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AQUATIC PLANT MANAGEMENT PLAN

Kirby Lake

Kirby Lake Management District

August 2021

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Executive Summary

Kirby Lake has exceptional aquatic plant diversity and distribution, and at the present time, there are no non-native, invasive aquatic plant species other than reed canary grass *Phalaris arundinacea*. The density of native aquatic plant growth; however, does create nuisance-level conditions that can prevent lake access and cause recreational-use issues for many property owners and lake users. As such, management of native aquatic plants to provide open water access and improved navigation is necessary. An integrated management approach that relies on a combination of manual and mechanical control methods is recommended to continue for Kirby Lake to provide lake constituents and general lake users more and better recreational opportunities on the lake while also maintaining its ecological integrity.

The plant management recommendations in this plan are inspired by the Kirby Lake Management District (KLMD) goals taken from the Watershed Inventory Report completed by Aron and Associates in 1994, as well as input from the general public. The goals of the KLMD are: to protect and maintain public health; to promote public comfort, convenience, necessity and welfare, in concert with the natural resource, through the environmentally sound management of the vegetation, fishery and wildlife populations in and around Kirby Lake; and to manage the lakes in an environmentally sound manner, pursuant to the standards and requirements set forth in Administrative Codes NR 103, *Water Quality Standards for Wetlands*, and NR 107, *Aquatic Plant Management*, to preserve and enhance its water quality and biotic communities, their habitats, and essential structure and function in the waterbody and adjacent areas.

The goals established by the KLMD and the general public for this plan are:

1. **Preservation, Protection, and Restoration.** Protect and restore the native plant species community in and around the lake to decrease susceptibility to the introduction of new aquatic invasive species.

2. **Prevention.** Prevent the introduction and establishment of new aquatic invasive species through early detection and rapid response.

3. **Management.** Maintain common navigation channels, individual riparian access lanes, and open water in areas of nuisance native plant and reed canary grass growth via mechanical and manual control.

4. **Education and Awareness.** Continue public outreach and education programs on aquatic invasive species.

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

6. **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 mechanical harvesting to control the extensive growth of native plants, as well as invasive reed canary grass, that limit and prevent recreational use in Kirby Lake on an 'as needed' basis. Additionally, this plan will focus on early detection and rapid response to aquatic invasive species (AIS) introductions should they occur. The overall goal of aquatic plant management in Kirby Lake 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 for the general public and lake constituents.

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 KLMD. Although this plan sets forth a five-year implementation schedule, it is not intended to be a static document; rather, it is a living document which will be evaluated annually to determine if it is meeting stated goals and community expectations and can be revised if necessary. The KLMD sponsored the development of this APM Plan, funded through a WDNR Aquatic Invasive Species Education, Prevention, and Planning Grant and in-kind donations by KLMD volunteers. The general public also provided recommendations included in this plan by attending lake meetings and workshops.

APM plans developed for northern Wisconsin lakes are evaluated according to Northern Region APM Strategy goals developed by the WDNR that went into effect in 2007 (Appendix A). All existing and new 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 KLMD in conjunction with the current state of the lake formed the framework for the development of this APM plan.

Introduction

Physiography

Kirby Lake (WBIC 1858200) is a shallow, perched, mesotrophic seepage lake located in the township of Maple Plain near the City of Cumberland in northwest Barron County, Wisconsin (Figure 1). The lake has a surface area of approximately 92 acres, a maximum depth of 18 feet, and an average depth of 8.5 feet with 3.23 miles of shoreline (Figure 2; Berg 2020). Aquatic vegetation is abundant, supporting a warm water fishery of northern pike, bass, and panfish. Much of the watershed surrounding the lake is hardwood forest, and a large wetland complex encompasses the southeastern portion of the lake (Figure 1). There are two miles of shoreline on the west side owned by Barron County which also maintains a primitive campground (Figure 2). The portion of Kirby Lake that is under public ownership encompasses nearly 50% of the total shoreland, and the shoreline has relatively low development.

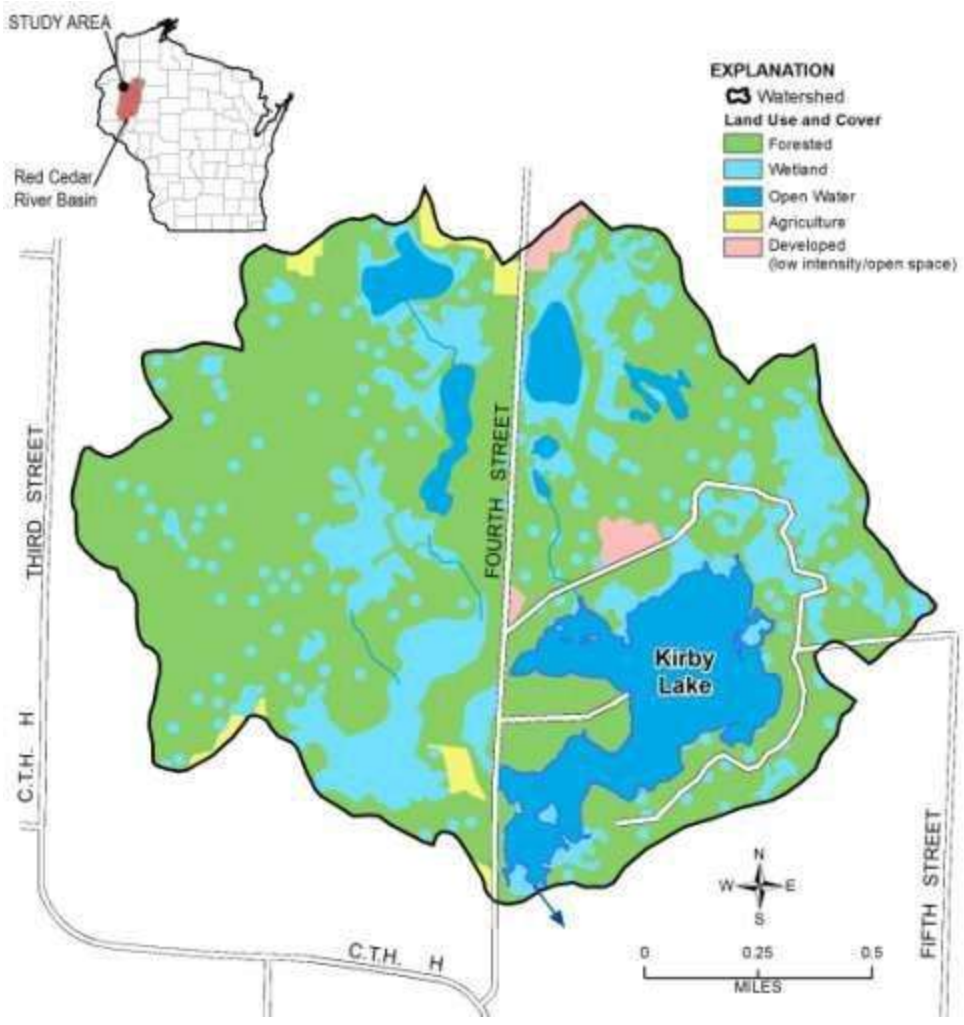


Figure 1. Location and land use of Kirby Lake, Barron County, WI

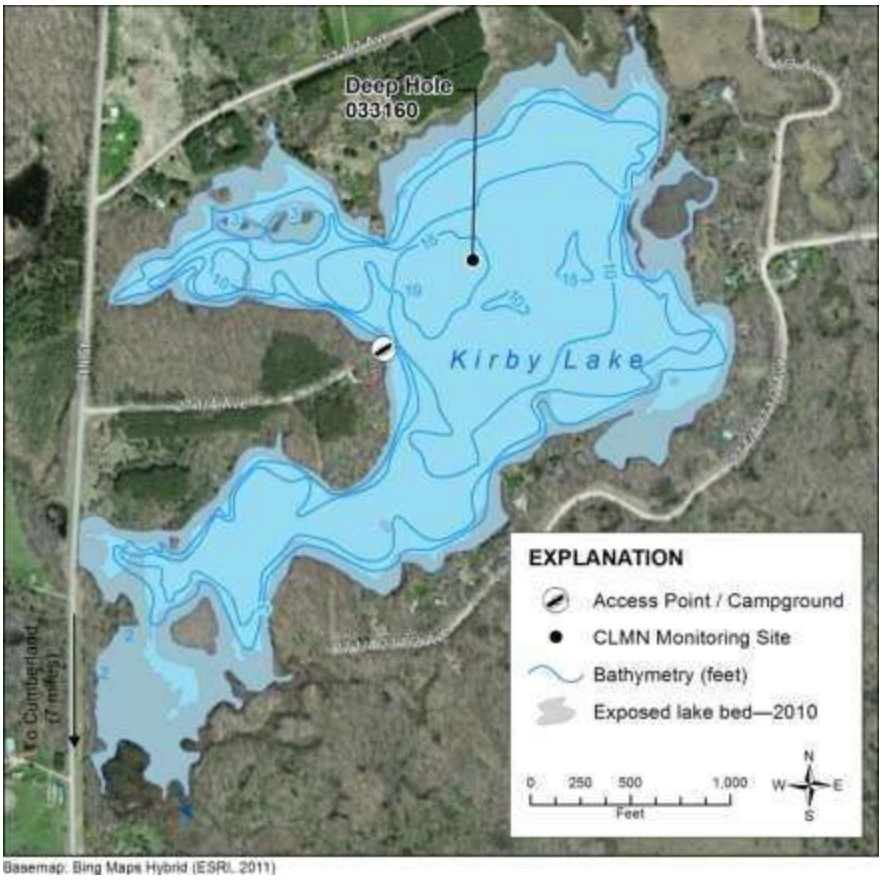


Figure 2. Morphometry of Kirby Lake, Barron Co, WI

Depth soundings taken at 315 survey points included in the 2012 and 2020 aquatic plant survey work revealed a varied underwater topography (Figure 3). The bays on the shoreline side of the lake's two islands were never deeper than 4ft while the lake's numerous shallow side bays generally dropped-off gradually into 5ft+ of water before joining the main basin. The exception to this was the western finger bay which contained two small 10ft+ potholes. The main basin also contained two separate holes that reached 15 to 18ft. Other notable features included a rocky 8ft saddle that ran from the boat landing due north to the point, and a small rock bar mid-lake at the pinch point entrance to the southwest bay. The lake bed is primarily sand and gravel out to depths of 3 to 5 feet and muck elsewhere (Figure 3).

During "wet years" water enters Kirby Lake from precipitation and numerous small, intermittently flowing tributaries. During normal or below normal precipitation years, total water entering Kirby Lake is likely less than what is lost primarily through outflow to groundwater, surface water outflow through the outlet which is considered an intermittent stream, or through evaporation (Rose 1998). Groundwater flow into the lake is likely limited to small areas of sub-surface flow separate from the established groundwater table, as data from the 1998 USGS Report indicates that Kirby Lake is "perched" above the local water table. The lake is situated in a hydrogeologically-complex area with groundwater likely flowing westward toward Sand Creek (IEMSLAA 1994).

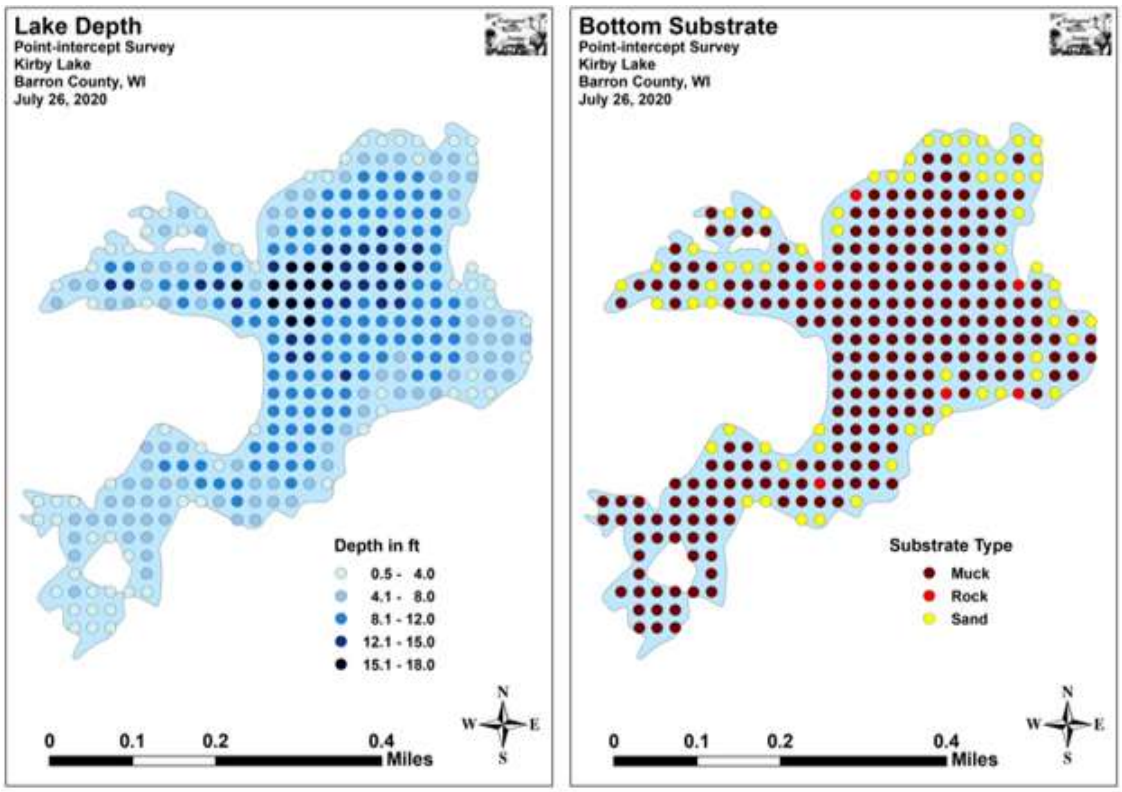


Figure 3. Kirby Lake depth and bottom substrate (Berg, 2020)

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. The watershed of Kirby Lake, delineated by the USGS, is 1070 acres. Land cover is primarily forested (about 60%) with wetlands, small lakes, agricultural land and development (residential and roads) making up the remainder (Figure 1; 3). The hummocky, glacially-derived landscape of the watershed has many areas of internal drainage, where surface runoff drains to closed depressions with no outlet for overflow. The direct tributary drainage area—the area which drains directly into Kirby Lake without first passing through other waterbodies—is 449 acres (IEMSLAA 1994). Land use and land cover in the direct drainage area is shown in Table 1.

Table 1. Land Use and Land Cover in the Kirby Lake Direct Drainage Area, 1990.

Land use	**Acres**	**Percent of total**
Residential	13	2.9
Roads/utilities	5	1.1
Recreation	2	.5
Forested/wetland	337	75.0
Water	92	20.5
Total	**449**	**100.0**
Source: Watershed Inventory Findings Report, 1994		

Land cover and land use management practices within a watershed have a strong influence on water quality and water quantity. Increases in impervious surfaces, such as roads, rooftops and compacted soils associated with residential and agricultural land uses, can reduce or prevent the infiltration of runoff. This leads to an increase in the volume and rate of stormwater runoff and pollutant loading to the lakes and their tributary streams. The removal of near-shore vegetation causes an increase in the amount of nutrient-rich soil particles transported directly to a waterbody during rain events. It is important to protect and restore the naturally occurring features of the direct drainage area (for example, the wetland fringe and native plant cover) to maintain and improve water quality.

Agriculture is limited in the watershed, but like shoreland improvement planning, there are agricultural best management practices that can be incorporated to lessen agricultural inputs to the lake. Conservation tillage, grassed waterways, field borders, and feed lot improvements are just a few examples.

Trophic Status

Citizen volunteers have worked in cooperation with the Wisconsin Department of Natural Resources (WDNR) to collect surface water samples of water clarity, nutrient levels, and chlorophyll-*a* (a measure of algal biomass in the lake) from the 'Deep Hole' site (see Figure 2) in Kirby Lake from 1991-2021. The Carlson's Trophic Status Index (TSI; Carlson, 1977), a commonly used measurement of water quality uses these data collected by volunteers to determine the trophic status of the lake as a proxy for water quality. From 1991-2020, Kirby Lake's TSI ranged from 40 to 65, classifying Kirby Lake as slightly eutrophic (nutrient-rich and algae dominated) to mesotrophic (intermediate nutrient levels and clearer water; Figure 4).

The specific measurements of water quality and trophic status in Kirby Lake have fluctuated over time. Secchi depth (a measure of water clarity) for the Deep Hole site in Kirby Lake is available from 1992 to 2020, but no data is available from 2001-2004 or 2015-2017. Secchi depths ranged from 4 feet to 9 feet with an overall average of 6.5 feet. The average summer (June-August) Secchi depth between 1992 and 2020 ranged from 4 feet to 9 feet, and the overall summer average was 6.3 feet, which classifies Kirby Lake as a mesotrophic system. Measurements of total phosphorus (a key nutrient in supporting aquatic life) taken from 1993-2001 and 2010-2020 ranged from 14.0 µg/L to 51.5 µg/L, averaging 27.3 µg/L, indicating eutrophic levels of nutrients. Chlorophyll-*a*, measured from 1993-2001 and 2010-2011, ranged from 1.5 to 83.6 µg/L, averaging 9.7 µg/L (trophic state value 45), which classifies Kirby Lake as a mesotrophic lake (Figure 4). More information can be found at: https://dnr.wi.gov/lakes/waterquality/Station.aspx?id=033160.

The dense, rich, and diverse plant community of Kirby Lake provides many beneficial functions to the lake. The plant community helps maintain its clear water, mesotrophic status by limiting the amount of nutrients that can be used by algae (a key determinant in pushing Kirby Lake towards becoming more eutrophic). 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 Kirby Lake from erosion by absorbing and mitigating waves before they can reach the vulnerable shore. Overall, maintaining the health of the plant community of Kirby Lake is critical in maintaining the quality of the water and the quality of the lake as a whole.

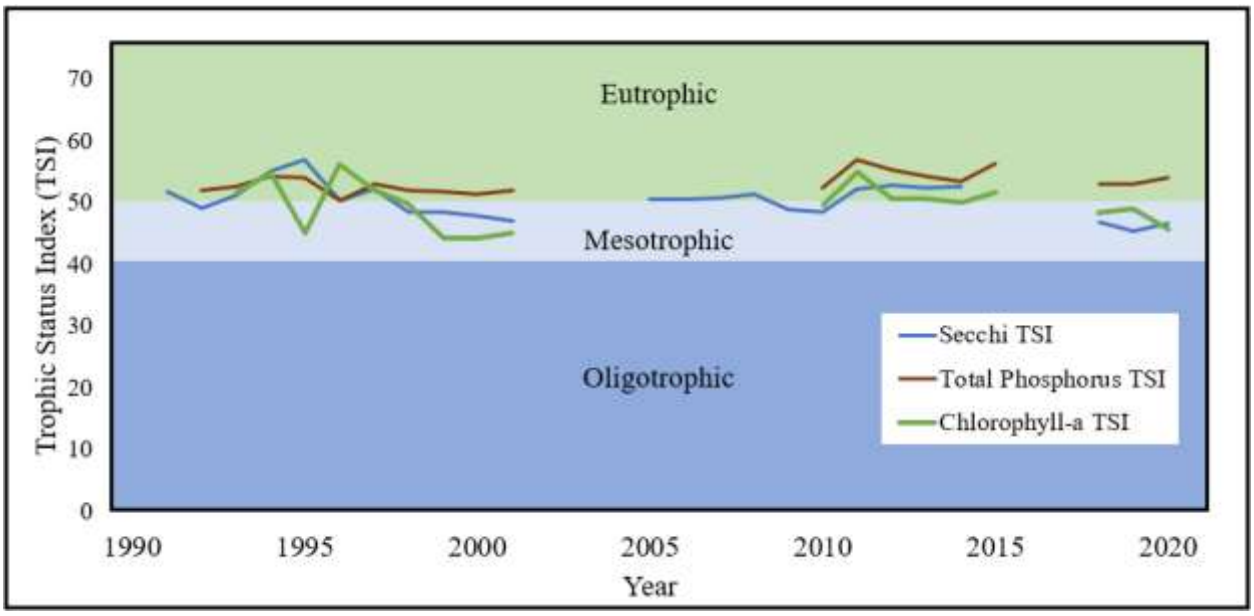


Figure 4. Kirby Lake Trophic Status Index from 1990-2020

Oxygen

Dissolved oxygen is essential for 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.

The epilimnion includes the surface waters and is oxygen-rich; next is the metalimnion, more commonly known as the thermocline; and below that is the oxygen-poor hypolimnion. The thermocline, when in place, acts as a barrier preventing warmer, oxygen-rich waters in the epilimnion from mixing with colder, deeper waters of the hypolimnion. As a result, the deeper waters of the hypolimnion have limited amounts of dissolved oxygen available to support aquatic life. As long as the waters of a given lake stay stratified, available oxygen in the hypolimnion (deep water) can be used up, often leading to very low, or even non-existent levels (anoxic) of dissolved oxygen in the lower portions of, or all of the waters in the hypolimnion.

In most cases a lake does not remain in a stratified state year-round. Citizen Lake Monitoring data indicates that Kirby Lake is dimictic, meaning that at least twice a year (spring and fall) stratification is replaced by a mixing event called "overturn" or "turnover" whereby 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 (like the 4th of July Weekend).

Citizen Lake Monitoring data for Kirby Lake indicates that hypoxia (low oxygen) regularly occurs at depths below 9 feet during summer months (June-September), indicating that Kirby Lake, though considered to be a shallow lake, does stratify and experiences hypolimnetic hypoxia (low oxygen in the bottom waters). Under winter ice, dissolved oxygen is also limited, and can be used up when excessive aquatic plant decay adds more organic matter to the sediment (Cooke et al. 2005). In 1995, dissolved oxygen monitoring under the ice indicated that levels of dissolved oxygen started out high

under early ice, but by late winter had decreased to hypoxic conditions (Rose 1998).

Winter hypoxic conditions have historically caused winterkill in Kirby Lake. To avoid winterkill, a compressed air system was installed in 1989 by Barron County with technical and financial assistance from WDNR (Cornelius 2006). The KLMD and Barron County are charged with maintenance of the system. Since installation, winterkill has been minimal (Cornelius 2006).

Public Use

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

- Fishing for panfish species, largemouth bass *Micropterus salmoides*, and northern pike
- 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, which is adjacent to a Barron County-owned primitive campground. The majority of the western shore is owned by Barron County, which means that 46% of the total shoreline has public access.

These activities may all be hindered by excessive plant growth in Kirby Lake, and some riparian owners may not even be able to access the lake due to thick vegetation. Therefore, management of native vegetation is necessary to allow users to access the lake.

Need for Management

Aquatic plants are the basis of a lake's ecosystem and are as important to the aquatic environment as trees are to a forest. They 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. Because of this, maintaining this community is critical to maintaining a healthy lake.

Kirby Lake's plant community is highly sensitive relative to most other lakes in the region. This tiny lake continues to boasts 14 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.

Kirby Lake's soft, acidic water and shallow depths provide ideal habitat for watershield, large purple bladderwort, and white water lily. As the lake's bays have grown shallower over time, these species have been able to expand their range on the lake to the point where they now dominate most areas in less than five feet of water. Because the majority of owners that live in the lake's bays will likely continue to have significant difficulty getting to and from their docks after June 1st when plants have topped out, some form of plant control is necessary to relieve navigation impairment (Figure 5). As the lake has such a rare and sensitive community, limited harvesting rather than blanket herbicide treatment is recommended as this likely provides the best compromise between maintaining the environment and promoting human enjoyment of the lake.

Figure 5: Nearly Inaccessible Shoreline on Kirby Lake (Berg, 2020)

2020 Warm-water Point-intercept Macrophyte Survey Results

Current Status

Point-intercept surveys conducted by Endangered Resource Services LLC in July 2020 show that Kirby Lake has an abundant plant community that is home to many sensitive and rare plants that are characteristic of relatively pristine, soft-water, seepage lakes. This community 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.

In shallow areas, beds of emergent plants prevent erosion by stabilizing the lakeshore, break up wave action, provide a nursery for baitfish and juvenile gamefish, offer shelter for amphibians, and give waterfowl and predatory wading birds, like herons, a place to hunt. These areas also provide important habitat for invertebrates like dragonflies and mayflies.

At the immediate shoreline, reed canary grass dominated the majority of the lake, albeit at much lower levels than in 2012. Disturbed areas like the public boat landing supported scattered path rush *Juncus tenuis*. Primarily on exposed points over firm sand and gravel in water up to 3ft deep, beds of creeping spikerush *Eleocharis palustris* and slender bulrush *Schoenoplectus heterochaetus* were also documented.

Reed canary grass (Berg 2020)

Over firm sandy muck, especially on the north shoreline, the emergent community was dominated by common yellow lake sedge *Carex utriculata* and three-way sedge *Dulichium arundinaceum* with patches of Torrey's three-square bulrush *Schoenoplectus torreyi*, and branched bur-reed *Sparganium androcladum* mixed in.

In bays with more organic muck, these species were replaced by bald spikerush *Eleocharis erythropoda*, water smartweed *Polygonum amphibium*, common arrowhead *Sagittaria latifolia*, water bulrush *Schoenoplectus subterminalis*, woolgrass *Scirpus cyperinus*, and broad-leaved cattail *Typha latifolia*. Primarily on and around the floating bogs in the southwest bay, a limited amount of blunt spikerush *Eleocharis obtusa* and Robbins' spikerush *Eleocharis robbinsii* were also documented.

Just beyond the emergent plant species, the lake's shallow sugar-sand areas tended to have the greatest species richness. They also tended to have low total biomass as the nutrient-poor substrates provided habitat most suited to fine-leaved "isoetid" turf-forming species. This habitat became rarer with rising water levels, and many of the species found here declined in distribution. Specifically, waterwort *Elatine minima*, needle spikerush *Eleocharis acicularis*, golden hedge hyssop *Gratiola aurea*, spiny-spored quillwort *Isoetes echinospora*, northern naiad *Najas gracillima*, and variable pondweed *Potamogeton gramineus* were all less common in 2020 than in 2012; and pipewort *Eriocaulon aquaticum*, brown-fruited rush *Juncus pelocarpus*, dwarf water-milfoil *Myriophyllum tenellum*, creeping spearwort *Ranunculus flammula*, and crested arrowhead *Sagittaria cristata* disappeared altogether.

When these shallow areas had at least a thin layer of sandy or organic muck, they were dominated by the floating-leaf species watershield *Brasenia schreberi* and white-water lily *Nymphaea odorata* with a lesser amount of spatterdock *Nuphar variegata* and water smartweed. The protective canopy cover these species provide is often utilized by panfish and bass.

Watershield (WED 2019)

White water lily (Falkner 2009)

Other pondweed species that occasionally or regularly produce floating leaves in this zone included large-leaf pondweed *Potamogeton amplifolius*, snail-seed pondweed *Potamogeton bicupulatus*, ribbon-leaf pondweed *Potamogeton epihydrus*, variable pondweed *Potamogeton gramineus*, floating-leaf pondweed *Potamogeton natans*, and Oakes' pondweed *Potamogeton oakesianus*.

Growing in gaps in the floating-leaf canopy and among the dominant pondweeds, scattered patches of spiny hornwort *Ceratophyllum echinatum*, slender waterweed *Elodea nuttallii*, and Farwell's water-milfoil *Myriophyllum farwellii* were 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 lifecycles, 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 were 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 included creeping bladderwort *Utricularia gibba*, flat-leaf bladderwort *Utricularia intermedia*, small bladderwort *Utricularia minor*, large purple bladderwort *Utricularia purpurea*, and common bladderwort *Utricularia vulgaris*.

Floating-leaf and shallow submergent species generally disappeared on Kirby Lake in water over 6-7ft deep. In these deeper submergent areas, large-leaf pondweed and small pondweed *Potamogeton pusillus* dominated the plant community and often formed dense beds of near-canopied vegetation. Predatory fish like the lake's northern pike are often found along the edges of these deep-water beds waiting in ambush.

Few species were present beyond 10ft, but, along with small pondweed, scattered patches of Nitella (*Nitella* sp. likely *flexilis*) – a type of colonial algae that looks like a higher plant – were found up to 13ft. In areas deeper than this, aquatic moss occurred at very low densities.

Comparison of Native Macrophyte Species in 2012 and 2020

In July 2012, watershield, large purple bladderwort, small pondweed, and creeping bladderwort were the most common vascular species (Table 2). They were present at 62.50%, 62.50%, 50.54%, and 40.76% of survey points with vegetation respectively, and; collectively, they accounted for 54.90% of the total relative frequency. White water lily (9.93%), flat-leaf bladderwort (7.45%), common bladderwort (6.90%), and Farwell's water milfoil (4.41%) also had relative frequencies over 4.00%. Aquatic moss was actually the most common macrophyte (present at 66.30% of vegetative sites however, because it is non-vascular, it was excluded from analysis (WDNR protocol excludes non-vascular plants like aquatic moss from all statistical calculations including species richness, relative frequency, and establishment of the lake's littoral zone).

During the 2020 survey, small pondweed, watershield, white water lily, and large purple bladderwort were the most common species. Present at 78.68%, 48.45%, 35.27%, and 33.72% of sites with vegetation (Table 3), they accounted for 67.56% of the total relative frequency. Common bladderwort (10.28%) and large-leaf pondweed (4.41%) also had relative frequencies over 4%.

Lake wide, fourteen species showed significant changes in distribution from 2012 to 2020 (Figure 6). Aquatic moss, large purple bladderwort, creeping bladderwort, flat-leaf bladderwort, Farwell's water-milfoil, and reed canary grass suffered highly significant declines; northern manna grass *Glyceria borealis* experienced a moderately significant decline and was not observed on the lake in 2020; and snail-seed pondweed and ribbon-leaf pondweed saw significant declines. Conversely, small pondweed and large-leaf pondweed experienced highly significant increases; filamentous algae had a moderately significant increase; and common arrowhead and freshwater sponges showed significant increases.

Table 2: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Kirby Lake, Barron County (Berg, 2020)
July 29, 31, 2012

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
	Aquatic moss	122	*	66.30	48.41	1.18	0
Brasenia schreberi	Watershield	115	15.86	62.50	45.63	2.39	12
Utricularia purpurea	Large purple bladderwort	115	15.86	62.50	45.63	1.41	7
Potamogeton pusillus	Small pondweed	93	12.83	50.54	36.90	1.35	5
Utricularia gibba	Creeping bladderwort	75	10.34	40.76	29.76	1.09	5
Nymphaea odorata	White water lily	72	9.93	39.13	28.57	1.97	15
Utricularia intermedia	Flat-leaf bladderwort	54	7.45	29.35	21.43	1.48	1
Utricularia vulgaris	Common bladderwort	50	6.90	27.17	19.84	1.10	6
Myriophyllum farwellii	Farwell's water-milfoil	32	4.41	17.39	12.70	1.25	9
Eleocharis palustris	Creeping spikerush	16	2.21	8.70	6.35	1.94	7
Phalaris arundinacea	Reed canary grass	16	2.21	8.70	6.35	2.06	5
Glyceria borealis	Northern manna grass	8	1.10	4.35	3.17	1.13	6
Utricularia minor	Small bladderwort	8	1.10	4.35	3.17	1.00	1
Dulichium arundinaceum	Three-way sedge	6	0.83	3.26	2.38	1.33	7
Eleocharis robbinsii	Robbins' spikerush	5	0.69	2.72	1.98	1.00	0
Nuphar variegata	Spatterdock	5	0.69	2.72	1.98	1.00	2
Potamogeton amplifolius	Large-leaf pondweed	5	0.69	2.72	1.98	1.00	5
Potamogeton gramineus	Variable pondweed	5	0.69	2.72	1.98	1.20	1
Sparganium androcladum	Branched bur-reed	5	0.69	2.72	1.98	1.00	2
Polygonum amphibium	Water smartweed	4	0.55	2.17	1.59	1.25	4
Potamogeton bicupulatus	Snail-seed pondweed	4	0.55	2.17	1.59	1.75	0
Potamogeton epihydrus	Ribbon-leaf pondweed	4	0.55	2.17	1.59	1.50	3
Potamogeton natans	Floating-leaf pondweed	4	0.55	2.17	1.59	1.00	0
Schoenoplectus subterminalis	Water bulrush	4	0.55	2.17	1.59	1.00	1
Nitella sp.	Nitella	3	0.41	1.63	1.19	1.00	0
Potamogeton oakesianus	Oakes' pondweed	3	0.41	1.63	1.19	1.00	2

* Excluded from relative frequency analysis

Table 2 (continued): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Kirby Lake, Barron County (Berg, 2020)
July 29, 31, 2012

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Eleocharis erythropoda	Bald spikerush	2	0.28	1.09	0.79	1.00	0
Elodea nuttallii	Slender waterweed	2	0.28	1.09	0.79	1.00	0
Gratiola aurea	Golden hedge-hyssop	2	0.28	1.09	0.79	1.00	1
Sagittaria cristata	Crested arrowhead	2	0.28	1.09	0.79	1.00	0
Ceratophyllum echinatum	Spiny hornwort	1	0.14	0.54	0.40	1.00	0
Lindernia dubia	False pimpernel	1	0.14	0.54	0.40	1.00	1
Sagittaria latifolia	Common arrowhead	1	0.14	0.54	0.40	1.00	2
Schoenoplectus heterochaetus	Slender bulrush	1	0.14	0.54	0.40	1.00	0
Schoenoplectus purshianus	Pursh's bulrush	1	0.14	0.54	0.40	3.00	1
Sparganium fluctuans	Floating-leaf bur-reed	1	0.14	0.54	0.40	1.00	0
Gallium sp.	Bedstraw	**	**	**	**	**	1
Najas gracillima	Northern naiad	**	**	**	**	**	1
Scirpus cyperinus	Woolgrass	**	**	**	**	**	2
Elatine minima	Waterwort	***	***	***	***	***	***
Eleocharis acicularis	Needle spikerush	***	***	***	***	***	***
Eleocharis obtusa	Blunt spikerush	***	***	***	***	***	***
Eriocaulon aquaticum	Pipewort	***	***	***	***	***	***
Isoetes echinospora	Spiny-spored quillwort	***	***	***	***	***	***
Juncus pelocarpus	Brown-fruited rush	***	***	***	***	***	***
Juncus tenuis	Path rush	***	***	***	***	***	***
Myriophyllum tenellum	Dwarf water milfoil	***	***	***	***	***	***
Potamogeton robbinsii	Fern pondweed	***	***	***	***	***	***
Ranunculus flammula	Creeping spearwort	***	***	***	***	***	***
Typha latifolia	Broad-leaved cattail	***	***	***	***	***	***

** Visual only *** Boat survey only

Table 3: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Kirby Lake, Barron County (Berg, 2020)
July 26, 2020

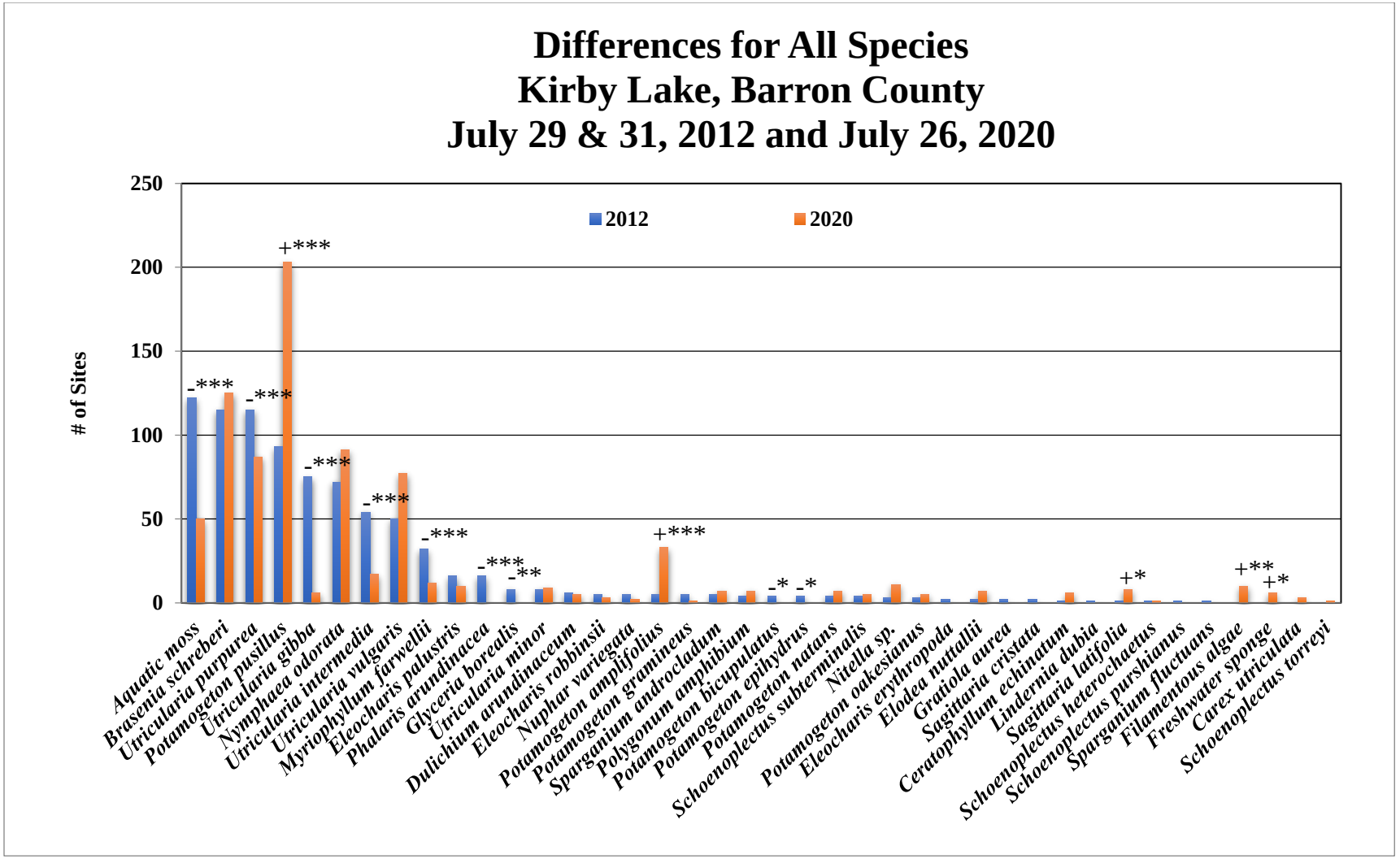
Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Potamogeton pusillus	Small pondweed	203	27.10	78.68	70.00	1.65	0
Brasenia schreberi	Watershield	125	16.69	48.45	43.10	2.42	11
Nymphaea odorata	White water lily	91	12.15	35.27	31.38	1.91	11
Utricularia purpurea	Large purple bladderwort	87	11.62	33.72	30.00	1.41	7
Utricularia vulgaris	Common bladderwort	77	10.28	29.84	26.55	1.30	4
	Aquatic moss	50	*	19.38	17.24	1.00	0
Potamogeton amplifolius	Large-leaf pondweed	33	4.41	12.79	11.38	1.39	8
Utricularia intermedia	Flat-leaf bladderwort	17	2.27	6.59	5.86	1.29	0
Myriophyllum farwellii	Farwell's water-milfoil	12	1.60	4.65	4.14	1.25	7
Nitella sp. likely *flexilis*	Nitella	11	1.47	4.26	3.79	1.00	0
Eleocharis palustris	Creeping spikerush	10	1.34	3.88	3.45	1.20	7
	Filamentous algae	10	*	3.88	3.45	1.20	0
Utricularia minor	Small bladderwort	9	1.20	3.49	3.10	1.11	0
Sagittaria latifolia	Common arrowhead	8	1.07	3.10	2.76	1.25	1
Elodea nuttallii	Slender waterweed	7	0.93	2.71	2.41	1.00	0
Polygonum amphibium	Water smartweed	7	0.93	2.71	2.41	1.14	2
Potamogeton natans	Floating-leaf pondweed	7	0.93	2.71	2.41	1.29	1
Sparganium androcladum	Branched bur-reed	7	0.93	2.71	2.41	1.43	5
Ceratophyllum echinatum	Spiny hornwort	6	0.80	2.33	2.07	1.17	0
	Freshwater sponge	6	*	2.33	2.07	1.00	0
Utricularia gibba	Creeping bladderwort	6	0.80	2.33	2.07	1.00	1
Dulichium arundinaceum	Three-way sedge	5	0.67	1.94	1.72	2.00	1
Potamogeton oakesianus	Oakes' pondweed	5	0.67	1.94	1.72	2.00	9
Schoenoplectus subterminalis	Water bulrush	5	0.67	1.94	1.72	1.40	0

* Excluded from relative frequency analysis

Table 3 (continued): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Kirby Lake, Barron County (Berg, 2020)
July 26, 2020

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Carex utriculata	Common yellow lake sedge	3	0.40	1.16	1.03	2.33	4
Eleocharis robbinsii	Robbins' spikerush	3	0.40	1.16	1.03	1.00	0
Nuphar variegata	Spatterdock	2	0.27	0.78	0.69	1.00	4
Potamogeton gramineus	Variable pondweed	1	0.13	0.39	0.34	1.00	0
Schoenoplectus heterochaetus	Slender bulrush	1	0.13	0.39	0.34	1.00	0
Schoenoplectus torreyi	Torrey's three-square	1	0.13	0.39	0.34	1.00	4
Potamogeton epihydrus	Ribbon-leaf pondweed	**	**	**	**	**	3
Scirpus cyperinus	Wool grass	**	**	**	**	**	2
Phalaris arundinacea	Reed canary grass	**	**	**	**	**	1
Elatine minima	Waterwort	***	***	***	***	***	***
Eleocharis acicularis	Needle spikerush	***	***	***	***	***	***
Eleocharis erythropoda	Bald spikerush	***	***	***	***	***	***
Eleocharis obtusa	Blunt spikerush	***	***	***	***	***	***
Gratiola aurea	Golden hedge-hyssop	***	***	***	***	***	***
Isoetes echinospora	Spiny spored-quillwort	***	***	***	***	***	***
Juncus tenuis	Path rush	***	***	***	***	***	***
Najas gracillima	Northern naiad	***	***	***	***	***	***
Potamogeton bicupulatus	Snail-seed pondweed	***	***	***	***	***	***
Typha latifolia	Broad-leaved cattail	***	***	***	***	***	***

** Visual only *** Boat survey only



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

Figure 6: Macrophytes Changes from 2012-2020 (Berg, 2020)

Watershield, the most common vascular species in 2012 and the second most common in 2020, was abundant in most areas from 2-6ft deep over sandy muck where it tended to dominate the plant community (Figure 7). Found at 115 sites in 2012, it demonstrated a non-significant increase (p=0.55) in distribution to 125 sites in 2020. Its mean rake fullness increased from 2.39 in 2012 to 2.42 in 2020 was also not significant (p=0.38).

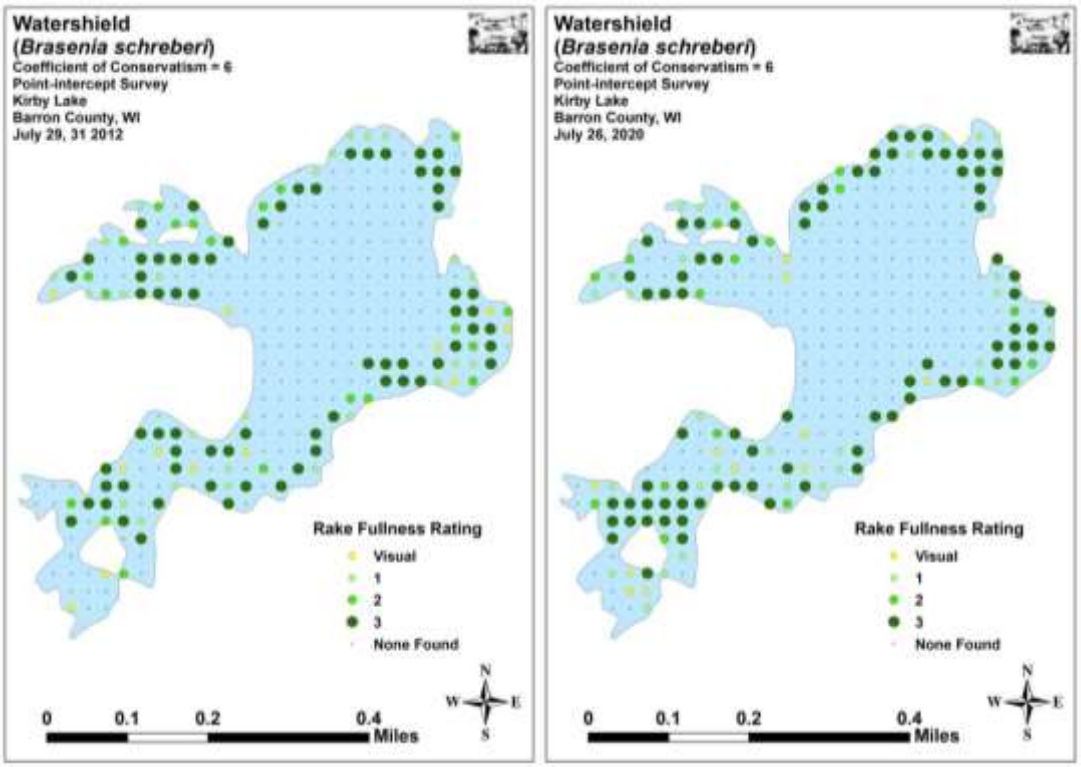


Figure 7: 2012 and 2020 Watershield Density and Distribution (Berg, 2020)

Large purple bladderwort was the second most common vascular species in 2012 and the fourth most common in 2020 (Figure 8). Although it demonstrated a highly significant decline **(p<0.001)** in distribution from 115 sites in 2012 to 87 sites in 2020, its density was unchanged (mean rake fullness of 1.41 each year).

Small pondweed, the third most common vascular species in 2012 and the most common in 2020, experienced a highly-significant increase **(p<0.001)** in both distribution (93 sites in 2012/203 in 2020) and density (mean rake of 1.35 in 2012/1.65 in 2020). Analysis of the maps showed this species seemed to exploit the rising water levels as it came to dominate the expanded 7-13ft zone (Figure 9). Similarly, large-leaf pondweed jumped from the fourteenth most common species in 2012 (5 sites/mean rake of 1.00) to the sixth most common in 2020 (33 sites/mean rake of 1.39). However, its highly significant increases **(p<0.001)** were more focused in the 7-10ft zone just beyond the watershield (Figure 10).

Similar to watershield, white water lily experienced a non-significant increase (p=0.48) in distribution (72 sites in 2012/91 sites in 2020) as its community rank rose from the fifth most common vascular species to the third most common (Figure 11). Most of this expansion was low density as its mean rake fullness declined from 1.97 in 2012 to 1.91 in 2020; however, this was not significant (p=0.33).

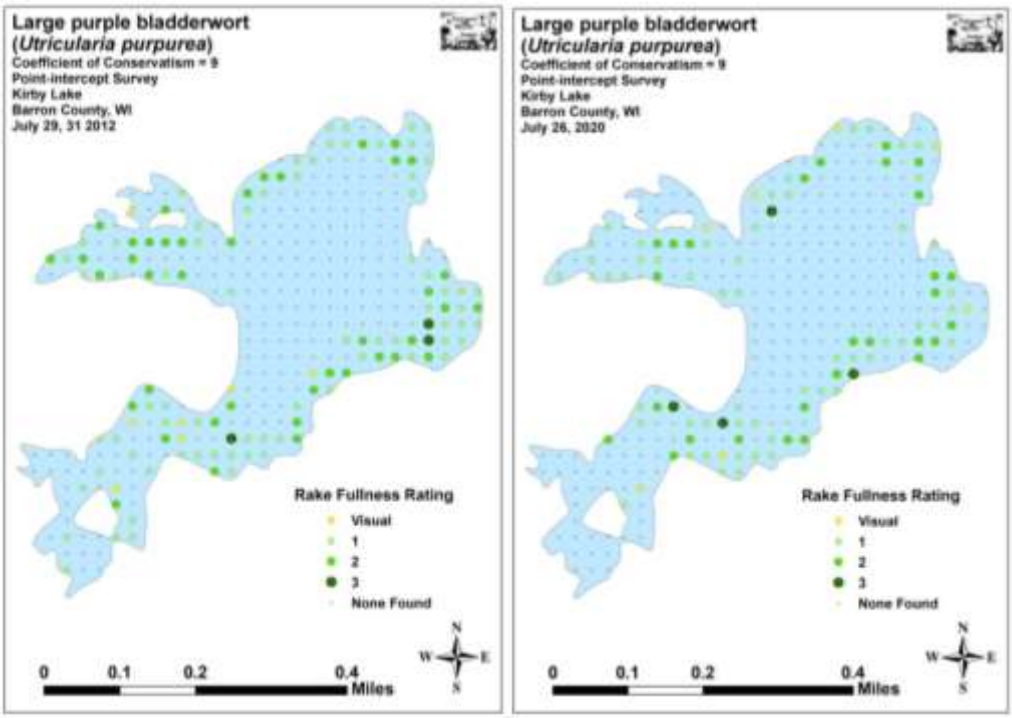


Figure 8: 2012 and 2020 Large Purple Bladderwort Density/Distribution (Berg, 2020)

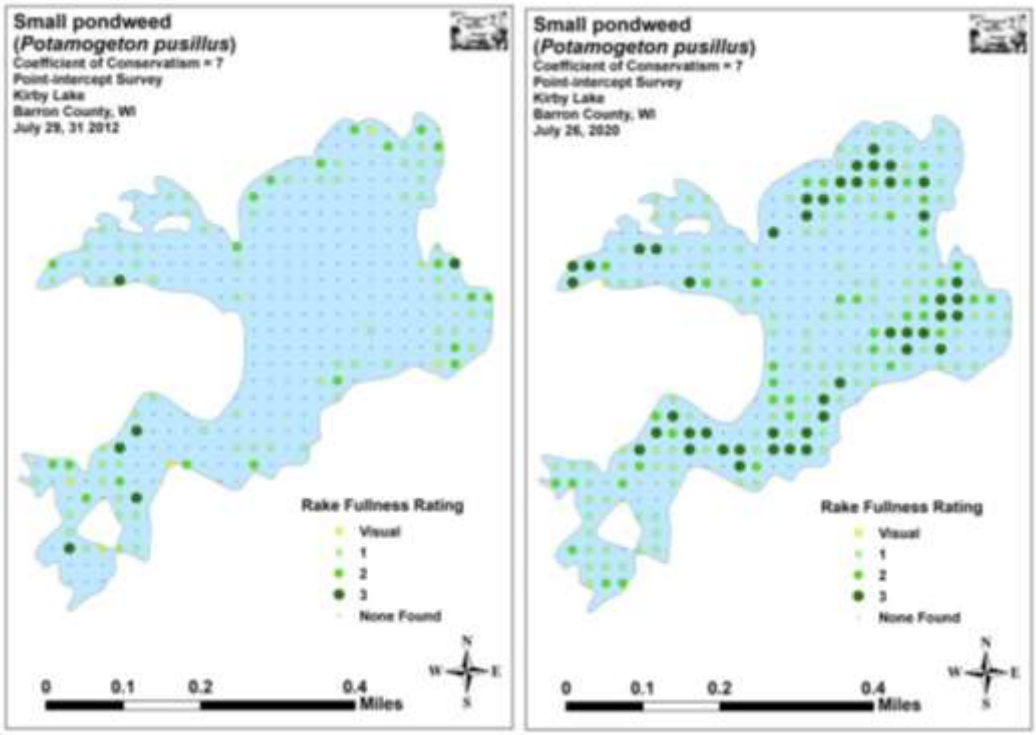


Figure 9: 2012 and 2020 Small Pondweed Density and Distribution (Berg, 2020)

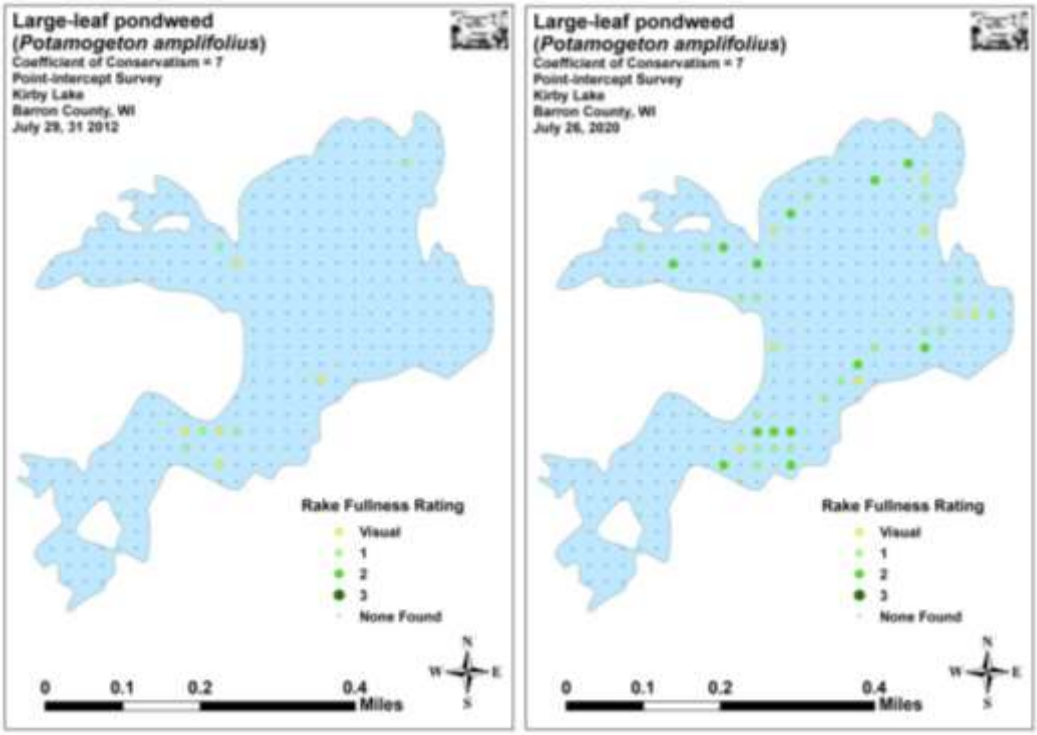


Figure 10: 2012 and 2020 Large-leaf Pondweed Density and Distribution (Berg, 2020)

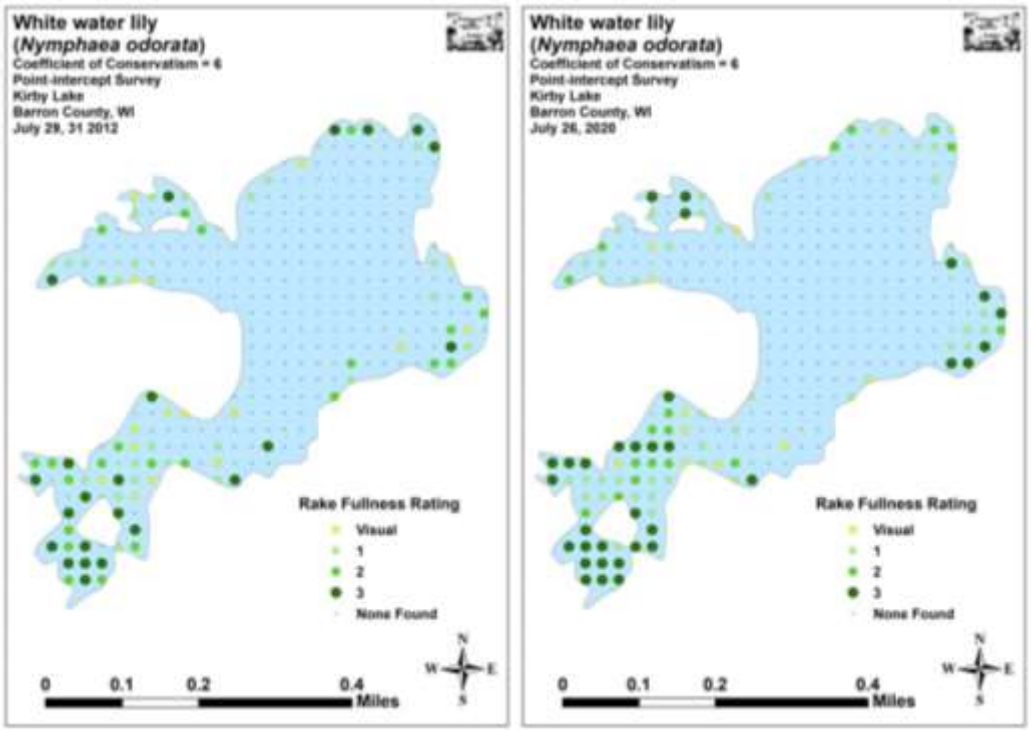


Figure 11: 2012 and 2020 White Water Lily Density and Distribution (Berg, 2020)

Although it is not factored into the community analysis, aquatic moss was worth mentioning as it was the most widely distributed plant on the lake in 2012 when found it at 122 sites with a mean rake fullness of 1.18. By 2020, following highly significant declines **(p<0.001)** in both distribution (50 sites) and density (mean rake of 1.00), it was only present in the deepest areas of the lake where no more than a few small individuals in a sample were found (Figure 12).

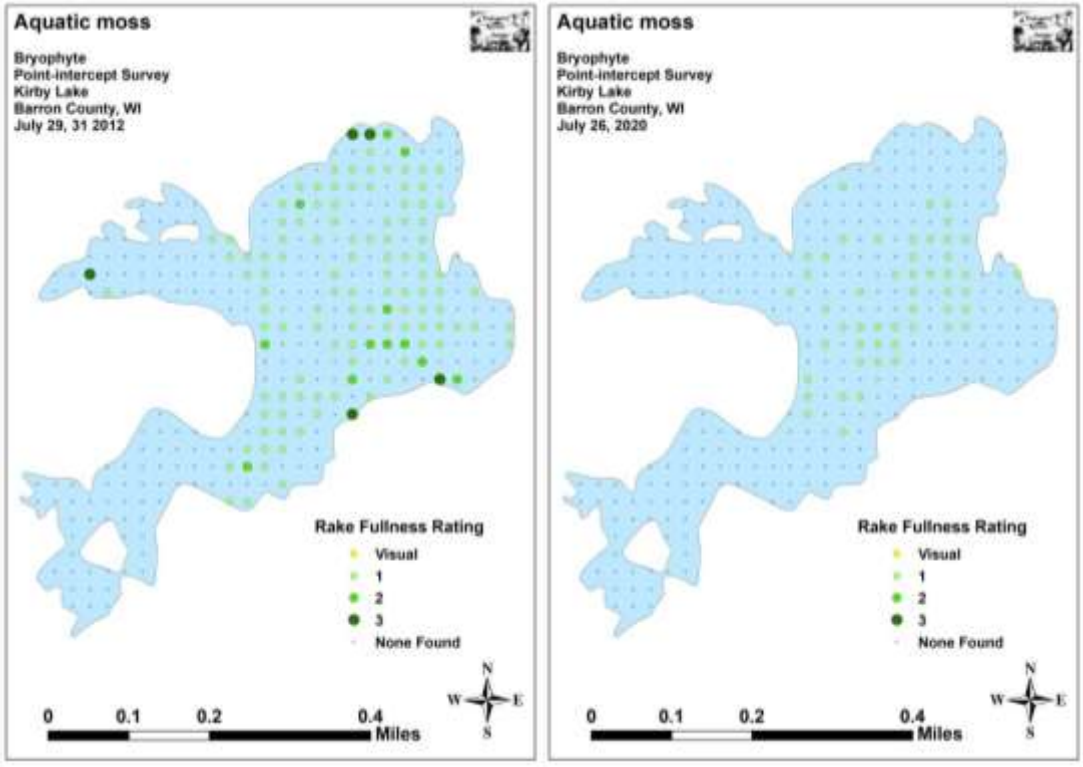


Figure 12: 2012 and 2020 Aquatic Moss Density and Distribution (Berg, 2020)

Comparison of Floristic Quality Indexes in 2012 and 2020

In 2012, a total of 31 **native index species** in the point-intercept survey were identified (Table 4). They produced a mean Coefficient of Conservatism of 7.6 and a Floristic Quality Index of 42.6.

Table 4: Floristic Quality Index of Aquatic Macrophytes
Kirby Lake, Barron County (Berg, 2020)
July 29, 31, 2012

Species	Common Name	C
Brasenia schreberi	Watershield	6
Ceratophyllum echinatum	Spiny hornwort	10
Dulichium arundinaceum	Three-way sedge	9
Eleocharis erythropoda	Bald spikerush	3
Eleocharis palustris	Creeping spikerush	6
Elodea nuttallii	Slender waterweed	7
Glyceria borealis	Northern manna grass	8
Gratiola aurea	Golden hedge-hyssop	10
Myriophyllum farwellii	Farwell's water-milfoil	8
Nitella sp.	Nitella	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Polygonum amphibium	Water smartweed	5
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton bicupulatus	Snail-seed pondweed	9
Potamogeton epihydrus	Ribbon-leaf pondweed	8
Potamogeton gramineus	Variable pondweed	7
Potamogeton natans	Floating-leaf pondweed	5
Potamogeton oakesianus	Oakes' pondweed	10
Potamogeton pusillus	Small pondweed	7
Sagittaria cristata	Crested arrowhead	9
Sagittaria latifolia	Common arrowhead	3
Schoenoplectus heterochaetus	Slender bulrush	10
Schoenoplectus subterminalis	Water bulrush	9
Sparganium androcladum	Branched bur-reed	8
Sparganium fluctuans	Floating-leaf bur-reed	10
Utricularia gibba	Creeping bladderwort	9
Utricularia intermedia	Flat-leaf bladderwort	9
Utricularia minor	Small bladderwort	10
Utricularia purpurea	Large purple bladderwort	9
Utricularia vulgaris	Common bladderwort	7
N		**31**
Mean C		**7.6**
FQI		**42.6**

In 2020, 24 **native index plants** were found in the point-intercept survey. They produced a mean Coefficient of Conservatism of 7.5 and a Floristic Quality Index of 36.7 (Table 5). Nichols (1999) reported an average Mean C for the Northern Central Hardwood Forests Region of 5.6, putting Kirby 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), three-way sedge (C = 9), water bulrush (C = 9), creeping bladderwort (C = 9), flat-leaf bladderwort (C = 9), small bladderwort (C = 10), large-purple bladderwort (C = 9), and the State Species of Special Concern **Robbins' spikerush (C = 10), Oakes' pondweed (C = 10), and slender bulrush (C = 10). Four other high value species of note were excluded because they were only seen during the boat survey (waterwort (C = 9), golden-hedge hyssop (C = 10) and **snail-seed pondweed (C = 9)), or they were not an index species (**Torrey's three-square bulrush (C = 9)).

** *"Special Concern"* species like Robbins' spikerush, Snail-seed pondweed and, Oakes' pondweed, Slender bulrush, and Torrey's three-square bulrush are those species about which some problem of abundance or distribution is suspected but not yet proved. The main purpose of this category is to focus attention on certain species before they become threatened or endangered.

Table 5: Floristic Quality Index of Aquatic Macrophytes
Kirby Lake, Barron County (Berg, 2020)
July 26, 2020

Species	Common Name	C
Brasenia schreberi	Watershield	6
Ceratophyllum echinatum	Spiny hornwort	10
Dulichium arundinaceum	Three-way sedge	9
Eleocharis palustris	Creeping spikerush	6
Elodea nuttallii	Slender waterweed	7
Myriophyllum farwellii	Farwell's water-milfoil	8
Nitella sp.	Nitella	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Polygonum amphibium	Water smartweed	5
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton gramineus	Variable pondweed	7
Potamogeton natans	Floating-leaf pondweed	5
Potamogeton oakesianus	Oakes' pondweed	10
Potamogeton pusillus	Small pondweed	7
Sagittaria latifolia	Common arrowhead	3
Schoenoplectus heterochaetus	Slender bulrush	10
Schoenoplectus subterminalis	Water bulrush	9
Sparganium androcladum	Branched bur-reed	8
Utricularia gibba	Creeping bladderwort	9
Utricularia intermedia	Flat-leaf bladderwort	9
Utricularia minor	Small bladderwort	10
Utricularia purpurea	Large purple bladderwort	9
Utricularia vulgaris	Common bladderwort	7
N		**24**
Mean C		**7.5**
FQI		**36.7**

Exotic Plant Species

There was no evidence of Eurasian water-milfoil, curly-leaf pondweed, or any other new aquatic or semi-aquatic exotic plant species in Kirby Lake during the 2020 survey. However, reed canary grass (RCG), a previously described exotic invasive emergent species, continues to be present. In 2012, it was found at 16 points, noted as a visual at five additional points, and calculated a mean rake fullness of 2.06. It had taken over large areas of the lake's shoreline and dominated several surrounding wetlands (Figure 13). Fortunately, rising water levels have resulted in a significant reduction in the available habitat for RCG. In 2020, it was recorded as a visual at a single point (Figure 14), and it was discovered that native emergent plant species, which can tolerate deeper water, have reclaimed most areas RCG formerly occupied.

Figure 13: Kirby Lake Shoreline in the Southwest Bay 7/29/12 (Berg, 2012)

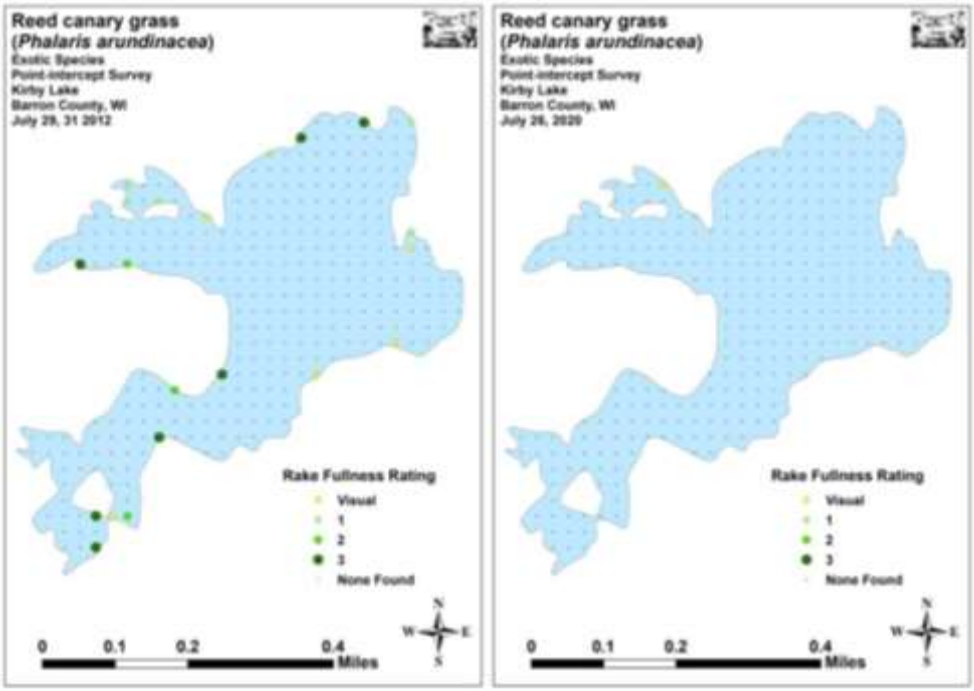


Figure 14: 2012 and 2020 Reed Canary Grass Density and Distribution (Berg, 2020)

Integrated Pest Management

Integrated Pest Management (IPM) is an ecosystem-based management strategy that focuses on long-term prevention and/or control of species of concern or their damage. 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 15). Integrated pest management projects should be informed by current, comprehensive information on pest life cycles and the interactions among pests and the environment.

Groups should focus their efforts to keep the species of concern from becoming a problem by looking into the environmental factors that affect the species and its ability to thrive. Once groups understand the species of concern, they can create conditions that are either unfavorable or less beneficial for it.

Monitoring means checking the waterbody to identify what species are present, how many there are and what their impacts are on each other and on water use. Correctly identifying the species of concern as well as all other species in the waterbody is key to knowing whether a species is likely to become a problem and determining the best management strategy.

After monitoring and considering the 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, the data collected on the species and the waterbody will also help groups select the most effective management methods and the best time to use them.

The most effective, long-term way to manage species of concern is by using a combination of methods that work better together than separately. 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.

IPM isn't a single solution to species of concern problems. It's a process that combines common-sense methods and practices to provide long-term, economic pest control. Over time, a good IPM program

should adapt whenever new information is provided on the target species 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 a group's 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.

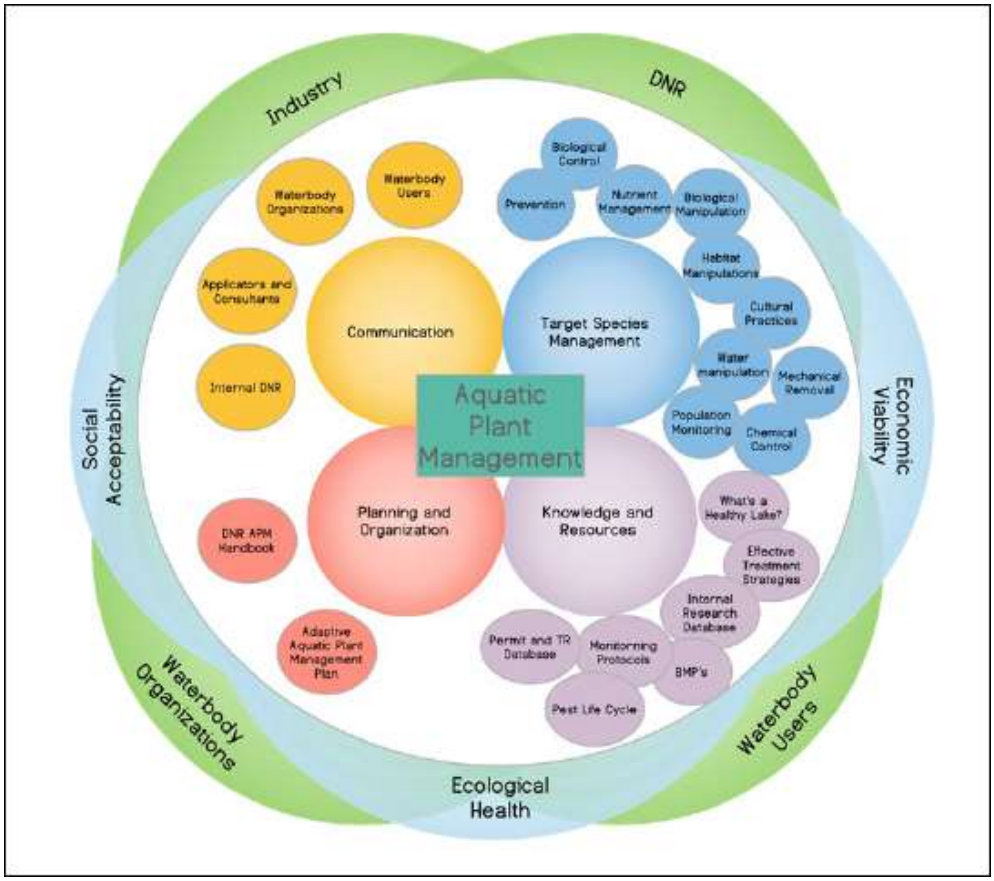


Figure 15: Wisconsin Department of Natural Resources: Wisconsin Waterbodies – Integrated Pest Management, March 2020

Aquatic Plant Management (APM) Plan

Kirby Lake supports a diverse aquatic plant community with a number of uncommon species and a quality fishery valued by the lake community. The lake currently has only one known invasive species – reed canary grass. Nuisance conditions and navigation impairment caused by dense native plant growth occur throughout the open water season. Through public input from the KLMD and lake constituents, this Aquatic Plant Management Plan established the following goals for aquatic plant management in Kirby Lake:

1. **Preservation, Protection, and Restoration**. Preserve, protect, and restore the native plant species community in and around the lake to decrease susceptibility to the introduction of new aquatic invasive species
2. **Prevention**. Prevent the introduction and establishment of new aquatic invasive species through early detection and rapid response
3. **Management**. Maintain common navigation channels, individual riparian access lanes, and open water in areas of nuisance native plant and reed canary grass growth via mechanical and manual control.
4. **Education and Awareness**. Continue public outreach and education programs on aquatic invasive species
5. **Research and Monitoring**. Develop a better understanding of the lake and the factors affecting lake water quality through continued and expanded monitoring efforts
6. **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. Preserve, Protect, Restore

To maintain the quality and diversity of the lake ecosystem, it is recommended that the KLMD provide riparian owners with educational materials on shoreland improvement and sponsor shoreland restoration training events. General information on shoreland restoration should be provided to all members in a newsletter and during public events. The cost of shoreland restoration and/or improvement projects is dependent on the size and type of restoration done, but can range in price from no cost (like for establishing no mow sites), a few hundred dollars for small restoration projects (like installing a rain garden), to several thousands of dollars for larger more comprehensive full shore restoration projects (like redesigning the shoreline to prevent erosion). There are many free on-line resources, and both free and low-cost paper resources including guides, pamphlets, and brochures available to help the average person work toward making improvements on their own properties. UW-Extension has offices in nearly every county in WI, Barron County included, and offer these materials for free or at very low prices. They also sponsor local workshops and/or training sessions, or can direct people to others who do. Local greenhouses and landscaping companies often have shoreland restoration packages for specific project types available to the public.

An alternative, or addition, to providing educational and informational materials is for the KLMD to sponsor individual property owner shoreline evaluations performed by resource professionals or trained KLMD volunteers. A quick, inexpensive walk-through of a property by a shoreland restoration specialist can often identify areas in need of improvement and provide basic consulting for how to make improvements. Shoreland restoration consultants generally charge $30-50 for first time site visits.

Information collected in this manner would provide baseline data on the status of the shoreline around Kirby Lake and would allow for focused education and outreach efforts.

It is also recommended that the KLMD should further encourage riparian property owners to diversify the shoreland environment by recognizing riparian owners who implement shoreland restoration and habitat improvement projects. For example, riparian owners who have improved their shoreline could be awarded with a special sign on the shoreline or acknowledged with a short article in the annual newsletter.

Goal 2. Prevention

Aquatic invasive species (AIS) can be transported via a number of vectors, but most invasions are associated with human activity. It is recommended that Clean Boats, Clean Waters monitoring of the boat launch on Kirby Lake continue, and all watercraft inspection data collected should be submitted to the WDNR SWIMS database. It is recommended that the KLMD participate in the Fourth of July Landing Blitz, a state-wide outreach effort to warn boaters of the dangers of transporting invasive species that takes place on the Fourth of July, a high-boat traffic day. It is also recommended that the KLMD continue to maintain and update signage at the boat launch kiosk 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 KLMD 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 curly-leaf pondweed, Eurasian watermilfoil, purple loosestrife, Japanese knotweed, giant reed grass, zebra mussels, and other invasive species. 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.

It is also recommended that all property owners be encouraged to monitor their shoreline and open water areas for new growths of AIS. If an AIS is found, or even suspected, it should be reported to the KLMD, County, and WDNR resource personnel. See Appendix B for more information and guidelines on identifying and reporting AIS.

Goal 3. Management

Management of native aquatic plants to provide open water access, as well as improve navigation and recreational opportunities is necessary in Kirby Lake. The best methods for completing this management goal are continued manual removal and mechanical harvesting. The main focus of native aquatic plant harvesting on Kirby Lake is to provide navigation relief by opening designated navigation and access lanes, as well as maintaining open water areas, to improve access to open water and recreational opportunities for all lake users. Much of the shoreline in Kirby Lake is impounded and inaccessible due to large, dense beds of native vegetation comprised of floating-leaf species like watershield and submerged species like small pondweed. Limited harvesting through these beds using mechanical and manual means would maintain access and recreation in the lake, and it is not likely that limited harvesting

will negatively impact the overall abundance and diversity of native aquatic vegetation in the lake. Additionally, secondary benefits of limited native aquatic plant harvesting would be improving fishing access, possibly improving the fishery, and reducing nutrient loading from decaying vegetation.

Manual Removal

Manual or physical removal is the recommended method to control plant growth around docks and in areas where the water depth is shallower than 3 feet. For aquatic plant control in small, shallow lake areas adjacent to shore, it is recommended that plant removal rakes and/or razors be purchased by the KLMD and made available for riparian property owners to use. Physical removal of aquatic plants is allowable without a permit within an area up to 30-ft wide near a dock or along a shoreline used for recreational activities, provided the parts of the plant cut or pulled are removed completely from the water and disposed of properly. By its very nature, physical removal is often a difficult and daunting task, thus minimizing how much plant material is actually removed. Native plant removal should be limited only to the amount needed to access open water areas or provide navigation and access lanes. Coarse woody habitat (tree falls, logs, etc.) should be left in the water, as it is a critical feature of lakes that influences fish behavior, spawning, predator-prey interactions, growth, and species diversity.

Mechanical Harvesting

Mechanical harvesting of aquatic plants can only be completed in water 3-ft or greater in depth to prevent damage to the lake bottom and its biota, as well as damage to the harvester. In waters at, or deeper than 3-ft, aquatic plants can be cut to the maximum depth of the harvester or two-thirds of the water column, whichever is less. At off-loading sites, the operator will attempt to return game fish, turtles, and other wildlife back to the water.

Plant survey work in 2020 identified approximately 80 acres of the total 98 acres as a littoral, or plant growing, zone. In an effort to protect the existing health of the lake, harvesting of navigation channels and riparian access lanes in any one season will not exceed 10% of the established littoral zone, or 8.0 acres total. This acreage does not include harvested reed canary grass or areas where aquatic vegetation is managed by physical means. This acreage also does not include harvesting necessary to keep the center of the lake open for recreational use.

It is recommended that KLMD harvester operators keep daily log sheets when harvesting. Information kept should include total loads, estimated surface area covered, and a list of the most common plants removed. If harvesting is contracted through an outside source, then the KLMD should expect and obtain a harvesting report from the contractor.

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

Areas to be Harvested

Harvesting plans will be designed to enhance both the ecological balance and recreational uses of the lake for lake constituents and the general public by establishing common use navigation channels and individual riparian access lanes. A common use navigation channel is a common navigation route for the general lake user. It is offshore and connects areas that boaters commonly would navigate to or cross, and

is for public benefit. An individual riparian access lane is an access lane to shore that normally is used by an individual riparian shore owner.

Navigation channels will be limited to 20-ft wide and individual riparian access lanes and fishing recreation lanes will be limited to 10-ft wide and both must be in water at a depth of 3-ft or greater (Appendix C). Once harvested, these areas should be kept open, and even expanded, through regular use of watercraft. If the navigation channels or access lanes fill in again, they can be re-cut under the same harvesting permit that allowed their initial cutting.

Additionally, maintaining open water navigation on Kirby Lake is critical to ensuring that the lake is usable and navigable for lake constituents and the general public. Several years of mapping the line between open water with no vegetation and visible vegetation delineates a little more than 45 acres of open water staring at about 9-ft in depth. It is recommended that this 45-acre area be kept as open water through mechanical harvesting to provide lake users more recreational opportunities while simultaneously maintaining the ecological integrity of the lake. These values may need to be re-evaluated on a yearly basis to account for changes in water levels and year-to-year plant growth. See Appendix C for the location of the area to be harvested to maintain open water in Kirby Lake.

The harvesting plan will be assessed annually to determine if changes should be made. Areas designated for harvesting in a given year, can be repeatedly harvested as needed in that year to maintain their function without the need for additional WDNR permitting or fees. Changes in the harvesting plan can be requested by property owners, and will be evaluated on an individual case basis as they arise. Appendix D provides guidelines for evaluating land owner requests and documenting the need to pursue management. Larger changes in the harvesting plan may be necessary due to variability in water levels, changes in lake use patterns, or with the introduction of a new aquatic invasive species.

Management Alternatives

Protecting native plants should be a primary focus of plant management in Kirby Lake due to its rich and diverse plant community and the benefits they offer including providing fish and wildlife habitat, keeping aquatic invasive plant species at bay, maintaining water quality, protecting the shoreline from erosion, improving lake aesthetics, and increasing land owner privacy. Management of aquatic vegetation and can take many alternate forms to the mechanical harvesting proposed in this plan. There are several management alternatives that have been determined to be inadequate and/or inappropriate for Kirby Lake.

Generally, control methods for nuisance aquatic plants can be grouped into four broad categories:

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

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

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 Kirby Lake due to the excessive restrictions to public and lake property owner access to the lake caused by the extensive growth of native vegetation.

Physical/Manual Removal: Recommended

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. In shallow, hard bottom areas of a lake, or where impacts to fish spawning habitat need to be minimized, this may be the best form of control. Pulling aquatic invasive species 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.

Many property owners along the shores of Kirby Lake already implement this management action, and it is recommended to continue. Some residents keep small areas around their docks or swimming areas open by raking and/or cutting plants. For residents where dense beds of aquatic vegetation can extend far out into the lake, this method of management is more difficult. In many cases, a dock area is cleared out, and then daily boat traffic from that area to the open water keeps a channel open.

Mechanical Harvesting: 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 plant 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 cause hardship of its own. Some research indicates that after cutting, reduction in available plant cover causes declines in fish growth and zooplankton densities. Other research finds that creating deep lake channels by harvesting increases the growth rates of some age classes of bluegill and largemouth bass (Greenfield et al, 2004). A major benefit of aquatic plant harvesting is the removal of large amounts of plant biomass from a water body.

A combination of small and large-scale (described below) is recommended to continue in Kirby Lake to make the lake navigable and open to recreation for the public and lake property owners. These methods are recommended because they will effectively and efficiently open navigation channels and areas in a controlled manner to protect and improve the ecological function and use of Kirby Lake.

Small-Scale Mechanical Harvesting

Removing a small amount of aquatic vegetation through mechanical harvesting is classified as small-scale mechanical harvest. The depth at which these mowers cut is set by the operator and is only limited by the depth of the lake, and the pole attached to the mower blade. However, it would not be expected that this kind of mower would be operated in deep water, and is likely most effective in water depth below five or six feet. In addition, this type of mower would cut the vegetation, but not remove it from the system. A

second boat or pontoon would have to follow to remove the cut vegetation. Cutting equipment of this nature can be purchased for just a few thousand dollars.

Small-scale aquatic plant harvesting in addition to larger scale contracted mechanical harvesting in Kirby Lake is likely the best management option to meet the lake's overall goal of maintaining recreational use of the lake for the general public and lake constituents. It would be expected that once the first round of harvesting was done, that regular boat traffic would keep navigation lanes open. By doing so, the amount of effort needed to open the lanes, particularly when using a mower blade attached to a pontoon or boat, would be minimized.

Large-Scale Mechanical Harvesting

Large-scale harvesting is removing several acres of aquatic vegetation, potentially at multiple times during a season. A mechanical harvester that would cut, remove, store, and transport aquatic vegetation would be needed. Large-scale harvesting is recommended for Kirby Lake to maintain open water areas, navigational lanes, and access lanes in addition to small scale harvesting performed by the KLMD and physical removal conducted by property owners.

Aquatic Herbicides: Not Recommended

Because the WDNR does not issue permits for chemical control of native aquatic vegetation, it is unlikely that the use of herbicides to treat native aquatic plants in Kirby Lake would be permitted. Furthermore, the plant community of Kirby Lake is highly diverse and contains several rare species; thus, using aquatic herbicides in Kirby Lake is not recommended.

Goal 4. Education and Awareness

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 recommended that the KLMD 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 KLMD 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 KLMD should distribute, or re-distribute, informational materials and provide educational opportunities on aquatic invasive species and other factors that affect Kirby Lake. At least one annual activity (picnic at the lake, public workshop, guest speakers, etc.) should be sponsored and promoted by the KLMD that is focused on AIS. Maintaining signs, continuing aquatic invasive species monitoring, and active inspections of watercraft at the public launch 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.

It is recommended that the KLMD continue to provide educational materials related to wildlife and wildlife monitoring programs during public events and meetings and in newsletters. Volunteers are currently participating in the Loon Watch program sponsored by the Sigurd Olson Institute. Other programs sponsored by the Citizen-based Monitoring Network of Wisconsin (http://wiatri.net/cbm/)

should be promoted by the KLMD and member participation encouraged. The KLMD should help make arrangements for training opportunities for these and other wildlife monitoring and appreciation events.

Goal 5. 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. Thus, it is recommended that the KLMD continue to participate in the CLMN Water Quality Monitoring Program. CLMN expanded monitoring parameters (Secchi, temperature, dissolved oxygen, total phosphorus, and chlorophyll-*a*) should be continued at the Deep Hole Site. The intensity of water quality monitoring efforts should be evaluated at least every three years. These evaluations should consider cost and their contribution to the creation of knowledge and formation of an effective lake management program. The background information and trends provided by these data are invaluable for comprehensive lake management planning.

Water quantity monitoring is also recommended, including lake level and precipitation. This information can also be used for comprehensive planning when determining hydrologic and nutrient budgets. Long-term lake level monitoring can provide information on how much water levels vary in a normal year (or longer time period) which can be useful in identifying processes that drive lake hydrology so management or adaptation can continue.

It is also recommended that an official staff gage be installed on a permanent structure in the lake or placed in reference to a permanent and unchanging structure on the shore. To facilitate daily readings, the staff gauge should be installed at the property of a volunteer who is a permanent resident on the lake. Lake levels can be recorded by reading the staff gauge on a daily or weekly basis.

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.

Goal 6. Adaptive Management

This APM Plan is a working document guiding management actions on Kirby 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. 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. 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 KLMD 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 KLMD, Barron County 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. Appendix E is a timeline for implementation of activities. 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 KLMD. Some activities in the timeline are eligible for grant support to complete (for more information: https://dnr.wisconsin.gov/aid/SurfaceWater.html).

Funding and Permitting

Because cutting and removal and/or harvesting is considered maintenance management by the WDNR, it is expected that the KLMD will cover the costs of any necessary management planning and aquatic plant cutting and removal and/or harvesting through Lake District funds. Recreational Boating Facilities (RBF) grant funding could be applied for by the KLMD if the decision is made to purchase any mechanical cutting and removal equipment or a harvester. RBF grants can be applied for at any time, but require a request be made in person in front of a five member Waterways Commission Advisory Board which generally convenes quarterly each year. Initial investigations completed by the KLMD into the availability of RBF grants to purchase a harvester for Kirby Lake suggest this grant funding may not be available for Kirby Lake management, but additional follow-up should be made. More information about the RBF grant is available at http://dnr.wi.gov/Aid/RBF.html.

A WDNR Mechanical/Manual Aquatic Plant Control Permit is necessary to implement the management actions in this Addendum. Information about mechanical harvesting and the need for a permit is available on line at https://dnr.wi.gov/lakes/plants/forms/.

Physical removal of aquatic plants, that which is done by hand with no motorized mechanical assistance, can be done legally without a permit according to Guidelines found in NR 109 (Appendix A).

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APPENDIX A

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

ISSUES

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

BACKGROUND

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

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

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

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

GOALS OF STRATEGY:

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

BASIS OF STRATEGY IN STATE STATUTE AND ADMINISTRATIVE CODE

State Statute 23.24 (2)(c) states:
"The requirements promulgated under par. (a) 4. may specify any of the following:

1. The **quantity** of aquatic plants that may be managed under an aquatic plant management permit.
2. The **species** of aquatic plants that may be managed under an aquatic plant management permit.
3. The **areas** in which aquatic plants may be managed under an aquatic plant management permit.
4. The **methods** that may be used to manage aquatic plants under an aquatic plant management permit.
5. The **times** during which aquatic plants may be managed under an aquatic plant management permit.
6. The **allowable methods** for disposing or using aquatic plants that are removed or controlled under an aquatic plant management permit.
7. The requirements for plans that the department may require under sub. (3) (b).

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

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

APPROACH

1. After January 1, 2009* no individual permits for control of native aquatic plants will be issued. Treatment of native species may be allowed under the auspices of an approved lake management plan, and only if the plan clearly documents "impairment of navigation" and/or "nuisance conditions". Until January 1, 2009, individual permits will be issued to previous permit holders, only with adequate documentation of "impairment of navigation" and/or "nuisance conditions". No new individual permits will be issued during the interim.
2. Control of aquatic plants (if allowed) in documented sensitive areas will follow the conditions specified in the report.
3. Invasive species must be controlled under an approved lake management plan, with two exceptions (these exceptions are designed to allow sufficient time for lake associations to form and subsequently submit an approved lake management plan):
    a. Newly-discovered infestations. If found on a lake with an approved lake management plan, the invasive species can be controlled via an amendment to the approved plan. If found on a lake without an approved management plan, the invasive species can be controlled under the WDNR's Rapid Response protocol (see definition), and the lake owners will be encouraged to form a lake association and subsequently submit a lake management plan for WNDR review and approval.
4. Individuals holding past permits for control of *invasive* aquatic plants and/or "mixed stands" of native and invasive species will be allowed to treat via individual permit until January 1, 2009 if "impairment of navigation" and/or "nuisance conditions" is adequately documented, unless there is an approved lake management plan for the lake in question
5. Control of invasive species or "mixed stands" of invasive and native plants will follow current best management practices approved by the Department and contain an explanation of the strategy to be used. Established stands of invasive plants will generally use a control strategy based on spring treatment (typically, a water temperature of less than 60 degrees Fahrenheit, or approximately May 31st, annually).
6. Manual removal (see attached definition) is allowed (Admin. Code NR 109.06).

DOCUMENTATION OF IMPAIRED NAVIGATION AND/OR NUISANCE CONDITIONS

Navigation channels can be of two types:

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

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

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

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

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

Documentation of the *nuisance* must include:

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

DEFINITIONS

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

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

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

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

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

APPENDIX B

AIS Rapid Response Plan for Kirby Lake, Barron County, Wisconsin

Monitoring

Continuous monitoring of the lake and the public access for the presence of EWM and CLP will be completed by trained Kirby Lake Management District (KLMD) volunteers, Citizen Lake Monitoring Network (CLMN) volunteers, watercraft inspectors, and others. KLMD volunteers will patrol the shoreline of Kirby Lake at least three times annually from May through October. In-lake inspection at the boat access site will be completed at least once a month from May through October by KLMD, CLMN, and other lake volunteers. Volunteers completing any monitoring will collect suspicious plants and document where they were found. Links for additional information about the identification of EWM, CLP, and other AIS and how to survey and/or report findings are included in this document. Suspicious plants will be submitted to designated KLMD personnel, this consultant, Barron County AIS representatives, or the WDNR for vouchering.

Specimen Vouchering

Volunteers are asked to collect at least two samples of the suspicious plant including roots if possible and place them in a zip-lock bag marked with the date, time, and location in the lake where it was found. The samples should be kept refrigerated until they can be submitted to one of the following appropriate personnel:

Kirby Lake Management District	
Joel Meyer, Chairman	612.910.9924
Barbara Brenny, Secretary	651.430.1759
Dan Boxrud, Harvesting/AIS Committee	boxruddan@gmail.com
LEAPS	
Dave Blumer, Lake Scientist	715.642.0635
Megan Mader, Lake Scientist	715.661.1831
Barron County Soil and Water Conservation Department	
Tyler Gruetzmacher, County Conservationist	715.537.6315
Wisconsin Department of Natural Resources	
Kris Larsen, AIS Specialist - Spooner	715.635.4072

Positive Identification

If EWM or CLP is positively identified in Kirby Lake, the WDNR and KLMD volunteers will install AIS warning signs at all private and public access points. Aquatic plant management, if any is occurring in the area where EWM or CLP was identified, will immediately cease until arrangements can be made for the completion of an intensive search for the suspected AIS in the immediate and nearby area in which it was found. If a sizable area of EWM or CLP is identified, marker buoys will be placed in the lake to keep boaters out of the infested area until management can be undertaken.

APM Plan Modification
If EWM or CLP is identified in the lake, the existing plant management plan will need to be modified to include the treatment of the new AIS. An evaluation will be completed to determine and implement the most effective short-term management option. If necessary, a WDNR AIS Early Detection and Response grant will be applied for to help implement recommendations made in the modified plan. Either in the same year or the year immediately following the new identification, a whole-lake plant survey will be completed to again look for the new AIS.

AIS Activity Funding
The KLMD collects an annual tax from its members. If these monies are not enough to cover the cost of an AIS treatment program, the KLMD will seek donations from its constituency and benefactors, undertake fundraisers and apply for an AIS Rapid Response and Early Detection grant to obtain appropriate funds. AIS Rapid Response and Early Detection grants can be applied for at any time as they are not subject to pre-determined application dates. Up to $20,000.00 is available for management implementation and planning activities.

This Appendix provides links to WDNR Rapid Response guidelines and information should a new AIS be discovered in Kirby Lake.

Invasive Species Rule, Wis. Admin. Code NR 40 information:
https://dnr.wisconsin.gov/topic/invasives/classification.html

Wisconsin's Rapid Response Framework for Aquatic Invasive Species:
https://dnr.wi.gov/lakes/invasives/wiaisrapidresponseframework2012.pdf

Aquatic and Wetland Invasive Species Monitoring general information:
https://dnr.wisconsin.gov/topic/Lakes/AIS/Monitoring.html

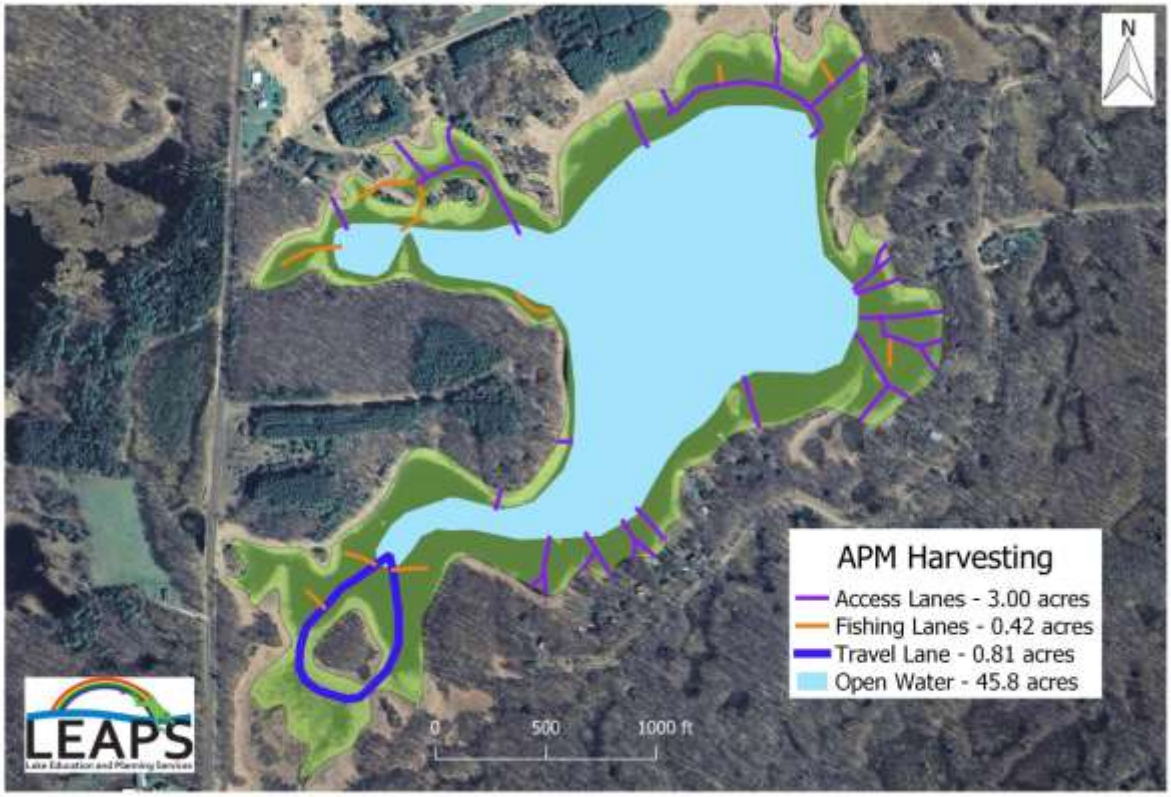
Wisconsin AIS Early Detector Handbook: https://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/programs/CLMN/publications/Wisconsin%20AIS%20Early%20Detector%20Handbook.pdf

Reporting Invasive Species: https://dnr.wisconsin.gov/topic/Invasives/report.html

Volunteer AIS Monitoring: https://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/programs/clmn/AIS.aspx

APPENDIX C

This figure identifies proposed harvest areas to allow property owners to access the main part of the lake, access lanes for the general public to navigate the lake, fishing lanes to provide more recreational opportunities in the lake, and an open water maintenance area to further provide recreational opportunities to the general public and lake constituents.



APPENDIX D

Nuisance and Navigation Guidelines for Native Plant Management

1) **Common Navigation Areas of Concern**
   a) Current navigation areas of concern are shown in Appendix C.
   b) New areas will be identified in the following manner:
      i) Residents will notify a designee of the KLMD about an area of potential concern prior to June 30 each year
      ii) Area of concern is inspected by the KLMD or its retainer
      iii) If navigation impairment is confirmed, it will be documented as described below.
2) **Documenting Navigation Impairment**
   a) Provide examples of specific impairment of navigation caused by the presence of aquatic plants
   b) Indicate when plants cause problems and how long problems persist
   c) List the species of plants causing the nuisance
   d) List adaptations or alternatives considered/used to lessen problem (some examples include)
      i) Physical or hand removal
      ii) Increasing general use by watercraft
      iii) Mechanical removal
      iv) Altering the chosen navigation route
   e) Locate suggested navigation routes with GPS coordinates
   f) Provide dimensions (length, width, and depth)
      i) Mechanical harvesting is limited to waters at least 3-ft deep
   g) Include photos of navigation impairments
   h) Provide a record of historical management at the site if it has been managed previously
3) **Documenting Nuisance Conditions**
   a) Provide examples of specific activities that are limited because of presence of nuisance aquatic plants
   b) Indicate when plants cause problems and how long problems persist
   c) List the species of plants causing the nuisance
   d) List adaptations or alternatives consider/used to lessen problem (some examples include)
      i) Physical or hand removal
      ii) Increasing general use
      iii) Extending the dock to a greater depth or moving the dock
      iv) Altering the route to and from the dock
   e) Provide dimensions (length, width, and depth)
      i) Mechanical harvesting is limited to waters at least 3-ft deep
   f) Include photos of navigation impairments
   g) Provide a record of historical management at the site if it has been managed previously
4) **Management Actions**
   a) If navigation impairment or nuisance condition is confirmed, a management action consistent with other management actions already occurring on the lake will be recommended and added to the permit application
5) **Selecting Appropriate Control Method**
   a) Physical or hand removal will be the first choice for management
   b) Mechanical harvesting will be the alternative management action

APPENDIX E

5-year Timeline of Recommended Actions in the 2022-26 Kirby Lake Aquatic Plant Management Plan									
Goal	**Objective**	**Recommendation**	**Grant Eligible**	**Facilitator**	**2022**	**2023**	**2024**	**2025**	**2026**
Native Species Preservation, Protection, and Restoration	Restoration of the shoreland	Provide education and information material	yes	KLMD, Consultant, WDNR, Outside Resources	x	x	x	x	x
		Provide for professional site planning services	yes		x	x	x	x	x
		Sponsor training sessions	yes		x	x	x	x	x
		Provide riparian owner recognition	yes		x	x	x	x	x
	Protect native habitat	Complete a habitat evaluation/sensitive area survey	yes	KLMD, Consultant, WDNR	x	x			
		Protect and/or improve native habitat	yes		x	x	x	x	x
		Support plant management that minimizes disturbance	yes		x	x	x	x	x
Prevention	Prevent AIS transport in/out	Implement and maintain a watercraft inspection program (CBCW)	yes	KLMD, WDNR, UWEX	x	x	x	x	x
	Monitor for AIS	Implement and maintain an in-lake and shoreline AIS monitoring program (CLMN)	yes	KLMD, WDNR, UWEX	x	x	x	x	x
		Follow the established AIS Rapid Response Plan	yes		x	x	x	x	x
		Train landowners to monitor their own lake front for AIS	yes		x	x	x	x	x
	Record all monitoring data	Submit CBCW and CLMN data to SWIMS	yes	KLMD	x	x	x	x	x
Management	Annual plant management planning	Contract with Resource Professional for planning services	yes	KLMD, Consultant	x	x	x	x	x
	Manual removal	Encourage land owner manual removal where possible	no	KLMD, Consultant	x	x	x	x	x
		Provide weed rakes or razors for use by landowners	no	KLMD	x	x	x	x	x
		Evaluate larger manual removal project for harvesting applicability	no	KLMD, Consultant	x	x	x	x	x
	Mechanical harvesting	Establish and maintain common use and open water areas, and navigation channels	no	KLMD, Consultant, Barron County, Contractor	x	x	x	x	x
		Establish and maintain riparian access lanes	no		x	x	x	x	x
		Purchase a mechanical harvester	?	Recreational Boating Facilities grant	?	?	?	?	?
		Operate and maintain the harvester annually	no	if owned	x	x	x	x	x

Goal	Objective	Recommendation	Grant Eligible	Facilitator	2022	2023	2024	2025	2026
Management (continued)	Mechnical harvesting (continued)	Prepare daily harvesting log sheets	no		x	x	x	x	x
		Establish at least one off-loading site for harvested vegetation	no	KLMD, Barron County	x				
		Establish a long-term storage site for harvested vegetation	no	if owned	?	?	?	?	?
Education and Awareness	Public particpartion and communication program	Publish a newsletter at least once annually	yes	KLMD	x	x	x	x	x
		Annual public event planning and implementation	yes		x	x	x	x	x
		Maintain a webpage	yes		x	x	x	x	x
	Promote wildlife monitoring programs	Provide information and education materials	yes	KLMD, UWEX, CBM	x	x	x	x	x
	Promote riparian owner participation in nutrient runoff best management practices	Provide education and information material	yes	KLMD, Barron County, WDNR	x	x	x	x	x
Research and Monitoring	CLMN expanded monitoring at the Deep Hole	Complete Secchi, Temp, DO, TP, CHL	no	KLMD, Consultant, CLMN	x	x	x	x	x
		Complete DO and temperature profiling year round	yes		x	x	x	x	x
	Complete regular lake level monitoring	Install a surface water staff gauge on the lake	yes	KLMD, Barron County	x				
		Record lake level data weekly	yes		x	x	x	x	x
	Complete regular precipitation monitoring	Install at least one rain gage on the lake	yes	KLMD, CoCoRaHs	x				
		Participate in the CoCoRaHs precipitation monitoring program	yes		x	x	x	x	x
	Complete a Comprehensive Lake Management Plan	Contract with a Resource Professional to develop plan	yes	KLMD, Consultant, WDNR		x	x		
Adaptive Management	Annual Project Activity and Assessment Reports	Complete annual plant management planning	yes	KLMD, Consultant	x	x	x	x	x
		Provide for document sharing	yes		x	x	x	x	x
	End-of-project Summary Report	Overall review of project successes and failures	yes	KLMD, Consultant					x
		Revise/rewrite APM Plan	yes						x
		Whole-lake point intercept plant	yes						x
		Provide for document sharing	yes						x

KLMD-Kirby Lake Management District; WDNR, Wisconsin Department of Natural Resources; UWEX, CBCW, Clean Boats, Clean Waters; University of Wisconsin Extension; CLMN, Citizen Lake Monitoring Network; CBM, Citizen-based Monitoring Network; CoCoRaHS, Community Collaborative Rain, Hail and Snow Program