Association mission statement is to preserve and protect Long Lake, its watershed, and its ecosystems. As such, this plan attempts to balance the need aquatic plant management while maintaining the integrity of Long Lake's ecosystem. For additional information regarding goals and objectives for areas of management, please see the *2024-2034 Long Lake Comprehensive Lake Management Plan.*[26]

PLANNING TERMS

Goals are broad statements of desired results.

Objectives are the measurable accomplishments toward achieving a goal.

Actions are the steps taken to accomplish objectives and ultimately goals.

The goals of this Long Lake Aquatic Plant Management Plan are to:

1. **Protect, preserve, and enhance the native aquatic plant community while simultaneously maintaining lake access and recreation opportunities for the general public and riparian landowners.**

2. **Monitor and manage curly-leaf pondweed, yellow flag iris, Japanese knotweed, and other AIS in and around the lake and its watershed; and prevent the introduction of additional AIS.**

3. **Educate and inform the lake community about the importance of aquatic plants in the lake ecosystem, management alternatives, and appropriate management actions.**

4. **Develop a Rapid Response Plan to ensure that the appropriate measures are in place if a new AIS is detected in the lake.**

[26] https://longlakellpa.org/resources/

Goal 1: Protect, preserve, and enhance the native aquatic plant community while simultaneously maintaining lake access and recreation opportunities for the general public and riparian landowners.	**Responsible Group(s)**	**Target Timeline(s)**
Objective 1: Provide open water access and navigation relief to areas impacted by dense growth of aquatic vegetation. Evaluate and measure this objective with updated point-intercept surveys; there will be no statistically significant decline in frequency of occurrence[27] for plant species at the population level of Long Lake.		
Action 1 – Identify mechanical harvesting plan. a. Cost (average cost \$600 - \$750 per acre; \$1,200 - \$1,500 per day for contracted services) b. Buy harvester, rent harvest, contract with harvester? c. Disposal plan (where to dispose of collected plant materials). d. Permitting process.	NWRPC; LLPA BOD	2024; Ongoing
Action 2 – Identify priority navigation lanes that may be candidates for mechanical harvesting (see Figure 14 for an example). a. Assess 2022 point intercept survey and social survey data to identify areas with dense aquatic vegetation where people may desire some level of management. b. Avoid designated Sensitive Areas c. Work to avoid impacts to native plant community and wildlife when developing and adapting mechanical harvesting plans. d. Educate adjacent riparian landowners that boat use helps maintain harvested navigation lanes.	NWRPC; LLPA BOD	2024; Ongoing
Objective 2: Control measures will have no significant impact to native aquatic plant species at the population level of Long Lake. Evaluate and measure this objective with updated point-intercept surveys; there will be no statistically significant decline in frequency of occurrence for plant species at the population level.		
Action 1 – Conduct whole lake aquatic plant point intercept surveys every 3-5 years. a. Include Mud Lake in next point intercept survey and APMP update. b. Compare areas where mechanical harvesting has been implemented to past years. c. Strategically plan to harvest as few times as possible to protect the plant community.	LLPA MC; ERS	Every 5-7 years (2027-29 next survey)

[27] Frequency of occurrence is the percentage of points in a point-intercept survey where a plant species is present.

Goal 2: Monitor and manage curly-leaf pondweed, yellow flag iris, Japanese knotweed, and other AIS in and around the lake and its watershed; and prevent the introduction of additional AIS.	**Responsible Group(s)**	**Target Timeline(s)**
Objective 1: No new AIS will be introduced to Long Lake. Evaluate and measure this objective with updated point-intercept surveys and scheduled AIS monitoring activities.		
Action 1 – Develop (and continue) an AIS monitoring schedule based on WDNR AIS Early Detection Monitoring Protocol that includes GPS mapping. a. Curly-leaf pondweed b. Yellow flag iris c. Japanese knotweed d. Other AIS species (zebra mussels)	NWRPC; LLPA BOD; LLPA MC	2024; Ongoing
Action 2 – Continue Clean Boats, Clean Waters program at boat landings.	LLPA BOD; LLPA MC	2024; Ongoing
Action 3 – Continue to maintain Decontamination Stations and signage at boat landings.	LLPA BOD; LLPA MC	2024; Ongoing

Goal 3: Educate and inform the lake community about the importance of aquatic plants in the lake ecosystem, management alternatives, and appropriate management actions.	**Responsible Group(s)**	**Target Timeline(s)**
Objective 1: Lake users are educated about the value of native aquatic vegetation and the potential risks of AIS introductions. Evaluate and measure this objective by documenting participation in education programs and an updated version of the 2023 social survey related to lake stewardship awareness.		
Action 1 – Share AIS educational materials with Long Lake users and LLPA membership through the LLPA website, Facebook, newsletters, annual meeting, email lists, and partnerships with WCLWCD, Hunt Hill, and the Tomahawk Scout Camp.	NWRPC; LLPA BOD; LLPA ECC	2024; Ongoing
Action 2 – Develop educational materials for shoreline business owners (restaurants and resorts) to share with lake users to prevent AIS introductions.	NWRPC; LLPA BOD; LLPA ECC	2024; Ongoing

Objective 2: Lake users are educated about AIS and native vegetation management strategies and alternatives. Evaluate and measure this objective by documenting participation in education programs and an updated version of the 2023 social survey related to lake stewardship awareness.		
Action 1 – Share a summary of the APMP through the website, annual meeting, newsletter, social media, and emailing lists. a. Share information regarding management alternatives to mechanical harvesting (no management and manual removal).	NWRPC; LLPA BOD; LLPA ECC	2024; Ongoing
Action 2 – Share information related to aquatic plants, AIS, and management strategies through the annual meeting, newsletter, social media, website, and emailing lists.	NWRPC; LLPA BOD; LLPA ECC	2024; Ongoing

Goal 4: Develop a Rapid Response Plan to ensure that the appropriate measures are in place if a new AIS is detected in the lake. See plan below.

Glossary of Terms:
BOD – Board of Directors (LLPA)
ECC – Education and Communication Committee (LLPA)
ERS – Endangered Resource Services, LLC
LLCC – Long Lake Chamber of Commerce
LLPA – Long Lake Preservation Association
MC – Monitoring Committee (LLPA)
NWRPC – Northwest Regional Planning Commission
Ongoing – no specific timeline; continued efforts for the foreseeable future
SCBC – Sustainability and Capacity Building Committee (LLPA)
SWRC – Shoreline and Watershed Restoration Committee (LLPA)
WCLWCD – Washburn County Land and Water Conservation Department
WDNR – Wisconsin Department of Natural Resources

Long Lake Rapid Response Plan

Aquatic Invasive Species (AIS) are non-native plant and animal species that can out-compete and displace native aquatic species. This damages lake habitat for fish and wildlife and can create nuisance conditions of dense stands of vegetation that impede navigation. Currently, Eurasian watermilfoil (EWM) – one of the primary AIS of concern for Long Lake – is not present in the lake, but many nearby waterbodies do have (EWM). Other AIS like zebra mussels and spiny water flea are of concern as well.

Long Lake Rapid Response Plan	Responsible Group(s)
1. Develop and maintain a contingency fund for rapid response to EWM or other AIS. a. Set a goal amount.	LLPA BOD; LLPA SCBC (fundraising)
2. Develop (and continue) an AIS monitoring schedule based on WDNR AIS Early Detection Monitoring Protocol that includes GPS mapping, focusing on public landings, resorts, and other likely areas of AIS introduction. a. If a suspected AIS is found, contact WDNR AIS Specialist, WCLWCD, and NWRPC (see contact information section).	LLPA MC; NWRPC
3. Direct lake residents and users to contact the LLPA at info@longlakellpa.org if they suspect that a plant or animal is an AIS. a. Provide signage and information at boat landings, website, annual meetings, newsletters, and emails that include photos and descriptions of AIS.	LLPA MC; LLPA ECC; NWRPC
4. If the LLPA is contacted with a suspected AIS, they will: a. Collect a sample b. Take a photo of the sample c. Record GPS coordinates (alternatively, mark with a temporary buoy) d. Fill out a WDNR AIS Incident Report form https://dnr.wisconsin.gov/topic/Invasives/report.html e. Contact NWRPC, WDNR AIS specialist, and WCLWCD	LLPA MC; LLPA ECC; NWRPC

5. If identification is positive, the LLPA will: i. Inform the person who reported the AIS, inform the entire BOD, NWRPC, and WCLWCD ii. Mark the location of the AIS (including GPS) iii. Post a WDNR notice at all public landings, notify lake users and LLPA members through email, website, and newsletter. iv. Include information about location, appearance, reporting additional sightings elsewhere, and how to prevent further spreading.	LLPA MC; LLPA ECC; LLPA BOD; NWRPC
6. Determine the extent of the AIS. a. Use visual boat survey or divers. Mark points or boundaries with GPS. b. If small amounts are found, divers or volunteers can hand pull plants (EWM) or remove AIS animals being sure to collect all plant fragments.	LLPA MC; LLPA BOD; NWRPC
7. Work with the WDNR AIS Specialist and Regional Biologist to determine a control plan specific to the AIS. a. The focus should be quick response and eradication if possible.	LLPA BOD; NWRPC
8. Implement control plan. a. Apply for necessary permits. b. Contract necessary services if trained volunteers cannot implement the required techniques.	LLPA BOD; NWRPC
9. Apply for an AIS Early Detection and Response Grant a. https://dnr.wisconsin.gov/aid/SurfaceWater.html	LLPA BOD; LLPA SCBC; NWRPC
10. Continue to frequently inspect where the AIS was found and the surrounding area to determine treatment effectiveness and if additional measures are warranted.	LLPA MC; NWRPC
11. Annually review the procedures, responsible groups, and contacts of this Rapid Response Plan. a. LLPA BOD approval for any major changes	LLPA MC; LLPA BOD; NWRPC

Rapid Response Contacts

Organization	Name	Role	Email	Phone
LLPA		General	info@longlakellpa.org	
LLPA	Byron Crouse	President	bjcrouse@wisc.edu	(715) 635-6518
LLPA	Randy Poznansky	Monitoring Committee	randypoz@gmail.com	
WDNR	Alexander Selle	AIS Coordinator	alexander.selle@wisconsin.gov	(715) 413-2376
WDNR	Austin Dehn	Water Resources Management Specialist	austin.dehn@wisconsin.gov	(715) 919-8059
WCLWCD	Lisa Burns	Conservation Coordinator	lburns@co.washburn.wi.us	(715) 468-4654
NWRPC	Megan Mader	Lake Scientist/Consultant	mmader@nwrpc.com	(715) 635-2197
ERS	Matt Berg	APM Monitoring/Consultant	saintcroixfly@gmail.com	(715) 483-2847

Works Cited

Berg, Matthew S. "Warm-water Point-intercept Macrophyte Survey Long Lake - WBIC: 2106800 Washburn County, Wisconsin." (2022).

Mader, Megan M. "2024-2034 Long Lake Comprehensive Lake Management Plan". (2024)

Nichols, Stanley A. "Floristic Quality Assessment of Wisconsin Lake Plant communities with Example Applications". *Journal of Lake and Reservoir Management* 15 (2) (1999): 133 141.

Roberts, Craig M. "WDNR Fisheries Survey Report for Long Lake, Washburn County, WI" (2023).

WDNR. "Aquatic Plant Management Strategy: DNR Northern Region" (2007)

Appendix A. Aquatic Plant Information

The following tables and maps have been obtained from the *Warm-water Point-intercept Macrophyte Survey Long Lake - WBIC: 2106800 Washburn County, Wisconsin* (Berg, 2022).

Table 2: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Long Lake – Washburn County, Wisconsin
July 27-31, 2011

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Potamogeton zosteriformis	Flat-stem pondweed	249	10.96	42.64	36.14	1.82	15
Ceratophyllum demersum	Coontail	235	10.35	40.24	34.11	1.60	1
Chara sp.	Muskgrass	194	8.54	33.22	28.16	1.91	1
Vallisneria americana	Wild celery	183	8.06	31.34	26.56	1.42	0
Potamogeton friesii	Fries' pondweed	167	7.35	28.60	24.24	1.60	6
Myriophyllum sibiricum	Northern water milfoil	142	6.25	24.32	20.61	1.46	4
Najas flexilis	Slender naiad	117	5.15	20.03	16.98	1.50	6
Elodea canadensis	Common waterweed	115	5.06	19.69	16.69	1.63	0
	Filamentous algae	107	*	18.32	15.53	1.54	0
Potamogeton pusillus	Small pondweed	103	4.54	17.64	14.95	1.50	0
Potamogeton richardsonii	Clasping-leaf pondweed	70	3.08	11.99	10.16	1.36	38
Potamogeton illinoensis	Illinois pondweed	65	2.86	11.13	9.43	1.26	13
Potamogeton gramineus	Variable pondweed	59	2.60	10.10	8.56	1.32	2
Nymphaea odorata	White water lily	54	2.38	9.25	7.84	2.24	8
Lemna trisulca	Forked duckweed	53	2.33	9.08	7.69	1.51	1
Stuckenia pectinata	Sago pondweed	47	2.07	8.05	6.82	1.28	10
Typha* X *glauca	**Hybrid cattail**	**32**	**1.41**	**5.48**	**4.64**	**2.84**	**2**
Potamogeton amplifolius	Large-leaf pondweed	30	1.32	5.14	4.35	1.27	14
Spirodela polyrhiza	Large duckweed	28	1.23	4.79	4.06	1.86	0
Potamogeton strictifolius	Stiff pondweed	27	1.19	4.62	3.92	1.22	0
Heteranthera dubia	Water star-grass	26	1.14	4.45	3.77	1.23	2
Lemna minor	Small duckweed	25	1.10	4.28	3.63	1.28	0
Nuphar variegata	Spatterdock	24	1.06	4.11	3.48	2.38	5
Eleocharis acicularis	Needle spikerush	22	0.97	3.77	3.19	1.59	0

* Excluded from the relative frequency calculation **Exotic species in bold**

Table 2 (continued): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Long Lake – Washburn County, Wisconsin
July 27-31, 2011

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Potamogeton praelongus	White-stem pondweed	20	0.88	3.42	2.90	1.25	11
Potamogeton robbinsii	Fern pondweed	20	0.88	3.42	2.90	1.75	2
Zizania palustris	Northern wild rice	20	0.88	3.42	2.90	1.40	6
Wolffia columbiana	Common watermeal	17	0.75	2.91	2.47	1.35	0
Sagittaria cristata	Crested arrowhead	16	0.70	2.74	2.32	1.56	2
Schoenoplectus acutus	Hardstem bulrush	12	0.53	2.05	1.74	1.83	1
Potamogeton natans	Floating-leaf pondweed	10	0.44	1.71	1.45	2.00	3
Potamogeton obtusifolius	Blunt-leaf pondweed	9	0.40	1.54	1.31	1.67	0
Pontederia cordata	Pickerelweed	7	0.31	1.20	1.02	2.14	4
Sparganium emersum	Short-stemmed bur-reed	7	0.31	1.20	1.02	1.29	5
Utricularia vulgaris	Common bladderwort	7	0.31	1.20	1.02	1.14	4
Myriophyllum verticillatum	Whorled water milfoil	6	0.26	1.03	0.87	2.17	3
Nitella sp.	Nitella	6	0.26	1.03	0.87	1.17	0
Typha latifolia	Broad-leaved cattail	6	0.26	1.03	0.87	2.67	1
Ranunculus aquatilis	White water crowfoot	5	0.22	0.86	0.73	1.60	0
	Aquatic moss	4	*	0.68	0.58	1.75	0
Brasenia schreberi	Watershield	4	0.18	0.68	0.58	1.75	4
Potamogeton crispus	**Curly-leaf pondweed**	**4**	**0.18**	**0.68**	**0.58**	**1.00**	**0**
Utricularia minor	Small bladderwort	4	0.18	0.68	0.58	1.25	1
Bidens beckii	Water marigold	3	0.13	0.51	0.44	1.00	0
Carex comosa	Bottle brush sedge	3	0.13	0.51	0.44	1.33	1
Schoenoplectus tabernaemontani	Softstem bulrush	3	0.13	0.51	0.44	1.67	1
Sparganium eurycarpum	Common bur-reed	3	0.13	0.51	0.44	2.00	0
Utricularia gibba	Creeping bladderwort	3	0.13	0.51	0.44	1.33	1

* Excluded from the relative frequency calculation **Exotic species in bold**

Table 2 (continued): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Long Lake – Washburn County, Wisconsin
July 27-31, 2011

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Calla palustris	Wild calla	2	0.09	0.34	0.29	2.00	0
Eleocharis erythropoda	Bald spikerush	2	0.09	0.34	0.29	2.50	0
Utricularia intermedia	Flat-leaf bladderwort	2	0.09	0.34	0.29	1.50	0
Equisetum fluviatile	Water horsetail	1	0.04	0.17	0.15	1.00	0
Potamogeton foliosus	Leafy pondweed	1	0.04	0.17	0.15	1.00	0
Sagittaria rigida	Sessile-fruited arrowhead	1	0.04	0.17	0.15	2.00	0
Sagittaria latifolia	Common arrowhead	**	**	**	**	**	1
Bolboschoenus fluviatilis	River bulrush	***	***	***	***	***	***
Eleocharis palustris	Creeping spikerush	***	***	***	***	***	***
Juncus effusus	Common rush	***	***	***	***	***	***
Leersia oryzoides	Rice cut-grass	***	***	***	***	***	***
Polygonum amphibium	Water smartweed	***	***	***	***	***	***
Riccia fluitans	Slender riccia	***	***	***	***	***	***
Typha angustifolia	**Narrow-leaved cattail**	***	***	***	***	***	***

*** Boat survey only **Exotic species in bold**

Table 3: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Long Lake – Washburn County, Wisconsin
August 2-4, 2016

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Myriophyllum sibiricum	Northern water-milfoil	226	10.82	39.24	31.61	1.63	8
Ceratophyllum demersum	Coontail	219	10.48	38.02	30.63	1.44	6
Potamogeton zosteriformis	Flat-stem pondweed	216	10.34	37.50	30.21	1.42	14
Chara sp.	Muskgrass	171	8.19	29.69	23.92	1.61	0
Vallisneria americana	Wild celery	139	6.65	24.13	19.44	1.13	2
Najas flexilis	Slender naiad	125	5.98	21.70	17.48	1.15	1
Potamogeton pusillus	Small pondweed	124	5.94	21.53	17.34	1.28	3
Elodea canadensis	Common waterweed	97	4.64	16.84	13.57	1.35	2
	Filamentous algae	88	*	15.28	12.31	1.17	0
Potamogeton friesii	Fries' pondweed	84	4.02	14.58	11.75	1.11	4
Potamogeton illinoensis	Illinois pondweed	83	3.97	14.41	11.61	1.06	15
Lemna trisulca	Forked duckweed	60	2.87	10.42	8.39	1.25	1
Potamogeton richardsonii	Clasping-leaf pondweed	60	2.87	10.42	8.39	1.17	26
Nymphaea odorata	White water lily	55	2.63	9.55	7.69	2.24	5
Potamogeton gramineus	Variable pondweed	47	2.25	8.16	6.57	1.13	4
Typha* X *glauca	**Hybrid cattail**	**41**	**1.96**	**7.12**	**5.73**	**3.00**	**1**
Heteranthera dubia	Water star-grass	32	1.53	5.56	4.48	1.22	5
Nuphar variegata	Spatterdock	27	1.29	4.69	3.78	2.11	5
Potamogeton amplifolius	Large-leaf pondweed	27	1.29	4.69	3.78	1.22	13
Stuckenia pectinata	Sago pondweed	27	1.29	4.69	3.78	1.19	14
Spirodela polyrhiza	Large duckweed	26	1.24	4.51	3.64	1.19	0
Potamogeton robbinsii	Fern pondweed	25	1.20	4.34	3.50	1.40	0
Lemna minor	Small duckweed	20	0.96	3.47	2.80	1.00	0

* Excluded from the relative frequency calculation **Exotic species in bold**

Table 3 (continued): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Long Lake – Washburn County, Wisconsin
August 2-4, 2016

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Wolffia columbiana	Common watermeal	16	0.77	2.78	2.24	1.25	0
Potamogeton natans	Floating-leaf pondweed	14	0.67	2.43	1.96	1.29	0
Potamogeton praelongus	White-stem pondweed	12	0.57	2.08	1.68	1.33	3
Utricularia vulgaris	Common bladderwort	12	0.57	2.08	1.68	1.00	1
Sagittaria cristata	Crested arrowhead	10	0.48	1.74	1.40	1.10	4
Ranunculus aquatilis	White water crowfoot	9	0.43	1.56	1.26	1.11	0
Schoenoplectus acutus	Hardstem bulrush	9	0.43	1.56	1.26	1.22	3
Brasenia schreberi	Watershield	7	0.34	1.22	0.98	1.43	0
Eleocharis acicularis	Needle spikerush	7	0.34	1.22	0.98	1.00	0
Najas guadalupensis	Southern naiad	7	0.34	1.22	0.98	1.43	0
Pontederia cordata	Pickerelweed	7	0.34	1.22	0.98	2.14	3
Myriophyllum verticillatum	Whorled water-milfoil	6	0.29	1.04	0.84	1.50	2
Utricularia gibba	Creeping bladderwort	6	0.29	1.04	0.84	1.17	0
Zizania palustris	Northern wild rice	6	0.29	1.04	0.84	1.00	10
Potamogeton strictifolius	Stiff pondweed	5	0.24	0.87	0.70	1.00	0
Sparganium emersum	Short-stemmed bur-reed	5	0.24	0.87	0.70	1.20	5
Bidens beckii	Water marigold	3	0.14	0.52	0.42	1.00	0
Potamogeton crispus	**Curly-leaf pondweed**	**3**	**0.14**	**0.52**	**0.42**	**1.00**	**1**
Sparganium eurycarpum	Common bur-reed	3	0.14	0.52	0.42	1.00	1
Schoenoplectus tabernaemontani	Softstem bulrush	2	0.10	0.35	0.28	1.00	0
Typha latifolia	Broad-leaved cattail	2	0.10	0.35	0.28	3.00	0
	Aquatic moss	1	*	0.17	0.14	1.00	0
Calla palustris	Wild calla	1	0.05	0.17	0.14	3.00	0
Carex comosa	Bottle brush sedge	1	0.05	0.17	0.14	1.00	0

* Excluded from the relative frequency calculation **Exotic species in bold**

Table 3 (continued): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Long Lake – Washburn County, Wisconsin
August 2-4, 2016

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Eleocharis erythropoda	Bald spikerush	1	0.05	0.17	0.14	2.00	0
Equisetum fluviatile	Water horsetail	1	0.05	0.17	0.14	1.00	0
Sagittaria latifolia	Common arrowhead	1	0.05	0.17	0.14	2.00	0
Sagittaria rigida	Sessile-fruited arrowhead	1	0.05	0.17	0.14	1.00	0
Utricularia intermedia	Flat-leaf bladderwort	1	0.05	0.17	0.14	1.00	0
Utricularia minor	Small bladderwort	**	**	**	**	**	1
Bolboschoenus fluviatilis	River bulrush	***	***	***	***	***	***
Decodon verticillatus	Swamp loosestrife	***	***	***	***	***	***
Eleocharis palustris	Creeping spikerush	***	***	***	***	***	***
Juncus effusus	Common rush	***	***	***	***	***	***
Leersia oryzoides	Rice cut-grass	***	***	***	***	***	***
Lythrum salicaria	**Purple loosestrife**	*******	*******	*******	*******	*******	*******
Polygonum amphibium	Water smartweed	***	***	***	***	***	***
Potamogeton alpinus	Alpine pondweed	***	***	***	***	***	***

** Visual only   *** Boat survey only   **Exotic species in bold**

Table 4: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Long Lake – Washburn County, Wisconsin
July 27-29, 2022

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Ceratophyllum demersum	Coontail	275	12.53	45.83	40.68	1.36	0
Potamogeton zosteriformis	Flat-stem pondweed	269	12.26	44.83	39.79	1.54	15
Potamogeton pusillus	Small pondweed	198	9.02	33.00	29.29	1.48	1
Myriophyllum sibiricum	Northern water-milfoil	165	7.52	27.50	24.41	1.50	4
Chara sp.	Muskgrass	144	6.56	24.00	21.30	1.68	1
Potamogeton friesii	Fries' pondweed	138	6.29	23.00	20.41	1.30	2
	Filamentous algae	135	*	22.50	19.97	1.43	0
Vallisneria americana	Wild celery	116	5.28	19.33	17.16	1.11	0
Najas flexilis	Slender naiad	93	4.24	15.50	13.76	1.25	2
Potamogeton illinoensis	Illinois pondweed	92	4.19	15.33	13.61	1.18	10
Elodea canadensis	Common waterweed	74	3.37	12.33	10.95	1.35	2
Lemna trisulca	Forked duckweed	68	3.10	11.33	10.06	1.25	1
Potamogeton richardsonii	Clasping-leaf pondweed	63	2.87	10.50	9.32	1.19	16
Nymphaea odorata	White water lily	61	2.78	10.17	9.02	2.00	7
Typha* X *glauca	**Hybrid cattail**	**38**	**1.73**	**6.33**	**5.62**	**3.00**	**2**
Potamogeton gramineus	Variable pondweed	37	1.69	6.17	5.47	1.30	6
Spirodela polyrhiza	Large duckweed	33	1.50	5.50	4.88	1.30	0
Nuphar variegata	Spatterdock	32	1.46	5.33	4.73	2.31	3
Potamogeton amplifolius	Large-leaf pondweed	30	1.37	5.00	4.44	1.23	5
Potamogeton robbinsii	Fern pondweed	29	1.32	4.83	4.29	1.45	1
Heteranthera dubia	Water star-grass	28	1.28	4.67	4.14	1.18	0
Stuckenia pectinata	Sago pondweed	26	1.18	4.33	3.85	1.15	13
Utricularia vulgaris	Common bladderwort	24	1.09	4.00	3.55	1.25	4
Lemna minor	Small duckweed	19	0.87	3.17	2.81	1.00	0

* Excluded from the relative frequency calculation **Exotic species in bold**

Table 4 (continued): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Long Lake – Washburn County, Wisconsin
July 27-29, 2022

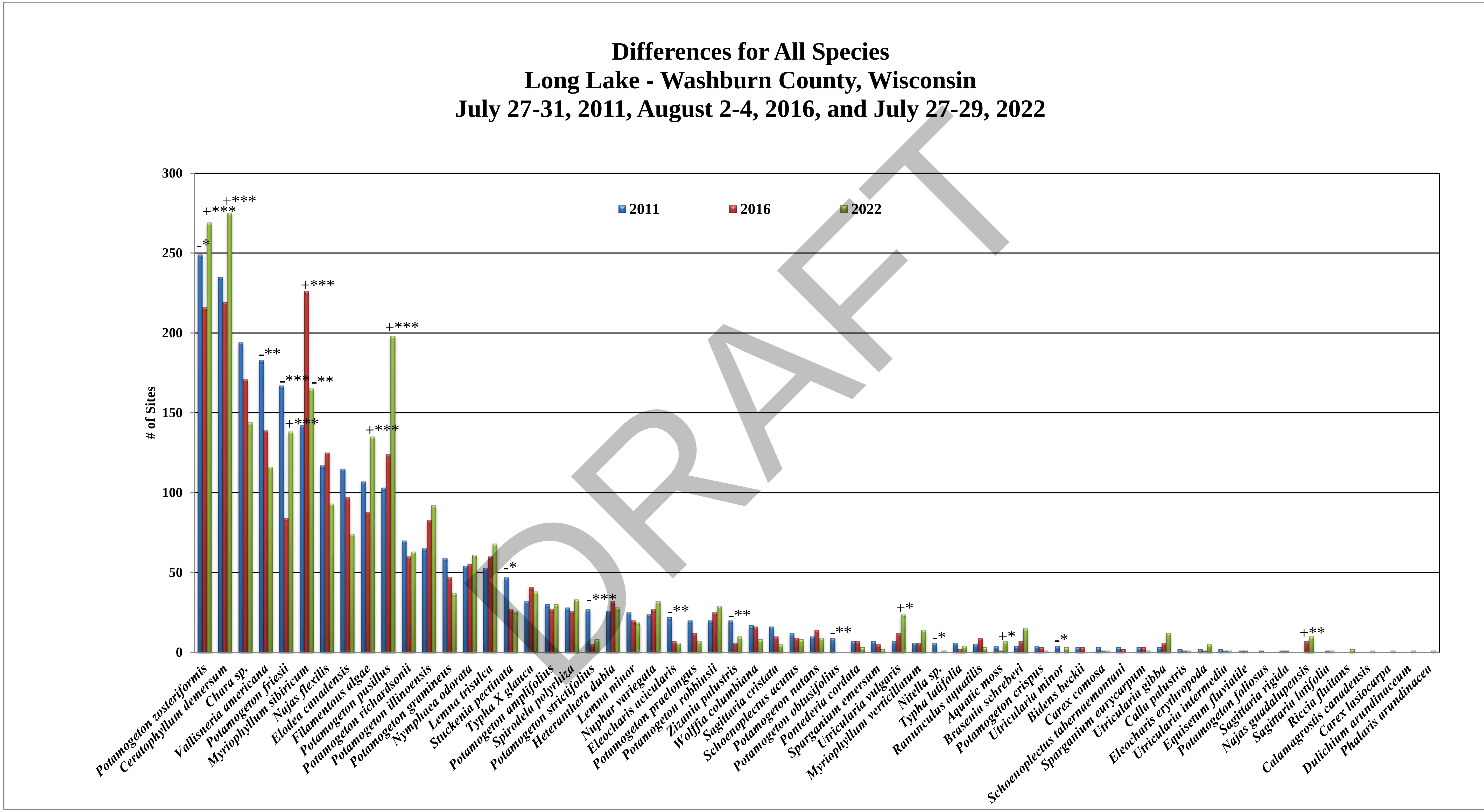
Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Brasenia schreberi	Watershield	15	0.68	2.50	2.22	2.40	0
Myriophyllum verticillatum	Whorled water-milfoil	14	0.64	2.33	2.07	1.43	3
Utricularia gibba	Creeping bladderwort	12	0.55	2.00	1.78	1.00	0
Najas guadalupensis	Southern naiad	10	0.46	1.67	1.48	2.00	0
Zizania palustris	Northern wild rice	10	0.46	1.67	1.48	1.20	10
Potamogeton natans	Floating-leaf pondweed	9	0.41	1.50	1.33	1.00	4
Potamogeton strictifolius	Stiff pondweed	8	0.36	1.33	1.18	1.13	0
Schoenoplectus acutus	Hardstem bulrush	8	0.36	1.33	1.18	1.13	1
Wolffia columbiana	Common watermeal	8	0.36	1.33	1.18	1.25	0
Potamogeton praelongus	White-stem pondweed	7	0.32	1.17	1.04	1.14	3
	Aquatic moss	7	*	1.17	1.04	1.29	0
Eleocharis acicularis	Needle spikerush	6	0.27	1.00	0.89	1.00	0
Eleocharis erythropoda	Bald spikerush	5	0.23	0.83	0.74	2.20	2
Sagittaria cristata	Crested arrowhead	5	0.23	0.83	0.74	1.00	2
Typha latifolia	Broad-leaved cattail	4	0.18	0.67	0.59	1.25	3
Pontederia cordata	Pickerelweed	3	0.14	0.50	0.44	1.67	4
Ranunculus aquatilis	White water crowfoot	3	0.14	0.50	0.44	1.00	0
Utricularia minor	Small bladderwort	3	0.14	0.50	0.44	1.00	0
Riccia fluitans	Slender riccia	2	0.09	0.33	0.30	1.00	0
Sparganium emersum	Short-stemmed bur-reed	2	0.09	0.33	0.30	1.00	4
Calamagrostis canadensis	Bluejoint	1	0.05	0.17	0.15	1.00	0
Calla palustris	Wild calla	1	0.05	0.17	0.15	1.00	1
Carex comosa	Bottle brush sedge	1	0.05	0.17	0.15	1.00	3
Carex lasiocarpa	Narrow-leaved wooly sedge	1	0.05	0.17	0.15	3.00	0

* Excluded from the relative frequency calculation

Table 4 (continued): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Long Lake – Washburn County, Wisconsin
July 27-29, 2022

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Dulichium arundinaceum	Three-way sedge	1	0.05	0.17	0.15	1.00	0
Nitella sp.	Nitella	1	0.05	0.17	0.15	1.00	0
Phalaris arundinacea	**Reed canary grass**	**1**	**0.05**	**0.17**	**0.15**	**1.00**	**0**
Potamogeton crispus	**Curly-leaf pondweed**	**1**	**0.05**	**0.17**	**0.15**	**1.00**	**0**
Sagittaria latifolia	Common arrowhead	1	0.05	0.17	0.15	2.00	0
Sparganium eurycarpum	Common bur-reed	1	0.05	0.17	0.15	1.00	4
Utricularia intermedia	Flat-leaf bladderwort	1	0.05	0.17	0.15	1.00	0
Bidens beckii	Water marigold	**	**	**	**	**	1
Iris pseudacorus	**Yellow iris**	******	******	******	******	******	**1**
Myosotis scorpioides	**Common forget-me-not**	******	******	******	******	******	**1**
Schoenoplectus tabernaemontani	Softstem bulrush	**	**	**	**	**	1
Bolboschoenus fluviatilis	River bulrush	***	***	***	***	***	***
Decodon verticillatus	Swamp loosestrife	***	***	***	***	***	***
Juncus effusus	Common rush	***	***	***	***	***	***
Phragmites australis	Common reed	***	***	***	***	***	***
Potamogeton epihydrus	Ribbon-leaf pondweed	***	***	***	***	***	***
Sagittaria rigida	Sessile-fruited arrowhead	***	***	***	***	***	***

** Visual only *** Boat survey only **Exotic species in bold**



Significant differences = * *p*<0.05, ** *p*<0.01, * *p*<0.001**

Figure 8: Macrophytes Showing Significant Changes from 2011-2016-2022

Comparison of Floristic Quality Indexes in 2011, 2016, and 2022:

In 2011, we identified a total of 51 **native index species** in the rake during the point-intercept survey (Table 5). They produced a mean Coefficient of Conservatism of 6.3 and a Floristic Quality Index of 44.9.

Table 5: Floristic Quality Index of Aquatic Macrophytes
Long Lake – Washburn County, Wisconsin
July 27-31, 2011

Species	Common Name	C
Bidens beckii	Water marigold	8
Brasenia schreberi	Watershield	6
Calla palustris	Wild calla	9
Carex comosa	Bottle brush sedge	5
Ceratophyllum demersum	Coontail	3
Chara sp.	Muskgrass	7
Eleocharis acicularis	Needle spikerush	5
Eleocharis erythropoda	Bald spikerush	3
Elodea canadensis	Common waterweed	3
Equisetum fluviatile	Water horsetail	7
Heteranthera dubia	Water star-grass	6
Lemna minor	Small duckweed	4
Lemna trisulca	Forked duckweed	6
Myriophyllum sibiricum	Northern water-milfoil	6
Myriophyllum verticillatum	Whorled water-milfoil	8
Najas flexilis	Slender naiad	6
Nitella sp.	Nitella	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Pontederia cordata	Pickerelweed	8
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton foliosus	Leafy pondweed	6
Potamogeton friesii	Fries' pondweed	8
Potamogeton gramineus	Variable pondweed	7
Potamogeton illinoensis	Illinois pondweed	6
Potamogeton natans	Floating-leaf pondweed	5
Potamogeton obtusifolius	Blunt-leaf pondweed	9
Potamogeton praelongus	White-stem pondweed	8
Potamogeton pusillus	Small pondweed	7
Potamogeton richardsonii	Clasping-leaf pondweed	5
Potamogeton robbinsii	Fern pondweed	8
Potamogeton strictifolius	Stiff pondweed	8
Potamogeton zosteriformis	Flat-stem pondweed	6
Ranunculus aquatilis	White water crowfoot	8
Sagittaria cristata	Crested arrowhead	9
Sagittaria rigida	Sessile-fruited arrowhead	8
Schoenoplectus acutus	Hardstem bulrush	6
Schoenoplectus tabernaemontani	Softstem bulrush	4

Table 5 (continued): Floristic Quality Index of Aquatic Macrophytes
Long Lake – Washburn County, Wisconsin
July 27-31, 2011

Species	Common Name	C
Sparganium emersum	Short-stemmed bur-reed	8
Sparganium eurycarpum	Common bur-reed	5
Spirodela polyrhiza	Large duckweed	5
Stuckenia pectinata	Sago pondweed	3
Typha latifolia	Broad-leaved cattail	1
Typha X *glauca*	Hybrid cattail	1
Utricularia gibba	Creeping bladderwort	9
Utricularia intermedia	Flat-leaf bladderwort	9
Utricularia minor	Small bladderwort	10
Utricularia vulgaris	Common bladderwort	7
Vallisneria americana	Wild celery	6
Wolffia columbiana	Common watermeal	5
Zizania palustris	Northern wild rice	8
N		**51**
Mean C		**6.3**
FQI		**44.9**

The 2016 point-intercept survey identified a total of 49 **native index plants** in the rake. They produced a mean Coefficient of Conservatism of 6.1 and a Floristic Quality Index of 42.9 (Table 6).

Table 6: Floristic Quality Index of Aquatic Macrophytes
Long Lake – Washburn County, Wisconsin
August 2-4, 2016

Species	Common Name	C
Bidens beckii	Water marigold	8
Brasenia schreberi	Watershield	6
Calla palustris	Wild calla	9
Carex comosa	Bottle brush sedge	5
Ceratophyllum demersum	Coontail	3
Chara sp.	Muskgrass	7
Eleocharis acicularis	Needle spikerush	5
Eleocharis erythropoda	Bald spikerush	3
Elodea canadensis	Common waterweed	3
Equisetum fluviatile	Water horsetail	7
Heteranthera dubia	Water star-grass	6
Lemna minor	Small duckweed	4
Lemna trisulca	Forked duckweed	6
Myriophyllum sibiricum	Northern water-milfoil	6
Myriophyllum verticillatum	Whorled water-milfoil	8
Najas flexilis	Slender naiad	6
Najas guadalupensis	Southern naiad	8
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Pontederia cordata	Pickerelweed	8
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton friesii	Fries' pondweed	8
Potamogeton gramineus	Variable pondweed	7
Potamogeton illinoensis	Illinois pondweed	6
Potamogeton natans	Floating-leaf pondweed	5
Potamogeton praelongus	White-stem pondweed	8
Potamogeton pusillus	Small pondweed	7
Potamogeton richardsonii	Clasping-leaf pondweed	5
Potamogeton robbinsii	Fern pondweed	8
Potamogeton strictifolius	Stiff pondweed	8
Potamogeton zosteriformis	Flat-stem pondweed	6
Ranunculus aquatilis	White water crowfoot	8
Sagittaria cristata	Crested arrowhead	9
Sagittaria latifolia	Common arrowhead	3
Sagittaria rigida	Sessile-fruited arrowhead	8
Schoenoplectus acutus	Hardstem bulrush	6
Schoenoplectus tabernaemontani	Softstem bulrush	4
Sparganium emersum	Short-stemmed bur-reed	8
Sparganium eurycarpum	Common bur-reed	5

Table 6 (continued): Floristic Quality Index of Aquatic Macrophytes
Long Lake - Washburn County, Wisconsin
August 2-4, 2016

Species	Common Name	C
Spirodela polyrhiza	Large duckweed	5
Stuckenia pectinata	Sago pondweed	3
Typha latifolia	Broad-leaved cattail	1
Typha X *glauca*	Hybrid cattail	1
Utricularia gibba	Creeping bladderwort	9
Utricularia intermedia	Flat-leaf bladderwort	9
Utricularia vulgaris	Common bladderwort	7
Vallisneria americana	Wild celery	6
Wolffia columbiana	Common watermeal	5
Zizania palustris	Northern wild rice	8
N		**49**
Mean C		**6.1**
FQI		**42.9**

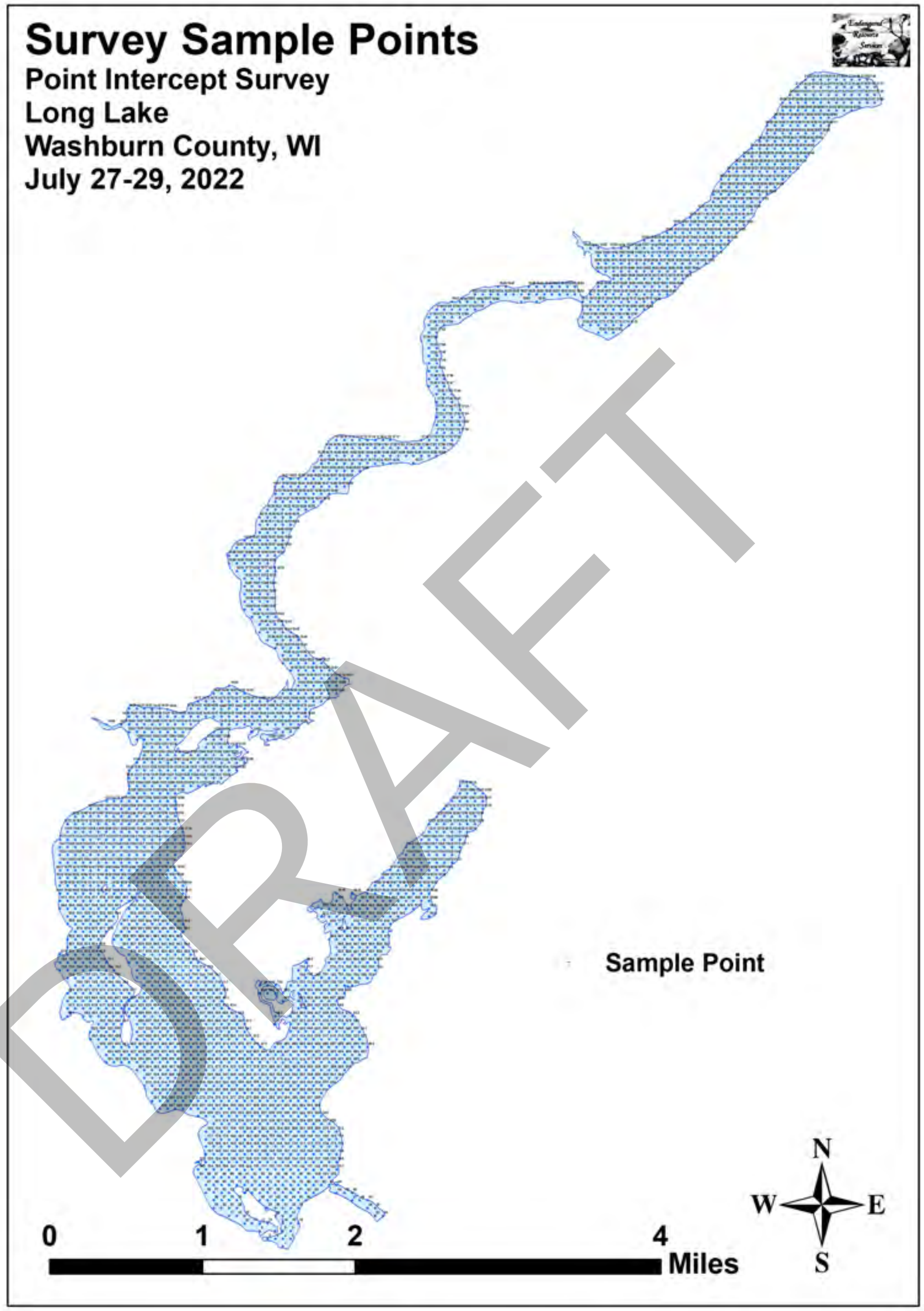
Our 2022 point-intercept survey found a total of 49 **native index plants** in the rake. They produced a mean Coefficient of Conservatism of 6.2 and a Floristic Quality Index of 43.7 (Table 7). Nichols (1999) reported an average mean C for the North Central Hardwood Forests Region of 5.6 putting Long Lake well above average for this part of the state. The FQI was also more than double the median FQI of 20.9 for the North Central Hardwood Forests (Nichols 1999).

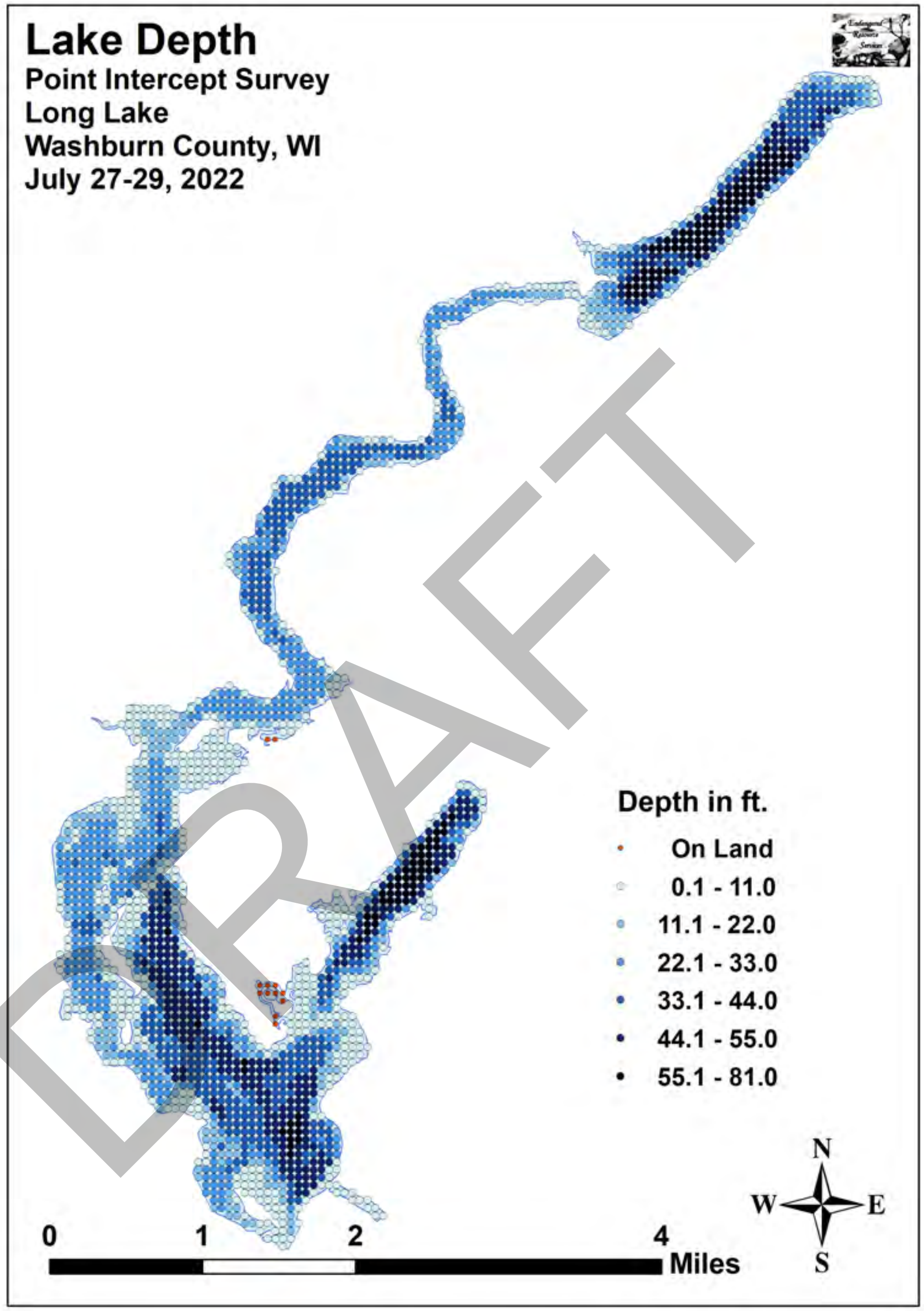
Table 7: Floristic Quality Index of Aquatic Macrophytes
Long Lake – Washburn County, Wisconsin
July 27-29, 2022

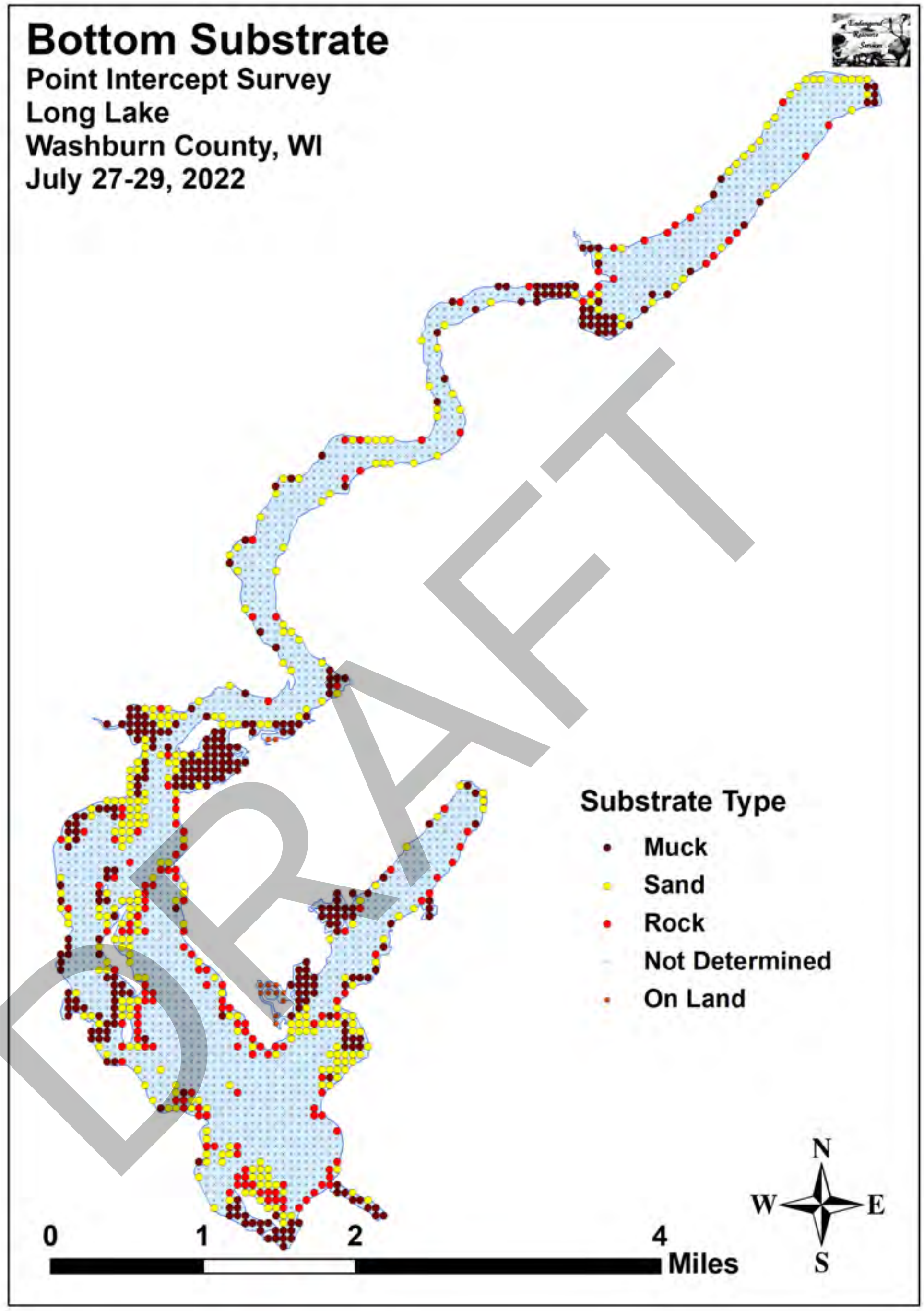
Species	Common Name	C
Brasenia schreberi	Watershield	6
Calla palustris	Wild calla	9
Carex comosa	Bottle brush sedge	5
Ceratophyllum demersum	Coontail	3
Chara sp.	Muskgrass	7
Dulichium arundinaceum	Three-way sedge	9
Eleocharis acicularis	Needle spikerush	5
Eleocharis erythropoda	Bald spikerush	3
Elodea canadensis	Common waterweed	3
Heteranthera dubia	Water star-grass	6
Lemna minor	Small duckweed	4
Lemna trisulca	Forked duckweed	6
Myriophyllum sibiricum	Northern water-milfoil	6
Myriophyllum verticillatum	Whorled water-milfoil	8
Najas flexilis	Slender naiad	6
Najas guadalupensis	Southern naiad	8
Nitella sp.	Nitella	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Pontederia cordata	Pickerelweed	8
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton friesii	Fries' pondweed	8
Potamogeton gramineus	Variable pondweed	7
Potamogeton illinoensis	Illinois pondweed	6
Potamogeton natans	Floating-leaf pondweed	5
Potamogeton praelongus	White-stem pondweed	8
Potamogeton pusillus	Small pondweed	7
Potamogeton richardsonii	Clasping-leaf pondweed	5
Potamogeton robbinsii	Fern pondweed	8
Potamogeton strictifolius	Stiff pondweed	8
Potamogeton zosteriformis	Flat-stem pondweed	6
Ranunculus aquatilis	White water crowfoot	8
Riccia fluitans	Slender riccia	7
Sagittaria cristata	Crested arrowhead	9
Sagittaria latifolia	Common arrowhead	3
Schoenoplectus acutus	Hardstem bulrush	6

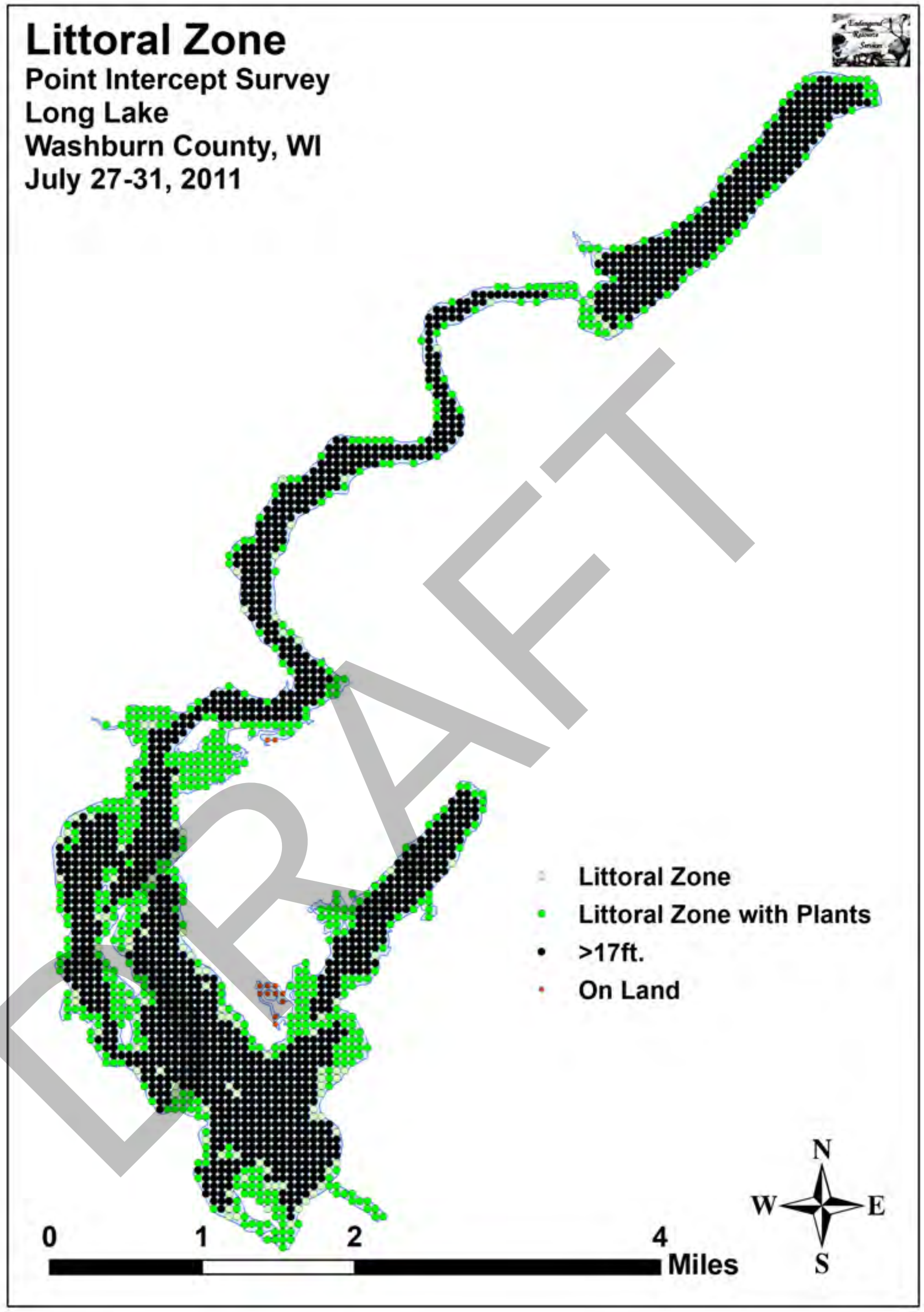
Table 7 (continued): Floristic Quality Index of Aquatic Macrophytes
Long Lake – Washburn County, Wisconsin
July 27-29, 2022

Species	Common Name	C
Sparganium emersum	Short-stemmed bur-reed	8
Sparganium eurycarpum	Common bur-reed	5
Spirodela polyrhiza	Large duckweed	5
Stuckenia pectinata	Sago pondweed	3
Typha latifolia	Broad-leaved cattail	1
Typha X *glauca*	Hybrid cattail	1
Utricularia gibba	Creeping bladderwort	9
Utricularia intermedia	Flat-leaf bladderwort	9
Utricularia minor	Small bladderwort	10
Utricularia vulgaris	Common bladderwort	7
Vallisneria americana	Wild celery	6
Wolffia columbiana	Common watermeal	5
Zizania palustris	Northern wild rice	8
N		**49**
Mean C		**6.2**
FQI		**43.7**

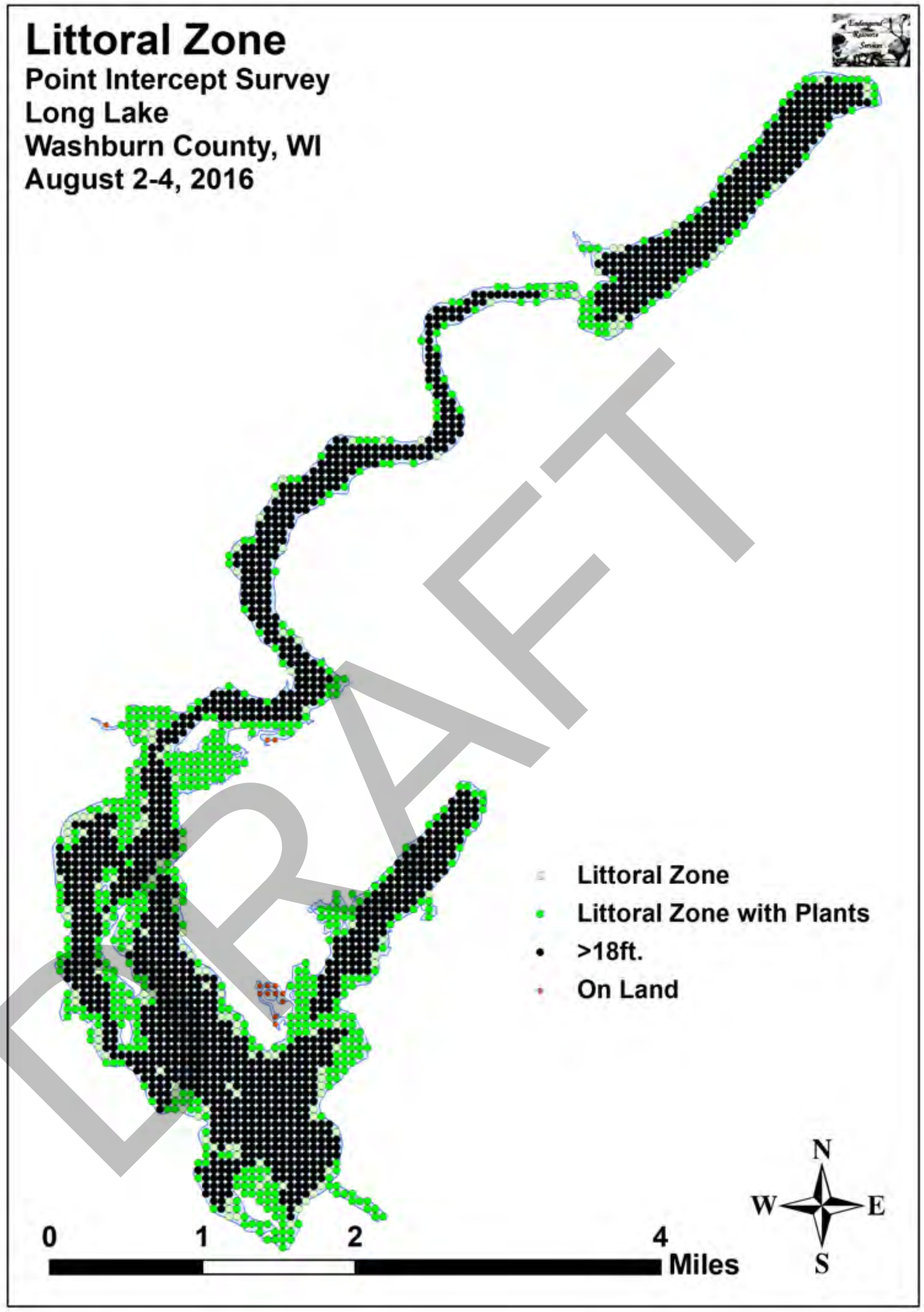

Survey Sample Points
Point Intercept Survey
Long Lake
Washburn County, WI
July 27-29, 2022
Sample Point
0
1
2
4
Miles
N
W
E
S
DRAFT

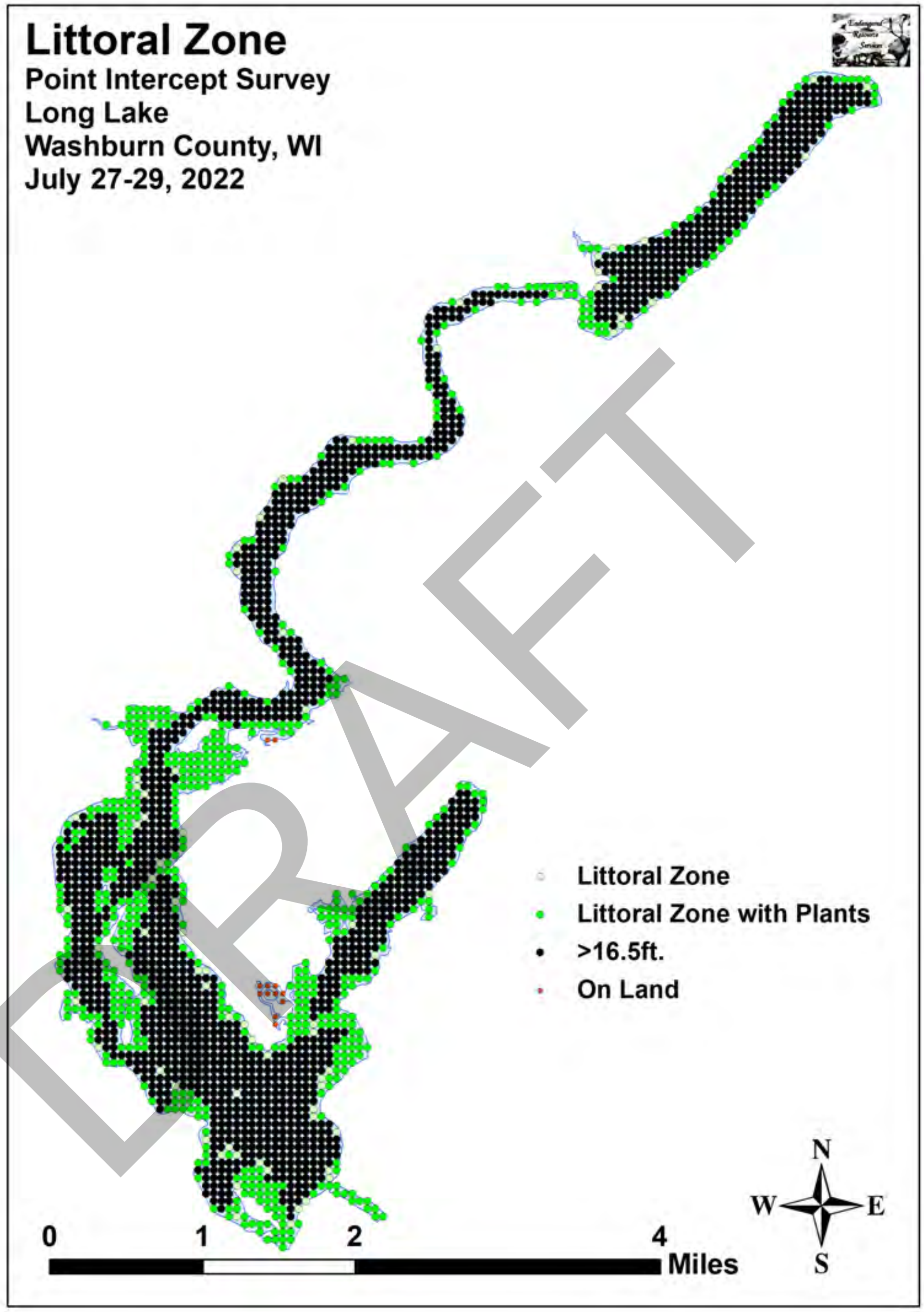

Lake Depth
Point Intercept Survey
Long Lake
Washburn County, WI
July 27-29, 2022
Depth in ft.
On Land
0.1 - 11.0
11.1 - 22.0
22.1 - 33.0
33.1 - 44.0
44.1 - 55.0
55.1 - 81.0
N
W
E
S
0
1
2
4
Miles
DRAFT

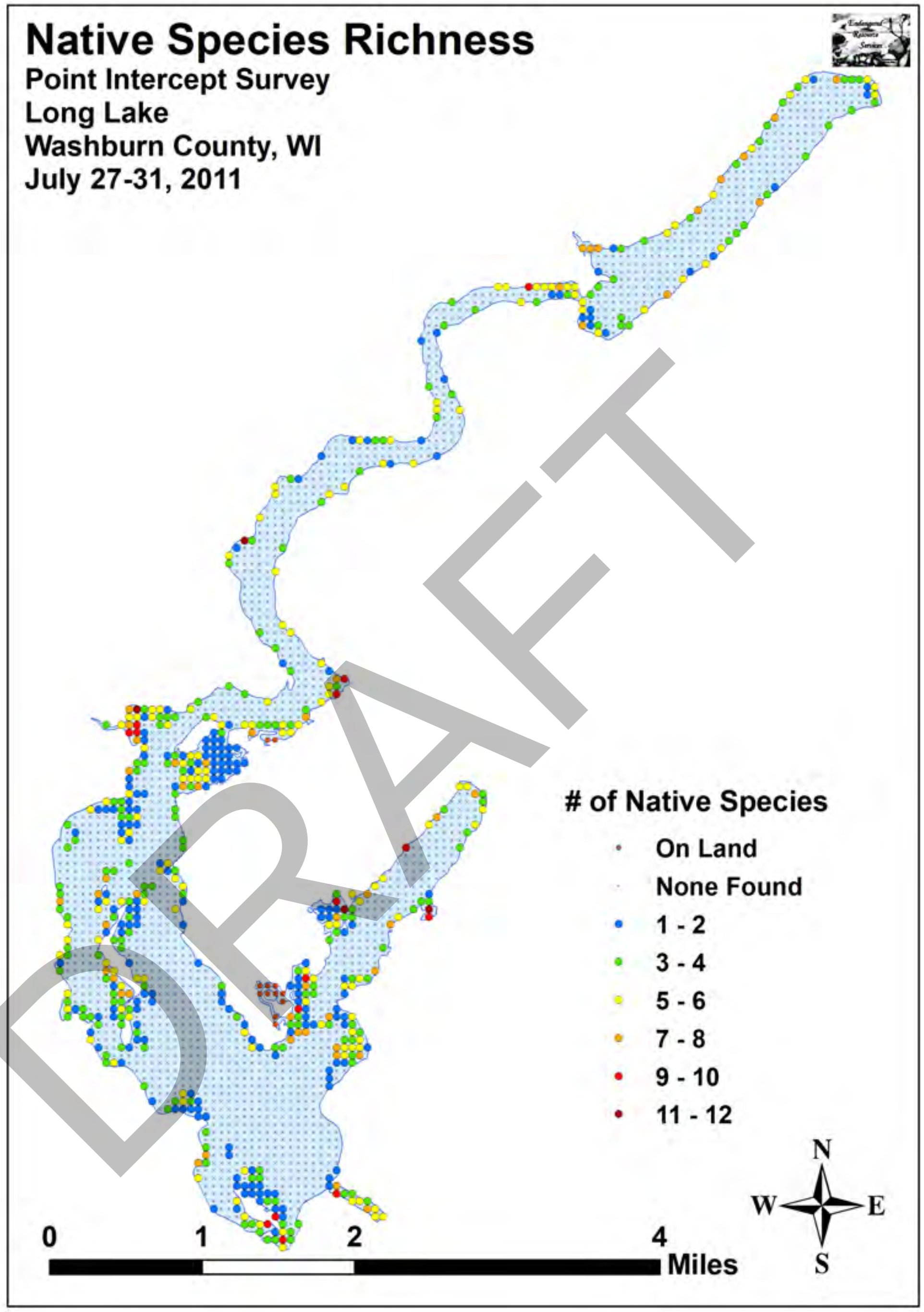

Bottom Substrate
Point Intercept Survey
Long Lake
Washburn County, WI
July 27-29, 2022
Substrate Type
Muck
Sand
Rock
Not Determined
On Land
0
1
2
4
Miles
N
W
E
S

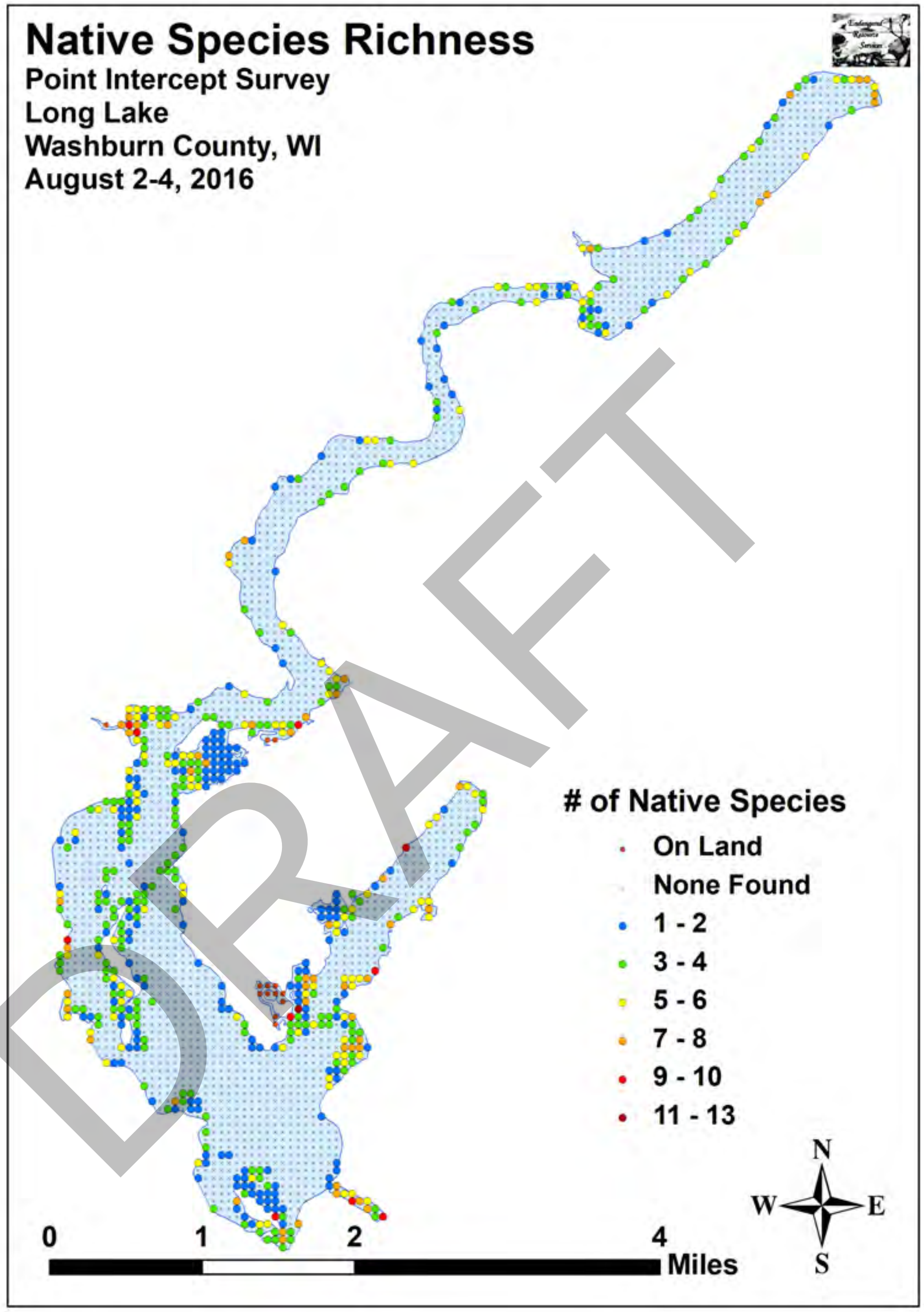


Littoral Zone
Point Intercept Survey
Long Lake
Washburn County, WI
July 27-31, 2011
Littoral Zone
Littoral Zone with Plants
>17ft.
On Land
0
1
2
4
Miles
N
W
E
S
DRAFT

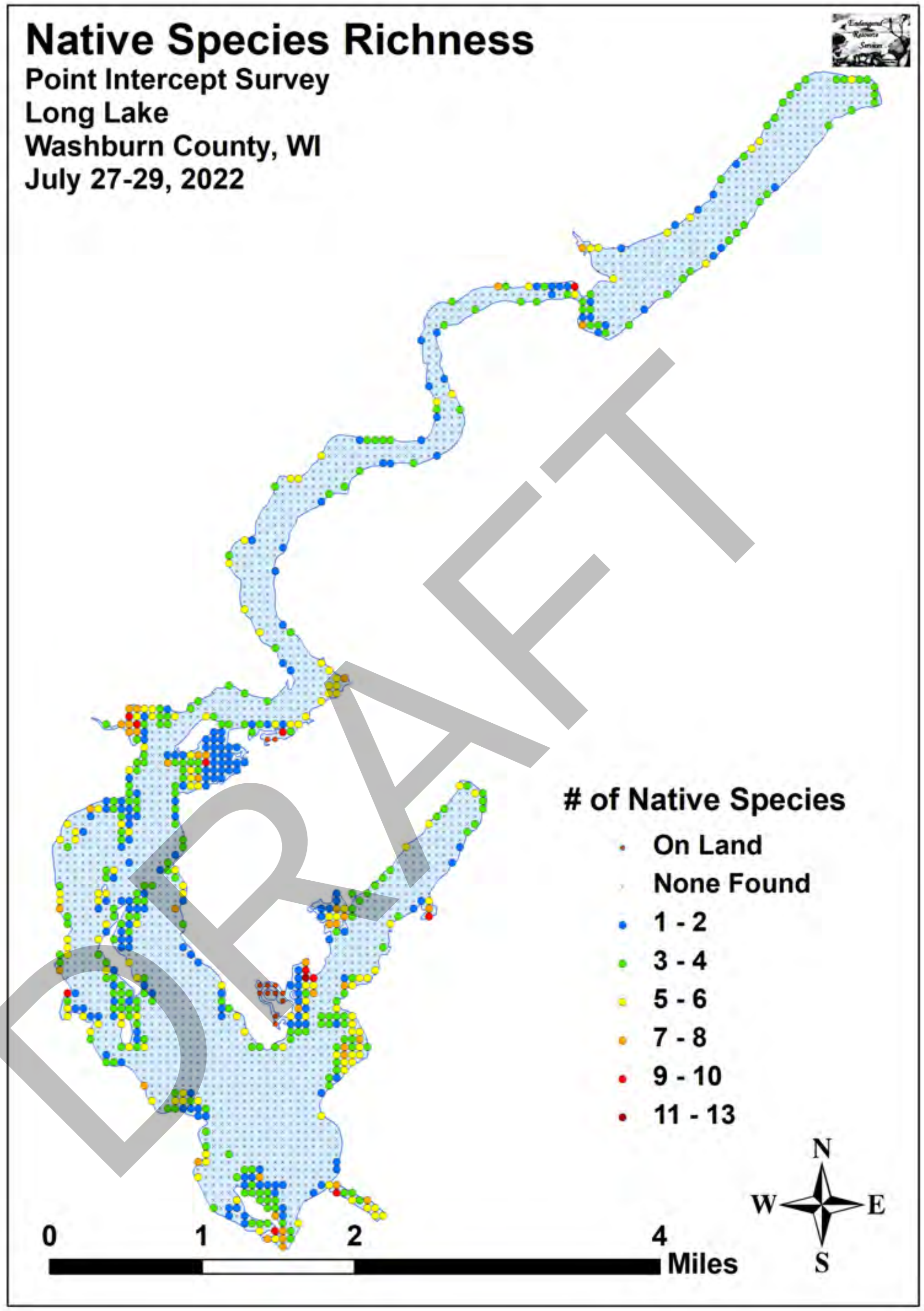

Littoral Zone
Point Intercept Survey
Long Lake
Washburn County, WI
August 2-4, 2016
Littoral Zone
Littoral Zone with Plants
>18ft.
On Land
N
W
E
S
0
1
2
4
Miles
DRAFT

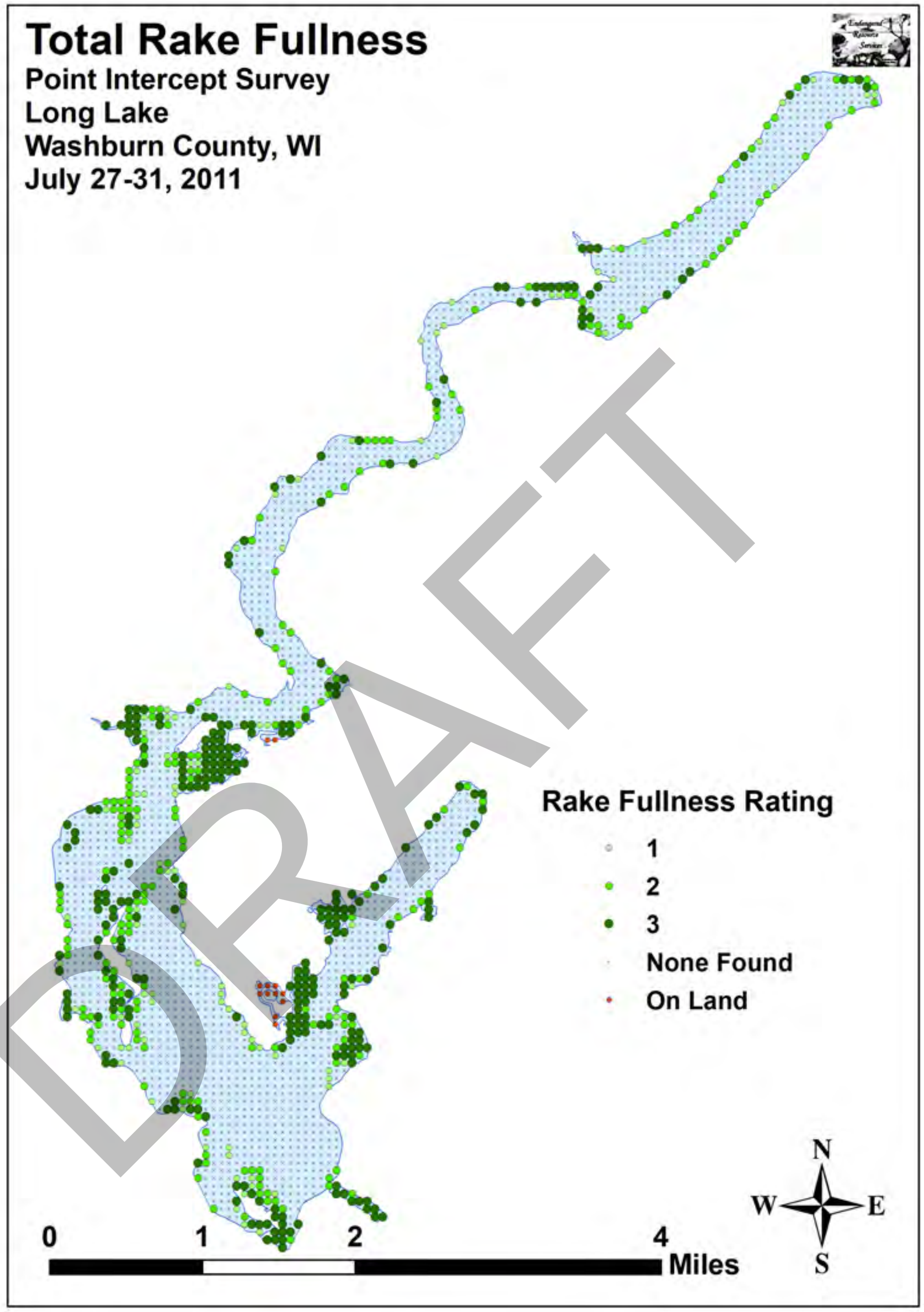

Littoral Zone
Point Intercept Survey
Long Lake
Washburn County, WI
July 27-29, 2022
Littoral Zone
Littoral Zone with Plants
>16.5ft.
On Land
0
1
2
4
Miles
N
W
E
S
DRAFT

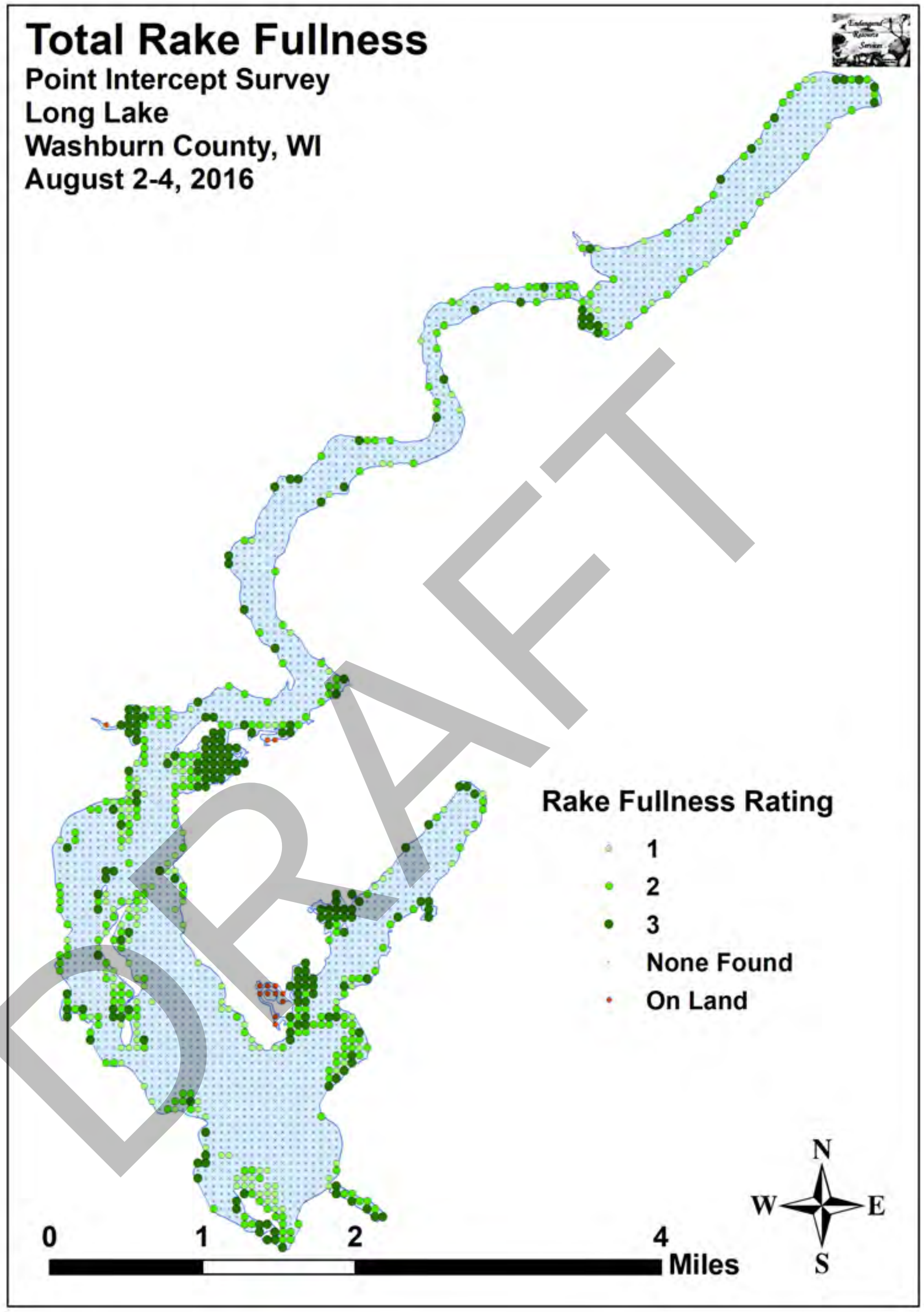

Native Species Richness
Point Intercept Survey
Long Lake
Washburn County, WI
July 27-31, 2011
# of Native Species
On Land
None Found
1 - 2
3 - 4
5 - 6
7 - 8
9 - 10
11 - 12
N
W
E
S
0
1
2
4
Miles
DRAFT

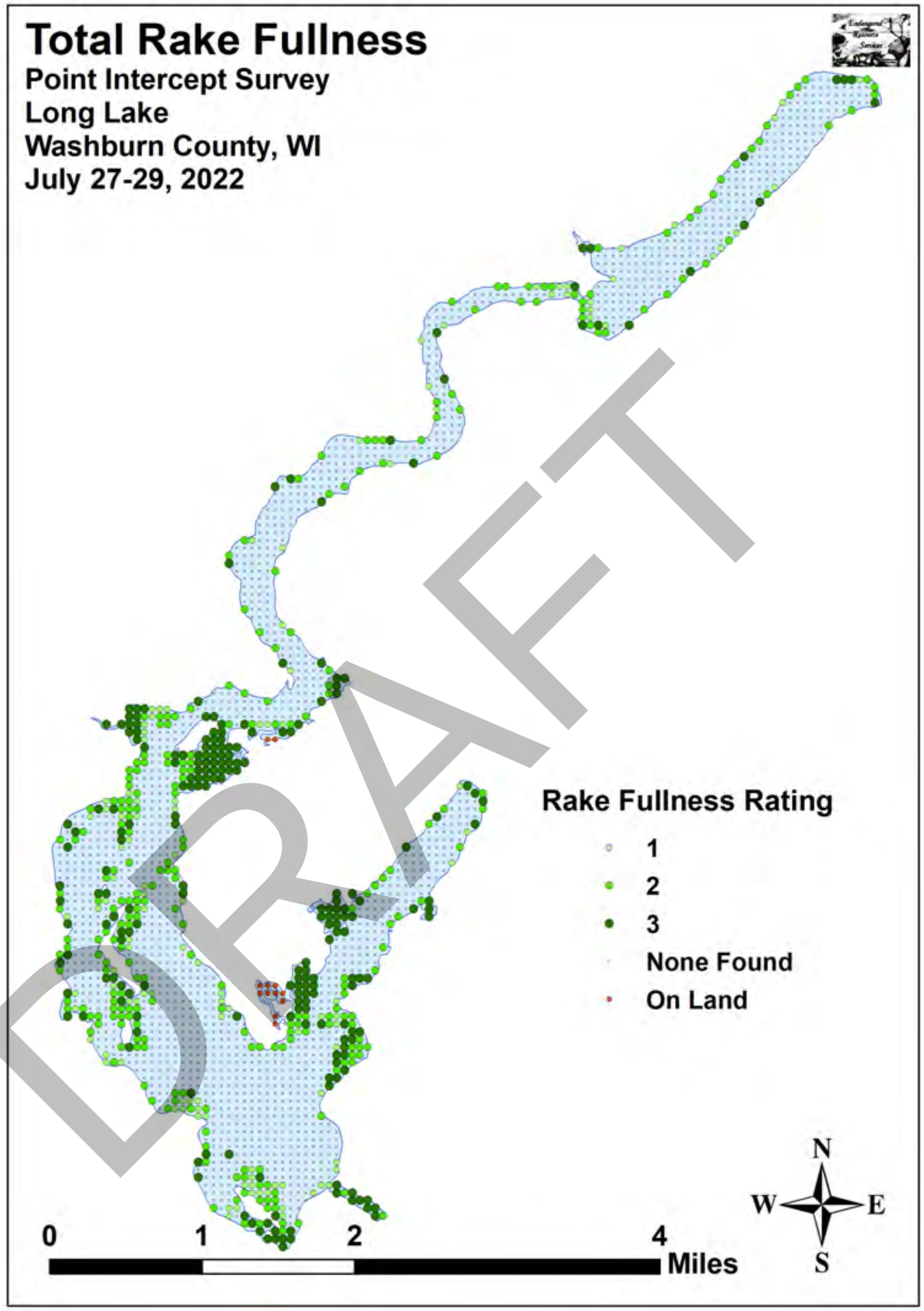


Native Species Richness
Point Intercept Survey
Long Lake
Washburn County, WI
August 2-4, 2016
# of Native Species
On Land
None Found
1 - 2
3 - 4
5 - 6
7 - 8
9 - 10
11 - 13
N
W
E
S
0
1
2
4
Miles
DRAFT


Native Species Richness
Point Intercept Survey
Long Lake
Washburn County, WI
July 27-29, 2022
# of Native Species
On Land
None Found
1 - 2
3 - 4
5 - 6
7 - 8
9 - 10
11 - 13
N
W
E
S
0
1
2
4
Miles
DRAFT


Total Rake Fullness
Point Intercept Survey
Long Lake
Washburn County, WI
July 27-31, 2011
Rake Fullness Rating
1
2
3
None Found
On Land
0
1
2
4
Miles
N
W
E
S
DRAFT


Total Rake Fullness
Point Intercept Survey
Long Lake
Washburn County, WI
August 2-4, 2016
Rake Fullness Rating
1
2
3
None Found
On Land
0
1
2
4
Miles
N
W
E
S
DRAFT



Total Rake Fullness
Point Intercept Survey
Long Lake
Washburn County, WI
July 27-29, 2022
Rake Fullness Rating
1
2
3
None Found
On Land
0
1
2
4
Miles
N
W
E
S
DRAFT

Appendix B. WDNR Aquatic Plant Management Strategy

AQUATIC PLANT MANAGEMENT STRATEGY

Northern Region WDNR
Summer, 2007

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

ISSUES

- Protect desirable native aquatic plants.
- Reduce the risk that invasive species replace desirable native aquatic plants.
- Promote "whole lake" management plans
- Limit the number of permits to control native aquatic plants.

BACKGROUND

As a general rule, the Northern Region has historically taken a protective approach to allow removal of native aquatic plants by harvesting or by chemical herbicide treatment. This approach has prevented lakes in the Northern Wisconsin from large-scale loss of native aquatic plants that represent naturally occurring high quality vegetation. Naturally occurring native plants provide a *diversity of habitat* that *helps maintain water quality*, helps *sustain the fishing* quality known for Northern Wisconsin, supports common lakeshore wildlife from loons to frogs, and helps to provide the *aesthetics* that collectively create the "up-north" appeal of the northwoods lake resources.

In Northern Wisconsin lakes, an inventory of aquatic plants may often find 30 different species or more, whereas a similar survey of a Southern Wisconsin lake may often discover less than half that many species. Historically, similar species diversity was present in Southern Wisconsin, but has been lost gradually over time from stresses brought on by cultural land use changes (such as increased development, and intensive agriculture). Another point to note is that while there may be a greater variety of aquatic vegetation in Northern Wisconsin lakes, the vegetation itself is often *less dense*. This is because northern lakes have not suffered as greatly from nutrients and runoff as have many waters in Southern Wisconsin.

The newest threat to native plants in Northern Wisconsin is from invasive species of aquatic plants. The most common include Eurasian Water Milfoil (EWM) and CurlyLeaf Pondweed (CLP). These species are described as *opportunistic invaders*. This means that these "invaders" benefit where an opening occurs from removal of plants, and without competition from other plants may successfully become established in a lake. Removal of native vegetation not only diminishes the natural qualities of a lake, it *may increase the risk that an invasive species can successfully invade onto the site where native plants have been removed*. There it may more easily establish itself without the native plants to compete against. This concept is easily observed on land where bared soil is quickly taken over by replacement species (often weeds) that crowd in and establish themselves as new occupants of the site. While not a providing a certain guarantee against invasive plants, protecting and allowing the native plants to remain may reduce the success of an invasive species becoming established on a lake. Once established, the invasive species cause far more inconvenience for all lake users, riparian and others included; can change many of the natural features of a lake; and often lead to *expensive annual control plans*. Native vegetation may cause localized concerns to some users, but as a natural feature of lakes, they generally do not cause harm.

To the extent we can maintain the normal growth of native vegetation, Northern Wisconsin lakes can continue to offer the water resource appeal and benefits they've historically provided. A regional position on removal of aquatic plants that carefully recognizes how native aquatic plants benefit lakes in Northern Region can help prevent a gradual decline in the overall quality and recreational benefits that make these lakes attractive to people and still provide abundant fish, wildlife, and northwoods appeal.

GOALS OF STRATEGY:

1. Preserve native species diversity which, in turn, fosters natural habitat for fish and other aquatic species, from frogs to birds.
2. Prevent openings for invasive species to become established in the absence of the native species.
3. Concentrate on a" whole-lake approach" for control of aquatic plants, thereby fostering systematic documentation of conditions and specific targeting of invasive species as they exist.
4. Prohibit removal of wild rice. WDNR – Northern Region will not issue permits to remove wild rice unless a request is subjected to the full consultation process via the Voigt Tribal Task Force. We intend to discourage applications for removal of this ecologically and culturally important native plant.
5. To be consistent with our WDNR Water Division Goals (work reduction/disinvestment), established in 2005, to "not issue permits for chemical or large scale mechanical control of native aquatic plants – develop general permits as appropriate or inform applicants of exempted activities." This process is similar to work done in other WDNR Regions, although not formalized as such.

BASIS OF STRATEGY IN STATE STATUTE AND ADMINISTRATIVE CODE

State Statute 23.24 (2)(c) states:

"The requirements promulgated under par. (a) 4. may specify any of the following:

1. The **quantity** of aquatic plants that may be managed under an aquatic plant management permit.
2. The **species** of aquatic plants that may be managed under an aquatic plant management permit.
3. The **areas** in which aquatic plants may be managed under an aquatic plant management permit.
4. The **methods** that may be used to manage aquatic plants under an aquatic plant management permit.
5. The **times** during which aquatic plants may be managed under an aquatic plant management permit.
6. The **allowable methods** for disposing or using aquatic

plants that are removed or controlled under an aquatic plant management permit.

7. The requirements for plans that the department may require under sub. (3) (b). "

State Statute 23.24(3)(b) states:
"The department may require that an application for an aquatic plant management permit contain a plan for the department's approval as to how the aquatic plants will be introduced, removed, or controlled."

Wisconsin Administrative Code NR 109.04(3)(a) states:
"The department may require that an application for an aquatic plant management permit contain an aquatic plant management plan that describes how the aquatic plants will be introduced, controlled, removed or disposed. Requirements for an aquatic plant management plan shall be made in writing stating the reason for the plan requirement. In deciding whether to require a plan, the department shall consider the potential for effects on protection and development of diverse and stable communities of native aquatic plants, for conflict with goals of other written ecological or lake management plans, for cumulative impacts and effect on the ecological values in the body of water, and the long-term sustainability of beneficial water use activities."

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

APPROACH

1. After January 1, 2009* no individual permits for control of native aquatic plants will be issued. Treatment of native species may be allowed under the auspices of an approved lake management plan, and only if the plan clearly documents "impairment of navigation" and/or "nuisance conditions". Until January 1, 2009, individual permits will be issued to previous permit holders, only with adequate documentation of "impairment of navigation" and/or "nuisance conditions". No new individual permits will be issued during the interim.

2. Control of aquatic plants (if allowed) in documented sensitive areas will follow the conditions specified in the report.

3. Invasive species must be controlled under an approved lake management plan, with two exceptions (these exceptions are designed to allow sufficient time for lake associations to form and subsequently submit an approved lake management plan):
   a. Newly-discovered infestations. If found on a lake with an approved lake management plan, the invasive species can be controlled via an amendment to the approved plan. If found on a lake without an approved management plan, the invasive species can be controlled under the WDNR's Rapid Response protocol (see definition), and the lake owners will be encouraged to form a lake association and subsequently submit a lake management plan for WNDR review and approval.
   b. Individuals holding past permits for control of *invasive* aquatic plants and/or "mixed stands" of native and invasive species will be allowed to treat via individual permit until January 1, 2009 if "impairment of navigation" and/or "nuisance conditions" is adequately documented, unless there is an approved lake management plan for the lake in question.

4. Control of invasive species or "mixed stands" of invasive and native plants will follow current best management practices approved by the Department and contain an explanation of the strategy to be used. Established stands of invasive plants will generally use a control strategy based on Spring treatment. (typically, a water temperature of less than 60 degrees Fahrenheit, or approximately May 31st, annually).

5. Manual removal (see attached definition) is allowed (Admin. Code NR 109.06).

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* *Exceptions to the Jan. 1, 2009 deadline will be considered only on a very limited basis and will be intended to address unique situations that do not fall within the intent of this approach.*

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

DOCUMENTATION OF IMPAIRED NAVIGATION AND/OR NUISANCE CONDITIONS

Navigation channels can be of two types:

- Common use navigation channel. This is a common navigation route for the general lake user. It often is off shore and connects areas that boaters commonly would navigate to or across, and should be of public benefit.

- Individual riparian access lane. This is an access lane to shore that normally is used by an individual riparian shore owner.

Severe impairment or nuisance will generally mean vegetation grows thickly and forms mats on the water surface. Before issuance of a permit to use a regulated control method, a riparian will be asked to document the problem and show what efforts or adaptations have been made to use the site. (This is currently required in NR 107 and on the application form, but the following helps provide a specific description of what impairments exist from native plants).

Documentation of *impairment of navigation* by native plants must include:

a. Specific locations of navigation routes (preferably with GPS coordinates)
b. Specific dimensions in length, width, and depth
c. Specific times when plants cause the problem and how long the problem persists
d. Adaptations or alternatives that have been considered by the lake shore user to avoid or lessen the problem
e. The species of plant or plants creating the nuisance (documented with samples or a from a Site inspection)

Documentation of the *nuisance* must include:

a. Specific periods of time when plants cause the problem, e.g. when does the problem start and when does it go away.
b. Photos of the nuisance are encouraged to help show what uses are limited and to show the severity of the problem.
c. Examples of specific activities that would normally be done where native plants occur naturally on a site but can not occur because native plants have become a nuisance.

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

DEFINITIONS

Manual removal: Removal by hand or hand-held devices without the use or aid of external or auxiliary power. Manual removal cannot exceed 30 ft. in width and can only be done where the shore is being used for a dock or swim raft. The 30 ft. wide removal zone cannot be moved, relocated, or expanded with the intent to gradually increase the area of plants removed. Wild rice may not be removed under this waiver.

Native aquatic plants: Aquatic plants that are indigenous to the waters of this state.

Invasive aquatic plants: Non-indigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Sensitive area: Defined under s. NR 107.05(3)(i) (sensitive areas are areas of aquatic vegetation identified by the department as offering critical or unique fish and wildlife habitat, including seasonal or lifestage requirements, or offering water quality or erosion control benefits to the body of water).

Rapid Response protocol: This is an internal WDNR document designed to provide guidance for grants awarded under NR 198.30 (Early Detection and Rapid Response Projects). These projects are intended to control pioneer infestations of aquatic invasive species before they become established.