# Horsehead Lake

Oneida County, Wisconsin

# Aquatic Plant Management Plan

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## Acknowledgements

This management planning effort was truly a team-based project and could not have been completed without the input of the following individuals:

# TABLE OF CONTENTS



# FIGURES



# TABLES



# PHOTOS



# MAPS



# APPENDICES

# 1.0 INTRODUCTION

Horsehead Lake, Oneida County, is a headwater drainage lake with a maximum depth of 11 feet and a mean depth of 8 feet. Water flows out of Horsehead Lake into Horsehead Creek and eventually into the Wisconsin River (Figure 1.0-1). This eutrophic lake has a relatively small watershed when compared to the size of the lake with a watershed to lake area ratio of 2:1. Horsehead Lake contains 40 native plant species, of which flat-stem pondweed is the most common. Two submerged exotic plant species are known to exist in Horsehead Lake.

In the summer of 2003, staff from the WDNR verified the presence of curly-leaf pondweed (*Potamogeton crispus*; CLP) in Horsehead Lake. In 2007, Eurasian watermilfoil (*Myriophyllum spicatum*; EWM) was also confirmed within Horsehead Lake. Due to the possible negative effects associated with these exotic species, including loss of important native plant communities and their associated habitat value, water quality degradation, reductions in recreational opportunities, decreased aesthetic value, and loss of economic vitality, CLP and EWM have continued to be monitored within the lake.

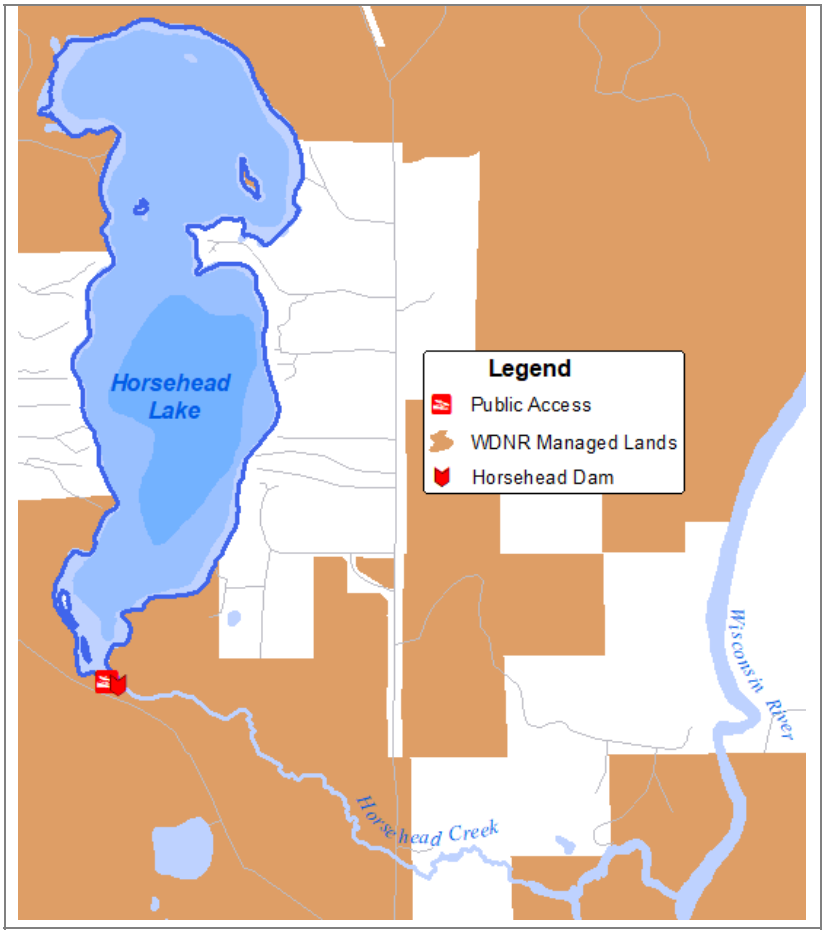



**Figure 1.0-1. Horsehead Lake, Oneida County, WI.**

Horsehead Lake is managed by Horsehead Lake Protection and Rehabilitation District No. 1 (HLPRD) which was formed in 1976, the first formed in the state of Wisconsin. Shortly after its formation, the district received approval to construct a dam at the outlet of the lake to help manage fluctuating water levels. The HLPRD since has completed a comprehensive management plan in 2011, updated that plan in 2020, and continued monitoring and management of AIS within the lake.

# 2.0 STAKEHOLDER PARTICIPATION

The HLPRD completed a comprehensive management planning project in 2020 and this project was focused upon updating the aquatic plant management components of that plan as needed. The comprehensive project had an extensive stakeholder participation component. This focused project utilized the experience of the HLPRD Board of Commissioners and their interactions with their constituents as the primary method of stakeholder engagement.

The highlights of this component are described below. Materials used during the planning process can be found in Appendix A.

## 2.1 District Board of Commissioners Meeting

On May 24, 2023 Josephine Barlament of Onterra met with members of the Horsehead Lake Board of Commissioners for about one hour. In advance of the meeting, attendees were provided an early draft of the study report to facilitate better discussion. The primary focus of this meeting was the delivery of the study results, conclusions, and to update Goals 2 and 3 from the Implementation Plan with the commissioners. All study components including Eurasian watermilfoil/curly-leaf pondweed survey results and aquatic plant inventories were presented and discussed.

## 2.2 Management Plan Review and Adoption Process

*Summary to be included in Final Draft.*

# 3.0 AQUATIC PLANTS

## 3.1 Primer on Aquatic Plant Data Analysis & Interpretation

Native aquatic plants are an important element in every healthy aquatic ecosystem, providing food and habitat to wildlife, improving water quality, and stabilizing bottom sediments. Because most aquatic plants are rooted in place and are unable to relocate in wake of environmental alterations, they are often the first community to indicate that changes may be occurring within the system. Aquatic plant communities can respond in a variety of ways; there may be increases or declines in the occurrences of some species, or a complete loss. Or, certain growth forms, such as emergent and floating-leaf communities may disappear from certain areas of the waterbody. With periodic monitoring and proper analysis, these changes are relatively easy to detect and provide relevant information for making management decisions.

The point-intercept method as described Wisconsin Department of Natural Resources Bureau of Science Services, PUB-SS-1068 2010 (Hauxwell, et al., 2010) has been conducted on Horsehead Lake in 2007, 2017, and 2022. At each point-intercept location within the *littoral zone*, information regarding the depth, substrate type (soft sediment, sand, or rock), and the plant species sampled along with their relative abundance on the sampling rake was recorded.

A pole-mounted rake was used to collect the plant samples, depth, and sediment information at point locations of 15 feet or less. A rake head tied to a rope (rope rake) was used at sites greater than 15 feet. Depth information was collected using graduated marks on the pole of the rake (at depths < 15 ft) or using an onboard sonar unit (at depths > 15 feet). Also, when a rope rake was used, information regarding substrate type was not collected due to the inability of the sampler to accurately "feel" the bottom with this sampling device. At each point that is sampled the surveyor records a total rake fullness (TRF) value ranging from 0-3 as a somewhat subjective indication of plant biomass. The point-intercept survey produces a great deal of information about a lake's aquatic vegetation and overall health. These data are analyzed and presented in numerous ways; each is discussed in more detail the following section.

### *Species List*

The species list is simply a list of all of the aquatic plant species, both native and non-native, that were located during the surveys completed in Horsehead Lake. The list also contains each species' scientific name, common name, status in Wisconsin, and coefficient of conservatism. The latter is discussed in more detail below. Changes in this list over time, whether it is differences in total species present, gains and losses of individual species, or changes in growth forms that are present, can be an early indicator of changes in the ecosystem.

### *Frequency of Occurrence*

Frequency of occurrence describes how often a certain aquatic plant species is found within a lake. Obviously, all of the plants cannot be counted in a lake, so samples are collected from pre-determined areas. In the case of the whole-lake point-intercept surveys that have been completed; plant samples were collected from plots laid out on a grid that covered the lake. Using the data collected from these plots, an estimate of occurrence of each plant species can be determined. The

**Littoral Zone** is the area of a lake where sunlight is able to penetrate down to the sediment and support aquatic plant growth.

occurrence of aquatic plant species is displayed as the *littoral frequency of occurrence*. Littoral frequency of occurrence is used to describe how often each species occurred in the plots that are within the maximum depth of plant growth (littoral zone), and is displayed as a percentage.

Relative frequency of occurrence uses the littoral frequency for occurrence for each species compared to the sum of the littoral frequency of occurrence from all species. These values are presented in percentages and if all of the values were added up, they would equal 100%. For example, if water lily had a relative frequency of 0.1 and we described that value as a percentage, it would mean that water lily made up 10% of the population.

## *Floristic Quality Assessment*

The floristic quality of a lake's aquatic plant community is calculated using its native *species richness* and their *average conservatism*. Species richness is the number of native aquatic plant species that were physically encountered on the rake during the point-intercept survey. Average conservatism is calculated by taking the sum of the coefficients of conservatism (C-values) of the native species located and dividing it by species richness. Every plant in Wisconsin has been assigned a coefficient of conservatism, ranging from 1-10, which describes the likelihood of that species being found in an undisturbed environment. Species which are more specialized and require undisturbed habitat are given higher coefficients, while species which are more tolerant of environmental disturbance have lower coefficients.

For example, algal-leaf pondweed (*Potamogeton confervoides*) is only found in nutrient-poor, acid lakes in northern Wisconsin and is prone to decline if degradation of these lakes occurs. Because of algal-leaf pondweed's special requirements and sensitivity to disturbance, it has a C-value of 10. In contrast, sago pondweed (*Stuckenia pectinata*) with a C-value of 3, is tolerant of disturbance and is often found in greater abundance in degraded lakes that have higher nutrient concentrations and low water clarity. Higher average conservatism values generally indicate a healthier lake as it is able to support a greater number of environmentally-sensitive aquatic plant species. Low average conservatism values indicate a degraded environment, one that is only able to support disturbance-tolerant species.

On their own, the species richness and average conservatism values for a lake are useful in assessing a lake's plant community; however, the best assessment of the lake's plant community health is determined when the two values are used to calculate the lake's floristic quality. The floristic quality is calculated using the species richness and average conservatism value of the aquatic plant species that were solely encountered on the rake during the point-intercept surveys (equation shown below). This assessment allows the aquatic plant community of Horsehead Lake to be compared to other lakes within the region and state.

$$FQI = \text{Average Coefficient of Conservatism} * \sqrt{\text{Number of Native Species}}$$

Horsehead Lake falls within the Northern Lakes and Forests (NLF) *ecoregion* (Figure 3.1-1), and the floristic quality of its aquatic plant community will be compared to other lakes within this ecoregion as well as the entire State of Wisconsin. Ecoregions are areas related by similar climate, physiography, hydrology, vegetation and wildlife potential. Comparing ecosystems within the same ecoregion is sounder than comparing systems within manmade boundaries such as counties, towns, or states. Ecoregional and state-wide medians were calculated from whole-lake point-intercept surveys conducted on 392 lakes throughout Wisconsin by Onterra and WDNR ecologists.

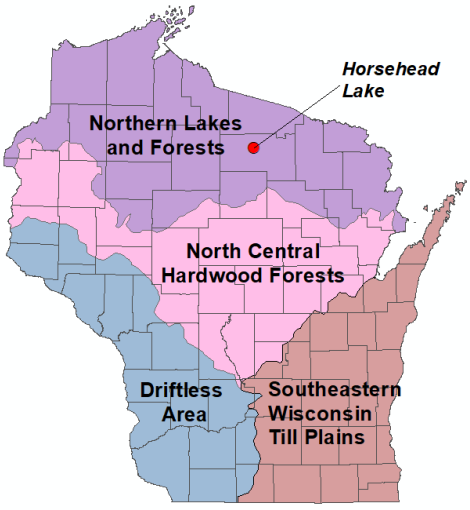



**Figure 3.1-1. Location of Horsehead Lake within the ecoregions of Wisconsin.** After (Nichols, 1999).

## *Species Diversity*

Species diversity is often confused with species richness. As defined previously, species richness is simply the number of species found within a given community. While species diversity utilizes species richness, it also takes into account evenness or the variation in abundance of the individual species within the community. For example, a lake with 10 aquatic plant species that had relatively similar abundances within the community would be more diverse than another lake with 10 aquatic plant species were 50% of the community was comprised of just one or two species.

An aquatic system with high species diversity is more stable than a system with a low diversity. This is analogous to a diverse financial portfolio in that a diverse aquatic plant community can withstand environmental fluctuations much like a diverse portfolio can handle economic fluctuations. Some managers believe a lake with a diverse plant community is also better suited to compete against exotic infestations than a lake with a lower diversity. However, in a recent study of 1,100 Minnesota lakes, researchers concluded that more diverse communities were not more resistant or resilient to invaders (Muthukrishnan, Davis, Jordan, & Forester, 2018).

The diversity of a lake's aquatic plant community is determined using the Simpson's Diversity Index (1-D):

$$D = \sum (n/N)^2$$

where: n = the total number of instances of a particular species
N = the total number of instances of all species
D is a value between 0 and 1

If a lake has a diversity index value of 0.90, it means that if two plants were randomly sampled from the lake there is a 90% probability that the two individuals would be of a different species. The Simpson's Diversity Index value from Horsehead Lake is compared to data collected by Onterra and the WDNR Science Services on 212 lakes within the Northern Lakes and Forests (lakes only, does not include flowages) Ecoregion and on 392 lakes throughout Wisconsin.

## 3.2 Horsehead Lake Aquatic Plant Survey Results

Whole-lake point-intercept surveys have been completed on Horsehead Lake in 2007, 2017, and 2022. This report will highlight the 2022 point-intercept survey results and will integrate comparisons to the previous 2007 and 2017 surveys throughout the section. The 2022 aquatic plant results are also located in Appendix B.

The data that continues to be collected from Wisconsin lake's is revealing that aquatic plant communities are highly dynamic, and populations of individual species have the capacity to fluctuate, sometimes greatly, in their occurrence from year to year and over longer periods of time. These fluctuations can be driven by a combination of natural factors including variations in temperature, ice and snow cover (winter light availability), nutrient availability, water levels and flow, water clarity, length of the growing season, herbivory, disease, and competition (Lacoul & Freedman, 2006). Adding to the complexity of factors which affect aquatic plant community dynamics, human-related disturbances such as the application of herbicides for non-native plant management, mechanical harvesting, watercraft use, and pollution runoff also affect aquatic plant community composition (Asplund & Cook, 1997); (Lacoul & Freedman, 2006).

During the 2022 point-intercept survey, information regarding substrate type was collected at locations sampled with a pole-mounted rake (less than 15 feet). These data indicate that 97% of the point-intercept locations contained soft organic sediments, 2% contained sand, and 1% contained rock (Figure 3.2-1). The soft organic sediment throughout the majority of Horsehead Lake is very conducive for supporting lush aquatic plant growth.

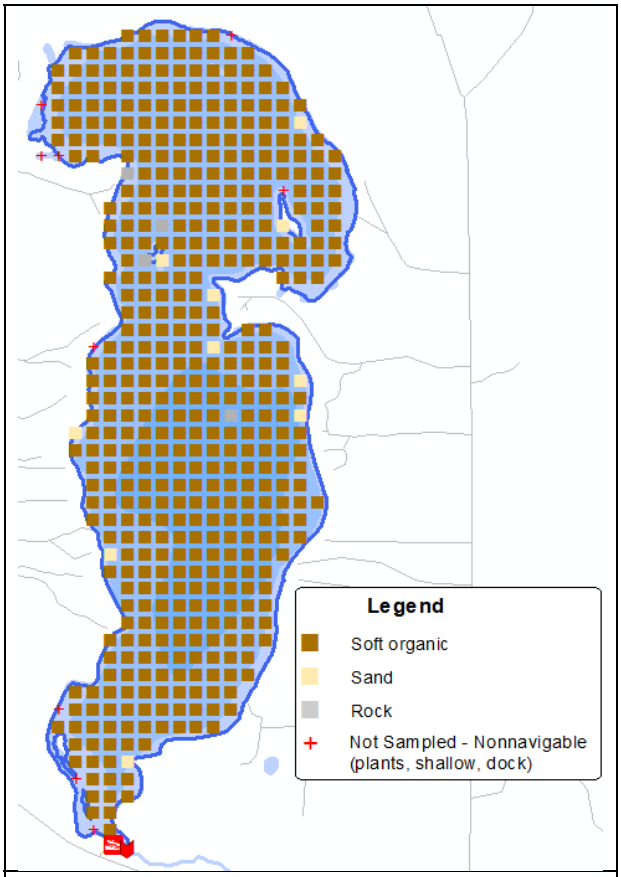



**Figure 3.2-1. Horsehead Lake proportion of substrate types within littoral areas.** Created using data from 2022 point-intercept survey.

Lakes in Wisconsin vary in their morphometry, water chemistry, water clarity, substrate composition, management, and recreational use, all factors which influence aquatic plant community composition. Like terrestrial plants, different aquatic plant species are adapted to grow in certain substrate types; some species are only found growing in soft substrates, others only in sandy/rocky areas, and some can be found growing in either. The combination of both soft sediments and areas of harder substrates creates different habitat types for aquatic plants, and generally leads to a higher number of aquatic plant species within the lake.

Table 3.2-1 displays all of the 43 species documented during the 2007, 2017, and 2022 point-intercept surveys on Horsehead Lake. Table 3.2-1 is organized by growth form which separates out species based on whether they are emergent species, floating-leaf species, submergent species,

or free-floating species. Species with an "X" on the table indicates the species was physically encountered on the survey rake during the point-intercept survey. Additional species are known to be present within the lake and were visually observed, these species are marked in the species list with an "I" for incidental. Species that are present in low amounts in the system can also sometimes not be detected by the point-intercept survey methodology.

**Table 3.2-1. Aquatic plant species located in the 2007, 2017, and 2022 point-intercept surveys.**

| Growth Form | Scientific Name | Common Name | Status in Wisconsin | Coefficient of Conservatism | 2007 | 2017 | 2022 |
|---|---|---|---|---|---|---|---|
| Emergent | *Alisma trivale* | Northern water-plantain | Native | 4 | X | | |
| | *Calla palustris* | Water arum | Native | 9 | X | I | |
| | *Carex comosa* | Bristly sedge | Native | 5 | X | I | |
| | *Carex utriculata* | Common yellow lake sedge | Native | 7 | | I | |
| | *Eleocharis palustris* | Creeping spikerush | Native | 6 | | I | |
| | *Iris pseudacorus* | Pale-yellow iris | Non-Native - Invasive | N/A | | I | I |
| | *Iris versicolor* | Northern blue flag | Native | 5 | | I | |
| | *Juncus effusus* | Soft rush | Native | 4 | | I | |
| | *Sagittaria latifolia* | Common arrowhead | Native | 3 | X | I | |
| | *Schoenoplectus acutus* | Hardstem bulrush | Native | 5 | | I | |
| | *Schoenoplectus tabernaemontani* | Softstem bulrush | Native | 4 | X | I | |
| | *Typha spp.* | Cattail spp. | Unknown (Sterile) | N/A | X | I | |
| FL | *Brasenia schreberi* | Watershield | Native | 7 | X | X | |
| | *Nuphar variegata* | Spatterdock | Native | 6 | X | X | X |
| | *Nymphaea odorata* | White water lily | Native | 6 | X | X | X |
| | *Persicaria amphibia* | Water smartweed | Native | 5 | X | | |
| | *Sparganium angustifolium* | Narrow-leaf bur-reed | Native | 9 | X | I | |
| FL/E | *Sparganium emersum var. acaule* | Short-stemmed bur-reed | Native | 8 | X | | |
| | *Sparganium sp.* | Bur-reed sp. | Native | N/A | | I | |
| Submergent | *Ceratophyllum demersum* | Coontail | Native | 3 | X | X | X |
| | *Chara spp.* | Muskgrasses | Native | 7 | | X | X |
| | *Elodea canadensis* | Common waterweed | Native | 3 | X | X | X |
| | *Heteranthera dubia* | Water stargrass | Native | 6 | | | X |
| | *Myriophyllum sibiricum* | Northern watermilfoil | Native | 7 | X | X | X |
| | *Myriophyllum spicatum* | Eurasian watermilfoil | Non-Native - Invasive | N/A | I | | |
| | *Najas flexilis* | Slender naiad | Native | 6 | | | X |
| | *Najas guadalupensis* | Southern naiad | Native | 7 | | | X |
| | *Nitella spp.* | Stoneworts | Native | 7 | X | | X |
| | *Potamogeton amplifolius* | Large-leaf pondweed | Native | 7 | X | X | X |
| | *Potamogeton berchtoldii & P. pusillus* | Slender and small pondweed | Native | 7 | X | | X |
| | *Potamogeton crispus* | Curly-leaf pondweed | Non-Native - Invasive | N/A | X | X | |
| | *Potamogeton gramineus* | Variable-leaf pondweed | Native | 7 | X | | |
| | *Potamogeton natans* | Floating-leaf pondweed | Native | 5 | | I | |
| | *Potamogeton pusillus* | Small pondweed | Native | 7 | X | | X |
| | *Potamogeton richardsonii* | Clasping-leaf pondweed | Native | 5 | X | X | X |
| | *Potamogeton robbinsii* | Fern-leaf pondweed | Native | 8 | X | X | X |
| | *Potamogeton zosteriformis* | Flat-stem pondweed | Native | 6 | X | X | X |
| | *Sagittaria sp. (rosette)* | Arrowhead sp. (rosette) | Native | N/A | | X | |
| | *Stuckenia pectinata* | Sago pondweed | Native | 3 | X | X | |
| | *Vallisneria americana* | Wild celery | Native | 6 | X | X | X |
| S/E | *Juncus pelocarpus* | Brown-fruited rush | Native | 8 | X | | |
| FF | *Lemna minor* | Lesser duckweed | Native | 5 | X | | X |
| | *Lemna trisulca* | Forked duckweed | Native | 6 | | | X |

*X = Located on rake during point-intercept survey; I = Incidentally located; not located on rake during point-intercept survey*
*FL = Floating-leaf; F/L = Floating-leaf & Emergent; S/E = Submergent and/or Emergent; FF = Free-floating*

A total of 43 aquatic plant species were recorded in Horsehead Lake during the 2007, 2017, and 2022 point-intercept surveys. Of these 43 species, flat-stem pondweed (*Potamogeton zosteriformis*), common waterweed (*Elodea canadensis*), and coontail (*Ceratophyllum*

*demersum*), were the most frequently encountered (Photo 3.2-1). Although EWM is known to exist in Horsehead Lake, no Eurasian watermilfoil plants were documented during the 2022 survey. Curly-leaf pondweed was found at one location during the early-season AIS survey in 2022. Because of their ecological, economical, and sociological significance, the non-native plants and their management in Horsehead Lake are discussed in the subsequent *Non-Native Aquatic Plants in Horsehead Lake* subsection (3.3).

Flat-stem pondweed was the most frequently encountered aquatic plant in Horsehead Lake in 2007, 2017, and 2022 (Figure 3.2-2). Flat-stem pondweed is often more abundant in productive lakes with soft sediments like Horsehead Lake. Flat-stem pondweed, as its name implies, can be distinguished from other thin-leaved pondweeds by its conspicuously flattened stem. Flat-stem pondweed can attain heights of 10 feet or greater, and provides excellent structural habitat for aquatic wildlife. In 2022 flat-stem pondweed was found at 54% of the point-intercept locations and also growing at various depths ranging from 2 to 11 feet (Figure 3.2-2).

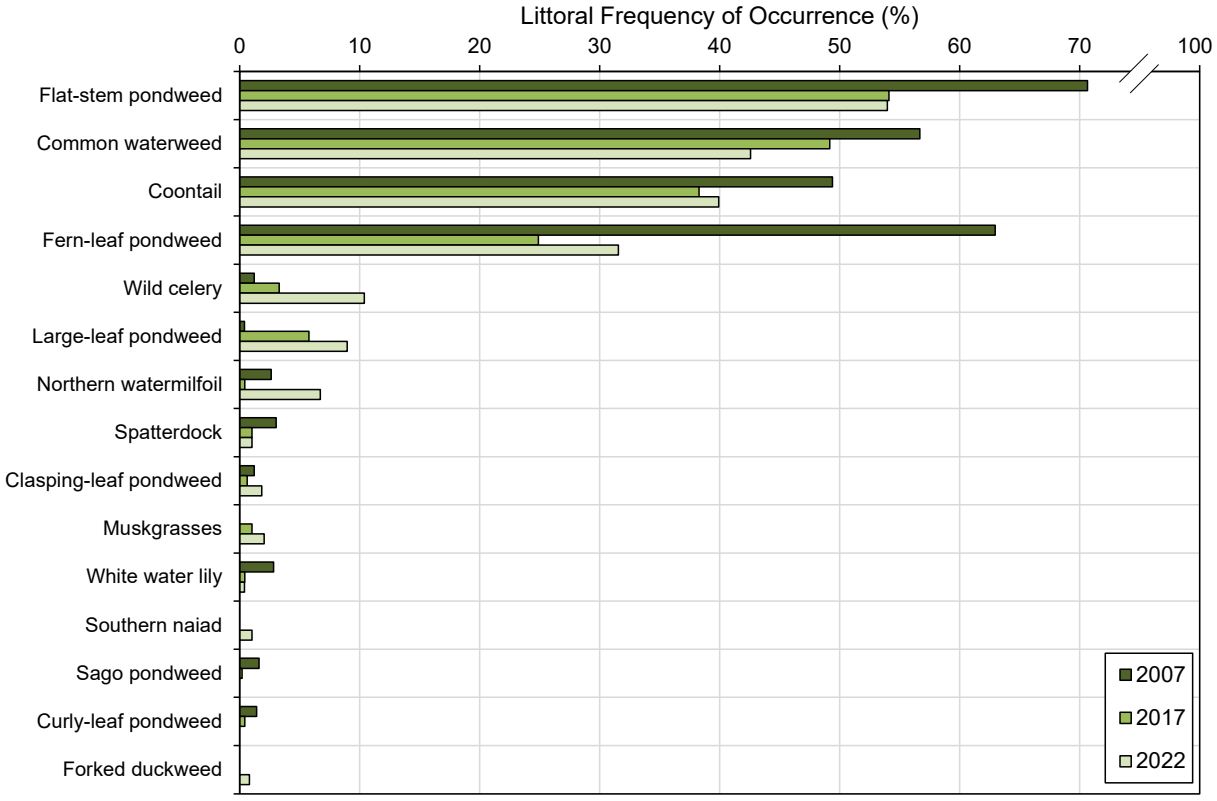
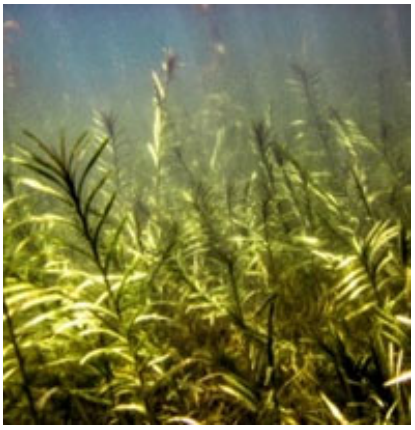



**Figure 3.2-2. Horsehead Lake 2007, 2017, and 2022 LFOO.** LFOO = littoral frequency of occurrence of plants with an occurrence of 1% or more.

Common waterweed was the second most frequently encountered aquatic plant in Horsehead Lake in 2022 (Figure 3.2-2). Common waterweed is an interesting plant in that although it sometimes produces root-like structures that bury themselves into the sediment, it is largely an unrooted plant that can obtain nutrients directly from the water. As a result, this plant's location in a lake can be dependent upon water movement. In 2022 common waterweed was found at 42.6% of the point-intercept locations and also growing at various depths ranging from 1 to 10 feet (Figure 3.2-2).

Coontail was the third most frequently encountered aquatic plants in Horsehead Lake in 2022 (Figure 3.2-2). Coontail has whorls of leaves which fork into two to three segments and provides ample surface area for the growth of periphyton and habitat for invertebrates. Unlike most of the submersed plants found in Wisconsin, coontail does not produce true roots and is often found growing entangled amongst other aquatic plants or matted at the surface. Because it lacks true roots, coontail derives most of its nutrients directly from the water (Gross, Erhard, & Ivanyi, 2003). This ability, in combination with a tolerance for low-light conditions, allows coontail to become more abundant in eutrophic waterbodies with higher nutrients and low water clarity. Coontail has the capacity to form dense beds that can float and mat on the water's surface. In 2022 coontail was found at 39.9% of the point-intercept locations and also growing at various depths ranging from 1 to 11 feet (Figure 3.2-2).

| Fern-leaf pondweed | Common waterweed | Coontail |
|---|---|---|
|  |  |  |

**Photograph 3.2-1. Common aquatic plant species found within Horsehead Lake.** Photograph credit Onterra.

As its name indicates, fern-leaf pondweed resembles a terrestrial fern frond in appearance (Figure 3.4-5), and is often a dominant species in plant communities of northern Wisconsin lakes. Fern pondweed is generally found growing in thick beds over soft substrates, where it stabilizes bottom sediments and provides a dense network of structural habitat for aquatic wildlife.

While at lower abundances, slender and southern naiads were located within the lake in 2022. Neither of these species were observed or encountered on the rake in the 2007 or 2017 plant survey.

Slender naiad is one of five naiad species that can be found in Wisconsin and is also the most common (Photograph 3.2-2). Slender naiad is an annual, meaning it reproduces via seed each year. Ongoing monitoring of aquatic plant communities in Wisconsin is indicating that the occurrence of this species can be highly variable from year to year, likely due to changes in suitability for seed germination. The numerous seeds produced by slender naiad have been shown to be an important food source for wildlife, including migratory waterfowl.

Though southern naiad is native to North America, it has been observed to be exhibiting aggressive growth in some northern Wisconsin lakes in recent years. In Big Sand Lake, Vilas County, southern naiad increased in occurrence to become one of the most abundant plant species in the lake between 2006 and 2016, increasing in littoral occurrence from <5% to 37%, respectively (Onterra 2017). It has since declined somewhat to a littoral occurrence of 27%, but remains one of the most abundant plants in the lake. Similarly, downstream from Big Sand Lake in Long Lake, southern naiad was first recorded in 2012 with a littoral occurrence of 1%. By 2017, it had become the most frequently encountered plant in the lake with a littoral occurrence of 29%.

The rapid population growth of southern naiad in some northern Wisconsin lakes has some ecologists questioning whether this species was historically present in these waterbodies or if it represents a recent introduction, likely via watercraft. While closely related to slender naiad, southern naiad is often perennial and lacking fruit (Les, Sheldon, & Tippery, 2010). Emerging research indicates that hybrids between southern naiad subspecies exist and are often observed growing aggressively and reaching nuisance levels in certain lakes. Continued monitoring of the aquatic plant community will track the occurrence of these species within Horsehead Lake.

**Photograph 3.2-2. Slender naiad, (left frame) and Southern naiad (right frame).** Photograph credit Onterra.

As explained above in the Primer on Data Analysis and Data Interpretation Section, the littoral frequency of occurrence analysis allows for an understanding of how often each of the plants is located during the point-intercept survey. Because each sampling location may contain numerous plant species, relative frequency of occurrence is one tool to evaluate how often each plant species is found in relation to all other species found (composition of population). For instance, while flat-stem pondweed was found at 54% of the sampling locations in Horsehead Lake, its relative frequency of occurrence is 26.6%. Explained another way, if 100 plants were randomly sampled from Horsehead Lake, 27 of them would be flat-stem pondweed. Looking at relative frequency of occurrence (Figure 3.2-3), six species comprise approximately 92.5% of the plant community in Horsehead Lake.

The calculations used for the Floristic Quality Index (FQI) for a lake's aquatic plant community are based on the aquatic plant species that were encountered on the rake during the point-intercept survey and does not include incidental species. The native aquatic plant species located on the rake during the point-intercept surveys in 2022 and their conservatism values were used to calculate the FQI for each waterbody within the system.

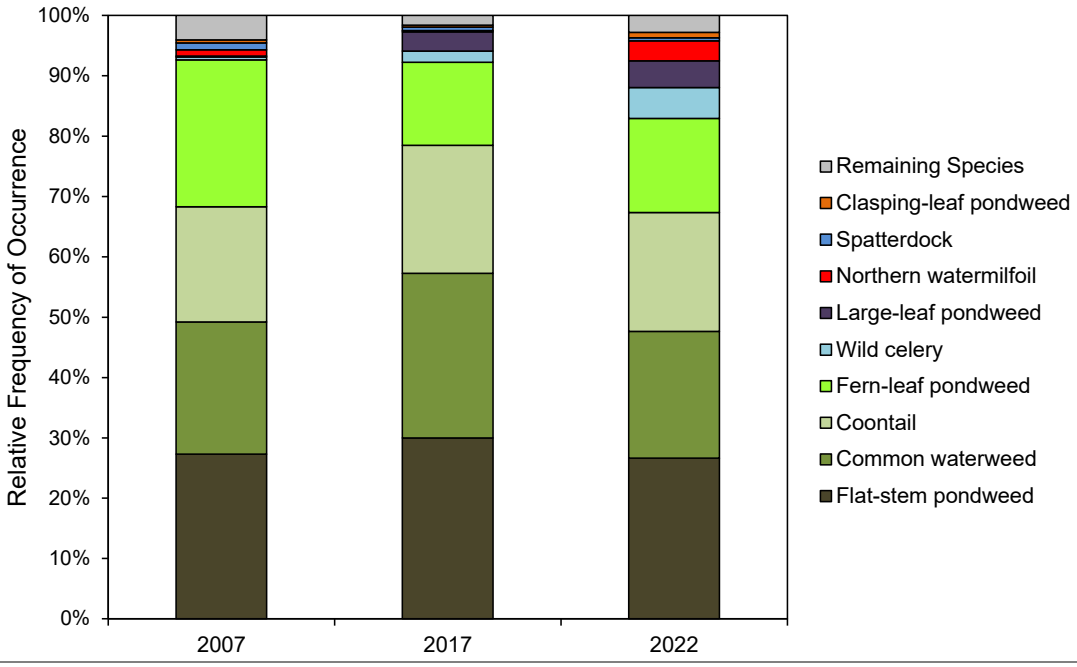



**Figure 3.2-3. Horsehead Lake aquatic plant relative frequency of occurrence.** Created using data from 2007, 2017, and 2022 survey.

A comparison of the species richness, average conservatism, and floristic quality from each of the two point-intercept surveys in Horsehead Lake is displayed on Figure 3.2-4. In the 2022 point-intercept survey, the total richness was 18 compared to 26 in 2007. Average conservatism values increased from 5.6 in 2007 to 6.0 in 2022. The floristic quality in Horsehead Lake was 28.6 in 2007 which is slightly higher than the 2022 survey at 25.5. The 2022 values were all slightly below the ecoregion and state median values.

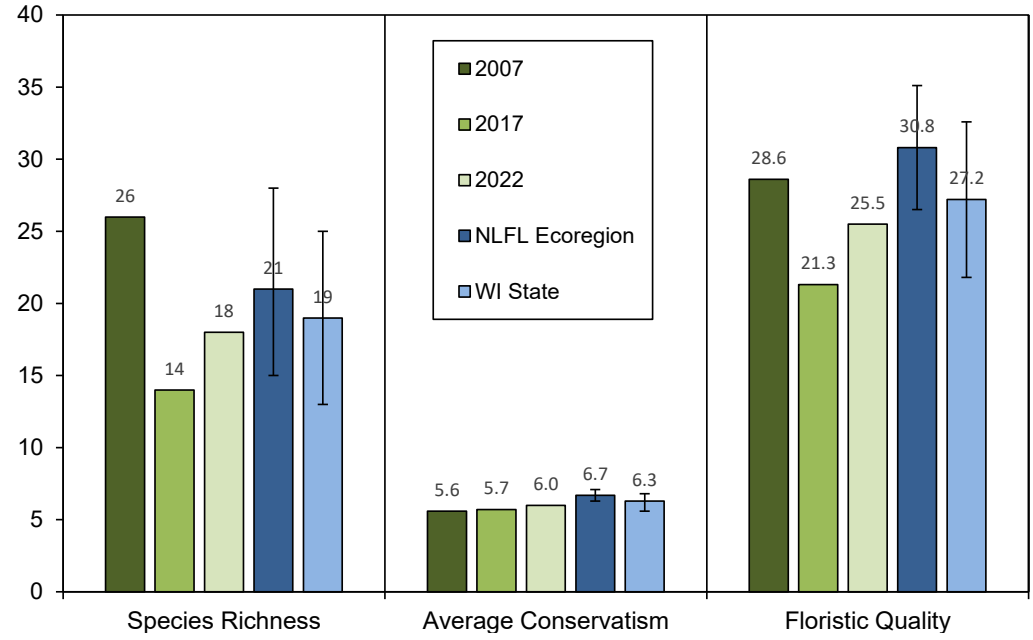



**Figure 3.2-4. Species richness, average coefficient of conservatism, and FQI.** Created using data from 2007, 2017, and 2022 point-intercept surveys.

While a method for characterizing diversity values of fair, poor, etc. does not exist, lakes within the same ecoregion may be compared to provide an idea of how Horsehead Lake's diversity values rank. Using data collected by Onterra and WDNR Science Services, quartiles were calculated for 212 lakes within the NLFL Ecoregion (Figure 3.2-5). Using the data collected from the whole-lake point-intercept surveys, Horsehead Lake was found to have an aquatic plant species diversity value of 0.82 in 2022 which is at the lower quartile range for the NLFL Ecoregion but is the highest recorded value since surveying of aquatic plants began in 2007.

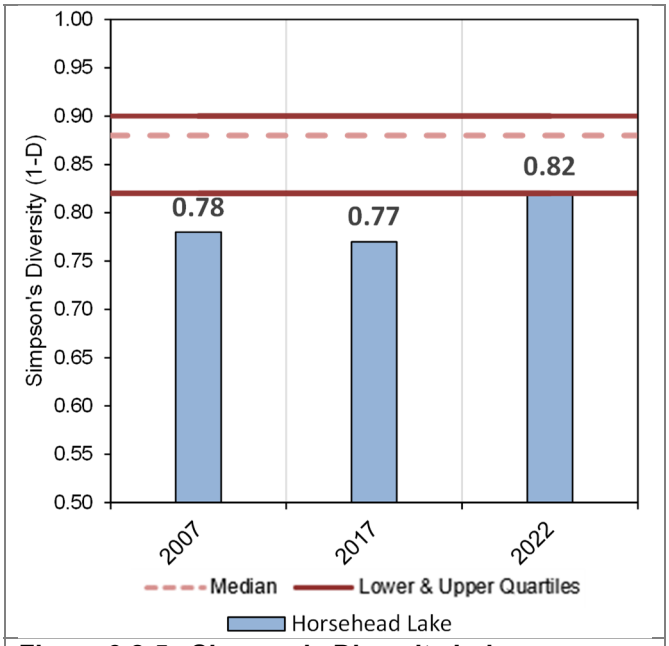



**Figure 3.2-5. Simpson's Diversity Index.**

## 3.3 Non-native Aquatic Plants in Horsehead Lake

### *Eurasian watermilfoil (Myriophyllum spicatum)*

One of the submersed non-native aquatic plants known to be present within Horsehead Lake is Eurasian watermilfoil (*Myriophyllum spicatum*). Eurasian watermilfoil (EWM) is an invasive species, native to Europe, Asia and North Africa, that has spread to most counties in Wisconsin (Figure 3.3-1). Eurasian watermilfoil is unique in that its primary mode of propagation is not by seed. It actually spreads by shoot fragmentation, which has supported its transport between lakes via boats and other equipment. In addition to its propagation method, EWM has two other competitive advantages over native aquatic plants: 1) it starts growing very early in the spring when water temperatures are too cold for most native plants to grow, and 2) once its stems reach the water surface, it sometimes does not stop growing like most native plants and instead continues to grow along the surface creating a canopy that blocks light from reaching native plants.

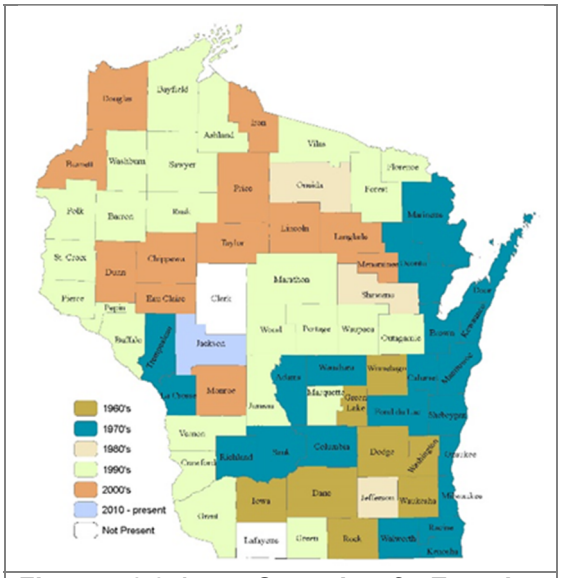


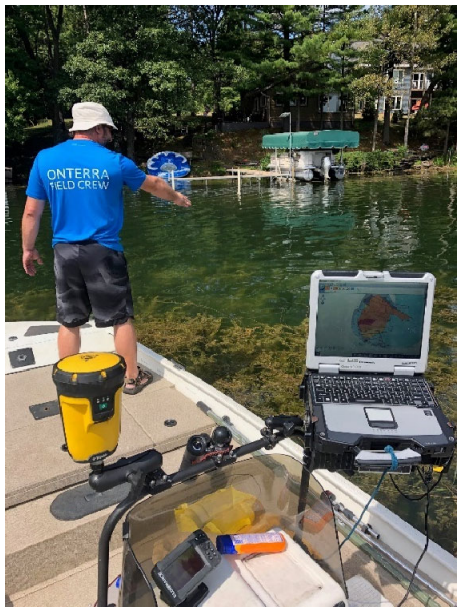

**Figure 3.3-1. Spread of Eurasian watermilfoil within WI counties.** WDNR Data 2022 mapped by Onterra.

Eurasian watermilfoil can create dense stands and dominate submergent communities, reducing important natural habitat for fish and other wildlife, and impeding recreational activities such as swimming, fishing, and boating. However, in some lakes, EWM appears to integrate itself within the community without becoming a nuisance or having a measurable impact to the ecological function of the lake.

It is important to note that two types of surveys are discussed in the subsequent materials: 1) whole lake point-intercept surveys and 2) AIS mapping survey.

The point-intercept survey provides a standardized way to gain quantitative information about a lake's aquatic plant population through visiting predetermined locations and using a rake sampler to identify all the plants at each location. The point-intercept survey can be applied at various scales. Most commonly, the point-intercept survey is applied at the whole-lake scale to provide a lake-wide assessment of the overall plant community.

While the point-intercept survey is a valuable tool to understand the overall plant population of a lake, it does not offer a full account (census) of where a particular species exists in the lake. During the AIS mapping survey, the entire littoral area of the lake is surveyed through visual observations from the boat (Photograph 3.3-1). Field crews supplemented the visual survey by deploying a submersible camera along with periodically doing rake tows. The AIS population is mapped using sub-meter GPS technology by using either 1) point-based or 2) area-based methodologies. Large colonies >40 feet in diameter are mapped using polygons (areas) and are qualitatively attributed a density rating based upon a five-tiered scale from *highly scattered* to *surface matting*. Point-based techniques were applied to AIS locations that were considered as *small plant colonies* (<40 feet in diameter), *clumps of plants*, or *single or few plants*.




**Photograph 3.3-1. AIS mapping survey.** Photo credit Onterra.

Overall, each survey has its strengths and weaknesses, which is why both are utilized in different ways as part of this project.

### *EWM population of Horsehead Lake*

Eurasian watermilfoil (EWM; Photograph 3.5-5) was first documented in Horsehead Lake in 2007 by Onterra ecologists during an early-season AIS survey aimed at mapping CLP. This initial discovery was comprised of a few plants located right near the public boat landing on the lake's south end. Onterra ecologists came out to survey the population in subsequent years and made an effort to hand-pull every EWM occurrence.

In the years since 2007, EWM was never observed outside of the small bay near the boat landing where it was originally discovered. Prior to 2022, the most recent survey completed for EWM in Horsehead Lake was in 2017, and that survey did not find any EWM occurrences. The last observed occurrence of EWM within Horsehead Lake was in 2013. During the aquatic plant surveys completed over the course of the summer in 2022, Onterra ecologists did not locate any EWM occurrences in Horsehead Lake. If EWM is still present in Horsehead Lake, it exists at an undetectable level which escaped detection for these plant surveys. Ongoing monitoring for EWM in Horsehead Lake should continue so any potential increases in its population can be detected early.

## *Curly-leaf Pondweed (Potamogeton crispus)*

Curly-leaf pondweed (CLP) is a non-native, invasive submersed aquatic plant native to Eurasia. Curly-leaf pondweed (Photograph 3.5-5) was first documented in Horsehead Lake in 1992 during the whole-lake point-intercept survey but was not verified by the WDNR until 2000.

Like some of Wisconsin's native pondweeds, CLP's primary method of propagation is through the production of numerous asexual reproductive structures called turions. Once mature, these turions break free from the parent plant and may float for some time before settling and overwintering on the lake bottom. Once favorable growing conditions return (i.e., spring), new plants emerge and grow from these turions (Photograph 3.3-2). Many of the turions produced by CLP begin to sprout in the fall and overwinter as small plants under the ice. Immediately following ice-out, these plants grow rapidly giving them a competitive advantage over native vegetation. Curly-leaf pondweed typically reaches its peak biomass by mid-June, and following the production of turions, most of the CLP will naturally senesce (die back) by mid-July. Although some CLP was present during the July 2021 point-intercept survey within Horsehead Lake, part of the population had likely already senesced by the time of the survey.

**Photograph 3.3-2. A single curly-leaf pondweed turion sprouting several new plants.** Photo credit Onterra.

If the CLP population is large enough, the natural senescence and the resulting decaying of plant material can release sufficient nutrients into the water to cause mid-summer algal blooms. In some lakes, CLP can reach growth levels which interfere with navigation and recreational activities. However, in other lakes, CLP appears to integrate itself into the plant community and does not grow to levels which inhibit recreation or have apparent negative impacts to the lake's ecology. Because CLP naturally senesces in early summer, surveys are completed early in the growing season in an effort to capture the full extent of the population.

Because a portion of the CLP turions produced each year do not sprout and lie dormant in the sediment to sprout in subsequent years, chemical management of CLP typically includes numerous, repeat annual herbicide applications completed a few weeks following ice-out. The goal of the herbicide treatment is to kill the CLP plants before they are able to produce turions. Following multiple years of herbicide application, the turion supply in the sediment becomes exhausted and the CLP population decreases significantly to levels that may be better managed with finer-scale strategies such as manual removal. In instances where a large turion base may have already built up, lake managers and regulators question whether the repetitive annual herbicide strategies may be imparting more strain on the environment than the existence of the invasive species.

Since its discovery within the lake, no management actions specifically targeting CLP have been taken to control this invasive plant. While the Horsehead Lake Protection and Rehabilitation District employs mechanical harvesting to improve navigation within the lake annually, this harvesting takes place in late-July following the natural senescence of the CLP population. Waiting to initiate mechanical harvesting until most of the CLP population has senesced is believed to help reduce its spread within the waterbody. However, CLP in the past has been found to be widespread throughout Horsehead Lake.

In the summer of 2017 Onterra ecologists mapped approximately 62 acres of highly scattered curly-leaf pondweed (Map 1). While 62 acres may seem significant, these areas represent the

lowest density rating Onterra ecologists attribute to these colonies, and highly scattered represents a collection of point-based CLP occurrences (i.e. single or few plants) that were just above a density at which each plant could be represented by a single point. CLP was mapped again in 2021 and no polygon mapping and only point-based data used. There was a large reduction of CLP between the 2017 and 2021 monitoring events. CLP was mapped once again by Onterra in 2022 and only one CLP *single or few plants* occurrence was identified near the boat landing (Map 1). This was the lowest density mapping of CLP since the monitoring began in 2007. Upon considering the 2021 CLP mapping data, it appears the population was naturally declining already which continued into 2022. It is unclear if the population will remain low or if it will rebound in the future. The CLP in Horsehead Lake has been monitored occasionally by Onterra since 2007, and the population has never been found to be at levels which interfere with recreation and navigation within the lake.

### *Pale-yellow Iris (Iris pseudacorus)*

Pale yellow iris (*Iris pseudacorus*) is a large, showy iris with bright yellow flowers (Photograph 3.3-3). Native to Europe and Asia, this species was sold commercially in the United States for ornamental use and has since escaped into Wisconsin's wetland areas forming large monotypic colonies and displacing valuable native wetland species.

**Photograph 3.3-3. The non-native wetland plant, pale-yellow iris.** Clump of the non-native pale-yellow iris mixed with the native blue-flag iris. Photo credit Onterra.

Pale-yellow iris is typically in flower during the second half of June. The foliage of pale-yellow iris and northern blue flag iris (valuable native species) is too similar to make a definitive identification based off of this alone. Positive ID really needs to come from the flowers or the seed pods, which come after the flower is pollinated. Control of pale-yellow iris includes digging and removing the entire plant, cutting leaves below the water's surface, cutting flowers before they can go to seed, and herbicide applications for larger colonies. A modest population of pale-yellow iris is present along the shores of Horsehead Lake (Map 2).

# 4.0 SUMMARY & CONCLUSIONS

Horsehead Lake, Oneida County, is a headwater drainage lake with a maximum depth of 11 feet and a mean depth of 8 feet. Horsehead Lake contains 40 native plant species, of which flat-stem pondweed is the most common. Three exotic plant species are known to exist in Horsehead Lake, Eurasian watermilfoil, curly-leaf pondweed, and pale-yellow iris.

The point-intercept method was used to quantitatively characterize the entire native and non-native plant community. It has been conducted on Horsehead Lake in 2007, 2017, and 2022. It is not possible to determine changes between the 10-year gap between the 2007 and 2017 datasets; however, the 5-year gap between the 2017 and 2022 data sets aligns well with the WDNR's recommended frequency of monitoring for lakes that implement aquatic plant management activities on a regular basis. An early-season AIS survey is used to qualitatively monitor curly-leaf pondweed and Eurasian watermilfoil, and has been conducted on Horsehead Lake in 2007, 2013, 2017, 2021, and 2022.

Aquatic plant species abundances fluctuate naturally from year-to-year primarily due to environmental factors. The species list and littoral frequencies of occurrences developed from the three point-intercept datasets show these variations over the monitoring timeframe. Even with changes, four native species, flat-stem pondweed, common waterweed, coontail, and fern pondweed remained highly dominant in all three surveys. These results show a healthy consistency in the highly abundant species in the lake. The 2007 and 2017 surveys showed a low species diversity, but this improved in 2022 with four new native species observed. Floristic quality was lower than other lakes within the state and ecoregion; however, species conservatism, a component of floristic quality, saw slight increases in both the 2017 and 2022 surveys.

While at lower abundances, slender and southern naiads were two of the four species located within Horsehead Lake for the first time in 2022. The rapid population growth of southern naiad in some other northern Wisconsin lakes has some ecologists questioning whether this species was historically present in these waterbodies or if it represents a recent introduction. It is unclear if these species were introduced recently or if they were not detected during earlier surveys because of a low abundance. Continued monitoring of the aquatic plant community will track the occurrence of these species within Horsehead Lake.

Two submergent non-native species are located within the lake, Eurasian watermilfoil (EWM) and curly-leaf pondweed (CLP) along with one non-native emergent species, pale-yellow iris. EWM was verified in the lake in 2007 but was last observed by Onterra in 2013. CLP has been quite variable within the lake in the absence of management with as much as 62 acres mapped in 2017 and as little as one single or few plants marked in 2022. Pale-yellow iris was mapped in 2017 and was observed growing along the shoreline mainly on the eastern shore. Iris was not mapped in 2022 but was observed incidentally during the early-season AIS survey.

**Table 4.0-1. Mechanical harvesting history on Horsehead Lake.**

| Year | Acres | Hours | Loads | Tons |
|---|---|---|---|---|
| 2010 | 49 | 84 | 39 | 87 |
| 2011 | 46 | 90 | 74 | 185 |
| 2012 | 35 | 72 | 44 | 110 |
| 2013 | 58 | 91 | 84 | 210 |
| 2017 | - | 60 | 39 | - |

Overall, the studies that were completed indicate it is a shallow and productive lake and is average in terms of its native aquatic plant community when compared to the Northern Lakes and Forests

ecoregion and state medians. Mechanical harvesting has been utilized on an as needed basis by the HLPRD and has not been used since 2017 (Table 4.0-1). Based upon the information compiled here, there is no indication that the harvesting has impacted native species or worked to spread exotic plants in Horsehead Lake. Consistent monitoring will continue to build the aquatic plant database for Horsehead Lake and aid in future management decisions.

# 5.0 UPDATED AQUATIC PLANT MANAGEMENT IMPLEMENTATION PLAN

The District's *Comprehensive Management Plan* for Horsehead Lake was finalized and approved by the WDNR in 2020. This *Plan* can be found on the WDNR website located here:

https://dnr.wi.gov/lakes/grants/project.aspx?project=144535144

The Implementation Plan Section of the *2020 Plan* includes the following management goals along with specific management actions developed to help reach those goals.

1) Preserve and Enhance the Ecological Integrity of Horsehead Lake
   - Monitor water quality through the WDNR Citizen Lake Monitoring Network
   - Inform Horsehead Lake riparian property owners regarding the importance of natural shorelines and septic system maintenance.
   - Work with WDNR fisheries staff to increase proper fish habitat and determine appropriate stocking routine.
   - Work with WDNR fisheries staff to determine if current aeration system is sufficient to prevent winter fish kills in Horsehead Lake.
2) Manage Current Aquatic Invasive Species Populations in and Prevent Further Introductions to Horsehead Lake
   - Perform Clean Boats Clean Waters watercraft inspections at public access location.
   - Conduct periodic qualitative and quantitative vegetation monitoring on Horsehead Lake.
   - Manage Eurasian watermilfoil in Horsehead Lake.
3) Maintain Navigation and other Recreational Opportunities on Horsehead Lake
   - Create HLPRD Harvesting Committee to manage mechanical harvesting on Horsehead Lake.
   - Utilize contracted mechanical harvesting services to maintain reasonable navigation on Horsehead Lake.
4) Increase the Horsehead Lake District's Capacity to Communicate with Lake Stakeholders and Facilitate Partnerships with Other Management Entities
   - Use information to promote lake protection and enjoyment through stakeholder education
   - Participate in annual Wisconsin Lakes Partnership Convention.
   - Continue HLPRD's involvement with other entities that have responsibilities in managing (management units) Horsehead Lake

**Figure 5.0-1. HLPRD management goals and actions developed to assist in reaching the goal.** From *Horsehead Lake Comprehensive Management Plan* (2020)

The objective of this project was to revisit the aquatic plant-related goals and actions of the Horsehead Lake Comprehensive Management Plan and adjust them appropriately based upon current best management practices (BMPs), the lessons learned during the years since the last plan was developed, and the information gathered during the studies completed in 2022 As a result, this project largely updates the Implementation Plan Management Goals 2 and 3 (listed as Goals 1 & 2 below) of the HLPRD's Comprehensive Management Plan.

The Implementation Plan presented below was created through the collaborative efforts of Horsehead Lake Protection & Rehabilitation District Board of Commissioners and ecologist/planners from Onterra. The Implementation Plan represents the path Horsehead Lake Protection & Rehabilitation District will follow in order to meet their lake management goals. The goals detailed within the plan are realistic and based upon the findings of the studies completed in conjunction with this planning project and the needs of the Horsehead Lake stakeholders as portrayed by the members of the Board of Commissioners. The Implementation Plan is a living document that will be under constant review and adjustment depending on the condition of the lake, availability of funds, level of volunteer involvement, and needs of the stakeholders.

## Management Goal 1: Manage Current Aquatic Invasive Species Populations in and Prevent Further Introductions to Horsehead Lake

| **Management Action:** | Perform Clean Boats Clean Waters watercraft inspections at public access location. |
|---|---|
| **Timeframe:** | Continuation of current effort |
| **Facilitator:** | HLPRD Board of Commissioners |
| **Potential Grant:** | WDNR AIS-Clean Boats Clean Waters Grant |
| **Description:** | Horsehead Lake is a somewhat popular destination by recreationists and anglers, making the lake vulnerable to new infestations of exotic species. The intent of the boat inspections would not only be to prevent additional invasive species from entering the lake through its public access point, but also to prevent the infestation of other waterways with invasive species that originated in Horsehead Lake. The goal is to cover the landing during the busiest times in order to maximize contact with lake users, spreading the word about the negative impacts of AIS on lakes and educating people about how they are the primary vector of its spread.<br><br>The HLPRD will work with the Oneida County Land and Water Department and/or Lumberjack RC&DC (see contact table on page 100) to develop this program. |
| **Action Steps:** | |
| | See description above. |

| **Management Action:** | Conduct periodic qualitative and quantitative vegetation monitoring on Horsehead Lake. |
|---|---|
| **Timeframe:** | Early-season AIS survey between point-intercept surveys (2-3 years)<br>Point intercept survey every 5 years<br>Floating-leaf and emergent community mapping every 10 years |
| **Possible Grant:** | Surface Water Lake Planning Grant |
| **Facilitator:** | HLPRD Board of Commissioners |
| **Description:** | As part of the ongoing AIS and nuisance native management program, the HLPRD will continue to monitor aquatic plants within Horsehead |

| | |
|---|---|
| | Lake utilizing the same methodologies as those used in the development of this management plan.<br><br>The Eurasian watermilfoil and curly-leaf pondweed populations in Horsehead Lake have remained at low levels; therefore, the district will sponsor early-season AIS surveys on the lake every 2-3 years to monitor the populations in between and on point intercept survey years. The early timing of this survey will also allow for the continued monitoring of curly-leaf pondweed within the lake as well as provide guidance for professional hand-harvesting if sufficient Eurasian watermilfoil is found to warrant that action.<br><br>A whole-lake point-intercept survey will be conducted once every 5 years. This will allow a continued understanding of the aquatic plant community dynamics within Horsehead Lake. A point-intercept survey was conducted on Horsehead Lake in 2022; therefore, the next point-intercept survey will be completed in 2027.<br><br>In order to understand the dynamics of the emergent and floating-leaf aquatic plant community in Horsehead Lake, a community mapping survey would be conducted every 10 years. A community mapping survey was conducted on Horsehead Lake in 2017 as a part of this management planning effort. The next community mapping survey will be completed 2027. |
| **Action Steps:** | |
| 1. | Schedule early-season AIS survey between and on point-intercept survey years (2-3 years) |
| 2. | Schedule point intercept survey every 5 years |
| 3. | Schedule floating-leaf and emergent community mapping every 10 years |

| | |
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| **Management Action:** | Manage Eurasian watermilfoil in Horsehead Lake. |
| **Timeframe:** | Dependent on plant survey findings |
| **Facilitator:** | HLPRD Board of Commissioners |
| **Description:** | Eurasian watermilfoil was first discovered in 2007 near the boat landing in Horsehead Lake. During subsequent surveys, it was mapped in other areas around the lake as well. The HLPRD has used professional hand-harvesters to search for and remove Eurasian watermilfoil in the past. During the aquatic plant surveys completed over the course of the summer in 2017, 2021, and 2022, Onterra ecologists did not locate any Eurasian watermilfoil occurrences in Horsehead Lake. It is probable that Eurasian watermilfoil is still present in Horsehead Lake, but has remained at a level which escapes detection. |

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| | The HLPRD intends to keep the level of Eurasian watermilfoil in Horsehead Lake very low, and as mentioned in the previous action, intends to sponsor early-season surveys to search the lake for the exotic every 2-3 years. Completing the survey early in the season, as mentioned above, would also allow for the mapping of curly-leaf pondweed and leave time for professional hand-harvesting later in the summer if deemed appropriate. The HLPRD has utilized professional divers and snorkelers in the past to remove Eurasian watermilfoil in known locations. |
| **Action Steps:** | See description above. |

# Management Goal 2: Maintain Navigation and other Recreational Opportunities on Horsehead Lake

| | |
|---|---|
| **Management Action:** | Create an informed HLPRD Harvesting Committee to manage mechanical harvesting on Horsehead Lake. |
| **Timeframe:** | 2023 |
| **Facilitator:** | HLPRD Board of Commissioners with sufficient volunteer effort to create committee. |
| **Description:** | Managing the mechanical harvesting program on Horsehead Lake has previously been the responsibility of a couple of district members, consisting of the district chairperson and occasionally another volunteer. Performing the tasks of assessing the vegetation growth on Horsehead Lake and determining the need for mechanical harvesting requires basic knowledge of aquatic plants and the advantages and disadvantages of utilizing mechanical harvesting. As described below, Harvesting Committee will be made up of the district chair and two at-large members. To assure that well-rounded management decisions are made, it is the district's preference that each of the at-large members meet at least one of the following:<br>1. Served on the planning committee during the development of a Horsehead Lake management plan<br>2. Possess a background in aquatic plants<br>3. Are a Wisconsin Lakes Partnership Lake Leader<br>4. Have attended the Annual Wisconsin Lakes and Rivers Convention<br><br>One of the primary objectives of forming this committee is to spread the work and decision making involved in managing the harvesting operations for Horsehead Lake among many members of the district. To meet that objective, the following guidelines will be used in creating the committee and maintaining its membership:<br>1. The committee membership will consist of the HLPRD Chairperson and two at large members of the district.<br>2. The district chairperson will serve on the committee for the extent that he or she is the district chairperson.<br>3. No member other than the chairperson can occupy consecutive terms.<br>4. The two district members will serve for two consecutive years, but to maintain some continuality among membership beyond just that of the district chairperson, the two district member terms will be staggered. When the committee is first formed, or if both members must resign at the same time and the committee must be reformed, one of the committee members will serve a three-year term and the second will serve the standard two-year term. This will be decided first by volunteering to fill the three-year term position and second, if |

| | |
|---|---|
| | either member volunteers, by a coin flip. The district may also direct the HLPRD Chair to appoint new members as well. |
| **Action Steps:** | |
| | See description above. |

| | |
|---|---|
| **Management Action:** | Utilize contracted mechanical harvesting services to maintain reasonable navigation on Horsehead Lake. |
| **Timeframe:** | Dependent on the findings of the annual Harvesting Committee survey |
| **Facilitator:** | HLPRD Harvesting Committee |
| **Description:** | For over a decade, the HLPRD has contracted to have harvesting of primarily native plants completed on Horsehead Lake. The harvesting normally occurs in July or August and is completed in areas specified by the district. The purpose of the harvesting is to increase navigability in certain areas of the lake that contain dense, nuisance levels of native aquatic plants while opening fish cruising lanes for predators. Over the past decade, members of the 2018 planning committee agreed that during the years harvesting was needed, the harvesting did provide improved navigation within Horsehead Lake.<br><br>The areas of Horsehead Lake requiring mechanical harvesting change from year-to-year in terms of areas that require harvesting and total acreage of harvesting; therefore, the harvesting plan must remain flexible. The WDNR permitting process requires specifics regarding areas of the lake that are slated for harvesting. To accommodate the WDNR permitting process and the flexible harvesting needs of the HLPRD, the 2011 Horsehead Lake Management Plan included a method for determining and reporting annual harvesting needs by the district. This method was also included in the 2020 comprehensive management plan and the HLPRD will continue to use this methodology in the coming years.<br><br>Map 3 includes 144 acres of Horsehead Lake that are available for harvesting based upon past harvesting needs of the district. Harvesting only occurs in areas with developed shoreline, with the exception of the lane that extends to the public boat landing on the southern end of the lake. The need for harvesting is defined by the submergent plants in the area being within 1-2 feet of the surface. The vast majority of the northern portion of the lake is considered a conservation area; therefore, no harvesting is considered in that area except as indicated on the harvest map near properties on Duck Road. While 144 acres of the lake may be considered as a part of the annual harvest plan, no more than 75 acres can actually be harvested in a single year. |

| | |
|---|---|
| | GPS technology exists to more easily and accurately determine the areas for harvesting by the district. Essentially, a background map can be loaded on a standard handheld GPS unit which would allow district volunteer to know exactly where they are in relation to the lake's shore and the harvesting grid found on Map 3. The volunteers could also collect points within the grid squares they believe would be included in that year's harvesting. The points could then be downloaded to a computer and emailed to the harvesting contractor for use in the contractor's GPS. The amount of harvesting completed would be reported by the contractor in their annual harvesting record. |
| **Action Steps:** | |
| 1. | HLPRD Harvesting Committee surveys the lake and marks quarter-acre squares with submersed plants within 1-2 feet of the surface on Map 3 for harvesting. |
| 2. | Squares are tallied and the sum acreage of that year's harvesting is calculated. |
| 3. | Harvesting map and estimated acreage are provided to WDNR 14 days prior to expected harvesting dates. |
| 4. | Harvesting contractor completes harvest record at end of year per WDNR permit requirements. |

# 6.0 LITERATURE CITED

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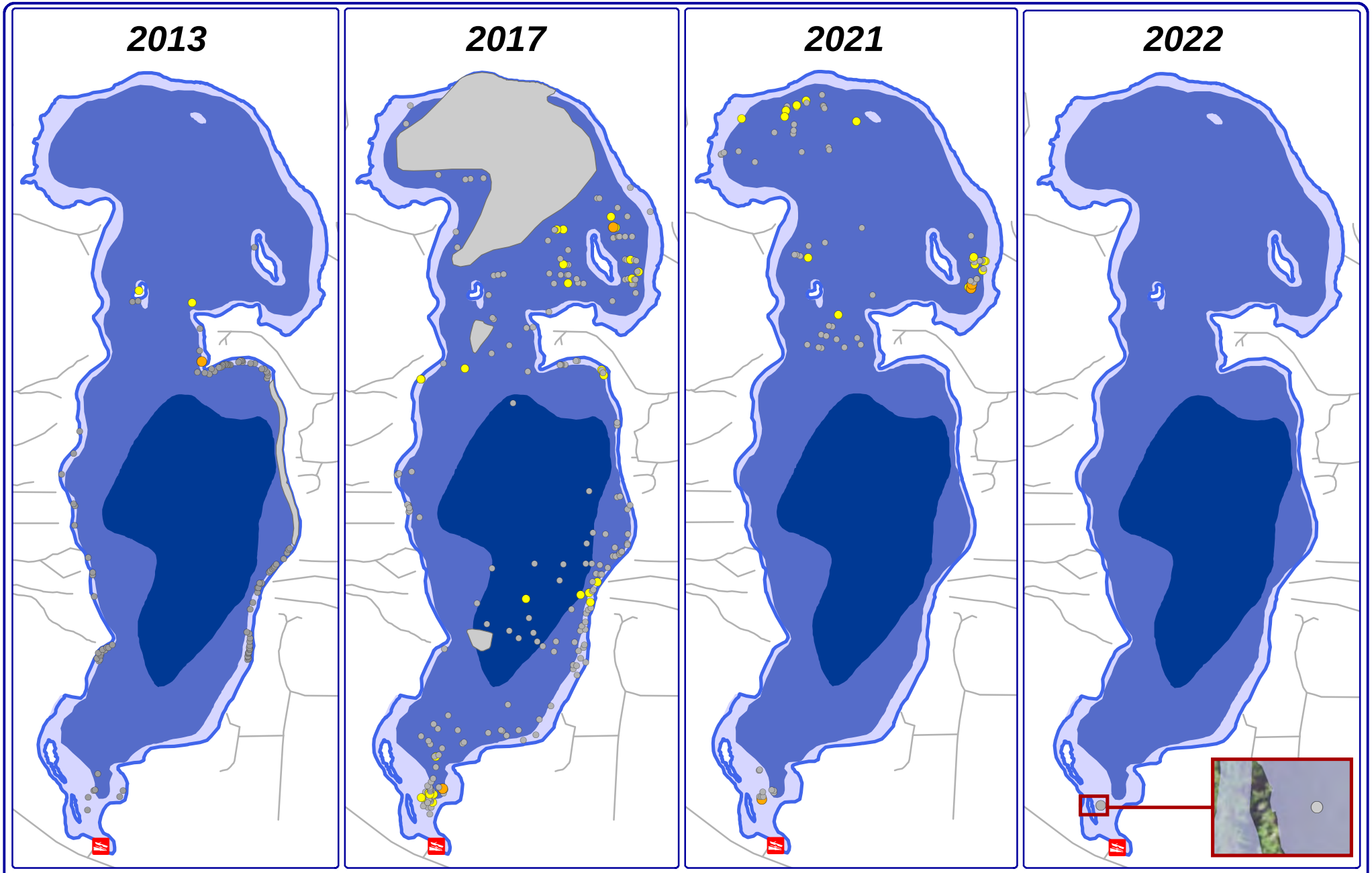


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920.338.8860
www.onterra-eco.com

**Sources:**
Roads and Hydro: WDNR
Bathymetry: Onterra
Aquatic Plants: Onterra, 2023-2022

**Map Date:** April 25, 2023 JMB
Filename:Map1_Horsehead_CLP_Compare.mxd

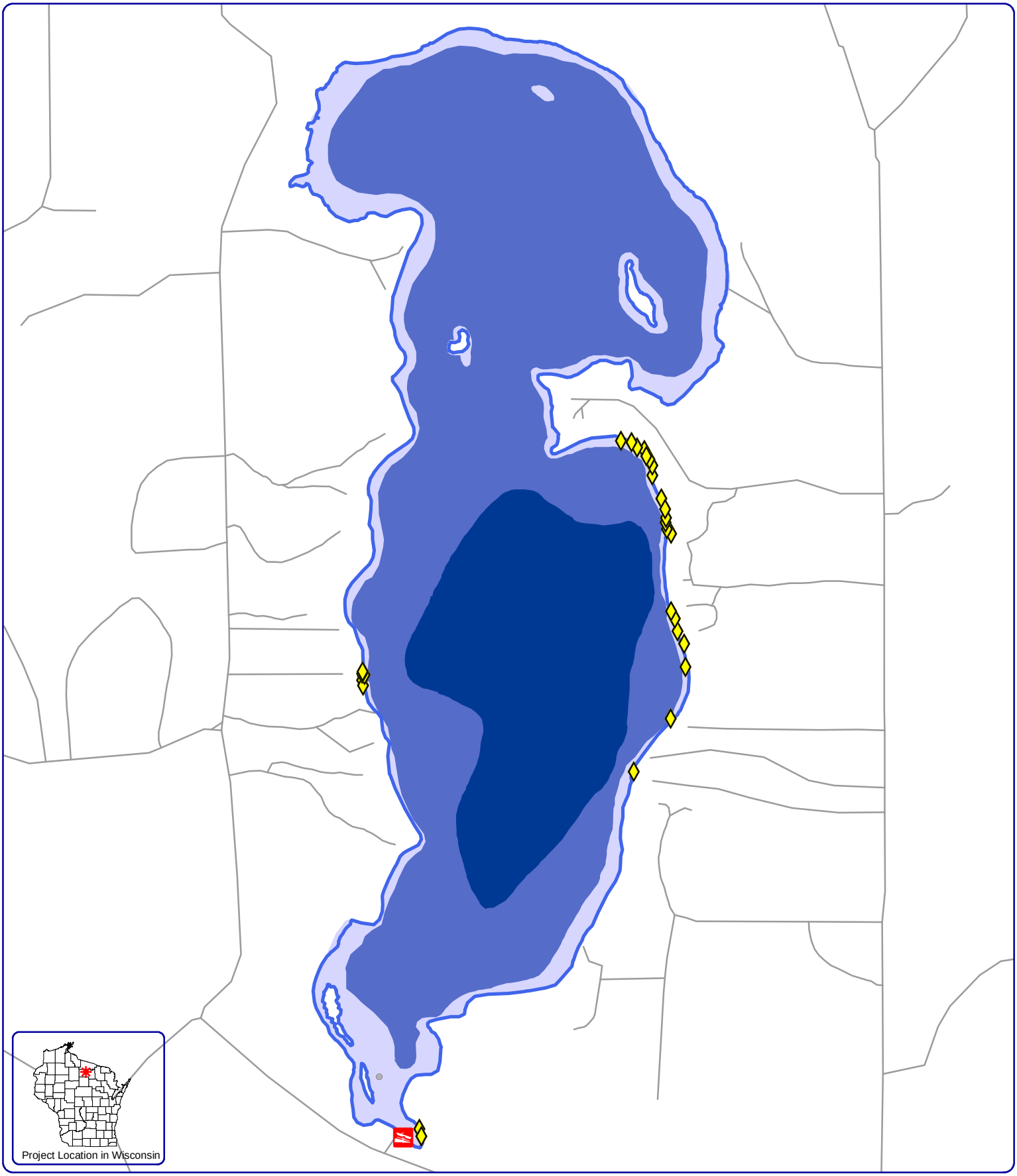
Project Location in Wisconsin

**Legend**

- Highly Scattered
- Scattered *(None)*
- Dominant *(None)*
- Highly Dominant *(None)*
- Surface Matting *(None)*
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- Public Boat Landing

Map 1
Horsehead Lake
Oneida Co, Wisconsin

# Curly-leaf Pondweed Survey Results

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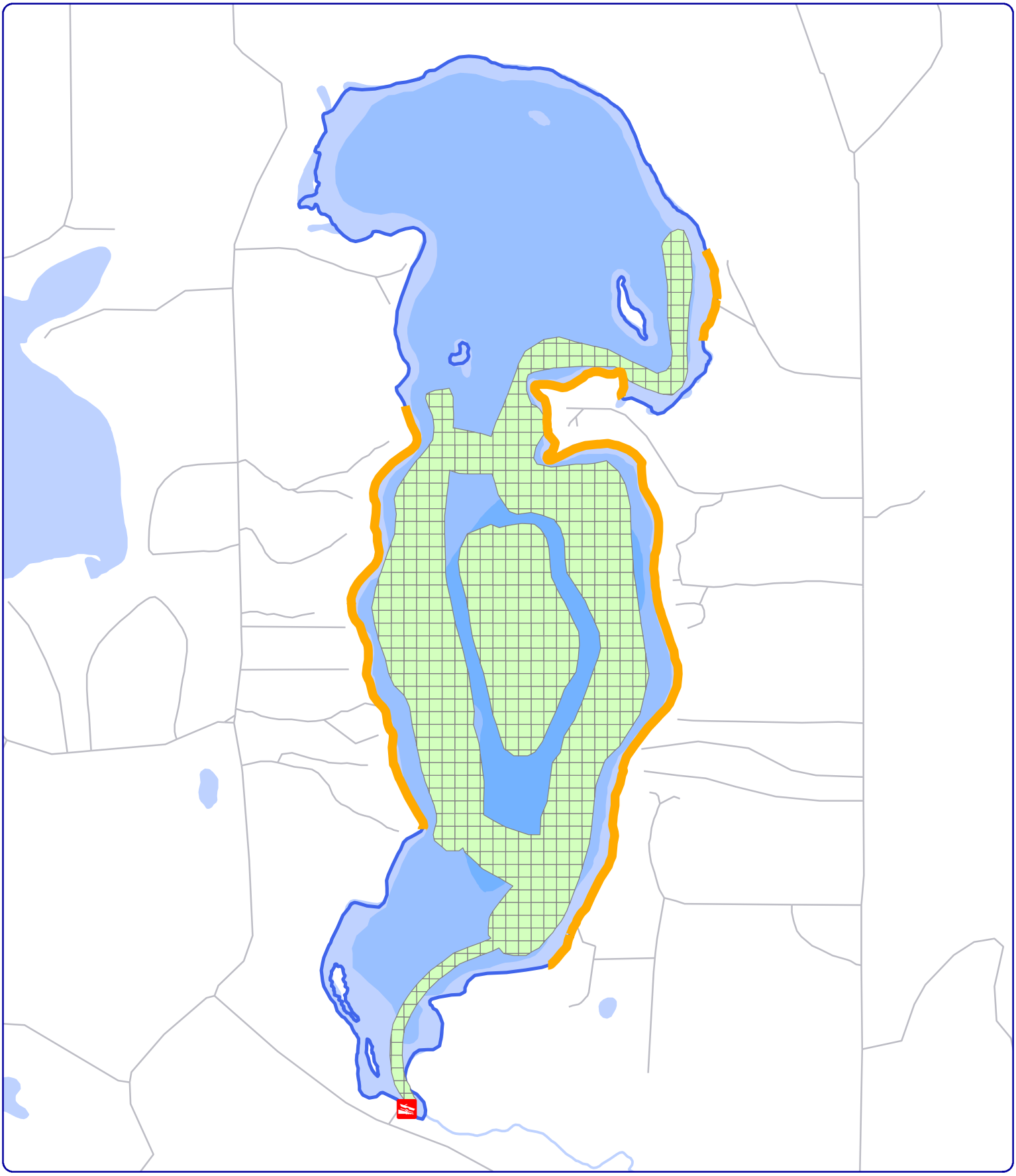
**Sources**
Roads and Hydro: WDNR
Bathymetry: WDNR
Aquatic Plants: Onterra, 2022
Orthophotography: NAIP, 2020
**Map Date:** April 25, 2023 JMB
**Filename:** *Insert Horsehead_PYI_2017.mxd*

**Legend**
***Pale-yellow iris (June 21, 2017)***

Single or Few Plants
Public Boat Landing

Map 2
# Horsehead Lake
Oneida County, Wisconsin
## 2017 PYI
## Survey Results



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**Sources:**
Roads and Hydro:WDNR
Bathymetry: WDNR, digitized by Onterra
**Map Date:** May 24, 2023 JMB
*Filename: MapX_Horsehead_HarvPlan.mxd*

Project Location in Wisconsin

## Legend

- Public Access
- Potential Harvesting Areas *(~144 acres)*
- Developed Shoreline

Map 3

# Horsehead Lake

Oneida County, Wisconsin

**Harvesting Plan**

# A

# APPENDIX A

## Stakeholder Participation


## Presentation Outline

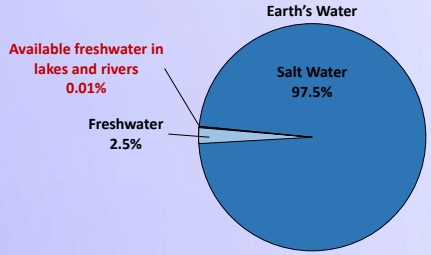
- Aquatic Plant Management Update Project Overview
- Study Results
  - Aquatic Plants
- "Big Picture"
- Management Plan Goals
- Discussion on Goal changes

Onterra LLC
Lake Management Planning

## Management Planning Project Overview

**Why create a lake management plan?**

- **Provides vast environmental services (drinking water, waste disposal, irrigation, food, recreation, aesthetics, etc.)**
- **Species richness is greater relative to habitat extent in freshwater ecosystems when compared to marine or terrestrial**
- **Freshwater ecosystems contain 12% of all species (25% of all vertebrates)**
- **Extinction rate of freshwater biodiversity is 5 times faster than all other groups**

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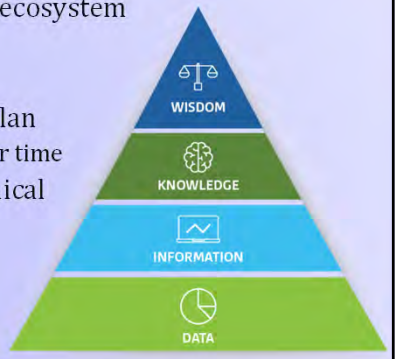
## Management Planning Project Overview

- Foster holistic understanding of ecosystem
- Collect & analyze data
  - Technical & sociological
- Construct long-term & useable plan
  - Living plan subject to revision over time
- Onterra's role is to provide technical direction
  - Not really recommendations

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## Aquatic Plant Surveys

- Assess both non-native & native species
- Two surveys completed in 2022
  - Early-Season AIS Survey (June 2022)
  - Whole-Lake Point-Intercept Survey (July 2022)

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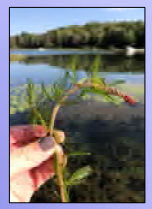
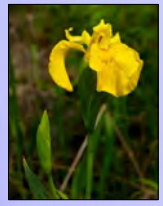
## Plant Data Overview

- 40 native plant species recorded
- 3 non-native plant species
  - Curly-leaf pondweed
  - Eurasian watermilfoil
  - Pale-yellow iris





| Growth Form | Scientific Name | Common Name | Status in Wisconsin | Coefficient of Conservatism | 2007 | 2022 |
|---|---|---|---|---|---|---|
| Emergent | *Alisma trivale* | Northern water-plantain | Native | 4 | X | |
| | *Calla palustris* | Water arum | Native | 9 | X | I |
| | *Carex comosa* | Bristly sedge | Native | 5 | X | I |
| | *Carex utriculata* | Common yellow lake sedge | Native | 7 | | I |
| | *Eleocharis palustris* | Creeping spikerush | Native | 6 | | I |
| | *Iris pseudacorus* | Pale-yellow iris | Non-Native - Invasive | NA | I | I |
| | *Iris versicolor* | Northern blue flag | Native | 5 | | I |
| | *Juncus effusus* | Soft rush | Native | 4 | | I |
| | *Sagittaria latifolia* | Common arrow-head | Native | 3 | X | I |
| | *Schoenoplectus acutus* | Hardstem bulrush | Native | 5 | | I |
| | *Schoenoplectus tabernaemontani* | Softstem bulrush | Native | 4 | X | I |
| | *Typha* spp. | Cattail spp. | Unknown (Sterile) | NA | X | I |
| FL | *Brasenia schreberi* | Watershield | Native | 7 | X | X |
| | *Nuphar variegata* | Spatterdock | Native | 6 | X | X |
| | *Nymphaea odorata* | White water lily | Native | 6 | X | X |
| | *Persicaria amphibia* | Water smartweed | Native | 5 | X | |
| | *Sparganium angustifolium* | Narrow-leaf bur-reed | Native | 9 | X | I |
| FLIE | *Sparganium emersum var. acaule* | Short-stemmed bur-reed | Native | 8 | X | |
| | *Sparganium* sp. | Bur-reed sp. | Native | NA | | I |
| Submergent | *Ceratophyllum demersum* | Coontail | Native | 3 | X | X |
| | *Chara* spp. | Muskgrasses | Native | 7 | X | X |
| | *Elodea canadensis* | Common waterweed | Native | 3 | X | X |
| | *Heteranthera dubia* | Water stargrass | Native | 6 | | X |
| | *Myriophyllum sibiricum* | Northern watermilfoil | Native | 7 | X | X |
| | *Myriophyllum spicatum* | Eurasian watermilfoil | Non-Native - Invasive | NA | I | |
| | *Najas flexilis* | Slender naiad | Native | 6 | | X |
| | *Najas guadalupensis* | Southern naiad | Native | 7 | | X |
| | *Nitella* spp. | Stoneworts | Native | 7 | X | X |
| | *Potamogeton amplifolius* | Large-leaf pondweed | Native | 7 | X | X |
| | *Potamogeton berchtoldii & P. pusillus* | Slender and small pondweed | Native | 7 | X | X |
| | *Potamogeton crispus* | Curly-leaf pondweed | Non-Native - Invasive | NA | X | X |
| | *Potamogeton gramineus* | Variable-leaf pondweed | Native | 7 | X | |
| | *Potamogeton natans* | Floating-leaf pondweed | Native | 5 | | I |
| | *Potamogeton pusillus* | Small pondweed | Native | 7 | X | X |
| | *Potamogeton richardsonii* | Clasping-leaf pondweed | Native | 5 | X | X |
| | *Potamogeton robbinsii* | Fern-leaf pondweed | Native | 8 | X | X |
| | *Potamogeton zosteriformis* | Flat-stem pondweed | Native | 6 | X | X |
| | *Sagittaria* sp. (rosette) | Arrowhead sp. (rosette) | Native | NA | X | |
| | *Stuckenia pectinata* | Sago pondweed | Native | 3 | X | X |
| | *Vallisneria americana* | Wild celery | Native | 6 | X | X |
| SIE | *Juncus pelocarpus* | Brown-fruited rush | Native | 8 | X | |
| FF | *Lemna minor* | Lesser duckweed | Native | 5 | X | X |
| | *Lemna trisulca* | Forked duckweed | Native | 6 | | X |

*X = Located on rake during point-intercept survey; I = Incidentally located; not located on rake during point-intercept survey*
*FL = Floating-leaf; FLIE = Floating-leaf & Emergent; SIE = Submergent and/or Emergent; FF = Free-floating*

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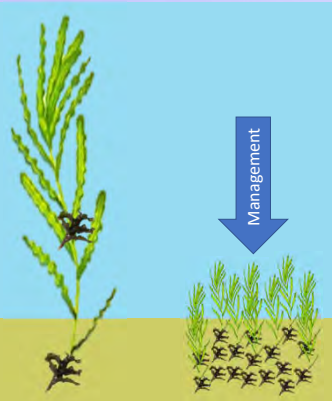
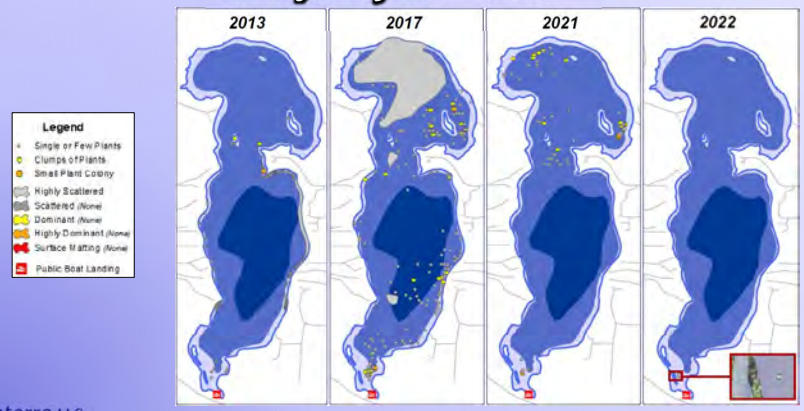
## CLP Life-Cycle & Control Strategy Philosophy




- CLP respond well to herbicides (*easy to kill*)
- Herbicide strategy requires repetition (*5-7+ years in a row*)
- Hand-harvesting is analogous to single treatment (*ineffective for established populations)*

## Curly-leaf Pondweed

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## Eurasian Watermilfoil

## EWM Propagation

- Produces seed, but low viability
- Spread primarily through fragments, a vegetative clone

**Auto-fragment**

- Purposefully produced
- High energy storage
- Higher viability

**Allo-fragment**

- Mechanical breakage
- Low energy storage
- Lower viability

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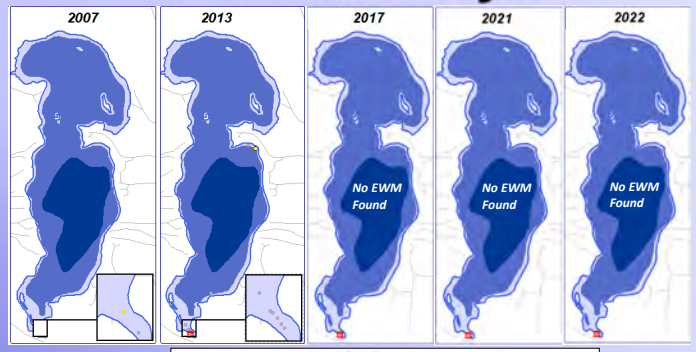
## Eurasian watermilfoil

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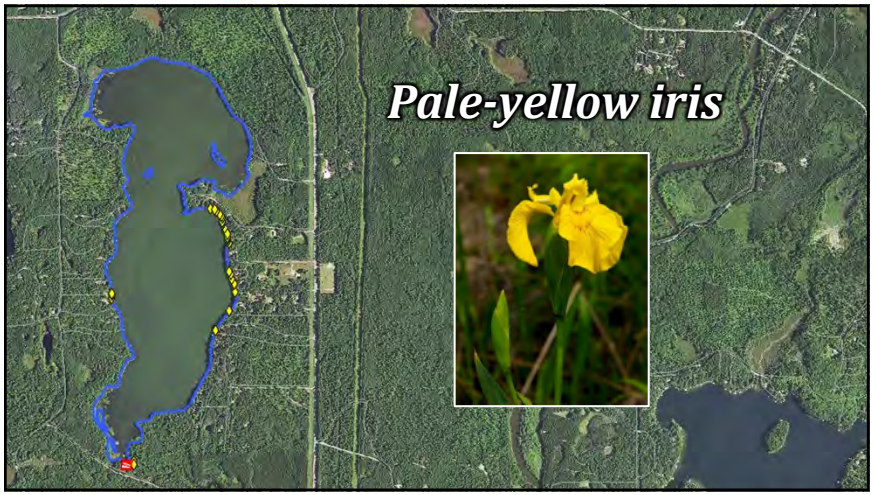
## Pale-yellow iris



## Whole-Lake Point-Intercept Survey

**Horsehead Lake**
52-meter resolution
500 total points

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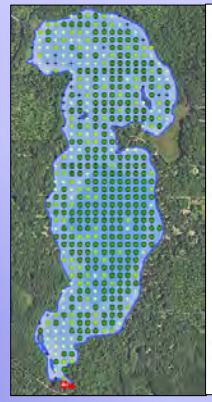
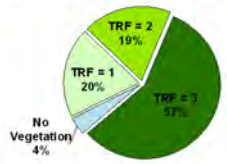
## Whole-Lake Point-Intercept Survey



Legend
- Total Rake Fullness = 1
- Total Rake Fullness = 2
- Total Rake Fullness = 3
- \+ Sampled - No Vegetation
- \+ Not Sampled - Dock, Shallow, or Nonnavigable (Plants)

Littoral Frequency of Occurrence

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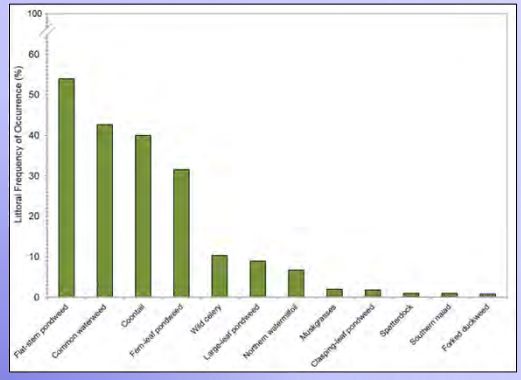
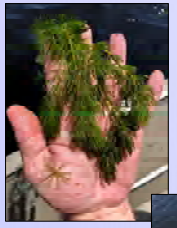
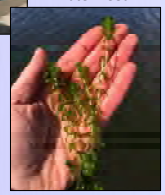
## Littoral Frequency of Occurrence




Coontail



Common waterweed



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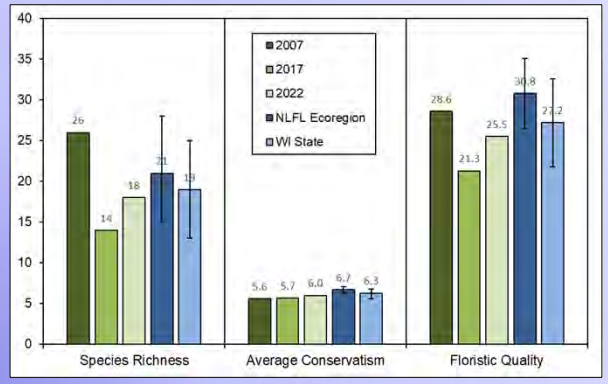
## Floristic Quality Analysis

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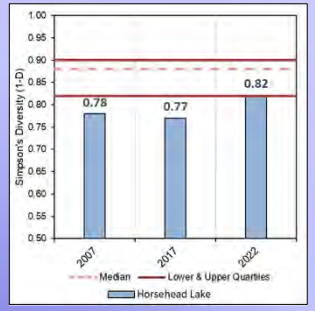
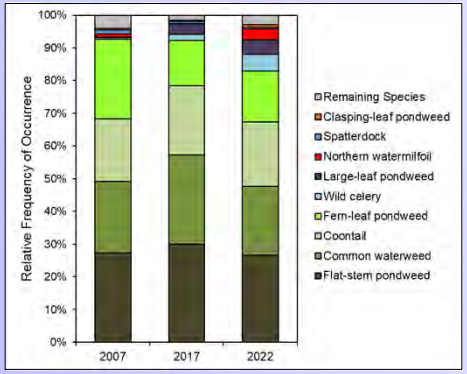
## Species Diversity




## Relative Frequency of Occurrence

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## Study Conclusions

**Aquatic Plant Community**

- Aquatic plant abundancies fluctuate naturally from year-to-year
- Four native species were highly dominant in all three surveys
  - Results in relatively low species diversity
- Overall plant community is lower in quality when compared to other lakes in the state and ecoregion
  - Have observed slight improvement in 2017 and 2022 data
- CLP has declined over the monitoring period
- EWM has not been found since 2013 survey
- Mechanical harvesting utilized on an as needed basis
  - Last used in 2017

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## Implementation Plan Development

**Goal**
- Reflects big picture
- Can be ambitious, but attainable

**Action**
- Step to meet goal
- Measurable outcome
- Timeframe
- Facilitator

- Management goals are broad statements, were as management actions are detailed.

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## Comp Mgmt Plan (2020): Implementation Plan

**Goal 1: Preserve and Enhance the Ecological Integrity**
- Monitor water quality through the WDNR Citizen Lake Monitoring Network
- Inform Horsehead Lake riparian property owners the importance of natural shorelines and septic system maintenance
- Work with WDNR fisheries staff to increase proper fish habitat and determine appropriate stocking routine
- Work with WDNR fisheries staff to determine if aeration system is sufficient to prevent winter fish kills

**Goal 2: Manage Current AIS Populations and Prevent Further Introductions**
- Perform Clean Boats Clean Waters watercraft inspections at public access location
- Conduct periodic qualitative and quantitative vegetation monitoring
- Manage Eurasian watermilfoil

**Goal 3: Maintain Navigation and other Recreational Opportunities**
- Create HLPRD Harvesting Committee to manage mechanical harvesting
- Utilize contracted mechanical harvesting services to maintain reasonable navigation

**Goal 4: Increase the HLPRD's Capacity to Communicate with Stakeholders and Facilitate Partnerships with Other Management Entities**
- Use information to promote lake protection and enjoyment through stakeholder education
- Participate in annual Wisconsin Lakes Partnership Convention
- Continue HLPRD's involvement with other entities that have responsibilities in managing

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## Updated APM Plan

**Goal 2: Maintain Navigation and other Recreational Opportunities**

***Action:*** Perform Clean Boats Clean Waters watercraft inspections at public access location

***Action:*** Conduct periodic qualitative and quantitative vegetation monitoring

***Action:*** Manage Eurasian watermilfoil

Frequency: Dependent on plant survey findings

| Frequency per 2020 plan: | Proposed frequency for updated plan: |
|---|---|
| -Early-Season AIS Survey, 2019-2021, then every 3 years | -Early-Season AIS Survey, every ~3 years (between PI surveys) |
| -Point-Intercept Survey every 3-5 years | -Point-Intercept Survey every 5 years |
| -Community Mapping every 7-10 years | -Community Mapping every 10 years |
| -Maintain grant eligibility & understand dynamics | -Maintain grant eligibility & understand dynamics |

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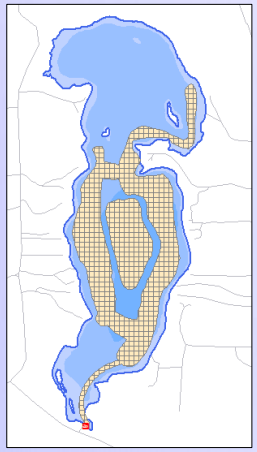
## *Updated APM Plan*

**Goal 3: Manage Current AIS Populations and Prevent Further Introductions**

- ***Action:*** Create HLPRD Harvesting Committee to manage mechanical harvesting
- ***Action:*** Utilize contracted mechanical harvesting services to maintain reasonable navigation



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# B

# APPENDIX B

## 2022 Aquatic Vegetation Results

| Scientific Name | Common Name | LFOO (%) | | |
|---|---|---|---|---|
| | | 2007 | 2017 | 2022 |
| *Potamogeton zosteriformis* | Flat-stem pondweed | 70.6 | 54.1 | 54.0 |
| *Elodea canadensis* | Common waterweed | 56.7 | 49.2 | 42.6 |
| *Ceratophyllum demersum* | Coontail | 49.4 | 38.3 | 39.9 |
| *Potamogeton robbinsii* | Fern-leaf pondweed | 63.0 | 24.9 | 31.6 |
| *Vallisneria americana* | Wild celery | 1.2 | 3.3 | 10.4 |
| *Potamogeton amplifolius* | Large-leaf pondweed | 0.4 | 5.8 | 9.0 |
| *Myriophyllum sibiricum* | Northern watermilfoil | 2.6 | 0.4 | 6.7 |
| *Nuphar variegata* | Spatterdock | 3.0 | 1.0 | 1.0 |
| *Potamogeton richardsonii* | Clasping-leaf pondweed | 1.2 | 0.6 | 1.8 |
| *Chara spp.* | Muskgrasses | 0.0 | 1.0 | 2.0 |
| *Nymphaea odorata* | White water lily | 2.8 | 0.4 | 0.4 |
| *Najas guadalupensis* | Southern naiad | 0.0 | 0.0 | 1.0 |
| *Stuckenia pectinata* | Sago pondweed | 1.6 | 0.2 | 0.0 |
| *Potamogeton crispus* | Curly-leaf pondweed | 1.4 | 0.4 | 0.0 |
| *Lemna trisulca* | Forked duckweed | 0.0 | 0.0 | 0.8 |
| *Potamogeton berchtoldii & P. pusillus* | Slender and small pondweed | 0.6 | 0.0 | 0.2 |
| *Potamogeton pusillus* | Small pondweed | 0.6 | 0.0 | 0.2 |
| *Nitella spp.* | Stoneworts | 0.2 | 0.0 | 0.4 |
| *Lemna minor* | Lesser duckweed | 0.6 | 0.0 | 0.2 |
| *Sagittaria sp. (rosette)* | Arrowhead sp. (rosette) | 0.0 | 0.6 | 0.0 |
| *Typha spp.* | Cattail spp. | 0.4 | 0.0 | 0.0 |
| *Najas flexilis* | Slender naiad | 0.0 | 0.0 | 0.2 |
| *Heteranthera dubia* | Water stargrass | 0.0 | 0.0 | 0.2 |
| *Brasenia schreberi* | Watershield | 0.2 | 0.2 | 0.0 |
| *Sparganium emersum var. acaule* | Short-stemmed bur-reed | 0.2 | 0.0 | 0.0 |
| *Sparganium angustifolium* | Narrow-leaf bur-reed | 0.2 | 0.0 | 0.0 |
| *Schoenoplectus tabernaemontani* | Softstem bulrush | 0.2 | 0.0 | 0.0 |
| *Sagittaria latifolia* | Common arrowhead | 0.2 | 0.0 | 0.0 |
| *Potamogeton gramineus* | Variable-leaf pondweed | 0.2 | 0.0 | 0.0 |
| *Persicaria amphibia* | Water smartweed | 0.2 | 0.0 | 0.0 |
| *Juncus pelocarpus* | Brown-fruited rush | 0.2 | 0.0 | 0.0 |
| *Carex comosa* | Bristly sedge | 0.2 | 0.0 | 0.0 |
| *Calla palustris* | Water arum | 0.2 | 0.0 | 0.0 |
| *Alisma trivale* | Northern water-plantain | 0.2 | 0.0 | 0.0 |