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2023-27 AQUATIC PLANT MANAGEMENT PLAN

Osprey Lake

Osprey Lake Property Owners Association

June 2022

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Acknowledgements:

Members of the Osprey Lake Property Owners Association who contributed to discussions and recommendations presented in this plan.

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Executive Summary

Osprey Lake is an exceptionally beautiful lake, home to many species of birds, game fish, and a diverse aquatic plant community. Unfortunately, invasive Eurasian watermilfoil *Myriophyllum spicatum* (EWM) has become established in Osprey Lake, threatening its biodiversity, recreation, and overall health. As such, management of EWM is necessary to protect this valuable resource and maintain its status as a high-quality waterbody. An integrated management approach that relies on a combination of manual and chemical control methods is recommended to continue for Osprey Lake.

The general public and the Osprey Lake Property Owners Association, Inc. (OLPOA) take an active role in managing the lake, and their mission "is to advocate, monitor and act for the protection, environmental and recreational preservation and enhancement of the quality of Osprey Lake, its shoreland and watershed areas located in Sawyer County, Wisconsin, and to respond to issues pertaining thereto as deemed relevant by the membership." Therefore, the primary goal of this plan is to protect Osprey Lake's ecosystem and native plant community for the benefit of all lake users through management efforts to control EWM.

This goal will be accomplished through the following objectives:

1. **EWM Management.** Limit the spread of EWM through environmentally responsible methods to benefit the native plant community while maintaining EWM at manageable levels.

2. **Education and Awareness.** Continue to educate property owners and lake users on aquatic invasive species through public outreach and education programs to help contain EWM within the lake and prevent its spread further in the lake, as well as to other waterbodies.

3. **Research and Monitoring.** Develop a better understanding of the lake and the factors affecting lake water quality through continued and expanded monitoring efforts.

4. **Adaptive Management.** Follow an adaptive management approach that measures and analyzes the effectiveness of control activities and modify the management plan as necessary to meet goals and objectives.

Aquatic Plant Management (APM) Strategy

We recommend the continuation of a combination of chemical and manual control methods to curb the spread of EWM in Osprey Lake and prevent it from dominating the lake. The overall goal of this Aquatic Plant Management (APM) Plan is to protect this outstanding resource from degradation by maximizing prevention of new invasions and through the containment and control of existing aquatic invasive species while maintaining recreational use of the lake.

This plan supports sustainable practices to protect, maintain and improve the native aquatic plant community, the fishery, and the recreational and aesthetic values of the lake as described in the goals of the OLPOA. This plan is intended to be a living document that will be evaluated annually to determine if it is meeting stated goals and community expectations, and can it be revised if necessary. The OLPOA sponsored the development of this APM Plan aided by a WDNR Directed Studies program.

APM plans developed for northern Wisconsin lakes are evaluated according to Northern Region APM Strategy goals developed by the WDNR (Appendix A). APM plans and the associated management permits (chemical or harvesting) are reviewed by the WDNR. Additional review may be completed by the Voigt Intertribal Task Force (VITF) in cooperation with the Great Lakes Indian Fish and Wildlife Commission (GLIFWC). WDNR aquatic plant management planning guidelines, the Northern Region Aquatic Plant Management Strategy, and the goals of the OLPOA in conjunction with the current state of the lake formed the framework for the development of this APM Plan. This plan is designed to be implemented over the course of 5 years with goals and objectives to be met throughout that time frame.

Public Input

Considerations of public input were included in the formation of this plan. Osprey Lake property owners were surveyed in late summer of 2021 on their general knowledge and feelings towards the current state of the lake and its management. To make statistically valid projections, a response rate of 60% is required; the survey was sent to all 37 constituents and 19 were returned for a response rate of 51.4%. Thus, the results reflect the views of approximately 50% of landowners around the lake.

Responders to the survey place a high value on the current quality of the lake and its scenic value (Figure 1). At least 41% of all property owners rate Osprey Lake's water quality as 'Excellent' or 'Good' while 24% feel that it has not changed and 11% feel that it has gotten worse or are not sure. Of those responses, 22% of people who have been on Osprey at least 11 years say that water quality has not changed, 5% of people who have been on Osprey at least 11 years say that water quality has gotten worse, 3% of people who have been on Osprey at least 11 years say that water quality has gotten better. This indicates that water quality has generally been good and has stayed good over time, which is supported by CLMN water quality data described below.

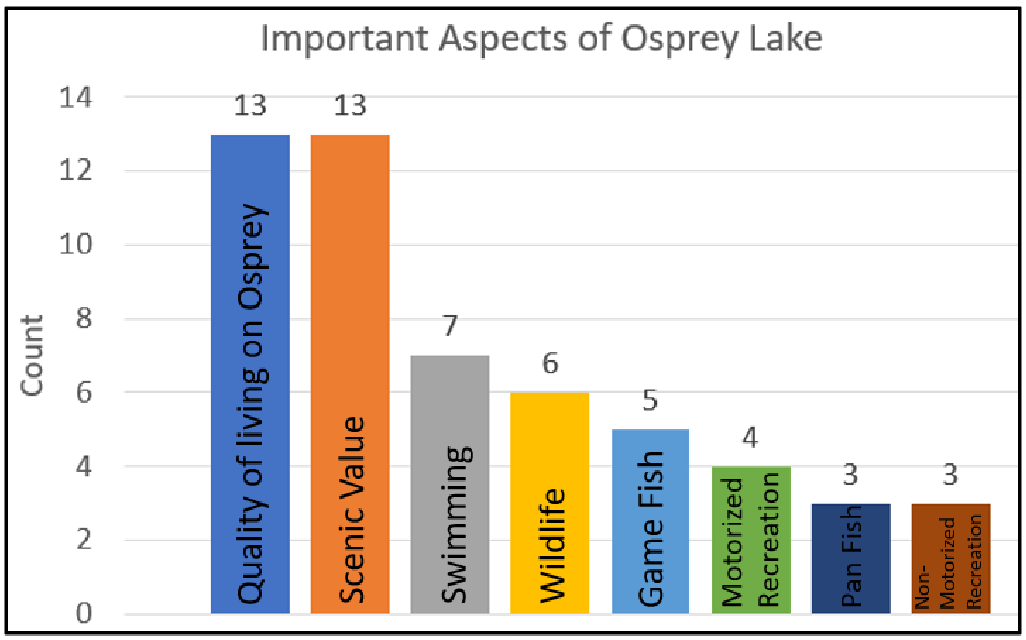

Figure 1: Shoreline property owner values on Osprey Lake

Responses to questions regarding management of aquatic invasive species (AIS) were regarded during the formation of this plan. At least 35% of Osprey Lake property owners support using hand pulling/raking methods to control EWM, and at least 24% support small scale (<10 acres) herbicide treatments with only a small percent opposing either method (Figure 2). Large scale (>10 acres) herbicide treatment, mechanical harvest, biological control, and no management are largely opposed (Figure 2). Osprey Lake constituents may benefit from an AIS education event that includes management options (35% indicated they would attend such an event). These recommendations are outlined on pages 25-31 in the Aquatic Plant Management Discussion and Plan.

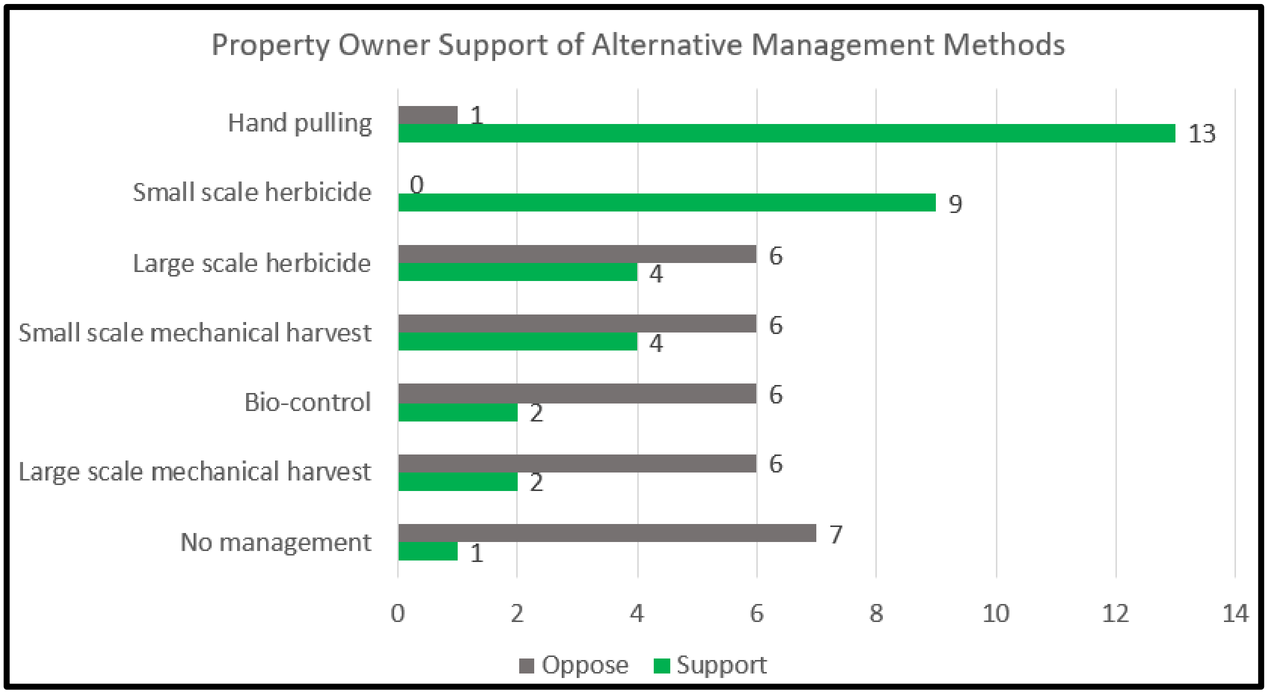

Figure 2: Osprey Lake shoreline property owner support of alternative management methods

Summarizing figures of the survey results are included in Appendix B.

Lake Information

Background

Osprey Lake (WBIC 2395100) is a clear, soft-water, seepage lake located in Sawyer County near Hayward, Wisconsin (Figure 3). The lake has a surface area of approximately 214 acres, a maximum depth of 32 feet, and an average depth of 12 feet (Figure 4). Osprey Lake primarily has mucky to sandy substrate with some rocky areas (Figure 4). Water quality data collected by the LCO Conservation Department has determined that Osprey Lake is a borderline mesotrophic to oligotrophic lake (clear water, low productivity, and no recreational use impairments). Aquatic vegetation is abundant, supporting a fishery of musky, northern pike, walleye, bass, and panfish. The two sub-basins (21 and 23 acres) of Osprey Lake, located west of the lake and connected by small channels during periods of high water, can only be accessed by non-motorized boats due to dense floating and emergent vegetation (Figure 3).

The southern portion of Osprey Lake falls within the Lac Courte Oreilles Band of Lake Superior Chippewa Indians Reservation and is considered a unique and significant water resource by the Lac Courte Orielles Band of Lake Superior Chippewa Indians (LCO) and the Wisconsin Department of Natural Resources (WDNR). The LCO Tribe maintains a public boat landing at the south end of the lake and utilizes the lake for spearing walleye (Figure 3).

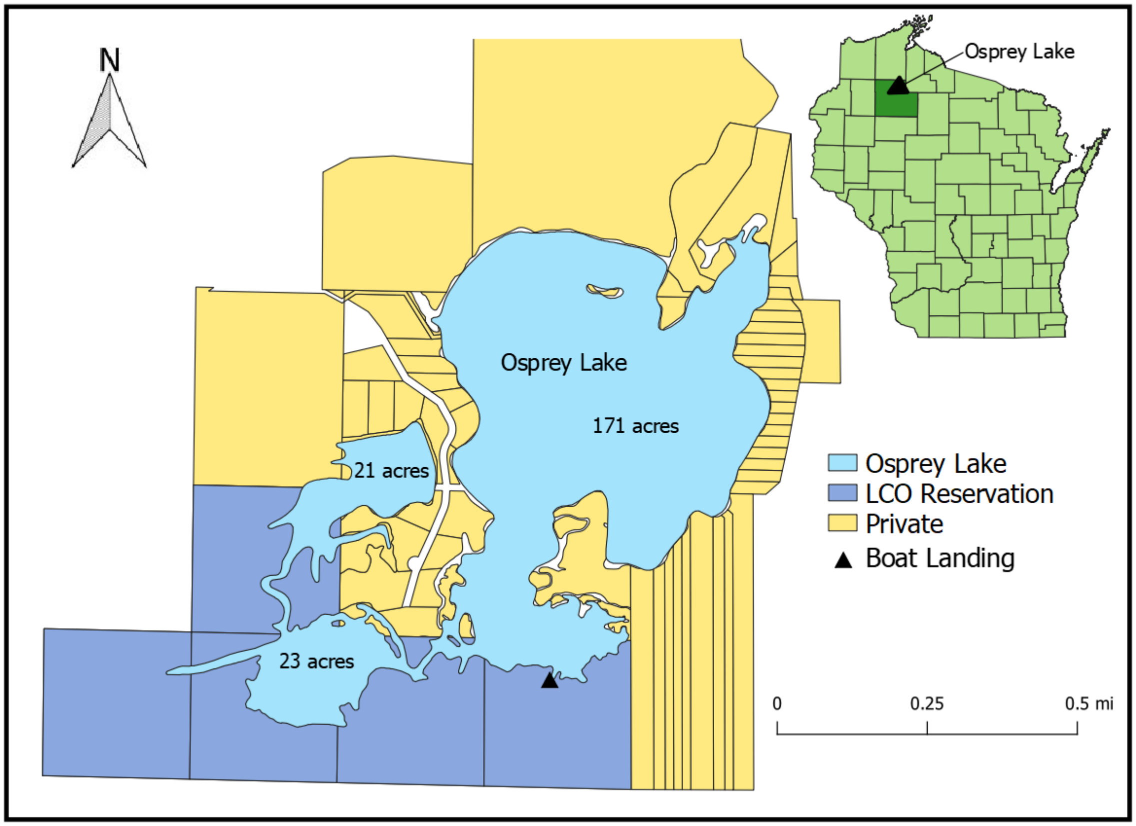

Figure 3: Location and land ownership of Osprey Lake, Sawyer County, Wisconsin

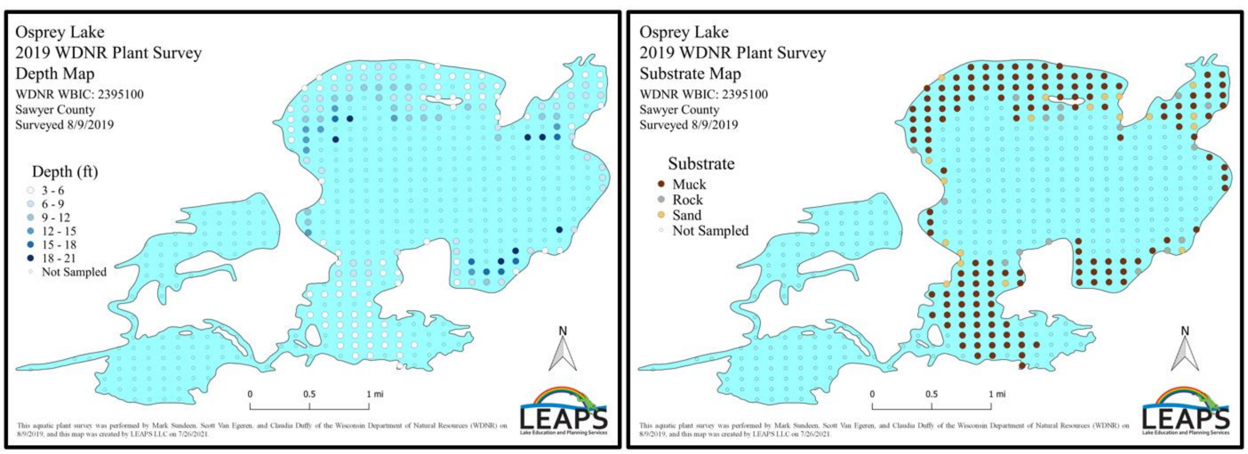

Figure 4: Osprey Lake depth and bottom substrate (WDNR, 2019)

Watershed Land Cover

A watershed is an area of land from which water drains to a common surface water feature such as a stream, lake, or wetland. Osprey Lake is part of the Couderay River watershed with an inlet stream that flows from Little Round Lake and an outlet stream that flows into Lac Courte Orielles Lake. The watershed is mostly forested (64.90%) with some large wetland complexes (13.50%) and some open land (8.70%; Figure 5). Within 500 feet of the lake is mostly forest and wetlands with a low amount of development.

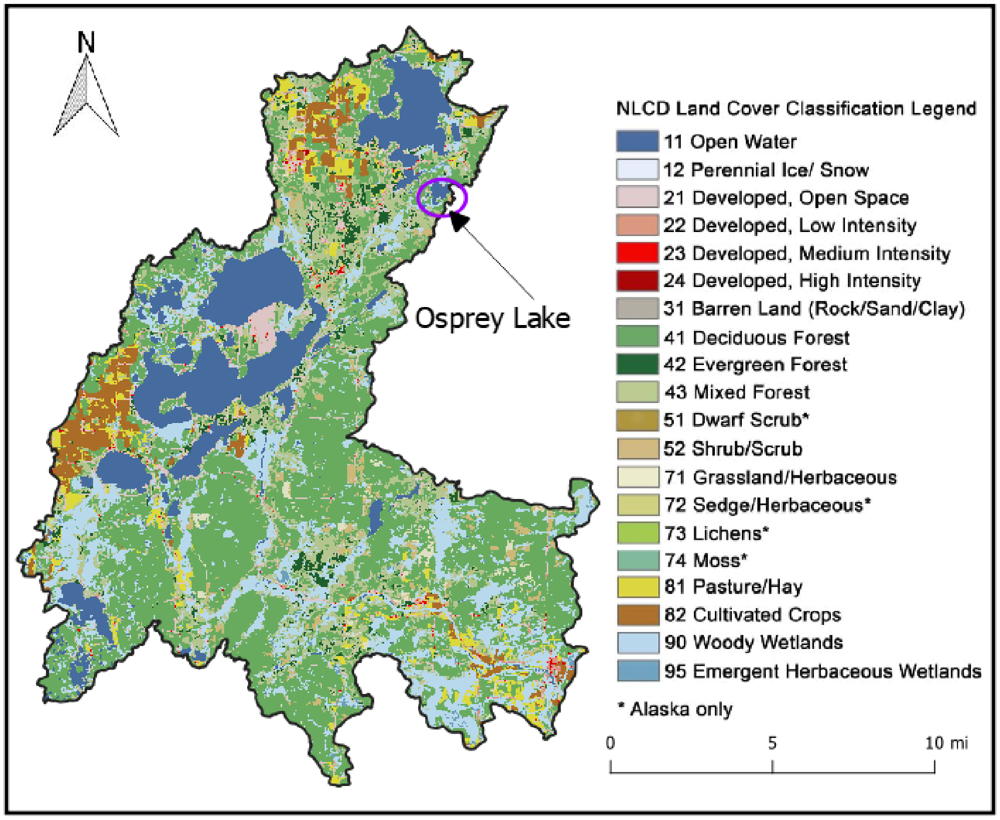

Figure 5: Couderay River watershed land cover (NLCD, 2016)

Trophic State

Trophic state and water quality are often used synonymously; however, they are not the same. Trophic state describes the biological condition of a lake using a scale that is based on water clarity, total phosphorus, and chlorophyll-*a* (Carlson 1977). Water quality is typically based on a perception of the lake, which may be subjective for different lake users. People who use the lake for primarily swimming usually classify lakes with clear water as having better water quality while the same lake might be classified as having poor water quality by a fisherman because the low productivity limits fish growth.

By combining data for water clarity, phosphorus, and chlorophyll-*a* in Osprey Lake, the trophic state as defined by Carlson's Trophic Status Index (1977) is able to be determined (Figure 6). Eutrophic lakes typically have large amounts of aquatic plant growth, higher nutrient concentrations, low water clarity due to algae blooms, and oxygen-depleted bottom waters. On the other end of the spectrum, oligotrophic lakes are nutrient-poor, have clear and cold water, and oxygen throughout the water column continually. Mesotrophic lakes fall in the middle and have intermediate nutrient levels, occasional algal blooms, and may experience bottom water oxygen depletion in the summer (Red ovals in Figure 7 represent Osprey Lake ranges).

The specific measurements of water quality and trophic status in Osprey Lake have fluctuated over time. Secchi depth (a measure of water clarity) in Osprey Lake is available from 2008-2014 (excluding 2010), 2019, and 2021. Secchi depths ranged from 8.7 to 22.8 feet with an overall average of 15.0 feet, which classifies Osprey Lake as an oligotrophic system. Chlorophyll-*a* in those same years ranged from 0.73 to 7.6µg/L, averaging 2.49µg/L (trophic state value 45), which classifies Osprey Lake as an oligotrophic lake (Figure 6). Total phosphorus has ranged from 10.1µg/L to 13.0µg/L and averages 11.8µg/L, which classifies the lake as borderline meso to oligotrophic. More information can be found at: https://dnr.wi.gov/lakes/waterquality/Station.aspx?id=10039031.

The rich plant community of Osprey Lake provides many beneficial functions to the lake. The plant community helps maintain its clear water status by limiting the amount of nutrients that can be used by algae (a key determinant in pushing Osprey Lake towards becoming more mesotrophic). It also supports a productive game fish community by sheltering young, small fish and providing ambush opportunities for game fish species like northern pike *Esox lucius*. The native plants also help protect the shoreline of Osprey Lake from erosion by absorbing and mitigating waves before they can reach the vulnerable shore. Overall, maintaining the health of the plant community of Osprey Lake is critical in maintaining the quality of the water and the quality of the lake as a whole.

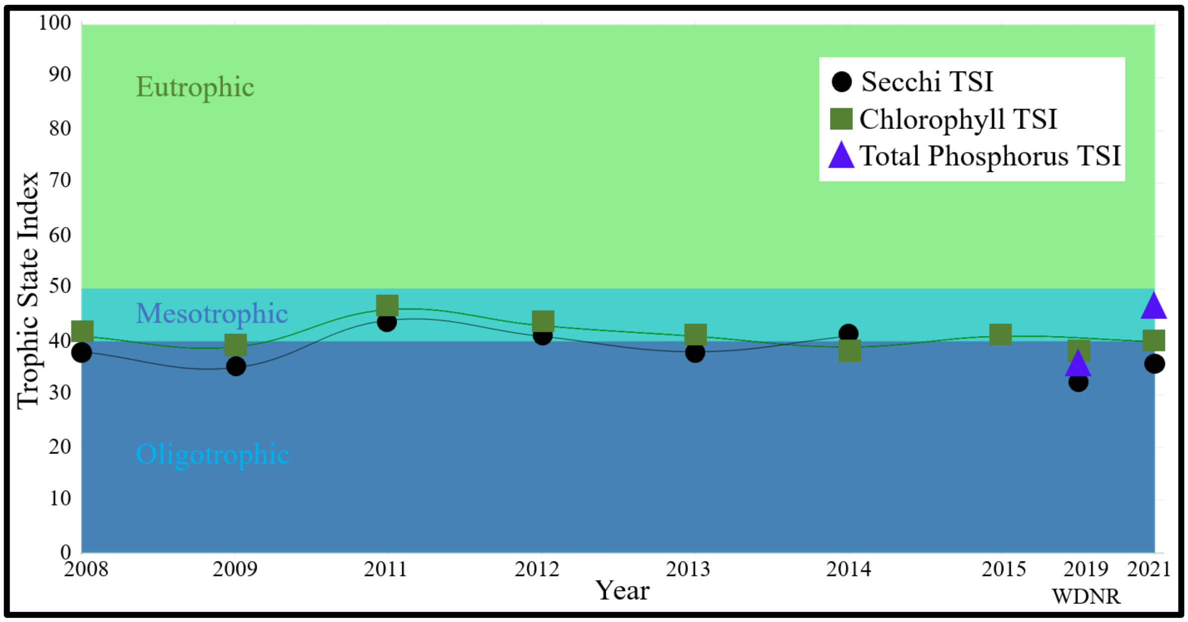

Figure 6: Osprey Lake trophic status index data (WDNR)

TSI	Chlorophyll-a (ug/L)	Secchi Depth (ft)	Total Phosphorus (ug/L)	Classification	Attributes	Fisheries and Recreation
<30	<0.95	>26	<6	ULTRAOLIOGOTROPHIC	clear water, many algal species, oxygen throughout the year in bottom water, cold water	oxygen-sensitive, cold water fish species in deep lakes
30-40	0.95 -2.6	13 - 26	6 - 12	OLIGOTROPHIC	clear water, many algal species, oxygen throughout the year in bottom water except possibly in shallow lakes, cold water	oxygen-sensitive, cold water fish species in deep lakes only
40-50	2.6 - 7.3	6.5 - 13	12 - 24	MESOTROPHIC	water moderately clear, but increasing chance of low dissolved oxygen in deep water during the summer	walleye may dominate
50-60	7.3 -20	3 - 6.5	24 - 48	EUTROPHIC	decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident	warm-water fisheries (pike, perch, bass, etc.)
60-70	20 - 56	1.5 - 3	48 - 96	EUTROPHIC	blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible	thick aquatic vegetation and algal scums may discourage swimming and boating
70-80	56 - 155	0.75 - 1.5	96 - 192	HYPEREUTROPHIC	heavy algal blooms possible throughout summer, dense plant beds, but extent limited by light penetration (blue-green algae block sunlight)	summer fish kills possible, rough fish dominant
>80	>155	<0.75	192 - 384	HYPEREUTROPHIC	Algal scums, few plants	

Figure 7: Osprey Lake trophic state summary

Circled values indicate the average water quality measurements and corresponding TSI scores for Osprey Lake from data collected by citizen volunteers. This figure is adapted from Carlson and Simpson 1996, information from the WDNR, and publicly available CLMN water quality data.

Oxygen and Thermal Stratification

Dissolved oxygen is essential for the survival of most aquatic animals, just like atmospheric oxygen is essential for most terrestrial animals. Surface waters (also called the epilimnion) exchange oxygen with the atmosphere and are usually oxygen-rich. In deeper lakes, or smaller lakes that are generally sheltered from prevailing winds, the water in the lake stratifies (or separates) into distinct zones during the summer months, impacting water quality and affecting biota. These zones are the epilimnion (usually oxygen-rich surface waters), the thermocline (the layer separating the surface and bottom waters), and the hypolimnion (oxygen-depleted bottom waters; Figure 8).

In most cases, a lake does not remain in a stratified state year-round. Monitoring data indicates that Osprey Lake is dimictic, meaning that at least twice a year (spring and fall) stratification is replaced by a mixing event called "overturn" or "turnover" where all waters in the lake (top and bottom) naturally mix, recharging levels of dissolved oxygen and distributing necessary nutrients throughout the water in the lake. Smaller and often limited "mixing" events can occur in the summer months due to large storm events or heavy recreational use. Monitoring data for Osprey Lake show that hypoxia (low oxygen) regularly occurs at depths below 21 feet during summer months (June-September).

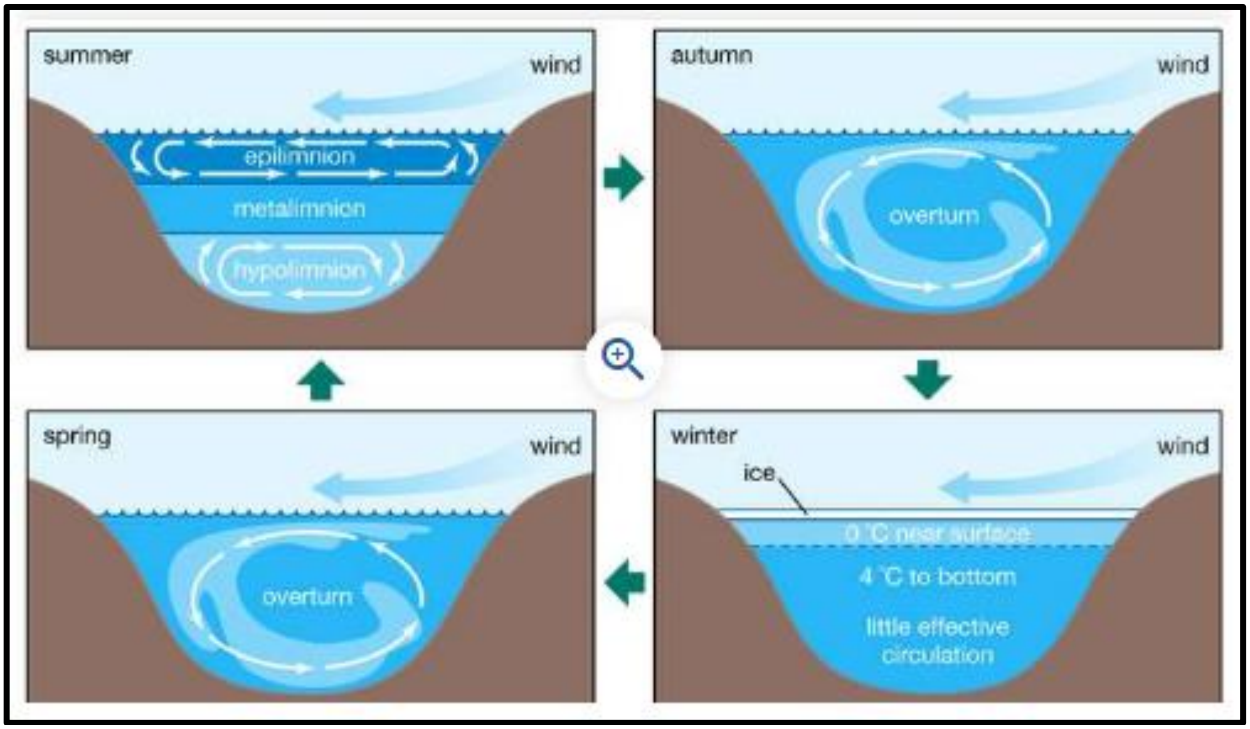

Figure 8: Seasonal thermal stratification in lakes (Encyclopedia Britannica)

Fishery and Wildlife Habitat

The fishery on Osprey Lake is managed by two organizations, the LCO Tribe and the Wisconsin Department of Natural Resources. The fishery supports largemouth bass, northern pike, smallmouth bass, walleye, musky, and panfish. There is great spawning habitat for northern pike, musky, bass and some limited areas for walleye spawning. Currently, there is a large population of largemouth bass and high numbers of northern pike. The growth rate of panfish in the lake is below average. A potential cause may be increased fishing pressure on predator fish reducing the number of smaller fish preyed upon each year (P. Christel, personal comm.).

Osprey Lake is being managed for walleyes. There is currently a walleye stocking program being implemented to determine if numbers can be raised enough to sustain a walleye fishery. On September 16, 2010 an electrofishing survey was done by the WI Department of Natural Resources to determine numbers of young walleye. Relatively low densities of walleye were found in the fall survey (3.2 young-of-year walleye/mile; J. Krahn, personal comm.). The walleye found in the survey most likely represent fish that were stocked the previous year and not a naturally reproducing population (J. Krahn, personal comm.). Bluegills and largemouth bass were common during the survey and northern pike were observed.

Osprey Lake is surrounded by exceptional wildlife habitat. The lake is considered an Area of Special Natural Resource Interest (ASNRI) by the WDNR. The forested areas surrounding the lake provide habitat for many animal species. Additionally, the wetlands along and near the lake provide high quality habitat for many birds and other species.

The relatively low density of homes and human disturbance on the lake make it attractive to wildlife. An eagle's nest is located on the island in the north part of the lake. Overall, with the predominantly natural shoreline that is found on the lake, the area is excellent wildlife and fishery habitat.

Public Use

Osprey Lake is used for a wide range of recreational activities, including:

- Fishing for panfish species, bass, northern pike, musky, and walleye
- Using nonmotorized boats while photographing or viewing nature
- Using motorized boats for recreational enjoyment of the lake
- Swimming

There is one public boat landing on the lake, located on the south end of the lake on the LCO Tribal Reservation (Figure 3).

These activities in Osprey Lake can all be hindered by EWM. Additionally, Osprey Lake may serve as a source point of EWM to other waterbodies if boats and trailers are not properly inspected. Therefore, management of this invasive species is necessary to allow full recreational use of the lake and prevent further spread into un-infected lakes.

Plant Community

Current Status

In the latest whole lake point-intercept survey completed by the WI-DNR in 2019, only points in the larger main basin were sampled. Of the 427 sample points in the main basin, 173 had aquatic plant growth and 206 points were shallower than the deepest point with vegetation. For the main basin of Osprey Lake, the littoral, or plant growing zone (considered to be water ≤21ft) covers about 82 of the 171 acres of the lake. In 2020, EWM covered 4.26 acres or a little more than 5% of that area (Figure 9). EWM can be found in most places in the lake with a firm, mucky bottom in depths from 3-10 feet (Figure 9).

The plant community of Osprey Lake can be subdivided into four distinct zones (emergent, shallow submergent, floating-leaf, and deep submergent) with each zone having its own characteristic functions in the lake ecosystem. Depending on the local bottom type (sand, rock, sandy muck, or nutrient-rich organic muck), these zones often had somewhat different species present. The steeply sloping bed of Osprey Lake causes the littoral zone to be relatively small; this confines each plant zone to relatively narrow areas (Figure 9).

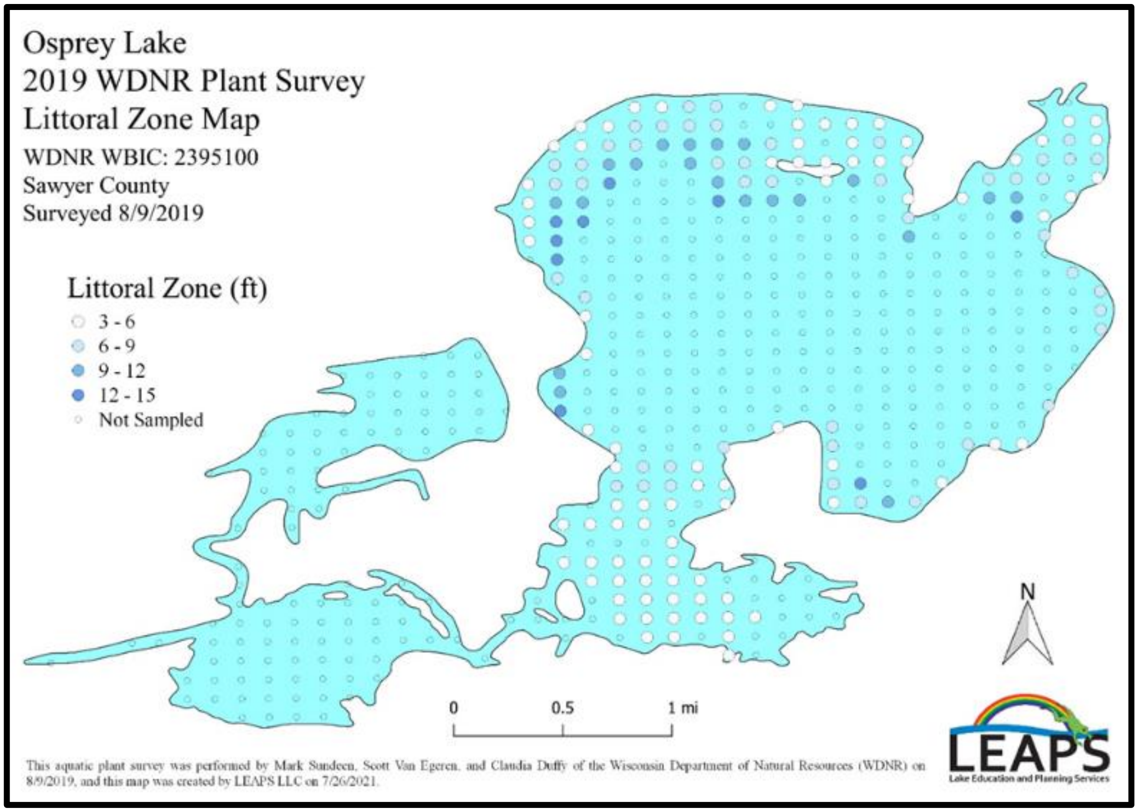

Figure 9: Littoral zone of Osprey Lake

In shallow areas, emergent plants prevent erosion by stabilizing the lakeshore, breaking up wave action, providing a nursery for baitfish and juvenile gamefish, offering shelter for amphibians, and giving waterfowl and predatory wading birds, like herons, a place to hunt. These areas also provide important habitat for invertebrates like dragonflies and mayflies. Over firm sandy muck, tight to the shoreline (especially in the channel connecting to the main basin) the emergent community contains Robbins' spikerush *Eleocharis robbinsii*, pipewort *Eriocaulon aquaticum*, and brown-fruited rush *Juncus pelocarpus*. In bays with more organic muck, these species are replaced by arrowhead *Sagittaria* sp. (especially along the north shore), and water bulrush *Schoenoplectus subterminalis* (in the southern bay of the main basin).

Just beyond the emergent plant species, the lakebed becomes more mucky, supporting a different array of species. These shallow areas (generally less than 6 feet in depth) are dominated by the floating-leaf species watershield, white-water lily, and spatterdock. The protective canopy cover these species provide is often utilized by panfish and bass. Other pondweed species that may produce floating leaves in this zone included large-leaf pondweed *Potamogeton amplifolius*, variable pondweed *Potamogeton gramineus*, and floating-leaf pondweed *Potamogeton natans*.

Growing in gaps in the floating-leaf canopy and among the dominant pondweeds, scattered patches of water marigold *Bidens beckii*, muskgrass *Chara* sp., common waterweed *Elodea canadensis*, slender naiad, variable pondweed *Potamogeton gramineus*, and fern-leaf pondweed are found. The roots, shoots, and seeds of all these species are heavily utilized by waterfowl for food, and they also provide important habitat for the lake's fish throughout their life cycles, as well as a myriad of invertebrates like scuds, dragonfly and mayfly nymphs, and snails.

Floating amongst the shallow-submergent and floating-leaf species, large numbers of carnivorous bladderworts can be encountered. Rather than drawing nutrients up through roots like other plants, these carnivores trap zooplankton and minute insects in their bladders, digest their prey, and use the nutrients to further their growth. This group includes flat-leaf bladderwort *Utricularia intermedia* and common bladderwort *Utricularia vulgaris* in Osprey Lake. Floating-leaf and shallow submergent species generally disappear on Osprey Lake in water over 6-7ft deep. In these deeper submergent areas, muskgrass, common waterweed, and fern-leaf pondweed dominate the plant community and often form dense beds. Predatory fish like musky, northern pike, and walleye are often found along the edges of these deep-water beds waiting in ambush.

Comparison of Native Macrophyte Species in 2006, 2015, and 2019

In each year of surveying Osprey Lake, dense vegetation and varying water levels have changed the number of points that can be sampled. In 2006, 319 of 535 possible points designated by the WDNR were sampled; in 2015, 267 of 535 possible points were sampled; and in 2019, 210 of 535 possible points were sampled (Table 1; Figure 10). Most notably, the two shallow sub-basins of Osprey Lake were not sampled in any year due to the dense floating vegetation that make navigation with a motor boat impossible. Point locations for 2006 are not available, and all data for 2006 and 2015 are from the Osprey Lake 2015 Aquatic Plant Survey and Comparison to 2006 Survey Report by Dan Tyrolt of the LCO Conservation District (Tyrolt, 2015). Plant survey data from 2019 are taken from the WDNR point intercept survey results.

Table 1: Osprey Lake aquatic plant survey summary statistics

SUMMARY STATS:	2006	2015	2019
Total number of points sampled	319	267	210
Total number of sites with vegetation	208	237	173
Total number of sites shallower than maximum depth of plants	292	260	206
Frequency of occurrence at sites shallower than maximum depth of plants	71.2	91.15	83.98
Simpson Diversity Index	0.93	0.93	0.91
Maximum depth of plants (ft)	25.0	23.0	21.0
Number of sites sampled using rake on Rope (R)	88	124	33
Number of sites sampled using rake on Pole (P)	191	142	172
Average number of all species per site (shallower than max depth)	2	2.87	2.18
Average number of all species per site (veg. sites only)	1.48	3.15	2.60
Average number of native species per site (shallower than max depth)	1.8	2.71	2.16
Average number of native species per site (veg. sites only)	1.48	3.15	2.58
Species Richness	35	33	33
Species Richness (including visuals)	37	37	33

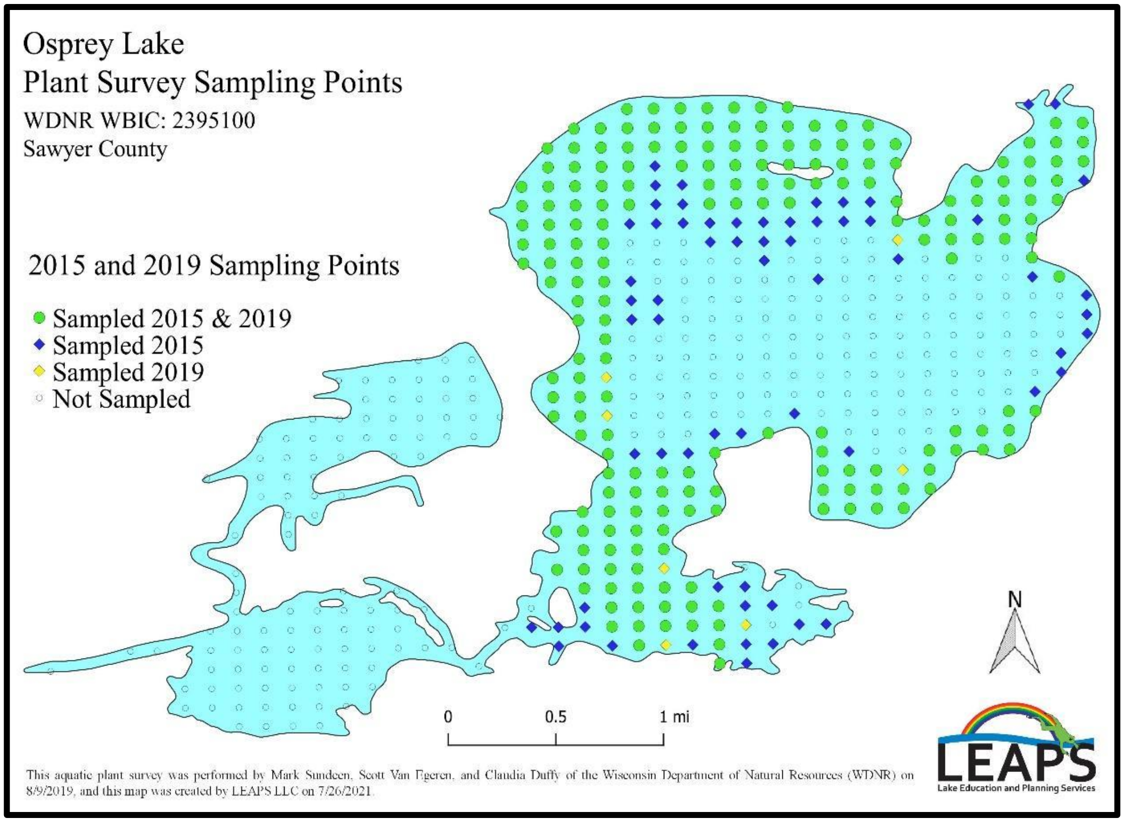

Figure 10: Points sampled in 2015 and 2019 Osprey Lake PI surveys

In 2006, muskgrass *Chara* sp., common waterweed *Elodea canadensis*, and fern-leaf pondweed *Potamogeton robinsii* were the three most common species (Table 2). They were present at 31.25%, 28.36%, and 27.88%, of survey points with vegetation respectively, and collectively, they accounted for 87.5% of the total relative frequency. During the 2015 survey, fern-leaf pondweed, muskgrass, and water celery *Valisneria americana* were the most common species (Table 2; Table 3). Present at 37.97%, 30.38%, and 29.54% and 33.72% of sites with vegetation, they accounted for 97.89% of the total relative frequency. In the 2019 survey, slender naiad *Najas flexilis*, water celery, and fern-leaf pondweed were the three most common species and were present at 38.15%, 37.57%, and 31.2% of survey points with vegetation, respectively (Table 3; Table 4). Notably, there were discrepancies in the reporting of slender naiad and bushy pondweed – which are the same species – between the two reports. But because the reports were compiled by two different entities the data was left unchanged.

Table 2: Change in species presence from 2006 to 2015

Species	2006	2015	+/-
Eurasian watermilfoil	present	present	---
Creeping spikerush	present	0	no change
Cattail	present	present	no change
Muskgrass	65	72	---
Common waterweed	59	38	-
Fern-leaf pondweed	58	90	+
Bushy pondweed	51	3	-
Nitella	40	57	+
Small pondweed	39	12	-
Variable pondweed	28	61	+
Water celery	18	70	+
Clasping-leaf pondweed	17	3	-
Water marigold	15	19	+
Flat-stem pondweed	14	0	-
White water lily	13	41	+
*Water bulrush	13	30	+
Sagittaria sp.	11	3	-
Needle spikerush	10	9	---
Floating-leaf pondweed	10	28	+
Watershield	9	39	+
*Dwarf watermilfoil	9	0	-
Northern watermilfoil	7	1	-
Large-leaf pondweed	7	25	+
Spatterdock	6	12	+
Water stargrass	4	3	-
Common bur-reed	4	2	-
Coontail	3	0	---
Aquatic moss	3	17	+
*Flat-leaf bladderwort	2	44	+
Freshwater sponge	2	4	+
Robbins spikerush	1	6	+
*Pipewort	1	2	+
Water smartweed	1	1	-
Pickerelweed	1	2	+
White-stem pondweed	1	7	+
Soft stem bulrush	1	2	+
Filamentous algae	0	42	+
Bottle brush sedge	0	present	no change
Small duckweed	0	present	---
*Narrow-leaved bur-reed	0	1	+
Short-stem bur-reed	0	1	+

Table 3: Change in species presence from 2015 to 2019

Species	2015	2019	+/-
Eurasian watermilfoil	present	present	---
Bottle brush sedge	present	0	no change
Cattail	present	0	no change
Robbins pondweed	90	54	-
Muskgrass	72	52	-
Water celery	70	65	-
Variable pondweed	61	22	-
Nitella	57	10	-
*Flat-leaf bladderwort	44	6	-
Filamentous algae	42	3	-
White water lily	41	10	-
Watershield	39	11	-
Common waterweed	38	32	-
*Water bulrush	30	18	-
Floating-leaf pondweed	28	12	-
Large-leaf pondweed	25	10	-
Water marigold	19	12	-
Aquatic moss	17	12	-
Spatterdock	12	11	-
Small pondweed	12	6	-
Needle spikerush	9	0	-
White-stem pondweed	7	1	-
Robbins spikerush	6	3	-
Freshwater sponge	4	1	-
Water stargrass	3	3	no change
Brown-fruited rush	3	1	-
Bushy pondweed	3	0	-
Clasping-leaf pondweed	3	12	+
Sagittaria sp.	3	2	-
*Pipewort	2	1	-
Pickerelweed	2	0	-
Soft stem bulrush	2	0	-
Common bur-reed	2	0	-
Northern watermilfoil	1	0	-
Water smartweed	1	0	-
*Narrow-leaved bur-reed	1	1	no change
Short-stem bur-reed	1	0	-
*Spiny hornwort	0	1	+
*Dwarf watermilfoil	0	2	+
Slender naiad	0	66	+
Leafy pondweed	0	2	+
Long-leaf pondweed	0	1	-
Spiral-fruited pondweed	0	1	+
*Vasey's pondweed	0	1	+

Table 4: Change in species presence from 2006 to 2019

Species	2006	2019	+/-
Eurasian watermilfoil	present	present	---
**Slender naiad	0	66	+
Water celery	18	65	+
Robbins pondweed	58	54	-
Muskgrass	65	52	-
Common waterweed	59	32	-
Variable pondweed	28	22	-
*Water bulrush	13	18	+
Water marigold	15	12	-
Aquatic moss	3	12	+
Floating-leaf pondweed	10	12	+
Clasping-leaf pondweed	17	12	-
Watershield	9	11	+
Spatterdock	6	11	+
Nitella	40	10	-
White water lily	13	10	-
Large-leaf pondweed	7	10	+
Small pondweed	39	6	-
*Flat-leaf bladderwort	2	6	+
Common bladderwort	0	6	+
Flat-stem pondweed	14	5	-
Filamentous algae	0	3	+
Robbins spikerush	1	3	-
Water stargrass	4	3	-
*Dwarf watermilfoil	9	2	-
Leafy pondweed	0	2	+
Sagittaria sp.	11	2	-
*Spiny hornwort	0	1	+
*Pipewort	1	1	no change
Brown-fruited rush	0	1	-
Long-leaf pondweed	0	1	+
White-stem pondweed	1	1	no change
Spiral-fruited pondweed	0	1	+
*Vasey's pondweed	0	1	+
*Narrow-leaved bur-reed	0	1	+
Freshwater sponge	2	1	-
Coontail	3	0	-
Needle spikerush	10	0	-
Creeping spikerush	present	0	no change
Northern watermilfoil	7	0	-
**Bushy pondweed	51	0	-
Water smartweed	1	0	+
Pickerelweed	1	0	+
Soft stem bulrush	1	0	-
Common bur-reed	4	0	-
*****Bushy pondweed and slender naiad are likely the same species***			

The overall species richness of Osprey Lake varied between surveys. From 2015 to 2019 (2006 raw survey data was not available), species richness increased in shallow to medium depths and stayed the same in deeper sites (Figure 11). Overall, the species richness of the lake as a whole did not drastically differ (Table 5). The Mean Coefficient of Conservatism (C) did increase from about 6.5 in 2006 and 2015 to 7.2 in 2019 (Table 5).

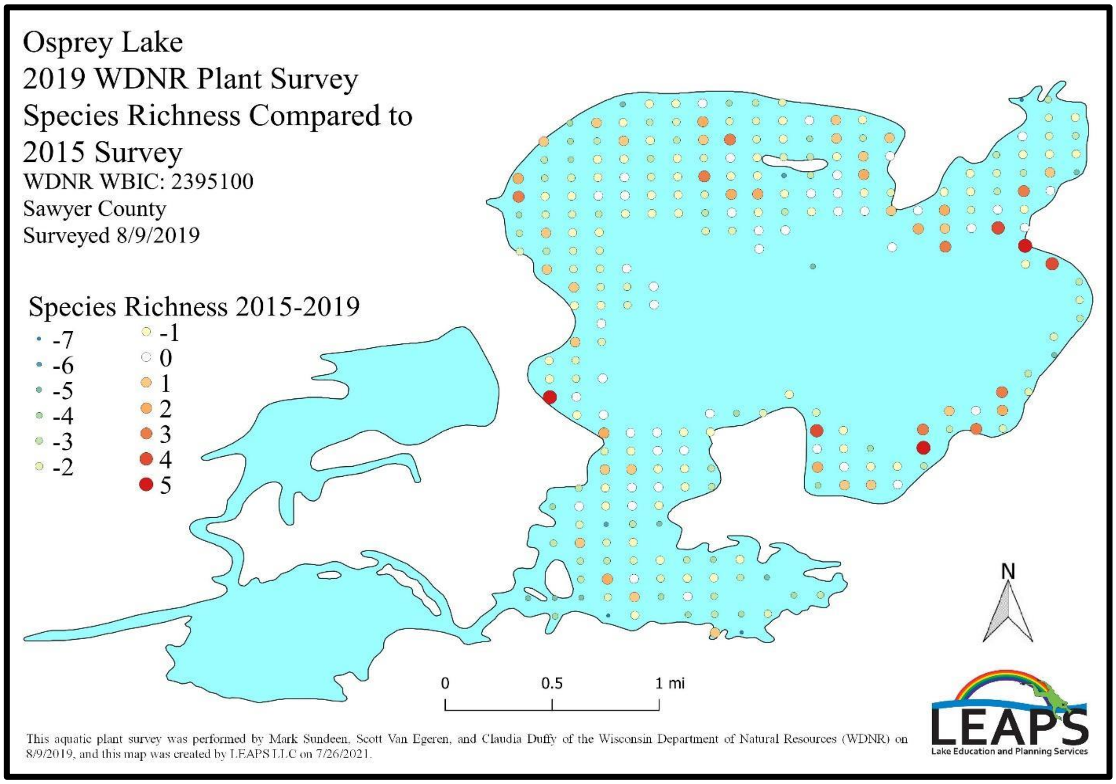

Figure 11: Change in species richness from 2015 to 2019 in Osprey Lake

Table 5: Floristic Quality Index of Aquatic Macrophytes Osprey Lake, Sawyer County

	2006	2015	2019
Species Richness	35	33	33
Simpson Diversity Index	0.93	0.93	0.91
Mean C	6.5	6.5	7.2
FQI	37.6	36.8	39.44

Across all surveys, 30 native index plants were found. They produced a mean Coefficient of Conservatism of 7.2 and a Floristic Quality Index of 39.44 (Table 5). Nichols (1999) reported an average Mean C for the Northern Central Hardwood Forests Region of 5.6, putting Osprey Lake well above average for this part of the state. The FQI was also well above the median FQI of 20.9 for the Northern Central Hardwood Forests Region (Nichols 1999). Exceptionally high value index plants of note included spiny hornwort (C = 10), dwarf watermilfoil *Myriophyllum tenellum* (C=10), water bulrush (C = 9), flat-leaf bladderwort (C = 9), and the State Species of Special Concern Robbins' spikerush (C = 10).

EWM and the Need for Management

Aquatic plants provide habitat for fish and other aquatic organisms, serve as food sources for waterfowl and other wildlife, stabilize the shoreline, and work to improve clarity by absorbing excess nutrients from the water. They are the foundation of a lake and key indicators of the lake's health. Thus, maintaining Osprey Lake's native community while treating invasive EWM is critical to maintaining a healthy lake.

Osprey Lake's plant community is relatively sensitive compared to most other lakes in the region. This lake regularly has 7 extremely high-value species. The water clarity and quality they depend on for survival also makes them dependent on continued landowner stewardship to maintain the lake's nearly pristine conditions.

Osprey Lake's clear, soft water provides ideal habitat for several species. In the sandy, mucky main basin of the lake, common waterweed *Elodea canadensis*, slender naiad *Najas flexilis*, fern-leaf pondweed *Potamogeton robinsii*, and water celery *Valisneria americana* dominate. Osprey Lake's shallow, small sub-basins have are highly dense (to the point of being unable to drive a motorized boat through them) with floating leaf species like white water lily *Nymphaea odorata*, spatterdock *Nuphar variegata*, and watershield *Brasenia schreberi*, as well as multiple bladderwort species. EWM can be found in larger, dense beds in several locations, and in smaller more isolated beds around the lake including the north shore, northwest bay, and in high boat traffic navigation areas. Because the location of EWM hinders landowners from using the lake and is in locations that may hinder general boat traffic, a combination of continued herbicide treatments and hand removal provides the best compromise between maintaining the high quality of the lake while also protecting recreational use.

EWM surveys in 2020 (Figure 12) and 2021 (Figure 13) are consistent in EWM locations and density. Bed 1 from the 2020 survey (Figure 12) was found directly in the center of the entrance to the main basin and was present again to a lesser extent in 2021 (Figure 13). Many plants were prop-clipped, and it seems likely that most boats coming to and from the public landing would motor right through it. Divers worked to remove this bed in 2021. Beds 2 and 3 from the 2020 survey (Figure 12) are located on the north and south ends of the main basin's southwest bay. Neither was large, but they were both dense (RF=2-3) and canopied or near canopy and were present again in 2021 (Figure 13). Although likely not more than a minor impairment to local residents, control in these areas may be desired due to their ability to reseed northern bays.

Bed 4 from the 2020 survey (Figure 14) was patchy and mostly open (RF=1) which likely made it nothing more than a minor navigation impairment. The northwest shoreline was dominated by Northern water-milfoil *Myriophyllum sibiricum* and diverse stands of native pondweeds; especially Large-leaf pondweed *Potamogeton amplifolius*. Eurasian water-milfoil was peppered throughout this thin band, but it was never dominant and most plants appeared to be young as they were only a couple of feet tall, and these findings were consistent in 2021. In the 2020 treatment area immediately east (Figure 14), the bottom was carpeted with Fern pondweed *Potamogeton robbinsii*, and there was no evidence of EWM anywhere.

Bed 6 from the 2021 survey (Figure 14) was the biggest on the lake, but EWM densities within it were highly variable, and these conditions persisted in 2021. In the 5-8ft bathymetric ring, EWM grew interspersed among beds of Wild celery *Vallisneria americana* before becoming the dominant and often the only species found in 9-10ft. There was a nearly continuous string of EWM plants near the shoreline north of the island (Bed 7), and a super cluster of plants in the bay northeast of the island (Bed 9; Figure 14). During the 2021 survey, plants in both places occurred at low density and were not very dense (RF=1) (Figure 13). The small area of Bed 10 from the 2020 (Figure 14) survey contained several canopied microbeds that had satellite plants radiating out in all directions. Treatments in Bed 11 from the 2020 survey (Figure 14) appeared to have knocked out the western half of the bed, but the untreated eastern piece was extremely dense (RF=3). Bed 12 from the 2020 survey is a deepwater microbed that was barely visible as all plants were <3ft tall in 2020. In 2021, Bed 12 grew in size and density (RF=2-3). The bed itself is not an issue, but it may be a source to reseed the north bays if ignored.

Beds 13-16 from the 2020 survey – the four beds in the northeast bay (Figure 14) should likely be considered for continuous management purposes. The area between them was completely open and free of EWM while the inner borders were fragmented and patchy. These areas were combined into one larger treatment in 2021 which knocked out much of them, but a few smaller, more concentrated beds remained in the 2021 survey (Figure 13).

Most of the remaining untreated areas from the 2020 survey were solid canopied beds (Figure 15). Like Bed 1 from the 2020 survey (Figure 12), many of these beds had at least some diver removal performed in 2021. Bed 17 was located along the point at the southern entrance to the northeast bay. Plants were regular, but only a few feet tall (RF=1-2). Beds 18-20 were narrow microbeds (RF=1) that were established perpendicular to the shoreline. This likely resulted in little to no impairment; especially as none were canopied, and they did not reappear in 2021. Beds 20 and 21 were dominated by young plants, and only a few mature towers were found at the core – only Bed 21 remained in 2021 (RF=1). Bed 22 was located just inshore from a 2020 treatment area, which explains its low overall density (RF=1), and it was eliminated in 2021. Bed 23 was little more than a super cluster of canopied plants (RF=3) that remained in 2021.

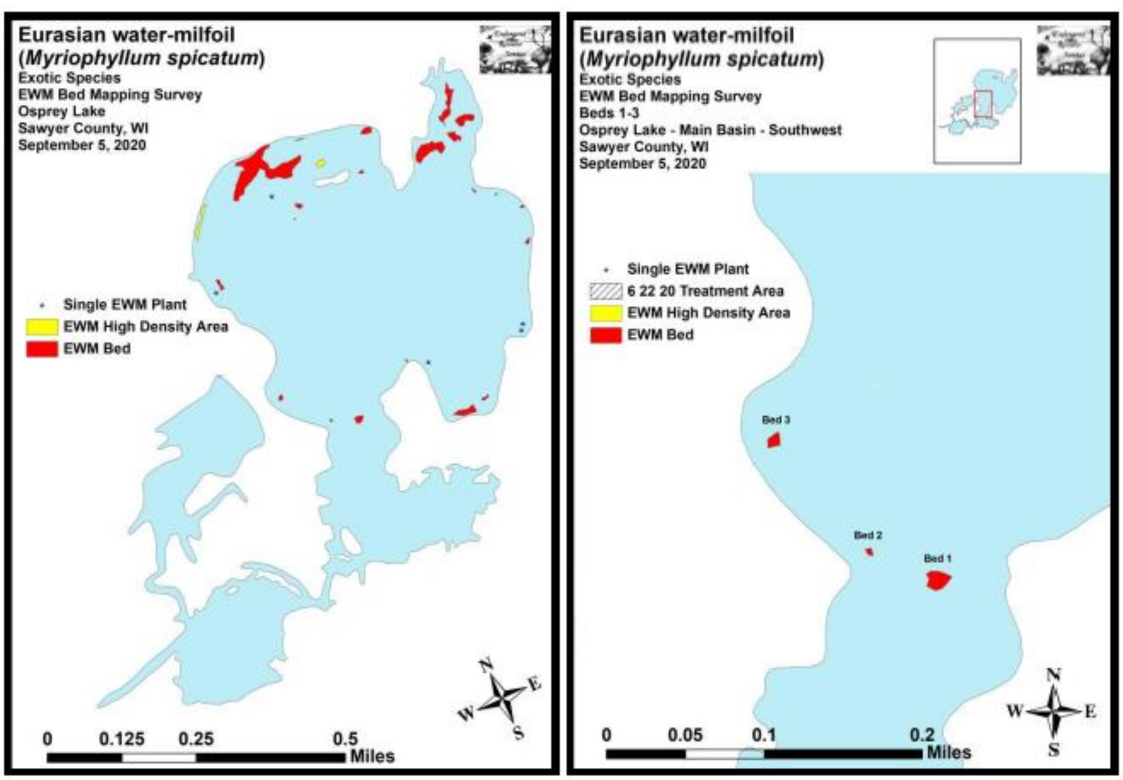

Figure 12: All 2020 EWM beds and close-up of beds 1-3 in Osprey Lake, Sawyer County

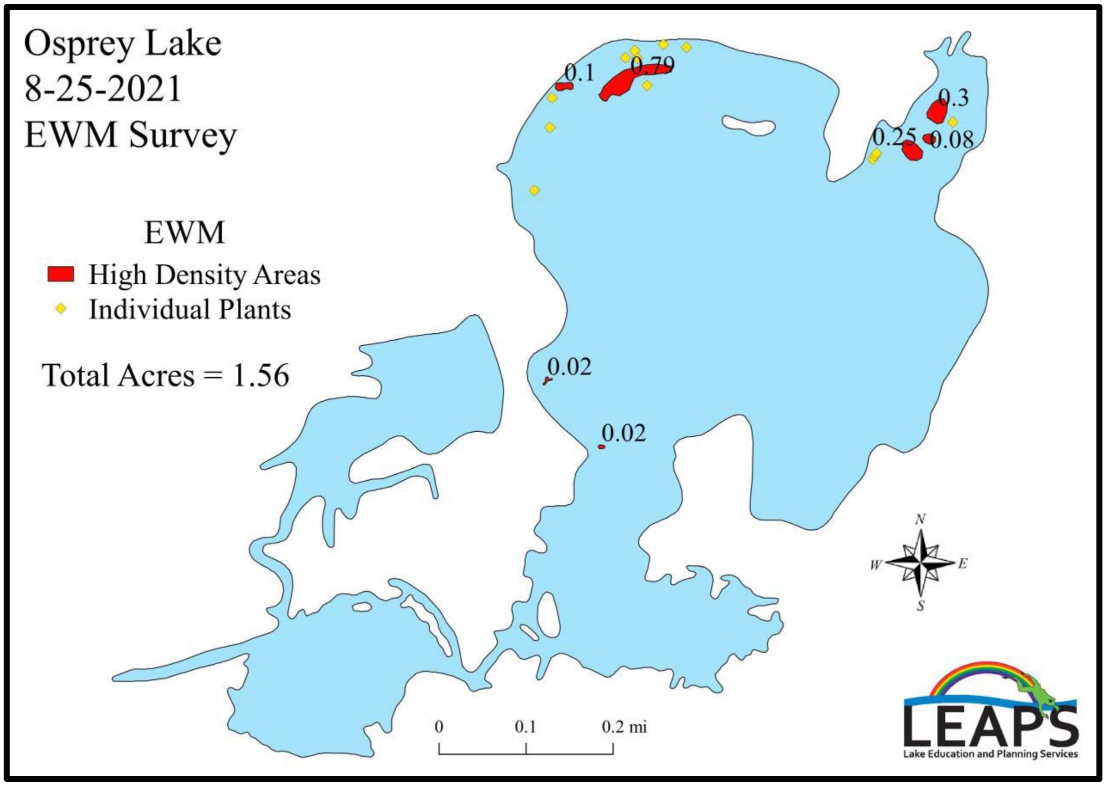

Figure 13: LEAPS 2021 Whole-lake EWM Survey Results

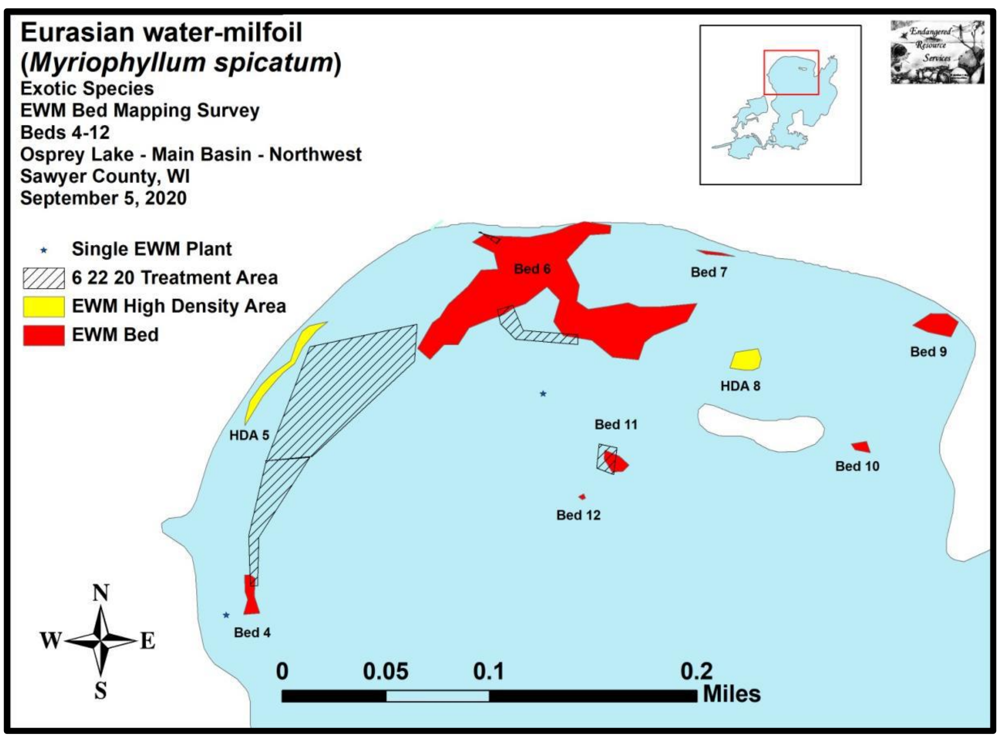

Figure 14: Close-up, 2020 EWM beds in Main Basin Northwest, Osprey Lake, Sawyer County

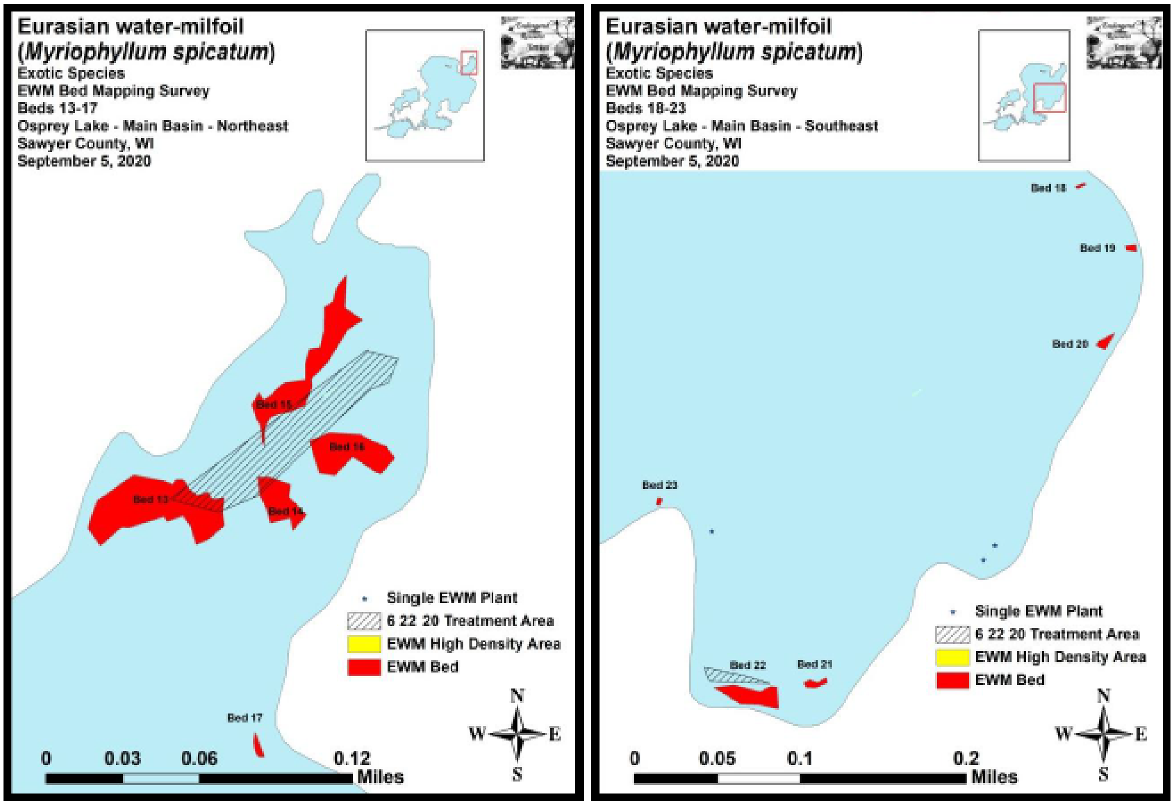

Figure 15: Close-up of 2020 EWM beds in the northeast and south east basins of Osprey Lake, Sawyer County

EWM Management History

EWM was first found in Osprey Lake by the LCO Conservation Department near the boat landing in 2005. At the time, surveys found less than 10 acres of EWM, and it was assumed that EWM had been in the lake less than 5 years. However, its spread met the requirements of the WDNR Rapid Response Grant that the OLPOA applied for and obtained. Three years of herbicide treatments were initiated under the Rapid Response Grant (2006-2008) (Table 6; Figure 16). After the first treatment of Navigate (2,4-D) herbicide in 2006, there were only a few plants found near the Round Lake inlet. In the spring of 2007, an additional 6 acres of EWM was treated with 2,4-D, but several more plants were found later in the year (Table 6; Figure 16). In 2008, 4 acres were treated (Table 6; Figure 16). In 2010, EWM was found to be spreading, and a larger treatment of 5 acres was applied (Table 6; Figure 16). Chemical herbicide treatments of 2,4-D continued until 2015, stopped, and resumed with resumed with 3.5-acre treatments using Renovate Max G in both 2019 and 2020 (Table 6; Figure 16). In 2021, a 3.5-acre treatment using 2,4-D Amine 4 was completed (Table 6; Figure 16). Throughout these years, hand pulling of EWM was implemented around docks, swimming areas, and other small areas that did not warrant a chemical treatment. Additionally, diver removal of EWM took place in 2021 (Figure 16).

There has been overlap in EWM herbicide treatments in Osprey Lake. The northwest corner, the northeast bay, and the southeast bay of Osprey have been consistently treated to varying degrees since 2006 (Figure 16). The northwest corner has especially been a “hot spot” for treatments (Figure 16). It is likely that this area is a major source of EWM fragments that create new EWM areas throughout the lake. The northeast bay is another area where EWM is consistently dense (RF=2-3) despite years of treatment, although relief has been noted directly within the treatment areas. See Appendix C for individual years and treatment areas.

Table 6: EWM treatment history in Osprey Lake (D. Dressel, contracted herbicide applicator and Tyler Mesalk, WDNR)

Year	Acres Treated	Herbicide	Rate (lbs/acre)	Rate (gal/acre)
2006	8.0	2,4-D	125	-
2007	6.0	2,4-D	100-125	-
2008	5.0	2,4-D	150	-
2009	1.0	2,4-D	150	
2010	5.0	2,4-D	150	-
2011	2.5	2,4-D	200	-
	3.5	Renovate Max G	300	
2012	12.0	2,4-D	??	
2013	9.0	2,4-D	262	-
2015	6.0	Renovate Max G	300	-
2019	4.2	Renovate Max G	300	
2020	3.2	Renovate Max G	330	-
2021	3.5	2,4-D Amine 4	-	12.0

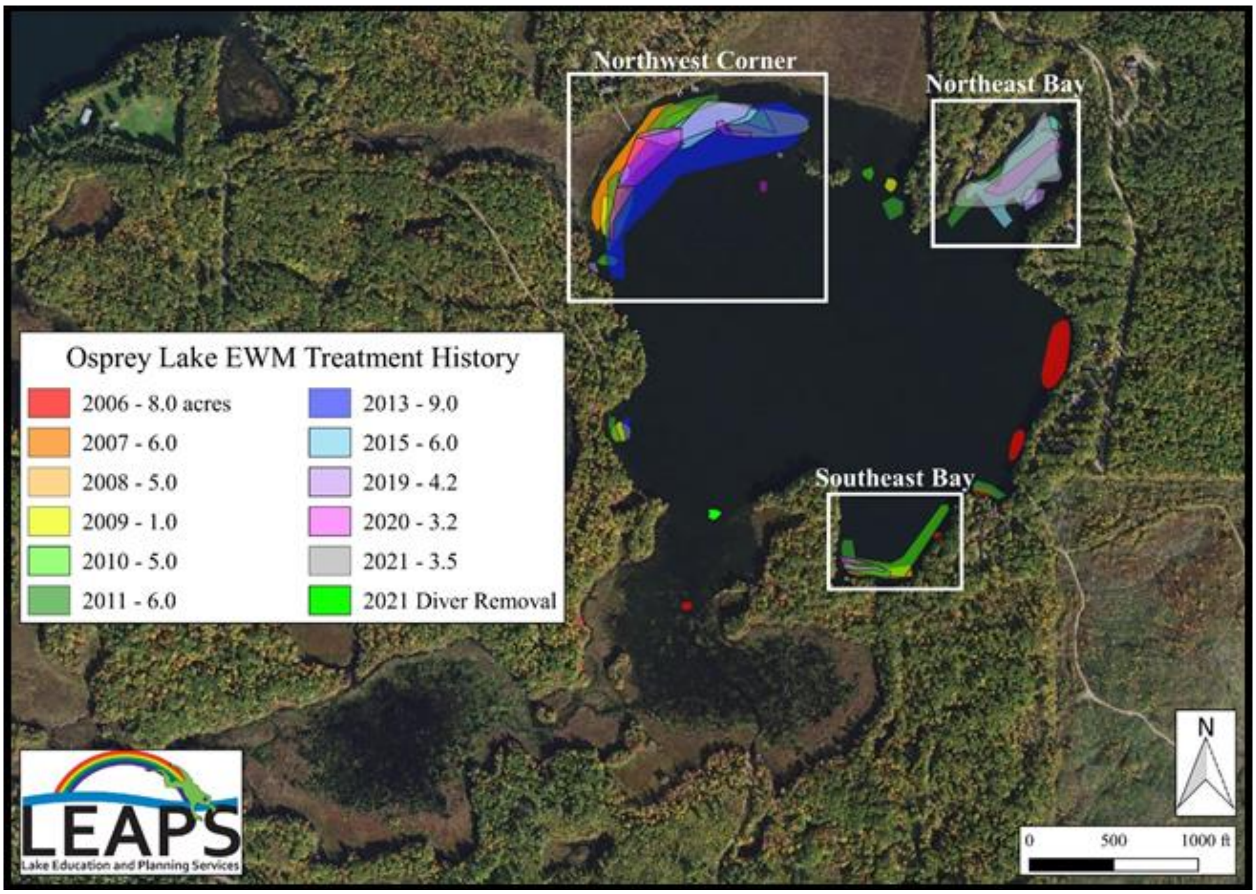

Figure 16: Osprey Lake EWM treatment history

EWM Treatment Effectiveness

EWM has been treated in Osprey Lake with some success. It appears that in the year after treatments, there is some EWM relief (Figure 16). Renovate Max G seems to be more effective at providing relief than 2,4-D products. There is little available whole lake EWM survey data to compare year to year between treatments. However, between 2020 and 2021 late summer bed mapping and treatment acreage is available (Figure 17). In 2020, 3.22 acres were treated with Renovate Max G. In late summer, 4.26 acres of EWM were mapped, but there was notably less to zero EWM where the treatment had occurred (Figure 17). In 2021, 3.47 acres of EWM were treated with 2,4-D Amine 4. In late summer of 2021, 1.56 acres of EWM were mapped, and again, there was less EWM in treated areas with the exception of the northeast bay (Figure 17). However, where Renovate Max G was used, there did seem to be year to year relief (Figure 17).

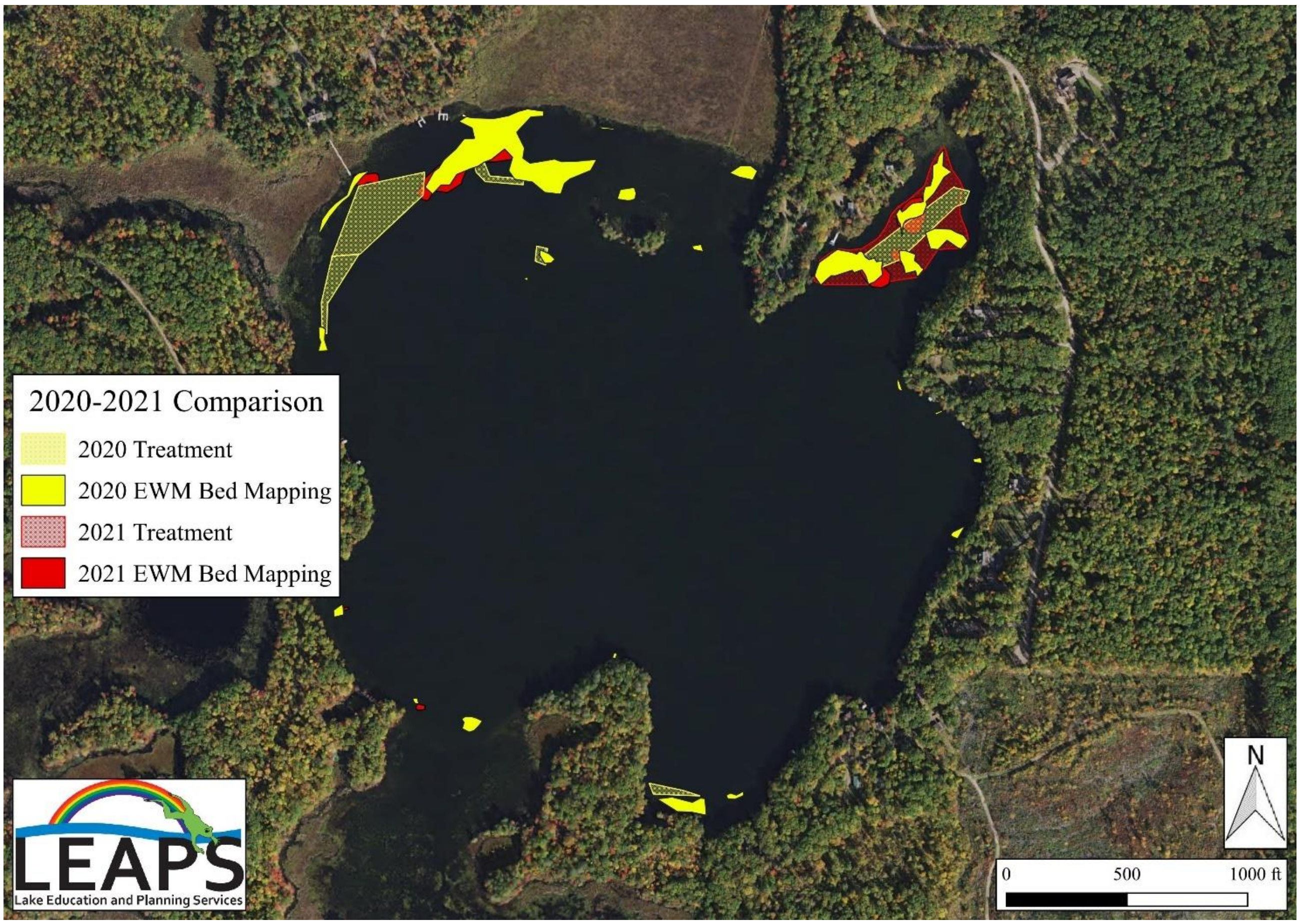

Figure 17. 2020-2021 EWM treatment effectiveness

Integrated Pest Management

Integrated Pest Management (IPM) is an ecosystem-based management strategy that focuses on long-term prevention and/or control of a species of concern. IPM considers all the available control practices such as: prevention, biological control, biomanipulation, nutrient management, habitat manipulation, substantial modification of cultural practices, pesticide application, water level manipulation, mechanical removal and population monitoring (Figure 18). In addition to monitoring and considering information about the target species' life cycle and environmental factors, groups can decide whether the species' impacts can be tolerated or whether those impacts warrant control. Then, an IPM-based plan informed by current, comprehensive information on pest life cycles and the interactions among pests and the environment can be formed.

After monitoring and considering information about the target species' life cycle and environmental factors, groups can decide whether the species' impacts can be tolerated or whether those impacts warrant control. If control is needed, data collected on the species and the waterbody will help groups select the most effective management methods and the best time to use them.

The most effective, long-term approach to managing a species of concern is to use a combination of methods. Approaches for managing pests are often grouped in the following categories:

- **Assessment** – is the use of learning tools and protocols to determine a waterbodies' biological, chemical, physical and social properties and potential impacts. Examples include: point-intercept (PI) surveys, water chemistry tests and boater usage surveys. This is the most important management strategy on every single waterbody.
- **Biological Control** – is the use of natural predators, parasites, pathogens and competitors to control target species and their impacts. An example would be beetles for purple loosestrife control.
- **Cultural controls** – are practices that reduce target species establishment, reproduction, dispersal, and survival. For example, a Clean Boats, Clean Waters program at boat launches can reduce the likelihood of the spread of species of concern.
- **Mechanical and physical controls** – can kill a target species directly, block them out, or make the environment unsuitable for it. Mechanical harvesting, hand pulling, and diver assisted suction harvesting are all examples.
- **Chemical control** – is the use of pesticides. In IPM, pesticides are used only when needed and in combination with other approaches for more effective, long-term control. Groups should use the most selective pesticide that will do the job and be the safest for other organisms and for air, soil, and water quality.

(Additional information on each method is outlined in the following section).

IPM is a process that combines informed methods and practices to provide long-term, economic pest control. A quality IPM program should adapt when new information pertaining to the target species is provided or monitoring shows changes in control effectiveness, habitat composition and/or water quality.

While each situation is different, eight major components should be established in an IPM program:

1. Identify and understand the species of concern
2. Prevent the spread and introduction of the species of concern
3. Continually monitor and assess the species' impacts on the waterbody
4. Prevent species of concern impacts
5. Set guidelines for when management action is needed
6. Use a combination of biological, cultural, physical/mechanical and chemical management tools
7. Assess the effects of target species' management

8. Change the management strategy when the outcomes of a control strategy create long-term impacts that outweigh the value of target species control.

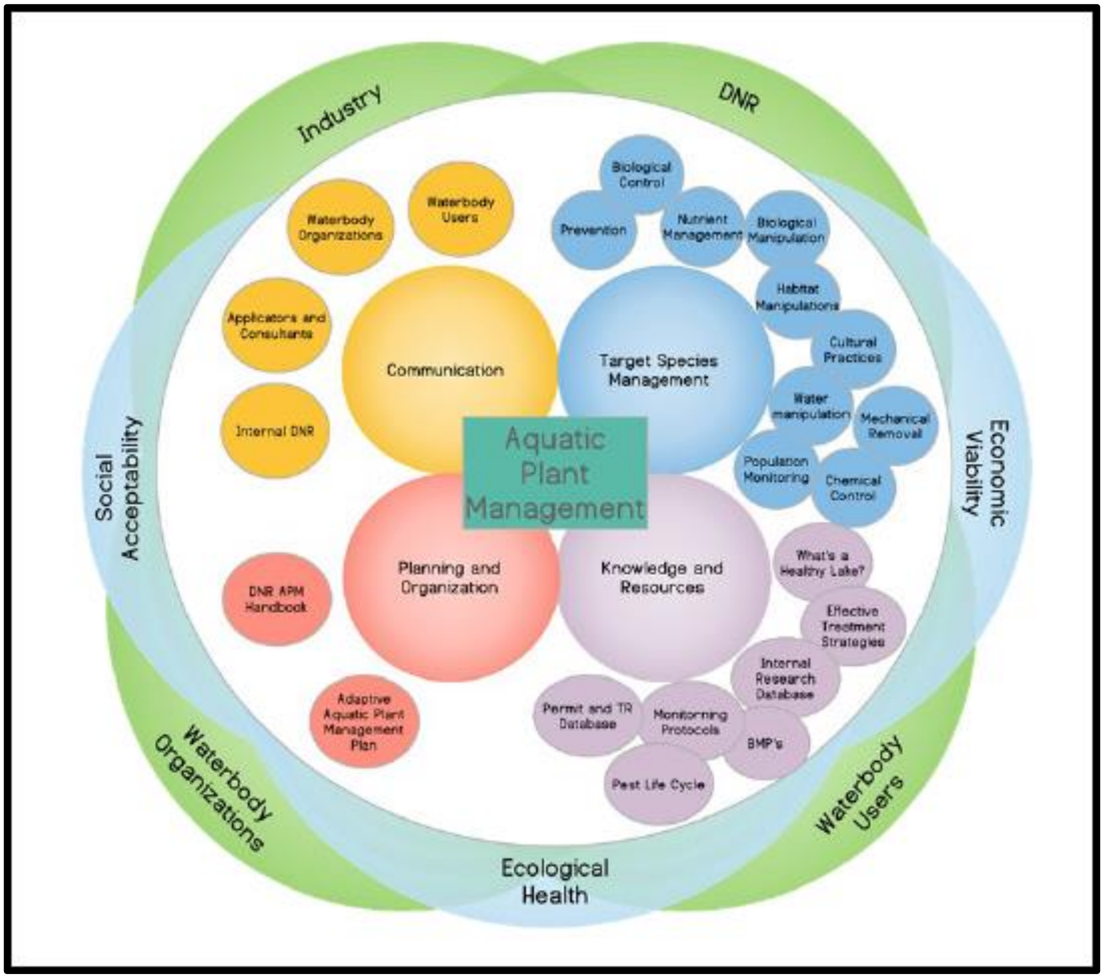

Figure 18: Wisconsin Department of Natural Resources: Wisconsin Waterbodies – Integrated Pest Management March 2020

Aquatic Plant Management Alternatives

Protecting native plants and limiting EWM through IPM is a primary focus of plant management in Osprey Lake due to its diverse plant community and the benefits it offers. Generally, control methods for nuisance aquatic plants can be grouped into four broad categories:

- Chemical control: use of herbicides
- Mechanical/physical control: pulling, cutting, raking and harvesting
- Biological control: the use of species that compete successfully with the nuisance species for resources
- Aquatic plant habitat manipulation: dredging, flooding, and drawdowns

In many cases, an IPM approach to aquatic plant management is the best way to protect and enhance the native plant community while maintaining functional use of the lake.

Physical/Manual Removal: Recommended

Physical removal will be completed by educated landowners who monitor their own shorelines or by a trained EWM Management Team sponsored by the OLPOA. There is no limit as to how far out into the lake this management activity can occur, provided the area cleared is no more than 30-ft wide. It limits disturbance to the lake bottom, is inexpensive, and can be practiced by many lake residents. Landowners should also continually monitor near their docks and swimming areas in the open water season and remove rooted plants as well as floating fragments that wash into their shoreline.

Pulling EWM while snorkeling or scuba diving in deeper water is also allowable without a permit and can be effective at slowing the spread of a new aquatic invasive species infestation within a waterbody when done properly. Diver removal will be completed by OLPOA volunteers and/or resource professionals retained by the OLPOA. These efforts will focus on smaller beds not treated with chemical herbicides in areas not directly adjacent to any landowner's property. Diver Assisted Suction Harvesting (DASH), a hand removal method that requires a diver to handfeed EWM into a suction tube, is not recommended at this time on Osprey Lake because the additional equipment, permitting, and overall cost is much greater compared to diver removal.

Chemical Herbicide Treatments: Recommended

Herbicides will be used to manage existing EWM and any existing or new areas with moderate to severe growth density and deemed too large for effective physical removal. Determining which herbicide to use (as approved by the state of Wisconsin) and at what concentration will be determined on a yearly basis during the treatment planning phase. Spring application of herbicides is preferred to reduce negative effects on native plants and fish habitat.

There are several chemical herbicide options currently available in the State of Wisconsin (as approved by the Environmental Protection Agency). There are two classes of aquatic chemical herbicides currently in use:

1) Systemic: moves through the entire plant. It is absorbed through the leaves or stem and moves through the entire plant and usually results in the death of the plant within two or more weeks

2) Contact: kills the plant at the point of contact. The entire plant may not be damaged, and the roots may still be viable for regrowth. Mostly used when an immediate removal of a plant is required.

Available aquatic herbicides for EWM include:

ProcellaCOR®

ProcellaCOR® is a relatively new systemic, selective herbicide that can be used to target EWM with limited impact to most native species. It is also very fast acting, making it an effective control measure on smaller beds like those located in Osprey Lake, especially ones in high boat traffic areas and/or deeper water. In addition, applications rates are measured in ounces, not gallons as is common with almost all other liquid herbicides. And while it is more expensive to use than 2,4-D equivalents, it has been shown to provide 2 or more years of control without re-application. ProcellaCOR® is recommended for future EWM management implementation.

Triclopyr

Triclopyr is a selective, systemic herbicide used to control broadleaf plants like EWM by mimicking plant hormones. Liquid triclopyr (Renovate®) or granular triclopyr combined with granular 2,4-D (Renovate Max

G®) may be an option in Osprey Lake. Renovate Max G® was successfully used on Osprey Lake in several previous years, and it may be a useful management tool again in the future, however neither triclopyr nor 2,4-D based herbicides are recommended for small-scale (<3ac) EWM treatments.

2,4-D (liquid)

2,4-D is a commonly used systemic herbicide that targets dicot plants (or broad-leaved plants) like EWM. Monocots (like pondweed species and water celery) are generally not affected by 2,4-D. Shredder Amine 4®, also referred to as 2,4-D Amine 4® is a liquid formulation of 2,4-D. It was successfully used on Osprey Lake in 2021 to control EWM, and is a viable option again in the future.

Chemical Herbicide Treatments: Not Recommended

The following herbicides and/or herbicide formulations have also been used effectively for control of EWM but are not recommended for use in Osprey Lake.

2,4-D (granular)

Granular 2,4-D, under the trade name Navigate® or Sculpin G® has been effectively used in Osprey Lake to treat EWM in the past, and its use may be warranted again in the future, although its use must be evaluated on a case by case basis.

Fluridone (liquid)

Fluridone is also a non-selective, systemic herbicide often used for whole-lake treatment. It is slow-acting and can be selective to EWM at low concentrations; however, the contact time must be very long in order for this to be effective, which may not be practical in Osprey Lake depending on wind and weather during and after applications. At the present time, whole-lake management of EWM is not a recommendation in this plan. As such, Fluridone is not appropriate for use in Osprey Lake.

Endothall (liquid)

Endothall is a non-selective contact herbicide. This herbicide is generally recommended when EWM growth needs to be suppressed to allow native plants to recover and potentially reclaim the area. It is not recommended for cases when eradication is the goal. In Osprey Lake, Endothall is not likely to be a viable option in the future in order to protect the native plant community and prevent EWM from re-growing in treated areas.

Diquat (liquid)

Diquat is another non-selective herbicide that is commonly used to control emergent and submersed aquatic vegetation. It is fast-acting and has no restrictions for swimming, fish, or wildlife, but there may be irrigation and drinking water restrictions for up to 5 days. Again, a non-selective contact herbicide is generally not going to be an option in Osprey Lake where the native plant community is so valuable and the risk of stressing the native plants and allowing EWM to re-grow would be detrimental to the lake.

Mechanical Harvesting: Not Recommended

Harvesters can remove thousands of pounds of vegetation in a relatively short time period. They are not, however, species specific. Everything in the path of the harvester will be removed, including the target species, other plants, macro-invertebrates, semi-aquatic vertebrates, forage fishes, young-of-the-year fishes, and even adult game fish found in the littoral zone (Booms, 1999). Plants are cut at a designated depth, but the root of the plants are often not disturbed. Cut plants will usually grow back after time, and re-cutting several times a season is often required to provide adequate annual control (Madsen, 2000). Harvesting activities in shallow water can re-suspend bottom sediments into the water column releasing nutrients and other accumulated compounds (Madsen, 2000). Even the best aquatic plant harvesters leave some cutting debris in the water to wash up on the shoreline or create loose mats of floating vegetation on the surface of the lake. This “missed” cut vegetation can potentially increase the amount of EWM in a lake by creating more fragments that can go on to establish new sites elsewhere. A major benefit, however, of aquatic plant harvesting is the removal of large amounts of plant biomass from a water body. Mechanical harvesting is not recommended in Osprey Lake due to the risk of releasing EWM fragments and further spreading it throughout the lake.

Biological Control: Not Recommended

Biological control uses one or more living organisms to control, or suppress, another living organism. Milfoil weevils *Euhychiopsis lecontei* are one method used to manage EWM. Weevils are an alternative to chemical treatments and potentially damaging mechanical harvesting. However, they are expensive to rear, easily predated on by sunfish, and only suppress – not eliminate – EWM. The milfoil weevil is native to North America and is likely present at some level in the lake. Survey work could be completed to determine their presence or absence, however attempting to artificially increase their population as a biological control method is not recommended.

Habitat Manipulation: Not Recommended

Habitat manipulation can take the form of flooding, dredging and drawdowns. None of these options are recommended or viable in Osprey Lake. Flooding and drawdowns are not possible because there are no water level control structures on or near Osprey Lake that could be used to manipulate the water levels. Dredging is not recommended because the high-water quality and valuable habitat of Osprey Lake would be jeopardized by removing large quantities of substrate and bottom materials.

No Management: Not Recommended

Regardless of the target plant species, native or non-native, sometimes no management is the best management option. Plant management activities can be disruptive to areas identified as critical habitat for fish and wildlife and should not be done unless it can occur without ecological impacts. This management alternative is not recommended for Osprey Lake due to the excessive growth of EWM in some areas and restrictions to public and lake property owner access to the lake. Additionally, limiting the spread of EWM within the lake through management protects the ecological integrity of the lake long-term.

Aquatic Plant Management Discussion

Osprey Lake supports a valuable aquatic plant community with a number of uncommon species and a quality fishery valued by the lake community and the general public. The lake currently has only one known fully aquatic invasive species – Eurasian watermilfoil. Nuisance conditions and navigation impairment occur throughout the open water season as a direct result of the EWM infestation. The main goal of the Aquatic Plant Management Plan is to control EWM in a sound, ecological manner. If the resources available to manage EWM are limited, Figure 19 provides a method to determine priority. Referred to as FLIPS, it involves evaluating each area of EWM in the lake in any given year based on when it was first discovered and managed (Formation), where it is located (Location), whether it causing issues for beneficial use (Impairment), whether it was mapped in a previous year (Prior Year), and whether it is negatively impacting the native aquatic plant community (Sensitive Area).

Eurasian Watermilfoil FLIPS Management Approach

Formation	Location	Impairment	Prior Year	Sensitive Area
Is the EWM location new this year, or an area untreated in the year prior?	Is the EWM in an area of high traffic or use? (boat landings, marinas, resorts, restaurants, high use docks)	Does the EWM cause beneficial use impairment? (preventing or limiting fishing, boating, swimming, navigation, etc.)	*For chemical management only* - Was the EWM mapped in the year prior?	Is EWM having a negative impact on native plants or other fauna in the area?

If answered "yes" for more than 3 questions for a given area with EWM, then that area of EWM should be given a high priority for management. If answered "yes" to less than 3 questions, then that area of EWM may be considered a lower priority for management, although some control actions could still be applied where possible to prevent EWM from spreading more.

Figure 19: FLIPS Management priority matrix

A combination of chemical and manual/physical removal control methods are recommended for Osprey Lake. Mechanical harvesting, biological control (for EWM), habitat manipulation, and zero management are not recommended at this time.

Any EWM discovered in the lake, even single plants, should be managed if possible. Each circumstance of EWM management should be evaluated on an individual basis. Figure 20 provides a framework to determine what EWM management actions should be implemented.

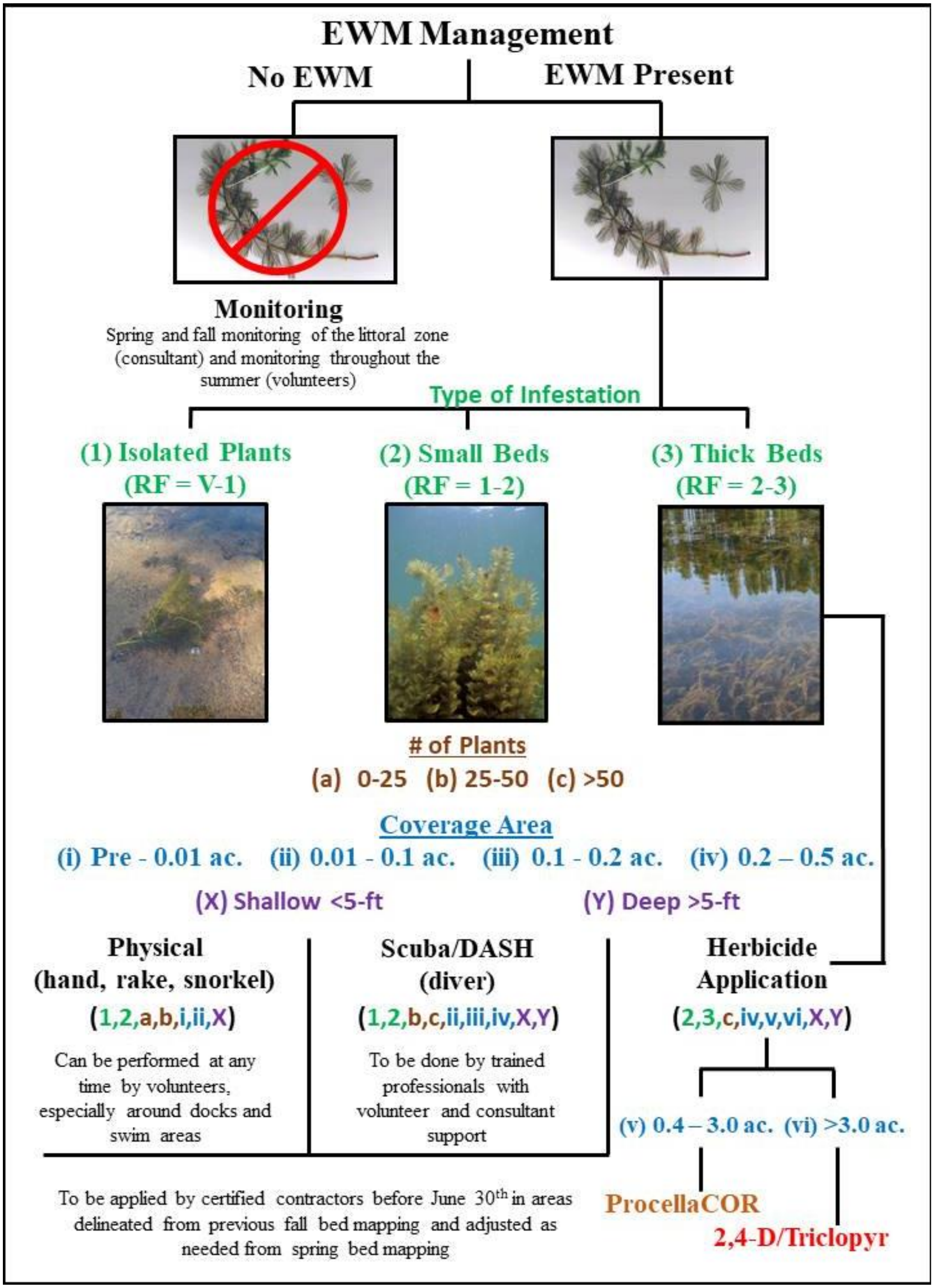

Figure 20: Management matrix guide to appropriate EWM control methods

In general, EWM management in Osprey Lake will be based on the following criteria.

1) Late summer or fall bed mapping will be completed every year.
2) Any amount of EWM in the lake can be managed at any time if chemical management is not used. Non-chemical management actions include hand pulling, rake removal, and snorkel/scuba diver removal, and/or DASH removal (still considered diver removal, but more expensive and requires a permit).
3) Chemical management of EWM may be considered if prior year mapping identifies any area of EWM that is ≥0.25 acres, and meets the criteria set forth in the FLIPS matrix.
    a. On EWM beds that are candidates for chemical treatment **AND** ≤3.0 acres, ProcellaCOR® should be used.
    b. On EWM beds >3.0 acres, ProcellaCOR, 2,4D-based, or triclopyr-based herbicides can be used based on the financial resources available.
4) Chemical management of EWM should not be completed on the same area in consecutive years.

Overuse of Aquatic Herbicides

Concerns exist when chemical treatments using the same herbicide are done over multiple and subsequent years. Target plant species may build up a tolerance to a given herbicide making it less effective, susceptible plant species may be damaged and/or disappear from the lake (ex. water lilies), fish and other wildlife might possibly be affected, and concerns over recreational use in chemically treated water may be raised. By using several different aquatic herbicides interspersed with physical removal efforts between treatments, many of these concerns are minimized. Given the treatment history on the lake and the recent plant surveys, the chemical treatments that are occurring are not likely to be causing great environmental harm. If there are any negative impacts to native plants in treated areas, plants would be available from other areas of the lake to re-colonize that location. It is also likely that an extensive seed bank of native plants throughout the lake would aide in the recovery of any area impacted by management actions.

Aquatic Plant Management Plan

This Aquatic Plant Management Plan establishes the following goals for aquatic plant management in Osprey Lake:

1. **EWM Management.** Limit the spread of EWM through environmentally responsible methods to benefit the native plant community while maintaining EWM at manageable levels.

2. **Education and Awareness.** Continue to educate property owners and lake users on aquatic invasive species through public outreach and education programs to help contain EWM within the lake and prevent its spread further in the lake, as well as to other water bodies.

3. **Research and Monitoring.** Develop a better understanding of the lake and the factors affecting lake water quality through continued and expanded monitoring efforts.

4. **Adaptive Management.** Follow an adaptive management approach that measures and analyzes the effectiveness of control activities and modify the management plan as necessary to meet goals and objectives.

Goal 1. EWM Management

Despite years of treatment, EWM continues to be a nuisance in Osprey Lake. A combination of management alternatives will be used to help minimize the negative impacts of EWM on native plants and water quality, and to provide relief for navigation impairment caused by EWM. EWM management options to be utilized include small-scale physical removal, diver removal, and targeted use of aquatic herbicides (see previous section). Other AIS will continue to be monitored for, but no specific management is recommended at this time.

Pre and Post Treatment Survey and Fall Bed Mapping

Management of EWM will be based on pre-treatment surveys and post-treatment surveys or management readiness surveys performed by either trained OLPOA volunteers or resource professionals retained by the OLPOA. Pre and post-treatment surveys are point-intercept based. A pre-treatment survey is best completed in the year prior to the year of planned chemical management. Post-treatment surveys should be performed within the same year of treatment and in at least the year following treatment. If resources are available, they can be completed in more than just the year after treatment, particularly if it is expected that management impacts will last more than two years.

Management readiness surveys are visual and rake-based surveys completed prior to actual management in the same year only to determine if a given management area is ready to be treated. Ready is defined as having target plants present in sufficient quantity and growth to go through with the proposed chemical treatment. Proposed treatment areas may be modified based on the results of the readiness survey but still must follow restrictions in the WDNR-approved chemical application permit.

Pre and post treatment surveys are not required by the WDNR unless the chemically treated area covers more than 10 acres or 10% of the littoral zone. However, completing these tasks is highly recommended in any treatment program, as they provide a means to measure success. Readiness surveys provide a quick check and balance on a proposed treatment proposal and are recommended in any year chemical treatment is to occur.

Fall bed mapping or reconnaissance surveys are completed in the late summer or fall each year to help identify potential areas for management in the following year. These are visual and rake-based, meandering surveys of the lake's littoral zone. GPS tracking of individual plants, small clumps, and beds of EWM is completed. With the fall bed mapping survey data, proposed treatment maps can be created.

Goal 2. Education and Awareness

Aquatic invasive species (AIS) can be transported via a number of vectors, but most invasions are associated with human activity. It is recommended that that the OLPOA continue to maintain and update signage at the boat launch as necessary.

Early detection and rapid response efforts increase the likelihood that a new aquatic invasive species will be addressed successfully while the population is still localized and levels are not beyond that which can be contained and eradicated. Once an aquatic invasive species becomes widely established in a lake, complete eradication becomes extremely difficult, so attempting to partially mitigate negative impacts becomes the goal. The costs of early detection and rapid response efforts are typically far less than those of long-term invasive species management programs needed when an AIS becomes established.

It is recommended that the OLPOA continue to implement a proactive and consistent AIS monitoring program. At least three times during the open water season, trained volunteers should patrol the shoreline and littoral zone looking for Eurasian watermilfoil (and other species like curly-leaf pondweed, purple loosestrife, Japanese knotweed, giant reed grass, zebra mussels). Free support for this kind of monitoring program is provided as part of the UW-Extension Lakes/WDNR Citizen Lake Monitoring Network (CLMN) AIS Monitoring Program. Any monitoring data collected should be recorded annually and submitted to the WDNR SWIMS database.

Providing education, outreach opportunities, and materials to the lake community will improve general knowledge and likely increase participation in lake protection and restoration activities. It is further recommended that the OLPOA continue to cultivate an awareness of the problems associated with AIS and enough community knowledge about certain species to aid in detection, planning, and implementation of management alternatives within their lake community. It is also recommended that the OLPOA continue to strive to foster greater understanding and appreciation of the entire aquatic ecosystem including the important role plants, animals, and people play in that system.

Understanding how their activities impact the aquatic plants and water quality of the lakes is crucial in fostering a responsible community of lakeshore property owners. To accomplish this, the OLPOA should distribute, or re-distribute, informational materials and provide educational opportunities on aquatic invasive species and other factors that affect Osprey Lake. At least one annual activity (picnic at the lake, public workshop, guest speakers, etc.) should be sponsored and promoted by the OLPOA that is focused on AIS. Maintaining signs and continuing aquatic invasive species monitoring should be done to educate lake users about what they can do to prevent the spread of AIS. Results of water quality monitoring should be shared with the lake community at the annual meeting, or another event, to promote a greater understanding of the lake ecosystem and potentially increase participation in planning and management.

Goal 3. Research and Monitoring

Long-term data can be used to identify the factors leading to changes to water quality, such as aquatic plant management activities, changes in the watershed land use, and the response of the lakes to environmental changes. From 2008 to at least 2015, LCO Tribal sampling of the lake for water clarity using a Secchi disk, total phosphorus (TP) chlorophyll-*a* (Chl-*a*), and dissolved oxygen and temperature profiles was regular but in consistent.

The CLMN Water Quality Monitoring Program supports volunteer water quality monitors across the state following a clearly defined schedule. In the first level of the program, Secchi disk readings are encouraged 2-3 times a month from ice out to ice on. In the CLMN expanded monitoring program, water samples are collected for analysis of TP two weeks after ice out, and once each in June, July and August. Water samples are collected and processed for chlorophyll-*a* once each in June, July, and August. Temperature profiles are encouraged anytime a Secchi reading is taken, but recommended to be done at the same time water samples for TP and chlorophyll-*a*. If the necessary equipment is available to collect dissolved oxygen profiles these are encouraged at least monthly as well.

Available data suggests that the OLPOA has never had lake volunteers collect basic water quality data through the CLMN Water Quality Monitoring Program. Thus, it is recommended that the OLPOA identify at least one volunteer and sign up for level one (collecting Secchi disk readings of water clarity) of the CLMN program. CLMN expanded monitoring parameters (temperature, dissolved oxygen, total phosphorus, and chlorophyll-*a*) should be added as soon as the lake can be enrolled by the WI-DNR. The intensity/success of water quality monitoring efforts should be evaluated at least every three years. The background information and trends provided by these data are invaluable for current and future lake and aquatic plant management planning.

An alternative to this approach is to work closely with LCO Tribal Resources to establish a regular, consistent, long-term trend water quality monitoring program.

To monitor any changes in the plant community, it is recommended that whole-lake point intercept aquatic plant surveys be completed at three to five-year intervals. This will allow managers to adjust the APM Plan as needed in response to how the plant community changes as a result of management and natural factors like water level.

To monitor changes in the amount of EWM in the system, late season bed mapping surveys should be completed annually.

Goal 4. Adaptive Management

This APMP is a working document guiding management actions on Osprey Lake for the next five years. This plan will follow an adaptive management approach by adjusting actions as the results of management and data obtained deem fit following IPM strategy. This plan is therefore a living document, progressively evolving and improving to meet environmental, social, and economic goals, to increase scientific knowledge, and to foster good relations among stakeholders. Annual and end of project assessment reports are necessary to monitor progress and justify changes to the management strategy, with or without state grant funding. Project reporting will meet the requirements of all stakeholders, gain proper approval, allow for timely reimbursement of expenses, and provide the appropriate data for continued management success. Success will be measured by the efficiency and ease in which these actions are completed.

The OLPOA and their retainers will compile, analyze, and summarize management operations, public education efforts, and other pertinent data into an annual report each year. The information will be presented to members of the OLPOA, Sawyer County, LCO Tribal Resources, and the WDNR and made available in hardcopy and digital format on the internet. These reports will serve as a vehicle to propose future management recommendations and will therefore be completed prior to implementing following year management actions (approximately March 31st annually). At the end of this five-year project, all management efforts (including successes and failures) and related activities will be summarized in a report to be used for revising the Aquatic Plant Management Plan.

Timeline of Activities

The activities in this APM Plan are designed to be implemented over a 5-year period beginning in 2022. The plan is intended to be flexible to accommodate future changes in the needs of the lake and its watershed, as well as those of the OLPOA. Some activities in the timeline are eligible for grant support to complete. Appendix D provides a spreadsheet version of the goals, objectives, and management actions to be completed and when. It also reflects those actions that are likely to be grant eligible.

Potential Funding

There are several WDNR grant programs that may be able to assist the OLPOA in implementing its new APM Plan. AIS grants are specific to actions that involve education, prevention, planning, and in some cases, implementation of AIS management actions. Lake Management Planning grants can be used to support a broad range of management planning and education actions. Lake Protection grants can be used to help implement approved management actions that would help to improve water quality.

More information about WDNR grant programs can be found at:
https://dnr.wisconsin.gov/aid/SurfaceWater.html

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APPENDIX A

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

APPENDIX B

Public Survey Results
Callahan and Mud Lakes Constituency

APPENDIX C

2006-2021 Individual Year Chemical Treatment Maps
Osprey Lake

APPENDIX D

Five Year Timeline of Management Actions
Callahan and Mud Lakes