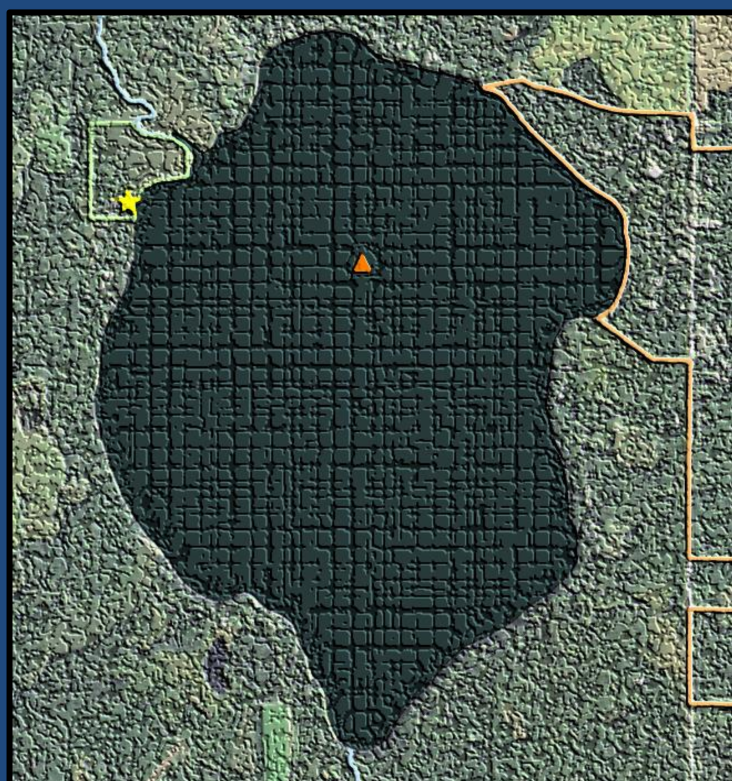
Aquatic Plant Management Plan

for

Big Round Lake
Polk County, Wisconsin

2019-2023



Prepared for:
Big Round Lake Protection & Rehabilitation District

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1.0 Executive Summary

Big Round Lake is located in Polk County, Wisconsin. The lake is 1,014 acres in surface area, has a maximum depth of 17 feet, and is located along the Straight River, which is the surface water inlet and outlet. A dam was constructed at the outlet in 1941, leading to a surface area increase of 400[1] acres to yield the current surface area. Although a comprehensive lake plan is in effect from 2016 through 2025, this aquatic plant management plan (APMP) was initiated to focus on curly-leaf pondweed, phosphorus loading, and algae blooms. The Big Round Lake Protection & Rehabilitation District ("District") was formed in 1967 and is the entity sponsoring this APMP. The District partnered with Aquatic Plant and Habitat Services LLC to create a 5-year management plan that is WDNR-approved and District-adopted. Public input was gathered in April 2019 (Section 10.0) and the management plan was released for public and WDNR review in June 2019.

Curly-leaf pondweed (CLP) was first officially documented in Big Round Lake in 1978. Blue Water Science has completed annual CLP surveys since 2005. Recent reports reveal CLP to be widely distributed with approximately 35 acres of persistent, heavy growth. To date, no active control of CLP has occurred.

During the summer of 2018, Big Round Lake residents reported the worst blue-green algae bloom in anyone's recollection. The algae was an impairment to swimming, boating, fishing, and general lake enjoyment in July and August due to the smell, sight, and condition of the water. Although algae blooms are not uncommon in the lake, the severity in 2018 prompted an internal phosphorus loading assessment May-Sept. 2019. Although previous studies suggest the cause of the algae blooms is internal phosphorus loading (as opposed to phosphorus loading from sources outside the lake), this is not conclusive and is another reason for executing the internal phosphorus study in 2019.

Although the CLP and algae are two distinct management issues, they are not unrelated and yet the degree of their connection is somewhat unknown. When CLP decomposes during the summer months, there is phosphorus release that can fuel algae blooms. Debate exists as to how much phosphorus is contributed directly by CLP. A study of nearby Bone Lake revealed CLP contributed 14%-21% of internal phosphorus during summer decomposition, but only 3% of total phosphorus loading (internal + external) (Schiffer & Clemens, 2010).

This aquatic plant management plan provides background information about Big Round Lake, identifies the issues and desire for management, reviews past management activities, and presents management options. All these components were considered in honing the goals and objectives developed during a planning meeting in May 2019. The outcome is a strategy that includes the following goals:

Goal 1 – Support the goals of the Comprehensive Lake Plan.
Goal 2 – Offer educational programs to Big Round Lake residents.
Goal 3 – Support recommendations of the phosphorus study.
Goal 4 – Continue learning about Big Round Lake.
Goal 5 – Control CLP in areas of navigation impairment.

[1] Verbal communication with District Treasurer, Mark Hilse on May 18th, 2019.

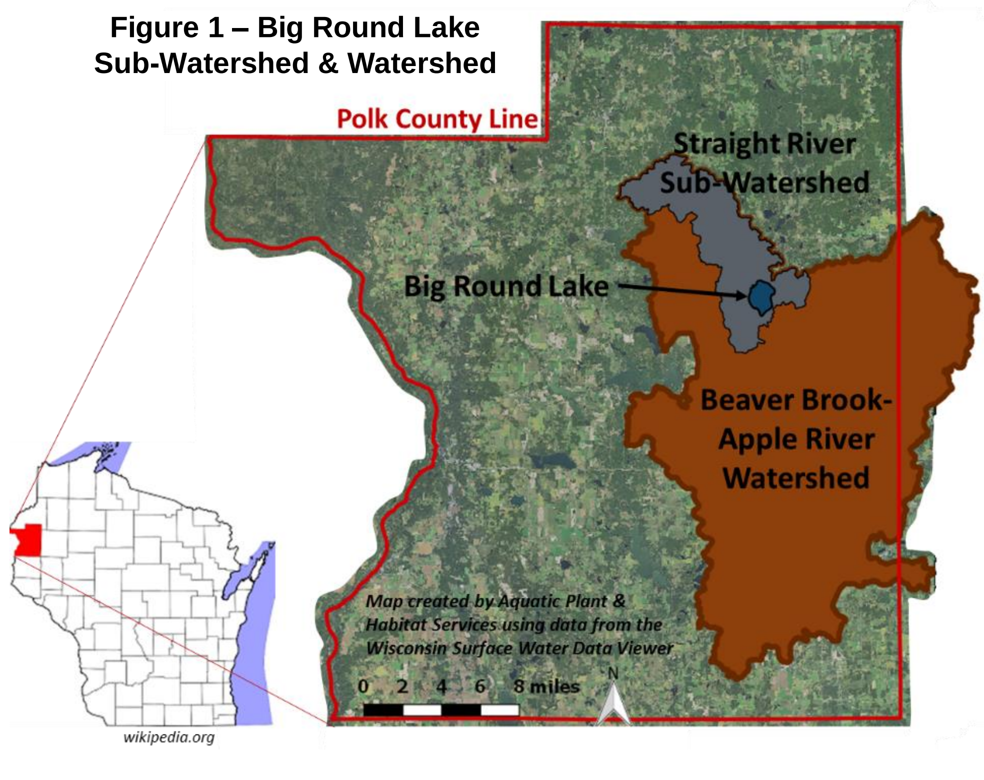
Part 1 – Big Round Lake Background Information

2.0 Watershed and Water Quality Implications

Big Round Lake is situated within the Straight River sub-watershed (33.5 sq mi), which is within the larger Beaver Brook-Apple River watershed (Figure 1). Forested land covers 58% of the Straight River sub-watershed and is the most common land use with agriculture covering 32% of the sub-watershed (Figure 4). The Straight River originates just upstream of Straight Lake and then flows into and out of Big Round Lake before flowing out of the sub-watershed via Little and Big Blake Lakes (Figure 3).

The water quality of a lake, stream, or river is directly impacted by its watershed, which includes land that is directly adjacent to a lake. The water quality of a lake, stream, or river is directly impacted by its catchment, which includes land that is directly adjacent to a lake (Figure 2). When waterfront land changes from forest-covered to a house, driveway, deck, garage, septic systems, lawns and sandy beaches, the water quality will be directly affected. It is the cumulative land cover change of many waterfront properties that leads to a decline in water quality. For example, the amount of phosphorus that enters a lake typically increases as land use changes from forested to residential (Panuska & Lillie, 1995 and Jeffrey, 1985). A developed site with a lawn will yield more runoff volume carrying phosphorus and nitrogen than a forested site (Graczyk et. al. 2003). Phosphorus is generally the key nutrient that leads to algae and nuisance aquatic plant growth. Phosphorus sources include human waste (leaky septic systems), animal waste (farm runoff), soil erosion, detergents, and lawn fertilizers (Shaw et al. 2004). Detergents and lawn fertilizer are less of an issues with recent laws. Developed sites have more impervious surface that does not allow precipitation to infiltrate into the soils.

Figure 1 – Big Round Lake Sub-Watershed & Watershed



This precipitation becomes surface water runoff in higher volumes and at warmer temperatures than at non-developed sites (Galli, 1988). The warmer water that flows into the lake can lead to increased lake water temperatures, and as water temperatures increase the amount of dissolved oxygen it can "hold" will decrease. The combined impacts of increased water temperatures, lower dissolved oxygen, and higher phosphorus can all result from shoreland development.

Figure 2 – Big Round Catchment Map

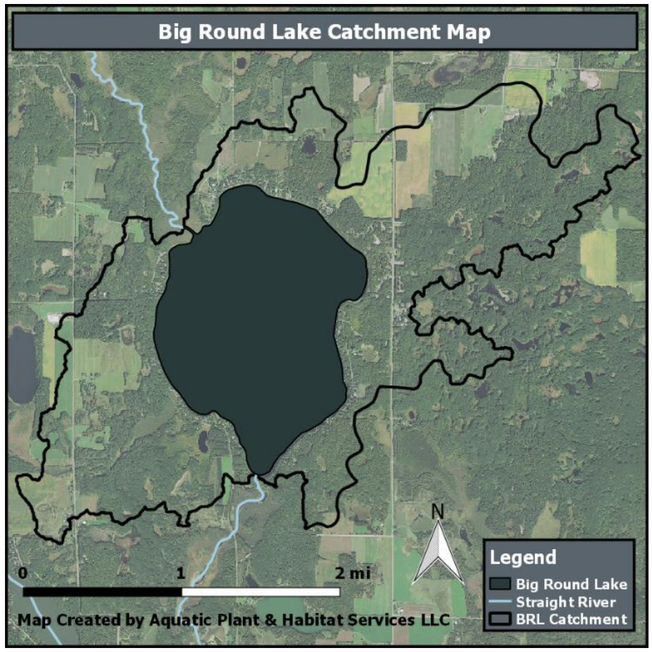


Figure 3 – Straight River Sub-Watershed Map

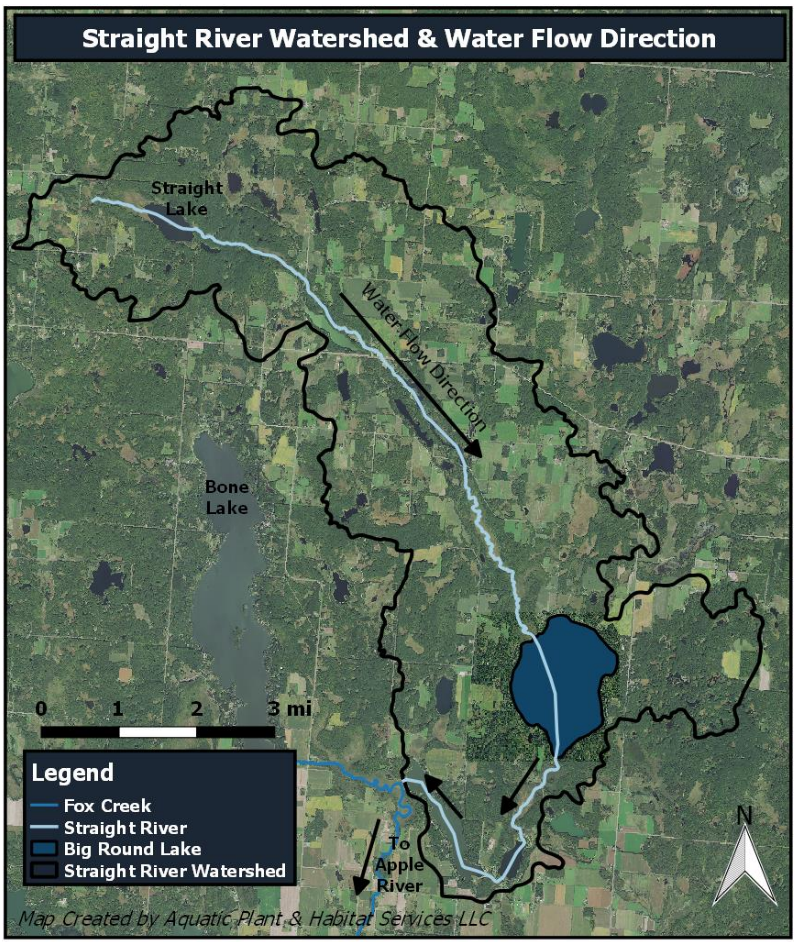
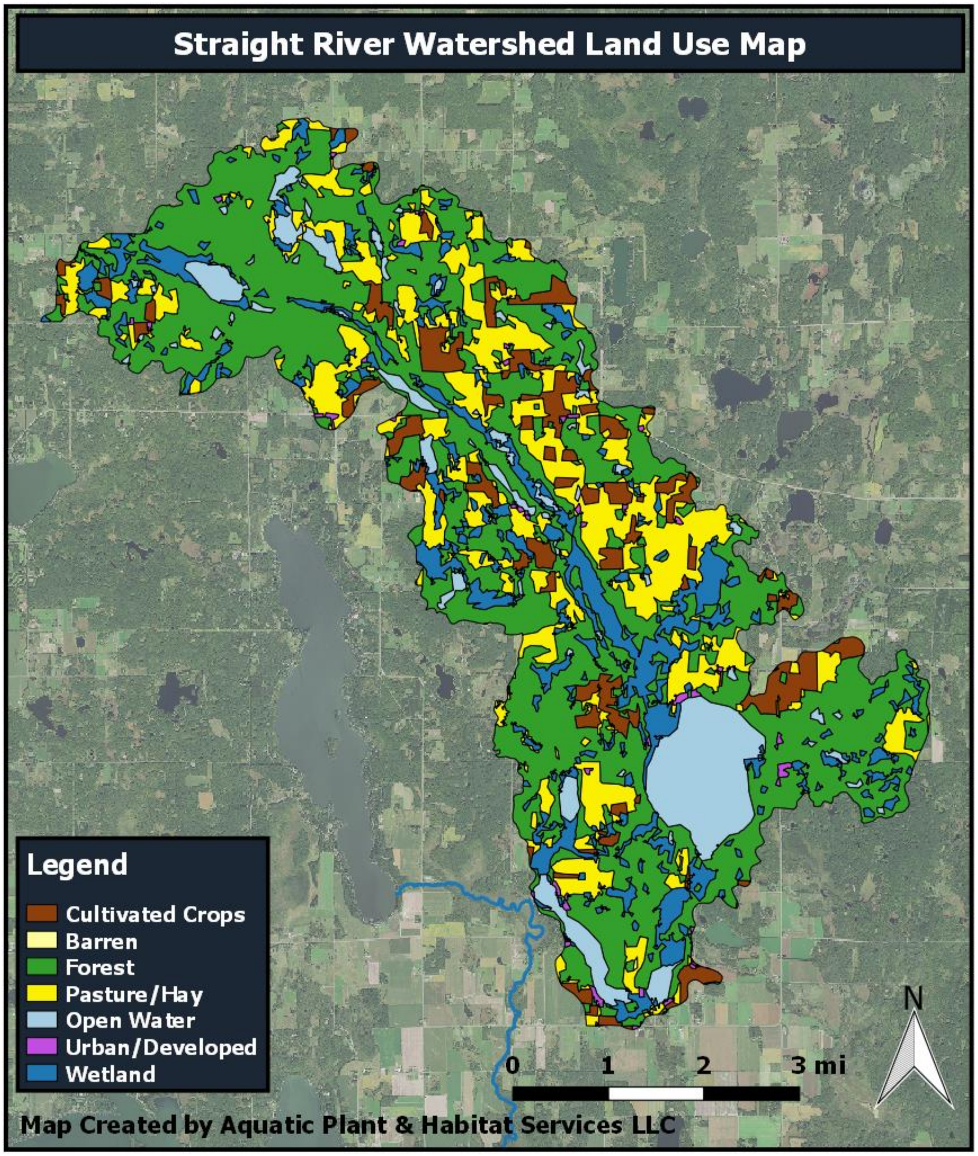
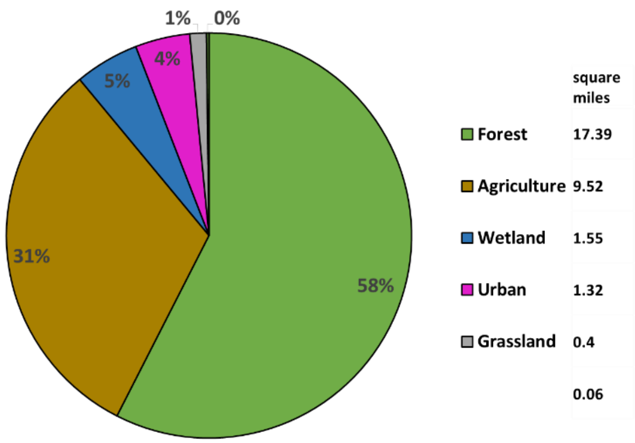


Figure 4 – Straight River Land Use Map & Chart

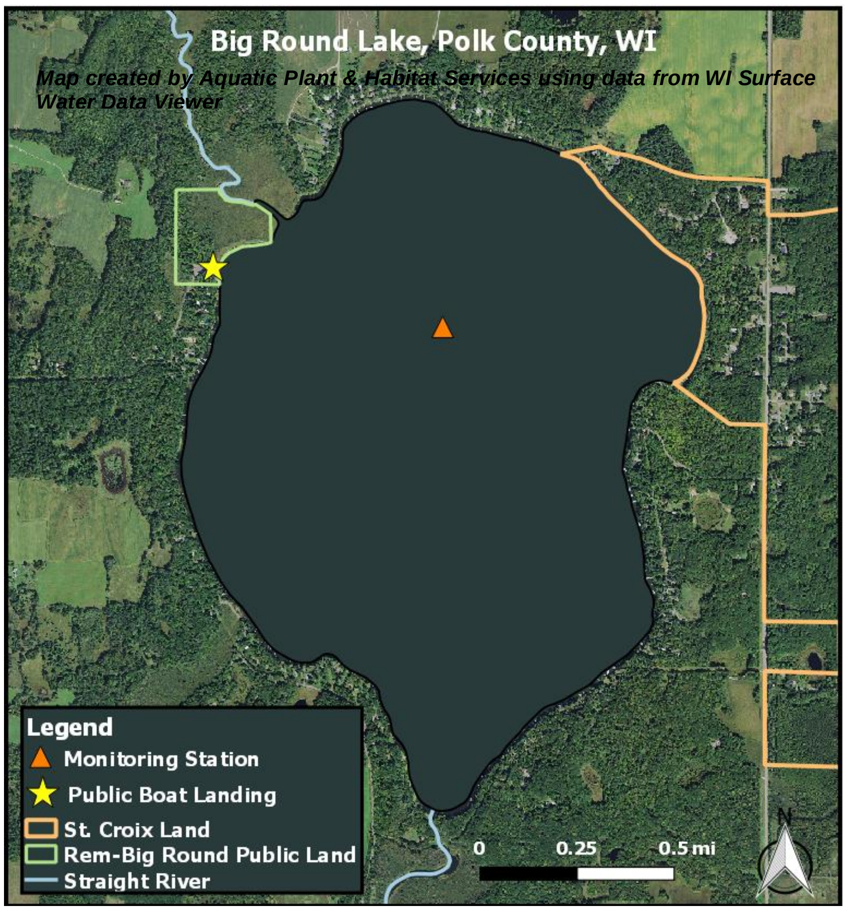




3.0 Study Site

Big Round Lake (WBIC 2627400) is located somewhat centrally in Polk County, Wisconsin (Figure 1) and is approximately 8 miles northeast of the Village of Balsam Lake. Big Round is considered a drainage lake, meaning it has surface water inlet(s) and outlet(s). The Straight River is the only surface water flowing into the lake along the northwest shore and flowing out at the southern shore. A dam was built at the outflow of the Straight River in 1941 leading to a surface area increase of 400 acres[2]. The dam is privately owned but at the time of writing this plan, discussions about a transfer of ownership to the District are underway. The dam is constructed of earth, logs, and rocks and there is no means of regulating water levels in the lake. The lake's surface area is 1,014 acres, maximum depth is 17 feet, mean depth is 10 feet, and the shoreline length is 5.7 miles.

Figure 5 – Big Round Lake Map



[2] Verbal communication with District Treasurer, Mark Hilse on May 18th, 2019.

4.0 Trophic State & Water Quality

Trophic state and water quality are often used interchangeably and while the two are related, they are not the same. Trophic state describes the biological condition of a lake using a scale that is based on measurable and objective criteria. Water quality is an objective descriptor of a lake's condition based on the observer's use of the lake. Clear-water lakes are often described as having "good" or "excellent" water quality, which may be true for swimmers or SCUBA divers. The same ultra-clear system may have low productivity and thus a limited fishery leading to an "average" water quality classification by an angler. This section describes the trophic state of Big Round Lake using Carlson's Trophic State Index (1977).

Water clarity, total phosphorus, and chlorophyll-*a* are variables used to determine the productivity or trophic state of a lake. Each variable can be used independently to gain insight on the approximate trophic state. However, combining data for clarity, phosphorus, and chlorophyll-*a* yields a more accurate lake classification. The Carlson Trophic State Index (TSI) is frequently used to determine biomass in aquatic systems. The trophic state of a lake is defined as the total weight of living biological material (or biomass) in a lake at a specific location and time. Eutrophication is the movement of a lake's trophic state in the direction of more plant biomass. Eutrophic lakes tend to have abundant aquatic plant growth, high nutrient concentrations, and low water clarity due to algae blooms. Oligotrophic lakes, on the other end of the spectrum, are nutrient poor and have little plant and algae growth. Mesotrophic lakes have intermediate nutrient levels and only occasional algae blooms (Red ovals in Figure 6 represent Big Round Lake ranges). Water quality data are available for Big Round Lake intermittently since 1992 thanks to Citizen Lake Monitoring Network volunteers.

Figure 6 – Trophic State Gradient adapted from Simpson & Carlson (1996)

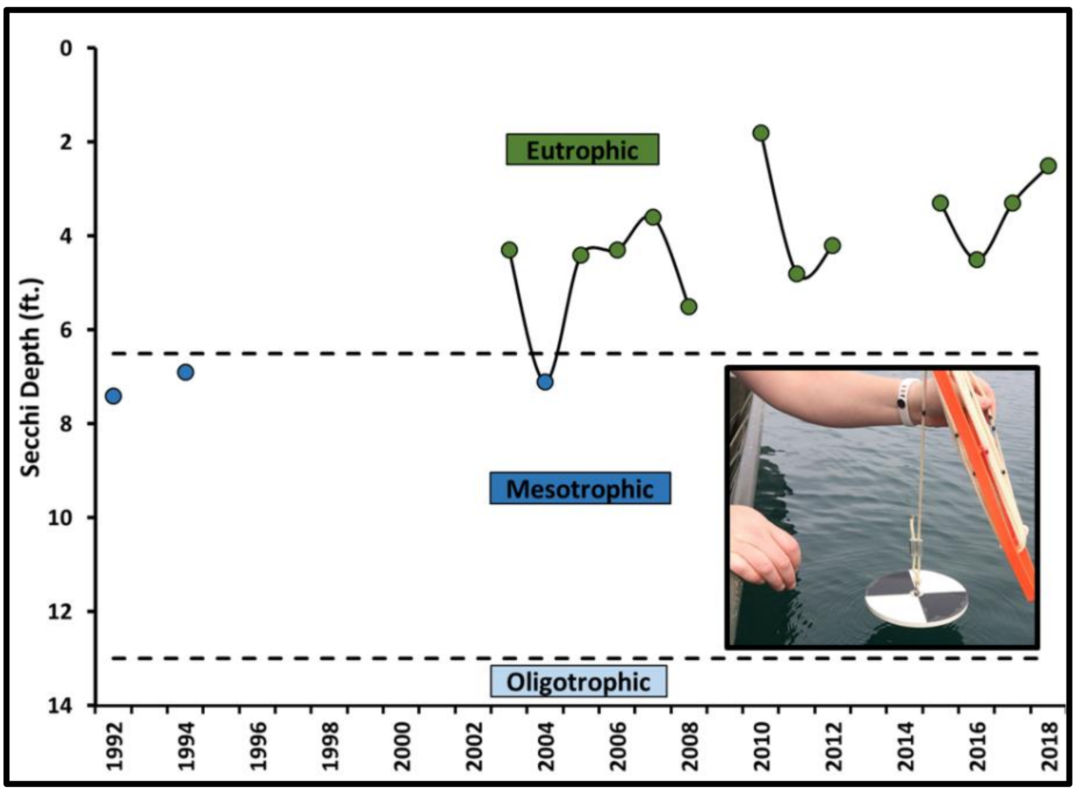
TSI	Chlorophyll-a (ug/L)	Secchi Depth (ft)	Total Phosphorus (ug/L)	Attributes	Fisheries & Recreation
<30	<0.95	>26	<6	Oligotrophic: Clear water, oxygen throughout the year in the hypolimnion	Salmonid fisheries dominate
30-40	0.95 - 2.6	13 - 26	6 - 12	Oligotrophic: Hypolimnia of shallower lakes may become anoxic	Salmonid fisheries in deep lakes only
40-50	2.6 - 7.3	6.5 - 13	12 - 24	Mesotrophic: Water moderately clear; increasing probability of hypolimnetic anoxia during summer	Hypolimnetic anoxia results in loss of salmonids. Walleye may predominate
50-60	7.3 - 20	3 – 6.5	24 - 48	Eutrophic: Anoxic hypolimnia, macrophyte problems possible	Warm-water fisheries only. Bass may dominate.
60-70	20 - 56	1.5 - 3	48 - 96	Eutrophic: Blue-green algae dominate, algal scums and macrophyte problems	Nuisance macrophytes, algal scums, and low transparency may discourage swimming and boating.
70-80	56 - 155	0.75 – 1.5	96 - 192	Hypereutrophic: (light limited productivity). Dense algae and macrophytes	Rough fish dominate; summer fish kills possible
>80	>155	<0.75	192 - 384	Algal scums, few macrophytes	

4.1 Water Clarity

The depth to which light can penetrate, or water clarity, is a factor that limits aquatic plant growth. Water clarity is measured by lowering a black and white Secchi disk (8 inches diameter) in the water and recording the depth of disappearance. The disk is then lowered further and slowly raised until it reappears. The Secchi depth is the mid-point between the depth of disappearance and the depth of reappearance. Because light penetration is usually associated with nutrient levels and algae growth, a lake is considered eutrophic when Secchi depths are less than 6.5 feet. Secchi depths vary throughout the year, with shallower readings in summer when algae concentrations increase, thus limiting light penetration. Conversely, deeper readings occur in spring and late fall when algae growth is lower.

Water clarity has been monitored in Big Round Lake since 1992 with an intermission in data collection between 1995 and 2002. Average summer Secchi depths ranged from 2 feet to 7.5 feet (Figure 7) with an overall average Secchi TSI of 58. From a water clarity perspective, this classifies Big Round Lake as **EUTROPHIC**.

Figure 7 - Average Summer (July-Aug) Secchi Depths, 1992-2018

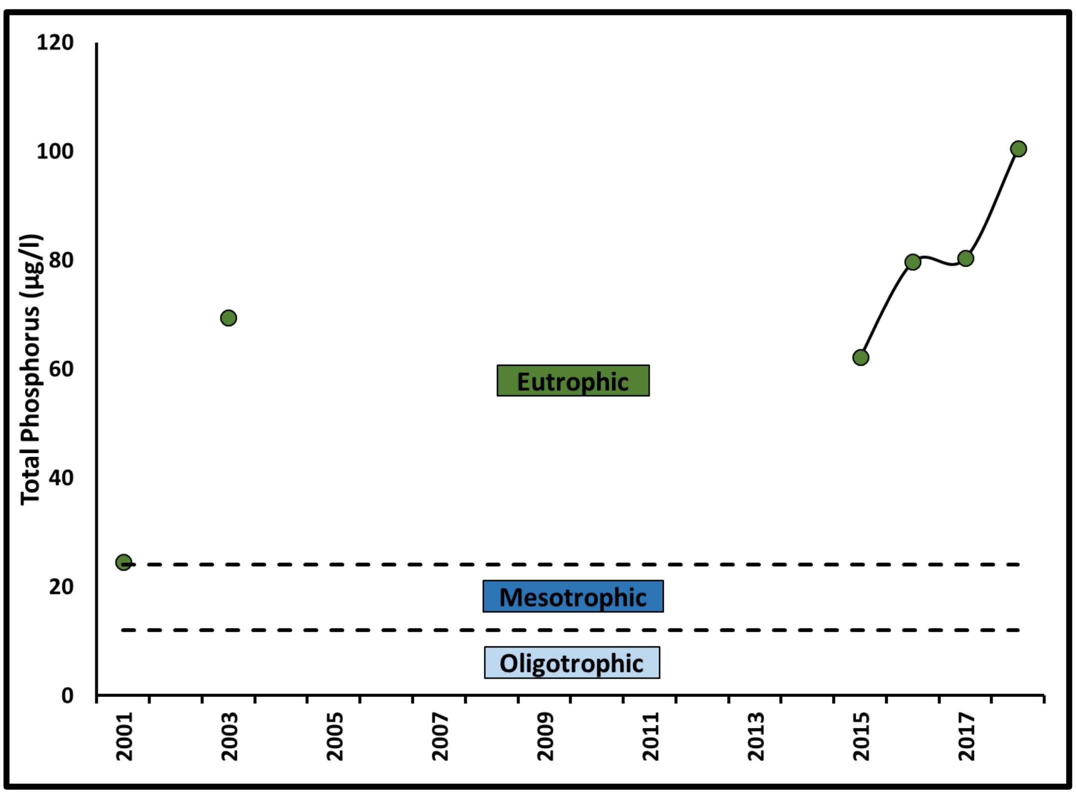


4.2 Phosphorus

Phosphorus is an important nutrient for plant growth and is commonly the limiting nutrient for plant production in Wisconsin lakes. As a limiting factor, adding small quantities of phosphorus to a lake can lead to dramatic increases in plant and algae growth and should therefore be the focus of management efforts to improve water quality. Phosphorus can be monitored at various depths because when a lake is thermally stratified in summer (warm water at surface, cooler water at bottom), higher levels of phosphorus are found in deeper waters. This is due to decomposition and sinking of dead zooplankton and algae, thereby causing a "build-up" of nutrients in deeper waters that do not readily mix during thermal stratification. Also due to the lack of mixing in summer, the oxygen levels in deeper waters fall. When dissolved oxygen is absent at the sediment-water interface, chemical changes allow phosphorus that was trapped in the sediment to be re-suspended into the water column thereby causing internal phosphorus loading. For these reasons, understanding thermal and oxygen stratification regimes are important when measuring and managing phosphorus and further discussed in Section 4.4.

Total phosphorus was monitored by volunteers in Big Round Lake in 2001, 2003, and 2015-2018. The mean Trophic State Index (TSI) values ranged from 43 (approx. 25 µg/l) to 70 (approx. 100µg/l). Figure 8 illustrates average total phosphorus values in July and August with all the points falling within the **EUTROPHIC** classification and the overall average value of 69µg/l.

Figure 8 - Average Summer (July-Aug) Total Phosphorus, 2001-2018

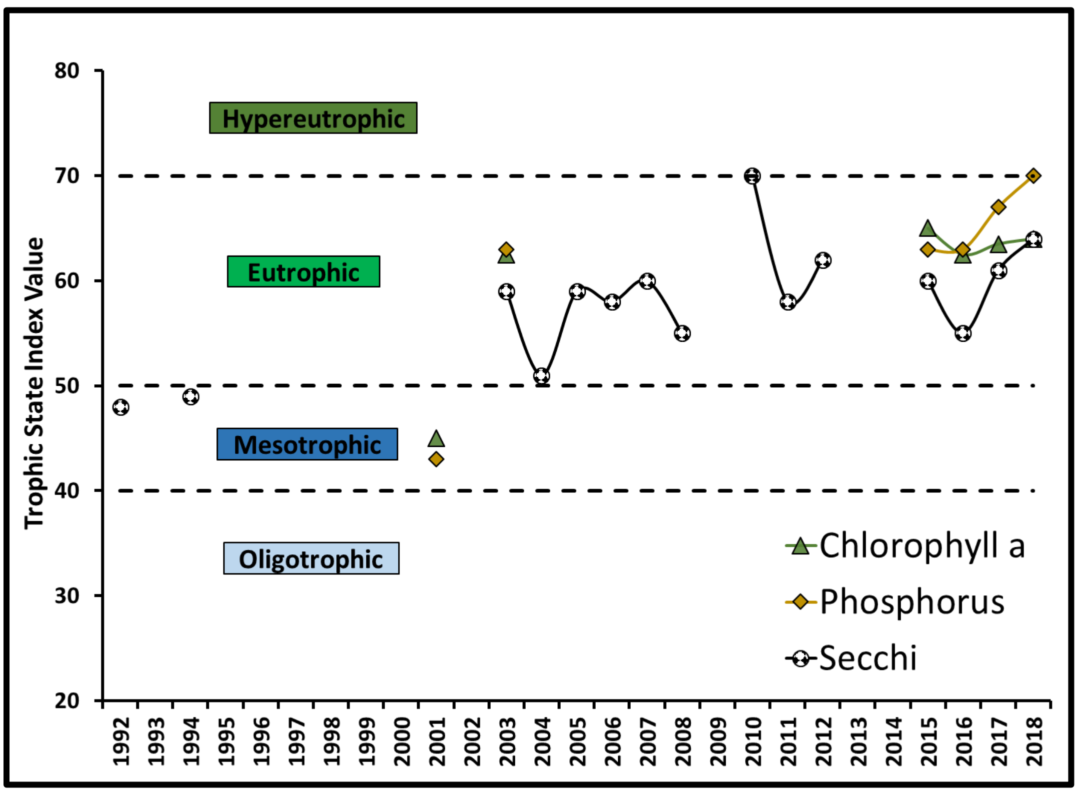


4.3 Chlorophyll-*a*

Chlorophyll-*a* is the green pigment found in plants and algae. The concentration of chlorophyll-*a* is used as a measure of the algal population in a lake. For trophic state classification, preference is given to the chlorophyll-*a* trophic state index (TSI_{CHL}) because it is the most accurate at predicting algal biomass.

Chlorophyll-*a* was monitored in Big Round Lake in 2001, 2003, and 2015-2018. Average summer (July-Aug) TSI_{CHL} values ranged from 45 (7.5µg/l) to 65 (54µg/l, eutrophic). The overall mean TSI_{CHL} was 60 (48µg/l), which classifies Big Round Lake as **EUTROPHIC.**

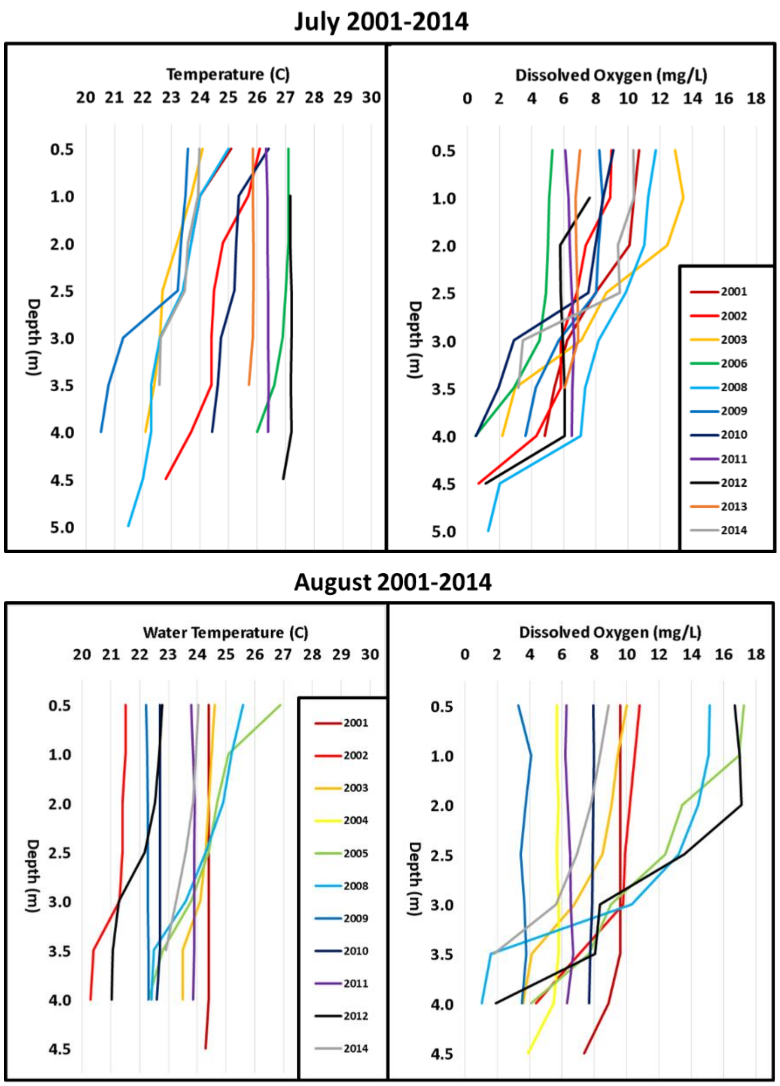
Figure 9 - Average Summer (July-Aug) TSI Values for Secchi Depth, Phosphorus, & Chlorophyll *a*, 1992-2018



4.4 Water Temperature & Dissolved Oxygen

Big Round is a shallow lake[3] that weakly stratifies in summer and dissolved oxygen (DO) depletion can occur in the deepest areas. DO and temperature data collected by St. Croix 2001-2014 support this claim (Figure 10). Because of its shallow depths, Big Round Lake is likely to mix, possibly several times, during the growing season with intense sediment-water interactions. Although this means DO can then mix into the deeper water, it also means nutrients may be mixed as well and available for uptake by algae. Although many studies of Big Round Lake by different entities have provided valuable information, a comprehensive analysis of internal phosphorus loading in one cohesive study is needed to guide future management and is further described in Goal 3, Section 23.0.

Figure 10 – Temperature & DO Profiles 2001-2014



Data collected by St. Croix Environmental & Natural Resources Department
Graphs created by Aquatic Plant & Habitat Services LLC

[3] Shallow Lakes are defined by the WDNR as those less than 18 feet. Big Round Lake maximum depth is 17 feet.

5.0 Aquatic Plants

Aquatic plant surveys using the point-intercept survey method developed by Hauxwell et al. (2010) were completed in 2008, 2013, and 2018 by Polk County Land and Water Resources Department. Aquatic invasive species surveys and monitoring have been done annually since 2005 by Blue Water Science using a line transect method with emphasis on sampling for curly-leaf pondweed.

5.1 2018 Survey Results

This section will focus on the results of the 2018 survey and how they compare to previous surveys. There were a possible 506 survey points in Big Round Lake based on the point-intercept survey grid (Appendix A). There were 484 points shallower than the maximum rooting depth of 15.5 feet. Vegetation was present at 288 points with an average rake fullness of 1.56. There were 26 species found, three of which were visual observations only. The Simpson Diversity Index was also relatively high with a value of 0.85 out of a maximum possible value of 1.00, suggesting the plant community is moderately heterogeneous. The mean coefficient of conservatism and floristic quality were 5.8 and 23.3, respectively, and both were higher than the average value for other lakes in the same ecoregion (Nichols, 1999). Overall, the statistics suggest that the Big Round Lake aquatic plant community is diverse, moderately heterogeneous, and vegetation occurrence is high.

Table 1 – Aquatic Plant Survey Results 2008, 2013, & 2018

Summary Statistic			2008	2013	2018
1	Total # of sites visited		487	501	505
2	Total # of sites with vegetation		353	246	288
3	Max. depth of plants (feet)		16	13.5	15.5
4	Total # of sites shallower than max. depth of plants		476	348	484
5	Frequency of occurrence at sites shallower than max. depth of plants		74.16	70.69	59.50
6	Average # of species per site	a) Shallower than max. depth	2.18	1.80	1.50
		b) Vegetated sites only	2.94	2.55	2.52
		c) Native shallower than max. depth	2.18	1.72	1.34
		d) Native species at vegetated sites only	2.93	2.44	2.32
7	Species Richness	a) Total # species on rake at all sites	22	19	23
		b) Including visuals	30	21	26
8	Simpson's Diversity Index		0.87	0.86	0.85
9	Mean Coefficient of Conservatism			5.6	5.8
10	Floristic Quality Index			23.3	27.1

Data provided by Polk County Land & Water Resources Department

There were no species with a conservatism(C) value of 9 or 10 found during any of the surveys (Table 2). The C value estimates the likelihood of that plant species occurring in an environment that is relatively unaltered from pre-settlement conditions. As human disturbance occurs, species with a low C value are more likely to dominate a lake. The average C value for Big Round Lake in 2018 (5.8) was slightly higher compared to the eco-region (5.6), but lower compared to the statewide average (6.0).

Table 2 – Floristic Quality 2008, 2013, 2018

Common Name		Scientific Name	C Value	2008	2013	2018
Coontail		*Ceratophyllum demersum*	3	X	X	X
Small pondweed		*Potamogeton pusillus*	7	X	X	X
Forked duckweed		*Lemna trisulca*	6	X	X	X
Flat-stem pondweed		*Potamogeton zosteriformis*	6	X	X	X
Northern water-milfoil		*Myriophyllum sibiricum*	6	X	X	X
Wild celery		*Vallisneria americana*	6	X	X	X
Muskgrasses		*Chara sp.*	7	X	X	X
Common waterweed		*Elodea canadensis*	3	X	X	X
Slender naiad		*Najas flexilis*	6	X	X	X
Clasping-leaf pondweed		*Potamogeton richardsonii*	5	X	X	X
White-stem pondweed		*Potamogeton praelongus*	8	X	X	X
Softstem bulrush		*Schoenoplectus tabernaemontani*	4	X	X	X
Spatterdock		*Nuphar variegata*	6	X	X	X
Sago pondweed		*Stuckenia pectinata*	3	X	X	X
Large-leaf pondweed		*Potamogeton amplifolius*	7	X	X	X
White water crowfoot		*Ranunculus aquatilis*	8	X		X
Water star-grass		*Heteranthera dubia*	6	X		X
Small duckweed		*Lemna minor*	4			X
Variable pondweed		*Potamogeton gramineus*	7			X
Illinois pondweed		*Potamogeton illinoensis*	6		X	X
Fern pondweed		*Potamogeton robbinsii*	8			X
Large duckweed		*Spirodela polyrhiza*	5			X
Nitella		*Nitella sp.*	7	X		
Floating-leaf pondweed		*Potamogeton natans*	5	X		
Northern wild rice		*Zizania palustris*	8		X	
N	*Statewide 13*	*Region 14*	Big Round Lake	-	17	22
Mean C	*Statewide 6.0*	*Region 5.6*	Big Round Lake	-	5.6	5.8
FQI	*Statewide 22.2*	*Region 20.9*	Big Round Lake	-	23.3	27.1

Data provided by Polk County Land and Water Resources Department. This table includes only those species that were found on the rake at survey points and those that are listed in Nichols (1999). X=present. Mean values are listed for statewide and eco-region comparisons to Big Round Lake.

Coontail (*Ceratophyllum demersum*), small pondweed (*Potamogeton pusillus*), and forked duckweed (*Lemna trisulca*) were the three most common species found in 2018 with occurrence at 45%, 20%, and 17% of survey points ≤15.5ft, respectively (Figure 11, Figure 12, Table 3). Together, they accounted for 55% of the total relative frequency, which is a moderate-to-high combined relative frequency and further suggests that Big Round Lake has a moderately heterogeneous plant community.

Table 3 – Individual Species Results, 2018

Common Name	Scientific Name	# Sites	Rel. Freq.	Freq. Occur. Veg. Sites	Freq. Occur ≤max depth	Avg. Rake Full.	# visual
Coontail	*Ceratophyllum demersum*	218	30.07	75.69	45.04	1.46	9
Small pondweed	*Potamogeton pusillus*	95	13.10	32.99	19.63	1.05	1
Forked duckweed	*Lemna trisulca*	83	11.45	28.82	17.15	1.01	2
Curly-leaf pondweed	*Potamogeton crispus*	76	10.48	26.39	15.70	1.00	0
Flat-stem pondweed	*Potamogeton zosteriformis*	62	8.55	21.53	12.81	1.03	1
Northern water-milfoil	*Myriophyllum sibiricum*	59	8.14	20.49	12.19	1.05	0
Wild celery	*Vallisneria americana*	28	3.86	9.72	5.79	1.00	0
Filamentous algae		27	-	9.38	5.58	1.19	0
Muskgrasses	*Chara sp.*	25	3.45	8.68	5.17	1.00	0
Common waterweed	*Elodea canadensis*	21	2.90	7.29	4.34	1.00	1
Slender naiad	*Najas flexilis*	13	1.79	4.51	2.69	1.00	0
Clasping-leaf pondweed	*Potamogeton richardsonii*	12	1.66	4.17	2.48	1.00	0
White-stem pondweed	*Potamogeton praelongus*	8	1.10	2.78	1.65	1.00	1
Softstem bulrush	*Schoenoplectus tabernaemontani*	7	0.97	2.43	1.45	1.14	5
Spatterdock	*Nuphar variegata*	5	0.69	1.74	1.03	1.20	2
Sago pondweed	*Stuckenia pectinata*	3	0.41	1.04	0.62	1.00	0
Large-leaf pondweed	*Potamogeton amplifolius*	2	0.28	0.69	0.41	1.00	0
White water crowfoot	*Ranunculus aquatilis*	2	0.28	0.69	0.41	1.00	0
Water star-grass	*Heteranthera dubia*	1	0.14	0.35	0.21	1.00	0
Small duckweed	*Lemna minor*	1	0.14	0.35	0.21	1.00	0
Variable pondweed	*Potamogeton gramineus*	1	0.14	0.35	0.21	1.00	0
Illinois pondweed	*Potamogeton illinoensis*	1	0.14	0.35	0.21	1.00	0
Fern pondweed	*Potamogeton robbinsii*	1	0.14	0.35	0.21	1.00	0
Large duckweed	*Spirodela polyrhiza*	1	0.14	0.35	0.21	1.00	0
White water lily	*Nymphaea odorata*	0	-	-	-	-	1
Arrowhead	*Sagittaria sp.*	0	-	-	-	-	2
Northern wild rice	*Zizania palustris*	0	-	-	-	-	4

Data provided by Polk County Land and Water Resources Department

Figure 11 – Coontail Map, 2018

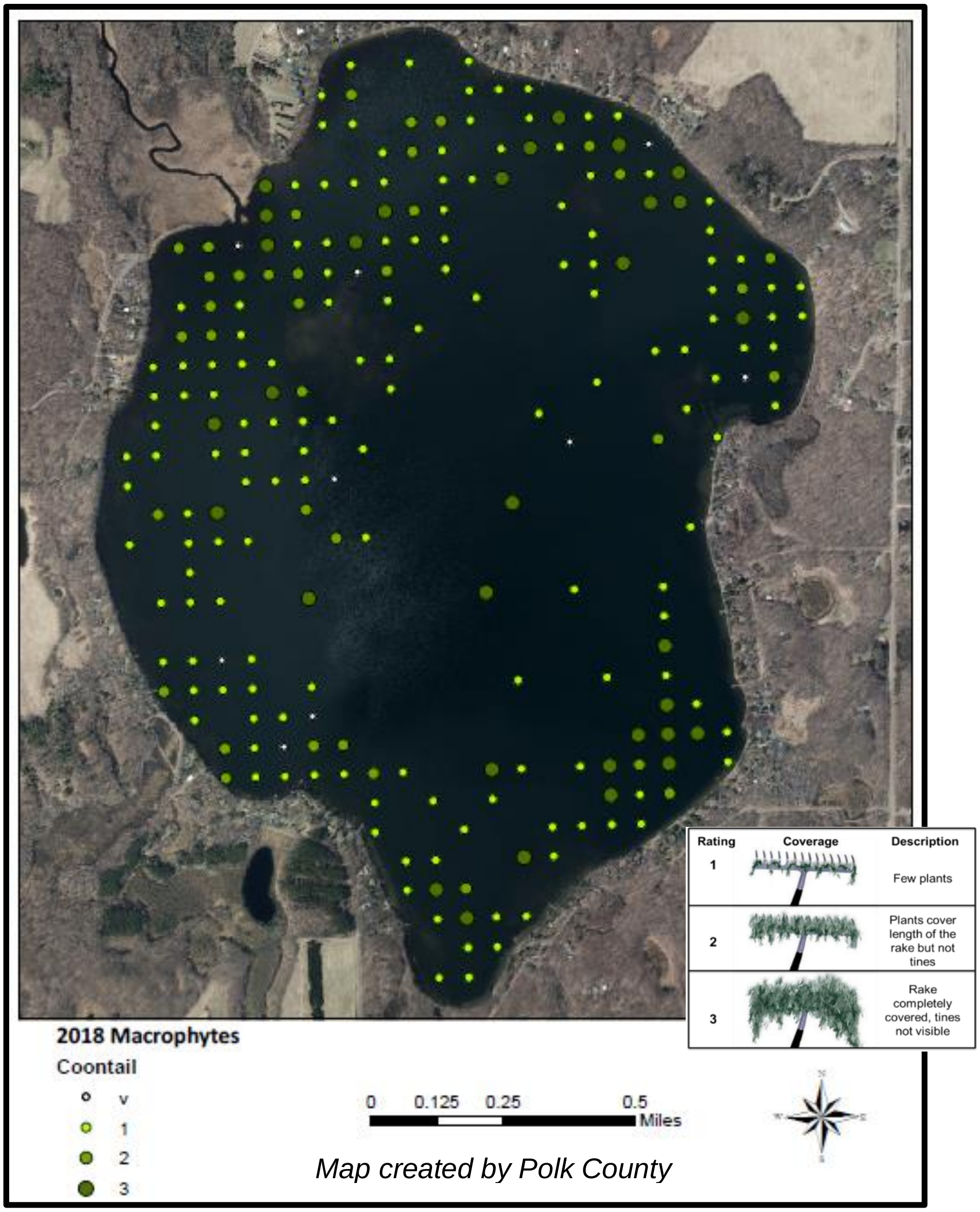
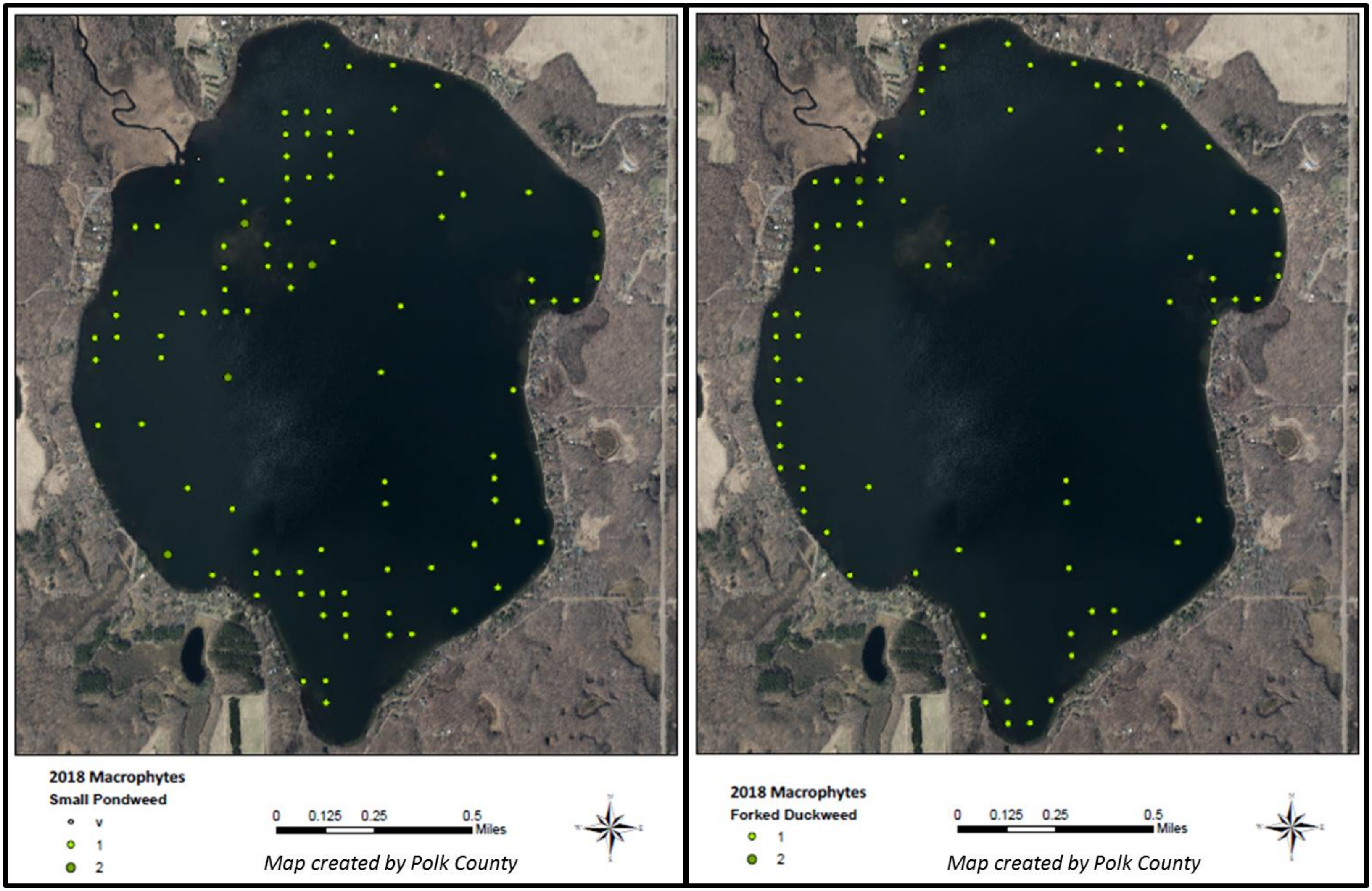


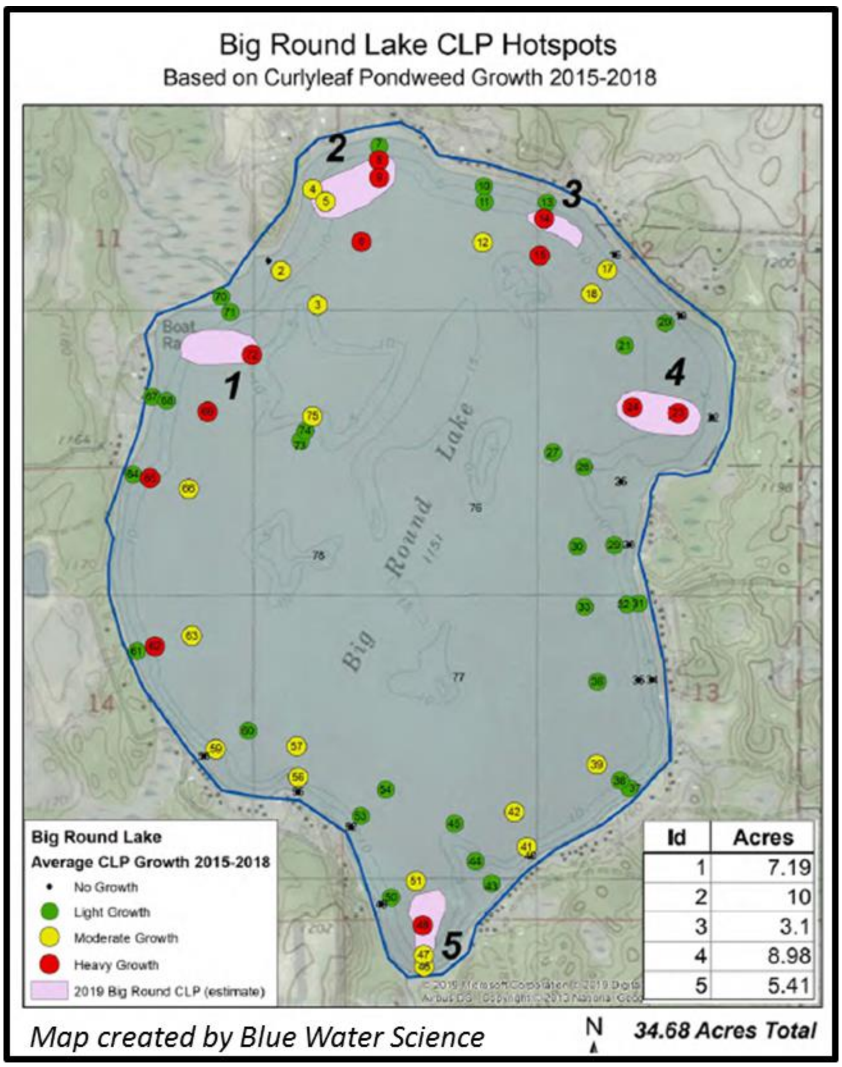
Figure 12 – Small Pondweed & Forked Duckweed Maps, 2018



5.2 Curly-leaf Pondweed

Curly-leaf pondweed (*Potamogeton crispus,* CLP*)* was first verified in Big Round Lake in 1978. CLP has been surveyed every June from 2005 through 2018 by Blue Water Science using 25 transects perpendicular to shore distributed relatively equidistant along the lake shore. Three survey points at different depth intervals along each transect plus another three points yields 78 sampling points to track CLP annually. Each sample point is assessed for growth conditions (none, light, moderate, or heavy). The most recent findings of Blue Water Science average June conditions from 2015 through 2018 and describe CLP to be widely distributed with some areas of heavy growth. The areas of persistent heavy growth 2015-2018 are mapped in Figure 13, yielding approximately 35 acres of CLP (McComas, 2019).

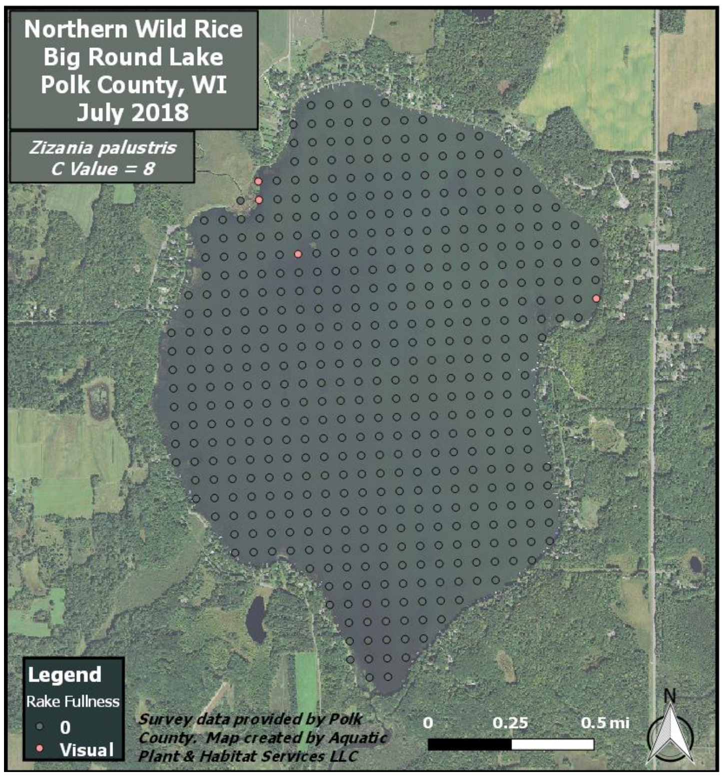
Figure 13 – Curly-leaf Pondweed Map, 2015-2018



5.3 Northern Wild Rice

Northern wild rice (*Zizania palustris)* has been documented during plant surveys of Big Round Lake since 2003, but with low frequency. In 2018 it was found as a visual observation (none on the survey rake but within 6 feet of the sample point) at only 4 locations (Figure 14). Even so, wild rice is an important resource for social, cultural, and ecological reasons lending special statutory protection under NR 19.09(1)[4]. At the time of writing this management plan, the WDNR is undergoing a Wild Rice Management Strategic Analysis and works with Ojibwe Tribes on proposed projects that have potential to impact wild rice in the Ceded Territory.

Figure 14 – Northern Wild Rice Map



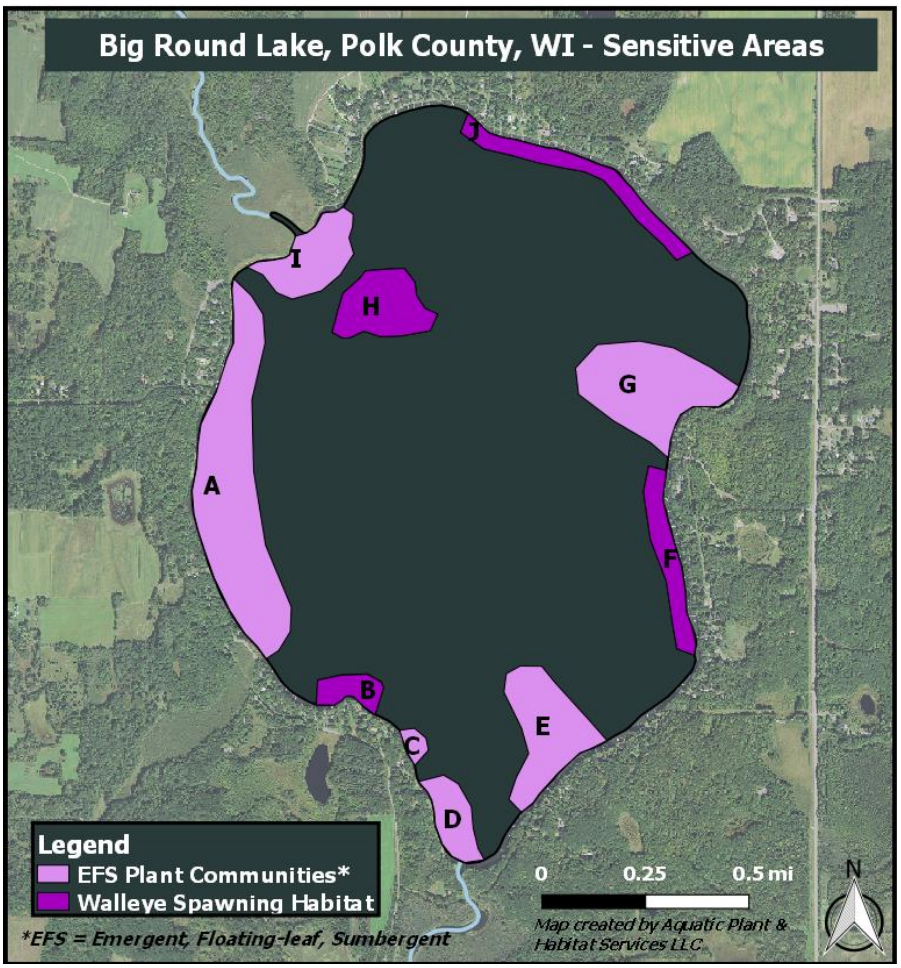
[4] No person may remove or destroy by hand, mechanical or chemical means wild rice growing in navigable lakes unless the department has approved the removal or destruction under par. (b) In addition to harvest in accordance with s. 29.607, Stats., and subs. (2) to (8), the department may authorize by written approval the removal of wild rice growing in navigable lakes upon a finding that: 1. The wild rice resource in the navigable lake will not be substantially affected. The department may consider cumulative effects of an approval on such a lake under this paragraph; and 2. The removal or destruction is necessary to allow reasonable access to the lake by the riparian owner.

6.0 Designated Sensitive Areas

There were 10 sensitive areas designated by the WDNR in 1999 (Cornelius & Cahow, 1999, Figure 15). Four of the areas are designated based on their rocky substrate that is considered good walleye spawning habitat. Alterations of these areas in any way are not recommended unless they are intended to improve walleye spawning habitat. Proper erosion control in nearshore areas and vegetative buffers along the shore are also recommended to prevent fine silt and sand from covering the gravel substrate.

The other 6 areas are designated based on their emergent, floating-leaf, and submergent vegetation that serves as important fish and wildlife habitat and provide shoreline stabilization. Aquatic vegetation removal in these areas is discouraged, but if necessary then manual removal is the preferred method of control. Other recommendations at these locations include leaving fallen trees and other large woody structure in the water, allowing vegetative buffers to grow along the shore, preventing erosion, and eliminate nutrient inputs from fertilizers and faulty septic systems.

Figure 15 – Sensitive Areas Map



7.0 Fisheries Surveys

Fish surveys of Big Round Lake were recently completed by the Wisconsin Department of Natural Resources in spring and fall 2018 with one fyke netting survey and three electrofishing surveys. Fish species targeted during the surveys included walleye, northern pike, largemouth bass, bluegill, pumpkinseed, yellow perch, and black crappie. The fyke netting survey was carried out from May 5th through May 9th to assess the walleye population. The first electrofishing survey was completed the night of May 9th to target walleye recapture. The second electrofishing survey targeted panfish and largemouth bass during the night of May 29th. The final electrofishing survey was completed October 15th to assess walleye recruitment. The same types of surveys were completed in 2012. All results presented in this section were provided by Aaron Cole, WDNR Fisheries Biologist based on data collected during the 2018 surveys and the Big Round Lake Fisheries Assessment 2012-2013 (Cole, 2014).

Survey results from 2018 suggest the population has decreased from estimated 1,090 walleye (1.1 fish/ac) in 2012 to 812 walleye (0.8 adults/acre), but the 2012 findings were typical for Polk County lakes. Big Round Lake is regularly stocked with walleye. Survey data reveal the population is dependent on stocking. In 2012, the average length-at-age for walleye was equal to or above the northern Wisconsin regional average for all but the oldest age class. That same year the average length of all walleye during the fyke netting survey was 16.7 inches while the average length during the 2018 fyke netting survey was 16.1 inches.

Only 5 northern pike with an average length of 26 inches were caught during the spring fyke netting survey. A spring 2012 fyke netting survey also found low abundance with 17 northern pike at an average length of 22 inches. These and other past surveys suggest lower densities of northern pike with good size structure is typical for Big Round Lake. The lake offers emergent vegetation such as wild rice and softstem bulrush, which is ideal habitat for northern pike spawning.

Largemouth bass were captured at a rate of 54.2 fish/mile with an average length of 11.9 inches during the May 29th 2018 electrofishing survey compared to 62.5 fish/mile with an average length of 12 inches in 2012. Largemouth bass also help regulate panfish populations, especially bluegill.

Bluegill were captured at a rate of 135 fish/mile with an average length of 5.7 inches during the May 29th 2018 electrofishing survey and 48 fish/mile with an average length of 7 inches during the 2012 electrofishing survey. Black crappies were captured at a rate of 5 fish/mile, pumpkinseed at 17 fish/mile, and yellow perch at 2 fish/mile during the electrofishing survey in May 2018.

Management recommendations in the 2012-2103 report suggest minimized disturbance to the lakeshore and littoral zone to protect fish and wildlife habitat and water quality. Continued AIS monitoring and prevention activities are also recommended.

8.0 Wildlife

The Wisconsin Natural Heritage Inventory (NHI) lists species and natural communities that are known or suspected to be rare in Wisconsin. The species are legally designated as endangered or threatened or they may be listed in an advisory capacity of special concern. The NHI lists species according to township and range, which includes T35N R16W for Big Round Lake. No NHI species were found in that township and range (NHI, 2019).

The local WDNR Wildlife Biologist, Kevin Morgan has recommendations for lakeshore residents to improve wildlife habitat[5]. First is to recognize that the zone within 100 feet of the lakeshore and into the shallows of the lake is a critical area for mammals, birds, reptiles, amphibians, and fish. If there are areas within this zone that have not already been cleared, leaving trees, shrubs, and vegetation for wildlife habitat is one way to protect existing habitat. If a lakeshore has already been cleared and developed then residents can restore habitat by allowing areas to grow wild (i.e., select areas that will not be mowed) and/or planting native plants and landscaping in a way that is aesthetically pleasing to residents and supplies habitat for wildlife. Protecting and restoring lakeshore buffers and natural shoreline also prevents issues with Canada geese that show preference for manicured lawns where their droppings become a nuisance to lake residents.

Near shore vegetation in the water creates habitat for frogs, turtles, furbearers, and waterfowl. Minimal clearing in this area will maintain critical habitat for these animals and important areas for fish spawning and development. Wild rice should be preserved for wildlife and for reasons of cultural significance for the St. Croix tribe of Chippewa Indians.

Fallen trees along the lakeshore also provide structural habitat for wildlife and fish. Examples include turtles basking on these fallen trees and wood ducks and mallards loafing on them as well. The submerged portions of the fallen trees serve as structure for fish, and anglers know well that fallen trees are a good fishing spot. There are grant funds and programs that promote placement of trees back in the water, but it is much easier to leave trees where they fall naturally whenever possible.

Moving away from the lakeshore and further upland, we know that land use impacts water quality and thus impacts which species of animals can thrive in and around the lake. And although this is important, the more critical concept is for lakeshore residents to be conscious of their practices near the lake.

[5] Email communication, April 10th, 2019.

Part 2 - Issues and Desire for Management

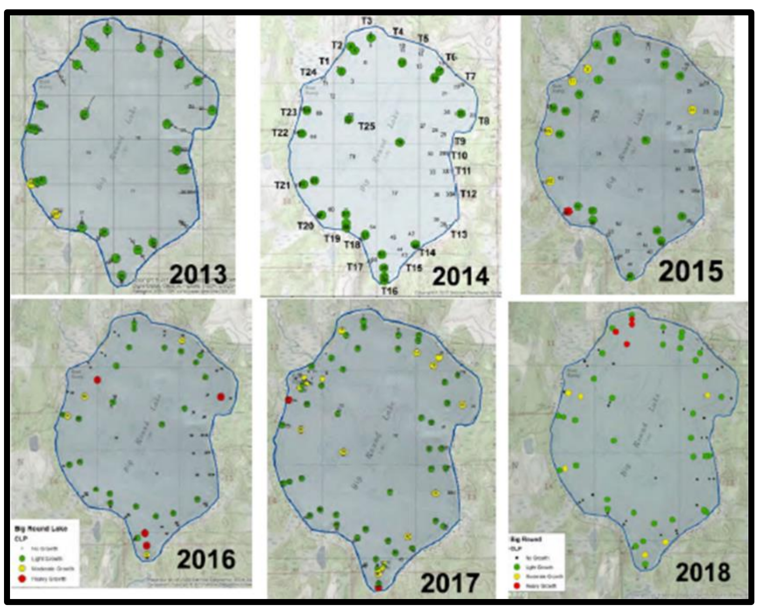
9.0 Aquatic Invasive Species

Aquatic invasive species (AIS) are defined by their tendency to out-compete native species thereby threatening the diversity and balance of plants and animals that are native to a particular system. The AIS of greatest concern in Big Round Lake at the time of this management plan is curly-leaf pondweed (*Potamogeton crispus*).

Curly-leaf pondweed (CLP) was first documented in Big Round Lake in 1978. CLP can become a dominant plant species because it tolerates low light and low temperature conditions, allowing it to actively grow beneath the ice before other native plant species are actively growing. There are times when CLP becomes canopied at the water's surface forming dense mats that impair recreation. Due to its early growth beneath the ice and in spring, the plant dies off in summer, releasing phosphorus during the active growth of algae and feeding algae blooms. The amount of phosphorus (*P*) released during die-back of CLP was measured in Bone Lake (Polk Co.), revealing about 21% of the *P* in CLP is released back into the lake. This accounted for 3% of the total P load for Bone Lake, or 14%-21% of the internal P load for Bone Lake[6]. Desiccating CLP can also accumulate on shore in the summer.

CLP has been monitored in Big Round Lake by Blue Water Science annually since 2005. The last four seasons of monitoring (2015-2018) suggest CLP is widespread at low to moderate growth in most locations. However, some areas of recurrent heavy growth have been identified and mapped in Figure 13. The majority of areas over the last 6 years in June reveal CLP to be present at "light growth" conditions (green dots) in most locations. "Heavy growth" (red dots) was found at 4 survey points in 2018 and 2016 and 2 survey points in 2017 (Figure 16).

Figure 16 – Curly-leaf Pondweed Survey Maps 2013-2018



Maps created by Blue Water Science

[6] Using the table from page 11 of Schieffer & Clemmons (2010), CLP load 39.8kg/Internal load 192kg = 20.7% of phosphorus from CLP decomposition. Text on the bottom of page 11 suggests the total internal load may be 290kg and calculations (CLP load 39.8kg/Internal load 290kg) yield 13.7% of phosphorus from CLP decomposition.

10.0 Public Input

A public meeting was held April 27th, 2019 at the Georgetown Town Hall in Balsam Lake, WI to gather public input regarding aquatic plant management in Big Round Lake. The input was used in developing goals for this plan. There were 40 people in attendance not including presenters/natural resource professionals (Sara Hatleli, Aquatic Plant & Habitat Services LLC; Mark Sundeen, WDNR; Jeremy Williamson, Polk County; and Connor McComas, Blue Water Science.

10.1 Verbal Public Input

During the first half of the meeting, information was shared on the 2018 aquatic plant survey results, the 2018 CLP survey results, and management options. Main points of the presentations and questions/discussions during the presentations were captured by the secretary of the district in minutes posted on the Big Round Lake website at www.bigroundlake.com. In this way, verbal input was gathered. The minutes are detailed and capture verbal input from the meeting but are also briefly summarized here:

1. Discussion regarding the use of blue green algae from the lake to fertilize lawn taking care not to create aerosols and not recommended where pets may ingest grass.
2. Aerate lawn to capture more surface water runoff before it enters the lake.
3. Remove plants that wash up on shore.
4. Feasible plant control options include mechanical harvest, manual removal, no active control, and nutrient input control.
5. How do we remove phosphorus from the lake if we don't remove the plant matter? The phosphorus will remain in the lake unless it is physically removed, which would be cost prohibitive and not always necessary. Alum treatment may be a good approach.
6. Discussion regarding recommendations from Blue Water Science in 2004 to control CLP and subsequent studies suggesting CLP decomposition was not significantly contributing to algae blooms.

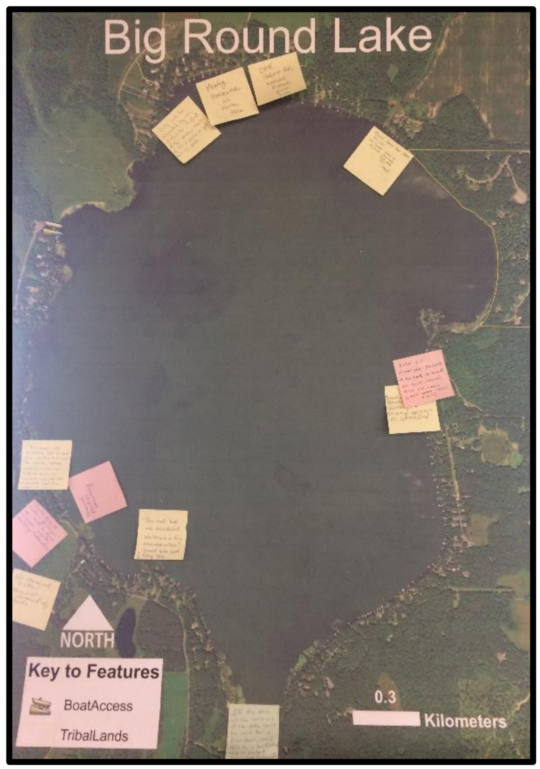
Figure 17 – Public Meeting Photo, April 2019

10.2 Written Public Input on Map

In the second half of the meeting, participants provided written comments on poster-sized maps of Big Round Lake. There were 24 comments/questions on the maps that fell into four main categories of public input.

1. Algae / Phosphorus
   - Pump green algae on lawns (as a means of control)
   - This area was unusable last summer even at the shoreline. It stunk, looked awful, and was not safe to swim or breathe around. Not enjoyable near the water at all. (western shoreline)
   - Lots of floating plants & algae growth on east/north side of lake (last year worst ever)
   - Aeration to increase oxygen
   - Would like to outlaw fertilizer use 75ft to shore or closer. Similar to building restrictions.
2. Curly-leaf Pondweed
   - Remove CLP
   - Thresholds are key. Decisions should be based on data. Question – best thresholds to follow?
   - No chemical control. Minimal removal of plants.
   - If the dam at the south end of the lake could be used for a drawdown, would this be a beneficial way to combat curly-leaf pondweed?
   - Curly-leaf has impacted my use of the lake in front of my home resulting in 3 or 4 pushes to get out to fish (north-northwest shore)
   - Mowing harvester on north side
3. Aquatic Plants
   - Expanding Lily pad area (in the far south). Difficult to get pontoon out. Huge thick mass of floating weeds pulled but not taken out of lake made it impossible to get our pontoon our for a month
   - Too many weeds at boat landing. Have heard complaints while doing clean boats clean waters.
   - This reed bed was devastated. Was there a fine associated with this? It used to be good fishing here (south-southwest shoreline)
   - Raise funds toward the plan
4. No Active Control / Fish
   - This area no active control except shoreline improvement (far southeast)
   - Habitat control (northern shore)
   - No active management (northern shore)
   - Heaving spawning area (northern shore)
   - Observed panfish spawning (south-southwest shoreline)
   - Fish spawning on shoreline, bass and sunnys. Many springs on shoreline (east)
   - DNR grant for natural buffer zone
   - Please leave our lake alone! We do not want to disturb fishing, boating, etc.
   - Shallow access at the boat landing

Figure 18 – Public Input Map*

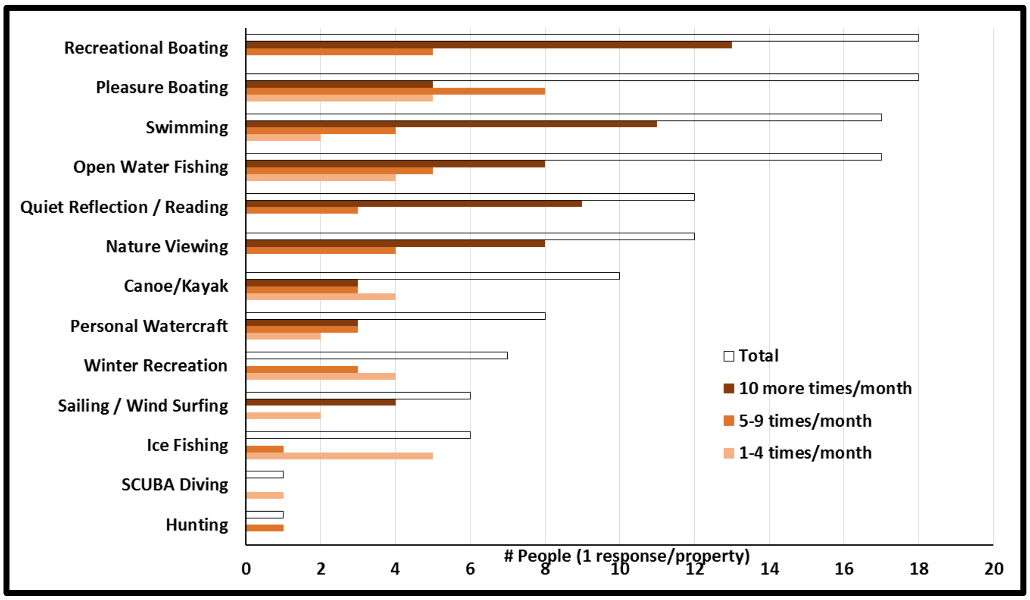


Map for meeting created and printed by Polk County

10.3 Lake Activities Survey

People were asked to participate in a voluntary survey to better understand the types of recreation enjoyed on the lake. Participants were asked how often they and their guests participate in the following activities year-round. Only one response was solicited per property. The most common activities were recreational boating (waterski & tube) with 18 responses and pleasure boating (cruise & sightsee) also at 18 responses. Swimming and open water fishing each had 17 total responses.

Figure 19 – Recreational Activities of Big Round Lake Residents Attending the April 27th Planning Meeting (2019)



10.4 Planning Meeting

Public input results were compiled and used to develop draft goals and objectives on May 18th, 2019. Big Round Lake P&R District representatives in attendance included Gary McDowell, Gordon Kill, Laura Hilse, Mark Hilse, Todd Strusz, Tim Saari, Eduardo Sotomayor, Chad Wagner, and Bob Tjernlund. Sara Hatleli (APHS) and Jeremy Williamson (Polk County) were also in attendance. Meeting minutes were recorded and posted on the Big Round Lake website[7]. Goals and objectives were unanimously endorsed by vote and are detailed in Sections 21.0 through 25.0.

[7] http://www.bigroundlake.com/

10.5 Public Review and Comment Period

A draft of this management plan was available to the general public for review and comment from June 10th through 24th, 2019. A public notice was placed in the County Ledger Press June 6th. A hard copy of the management plan was available at the Luck Public Library in Luck, WI. The draft document provided instructions and contact information for providing comments directly to Aquatic Plant and Habitat Services LLC.

The majority of the input was received from Alex Smith, WDNR Lake Biologist and largely pertained to the Management Strategy in Part 5, Goals 4 and 5. Changes were made according to Mr. Smith's suggestions and provided to the District Commissioners and members of the Aquatic Plant Management Committee for review and ultimately were supported. Other changes recommended during the public review period were largely of a grammatical nature and did not change the essence of the plan.

10.6 Annual Meeting and District Endorsement

On June 30, 2019 the Big Round Lake Protection & Rehabilitation District held its annual meeting at the Georgetown Lutheran Church in Balsam Lake, WI. The goals and objectives of this APMP were presented orally and in written form. After some discussion regarding the goals and associated budget for achieving them, the District members voted to approve the APMP.

Part 3 - Past Aquatic Plant Management Activities

11.0 Citizen Lake Monitoring Network

The Citizen Lake Monitoring Network (CLMN) is a volunteer-based approach to monitoring water clarity, phosphorus, chlorophyll, temperature, dissolved oxygen, and aquatic invasive species. Volunteers collected data on Big Round Lake 1992 and 1994, then a hiatus until consistent monitoring was revived in 2001. One volunteer currently collects water clarity, phosphorus, and chlorophyll samples from one site in the lake. Section 21.0 (Goal 1) recommends this monitoring is continued. If an estimated 3 hours is spent per monitoring event, 4 times per year, for the past 20 years, there is a total estimated 240 hours logged in volunteer hours. At a rate of $12/hour, this amounts to a value of $2,880 in contributed volunteer time.

12.0 Education & Outreach

The Big Round Lake Protection & Rehabilitation District manages a website and has kept lake management information updated and relevant throughout the current planning process (http://www.bigroundlake.org). The website includes contact information for board members, links to newsletters, and lake management activities. The district organizes an annual membership meeting in the summer and annual meetings with partners in January. The annual membership meetings provide an opportunity for curly-leaf pondweed updates, volunteer opportunities, discussion regarding AIS, and dissemination of printed educational materials. Additional educational and outreach activities are included in Section 22.0 (Goal 2) as part of this plan.

13.0 Watercraft Inspection & ILIDS Camera

Clean Boats Clean Waters is program that provides training and resources for volunteers and staff to conduct watercraft inspection of boats launching and leaving a lake. CBCW has been conducted on Big Round Lake at the public boat landing since 2012. The comprehensive lake plan mentioned boaters traveling most frequently from Balsam Lake, Bone Lake, and Cedar Lake before visiting Big Round Lake. Eurasian watermilfoil was discovered in Cedar Lake in 2015.

There has also been a camera at the boat landing since 2012, installed by Environmental Sentry Protection, LLC. The camera records boat landing use and boater behavior at the landing.

14.0 Aquatic Plant Management

Past aquatic management activities have focused on monitoring in the form of a comprehensive lake management plan, aquatic plants surveys, aquatic invasive species monitoring, and curly-leaf pondweed surveys.

14.1 Comprehensive Lake Management Plan

Harmony Environmental was hired to complete a comprehensive lake management plan, which was finalized in 2016 and is effective for 10 years. This plan was intended to update the previous lake management plan from 2004 and maintain the district's eligibility for WDNR grants and guide management activities. The goals and objectives listed in the comprehensive plan are also referenced in this plan in Section 21.0 (Goal 1).

14.2 Aquatic Plant Surveys

Polk County Land and Water Resources Department completed whole-lake aquatic plant surveys during the summers (July-Aug) of 2008, 2013, and 2018[8]. In addition, Blue Water Science Inc. completed summer (Aug-Sept) aquatic plant surveys using 25 transects along which there were a total of 78 survey points in 2003 and 2006-2018. Results from the Polk County 2018 aquatic plant survey is summarized in Section 5.1.

14.3 Aquatic Invasive Species Monitoring

Aquatic invasive species (AIS) surveys were conducted in Big Round Lake by Blue Water Science from 2011 through 2018. Zebra mussels and Eurasian watermilfoil were specifically targeted for detection and fortunately not found. The Chinese Mystery Snail are present in Big Round Lake but do not pose an ecological or recreational problem. Purple loosestrife and rusty crayfish are in the vicinity but not present in Big Round Lake.

Curly-leaf pondweed surveys have been conducted on Big Round Lake by Blue Water Science since 2003. More information on the status of CLP is in Section 5.2.

[8] Whole-lake surveys completed were done according to WDNR point-intercept methods from Hauxwell et al. 2010.

Part 4 - Plant Management Options

Aquatic plants in Wisconsin water bodies can be managed in a variety of ways. The best way to manage aquatic plants will be different for each lake and depends on the overall plant community, the species that require control, whether AIS are present, the level of human use of the system, and various other background information previously presented in this management plan.

Aquatic plant management is regulated under Wisconsin Administrative Codes, Chapters NR107 and NR109 and some management activities require a permit.

There are five broad methods of aquatic plant management:

- No active control, which means nothing is done to address plant growth, but a strong monitoring and education component may be included.
- Manual and/or mechanical removal of plants, which includes activities such as hand pulling, raking, diver assisted suction harvesting (DASH), and using plant harvesters.
- Chemical treatment, which involves the use of herbicide to kill aquatic plants.
- Habitat alteration, which means plants are reduced by altering variables that affect growth such as sediment (e.g., dredging), light availability, or depth.
- Biological control, which includes the use of living organisms, such as insects, to control plant growth.

15.0 Feasibility Factors

In order for a control method to be appropriate, it must be feasible from a biological, social, and financial perspective. Biological feasibility infers the control action will not cause significant harm to other aspects of lake ecology. Socially feasible actions are those that have support from project partners and in this case include the district, St. Croix tribe, Polk County, and WDNR. Social feasibility also infers that control actions meet regulatory requirements and will be formally permitted by regulatory agencies. Financial feasibility simply implies that any control action is affordable for the district and partners providing cost share. All control actions are accompanied by risks and potential impact to non-target aspects of a lake, but the benefits must outweigh those risks and potential detriments.

16.0 No Active Control

Sometimes the best course of management is to take no immediate action. There are many benefits including the lack of disturbance to desirable native species and the lake system, there is no financial cost, there are no unintended consequences of active control, and no permit is required. Disadvantages to this approach include the potential for an issue to become more challenging to control later. This approach often includes a strong monitoring and educational component. Annual surveys of curly-leaf pondweed are important to determine whether action should be considered the following year. Educating lake residents and visitors can help promote the best course of action and help them weigh in on whether control action should occur. **No active plant control is a feasible option for Big Round Lake.**

17.0 Mechanical or Manual

Mechanical/manual control includes pulling plants by hand or by using harvesting machines or devices. Permits are required for some activities and there are a variety of options under this type of control. Mechanical control is regulated under Chapter NR 109.

Manual Plant Removal

Figure 20 – Manual Removal Photo

Shoreland property owners are allowed to manually remove a 30-foot wide section of native aquatic plants perpendicular to their shoreline without a permit. This can only occur in a single area and all piers, boatlifts, swim rafts, or other recreational or other water use devices must be within that 30-foot zone. This method can only be employed where other plant control methods are not being used and cannot be used in designated sensitive areas. Designated sensitive areas are illustrated in Figure 15. Property owners considering this method for recreational purposes are encouraged to contact their local WDNR Lakes Coordinator if they have any questions or need clarification on native plant removal at their particular site. Additionally, there are no limits on raking loose plant material that accumulates along the waterline. AIS can be selectively removed by manual means anywhere along shore or in open water areas without a permit. Regulations require that the native plant community is not harmed during manual removal of AIS. Benefits of this technique includes little damage to the lake and plant community, the removal can be highly selective, and can be very effective in a small colony of AIS. On the other hand, this method can be very labor intensive. Furthermore, all of the plants must be removed. This method is most appropriate for small-scale control (i.e., <10 acres or <10% of littoral area). **Manual plant removal is an appropriate option for Big Round Lake.**

Diver Assisted Suction Harvest (DASH)

Figure 21 – DASH Photo

This form of mechanical removal involves the use of suction tubes connected to pumps mounted on a barge or pontoon. The suction tubes reach to the bottom of the lake and SCUBA divers manually uproot invasive plants to be sucked through the tubes, up to the barge, and strained. Uprooting aquatic plants causes suspension of sediments. Sites with native plants rooted in the sediment may help keep sediment suspension at a minimum, but complicates the underwater process of selectively harvesting only non-native species. This method is labor intensive and costly ($2,300 per day), and mainly appropriate for small areas of Eurasian watermilfoil

(EWM) control (i.e., less than 1/2-acre). **DASH is not recommended as a feasible means of control for CLP at this time** because sediment suspension can increase the internal phosphorus loading. Also, CLP in Big Round Lake is widespread. The control of AIS using DASH is appropriate for small and isolated beds of aquatic plants.

Mechanical Harvest

This method includes "mowing" of aquatic plants down to depths of 5 feet and then collecting the plants and removing them from the lake. This technique is most appropriate for lake systems with large-scale or whole-lake aquatic plant issues. Mechanical harvesters provide immediate results and usually cause minimal impact to lake ecology while removing some nutrients from the lake via plant biomass reduction. Harvesting lanes in dense plants beds can improve growth and survival of some fish species. Also, if harvesting is done early enough in the season, impacts to native plants should be minimal (Barton et. al. 2013). However, care should be taken when harvesting early in the season to minimize impacts to spawning fish[9]. A disposal site for harvested plants is a necessary part of a harvesting plan. Hiring mechanical harvesters to visit the lake costs $2,200 per acre ($2,000/acre for more than 3 days). The purchase of a brand new harvester is highly variable and depends on the type of harvester purchased. Cutting harvesters begin at $100,000. A harvester that can skim and pull the plants from their roots is $76,000. The use of skimming harvesters to pull aquatic plants from the roots is not currently recommended by the WDNR due to causality of sediment suspension that can fuel algae. Furthermore, the cutting of aquatic plants 5 feet below the lake surface leaves vegetation to serve as structural habitat while pulling aquatic plants by the roots removes structural habitat and exposes sediment for possible AIS introduction/expansion. Chetek Lake Protection Association in Barron County uses a skimmer to remove floating duckweed, filamentous algae, and some limited CLP harvesting work[10]. With a cutting harvester, a shore conveyor (starting at $35,000) is needed to offload the plants into a truck or dumpster for transport to a disposal site. A Recreational Boating Facilities Grant may help pay for up to 50% of eligible costs associated with purchasing harvesting equipment. Annual costs include paying an operator, storage of the harvester, insurance, and maintenance. As an example, nearby Blake Lake's 2018 harvesting budget was $27,700[11]. **Mechanical harvest is a viable option for Big Round Lake plant management and is further discussed in Section 25.0**.

Figure 22 – Mechanical Harvester Photos

[9] Email correspondence with Aaron Cole, Fisheries Biologist, WDNR. 11 April, 2019.
[10] Email correspondence between Tim Saari, Big Round Lake, and Alex Smith, Lake Biologist, WDNR. 8 June, 2019.
[11] 2018 Annual Harvesting Budget Blake Lake: $2,500 APM Coordinator, $1,500 Lakes Convention, $475 Dues, $8,500 Harvester Labor & Expenses, $4,500 Insurance, $4,525 Administration, $5,700 Lake Management Plan.

18.0 Chemical Control

Chemical control is regulated under Wisconsin Administrative Code Chapter NR 107[12]. The amount of time required to control plants depends upon the specific product, formulation (granular or liquid) and concentration used. Herbicides must be applied in accordance with label guidelines and restrictions. Cost estimates of a whole-lake herbicide treatment are approximately $100/acre. Permit costs from the WDNR are $25/acre with a maximum fee of $1,270. If whole-lake treatment is done herbicide concentration monitoring after treatment could cost up to $4,000, depending on the number of samples required. Post-treatment aquatic plant survey costs are estimated at $5,000. The benefits of chemical control include flexibility in herbicide selection depending on the target plant species (some herbicides are more selective), size of treatment area, lake depth, and other lake variables. The detriments of chemical control include unintended consequences such as toxicity to animals or humans, impacts to desirable plant species, possible drop in dissolved oxygen depending on plant biomass killed and other lake variables. **Chemical control is not a recommended aquatic plant control method for Big Round Lake** because it is not meet social feasibility as it is not supported by St. Croix tribe.

19.0 Habitat Alteration

Various habitat alterations exist and most are not appropriate for consideration in Big Round Lake. Many of these alterations require a Chapter 30 permit.

Bottom Barriers

Bottom barriers prevent light from reaching aquatic plants but allow for gas accumulation under the barrier and subsequent dislodging. They can also impact fish spawning and food sources, and an anaerobic environment below the barrier could cause nutrient release from the sediment. **Bottom barriers were not recommended during the public planning meetings in April-May, 2019**. However, if individual property owners are interested in this approach, they should contact the DNR directly for a miscellaneous structure permit under Chapter 30.[13]

Figure 23 – Bottom Barrier Photo

Drawdown

This control technique involves the lowering of water levels in fall and exposing sediments to freezing and drying, which results in plant death before allowing the lake to refill the following spring and summer. A water level control device, such as a dam, is required for this method. Although a dam is located at the southern end of the lake, it was not constructed to allow water level fluctuation.

[12] Chapter NR 107 is available at *http://docs.legis.wisconsin.gov/code/admin_code/nr/100/107.pdf*.
[13] Contacts at the time of this plan are Michelle Nault 608-513-4587, Mark Sundeen 715-635-4074, and Alex Smith 715-635-4124

Dredging
Dredging includes the removal of plants along with sediment and is generally used to restore lakes that have been filled in with sediments, have excess nutrients, need deepening for navigation, or require removal of toxic substances. This process consists of three primary steps; 1) removing the sediment, 2) processing the removed material (dewatering and transportation to disposal site), and 3) placement of the dredged material at the disposal site. Permits or regulatory approval from the WDNR may be needed at each step. This high level of disturbance may create favorable conditions for the invasion of other non-native species. The cost depends on the amount of material targeted for removal, the content and condition of material being dredged, and distance to disposal site. Because these factors are highly variable, it is difficult to determine a cost estimate without a sediment analysis. One online source suggests the cost ranges from $20,000 to $75,000 per acre[14]. For every 2 acres of material dredged, an average of 3 feet of material is removed, which will fill one acre of land with a 6-foot increase in elevation. A sediment analysis provides information on sediment thickness and therefore can guide the amount of material to be dredged. **Dredging is not recommended for aquatic plant management in Big Round Lake.**

Dyes
The use of dyes is for reducing water clarity thereby reducing light availability to aquatic plants. This is only appropriate for very small water bodies with no outflow and is therefore **not recommended for Big Round Lake**.

Non-point Source Nutrient Control
No permit is required for this type of nutrient management, which reduces the runoff of nutrients from the watershed. As a result, fewer nutrients enter the lake and are therefore not available for plant growth. This approach is beneficial because it attempts to correct the source of a nutrient problem and not just treat the symptoms. The WDNR has developed a Total Maximum Daily Load (TMDL) for Total Phosphorus in the Lake St. Croix basin[15], which includes the Straight River sub-watershed and Big Round Lake. As a part of this TMDL, phosphorus loads in the Lake St. Croix basin are targeted for 27% reduction (123 metric tons/year decrease in phosphorus. **Big Round Lake residents can reduce nutrient loading and protect water quality of their lake by:**

- Installing water diversion(s) that move water to areas where it can soak into the ground instead of running straight into the lake.
- Protecting or enhancing shore land buffers in riparian zones.
- Planting native species including grasses, wildflowers, shrubs and trees. https://healthylakeswi.com/best-practices/ provides templates based on property owners' interests (bird/butterfly habitat, low-growing garden, etc.).
- Using rock infiltration practices along roof drip lines and driveways to provide space for runoff to filter itself.
- Installing rain gardens that improve habitat and filter runoff while providing a naturally beautiful view.
- minimizing or ending the use of fertilizers
- having septic systems inspected and repaired as needed

[14] https://www.clean-flo.com/maintenance/alternative-dredging-techniques-muck-removal. Accessed April 5, 2018.
[15] The TMDL can be viewed at https://dnr.wi.gov/topic/nonpoint/documents/9kep/St_Croix_River_Basin-Plan.pdf.

20.0 Biological Control

Insects

Insect biocontrol options are available for EWM and purple loosestrife. However, neither of these species were found during the 2018 aquatic plant surveys.

Native Plantings

Another form of biological control is to promote a diverse native plant community that will compete with AIS. Native plants provide valuable food and habitat for fish and wildlife and a diverse community is more repellant to invasive species. Fortunately in Big Round Lake, a healthy native aquatic plant community already exists. Protection of native plants, such as those in designated sensitive areas, is an important component of controlling curly-leaf pondweed in the lake.

Part 5 - Management Strategy 2017-2021[16]

[16] The goals are numbered for reference but the numbering is not meant to infer priority.

The goals, objectives, and action items listed in this aquatic plant management plan are a product of a public input meeting and a planning meeting, held in April and May (Section 10.0).

21.0 Goal 1 – Support the goals of the Comprehensive Lake Plan.

A comprehensive lake management plan for Big Round Lake was completed in 2016 by Harmony Environmental and is available at www.bigroundlake.com under the “Lake Management” tab. The first goal of this aquatic plant management plan is to support the goals and objectives already established in the comprehensive plan. Those goals and objectives are copied from the comprehensive plan and summarized here.

Goal 1a: The Big Round Lake Community is knowledgeable about and engaged in lake stewardship.

- AIS concerns are understood.
- People can identify AIS that threaten Big Round Lake (or know who to contact).
- Volunteers participate in lake monitoring activities.
- There is good attendance at lake related event such as the annual meetings.

Goal 1b: Prevent the introduction and spread of aquatic invasive species (AIS).

- Boaters inspect, clean, and drain boats, trailers, and equipment. Use ILIDS (boat landing camera) and Clean Boats Clean waters program.
- Identify AIS as soon as possible after introduction to the lake. Use consultant AIS surveys of zebra mussels and EWM. Also use volunteer AIS meander surveys and zebra mussel veliger tows.
- Rapidly and aggressively respond to new introductions of AIS such as Eurasian watermilfoil. Use rapid response plan if new AIS detected (Appendix J of Comprehensive Plan).
- Continue consultant curly-leaf pondweed monitoring.
- Continue whole-lake point-intercept surveys every 5-7 years.

Goal 1c: Understand water quality to potentially reduce the severity of algae blooms.

- Develop a phosphorus budget.
- Evaluate chlorophyll, total phosphorus, and secchi depth results annually.
- Collect temperature and oxygen profiles.
- Monitor algae abundance and biomass.

Goal 1d: Preserve and enhance great fishing on Big Round Lake.

- Support WDNR and St. Croix Tribe fish management efforts and stocking.
- Encourage quality fish habitat.
- Provide input for WDNR and tribal fish management.
- Educate lake residents to encourage natural shorelines.

22.0 Goal 2 - Offer educational programs to Big Round Lake residents.

Objective 2a: Offer "Pontoon Classroom" programs on the lake.

Pontoon classroom programs offer hands-on learning to lake residents. Volunteer pontoon drivers are needed and educators are hired or requested from the state/county to lead programs. There could be a collection of pontoons that rotate stations with several educational topics in one day or the pontoons could link to form a larger classroom with one instructor covering a single topic in one day. There are many possibilities with this mode of instruction.

- Apply for a Surface Water Grant in February, 2020 to fund this activity.
- Offer pontoon classroom program(s) in 2020, 2021, and/or 2022 as will be specified in the Feb. 2020 grant application.
- Pontoon classroom topic ideas include aquatic plant identification, water chemistry and temperature lessons, algae identification and instruction, and curly-leaf pondweed identification and life history.
- Record instructors during pontoon programs and post videos on the Big Round Lake website.

Objective 2b: Develop an aquatic plant identification guide for the plants in Big Round Lake.

- Apply for a Surface Water Grant in February, 2020 to fund this activity.
- Request permission to use existing photos of aquatic plants to develop a booklet for Big Round Lake complete with photos and plant descriptions. This could be completed by hired booklet designer.
- Hire a graphic designer and/or biologist in 2020 to develop the booklet and work closely with the district on design and layout.
- Provide a free copy of the plant guide District members in 2021.

Objective 2c: Host a Healthy Lakes Grant information session and recruit lakeshore property owners to implement practices.

The DNR offers cost-share grants for Healthy Lakes practices through lake organizations and local governments. Participating lakefront property owners receive up to $1,000 to help cover the cost of practices that help improve habitat and water quality. Healthy Lakes practices include Fish Sticks (near shore tree drops), 350 ft^2 Native Plantings, Diversions, Rock Infiltrations, and Rain Gardens.

- Apply for a Surface Water Grant in February, 2020 to fund the information session and plan for Healthy Lakes practice implementation.
- Host a Healthy Lakes Grant information session in summer 2020, ideally on-site where some practice(s) is/are already installed so participants can view them first-hand. This could also be done on neighboring lakes.
- Aim to recruit 5 lakeshore property owners to participate.
- District apply for a Healthy Lakes grant to implement practices in February 2021. The maximum state grant award is capped at $25,000 and requires a 75/25 state/sponsor match. The individual Healthy Lakes best practices are capped at $1,000/each. Funding is designed to encourage committed property owners with shovel-ready projects so each grant has a timeline with an April 15 start date and June 30 end date a little more than two years later.
- Install Healthy Lakes practices according to conditions and instruction of the Healthy Lakes grant.

23.0 Goal 3 – Support the recommendations of the phosphorus study.

A phosphorus study is underway May-September 2019. The study is being led by UW-Stout Center for Limnological Research and Rehabilitation with a final report expected in early 2020.

Objective 3a: Follow the recommendations of the phosphorus study to help reduce internal loading of phosphorus.

- Recommendations must be feasible for the Lake District from a social, biological, and financial perspective.

24.0 Goal 4 – Continue learning about Big Round Lake

Several aquatic plant and water quality studies have been completed on Big Round Lake that help guide management. Some of these studies include aquatic plant surveys every 5 years, annual aquatic invasive species monitoring, annual curly-leaf pondweed surveys, annual water quality monitoring (volunteer and tribal), sediment core analysis, and internal phosphorus loading assessment (currently underway). Some of these studies reveal the need for further analysis and hence some additional studies are recommended.

Objective 4a: Complete a watershed model for Big Round Lake.

- Apply for a Surface Water Grant in February, 2020 to fund this activity.
- Work with Polk County and hired consultant (if required) to complete a watershed model of Big Round Lake by the end of 2021. The current phosphorus study will reveal the amount of phosphorus loading internally but does not provide information on the entire phosphorus budget for the lake. A watershed model will estimate the sources of phosphorus and help the District prioritize funding that will address the highest phosphorus sources.

Objective 4b: Assess the contribution of phosphorus from curly-leaf pondweed decomposition.

- Apply for a Surface Water Grant in February, 2020 to fund this activity.
- Hire a consultant to analyze the amount of phosphorus contributed by curly-leaf pondweed decomposition in Big Round Lake. A similar study was completed on Bone Lake in Polk County. The study could be completed in 2020 or 2021.

Objective 4c: Document issues associated with native plants washing ashore.

During the planning meetings in April and May 2019, it became apparent that free-floating and uprooted vegetation washes ashore and impedes navigation. Documenting this issue with photos and lat-long coordinates will help determine the best approach for mitigation.

- Organize a strategy for Big Round Lake residents to submit digital photos, dates, and lat-long coordinates to the district as a means of documenting this issue. This could be initiated in 2019 but definitely by 2020 and implemented each summer thereafter.

- The Aquatic Plant Management Committee (Objective 5c) is an appropriate body to receive and organize photos, GPS coordinates, and other observations associated with floating vegetation impairing recreation.
- Lake residents can use a handheld GPS to collect location data or load apps on their smartphones, such as "MyGPSCoordinates".
- Share the strategy for documenting issues with lake residents. This can be done with a mailing, email, special meeting, or a combination of outreach efforts. An announcement should also be listed on the website.
- Once a summer's worth of documentation exists, the district can meet with the DNR to determine the best approach for addressing the issue.

Objective 4d: Document curly-leaf pondweed abundance using a spring point-intercept survey and bed mapping.

- Apply for a Surface Water Grant in February, 2020 to fund this activity.
- Hire a consultant to complete a whole-lake point-intercept survey in spring (usually May) each year of the grant project (2020, 2021, and 2022).
- Hire a consultant to map the beds of CLP in the lake. This can be done the same time as the PI surveys.
- These surveys will serve the APM Committee (Obj. 5c) and WDNR in management decisions.

25.0 Goal 5 – Control curly-leaf pondweed in areas of navigation impairment.

At the time of writing this management plan, mechanical harvest and manual removal are the only control options feasible. Curly-leaf pondweed harvesting is to be for navigation improvement and not for CLP reduction on a lake-wide scale.

Objective 5a: Protect designated sensitive areas.

- Designated sensitive areas (Figure 15) will be avoided during harvesting operations.
- If documentation exists (Obj. 4c) and the APM Committee (Obj. 5c) deems harvesting of CLP of native plants in sensitive areas necessary due to navigation impairment, the District will submit a permit application to harvest or schedule a meeting with the WDNR. Harvesting in designated areas should be done sparingly, if ever, and only when sufficient evidence of navigation impairment exists.

Objective 5b: Use CLP surveys to guide control efforts.

- Annual CLP surveys can be used to guide control efforts for the following year. For example, the results of the 2018 CLP survey would be used to guide CLP control efforts in 2019.
- Annual CLP point-intercept surveys and bed mapping can also be used to guide control efforts the same year if funds for harvesting are available. For example, the results of a 2020 CLP survey could be used to guide CLP control efforts in 2020.
- The year of possible lag time between surveys and control actions will prompt the need for real-time adjustments. A committee is recommended to serve this and other purpose (Obj. 5c).

Objective 5c: Establish an Aquatic Plant Management Committee.

- The District will establish an Aquatic Plant Management (APM) Committee by the end of 2019.
- The APM Committee will apply for harvesting permits each year control is anticipated.
- CLP control areas will be guided by CLP surveys.
- The APM Committee will provide details to the District each year that harvesting is pursued. Harvesting details include location (maps), size, water depth, CLP density, timing to avoid fish spawning, and disposal sites. These details may be thought of as the Annual Harvesting Plan. The committee may work closely with whomever completes the spring CLP surveys each year to determine the harvesting details and provide maps.
- The APM Committee will field requests from lake residents for new harvesting areas and modifications to that year's plan.
- The first year of harvesting will yield the first Annual Harvesting Plan, which will serve as a template going forward. Each year's gained information will help refine management actions for future years.

Objective 5d: Develop a budget for CLP control.

- The District will develop an annual budget to cover the cost of harvesting.
- If contracted, harvesting costs are $2,000-$2,200 per day with an estimate of at least 3 days required to harvest 30 acres of CLP. The rate of harvesting depends on the location of plant offloading sites.

Table 4 – Implementation Table for Goal 2

Implementation of the Big Round Lake Aquatic Plant Management Plan*								
Goals, Objectives, and Action Items		Entities Involved	2019	2020	2021	2022	2023	Surface Water Grant Eligible
2.	**Offer educational programs to Big Round Lake residents.**							
2a	**Offer "Pontoon Classroom" programs on the lake.**							BRL funded to hire RP for grant application preparation
	Apply for Surface Water Grant Feb. 1 2020 to fund this activity.	BRL, RP		X				
	Offer Pontoon Classroom program(s) as specified in grant application.	BRL, RP, SC		Possibly one, two, or all three years depending on grant application				Surface Water Grant Feb. 1
	Record pontoon classroom sessions and post on Big Round Lake website	BRL		Possibly one, two, or all three years depending on grant application				
2b	**Develop an aquatic plant identification guide for plants in Big Round Lake.**							BRL funded to hire RP for grant application preparation
	Apply for Surface Water Grant Feb. 1 2020 to fund this activity.	BRL, RP	.	X				
	Hire graphic designer and/or biologist to develop the booklet in close coordination with the district.	BRL, RP		X	X			Surface Water Grant Feb. 1
	Distribute free copies of the plant guide to district members.	BRL			X			
2c	**Host a Healthy Lakes Grant informational session and recruit lakeshore property owners to implement practices.**							BRL funded to hire RP for grant application preparation
	Apply for Surface Water Grant Feb. 1 2020 to fund this activity.	BRL, RP		X				
	Host a Healthy Lakes Grant information session.	BRL, SC		X				Surface Water Grant Feb. 1
	Aim to recruit 5 property owners to implement Healthy Lakes practices on Big Round Lake. Finish planning for practices so they are shovel-ready.	BRL, SC, RP to plan		X				
	Apply for Healthy Lakes Grant to implement shovel-ready practices.	BRL, RP			X			BRL funds to hire RP for grant application preparation
	Install Healthy Lakes practices according to conditions and instructions of the Healthy Lakes Grant.	BRL, RP			X			Healthy Lakes Grant Feb. 1

Goal 1 is detailed in the Comprehensive Lake Management Plan. BRL = Big Round Lake P&R District. SC – St. Croix Tribe. CO = Polk County. RP = Resource Professional. WDNR = Wisconsin Department of Natural Resources

Table 5 – Implementation Table for Goal 4

Implementation of Big Round Lake Aquatic Plant Management Plan*								
Goals, Objectives, and Action Items		Entities Involved	2019	2020	2021	2022	2023	Surface Water Grant Eligible
4. Continue learning about Big Round Lake.								
4a	**Complete a watershed model for Big Round Lake.**							BRL funded to hire RP for grant application preparation
	Apply for Surface Water Grant Feb. 1 2020 to fund this activity.	BRL, RP		X				
	Develop a watershed model for Big Round Lake.	BRL, CO		X	X			Surface Water Grant Feb. 1
4b	**Assess the contribution of phosphorus from CLP decomposition.**							BRL funded to hire RP for grant application preparation
	Apply for Surface Water Grant Feb. 1 2020 to fund this activity.	BRL, RP		X				
	Hire a consultant to carry out this study.	BRL, RP		X	X			Surface Water Grant Feb. 1
4c	**Document issues associated with native plants washing ashore.**							
	Organize a strategy for lake residents to document and submit issues associated with plants washing ashore.	BRL	X	X				Surface Water Grant Feb. 1
	Communicate strategy with lake residents.	BRL, SC	X	X	X	X	X	
	Meet with the DNR to determine a mitigation strategy.	BRL, SC		X	X	X	X	
4d	**Document CLP abundance using spring point-intercept survey and bed mapping.**							
	Apply for Surface Water Grant Feb. 1 2020 to fund this activity.	BRL, RP		X				BRL funded to hire RP for grant application preparation
	Whole-lake spring point-intercept survey and bed mapping.	RP		X				Surface Water Grant Feb. 1
	Use the spring survey to guide efforts in Obj. 5b.	BRL		X	X	X	X	None required.

*** Goal 3 is largely dependent on the results of the phosphorus study and therefore not listed in table form. BRL = Big Round Lake P&R District. SC – St. Croix Tribe. CO = Polk County. RP = Resource Professional. WDNR = Wisconsin Department of Natural Resources***

Table 6 – Implementation Table for Goal 5

5. Control CLP in areas of navigation impairment.								
5a	**Protect designated sensitive areas.**							None required.
	Avoid designated sensitive areas during harvesting operations.	BRL, RP		X	X	X	X	
	Document navigation impairment in sensitive areas if/when occurs. Meet with WDNR to discuss or submit permit application.	BRL		X	X	X	X	None required.
5b	**Use CLP surveys to guide control efforts**							Surface Water Grant Feb. 1
	Hire consultant to complete annual CLP surveys.	BRL, RP		X	X	X	X	
5c	**Establish an aquatic plant management committee**							Not eligible for grant funding.
	The APM committee will apply for annual permits using survey(s) as guidance in developing an annual **harvesting plan** (i.e., location, CLP bed size & density, water depth, timing to avoid fish spawning, and disposal location for harvested CLP.	BRL	Each year as needed depending on extent of CLP					
	APM committee will field requests from lake residents for new harvesting areas or modifications to the annual harvesting plan	BRL	Each year as input is received by residents.					Not eligible for grant funding.
5d	**Develop a budget for CLP control.**							Not eligible for grant funding.
	Develop an annual budget based on costs of hiring a contractor to mechanically harvest CLP.	BRL	X	X	X	X	X	

BRL = Big Round Lake P&R District. SC – St. Croix Tribe. CO = Polk County. RP = Resource Professional. WDNR = Wisconsin Department of Natural Resources

26.0 References

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Appendix

27.0 Appendix A – Aquatic Plant Survey Map