Lilly Lake

Kenosha County, Wisconsin

2021-2023 Final HWM Management & Monitoring Report

December 2023

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Funded by: Lilly Lake Protection & Rehabilitation District
Wisconsin Dept. of Natural Resources (ACEI-295-22)

1.0 INTRODUCTION

Lilly Lake, Kenosha County, is an approximately 85-acre seepage lake with a maximum depth of 22 feet and a mean depth of 11 feet (Photo 1.0-1). This oligo-mesotrophic lake has a relatively small watershed when compared to the size of the lake. Lilly Lake contains many native plant species, of which muskgrasses are the most common.

Photo 1.0-1. Lilly Lake, Kenosha County.

The primary citizen-based organization leading management activities on Lilly Lakes is the Lilly Lake Protection & Rehabilitation District (LLPRD). The LLPRD completed an *Aquatic Plant Management Plan* for Lilly Lake in 2021, which outlined a three year project targeting the management of hybrid Eurasian watermilfoil. The project was initiated with *year before treatment* monitoring and planning activities in 2021. With Onterra's assistance, the LLPRD received almost $22,000 in grant funds to cost-share management and monitoring efforts in 2022-2023. This included a whole-lake herbicide treatment in early spring 2022. This final report details the efforts conducted during this three-year project, including serving as the final grant deliverable for ACEI-295-22.

1.1 Historic AIS Management & Planning

Eurasian watermilfoil (EWM) has been present in Lilly Lake since at least 1976, with hybrid Eurasian watermilfoil (HWM) being verified in 2014. Within this report, the collective populations of EWM and HWM are referred to as HWM unless specified otherwise.

The Lilly Lake Protection & Rehabilitation District (LLPRD) has been managing Lilly Lake's HWM population on an annual basis primarily targeting the population with 2,4-D spot treatments. While some of these historical treatments have approached whole-lake levels, these treatments have at best resulted in seasonal control and have failed to achieve longer-term, multi-year control of the HWM population. It is likely that the long history of annual use of 2,4-D has selected for an HWM population that is more resistant to this herbicide. Surveys conducted in 2020 and 2021 revealed the widespread presence and establishment of HWM in Lilly Lake. The densest colonies were identified in shallow, near-shore areas, where they disrupt lake access, recreational activities, and the overall visual aesthetics of the lake.

As a part of the LLPRD's plan development, the group learned about the realistic management of HWM with herbicides and why annual use of a single herbicide is not ecological sound and often not fiscally efficient. In the LLPRD's 2021 *Aquatic Plant Management Plan*, a new approach to HWM management was included that utilizes a relatively new herbicide, ProcellaCOR™, in an effort to achieve longer-term control of the HWM population. Although ProcellaCOR™ shares a mode of action similar to 2,4-D by mimicking auxin hormones, the variances in molecular structure and binding affinity are believed to elicit a distinct plant response, thus reducing the potential for similarity.

The LLPRD's *Aquatic Plant Management Plan* (2021) outlines an HWM population control goal to reduce or eliminate large, contiguous, monotypic colonies of HWM. The LLPRD conducted HWM monitoring in 2021 without grant funds to serve as a pretreatment dataset in anticipation of an early-season 2022 herbicide treatment.

The LLPRD contracted with Onterra and paid for a whole-lake point-intercept survey in 2021 to quantify the HWM and native plant populations ahead of the proposed 2022 treatment. A late-season HWM mapping survey was also completed to obtain an up-to-date picture of the HWM population and to aid in the construction of herbicide application areas. The 2021 point-intercept survey showed HWM increased in occurrence from 37% in 2020 to 52% in 2021. The HWM late-summer mapping survey showed that the acreage of colonized HWM increased from 8.0 acres in 2020 to 24.0 acres in 2021. Most of this increase was attributable to an increase in areas of *scattered* HWM; however, approximately 11.0 acres contained *dominant*, *highly dominant*, or *surface-matted* HWM (Map 1).

1.2 2022 HWM Herbicide Treatment Summary

The LLPRD developed a 2022 HWM control strategy to target dense HWM occurrences in high-use areas, understanding that HWM control was likely to extend outward and potentially lake-wide from this treatment. The herbicide treatment design included treating three individual application areas totaling 10.5 acres with florpyrauxifen-benzyl (ProcellaCOR) at an application rate of 4.0 PDU/acre-ft. The treatment was completed on the morning of May 23, 2022 by Schmidt's Aquatic. Details of the 2022 herbicide treatment strategy development, implementation, and *year of treatment* monitoring results are included within the *Lilly Lake 2022 HWM Management & Monitoring Report* (Jan 2023).

The herbicide treatment's monitoring plan included comparative late-season HWM Mapping Surveys and whole-lake point-intercept surveys during the *year before treatment* (2021), *year of treatment* (2022), and *year after treatment* (2023). In addition, water samples would be collected during the days and weeks following the treatment to understand the levels of herbicide achieved in association with the treatment.

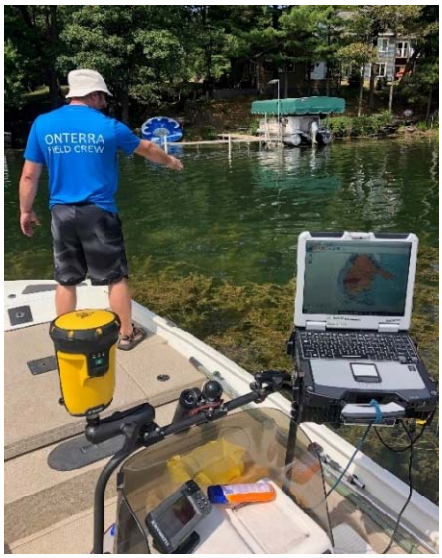
Results of the *year of treatment* surveys in 2022 documented lake-wide impacts to HWM with just one individual plant found on the point-intercept survey and no HWM plants found during the visual mapping survey. Native plant impacts were limited to water stargrass (*Heteranthera dubia*) which exhibited a statically significant decline in abundance in 2022 when compared to pre-treatment in 2021.

The calculated potential whole-lake concentration of the active ingredient in ProcellaCOR (florpyrauxifen-benzyl) was 0.84 ppb, while the measured concentrations were near 0.3 ppb in the center of the lake during approximately the first two days after treatment. Uptake and conversion of the active ingredient into a derivative form (florpyrauxifen acid) was confirmed occurring as soon as 3 hours after treatment, which may account for the measured concentrations falling short of the theoretical target. While the active ingredient was below detectable levels by 14 days after treatment, the acid metabolite remained above detection limits through the duration of the post-treatment monitoring period which was out to 28 days after treatment. It is not known the duration for which the acid remained above detection limits; however, more recent monitoring in other lakes in Wisconsin has shown the acid can remain detectable through ten weeks after treatment. It is unclear the role of which florpyrauxifen acid plays in contributing towards HWM impacts and this continues to be a topic of further study in the state. More

details on the herbicide concentration monitoring component can be found within *Lilly Lake 2022 HWM Management & Monitoring Report* (Jan 2023).

2.0 2023 AQUATIC PLANT MONITORING RESULTS

It is important to note that two types of surveys are discussed in the subsequent materials: 1) point-intercept surveys (Photograph 2.0-2) and 2) HWM mapping surveys (Photograph 2.0-1). Overall, each survey has its strengths and weaknesses, which is why both are utilized in different ways as part of this project. 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 survey methodology allows comparisons to be made over time, as well as between lakes. It is common to see a particularly plant species, such as HWM, very near the sampling location but not yield it on the rake sampler. Particularly in low-density colonies such as those designated by Onterra as *highly scattered* and *scattered*, large gaps between HWM plants may exist resulting in HWM not being present at a particularly pre-determined point-intercept sampling location in that area.



Photograph 2.0-1. HWM mapping survey on a Wisconsin lake. Photo credit Onterra.

Photograph 2.0-2. Point-intercept survey on a Wisconsin lake. Photo credit Onterra.

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 HWM mapping survey, the entire littoral area of the lake is surveyed through visual observations from the boat (Photo 2.0-1). Field crews may supplement the visual survey by deploying a submersible camera along with periodically doing rake tows. The HWM 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*.

2.1 Quantitative Monitoring: Whole-Lake Point-Intercept Survey

A whole-lake point-intercept aquatic plant survey was conducted in Lilly Lake by Onterra on August 1, 2023 (Photograph 2.0-2). Point-intercept surveys covering the entire lake were also conducted in 2008, 2020, 2021, 2022, and 2023. While older surveys were conducted in 1967 and 2008, this report will primarily concentrate on the most recent whole lake point-intercept surveys available from 2021 to 2023 for the purposes of assessing the aquatic plant population surrounding the 2022 herbicide treatment. The subsequent text contains the results and comparative analysis from the 2023 survey. Aquatic plants have been found growing to a maximum depth of 19-20 feet in the point-intercept surveys, which indicates that the littoral zone spans essentially the entire lake.

Species List

In total, 31 species have been recorded from Lilly Lake over the course of these three surveys, with 20 having a submergent growth form (Table 2.1-1). The completion of an emergent and floating-leaf plant mapping survey in 2020 documented additional species growing in near-shore areas that were not documented in subsequent surveys. The list also contains the species' scientific name, common name, status in WI, and its 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.

Table 2.1-1. Aquatic plant species located in Lilly Lake.

Growth Form	Scientific Name	Common Name	Status in Wisconsin	Coefficient of Conservatism	2020	2021	2022	2023
Emergent	*Eleocharis erythropoda*	Bald spikerush	Native	3	I			
	Iris pseudacorus	Pale-yellow iris	Non-Native - Invasive	N/A	I			
	Lythrum salicaria	Purple loosestrife	Non-Native - Invasive	N/A	I			
	Phalaris arundinacea	Reed canary grass	Non-Native - Invasive	N/A	I			
	Phragmites australis subsp. australis	Giant reed	Non-Native - Invasive	N/A	I			
	Schoenoplectus acutus	Hardstem bulrush	Native	5	I			
	Schoenoplectus pungens	Three-square rush	Native	5	I			
	Typha angustifolia	Narrow-leaved cattail	Non-Native - Invasive	N/A	I			
	Typha latifolia	Broad-leaved cattail	Native	1	I			
Submergent	*Chara spp.*	Muskgrasses	Native	7	X	X	X	X
	Elodea canadensis	Common waterweed	Native	3	X	X	X	X
	Heteranthera dubia	Water stargrass	Native	6	X	X	X	X
	Myriophyllum spicatum	Eurasian watermilfoil	Non-Native - Invasive	N/A	X	X	X	
	Najas flexilis	Slender naiad	Native	6	X	X	X	X
	Najas guadalupensis	Southern naiad	Native	7	X	X	X	X
	Nitella spp.	Stoneworts	Native	7		X	X	
	Potamogeton amplifolius	Large-leaf pondweed	Native	7			X	
	Potamogeton amplifolius x P. praelongus	Large-leaf x white-stem pondweed hybrid	Native	N/A	X	X	X	X
	Potamogeton crispus	Curly-leaf pondweed	Non-Native - Invasive	N/A	X	X	I	X
	Potamogeton gramineus	Variable-leaf pondweed	Native	7			X	X
	Potamogeton illinoensis	Illinois pondweed	Native	6	X	X	X	X
	Potamogeton nodosus	Long-leaf pondweed	Native	5	I			
	Potamogeton praelongus	White-stem pondweed	Native	8	X	X	X	X
	Potamogeton richardsonii	Clasping-leaf pondweed	Native	5			X	
	Potamogeton robbinsii	Fern-leaf pondweed	Native	8	X	X	X	X
	Potamogeton strictifolius	Stiff pondweed	Native	8	X	X	X	
	Potamogeton zosteriformis	Flat-stem pondweed	Native	6	X	X	X	X
	Stuckenia pectinata	Sago pondweed	Native	3	X	X	X	X
	Vallisneria americana	Wild celery	Native	6	X	X	X	X
S/E	*Eleocharis acicularis*	Needle spikerush	Native	5		X		X
	Sagittaria graminea	Grass-leaved arrowhead	Native	9		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

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 survey completed on Lilly Lake; 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 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.

A total of 15 aquatic plant species were encountered directly on the rake during the 2023 whole-lake point-intercept survey. Due to the difficulty of identifying in the field, the occurrences of large-leaf pondweed, white-stem pondweed, and a hybrid white-stem/large-stem pondweed are combined for analysis purposes. Muskgrasses (82.2%), southern naiad (58.9%), and white-stem/ large-leaf X white-stem pondweed hybrid (49.8%) were the most frequently encountered species in the 2023 point-intercept survey (Figure 2.1-1).

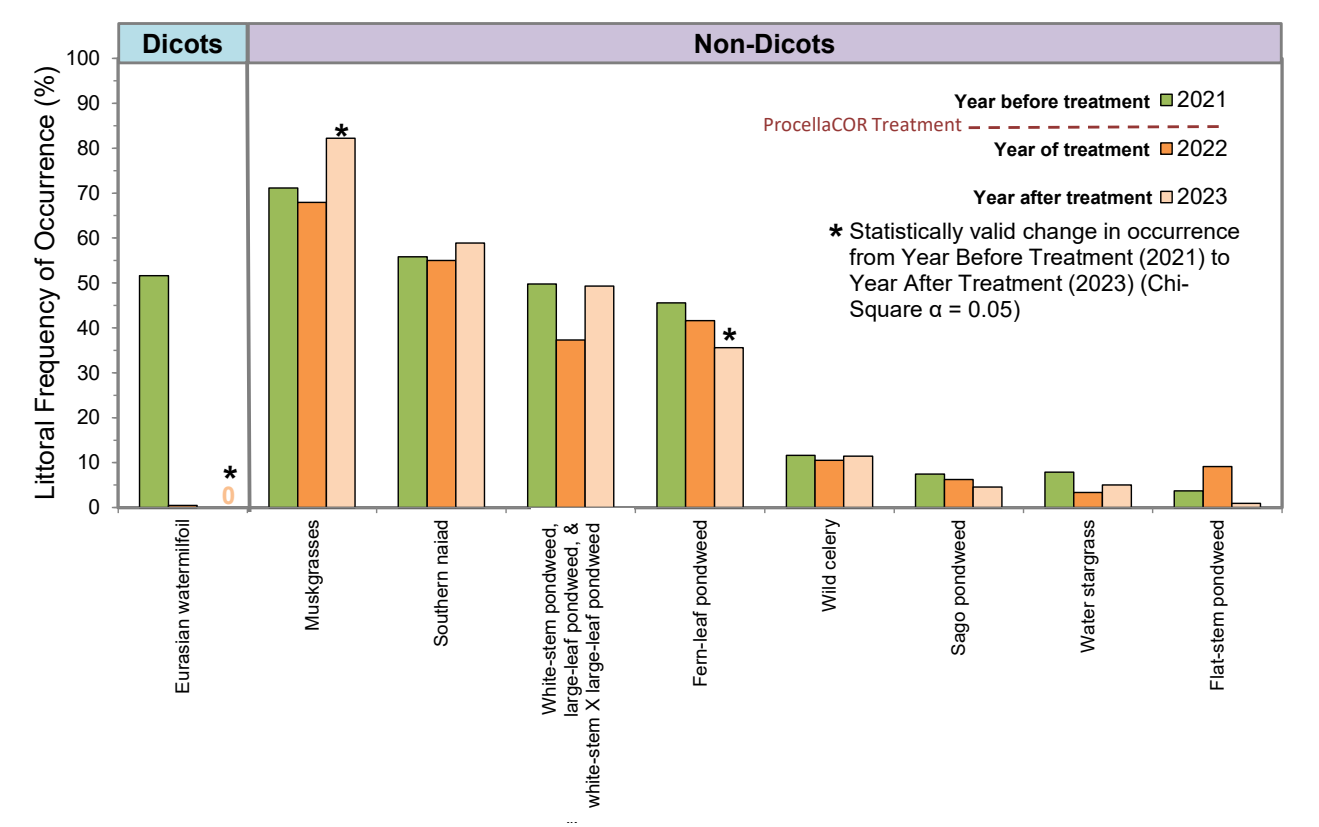


Figure 2.1-1. 2021-2023 littoral frequency of occurrence of aquatic plant species. Created using data from the 2021, 2022, and 2023 whole-lake point-intercept surveys.

Figure 2.1-1 compares the littoral frequency of occurrence for the most commonly encountered aquatic plant species located in point-intercept surveys between 2021-2023 in Lilly Lake. HWM exhibited a statistically valid 99.1% decrease in occurrence between 2021 and 2022 following the herbicide

treatment management strategy and was not detected on the 2023 survey (0%) indicating that the treatment met the pre-determined control expectations of at least a 70% decrease in HWM occurrence between pre-treatment (2021) and post-treatment (2023).

The most commonly encountered species in Lilly Lake are not thought to be particularly susceptible to ProcellaCOR treatment strategies. The aquatic plant monitoring that took place surrounding the 2022 treatment showed no statistically valid changes in occurrence to the majority of the native species present in Lilly Lake (Figure 2.1-1). The only native aquatic plant species that had a statistically valid population decrease during the *year of treatment* was water stargrass and this species saw a slight increase in occurrence during 2023. When comparing the *year before treatment* (2021) to the *year after treatment* (2023), fern-leaf pondweed (*Potamogeton robbinsii*) exhibited a statistically valid 21.9% decrease in occurrence. Fern-leaf pondweed, like other *Potamogeton* species, is not believed to be sensitive to ProcellaCOR™ treatments and with an occurrence of 35.6% in the 2023 survey, remains present in high abundance within the lake. Muskgrasses (*Chara spp*.) exhibited a statistically valid increase in occurrence between 2021 and 2023 and has consistently been the most commonly encountered species in the lake in recent years. The occurrence of flat-stem pondweed (*Potamogeton zosteriformis*) was statistically lower in 2023 compared to 2022, but when comparing the 2023 occurrence to the 2021 (pre-treatment) occurrence, they are not statistically different. A full matrix that displays the littoral frequency of occurrences for all species sampled during the point-intercept surveys is included in Appendix A.

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. 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 Lilly Lake to be compared to other lakes within the region and state.

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

Data collected during the aquatic plant surveys was also used to complete a Floristic Quality Assessment (FQA) which incorporates the number of native aquatic plant species recorded on the rake during the

point-intercept survey and their average conservatism. The data used for these calculations does not include any incidental species (visual observations) but only considers plants that were sampled on the rake during the survey. Figure 2.1-2 displays the species richness, average conservatism, and floristic quality of Lilly Lake along with ecoregion and state median values.

Lilly Lake's native plant species richness values have ranged from 13 in 2020 to 16 in 2021 compared to the median values for lakes within the SWTP ecoregion (15) and lakes across Wisconsin (19). However, Lilly Lake's average species conservatism of 6.0 in 2023 falls above the SWTP median value of 5.4 and the statewide value of 6.3. This indicates that on average Lilly Lake has a higher number of environmentally sensitive species (higher C-values) when compared to most lakes within the SWTP ecoregion. The absence of stiff pondweed and stoneworts from the 2023 survey declined this value and neither of these species are known to be susceptible to ProcellaCOR™ treatments. Using the species richness and average conservatism values, Lilly Lake's Floristic Quality Index was 22.4 in 2020, 25.2 in 2021 and 2022, and 22.4 in 2023 falling above the median value for lakes in the SWTP ecoregion (21.1) and below the median value for lakes statewide (27.2).

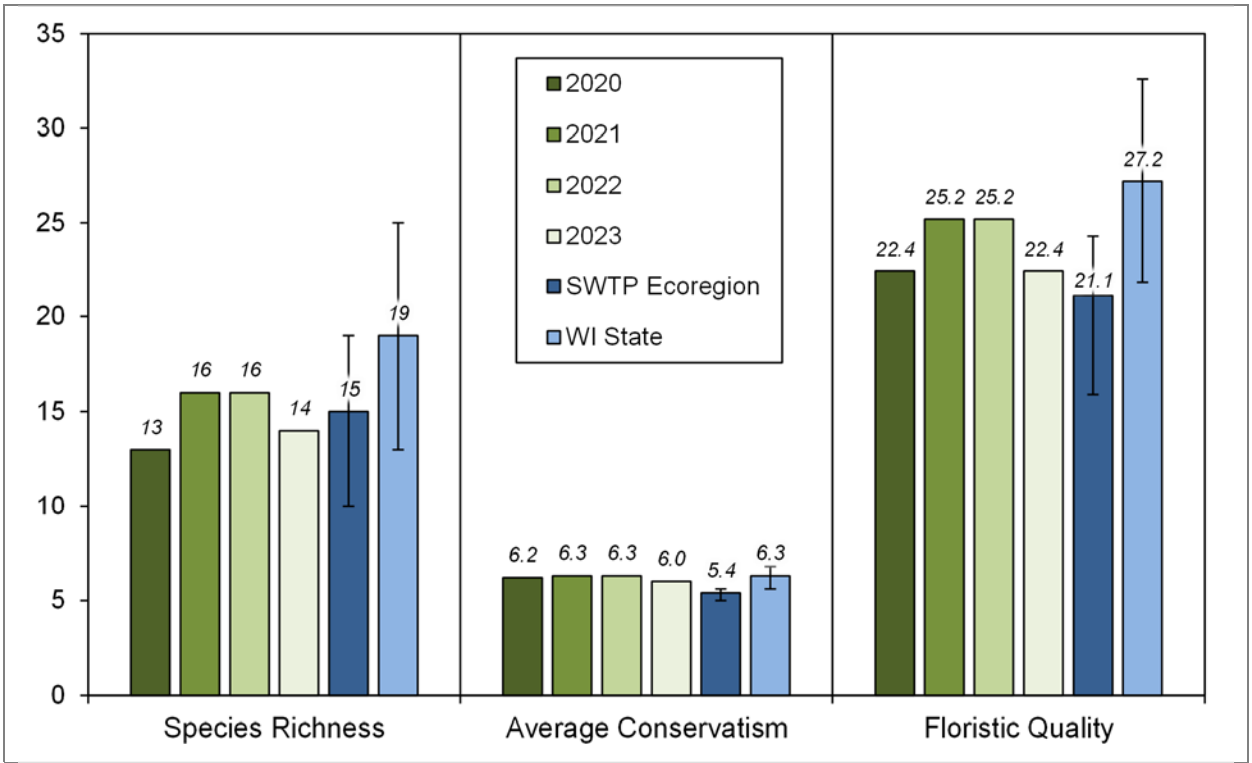


Figure 2.1-2. Floristic Quality Assessment. Created using data from point-intercept surveys. Analysis following Nichols (1999) where SWTP = Southeastern Wisconsin Till Plains - Lakes Ecoregion.

Species Diversity

Species diversity is often confused with species richness. 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.

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 Lilly Lake is compared to data collected by Onterra and the WDNR Science Services on lakes within the Southeastern Wisconsin Till Plains ecoregion and on lakes throughout Wisconsin (Figure 2.1-3). 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 Lilly Lake's diversity values rank. Lilly Lake's Simpson's Diversity Index value has been stable at 0.79-0.86 over the course of the four point-intercept surveys spanning 2020-2023, falling between the lower and upper quartiles.

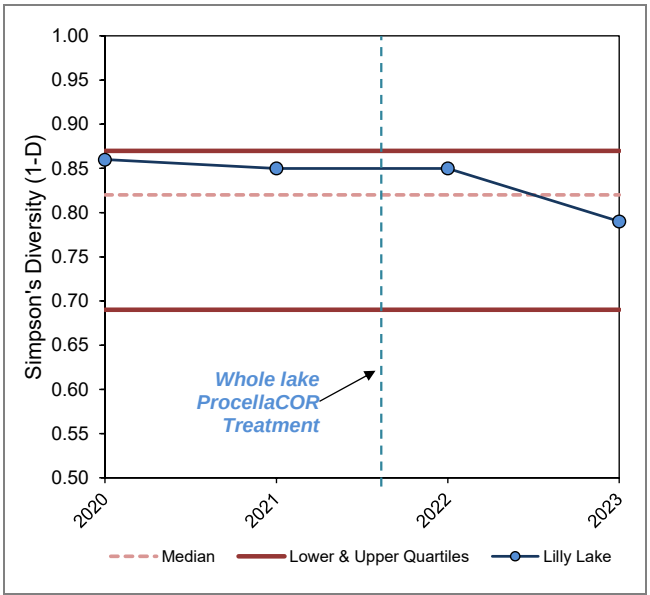


Figure 2.1-3. Simpson's Diversity Index. Created using data from point-intercept surveys.

Additional Aquatic Plant Metrics

Figure 2.1-4 displays number of sampling locations that contained native plants, AIS and native plants, or AIS only from the 2020-2023 point-intercept surveys. These data indicate the expanding HWM population as the sampling points with HWM increased from 79 in 2020 to 112 in 2021. After the spring 2022 herbicide treatment, HWM was present on one sampling site, while the number of sampling points containing native plants decreased slightly from 198 to 189. The most recent survey in 2023 showed the number of sampling locations with native species was 206, while HWM was not present at any sampling locations.

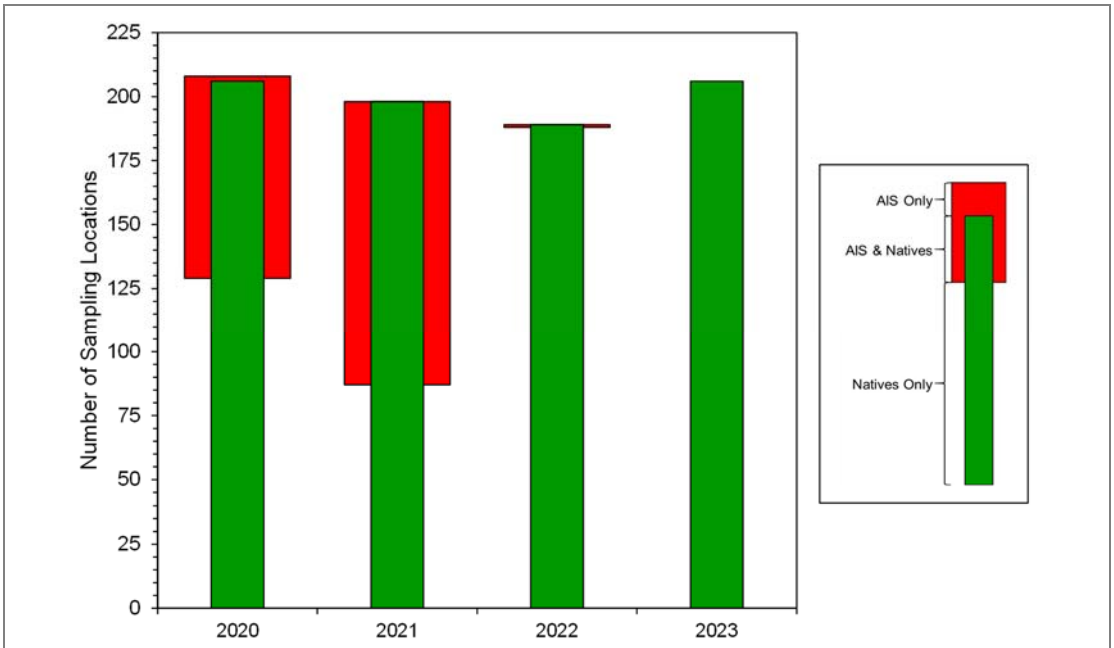


Figure 2.1-4. Number of PI Locations with Native Species and/or HWM in Lilly Lake. Created using data from point-intercept surveys.

Another metric that assesses the native plant community in the lake over time is through comparing the average number of native plant species per sampling location from the point-intercept surveys. In Lilly Lake, 2.59 species per/point were present during the 2020 point-intercept survey, compared to 2.64 in 2021 (Figure 2.1-5). Between 2021 to 2022 which corresponds to the year of the whole lake herbicide treatment, this value decreased to 2.44 species per sampling point. The value was 2.58 in during 2023 which is nearly the same as pre-treatment surveys. Overall, these data show a steady native species per point value over the entire period of study.

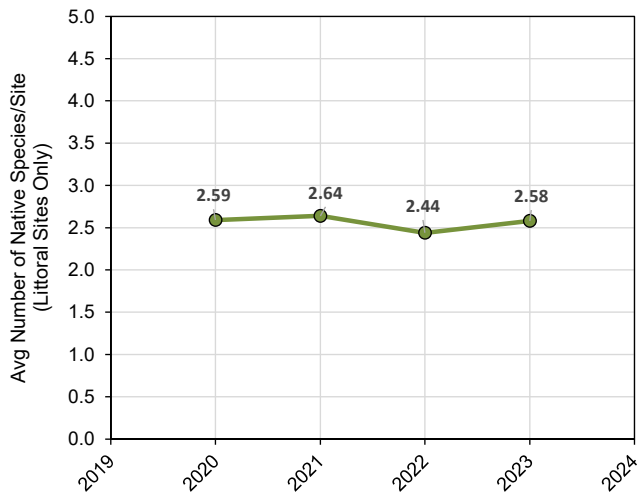


Figure 2.1-5. Number of Native Aquatic Plant Species per Sampling Site. Created using data from point-intercept surveys.

2.2. Qualitative Monitoring: HWM Mapping Surveys

Qualitative monitoring compares the late-summer HWM mapping survey population mapped during 2021 (pre-treatment) and late-summer 2022 and 2023 (post-treatment). Onterra ecologists conducted the Late-Summer HWM Mapping Survey on Lilly Lake on October 3, 2023. The purpose of the survey was to search for and map all occurrences of HWM in the lake. The crew completed a visual meander survey around the lake without detecting any HWM. After completing the visual survey, the crew deployed a submersible camera in deeper areas of the lake to search for short-statured plants. The crew also took several rake tows in former HWM colonies around the lake to search for surviving HWM plants. All of these methods resulted in not finding any HWM in Lilly Lake. The crew noted that native plants appeared green and healthy with many native pondweeds present.

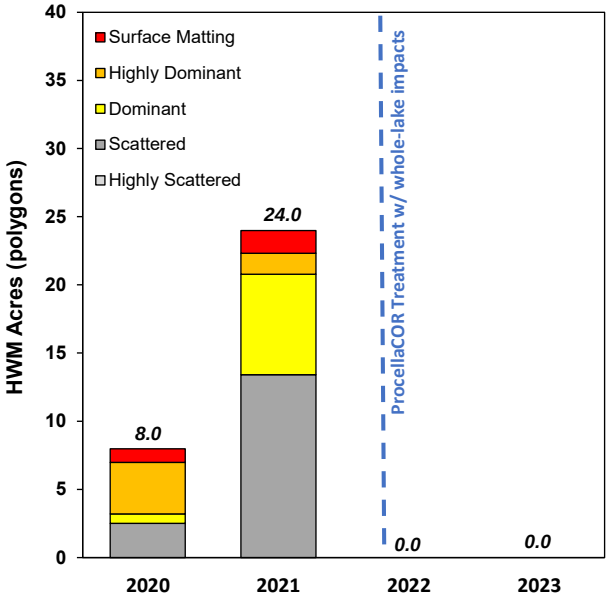


Figure 2.2-1. Acreage of mapped HWM colonies on Lilly Lake from 2020-2023. Data from Onterra Late-Summer HWM Mapping Surveys.

The acreage of colonized HWM that has been mapped in late-summer surveys between 2020-2023 is displayed on Figure 2.2-1. In 2020, 8.0 acres were delineated, whereas 24.0 acres were delineated in the 2021 mapping survey. Approximately 10.6 acres of HWM was comprised of *dominant*, *highly dominant* or *surface matted* densities in the 2021 survey. Following the 2022 herbicide treatments, no colonized HWM was located in Lilly Lake. It is important to note that Figure 2.2-1 only accounts for HWM that is mapped with area-based mapping (polygons) and does not account for any occurrences mapped with point-based attributes such as *single plants*, *clumps of plants*, or *small plant colonies*.

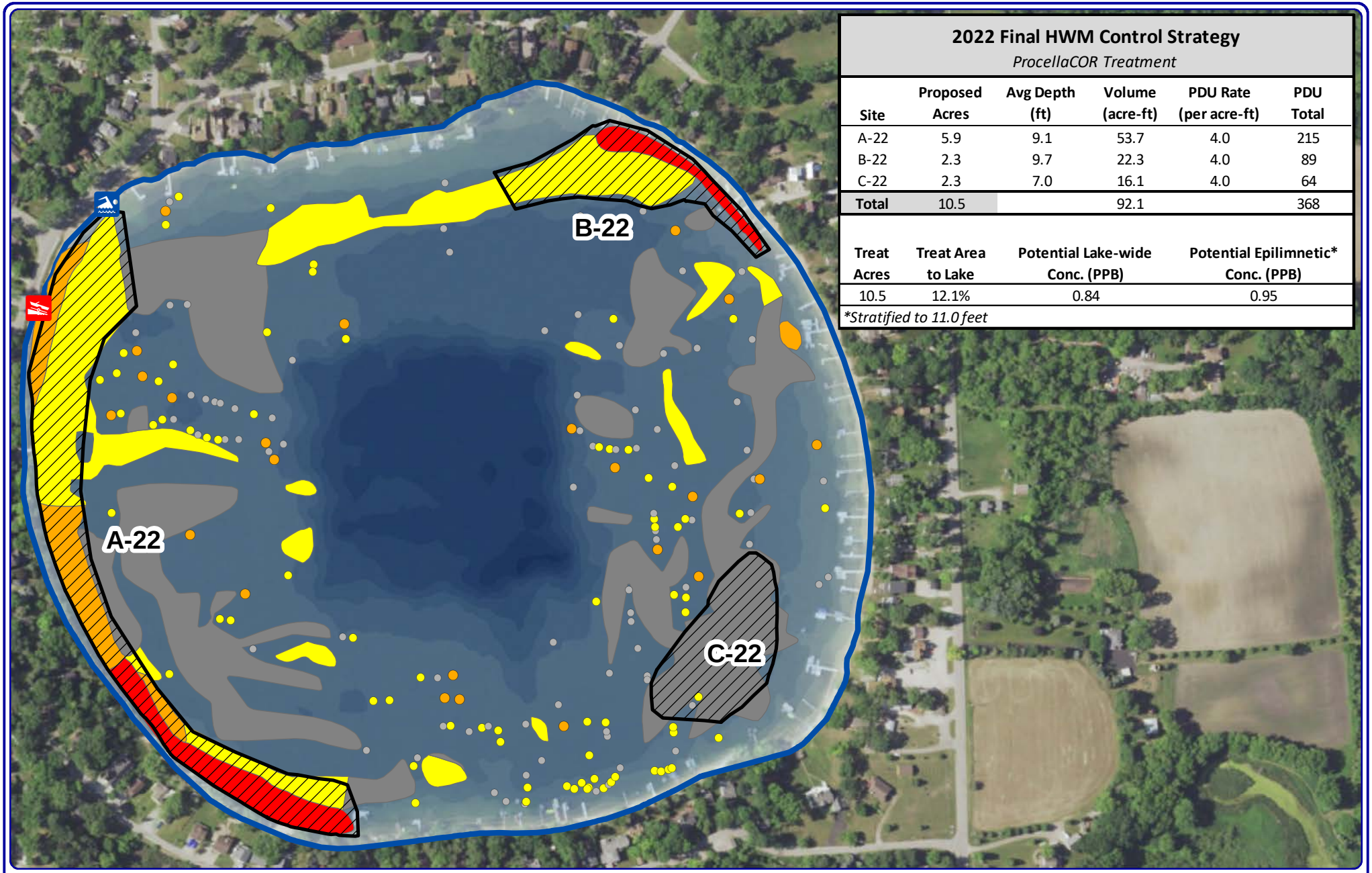
3.0 CONCLUSIONS AND DISCUSSION

The 2022 herbicide treatment strategy was designed to target specific colonies of HWM where herbicide was directly applied; however lake-wide impacts to HWM were anticipated and were confirmed through post-treatment monitoring. Aquatic plant monitoring surveys in 2023 yielded no HWM in the lake. The outcome of the whole lake treatment has met control expectations with HWM reductions lasting through the *year after treatment*. Continued monitoring will provide insights into how the HWM population trends in subsequent years. While few whole-lake ProcellaCOR treatment studies have progressed to the point of being multiple years post-treatment, the results from this treatment to-date suggests that HWM control will likely extend 3-5 years or beyond. As HWM rebounds, following up with manual removal efforts may further extend the interval between which HWM returns to pretreatment levels.

Although no HWM was located during the professional monitoring studies that took place in 2023, HWM is likely still present in the lake in the form of small-statured plants or surviving root crown that are below detection limits. A local lake user reported observing a few small HWM plants in shallow waters in the vicinity of the public boat access and swimming beach during recreational activities in summer of 2023. These isolated individual plants were hand pulled as they were spotted by the observer.

Native aquatic plant monitoring following the 2022 treatment showed limited impacts to the non-target plant community as described in section 2.1 above. This report looks at trends in the frequencies of individual species, as well as overall aquatic plant metrics; all demonstrating that 2022 treatment had minimal impact on the native aquatic plant community while causing drastic reductions in the HWM population.

This report provides the final deliverable for the LLPRD's current AIS Control grant (ACEI-295-22). Onterra recommends continued monitoring of the aquatic plant community, particularly the HWM population. Volunteer-based monitoring for HWM would help understand the rate of HWM rebound in 2024 to potentially trigger volunteer- or professional-based manual removal effort. As discussed in the *Aquatic Plant Management Plan (2021)*, contracting a professional survey towards the end of the 2024 growing season would continue the consistent level of qualitative monitoring that has occurred since 2020.



2022 Final HWM Control Strategy

ProcellaCOR Treatment

Site	Proposed Acres	Avg Depth (ft)	Volume (acre-ft)	PDU Rate (per acre-ft)	PDU Total
A-22	5.9	9.1	53.7	4.0	215
B-22	2.3	9.7	22.3	4.0	89
C-22	2.3	7.0	16.1	4.0	64
Total	10.5		92.1		368

Treat Acres	Treat Area to Lake	Potential Lake-wide Conc. (PPB)	Potential Epilimnetic* Conc. (PPB)
10.5	12.1%	0.84	0.95

**Stratified to 11.0 feet*

N W E S

400

Feet

Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Hydro: WDNR; modified by Onterra
Orthophotgraphy: NAIP 2022
Map Date: March 15, 2022 TWH
Map Filename: Lilly_HWM_Prelim3.mxd

Project Location in Wisconsin

Legend

HWM Mapping Survey: August 2021

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- Public Boat Landing
- Public Beach
- Final 2022 Herbicide Application Area

Map 1
Lilly Lake
Kenosha County, Wisconsin

Final 2022 Hybrid Watermilfoil Control Strategy

A

APPENDIX A

Lilly Lake Point-Intercept Survey Littoral Frequency of Occurrence Matrix: 2020-2023

Scientific Name	Common Name	LFOO (%)			
		2020	2021	2022	2023
Chara spp.	Muskgrasses	73.2	71.2	67.9	82.2
Najas guadalupensis	Southern naiad	41.3	55.8	55.0	58.9
*Potamogeton praelongus, P. amplifolius & hybrid**	White-stem pondweed, large-leaf, and hybrid	53.1	49.8	37.3	49.3
Potamogeton robbinsii	Fern-leaf pondweed	42.3	45.6	41.6	35.6
Potamogeton praelongus	White-stem pondweed	42.3	32.6	23.9	45.7
Myriophyllum spicatum	Eurasian watermilfoil	37.1	51.6	0.5	0.0
Vallisneria americana	Wild celery	11.7	11.6	10.5	11.4
Potamogeton amplifolius x P. praelongus	Large-leaf x white-stem pondweed hybrid	17.4	19.1	12.4	4.1
Stuckenia pectinata	Sago pondweed	9.9	7.4	6.2	4.6
Heteranthera dubia	Water stargrass	11.3	7.9	3.3	5.0
Potamogeton zosteriformis	Flat-stem pondweed	5.6	3.7	9.1	0.9
Potamogeton illinoensis	Illinois pondweed	0.5	0.5	7.2	3.7
Najas flexilis	Slender naiad	1.4	1.9	0.5	3.2
Elodea canadensis	Common waterweed	1.4	2.3	1.9	1.4
Potamogeton strictifolius	Stiff pondweed	0.9	1.4	1.0	0.0
Nitella spp.	Stoneworts	0.0	1.4	1.4	0.0
Potamogeton gramineus	Variable-leaf pondweed	0.0	0.0	0.5	0.9
Potamogeton crispus	Curly-leaf pondweed	0.5	0.9	0.0	0.5
Potamogeton amplifolius	Large-leaf pondweed	0.0	0.0	1.9	0.0
Eleocharis acicularis	Needle spikerush	0.0	0.5	0.0	0.5
Sagittaria graminea	Grass-leaved arrowhead	0.0	0.9	0.0	0.0
Potamogeton richardsonii	Clasping-leaf pondweed	0.0	0.0	0.5	0.0

**Morphologically similar species lumped for statistical analysis.*