Lac Courte Oreilles Lake

Aquatic Plant Management Plan for 2021-2025

Sawyer County, WI
WIBC: 2390800

***Prepared for*:**
Courte Oreilles Lakes Association

***Prepared by*:**
Daniel D. Tyrolt
Lac Courte Oreilles Conservation Department
13394W Trepania Road, Bldg. 1
Hayward WI, 54843
715-634-0102

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Executive Summary

Lac Courte Oreilles Lake located in Sawyer County, Wisconsin, is considered a unique and significant water resource by the Courte Oreilles Lake Association (COLA), the Lac Courte Oreilles Band of Lake Superior Chippewa Indians (LCO), Sawyer County and the Wisconsin Department of Natural Resources (WDNR). The WDNR lists the lake as an outstanding resource water (ORW) and a priority navigable waterway which contains a self-sustaining walleye population.

The lake is located approximately 8 miles southeast of the city of Hayward. There are several inlets flowing into the lake and an outlet that flows into Little Lac Courte Oreilles. It has a surface area of approximately 5,039 acres with a maximum depth of 90 feet, which is one of the deepest lakes in Sawyer County. The total shoreline of the lake spans 25.4 miles. The lake has a varied fishery which includes walleye, muskellunge, northern pike, panfish, crappie, and small and largemouth bass. Cisco are also common and provide a high energy forage base for the gamefish allowing for trophy gamefish potential. The lakeshore property owners, LCO tribal members and the general public, via the public accesses, utilize the lake for a wide variety of activities, including fishing, boating, skiing, swimming, snorkeling, SCUBA diving and viewing wildlife.

Curly leaf pondweed (CLP) was first discovered in the lake in 2005 and Eurasian Water Milfoil (EWM) was first discovered in 2017. Since the discovery of CLP, management efforts related to aquatic plants have primarily focused on controlling CLP and more recently EWM. To help address the issue of CLP the Courte Oreilles Lake Association (COLA) had an aquatic plant management plan completed for the lake in 2011. This plan updates that previous plan. It also identifies the issues and need for management, reviews past management aquatic plant activities and presents management options. By evaluating these components and issues, a sound strategy was developed for the management of aquatic plants in the lake which includes the following goals:

Goal 1) Control existing populations of AIS.

Goal 2) Prevent the introduction and spread of aquatic invasive species.

Goal 3) Preserve the lakes' diverse native plant communities.

Goal 4) Lake residents and users are made aware of the importance of native aquatic plants, the means to protect them, and the threat of aquatic invasive species.

Goal 5) Restoration and preservation of native shoreline vegetation

Goal 6) Waterfront residents will protect lake water quality and plant communities by minimizing runoff of pollutants from their lake property.

This plan will allow for COLA to maintain eligibility for WDNR aquatic invasive control grants and guide COLA, LCO, Sawyer County, and the WDNR in aquatic plant management for the lake over the next five years (2021 through 2025).

Public Input for Development

The Courte Oreilles Lakes Association Aquatic Plant Management Committee provided input for the development of this aquatic plant management plan. The committee was comprised of board members from the Courte Oreilles Lakes Association with representation from the Lac Courte Oreilles Conservation Department, the Wisconsin Department of Natural Resources and the Sawyer County Aquatic Invasive Species Coordinator. The Courte Oreilles Lakes Association Aquatic Plant Management Committee members included the following:

- Kris Sivertsen
- Kevin Horrocks
- Gary Pulford
- Jeff Aspenwall
- Dick Laumer
- Mark Laustrup

The Aquatic Plant Management Committee met once during September via a Zoom conference and communicated many times through email. At the first meeting the committee reviewed aquatic plant management planning requirements, plant survey results, plant concerns, AIS management efforts to date and a timeline for the completion of the plan. The APM Committee expressed a variety of concerns that are reflected in the goals and objectives for aquatic plant management in this plan.

The COLA board announced availability of the draft Aquatic Plant Management plan for review to all lake residents via their newsletter *Short Ears, Long Tales*. A copy of the plan was also made available to the public through the COLA website. Comments were accepted through March 30, 2021 and the plan was accepted and approved by the AIS committee is March 2021. One comment received was appreciative to COLA saying it was: "Very comprehensive and thought-out plan". The Wisconsin DNR approved the plan August 17, 2022. The Plan was updated with the DNR comments.

Lake Information

Lac Courte Oreilles Lake located in Sawyer County, Wisconsin, is considered a unique and significant water resource by the Courte Oreilles Lakes Association (COLA), the Lac Courte Oreilles Band of Lake Superior Chippewa Indians (LCO), Sawyer County and the Wisconsin Department of Natural Resources (WDNR). Lake maps of Lac Courte Oreilles Lake are shown in Figures 1 and 2. Figure 1 is the west half and Figure 2 is the east half of the lake.

The lake is a soft-water drainage lake located in the Upper Chippewa River Basin. There are several inlets flowing into the lake. These include Osprey Creek (flowing into Barbertown Bay), Ghost Creek, Spring Creek, Whitefish Creek (from Whitefish Lake), Little Grindstone Creek (from Grindstone Lake), and Ring Creek. It has a surface area of approximately 5,139 acres and a volume of approximately 168,840 acre-feet. The maximum depth is 90 feet, which is one of the deepest lakes in Sawyer County. Approximately 68% of the lake is over 20 feet deep and only 3% is less than 3 feet deep. The total shoreline of the lake spans 25.4 miles. The lake has a varied fishery which includes walleye, muskellunge, northern pike, panfish, crappie, and small and largemouth bass. Cisco are also common and provide a high energy forage base for the gamefish. Whitefish are also present in unknown numbers. The lakeshore property owners, LCO tribal members and the general public, via the public accesses, utilize the lake for a wide variety of activities, including fishing, boating, skiing, swimming, snorkeling, SCUBA diving and viewing wildlife.

Water Quality

Lac Courte Oreilles Lake has been classified as an Outstanding Resource Water (ORW) by the Wisconsin Department of Natural Resources. The water quality data show that Lac Courte Oreilles Lake, apart from Musky Bay, has water quality that would be consistent with a north temperate meso-oligotrophic lake. Musky Bay, on the other hand, is classified as meso-eutrophic.

Lac Courte Oreilles Lake is a long-term trend water quality site for the WDNR and has been monitored at the deepest hole in the lake several times each summer since 1986. The LCO Conservation Department has also been collecting water quality data on a regular basis at several sites throughout Lac Courte Oreilles Lake dating back to as early as 1996. This data is used to determine if long-term trends are occurring and to monitor existing water quality conditions in the lake. The data collected includes total phosphorus, chlorophyll-a and Secchi disk readings. Water column profiling data has also been collected. This includes parameters such as dissolved oxygen, temperature and ph. The profiling data is essential in determining the amount of available oxy-thermal habitat that is available for the two-story cold-water fishery present in the lake.

Figure 1: Lac Courte Oreilles Lake: West Half

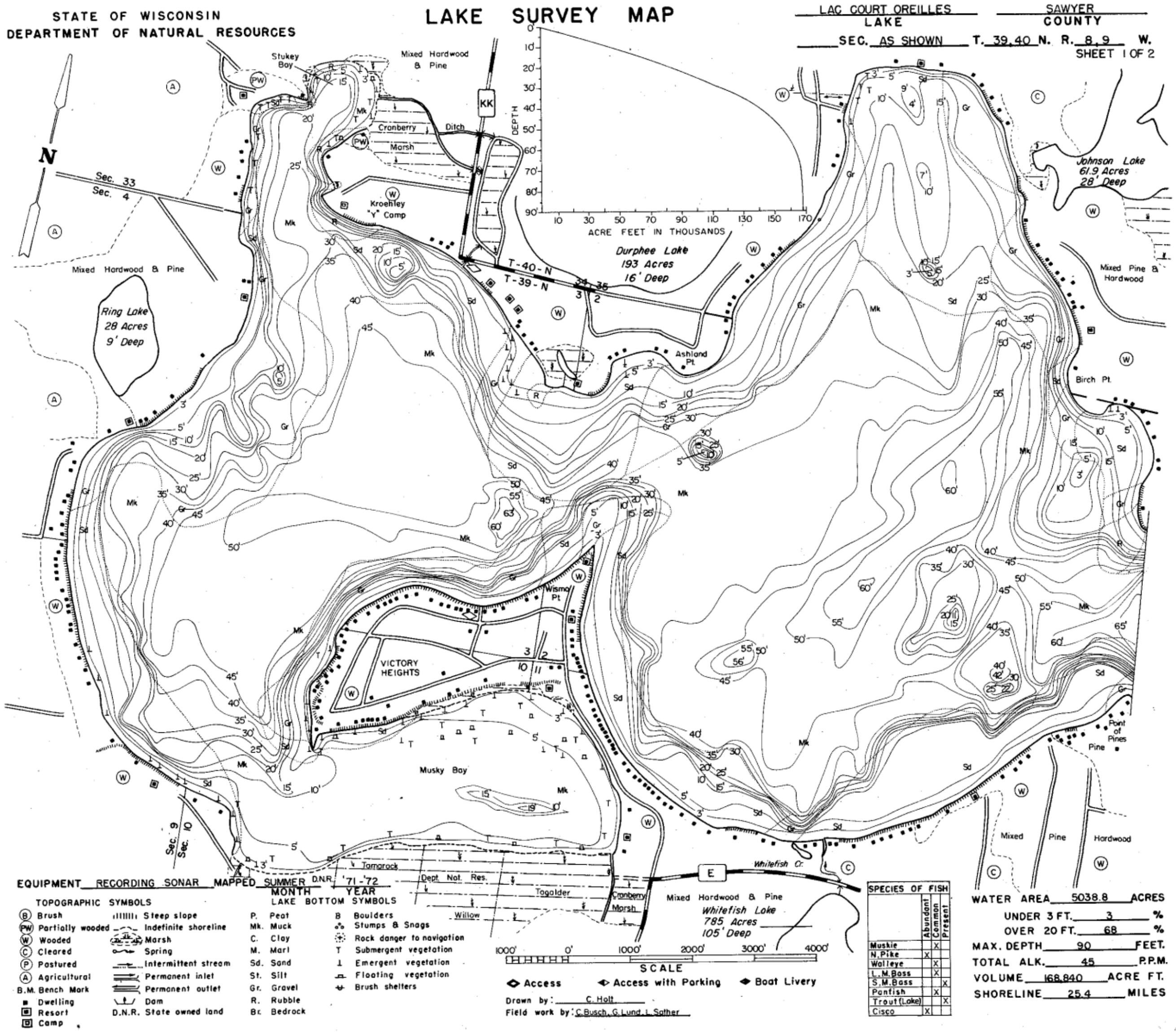
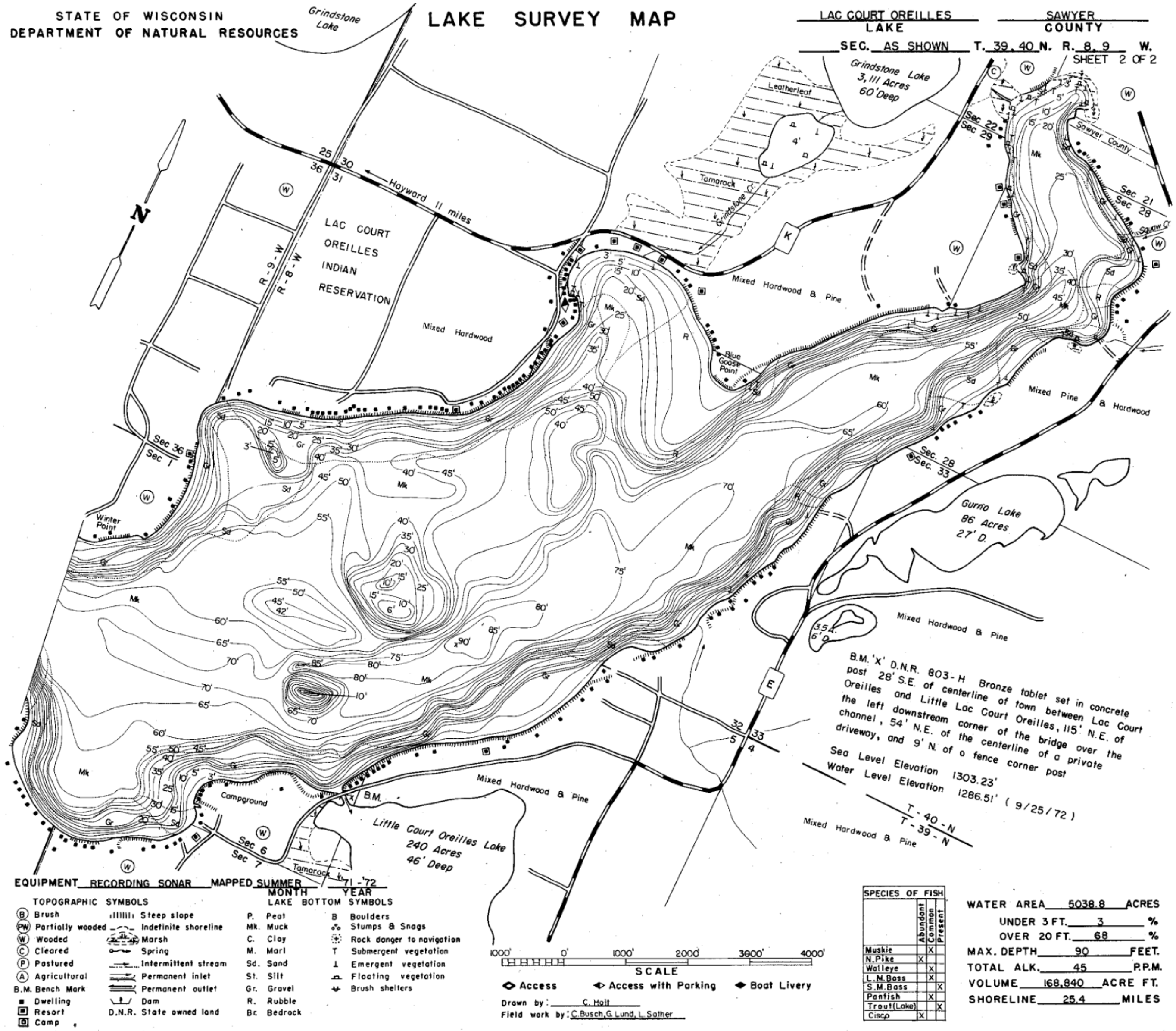


Figure 2: Lac Courte Oreilles Lake: East Half



Impaired Waters Status

Approximately four years after the federal listing of Musky Bay, on August 2, 2018, the US EPA approved the inclusion of all LCO Lake on the Wisconsin list of impaired waters based on low dissolved oxygen. The impetus for listing the whole lake stemmed from when COLA and the LCO Tribe completed an assessment of sampling data from 2012 to 2016 and determined that recent changes in dissolved oxygen and phosphorus concentrations would result in the extinction of the cold-water fish species in LCO. High phosphorus concentrations are resulting in more algae and algal blooms, a decrease in water clarity, and excessive aquatic plant growth. The microbial breakdown of excessive aquatic plant and algal residue reduces dissolved oxygen concentrations thereby threatening cold-water fish species - cisco and lake whitefish. Therefore, COLA and the LCO Tribe requested that all LCO Lake be listed as an impaired water which the EPA eventually approved.

Evaluation of Historical Water Quality Data

Water quality data collected by the LCO Conservation Department is used for the following discussions of water quality trends.

Total Phosphorus

Phosphorus is the plant nutrient that most often limits the growth of algae. Phosphorus-rich lake water indicates a lake has the potential for abundant algal growth, which can lead to lower water transparency and a decline in hypolimnetic oxygen levels in a lake. While nitrogen can limit algal growth, it can be obtained from the atmosphere by certain algal species. This is termed nitrogen fixation. Thus, phosphorus is the only essential nutrient that can be effectively managed to limit algal growth.

Figure 3 shows the average summer total phosphorus values of the main basins in the lake from 2000 thru 2019. Figure 4 shows the average summer total phosphorus values for Musky Bay from 2000 thru 2019.

Phosphorus concentrations vary seasonally and from year to year. The long-term monitoring data indicates that no statistically significant trend exists for the total phosphorus data. The differences in total phosphorus values at this point can be attributed to natural variation.

Figure 3:Main Basin Average Summer TP Concentrations

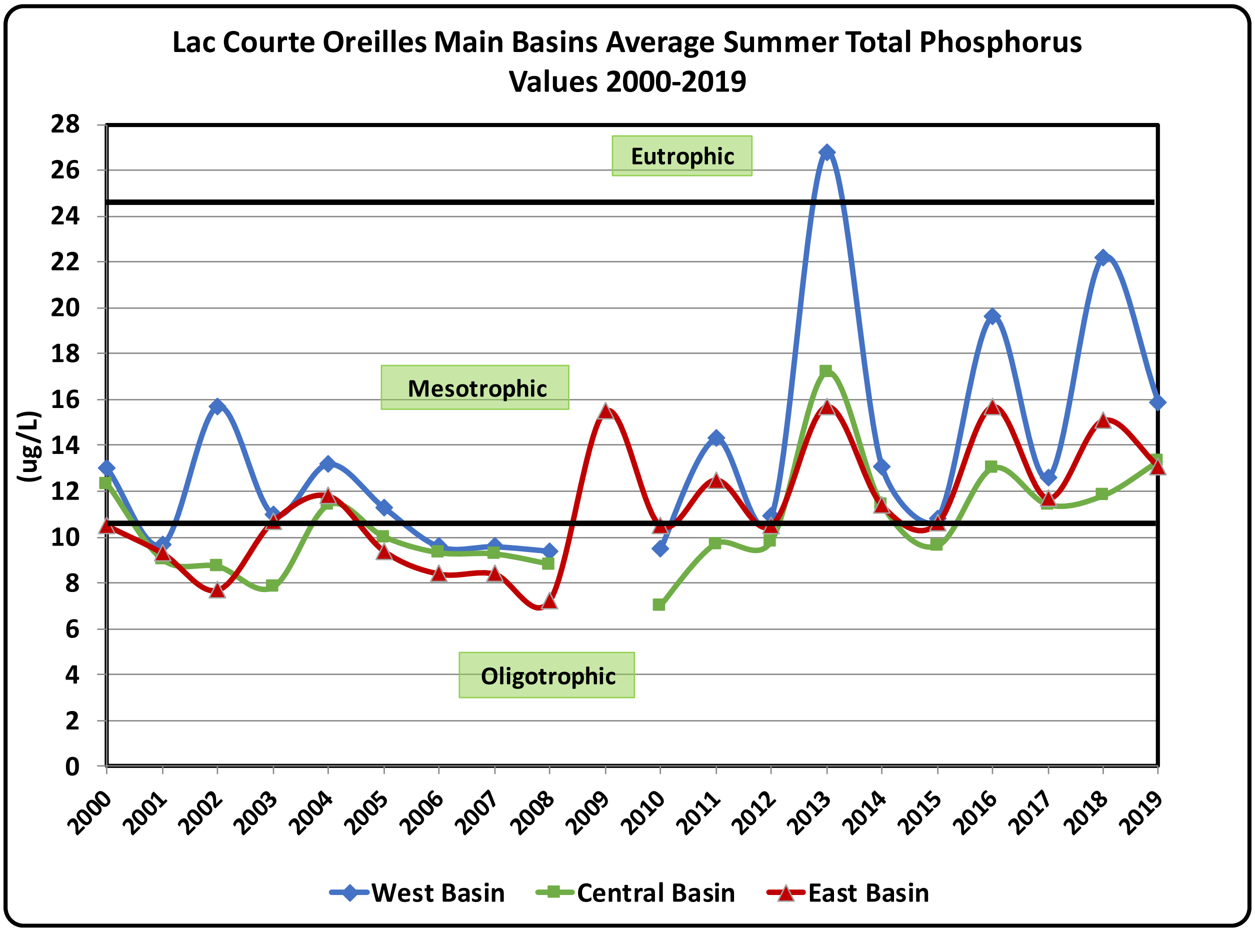
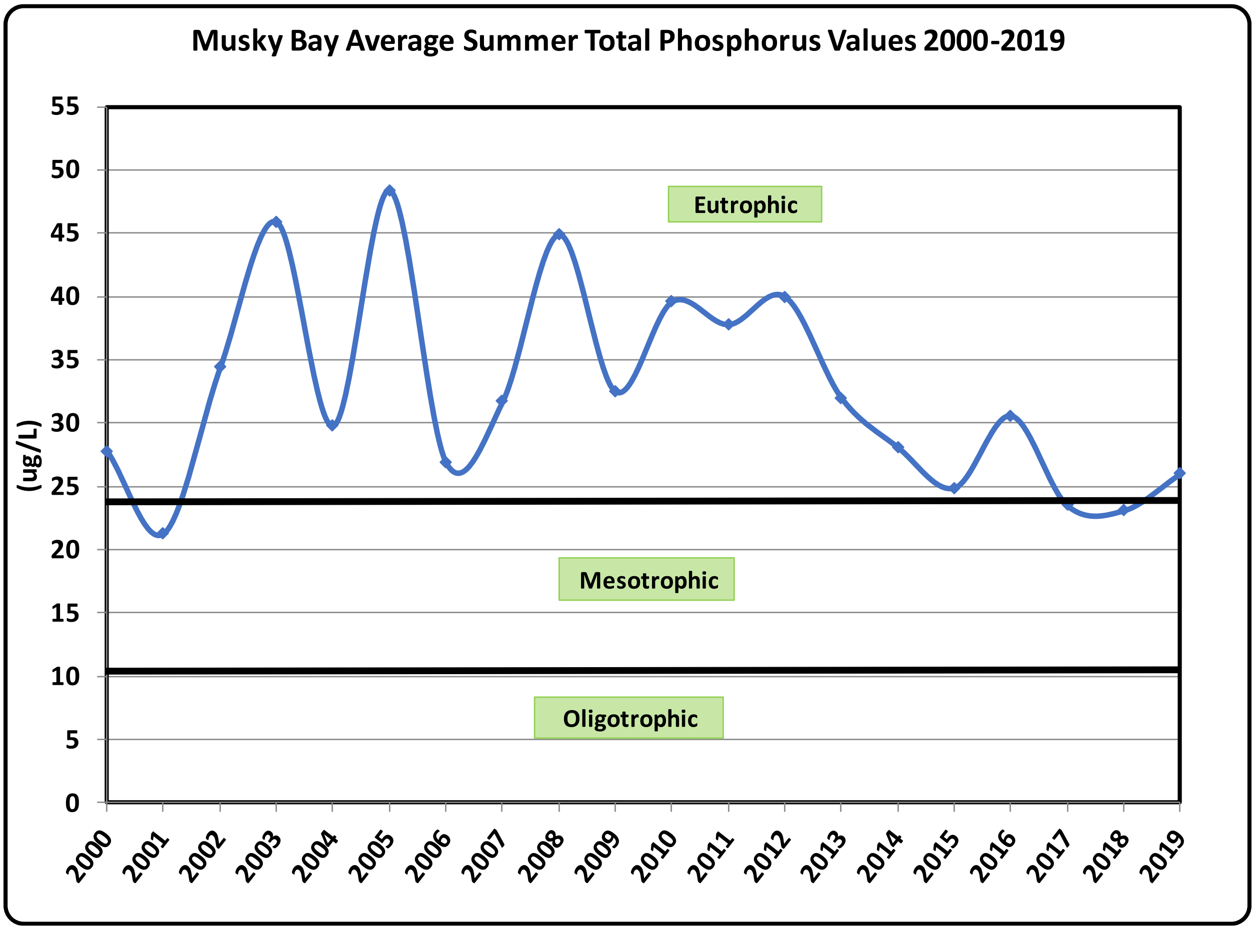


Figure 4: Musky Bay Average Summer TP Concentrations



Chlorophyll-a

Chlorophyll-a is a measure of algal abundance within a lake. High chlorophyll-a concentrations indicate excessive algal abundance (i.e. algal blooms), which can lead to recreational use impairment. Figure 5 shows the average summer Chlorophyll-a values of the main basins in the lake from 2000 thru 2019. Figure 6 depicts the average summer chlorophyll-a values for Musky Bay from 2000 thru 2019.

Chlorophyll-a concentrations vary seasonally and from year to year. The long-term monitoring data indicates that no statistically significant trend exists for the chlorophyll-a data. The differences in values at this point can be attributed to natural variation.

Figure 5: LCO Main Basin Chl-a Values

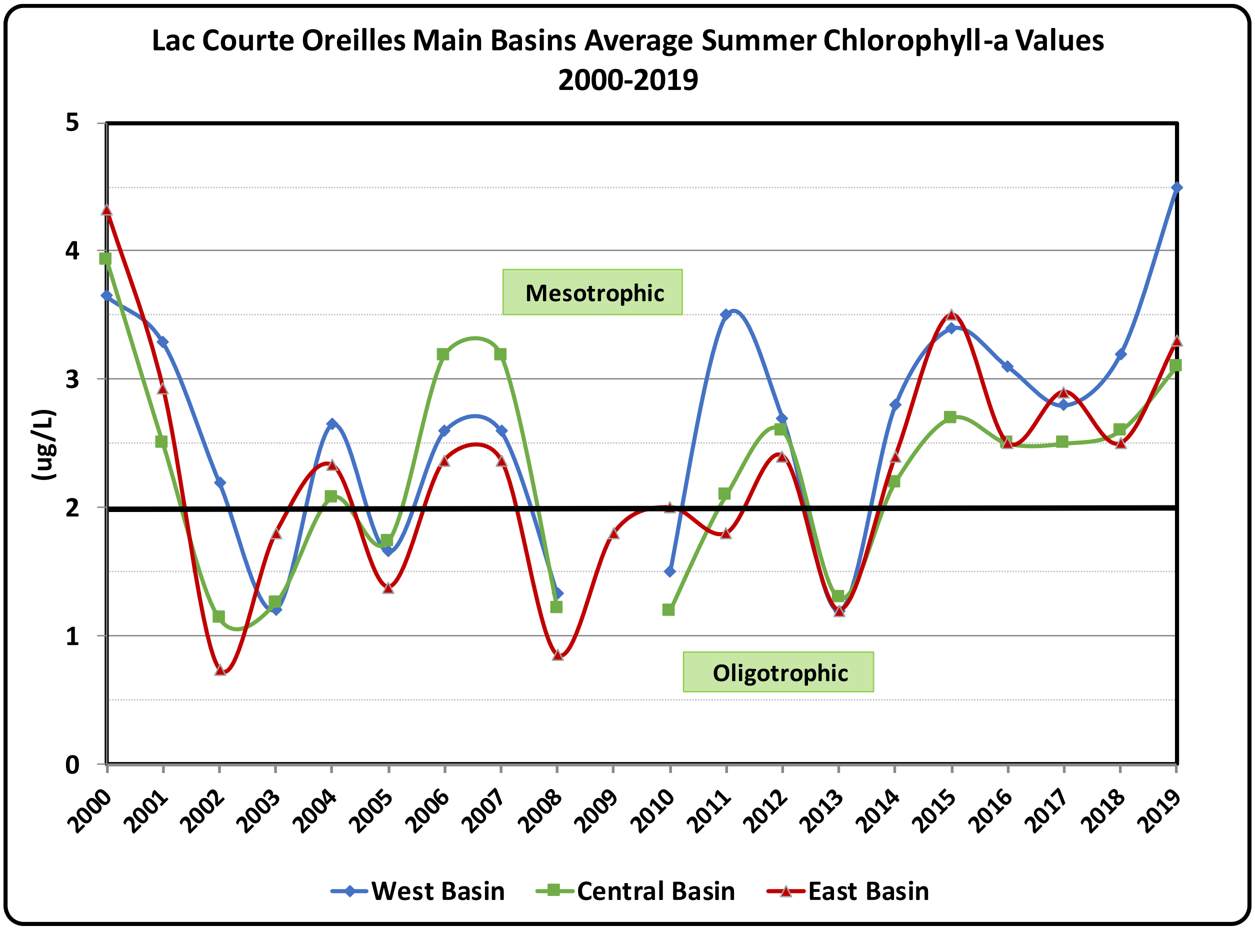
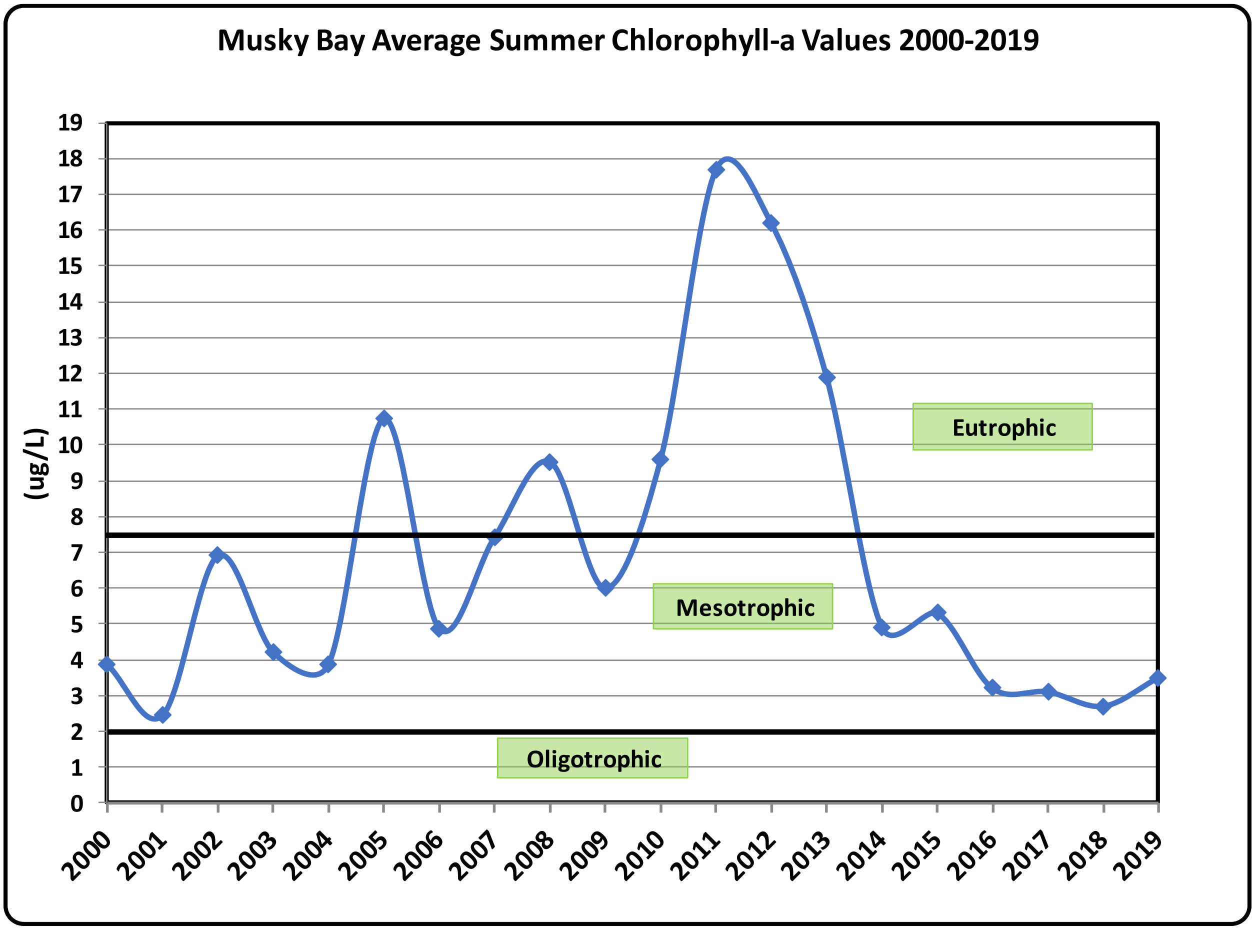


Figure 6: Musky Bay Average Chl-a Values



Secchi Disk

Secchi disk transparency is a measure of water clarity. Perceptions and expectations of people using a lake are generally correlated with water clarity. The results of a survey completed by the Metropolitan Council (Osgood, 1989) indicated that the following relationships can generally be perceived between a lake's recreational use impairment and Secchi disk transparencies:

- No impairment occurs at Secchi disk transparencies greater than 4 meters (13 feet).[1]
- Minimal impairment occurs at Secchi disk transparencies of 2 to 4 meters (6.5 - 13 feet).

[1] Osgood, R.A.;1989. Assessment of Lake Use - Impairment in the Twin Cities metropolitan Area. Prepared for the Minnesota Pollution Control Agency. Metropolitan Council Publication 590-89-130. 12 pp.

- Moderate impairment occurs at Secchi disk transparencies of 1 to 2 meters (3.3 - 6.5 feet).
- Moderate to severe use-impairment occurs at Secchi disk transparencies less than 1 meter (3.3 feet).

Figure 7 shows the average Secchi disk readings for the main lake basins from 1998 thru 2019 and Figure 8 shows the average Secchi disk readings for Musky Bay through the same time period.

The long-term monitoring data indicates a statistically significant decreasing trend exists for water clarity in the main basins of the lake, which is indicated by the long-term trend line seen in Figure 7.

Figure 7: LCO Lake Average Secchi Disk Values

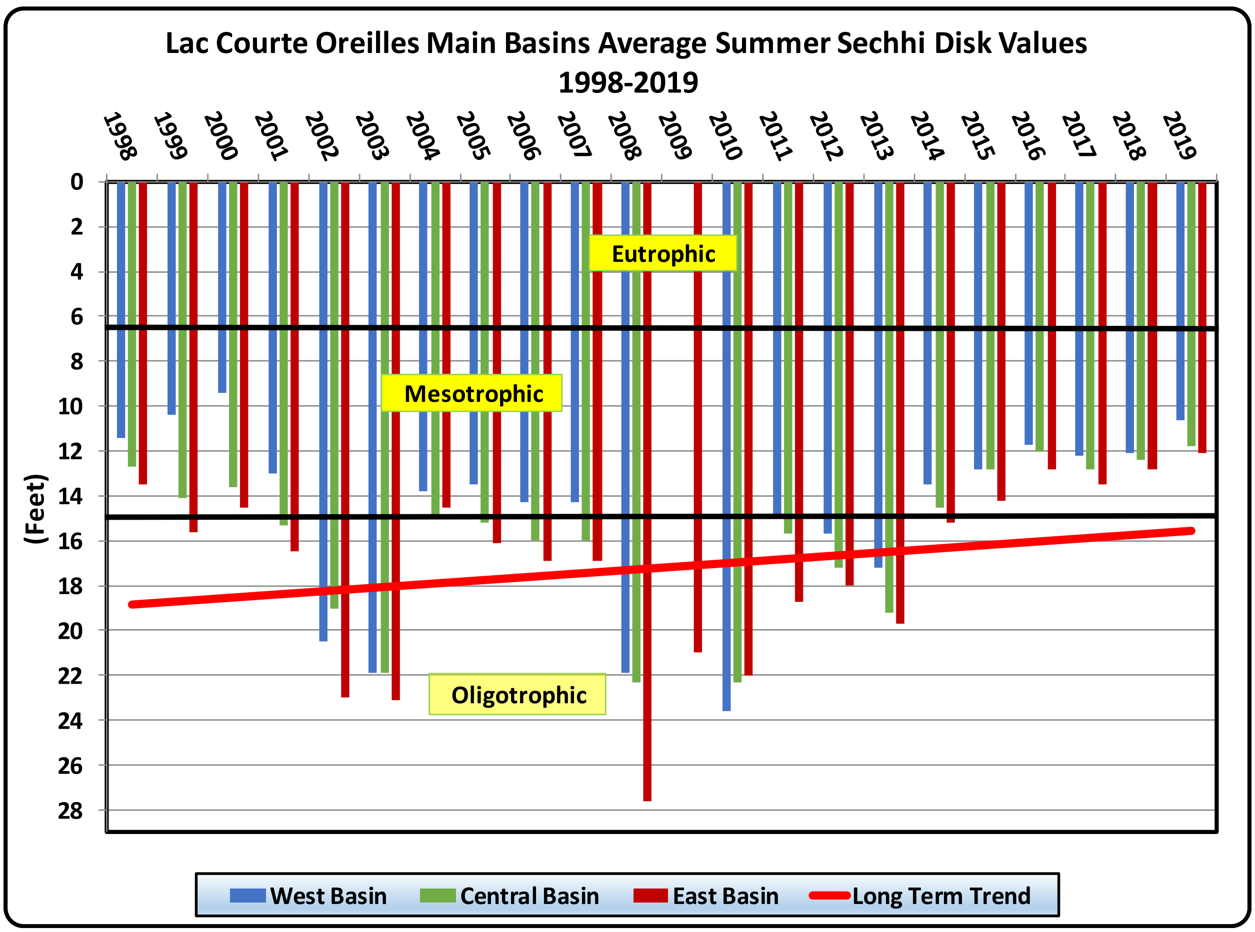
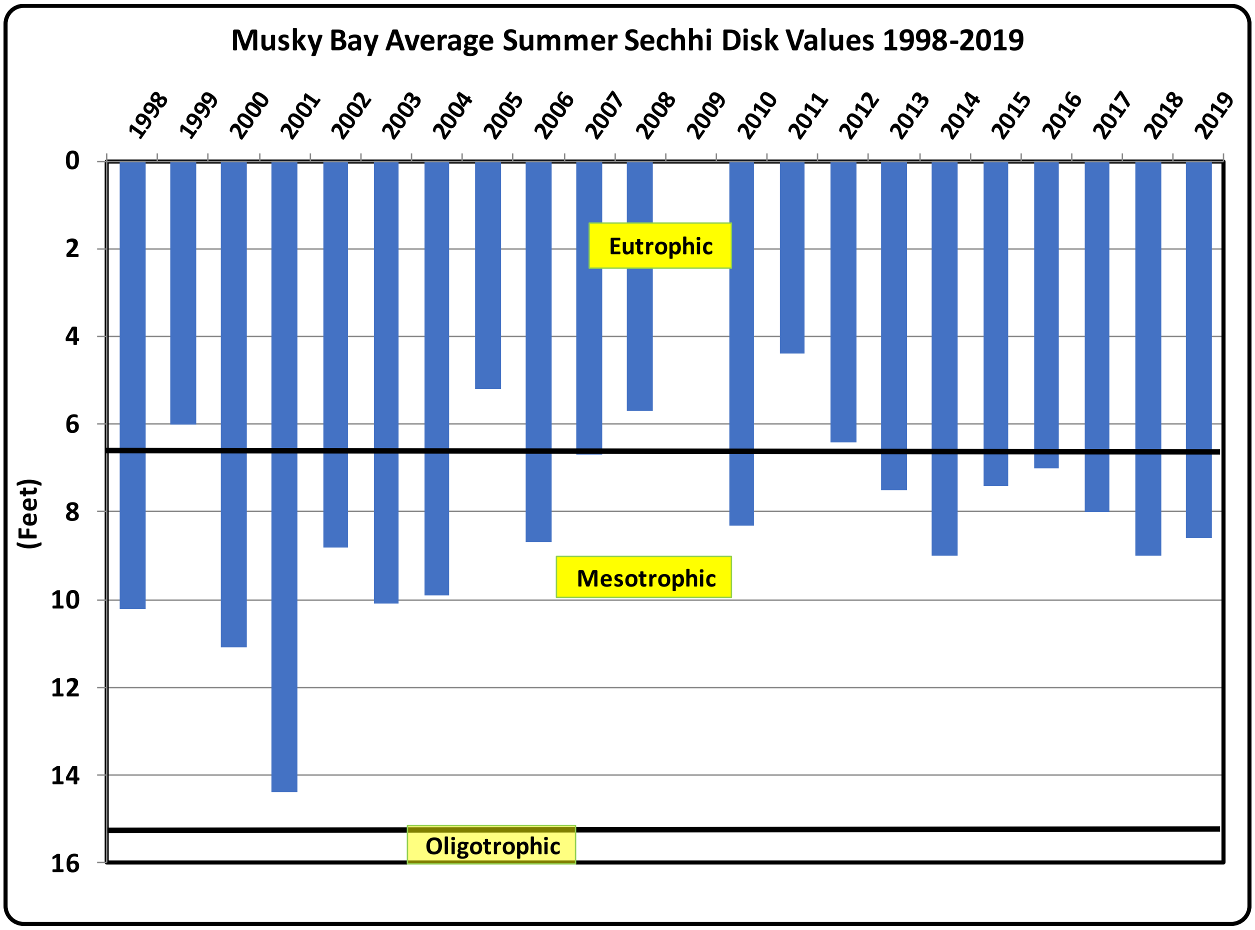


Figure 8: Musky Bay Average Secchi Disk Values



Alkalinity

Alkalinity is associated with the carbon system in the lake. Another term used to indicate a lake's alkalinity is hardness. Hard water lakes (greater than 60 mg/L calcium carbonate) tend to be better producers of aquatic life, including both plants and animals. Soft water lakes (less than 60 mg/L calcium carbonate) are not as productive. Extremely low alkalinities (less than 5 mg/L calcium carbonate) are more likely to be impacted by acidification resulting from acid rain. Alkalinities above 5 mg/L calcium carbonate have enough buffering to counteract the effects of acid rain. Alkalinity Data for Lac Courte Oreilles Lake indicates that it has an alkalinity of 50 mg/L. Lac Courte Oreilles Lake would therefore be classified as a soft water lake.

Watershed

The area of land that drains to a lake is called the lake's watershed. This area may be small, as is the case of small seepage lakes. Seepage lakes have no stream inlet or outlet and their watersheds include only the land draining directly to the lake. On the other hand, a lake's watershed may be large, as in drainage lakes such as Lac Courte Oreilles Lake. Drainage lakes have at least one stream inlet and an outlet and therefore their watersheds include the land draining to the streams in addition to the land draining directly to the lake. The water draining to a lake may carry pollutants that affect the lake's water quality. Therefore, water quality conditions of the lake are a direct result of the land use practices within the entire watershed. Poor water quality may reflect poor land use practices or pollution problems within the watershed. Good water quality conditions suggest that proper land use controls and best management practices (BMP's) are occurring in the watershed or there is minimal development within the watershed.

All land use practices within a lake's watershed impact the lake and determine its water quality. Impacts result from the export of sediment and nutrients, primarily phosphorus, to a lake from its watershed. Each land use contributes a different quantity of phosphorus to the lake, thereby, affecting the lake's water quality differently. An understanding of a lake's watershed, phosphorus exported from the watershed, and the relationship between the lake's water quality and its watershed must be understood.

The watershed for Lac Courte Oreilles Lake is part of the Couderay River watershed (Watershed Identification Key UC20) located in the Upper Chippewa River Basin. See Figure 9. The watershed is primarily forest with development occurring along the lakeshore. The forested land is a good land cover to have around the lakes in the watershed since it contributes much smaller nutrient and sediment amounts into the lakes compared to developed land covers such as residential and agriculture. The entire LCO watershed encompasses 68,990 acres and includes several other lakes. Water quality changes in these lakes would also be reflected in Lac Courte Oreilles Lake. The major lakes within the Lac Courte Oreilles lakes watershed include the following:

- Round Lake (3,054 acres)
- Grindstone Lake (3,116 acres)
- Sand Lake (928 acres)
- Whitefish Lake (786 acres)
- Sissibagama Lake (719 acres)

Watershed land use acreages were taken from the "Lac Courte Oreilles Lake Management Plan" prepared by C. Bruce Wilson (Wilson, 2011). In total, the watershed covers a surface area of 68,990 with the majority of land cover in forest 36,517 acres (53%) and water covering about 21,557 acres (31%). Grass and pasture were tabulated to cover over 5,300 acres with high-density and low-density residential covering about 2, 900 acres and agriculture about 2,704 acres. These are represented in Figure 10.

Forest plus water categories cover about 84% of the watershed with agriculture, commercial, industrial and residential less than 9%.

Figure 9: LCO Watershed

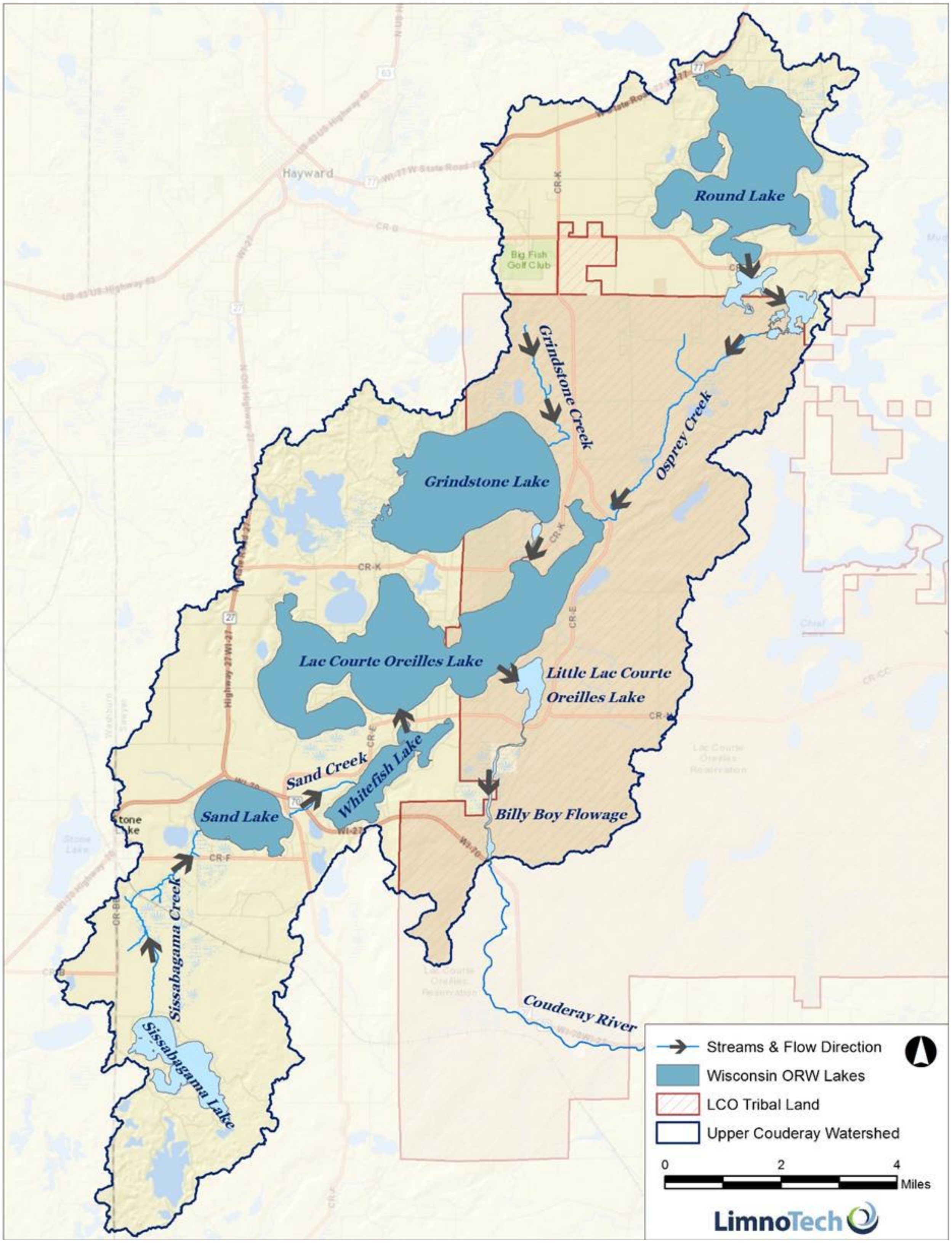
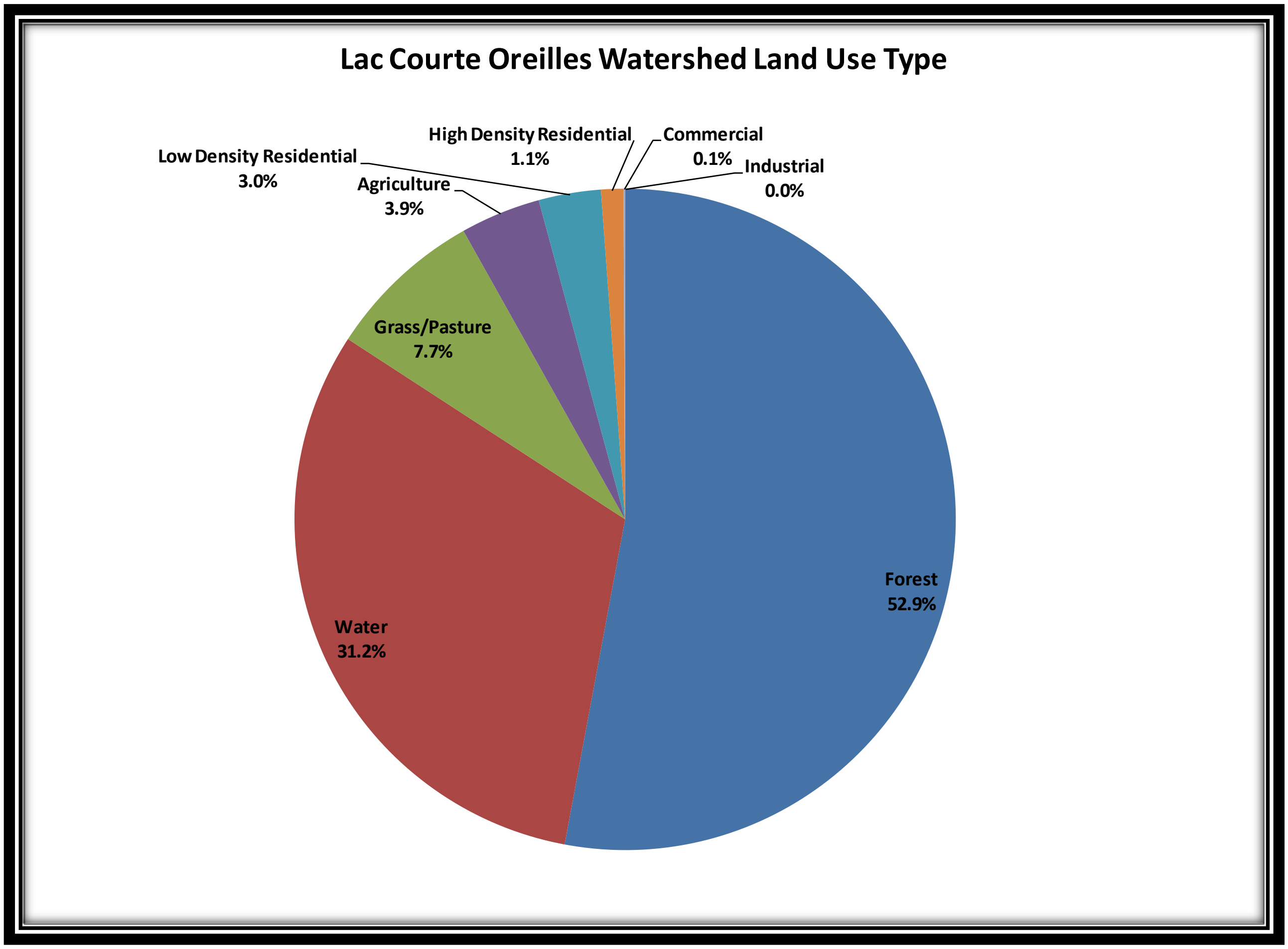


Figure 10: Lac Courte Oreilles Watershed Land Use



Aquatic Habitats

Primary Human Use Areas

The lakeshore property owners, LCO tribal members and the general public, via the public accesses, utilize the lake for a wide variety of activities, including fishing, boating, skiing, swimming, snorkeling, SCUBA diving and viewing wildlife. Public access to the lake is via the three public boat launches.

Presently, there are 695 single family dwellings on Lac Courte Oreilles. All these dwellings utilize septic systems. An earlier septic system survey was completed in 1994 and the most recent survey was completed in 2013[2]. Both surveys were completed by Sawyer County. The most recent survey revealed 38 systems out of 695 that were determined to be failing (5.5%) and 65

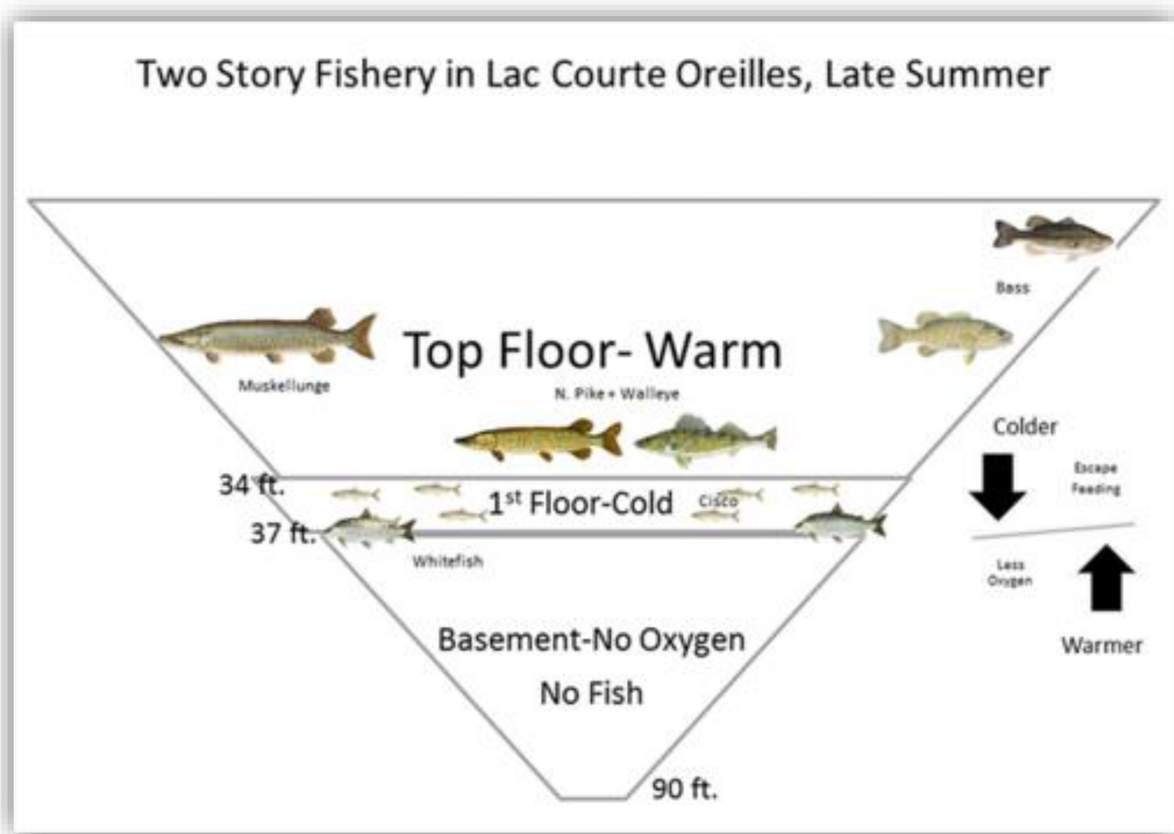
[2] https://www.cola-wi.org/s/LCO_FINAL_WEB.pdf

systems were initially determined to be inconclusive. I depth follow up inspections revealed an additional 7 failed systems. All 45 failed systems were ordered to be corrected and by 2015 all the failed systems had been replaced.

A shoreline buffer survey was completed in 2015 to record existing shoreline conditions around the lake and to identify properties where enhancement or establishment of shoreline buffers would be beneficial to protecting water quality[3]. The survey revealed that a majority (60%) of the properties around the lake appear to already be at or near optimal shoreline buffer conditions which indicates that maintenance and conservation efforts of these buffers is important in protecting the quality of Lac Courte Oreilles lake. The remainder of the properties are where shoreline buffer enhancement or establishment are necessary to reduce sediment and phosphorus discharge to the LCO Lakes which will help improve the quality of the lake.

Fisheries

Lac Courte Oreilles Lake is a two-story fishery lake. It is a lake capable of supporting warm water species such as walleye, bass, northern pike and muskellunge in its warmer, "top story" and in the deeper colder well-oxygenated "lower story" it supports cold-water species such as cisco and



[3] https://www.cola-wi.org/s/Shoreland-buffer-report.pdf

whitefish. The interaction between these top-story fisheries and lower-story fisheries is an essential interaction to maintaining the quality fishery of the lake. These 2nd story fish which are comprised of cisco and whitefish are a key component of prey for gamefish such as walleye, muskellunge, and northern pike. Having robust populations of cisco and whitefish help to maintain the quality trophy fishery for walleye, northern pike and muskellunge. In the absence of the cold-water fishery the gamefish would be less abundant, smaller and slower growing.

Warm-water Fishery

Lac Courte Oreilles Lake has a varied sport fishery which includes walleye, musky, panfish, largemouth and smallmouth bass, and northern pike. It is a stocked walleye lake with approximately 1.4 adult walleye per acre[4]. Table 1 includes a history of stocking by the WDNR over the last 20 years.

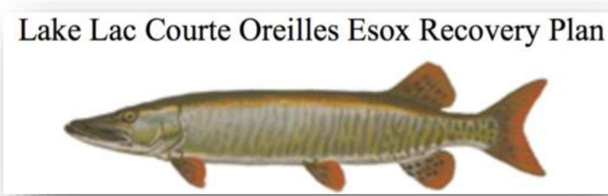
Table 1: Stocking History of LCO for Past 20 Years

Year	Species	Age Class	Number Stocked	Avg Length (in)
2019	WALLEYE	LARGE FINGERLING	25,660	6.48
2017	MUSKELLUNGE	LARGE FINGERLING	3,474	12.64
2017	WALLEYE	LARGE FINGERLING	51,353	5.32
2014	MUSKELLUNGE	LARGE FINGERLING	4,031	11.7
2011	MUSKELLUNGE	LARGE FINGERLING	2,519	9.8
2009	MUSKELLUNGE	LARGE FINGERLING	2,499	9.8
2009	WALLEYE	SMALL FINGERLING	100,810	1.7
2007	MUSKELLUNGE	LARGE FINGERLING	2,496	12.4
2005	MUSKELLUNGE	LARGE FINGERLING	1,882	11.85
2004	WALLEYE	SMALL FINGERLING	100,187	1.43
2003	MUSKELLUNGE	LARGE FINGERLING	2,493	11.1
2003	WALLEYE	FRY	4,900,000	0.2
2003	WALLEYE	SMALL FINGERLING	99,895	2.13

[4] https://dnr.wi.gov/topic/fishing/documents/north/SawyerLCO16SN1.pdf

Year	Species	Age Class	Number Stocked	Avg Length (in)
2002	WALLEYE	FRY	4,000,000	0.3
2001	MUSKELLUNGE	FRY	60,000	0.4
2001	MUSKELLUNGE	LARGE FINGERLING	2,519	10.95
2001	WALLEYE	FRY	3,800,000	0.3
2001	WALLEYE	SMALL FINGERLING	100,000	1.6
2000	MUSKELLUNGE	LARGE FINGERLING	1,500	12.1
2000	WALLEYE	FRY	2,250,000	0.3
1999	MUSKELLUNGE	FRY	75,000	0.5
1999	WALLEYE	FRY	2,900,000	0.2
1999	WALLEYE	SMALL FINGERLING	100,000	1.5

The muskellunge population in LCO lake is deemed impaired. Muskellunge are present but rare.



The musky population in Lac Courte Oreilles lake faces a variety of challenges that include extremely low natural reproduction, competition with other species (northern pike), low stocking success and adult mortality[5]. A musky recovery plan was initiated in 2016 to restore muskellunge as the dominant esoxx species in LCO and create a more desirable muskellunge fishery for both anglers and tribal harvesters[6]. The objectives of the plan include:

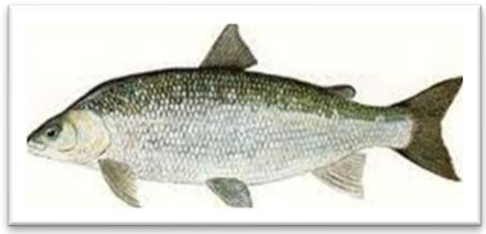
1. Reduce density of northern pike to acceptable levels
2. Increase density of adult muskellunge (to 0.2-0.3 adults per acre)
3. Improve muskellunge recruitment and stocking success

[5] https://dnr.wi.gov/topic/fishing/documents/north/SawyerLCOSN12016.pdf
[6] https://www.cola-wi.org/s/COLA-EsoxRecoveryPlan-April2017-pklb.pdf

The population of Largemouth bass in Lac Courte Oreilles Lake is increasing and may become a management problem. The increasing numbers of largemouth bass may be linked to a shift in the macrophyte community in the lake.[7] A majority of the near shore habit in the lake is sub-optimal habit for largemouth bass (rock cobble or sandy substrate without plants or woody structure); but an increase in survival of young fish facilitated by an increase in aquatic plants could lead to the development of a significant largemouth bass population (Kahn, 2010). Results of a recent survey of LCO residents suggests a significant increase in coverage and density of aquatic plant over the last twenty years.

Two-Story Fishery

LCO is unique in that it is one of only five of Wisconsin's approximately 15,000 lakes that is known to support both a lake whitefish and cisco population. These cold-water fish require a layer of water that has both cold enough temperatures and high enough oxygen for them to survive. Unfortunately, the populations of cisco and whitefish in LCO are threatened. Increased nutrient loading to the lake is resulting in reduced oxygen in the colder deeper portions of the lake causing fish kills of these species. One such massive die-off was documented in 2016[8]. The loss of this habitat is what prompted the EPA in 2018 to declare Lac Courte Oreilles Lake impaired due to low dissolved oxygen values.



Whitefish

Cisco

Rare and Endangered Species Habitat

Lac Courte Oreilles Lake is in T39N 40N, R8, 9W. Table 2 lists the species that the Wisconsin Natural heritage Inventory has listed for the Town and Range that Lac Courte Oreilles Lake is located in. The listing does not provide enough detail to know if the species are actually found in Lac Courte Oreilles Lake.

[7] Personal communication, Frank Pratt, WI DNR Fisheries Biologist (retired).

[8] https://static1.squarespace.com/static/589d2006ebbd1a9c437fd84a/t/599f4c5e893fc0e0670bc83c/1503612002051/PressRelease-LINKS-10-16-16.pdf

Table 2: Rare and Endangered Species (T39N 40N R8W R9W)

Scientific Name	Common Name	State Status[9]
Eleocharis robbinsii	Robbins' Spikerush	SC
Haliaeetus leucocephalus	Bald Eagle	SC/P
Lepomis megalotis	Longear Sunfish	THR
Potamogeton pulcher	Spotted Pondweed	END
Scirpus torreyi	Torrey's Bulrush	SC

PLANT COMMUNITY

The Courte Oreilles Lakes Association contacted Wisconsin Lake & Pond Resource, LLC (WLPR) to conduct a full aquatic plant survey of Lac Courte Oreilles Lake following WDNR survey protocol. This survey was designed to assess the current state of the plant community and to allow for comparison to previous plant surveys to document any changes in the plant community. The survey was completed on July 23-25, 2018. A copy of the full aquatic plant survey report is included in Appendix A.

Functions and Values of Aquatic Plants

Native aquatic plants play a key role in the ecology of a lake and are vital to the health of the lake. They can help to maintain water quality, prevent shoreline erosion and provide habit for a wide diversity of species from fish to amphibians to mammals. Table 3 lists the thirty-nine species of plants that were sampled or observed in Lac Courte Oreilles Lake during the 2018 survey and their ecological significance.

Table 3: Lac Courte Oreilles Lake Plants and Their Significance

Scientific Name	Common Name	Ecological Significance[10]
Myriophyllum spicatum	Eurasian water milfoil	**Invasive species**
Potamogeton crispus	Curly-leaf pondweed	**Invasive Species** Provides habitat for fish and invertebrates in the winter and spring when most other aquatic plants are reduced to rhizomes and winter buds. However, the midsummer die-off of curly-leaf pondweed creates a sudden loss of habitat and releases nutrients into the water column that can trigger algal blooms and create turbid water conditions.

[9] THR = Threatened, SC = Special Concern, SC/FL = Special Concern (federally protected as endangered or threatened), SC/P = Special Concern (federally protected), END = endangered
[10] Summarized from Through the Looking Glass. Borman etal. 1997.

Scientific Name	Common Name	Ecological Significance[10]
Bidens beckii (formerly Megalodonta)	Water marigold	The submersed foliage offers shade, shelter and foraging opportunities for fish. Waterfowl and shorebirds may consume the fruit when the plant produces it. It is considered an "indicator species." It is sensitive to changes in water quality and may be one of the first submersed plants to disappear from a lake when water quality declines.
Ceratophyllid demersum	Coontail	The stiff whorls of leaves offer prime habitat for a host of critters, particularly during the winter when many other plants are reduced to roots and rhizomes. Both the foliage and fruit are grazed by waterfowl. Bushy stems of coontail harbor many invertebrates and provide important shelter and foraging opportunities for fish.
Chara	Muskgrasses	A favorite waterfowl food. Algae and invertebrates found on it provide additional grazing. It is also considered valuable fish habitat. Beds of muskgrass offer cover and are excellent producers of food, especially for young trout, largemouth bass and smallmouth bass. The rhizoids slow the movement and suspension of sediments. Therefore, stands of muskgrass can benefit water quality. It is a good bottom stabilizer.
Elatine minima	Waterwort	Moss-like mats are grazed by a variety of ducks. It also offers habitat for zooplankton and fish fingerlings.
Eleocharis acicularis	Needle Spikerush	Provides food for a wide variety of waterfowl as well as muskrats. Submersed beds offer spawning habitat and shelter for invertebrates.
Eleocharis palustris	Creeping spikerush	It is an anchor of the nearshore community. The stems are spaced far enough apart for ducks and fish to navigate through a stand, but close enough to offer camouflage and dampen the force of waves. The nutlets are consumed a variety of waterfowl. Muskrats and geese graze on the rhizomes. Extensive beds help anchor sediment, buffer wave action and provide cover.
Elodea canadensis	Common waterweed	The branching stems offer valuable shelter and grazing opportunities for fish, although very dense stands can obstruct fish movement. It also provides food for muskrats and waterfowl.
Heteranthera dubia	Water star-grass	A locally important source of food for geese and ducks including northern pintail, blue-winged teal and wood duck. It also offers good cover and foraging opportunities for fish.
Isoetes sp.	Quillwort	Provide habit in low nutrient lakes that may have very limited plant growth. The foliage is sometimes consumed by waterfowl or game birds including sharp-tailed grouse.

Scientific Name	Common Name	Ecological Significance[10]
Juncus pelocarpus f. submersus	Brown-fruited rush	It can form a spreading turf in shallow water this valuable for fish spawning and invertebrate habitat. The emergent plants provide cover and seed for a variety of waterfowl and marsh birds. Stem shoots and roots may be grazed by muskrats.
Lemna minor	Small duckweed	It is a nutritious food source that can provide up to 90% of the dietary needs for a variety of ducks and geese. It is also consumed by muskrat, beaver and fish. Rafts of duckweed offer shade and cover for fish and invertebrates. Extensive mats of duckweed can also inhibit mosquito breeding.
Lemna trisulca	Forked duckweed	A good food source for waterfowl. Tangled masses of fronds also provide cover for fish and invertebrates.
Myriophyllum alterniflorum	Alternate-flowered watermilfoil	Leaves and fruit are consumed by a variety of waterfowl. The feathery foliage traps detritus and provides invertebrate habitat. Beds offer shade, shelter and foraging opportunities for fish.
Myriophyllum sibiricum	Northern water milfoil	Leaves and fruit are consumed by a variety of waterfowl. The feathery foliage traps detritus and provides invertebrate habitat. Beds offer shade, shelter and foraging opportunities for fish.
Myriophyllum tenellum	Dwarf water milfoil	Provides good spawning habitat for panfish and shelter for small invertebrates. The network of rhizomes helps stabilize sediment.
Najas flexilis	Bushy pondweed	It is one of the most important plants for waterfowl. Stems, leaves and seeds are all consumed by a wide variety of ducks. It is also important to a variety of marsh birds as well as muskrats. It is a good producer of food and shelter for fish.
Nitella sp.	Nitella	It is sometimes grazed by waterfowl. The algae and invertebrates on its surface are attractive to ducks and geese. It also offers foraging opportunities for fish.
Nuphar variegata	Spatterdock	It anchors the shallow water community and provide food for many residents. It provides seeds for waterfowl. The leaves, stems and flowers are grazed by deer. Muskrat, beaver and even porcupine have been reported to eat the rhizomes. The leaves offer shade and shelter for fish as well as habitat for invertebrates.
Nymphaea odorata	White water lily	It provides seeds for waterfowl. The leaves, stems and flowers are grazed by deer. Muskrat, beaver and even porcupine have been reported to eat the rhizomes. The leaves offer shade and shelter for fish.

Scientific Name	Common Name	Ecological Significance[10]
Pontederia cordata	Pickerelweed	The flowering stalk is a haven for many insects - some seeking nectar and others a spot to rest. The seeds are consumed by waterfowl as well as muskrats. Networks of rhizomes and leaves also offer shade and shelter for fish. Beds can be important shoreline stabilizers and help dampen wave action.
Potamogeton amplifolius	Large-leaf pondweed	The broad leaves offer shade, shelter and foraging opportunities for fish. Abundant production of large nutlets makes this a valuable waterfowl food.
Potamogeton friessii	Fries' pondweed	It can be a locally important food source for a variety of ducks and geese. It may also be grazed by muskrat, deer, beaver and moose. It provides a food source and cover for fish.
Potamogeton gramineus	Variable pondweed	The fruits and tubers are grazed by a variety of waterfowl. The foliage and fruit may also be eaten by muskrat, beaver and deer. The extensive network of leafy branches offers invertebrate habitat and foraging opportunities for fish.
Potamogeton illinoensis	Illinois pondweed	The fruit which are produced are grazed by a variety of waterfowl. The fruit may also be eaten by muskrat, beaver and deer. Offers excellent shade and cover for fish and good surface area for invertebrates.
Potamogeton natans	Floating-leaf pondweed	The fruit is held on the stalk until late in the growing season. This provides valuable grazing opportunities for ducks and geese. Portions of the plant may also be consumed by muskrat, beaver and deer. It is considered good fish habitat because it provides shade and foraging opportunities.
Potamogeton praelongus	White-stem pondweed	The fruit provides valuable grazing opportunities for ducks and geese. Portions of the plant may also be consumed by muskrat, beaver and deer. It is considered a good food producer for trout and valuable habitat for muskellunge.
Potamogeton pusillus	Small pondweed	It can be a locally important food source for a variety of ducks and geese. It may also be grazed by muskrat, deer, beaver and moose. It provides a food source and cover for fish.
Potamogeton richardsonii	Clasping-leaf pondweed	It can be a locally important food source for a variety of ducks and geese. It may also be grazed by muskrat, deer, beaver and moose. It provides a food source and cover for fish.
Potamogeton robbinsii	Fern pondweed	It provides habitat for invertebrates that are grazed by waterfowl. It also offers good cover and foraging opportunities for fish, particularly northern pike.

Scientific Name	Common Name	Ecological Significance[10]
Potamogeton zosteriformis	Flat-stem pondweed	It can be a locally important food source for a variety of ducks and geese. It may also be grazed by muskrat, deer, beaver and moose. It provides a food source and cover for fish.
Ranunculus aquatilis	Stiff water crowfoot	As flowers give way to fruit, the water crowfoot bed becomes a choice spot for dabbling ducks. Both fruit and foliage are consumed by variety of waterfowl. When it is growing in shallow zones, it is sometimes consumed by upland game birds including ruffed grouse. Stems and leaves provide valuable invertebrate habitat and it is considered a fair producer of food for trout.
Ranunculus flammula	Creeping spearwort	Sprawling submersed beds of spearwort offer valuable invertebrate habitat and fish spawning areas.
Sagitaria sp.	Arrowhead	It is one of the highest value aquatic plants for wildlife. Waterfowl depend on the high-energy tubers during migration and the seeds are also consumed by a wide variety of ducks, geese, marsh birds and shore birds. Muskrats, beavers and porcupines are known to eat both tubers and leaves. Arrowhead beds offer shade and shelter for young fish.
Schoenoplectus acutus	Hardstem bulrush	It offers habitat for invertebrates and shelter for young fish, especially northern pike. The nutlets are consumed by a wide variety of waterfowl, marsh birds (including bitterns, herons, rails) and upland birds. Stems and rhizomes are eaten by geese and muskrats. Bulrushes also provide nesting material and cover for waterfowl, marsh birds and muskrats.
Sparganium angustifolium	Narrow-leaved bur-reed	Colonies of bur-reed help anchor sediment and provide nesting sites for waterfowl and shorebirds. The fruit is eaten by a variety of waterfowl including mallards and tundra swans. The whole plant is grazed by muskrat and deer.
Stuckenia pectinata	Sago pondweed	It is considered one of the top food producers for waterfowl. Both the fruit and tubers are heavily grazed and are considered critical for a variety of migratory waterfowl. It also proved food and shelter for juvenile fish.

Scientific Name	Common Name	Ecological Significance[10]
Vallisneria americana	Wild celery	It is a premier source of food for waterfowl. All portions of the plant are consumed including foliage, rhizomes, tubers and fruit. Wild celery is a prime destination for canvasback ducks. It is also important to marsh birds and shore birds including rail, plover, sand piper and snipe. Muskrats are also known to graze on it. Beds are considered good fish habitat providing shade, shelter and feeding opportunities.

Aquatic Plant Survey Results

The aquatic plant community of Lac Courte Oreilles was sampled on July 23-25, 2018 by WLPR. A full point-intercept survey was completed and included sampling at 2,254 locations. A summary of the sampling statistics is included in Table 4.

During the survey in 2018, vegetation within LCO was limited to mainly to shallow flats and bays because of the steep-dropping bottom in many areas. There were many locations that, though within the photic zone, did not provide ideal growing conditions due to nutrient limitation with sandy sediments. This pattern in most recent years appears to be changing with aquatic plants beginning to occupy sandy sediment areas that historically have been vegetation free. Increasing nutrient levels in the lake is believed to be contributing to the aquatic plant colonization's of these less than ideal plant growing areas.

Table 4: 2018 Lac Courte Oreilles Lake Aquatic Plant Survey Statistics

SUMMARY STATS:	
Total number of points sampled	2254
Total number of sites with vegetation	515
Total number of sites shallower than maximum depth of plants	763
Frequency of occurrence at sites shallower than maximum depth of plants	67.5%
Simpson Diversity Index	.93
Maximum depth of plants (ft)	21
Average number of all species per site (shallower than max depth)	1.67
Average number of all species per site (veg. sites only)	2.48
Average number of native species per site (shallower than max depth)	1.67
Average number of native species per site (veg. sites only)	2.47
Species Richness	39
Floristic Quality Index	40
Average Coefficient of Conservatism	6.67

The aquatic macrophyte community of the Lake included 39 floating-leaf, emergent, and submerged aquatic plant species during 2018. Plants were found growing to a maximum depth of 21 feet, with only 763 of the 2,254 locations shallower than this and 67.5% of locations within the photic zone were vegetated. Slender naiad (*Najas flexilis*) was the most dominant species sampled in 2018, found at 20.6% of photic-zone locations. This species is commonly found in Wisconsin and has no substrate preference, growing in many different habitats. Common waterweed (*Elodea canadensis*) and wild celery (*Vallisneria Americana*), are both native plants, valuable for near-shore sediment stabilization and are important food sources for waterfowl and were the next most common species sampled (Table 5). The variability of lake substrates within the littoral zone of LCO Lake allow for a wide range of species to grow and is depicted in Figure 11. Sand was the most dominant substrate type (53%) followed by muck (30%) and then rock (17%).

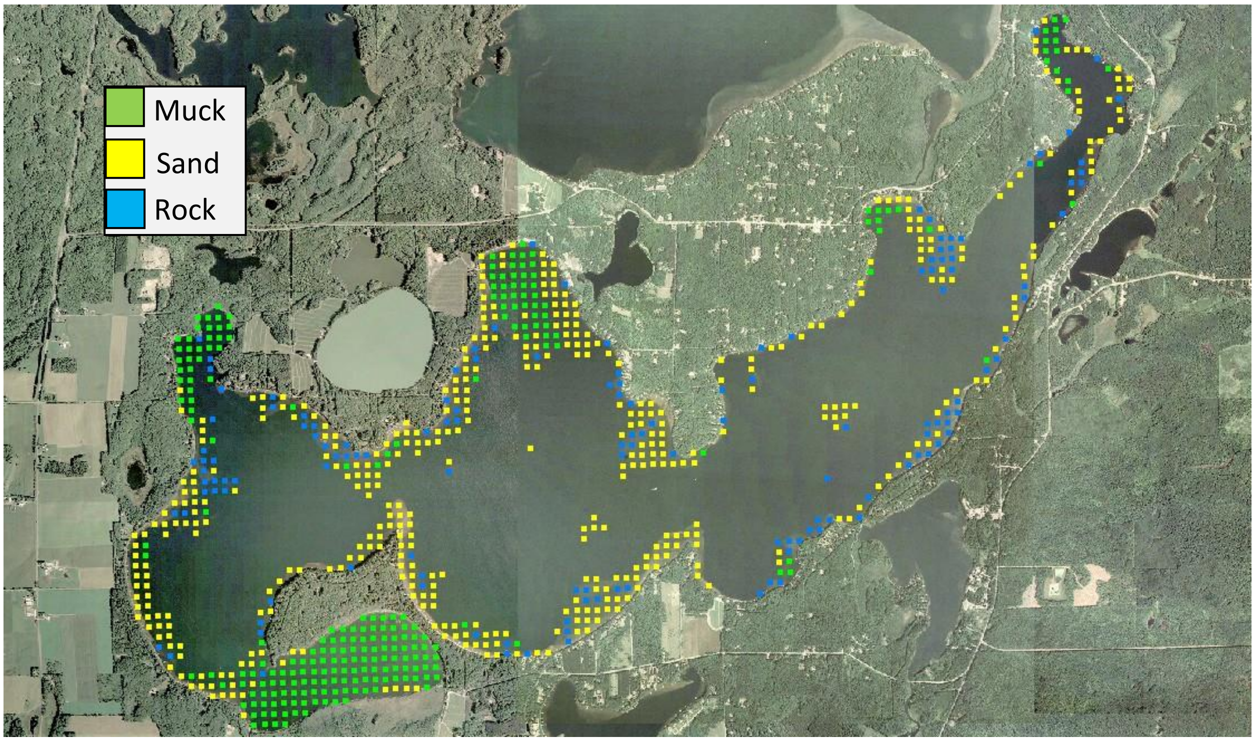
Table 5: 2018 Aquatic Plant taxa-specific Statistics

Common Name	% Frequency of Occurrence within vegetated areas	% Frequency of Occurrence at sites shallower than max depth of plants	% relative Frequency of Occurrence	# of intercept points where detected	Average Density
Eurasian water milfoil	**0.39**	**0.26**	**0.16**	**2**	**1**
Curly-leaf pondweed	**0.39**	**0.26**	**0.16**	**2**	**1**
Water marigold	1.36	0.92	0.55	7	1
Coontail	20.19	13.63	8.14	104	1.1
Muskgrasses	17.67	11.93	7.13	91	1
Waterwort	0.78	0.52	0.31	4	1
Needle spikerush	7.96	5.37	3.21	41	1
Creeping spikerush	0.19	0.13	0.08	1	1
Common waterweed	25.83	17.43	10.42	133	1.02
Water star-grass	8.16	5.5	3.29	42	1
Quillwort	5.44	3.67	2.19	28	1
Brown-fruited rush	0.58	0.39	0.23	3	1
Small duckweed	0.19	0.13	0.08	1	1
Forked duckweed	0.19	0.13	0.08	1	1
Alternate-flowered watermilfoil	1.94	1.31	0.78	10	1
Northern watermilfoil	15.92	10.75	6.42	82	1.04
Dwarf watermilfoil	4.85	3.28	1.96	25	1
Slender naiad	30.49	20.58	12.29	157	1
Nitella	4.08	2.75	1.64	21	1
Spatterdock	0.97	0.66	0.39	5	1
White water lily	0.97	0.66	0.39	5	1
Pickerelweed	0.58	0.39	0.23	3	1
Large-leaf pondweed	2.72	1.83	1.1	14	1
Fries' pondweed	1.36	0.92	0.55	7	1

Common Name	% Frequency of Occurrence within vegetated areas	% Frequency of Occurrence at sites shallower than max depth of plants	% relative Frequency of Occurrence	# of intercept points where detected	Average Density
Variable pondweed	13.01	8.78	5.25	67	1
Illinois pondweed	0.39	0.26	0.16	2	1
Floating-leaf pondweed	0.39	0.26	0.16	2	1
White-stem pondweed	2.52	1.7	1.02	13	1
Small pondweed	13.59	9.17	5.48	70	1.09
Clasping-leaf pondweed	14.56	9.83	5.87	75	1.05
Fern pondweed	7.77	5.24	3.13	40	1.08
Flat-stem pondweed	16.12	10.88	6.5	83	1
White water crowfoot	3.69	2.49	1.49	19	1
Creeping spearwort	0.19	0.13	0.08	1	1
Arrowhead	0.19	0.13	0.08	1	1
Hardstem bulrush	1.17	0.79	0.47	6	1
Narrow-leaved bur-reed	0.19	0.13	0.08	1	1
Sago pondweed	0.19	0.13	0.08	1	1
Wild celery	20.78	14.02	8.38	107	1

Frequency of occurrence within vegetated areas (%): *Number of times a species was seen in a vegetated area divided by the total number of vegetated sites.*
Frequency of occurrence at sites shallower than maximum depth of plants: *Number of times a species was seen divided by the total number of sites shallower than maximum depth of plants (whole lake value-how often it occurs within the entire littoral zone)*

Figure 11: Lac Courte Oreilles Lake Littoral Zone and Substrate Type



Two AIS were found during the survey. These were Eurasian watermilfoil and curly-leaf pondweed. These species can grow rapidly and dense, reaching the surface and forming a canopy that shades out native species and hampers recreational opportunities. The life cycle of curly-leaf pondweed is different from all other aquatic plants in Wisconsin. CLP dies back during mid to late summer, typically in July. Because of this, early-season surveys typically completed in April-May are required to accurately document distribution of CLP within a lake. It is likely that CLP is under-represented in the survey completed due to this. Though historically dense in some locations within LCO, there were no locations of dense CLP growth noted during this survey. EWM is a new invader into LCO being first identified in 2017. During the 2018 survey it was found primarily in scattered locations with one dense bed mapped at 0.5 acres.

Species Richness

The total number of species identified was 39. Two AIS – Eurasian watermilfoil and curly-leaf pondweed were found to be present in the lake. The species sampled were present in four categories: emergent, near shore species which are rooted below the water's surface, but their growth extends above the water (i.e. bur-reed - *Sparganium sp.*), submersed species which root on the lake bottom and remain below the water's surface (i.e. coontail – *Ceratophyllid* *demersum*), free-floating species which are not rooted to the lake bottom an freely float on the surface (i.e. forked duckweed – *Lemna trisulca*), and floating-leaf species which root on the lake bottom with vegetation growing to and floating on the surface (i.e. white water lily – *Nymphaea odorata*).

Plant Diversity

Lac Courte Oreilles Lake has a very diverse plant community consisting of 37 native species and two exotic species for a total count of 39 species. The Simpson's diversity index (SDI) is also very high at 0.93 indicating a healthy ecosystem and a high degree of diversity. The SDI value can range from 0 to 1.0. The greater the value, the more diverse the plant community is in a lake. No single plant dominates within the lake. The plant species abundance is very balanced between many different types.

Floristic Quality Index

The Floristic Quality Index (FQI) is an index developed by Dr. Stanley Nichols of the University of Wisconsin-Extension. This index is a measure of the plant community in response to development (and human influence) on the lake. It considers the species of aquatic plants found and their tolerance for changing water quality and habitat quality. The index uses a conservatism value assigned to various plants ranging from 1 to 10. Non-native plants don't have a conservatism value. A high conservatism value indicates that a plant is intolerant to disturbance while a lower value indicates tolerance. Those plants with higher values are more apt to respond adversely to water quality and habitat changes, largely due to human influence. The FQI is calculated using the number of species and the average conservatism value of all species used in the index.

The formula is:

$$FQI = \text{Mean } C \cdot \sqrt{N}$$

Where C is the conservatism value and N is the number of species.

A higher FQI, indicates a healthier aquatic plant community. This value can then be compared to the mean for other lakes in the assigned eco-region. There are four eco-regions used throughout Wisconsin. These are Northern Lakes and Forests, Northern Central Hardwood Forests, Driftless Area, and Southeastern Wisconsin Till Plain. Lac Courte Oreilles Lake is in the Northern Lakes and Forest eco-region. Lakes within the Northern Lakes and Forest region are typically natural lakes created by glaciation with lower shoreline and overall development in the watershed. Lessened development around the lake and in the watershed and overall use of these lakes leads to fewer disturbances and nearer undisturbed, natural conditions when compared to lakes in other ecoregions. Low disturbance leads to increased plant community metrics like FQI and coefficient of conservatism.

There were 36 species used to calculate the FQI for LCO. LCO has a mean C value at the eco-region median with a very high FQI (40). Refer to Table 6. This high FQI exceeds the upper quartile for all lakes in the eco-region (Northern Lakes and Forests). The number of species of plants in the lake also exceeds the upper quartile for the eco-region. Figure 12 compares these values to the ecoregion. The high FQI is indicative of a plant community that is intolerant to development and other human disturbances in the watershed. It indicates that the plant community is healthy and has changed little in response to human impact on water quality and habit (sediment) changes.

Table 6: C values and FQI for LCO Lake 2018

Common Name	C value
Water marigold	8
Coontail	3
Muskgrasses	7
Waterwort	9
Needle spikerush	5
Creeping spikerush	6
Common waterweed	3
Water star-grass	6
Quillwort	8
Brown-fruited rush	8
Small duckweed	4
Forked duckweed	6
Alternate-flowered watermilfoil	10
Northern watermilfoil	6
Dwarf watermilfoil	10
Slender naiad	6
Nitella	7
Spatterdock	6
White water lily	6
Pickerelweed	8
Large-leaf pondweed	7
Fries' pondweed	8
Variable pondweed	7
Illinois pondweed	6
Floating-leaf pondweed	5
White-stem pondweed	8
Small pondweed	7
Clasping-leaf pondweed	5
Fern pondweed	8

Common Name	C value
Flat-stem pondweed	6
White water crowfoot	8
Creeping spearwort	9
Hardstem bulrush	6
Narrow-leaved bur-reed	9
Sago pondweed	3
Wild celery	6
Total Species	36
Mean C	6.67
Floristic Quality Index (FQI)	**40**

Note: There is no Coefficient of Conservatism for exotic species such as Curly leaf pondweed or plants not identified to the species level (i.e. Sagittaria sp.).

Coefficient of Conservatism C

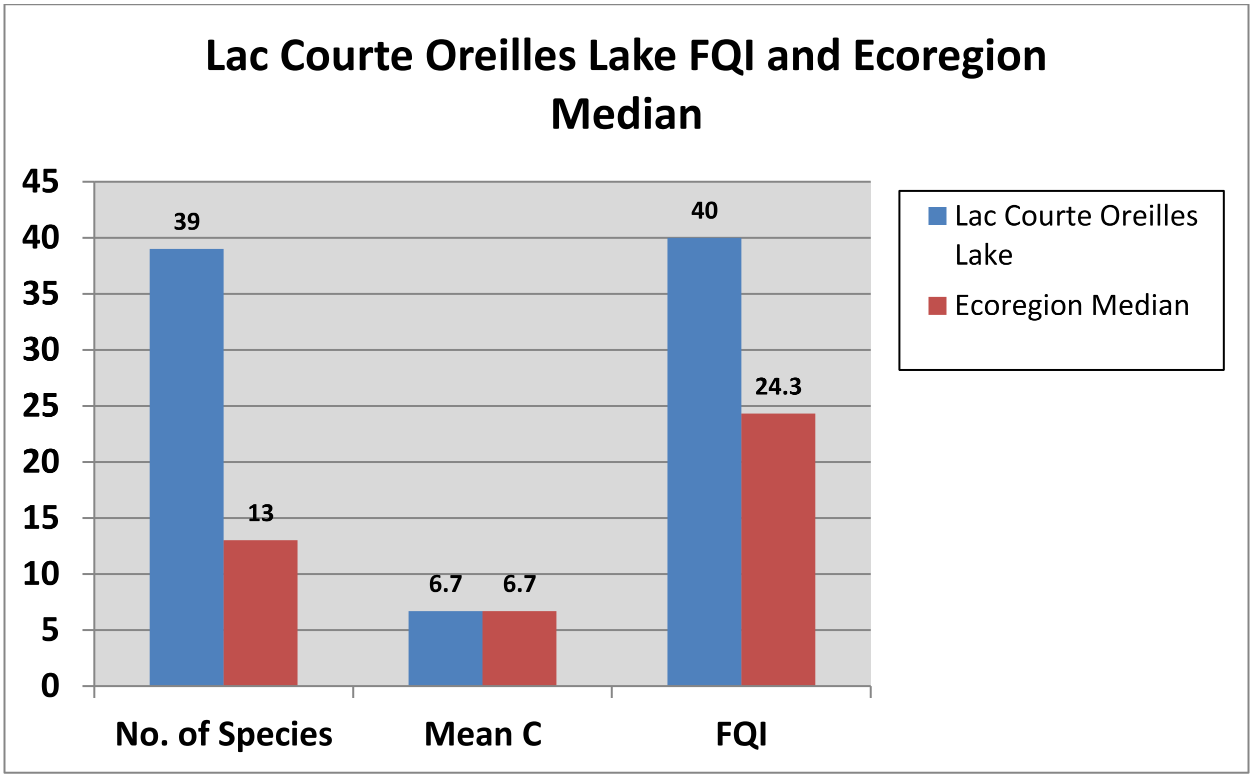
0-3 taxa found in wide variety of plant communities and very tolerant of disturbance.

4-6 taxa associated with specific plant communities and tolerates moderate disturbance.

7-8 taxa found in narrow range of plant communities and tolerate minor disturbance.

9-10 taxa restricted to a narrow range of conditions with low tolerance of disturbance.

Figure 12: LCO Lake Comparison to Ecoregion Median



Historical Comparison to Past Surveys

The most recent aquatic plant survey conducted in 2018 repeated the original 2010 survey and used the same sampling grid and points. This allows for a direct comparison of the aquatic plant community and changes of individual species between events. For comparison only the 2010 whole-lake survey data was used. A second survey of only Musky Bay was completed at a separate time with results included in the discussion for Musky Bay only.

Overall, Lac Courte Oreilles was very comparable between surveys with excellent diversity and aquatic plant community health indicators. From 2010 to 2018 the total aquatic plant community remained extremely diverse and healthy. During both surveys over 30 species were sampled, SDI was high nearly identical at 0.93 and 0.94, average coefficient of conservatism slightly increased, and the FQI was within the upper quartile for lakes State-wide and within the ecoregion (Table 7). Additional species found during a special survey of Musky Bay only are not included in this discussion.

Table 7: Comparative Aquatic Plant Community Statistics, LCO Lake

Year	2010	2018
Date Sampled	8/2-4, 8/9-11	7/23-25
Points Sampled	820	2254*
Points with vegetation	626	515
Points shallower than maximum depth of plants	810	763
Frequency of occurrence	77.28%	67.50%
Simpson Diversity Index	0.94	0.93
Maximum depth of plants (ft)	24	21
Average number of species per site (shallower than max depth)	2.26	1.67
Average number of species per site (veg. sites only)	2.93	2.48
Average number of native species per site (shallower than max	2.1	1.67
Average number of native species per site (veg. sites only)	2.88	2.47
Species Richness	30	39
Floristic Quality Index	32.05	40
Average Coefficient of Conservatism	6.54	6.67

**Total number of sampling points on WDNR generated sampling grid. Not all points were actually sampled.*

A few notable, positive changes were noted from the 2010 to 2018 surveys; total species sampled and FQI increased significantly from 30 to 39 and 32.05 to 40.0, respectively. Both community indicators show an increasingly healthy and diverse aquatic plant population. An increase in FQI is directly related to the increased number of species sampled. This is especially the case as 11 species sampled in 2018 were not present in the 2010 survey. These include high quality, uncommon species with raised coefficients of conservatism.

High quality species newly identified in 2018 and their coefficients of conservatism include; small waterwort (*Elatine minima* – 9), brown-fruited rush (*Juncus pelocarpus* – 8), alternate-flowered water-milfoil (*Myriophyllum alterniflorum* – 10), pickerelweed (8), creeping spearwort (*Ranunculus flammula* – 9), and narrow-leaved bur-reed (*Sparganium angustifolium* – 9). Interestingly, all these species are commonly found in near-shore areas and, outside of narrow-leaved bur-reed, small in stature and can be easily overlooked. It is likely that these species were present in 2010, but simply missed due to difficulty collecting a sample with a rake and variance in direct sampling locations due to GPS accuracy, among other factors.

Continuing presence – absence comparison there were three aquatic plant species identified in 2010 that were not sampled in 2018: pipewort (*Ericolin aquaticum*), water lobelia (*Lobelia dortmanna*), and common reed (*Phragmites australis*). Similar to the new species sampled in 2018, these “missing” species are mainly small, near shore species and still present in the Lake. Lobelia was visually noted outside of direct sample areas in 2018.

To further assess changes of individual species a statistical comparison using a Chi-square test was completed. Statistical changes were noted from 2010 to 2018 as both increases and decreases for 21 individual species (Table 8). In total, 13 species were noted to have declined and eight increased significantly. Changes in the makeup of an aquatic plant community are expected over time and not an immediate cause for concern as environmental conditions vary. However, significant management of CLP in Musky Bay has taken place between surveys and is a localized, direct impact to a large area of LCO. Changes of the aquatic community to Musky Bay are discussed in detail in the following section.

To better assess changes in LCO independent from a concentrated AIS management regime the Musky Bay sample points were removed from the data pool. Remaining sample points were then re-assessed following the same protocol used above. This allows pinpointing of the data and potential reason for statistical changes. Curly-leaf pondweed, for example, significantly reduced from 2010 to 2018 when using the entire lake's data. But, when removing the Musky Bay sample points, there was nearly no change in abundance in the rest of LCO. This shows the change was only in Musky Bay. The same is true for coontail, common waterweed, and white-water crowfoot (*Ranunculus aquatillus*) where the statistical decline was limited to Musky Bay and due to targeted management.

In using data for LCO without Musky Bay there were statistically significant changes in 15 species; 9 decreased and 6 increases (Table 8). All species that increased significantly between surveys were also noted to increase when using the entire lake's data, showing the change was outside of Musky Bay. Two species of note, water star-grass and white-stem pondweed (*Potamogeton praelongis*), provide important habitat for fish and aquatic organisms. Similarly, the species that declined significantly also did so when including the Musky Bay data. This shows that management practices in Musky Bay were not the driving cause for that location and non-target impact from management practices had a lessened effect than initially assessed.

Again, changes in individual species will occur over time. With 8 years passing between surveys some change is expected on a small scale due to environmental factors. More importantly, the indicators of the aquatic plant community remained excellent and slightly increased, showing continued health and diversity of Lac Courte Oreilles.

Table 8: Statistical Significance of Species between Sampling Events, Lac Courte Oreilles Lake

	Littoral Zone Frequency of Occurrence		2018 v 2010			2018 v 2010 - Without Musky Bay		
Species	**2010**	**2018**	**+/-**	**p-value**	**significance**	**+/-**	**p-value**	**significance**
Eurasian water milfoil	---	0.26	↑	0.144828	ns.	↑	0.142449	ns.
Curly-leaf pondweed	3.83	0.26	↓	**8.19E-07**	***	↓	0.605536	ns.
Water marigold	7.53	0.92	↓	**1.15E-10**	***	↓	**2.47E-10**	***
Coontail	18.27	13.63	↓	**0.012138**	*	↑	0.214288	ns.
Muskgrasses	15.56	11.93	↓	**0.036989**	*	↓	**0.013774**	*
Waterwort	---	0.52	↑	**0.039084**	*	↑	**0.037908**	*
Needle spikerush	0.12	5.37	↑	**1.08E-10**	***	↑	**2.81E-11**	***
Creeping spikerush	---	0.13	↑	0.302697	ns.	↑	0.299857	ns.
Common waterweed	24.69	17.43	↓	**0.000427**	***	↓	0.705251	ns.
Pipewort	3.09	---	↓	**2.19E-07**	***	↓	**4.06E-07**	***
Water star-grass	0.12	5.5	↑	**6.10E-11**	***	↑	**0.014272**	*
Quillwort	5.31	3.67	↓	0.117627	ns.	↓	0.15745	n's
Brown-fruited rush	---	0.39	↑	0.07405	n's	↑	0.072327	ns.
Small duckweed	---	0.13	↑	0.302697	n's	↑	0.299857	n.s.
Forked duckweed	---	0.13	↑	0.302697	n.s	↑	0.299857	n.s.
Water lobelia	0.12	---	↓	0.169614	n.s	↓	0.172049	n.s.
Alternate-flowered water-milfoil	---	1.31	↑	**0.001081**	**	↑	**0.001003**	**
Northern water-milfoil	6.91	10.75	↑	**0.007233**	**	↓	0.870999	n.s
Dwarf water-milfoil	7.78	3.28	↓	**0.000103**	***	↓	**0.000238**	***
Slender naiad	12.84	20.58	↑	**5.11E-05**	***	↓	0.628235	n.s.
Nitella	9.63	2.75	↓	**1.98E-08**	***	↓	**1.03E-08**	***
Spatterdock	0.12	0.66	↑	0.22391	n.s	↑	0.942977	n.s.
White water lily	0.25	0.66	↑	0.22391	n.s.	↑	0.597255	n.s.
Common reed	Visual Only	---	↓	0.331617	n.s.	↓	0.334398	n.s.
Pickerelweed	---	0.39	↑	0.07405	n.s.	↑	0.299857	n.s.
Large-leaf pondweed	2.72	1.83	↓	0.188857	n.s.	↓	0.050835	n.s.
Fries' pondweed	---	0.92	↑	**0.006293**	**	↑	**0.005973**	**
Variable pondweed	14.07	8.78	↓	**9.81E-05**	***	↓	**0.000161**	***
Illinois pondweed	0.86	0.26	↓	0.113589	n.s.	↓	0.117358	n.s.
Floating-leaf pondweed	0.12	0.26	↑	0.528705	n.s	↑	0.521978	n.s.
White-stem pondweed	0.49	1.7	↑	**0.020362**	*	↑	**0.025717**	*
Small pondweed	10.99	9.17	↓	0.2331	n.s	↓	0.190136	n.s.
Clasping-leaf pondweed	9.14	9.83	↑	0.638611	n.s	↓	0.206363	n.s.
Fern pondweed	13.21	5.24	↓	**5.77E-08**	***	↓	**1.42E-05**	***
Flat-stem pondweed	15.93	10.68	↓	**0.003389**	**	↓	**0.000277**	***
White water crowfoot	6.05	2.49	↓	**0.000522**	***	↓	0.479978	n.s.
Creeping spearwort	---	0.13	↑	0.302697	n.s	↑	0.299857	n.s.
Arrowhead	---	0.13	↑	0.302697	n.s	↑	0.299857	n.s.
Hardstem bulrush	0.74	0.79	↑	0.917211	n.s	↓	0.853984	n.s.
Narrow-leaved bur-reed	---	0.13	↑	0.302697	n.	↑	0.299857	n.s.
Sago pondweed	---	0.13	↑	0.302697	n.s	↑	0.299857	n.s.
Wild celery	22.84	14.02	↓	**3.09E-06**	***	↓	**6.81E-05**	***

*,**,*** - Levels of significance

n.s. - Change not significant
--- Specie was not sampled

Musky Bay Historical Comparison

Reduction of CLP, the main goal of the treatments, has been largely successful in Musky Bay since 2009. Originally, over 90 acres were managed which, over time, has been drastically reduced. However, due to a large accumulation of turions, reproductive structures for CLP, within the sediment, patches of CLP growth pop up each year. These patches vary in location and density between years and, until exhausted, may continue to cause nuisance within Musky Bay. In 2018 areas of CLP growth requiring management was reduced to only 5.0 acres, showing excellent control since 2009.

Native species restoration and limiting non-target impact is also an important goal of all AIS management. Though successful, CLP control within Musky Bay has not been without impact to non-target native species, which peaked in 2012 following consecutive years of aggressive herbicide applications of endothall at bay-wide rates. Endothall is not only active on curly-leaf pondweed, but also native species of pondweeds. Since 2007, there have been 11 different native pondweeds sampled within Musky Bay with up to 10 of them present per year (2007 and 2016).

When comparing the 2018 survey data to historical, 2007 & 2010 pre large-scale management data, it would appear at first glance that management has had a profound, negative affect on native species, as 10 are indicated to have declined significantly (Table 9). However, some of the indicated declines of native species are exaggerated due to the conditions inferred in the statistical comparison.

In 2007 and 2018, the sample set of points was much smaller compared to 2010 and 2016, where a denser survey grid introduced many more sample points. When increasing sample points, the statistical comparison assumes the same conditions would apply to all components in Musky Bay. However, the habitat requirements some species (shallow, sandy areas) may occupy only make up a small portion of Musky Bay. Though the sample points increase, the area of suitable habitat remained the same.

From 2016 to 2018 the plant community remained relatively stable under small scale management of CLP. Only two species, wild celery and chara, were noted to have a significant decline in population. Conversely, five species increased significantly; water star-grass, northern water-milfoil, slender naiad, clasping-leaf pondweed, and flat-stem pondweed. Changes between these surveys should be noted as natural variance of the community and not a cause for alarm. Clasping- leaf pondweed, for example, has been documented to fluctuate dramatically on a two-year cycle within Musky Bay. Its presence varies from high to low every other year with

2018 being a year of high distribution. Chara, on the other hand, is still above historical 2007 levels and has significantly increased from 2010. The downturn of chara in 2018 is not a cause for concern.

When digging deeper into the initial 2007 pre-management data, more changes are evident and CLP management has influenced some species of Musky Bay. Of concern are the decreases of large-leaf pondweed, fern pondweed, and flat-stem pondweed. All these species are susceptible to the active ingredient endothall used for herbicide control of CLP in Musky Bay. The early whole-bay treatments for CLP management significantly reduced populations of these native species. All, however, are beginning an upward trend since. Fern pondweed and flat- stem pondweed was both absent for periods from surveys after 2010. Both have become re-established since.

Table 9: Statistical Significance of Species between Sampling Events, Musky Bay

Species	2018 v 2016			2018 v 2010			2018 v 2007		
	+/-	P-value	significance	+/-	P-value	significance	+/-	P-value	significance
Curly-leaf pondweed	↑	0.418853	n.s.	↓	**6.50E-08**	***	↓	**1.70E-12**	***
Filamentous algae	---	---	---	---	---	---	↓	0.027343	*
Water marigold	↓	0.41627	n.s.	↓	**0.00898**	**	↑	0.656573	n.s.
Coontail	↓	0.1790071	n.s.	↓	2.10E-18	***	↓	**8.90E-08**	***
Chara	↓	**0.00588**	**	↑	**0.00231**	**	↑	0.172579	n.s.
Needle spikerush	↑	0.9821684	n.s.	↑	0.982168	n.s.	↑	0.305303	n.s.
Elodea	↑	0.3213072	n.s.	↓	8.80E-22	***	↓	**2.90E-14**	***
Water horsetail	---	---	---	---	---	---	---	---	---
Water stargrass	↑	1.42E-06	***	↑	3.70E-26	***	↑	**1.60E-10**	***
Quillwort	---	---	---	---	---	---	↓	0.088642	n.s.
Small duckweed	↓	0.5683229	n.s.	↓	0.568323	n.s.	---	---	---
Forked duckweed	↓	0.5683229	n.s.	↓	0.568323	n.s.	---	---	---
Watermoss	---	---	---	---	---	---	---	---	---
Northern water-milfoil	↑	0.000606	***	↑	1.00E-08	***	↑	**6.10E-05**	***
Dwarf water-milfoil	↓	0.5683229	n.s.	↓	0.419311	n.s.	↓	0.165291	n.s.
Slender naiad	↑	2.31E-26	***	↑	3.90E-53	***	↑	**2.00E-20**	***
Nitella	↑	0.0790642	n.s.	↑	0.079064	n.s.	↑	0.305303	n.s.
Spatterdock	↑	0.5353416	n.s.	↑	**0.01849**	*	↑	0.614698	n.s.
White water lily	↓	0.871537	n.s.	↑	0.613804	n.s.	↓	0.17041	n.s.
Pickerelweed	↑	0.0888125	n.s.	↑	**0.01292**	*	↑	0.53477	n.s.
Large-leaf pondweed	↑	0.1059739	n.s.	↑	0.659655	n.s.	↓	**0.00047**	***
Leafy pondweed	↓	0.5683229	n.s.	---	---	---	↓	0.327468	n.s.
Frie's pondweed	↓	0.4193111	n.s.	---	---	---	↓	**0.04886**	*
Variable pondweed	↓	0.4193111	n.s.	↓	0.25248	n.s.	↓	**0.04886**	*
Illinois pondweed	---	---	---	---	---	---	↓	**0.02734**	*
Floating-leaf pondweed	---	---	---	---	---	---	---	---	---
White-stem pondweed	↓	0.0680142	n.s.	↓	0.860613	n.s.	↑	0.472195	n.s.
Small pondweed	↑	0.234421	n.s.	↑	0.088813	n.s.	↓	**0.0224**	*
Clasping-leaf pondweed	↑	**0.00771**	**	↑	0.403809	n.s.	↓	0.693102	n.s.
Fern pondweed	↑	0.4188529	n.s.	↓	3.30E-05	***	↓	**1.20E-50**	***
Flat-stem pondweed	↑	4.97E-07	***	↑	0.134756	n.s.	↓	**0.00056**	***
Stiff water crowfoot	↓	0.2292514	n.s.	↓	2.70E-06	***	↓	**0.0122**	*
Grass-leaved arrowhead	---	---	---	---	---	---	↓	0.165291	n.s.
Arrowhead species	↓	0.4193111	n.s.	↓	0.568323	n.s.	↓	0.327468	n.s.
Hard-stem bulrush	↑	0.401377	n.s.	↑	0.401377	n.s.	↑	0.974058	n.s.
Bur-reed species	---	---	---	---	---	---	---	---	---
Floating-leaved bur-reed	---	---	---	---	---	---	↓	0.165291	n.s.
Narrow-leaved bur-reed	↓	0.5683229	n.s.	---	---	---	---	---	---
Large duckweed	↓	0.5683229	n.s.	↓	0.419311	n.s.	---	---	---
Common bladderwort	↓	0.3221364	n.s.	---	---	---	---	---	---
Wild celery	↓	**0.01238**	*	↓	**0.01238**	*	↓	0.412633	n.s.

*,**,*** - Levels of significance

n.s. - Change not significant

--- Specie was not sampled

Invasive Species

Aquatic invasive species (AIS) are defined by their tendency to out-compete native species which threatens the balance and diversity of the plants and animals that are native to that ecosystem. There are currently two invasive aquatic plant species found in LCO, curly-leaf pondweed (*Potamogeton crispus L.)* and Eurasian watermilfoil (*Myriophyllum spicatum L.*). A small curly-leaf pondweed (CLP) infestation was first discovered in LCO in July 2006 and Eurasian watermilfoil was discovered in 2017. Banded and Chinese mystery snails along with rusty crawfish have also been documented by the WI DNR to be present in Lac Courte Oreilles Lake.

Curly-leaf Pondweed

The first infestation of CLP was discovered near the entrance of Musky Bay and encompassed a dense patch that was approximately 0.20 acre. After 2006, CLP slowly spread into other areas of the lake. The Curly-leaf pondweed has been actively managed primarily by chemical treatment since 2009. Initially, large-scale applications were completed in Musky Bay to control a very dense population of the AIS. Since then control measures have also been completed in Barbertown and Stucky Bays at various times as well. Refer to Table 10 for a treatment history of CLP in Lac Courte Oreilles Lake.

Curly leaf pondweed

A recent aquatic invasive species survey by Wisconsin Lake and Pond, LLC was completed on Lac Courte Oreilles lake in 2019. A full copy of this survey report is included in Appendix B. The initial survey for AIS on May 22-23, 2019 identified minimal CLP. Spring of 2019 included a late ice-out date and was unseasonably cold and wet. However, a large growth of CLP was observed by COLA on June 6, 2019 and prompted a second survey completed on July 11-12, 2019. The cool, wet spring suppressed growth of native aquatic plant species throughout Wisconsin. Decreased competition allowed CLP turions that would have normally remained dormant to grow and cause a late, second growth of CLP. This condition was noted on multiple lakes in Wisconsin in 2019.

All locations of known or potential populations of CLP in Lac Courte Oreilles were mapped on July 11-12, 2019. Survey locations were chosen based on the location of CLP identified on past surveys, such as the 2018 whole lake survey, or past reporting of known locations by COLA, the WDNR, and other entities. Figure 13 depicts the locations of CLP identified during the most recent survey AIS survey in 2019. The 2019 survey identified CLP in four primary locations within Lac Courte Oreilles:

1. **Eastern Basin – 2.2**: These locations are primarily near-shore and in shallow water. Locations A and B are within a man-made trench of 2-3 ft deep that accumulates organic matter in an area

that is normally shallower and sandier. Curly-leaf plants here are highly scattered and easily hand-pulled. Location C is also near-shore but extends offshore following a sand bar.

2. **Barbertown Bay – 2.3**: Barbertown Bay has had a varying population of CLP since 2010. Curly-leaf pondweed is typically in shallower water along the northern shore. However, in 2019 the CLP was extended southwest into deeper water (8-10 ft).

3. **Stucky Bay– 2.4**: Like other locations of CLP in Lac Courte Oreilles, the population in Stucky Bay has been present since 2010 and may include areas of the adjacent agricultural cranberry marsh channel. Plants found here were in shallow water, near the channel inlet, and spread out.

4. **Musky Bay – 2.5-2.6**: Musky bay has been the primary CLP control site in Lac Courte Oreilles with up to 90+ acres of growth present in the past. Past growth has built up a considerable bank of turions within the sediment here. Large scale control has brought the population down significantly with only minimal management necessary in 2018. However, the population of CLP unexpectedly grew significantly in 2019 once again occupying an area greater than 51 acres. Though there is a high frequency of CLP present in Musky Bay, the overall density is low. Many plants were seen growing in clumps scattered 20+ feet apart. Many of these locations were lumped together to form larger areas for future management.

Another area that should be watched very closely for CLP is Grindstone Bay (also referred to as Anchor Bay). This area needs to be watched closely since CLP has been found in Little Grindstone Lake which flows into this bay. No CLP is currently found in Grindstone Bay so by closely monitoring it any CLP that is found should either be isolated plants or small beds.

Table 10: Lac Courte Oreilles Lake CLP Treatment History

Year	Treatment Date	Location	Acres[11]	Herbicide	Concentration	Comments
2006	No treatments	Musky Bay	**0.2**	---	---	First discovered
2007	No treatments	---	---	---	---	Not surveyed during 2007
2008	No treatments	Musky Bay	**6.5**	---	---	
2009	19-May	Musky Bay	7	Aquathol-K		6.425 acres of CLP treated on 5/19
		Stucky Bay	0.5	---	---	New discovery in Stuckey Bay; not treated
		Total	**7.5**			
2010	26-May	Musky Bay	90+	Aquathol-K		Only 9.2 acres out of the 90+ acres were treated due to permit limitations
		Stucky Bay	0.7	Aquathol Super-K		0.7 acre treated on 5/26
		Barbertown Bay	1.75	---	---	New discovery in Barbertown Bay; not treated
		Total	**92.45**			
2011	2-Jun	Musky Bay	90.48	Aquathol-K	.75 ppm	Whole-bay treatment
		Stucky Bay	2.52	Clearcast 2.7	250 ppb	
		Barbertown Bay	1.09	Clearcast 2.7	250 ppb	
		Total	**94.09**			
2012	18-May	Musky Bay	64.9	Aquathol-K	.7 ppm	Whole-bay treatment
		Barbertown Bay	2.5	Aquathol-K	1.5ppm	
		Total	**67.4**			
2013	6-Jun	Musky Bay	29	Clearcast 2.7	250 ppb	Assumed a whole-bay concentration of 45 ppb

[11] Number of acres treated unless otherwise indicated in Treatment Date or Comments

Year	Treatment Date	Location	Acres[11]	Herbicide	Concentration	Comments
		Stucky Bay	2	Clearcast 2.7, Aquathol-K	250 ppb, 3 ppm	Stucky Bay treated with Clearcast and cranberry outlet canal treated with Aquathol-k
		Barbertown Bay	5.38	Clearcast 2.7	300 ppb	
		Total	**36.38**			
2014	13-Jun	Musky Bay	2	Aquathol-K, Clearcast 2.7	2 ppm, 200ppb	
		Stucky Bay	1	Aquathol-K	3 ppm	
		Barbertown Bay	0.5	Aquathol-K, Clearcast 2.7	2 ppm, 250ppb	
		Total	**3.5**			
2015	21-May	Musky Bay	25.32	Aquathol-K, Clearcast 2.7	2 ppm, 200ppb	7.49 acres were treated on 5/21 (max the permit allowed) and the remaining acres in Musky bay were treated on 6/21 after getting new permit for the additional acres that were found during pre-treatment survey
		Stucky Bay	0.5	Aquathol-K	3 ppm	
		Barbertown Bay	1	Aquathol-K, Clearcast 2.7	2 ppm, 250ppb	
		Total	**26.82**			
2016	20-May	Musky Bay	25	Aquathol-K	2ppm	Not enough to warrant treatment in Stucky and Barbertown Bays
		Stucky Bay	<1	---	---	
		Barbertown Bay	<1	---	---	
		Total	**25**			
2017	2-June	Musky Bay	5.52	Aquathol-K	2ppm	5.52 acres were treated on 6/2
		Stucky Bay	<1			Not enough to warrant treatment in Stucky and Barbertown Bays

Year	Treatment Date	Location	Acres[11]	Herbicide	Concentration	Comments
		Barbertown Bay	<1			
		Total	**5.52**			
2018	4-June	Musky Bay	5.74	Aquathol-K	3 ppm	5.74 acres were treated on 6/4
		Stucky Bay	1	Aquathol-K	3 ppm	1.0 acre was treated on 6/4
		Barbertown Bay	1.75	Diquat	3 ppm	1.75 acres were treated on 6/4
		Total	**8.49**			
2019	No treatments	Musky Bay	51.4	---	---	
		Stucky Bay	1.2	---	---	
		Barbertown Bay	4	---	---	
		East Shoreline	2.6	---	---	New infestation on eastern shoreline in NE part of lake. Hand pulled
		Total	**59.2**	---	---	
2020	6-June	Musky Bay	0			No treatment… the 51.4 acres of CLP mapped during July 2019 never materialized in 2020
		Stucky Bay	1.20	Aquathol-K		1.20 acres treated on 6/6
		Barbertown Bay	4.0	Aquathol-K		4.0 acres treated on 6/6
		East Shoreline	2.6			Hand pulled on several occasions during June and July
		Total	**7.8**			

Figure 13: 2019 Lac Courte Oreilles Lake Curly-leaf Pondweed Locations

Eurasian Watermilfoil

Eurasian watermilfoil was first identified in Lac Courte Oreilles in 2017 in Anchor Bay near the inlet from Grindstone Lake which coincidentally is also near a public boat launch. Since then, it has been identified in other locations spread throughout the lake with the largest area on a mid-lake hump in the western basin of the lake encompassing nearly a 0.5-acre area.


Eurasian Water Milfoil

All locations of known or potential populations of EWM in LCO Lake were mapped by Wisconsin Lake and Pond Resource, LLC on July 11-12, 2019 during a survey for aquatic invasive species (Appendix B.) Survey locations were chosen based on the location of EWM identified on past surveys, such as the 2018 whole lake survey, or past reporting of known locations by COLA, the WDNR, and other entities. The 2019 survey was focused on known locations of EWM or potential EWM. The survey identified EWM in six primary locations within Lac Courte Oreilles shown in Figure 14:

1. Western Basin – 1.2: First identified in 2018 during the whole-lake survey this location is on top of a small sand/gravel hump surrounded by deep water and is nearly monotypic and reaches the surface. Management in 2018 with Weedar 64 (2,4-D) herbicide application did not control this location. In 2019 the location was treated with Weedar 64 and diquat with good results. In 2020 there was no observable growth of EWM at this location. This location of EWM may have been a primary source of infestation to new area of LCO.

2. Ashland Point – 1.3: First identified in late 2017 and verified during the 2018 whole-lake survey. EWM located here is found in a small bed of scattered clumps and intermixed with native species. This location was hand pulled in 2019 and monitored for EWM presence in 2020. No EWM was observed in 2020.

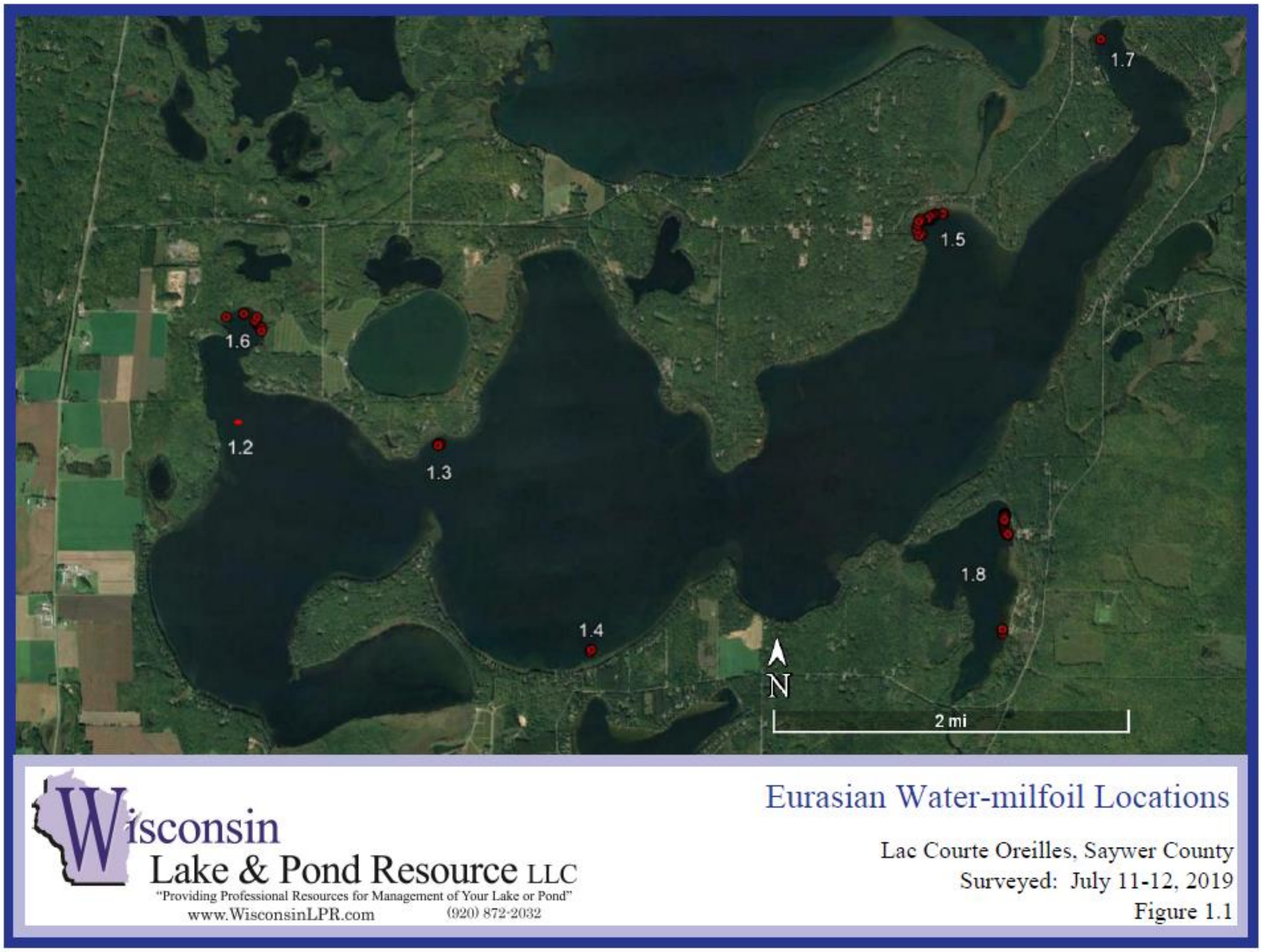
3. Whitefish Inlet – 1.4: First identified in 2018, this location is adjacent to the Whitefish Lake inlet. Whitefish Lake is likely the source of infestation with EWM first identified in Whitefish Lake in 2008. This location is adjacent to a steep-dropping lake bottom and located in a narrow band of water from 10-14 feet deep. This location was treated in 2019 with Weedar 64 and diquat. This area needs to be resurveyed in 2021.

4. Grindstone Inlet – 1.5: First identified in 2017 as the initial location of EWM infestation in Lac Courte Oreilles. Only a few scattered plants were located during the 2018 whole-lake survey. In 2019, EWM had become more prevalent and spread out over four (4) acres. In 2020, the dominating EWM patches within the 4 acre area were treated with Weedar 64. A post treatment, end of season survey determined the treatment to be less than successful. EWM was stunted with loss of chlorophyll production but not terminated.

5. Stucky bay – 1.6: EWM in Stucky Bay is a new infestation in Lac Courte Oreilles and found for the first time in 2019 during the July survey. EWM plants are primarily located in shallow water and adjacent to the agricultural cranberry marsh channel/inlet, similar to where CLP has been historically located. In 2020 the CLP/EWM was treated with Aquathol K.

6. Barbertown bay – 1.7: A single plant of EWM was located and hand-pulled during the spring, 2018 AIS survey in the shallow, norther part of the bay. In 2019, a single location was located and hand pulled.

Figure 14: LCO Lake 2019 EWM Locations



Plant Management Options

The focus of plant management in Lac Courte Oreilles Lake will be aquatic invasive species. Native plants currently are not causing any impediments to the lake ecosystem or use and enjoyment of the lake. There are a variety of ways to manage aquatic plants in a water body. The best way to manage aquatic plants depends on many variables such as the makeup of the overall plant community, the species that may require control, whether AIS are present, the level of human use of the lake and watershed, and various other background information which has previously been discussed in this aquatic plant management plan. It should be thoroughly understood that the application, location, timing and combination of treatment methods must be carefully considered to effectively manage aquatic plants.

The eradication of non-native aquatic invasive plant species such as CLP and EWM is generally not feasible but preventing them from becoming a more significant problem is a realistic goal. Aquatic invasive species can negatively impact the native plant ecosystem. Targeted early- and mid-season removal or treatment can minimize some of these impacts by preventing the AIS from becoming the dominant plant species in the lake which allows for the growth of more desirable native aquatic plants.

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

There are five broad categories that can be considered for aquatic plant management. These include:

- **No active management.** This essentially means that nothing is actively done to control the growth of plants. It is however recommended that a strong monitoring and education component may be included, especially in the case of aquatic invasive species.
- **Chemical treatment.** This consists of the use of herbicide to kill aquatic plants.
- **Manual & mechanical removal of plants.** This includes activities such as hand pulling, raking, and using plant cutters and plant harvesters, such as an Ecoharvester.
- **Physical habitat alteration.** This is a means by which plants are reduced by altering variables that affect their growth such as sediment, light availability, or depth.
- **Biological control** This includes the use of living organisms, such as weevils, to control plant growth.

The benefits and limitations of each of these broad management categories are further described below. The WDNR also has a discussion of pros and cons for various management techniques to control aquatic plants.[12]

No Active Management

Often the best course of management is to take no immediate action and to just monitor the situation. This approach does have its benefits including the lack of disturbance to desirable native plant species and the lake system, there is no financial cost (unless there are monitoring/survey costs), there are no unintended consequences of chemical treatment, and no permit is required.

[12] Appendix-E.pdf (uwsp.edu)

There are however some disadvantages to this approach. One of the main disadvantages could be the potential for small beds of AIS to become larger and more challenging to control later. These sites can provide a source of AIS that can spread to other parts of the lake or bay that they are in risking new infestation sites. With CLP, a bank of turions can be formed prolonging future treatments, and expense, at the site if warranted in the future.

Just because this management approach has no active management of the actual plants does not mean nothing needs to be done at all. It is highly recommended that a strong monitoring and educational component be included. Actively monitoring beds of AIS, no matter how small, is important to determine whether additional action is required in the future. Educating users of the lake can help prevent the spread of AIS to other areas in the lake. There are some smaller areas of CLP and EWM in Lac Courte Oreilles where this approach may be appropriate.

Manual & Mechanical Control

This method of control includes pulling plants by hand or by using harvesting machines or devices. Permits are required for some of these activities and there are a variety of options under this type of control. Mechanical control is regulated under Chapter NR 109, which is included in Appendix C.

Manual Plant Removal

This method is only appropriate for small-scale control. Shore land property owners can manually remove a 30-foot wide section of native aquatic plants, except for wild rice, parallel to their shoreline without a permit if it is not in a designated sensitive area. All raked or pulled plant material must be taken completely out of the lake and removed from the shoreline. The removed plant material can be composted or added directly to a garden. It can only be done in one area along their shoreline and there must be structures or other water use devices such as piers, boatlifts, swim rafts, etc. within that 30-foot zone. There currently are no designated sensitive areas on Lac Courte Oreilles Lake but any property owner that is considering this method in front of their property is advised to contact their local WDNR Lakes Coordinator. It should be noted that there could be potential for harm to the plant community and lake ecosystem if many adjacent property owners along a stretch of shoreline remove thirty foot sections of native aquatic vegetation. Additionally, there are no limits on raking loose plant material that may wash up along the shoreline.

It should be noted that AIS plants can be selectively removed by manual means anywhere along the shoreline, not just within a 30-foot zone, or in open water area without a permit. Regulations do require that native plants are not harmed during any manual removal of AIS.

Hand-pulling does provide several benefits. It is very selective and for the most part does little damage to the lake and the rest of the plant community. There could be potential for harm if many adjacent property owners along a stretch of shoreline remove 30-foot sections of plants. The downside to manual removal is that it can be very labor intensive, which could also result in high costs if for instance SCUBA divers are hired for the removal. When manually removing EWM, plant fragments of EWM can root and grow elsewhere, so all the plant and any fragments must be removed. When manually removing CLP, care must be taken to not leave behind any turions.

Diver Assisted Suction Harvest (DASH)

DASH can be a useful tool used in the management of aquatic invasive plant species. DASH utilizes divers to hand remove aquatic invasive plants from the lake-bed. Instead of divers coming to the surface to dispose of the removed plants or bagging them underwater, the plants are fed into a suction line that transports plants to the surface usually on some sort of barge or pontoon.

DASH is more suited to smaller infestation sites and good visibility in the lake is needed. The uprooting of the plants causes suspension of sediments which can quickly limit diver visibility mainly limiting this control method to areas of the lake with firmer substrates. Many of the areas that contain CLP and EWM in LCO are in bays with flocculent sediment which could greatly complicate the effectiveness of DASH in these areas. There are some areas in the main lake basins with firmer substates that may be more suitable to DASH operation. Cost and availability of consulting firms conducting DASH can be significant barriers to using DASH at this time.

Mechanical Harvest

This technique is most appropriate for lakes with larger scale aquatic plant issues. Mechanical harvesters provide immediate results and usually cause minimal impact to lake ecology. A disposal site for harvested plants is a necessary part of a harvesting plan. When using mechanical control methods, plant fragments must be removed from the water to the extent practical. One of the benefits of this management alternative is that plant material and the nutrients contained in it are removed completely from the water. Early season or cool water plants like curly-leaf pondweed that senesce in early summer can be a significant source of phosphorous loading which could promote algae blooms and low dissolved oxygen levels. When harvesting CLP, it is important that all material is removed since free-floating CLP fragments can remain viable and produce turions for up to two weeks after being cut or detached from the root structure. It is also imperative that EWM fragments be removed since one of the ways the EWM propagates is by fragmentation.

There are a couple of different types of mechanical harvesters that can be employed. The most common type of mechanical harvester is the type that cuts or "mows" the aquatic plants down to depths of 5 feet and then collects the plants which are removed from the lake. This cutting method is primarily utilized to improve aesthetics or navigation. The plants are cut but the root of the plant is often left intact. Cut plants will usually grow back after time, just like when you cut the grass. Re-cutting during the growing season is often required to provide adequate annual control.

The other type of harvester, such as an Ecoharvester, is one that supposed to pull the plant out by the roots, thus removing the entire plant. The main benefit of this type of harvester vs one that just cuts the plants is that the entire plant is removed which results in a more permanent type of control. This type of harvester can also be more selective in the plants that it removes. AIS such as CLP and EWM which typically emerge early in the growing season can be targeted before natives are emerging thus leaving them intact while they grow later in the season. EWM can be targeted later in the season once it has topped out on the surface and growing above the native plants. Setting it above the level of the native plants it will leave them intact while pulling the entire EWM plant.

Chemical Control

Aquatic herbicides are chemicals specifically formulated for use in water to kill or control aquatic plants. Herbicides must be applied in accordance with label guidelines and restrictions and chemical control is regulated under Wisconsin Administrative Code Chapter NR 107. See Appendix D for a copy of Chapter NR 107.

The amount of herbicide exposure time required to control plants depends upon the specific product, formulation (granular or liquid) and concentration used. Impacts to native aquatic plants are an important factor when deciding whether to use chemical control. If the native plants are reduced by repeated chemical control, there is more area for AIS to grow since they are more opportunistic plants. Spring and early summer are the preferred time for application because exotic species such as CLP and EWM are actively growing then, whereas many native plants are not, fish spawning has ceased, and recreational use is generally low thereby limiting human contact. Also, if the duration of control only lasts for one or two growing seasons, one should weigh the financial costs combined with impacts to native plants versus the relatively short-lived control.

There are two major types of herbicide commonly used to treat AIS infestations, systemic and contact herbicides. Systemic herbicides translocate throughout the entire plant and under ideal conditions can provide complete control of the target plant while contact herbicides cause the parts of the plant in contact with the herbicide to die, this can often leave the roots alive and able to re-grow.

Herbicides are also classified as either broad-spectrum (or non-selective) or selective. Broad-spectrum herbicides will generally kill or injure all plants contacted. Selective herbicides will affect only some plants. Different herbicides are selective for different types of aquatic plant species. For instance, 2,4-D is more selective towards control of dicots (although some thinner leaf monocots are also adversely affected) while endothall is more selective towards many monocots. Often dicots (broad-leafed plants like EWM) will be affected by selective herbicides whereas monocots, such as common elodea (Elodea canadensis) may not be affected. The selectivity of an herbicide can be influenced by the method, timing, formulation, amount of exposure time and concentration used.

Physical Habitat Alteration

There are many different types of physical habitat alterations that can be used to help control AIS but most of them are not feasible or able to be used in Lac Courte Oreilles Lake. Many of these types of physical habitat alterations require a Chapter 30 Waterway permit from the WDNR.

Benthic Barriers

These barriers prevent light from reaching aquatic plants, which kills all aquatic vegetation. The basic idea is that the plants are covered over with a layer of a growth-inhibiting substance. Many materials have been used, including sheets or screens of organic, inorganic and synthetic materials, sediments such as dredge sediment, sand, silt or clay and combinations of the above. The screens must be removed each fall and reinstalled in the spring to be effective over the long term. They can impact fish spawning and food sources, and an anaerobic environment below the barrier could cause nutrient release from the sediment. Benthic barriers are not recommended for any type of aquatic plant control in LCO.

Drawdown

This control technique involves the lowering of water levels and exposing sediments to freezing and drying, which results in plant death. A water level control device, such as a dam, is required for this method. Lac Courte Oreilles Lake does not have a control structure so a drawdown would not be an option. There is a dam located on the Billyboy Flowage, which is downstream of Lac Courte Oreilles Lake, but this control structure is to far removed from the direct watershed of Lac Courte Oreilles Lake to have any appreciable drawdown impact.

Dredging

Dredging includes the removal of plants along with sediment and is most appropriate for systems that are extremely impacted with sediment deposition and nuisance plant growth. Dredging is usually not performed solely for aquatic plant management but to restore lakes that have been filled in with sediments, have excess nutrients, need deepening for navigation, or require removal of toxic substances.

Some small-scale dredging could potentially benefit Lac Courte Oreilles Lake, particularly Musky Bay. Flocculent sediment buildup in this bay due to excessive nutrients from cranberry farming discharges has impacted the ecosystem of the bay. The nutrient rich sediments have helped cause nuisance growth of algae and even native plants and most recently have helped the proliferation of CLP in the bay. The highly flocculent sediment layer has also all but precluded historical musky spawning habit in the bay.

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. This would not be appropriate for Lac Courte Oreilles Lake or in any of its smaller bays since significant mixing occurs between the bays and the main basins of the lake.

Non-point Source Nutrient Control

Reducing the amount of runoff and nutrients into the lake is a high a priority for COLA. Reducing the amount of nutrients entering the lake will result in fewer nutrients being available for plant, i.e. invasive species and algae growth. It will also help to alleviate the problem impairment of the two-story fishery which was discussed earlier. Reducing non-point source pollution is key because it attempts to correct the source of a nutrient problem and not just treat the symptoms.

Biological Control

Insects

Biological control is the use of parasitoid, predator, pathogen, antagonist, or competitor populations to suppress an AIS population, making it less abundant and thus less damaging than it would otherwise be. There are currently no biological controls for CLP, but research to identify and establish biological control is on-going. The most used biological control of Eurasian watermilfoil (EWM) is the indigenous weevil, *Euhrychiopsis lecontei.* The milfoil weevil is native to our region and is hosted by native watermilfoils, especially northern watermilfoil, *Myriophyllum sibiricum*. The weevil spends its summers on watermilfoil plants where it completes the various stages of its life cycle and overwinters in dry leaf litter along the shore.

Milfoil Weevil

The milfoil weevil is highly specific to watermilfoils, and research has shown that weevils that have been exposed to Eurasian watermilfoil prefer it over the native milfoils. The milfoil weevil has been shown to prevent growth of watermilfoil in laboratory and field settings and is often associated with numerous milfoil declines. It is, however, completely unpredictable as to the success of the milfoil weevil in a certain lake, but if milfoil weevil populations are successful at controlling EWM the weevil milfoil relations will most likely become cyclic. Also, the weevils do not prefer deep areas, yet they do not need to be near shore. It is difficult to maintain milfoil weevil populations, and the native plants must be competitive enough to push out the weevil impacted Eurasian watermilfoil.

Controlling EWM using weevils is not recommended at this time but monitoring for native populations of weevils is an appropriate first step to determine the possibility of this biological control option in the future.

Native Plantings

Another form of biological control is to introduce a diverse native plant community that will compete with the AIS. Native plants provide a diverse community that is more repellant to invasive species. Fortunately, Lac Courte Oreilles Lake does have a healthy and diverse aquatic plant community which will help to slow current infestations of AIS and help prevent the introduction of new infestations of AIS. Protection and enhancement of native plants is a large component of controlling AIS in Lac Courte Oreilles Lake.

Recommended Management Strategy

Control of aquatic invasive species is just that, "control." It is unlikely that aquatic invasive species such as curly-leaf pondweed and Eurasian water-milfoil can ever be eradicated from a lake once they become established. All control options are accompanied by risks and potential impact to non-target aspects of a lake, but the benefits must outweigh those risks and potential detriments. Taking inventory of the present situation in order to predict possible outcomes will prove vital in the decision-making process of what control option(s) for AIS would be the most successful for Lac Courte Oreilles Lake. In some instances, it may be preferable to choose a no action option for a short period of time to provide more time for further exploration and discussion of appropriate control options.

For a control method to be appropriate several criteria must be met. The method must be feasible from a biological, social, and financial perspective. Biological feasibility infers that the control method being used will not be a detriment to other aspects of the lake ecosystem, such as reducing native plant species density or impacting fish fry or spawning activities. To be socially feasible, the control action needs to have support from lake users and other interested parties such as the COLA membership, LCO Reservation, Sawyer County and WDNR. Financial feasibility is just that, the control action must be affordable for COLA and use the funds in a fiscally responsible manner.

Considering the control option alternatives available to control AIS in Lac Courte Oreilles Lake the COLA board of directors chose to use an innovative mechanical control strategy using an Ecoharvester for the primary long-term control of populations of AIS. After careful consideration and seeing demonstrations of the Ecoharvester in action, the board deemed this to be the most practical, affordable (chemical treatments at times have been upwards of $30,000/yr.), effective, and environmentally acceptable alternative.

Detailed information on the design features, operation, advantages, and costs of the Eco-Harvester aquatic plant harvesting machine (manufactured and sold by Lake Weeders Digest LLC of New Hope, Minnesota) can be seen by visiting the product webpage[13]. The COLA Board considered other mechanical harvesters but most of them cut weeds rather than pulling them which leaves behind rooted stems which will resume growth and sprout new stems. The drum of the Eco-Harvester is reported by the manufacturer to be 95% efficient in pulling the plants up from their roots. It is also significantly cheaper than comparable harvesters.

Photo: Weeder's Digest - EcoHarvester

The AIS treatment areas, standards, and control methods will be reviewed each season to see if they are effective, minimizing impacts to the lake ecosystem and cost efficient. Changes may be made to the treatment approach based upon project results. Significant changes will be documented as brief addendums to this aquatic plant management plan to be reviewed by the COLA Board and the Department of Natural Resources. One of the main factors to evaluate is the effectiveness of the EcoHarvester.

Curly-leaf Pondweed Strategy

The EcoHarvester is the preferred control option for all CLP control activities. The current populations of CLP are located within historically known areas. Both large and small areas of CLP can be effectively targeted with the EcoHarvester. Mechanical removal is recommended to occur in early spring when CLP is typically the dominant plant growing that early in the season. Harvesting CLP early in the season once it is tall enough to be effectively collected by the EcoHarvester will minimize any major impacts to the native plants. Harvesting CLP early enough in the spring before turion formation is also a major goal to help prevent a seed bank of CLP forming. If turions form and drop to the bottom this impede the long-term management goal of controlling CLP.

[13] http://www.lakeweedharvester.com/eco-harvester/

A study is recommended to be performed to determine a baseline of the existing turion seed bank in historically known locations of CLP. This study can be repeated in the future to determine if levels of turions in the sediment are decreasing. This would indicate that the management strategy and use of the EcoHarvester is in fact successful in reducing turion load in the sediment.

If for some reason the COLA Board decides to use herbicide applications for control measures of CLP, the following chemical control strategy outlined by Wisconsin Lake & Pond Resource LLC (Appendix B) will be considered as an alternative option:

Recommended products and rates for Curly-leaf pondweed are as follows:

> ***Large-scale recommendation – Whole bay treatments (i.e. Musky Bay): Aquathol K, active ingredient endothall, and whole-bay rate of 0.65-0.70 PPM*.**
> Aquathol K contains endothall, a systemic herbicide that has proven extremely successful for CLP control throughout Wisconsin and within Lac Courte Oreilles. This practice was used successfully in the past in Musky Bay and will ensure adequate contact time for CLP control. The water volume of Musky Bay was calculated at 1081 ac-ft. Use of Aquathol K at recommended whole-bay rates does not require a water-use restriction for irrigation and will limit impact to adjacent cranberry operations.
>
> ***Small-scale recommendation – I.e. Barbertown & Stucky Bays: Aquastrike at 3 PPM.***
> Aquastrike has been successfully used throughout Wisconsin to control populations of CLP. Aquastrike combines a systemic active ingredient (endothall) with a fast-acting contact (diquat) to control target plants. Due to the lakes' morphology application rates should be near the maximum allowed at 1.625 gallons/ac-ft.

Eurasian Water Milfoil Strategy

The EcoHarvester is the preferred control option for all EWM control activities. Fortunately, the Eurasian water milfoil in Lac Courte Oreilles Lake is very limited currently. Smaller patches of EWM which currently exist in LCO Lake can be effectively targeted with the EcoHarvester. Mechanical removal is recommended to occur in late spring/early summer when EWM is typically taller than most native plants and therefore vulnerable to selective mechanical removal without major impacts to the native plants. The Quiet Lakes Association determined through use of their EcoHarvester that the most effective way to remove the early season growing EWM without significant breakage is to lower the rotating drum to the appropriate depth and significantly reduce its rotation speed along with the boat speed. The other optimum time they found to harvest EWM to reduce fragmentation and remove a majority of the EWM by its roots was when it started to first “top out” on the surface (Neuswanger, 2019). The native plants were also well below the surface minimizing the impact to them. Any minor fragmentation of EWM during Eco-Harvester operations can be cleaned up by operating it in “skimmer” mode to quickly and efficiently clean up any floating fragments after a bed has been harvested. Kayakers and/or other boats will also be present to collect any fragments due to a result of harvesting activities until it can be confirmed whether the EcoHarvester can adequately collect any fragments on its own.

Currently the populations of EWM are not large enough for chemical herbicide treatment to be an effective control strategy. The current populations of EWM are relatively small scattered patches which makes herbicide ineffective. The locations are adjacent to large areas of deep water which limits contact time of the herbicides used since the herbicide freely diffuses off site. This only allows for contact time of just hours. The one exception is the Anchor Bay site which now currently occupies nearly 5 acres in shallow water of 4-5 feet deep. 2,4-D has been the primary active component of herbicides used to control EWM in Wisconsin and even at maximum label rates, it requires 24 hours or more of contact time to be effective. 2,4-D has been tried on populations of EWM in Lac Courte Oreilles Lake and only provided minimal results and sometimes nothing at all. There just simply was not enough contact time due to the smaller size of the sites and their locations to deeper water.

If the EWM beds expand in size and the COLA Board decides to use any herbicide applications for control measures, the following chemical control strategy outlined by Wisconsin Lake & Pond Resource LLC (Appendix B) could be considered as an option:

<u>Herbicide management of larger populations of EWM</u>

Larger populations of EWM should be controlled with a systemic herbicide that can provide adequate contact time for extended control. Based on 2018 results and the natural lake morphology use of products with the active ingredient 2,4-D only is not recommended. Any application should be completed during periods of calm weather to increase contact time as much as possible. Recommended products and rates are as follows:

Primary recommendation: ProcellaCOR - active ingredient florpyrauxifen-benzyl. ProcellaCOR is a newly developed systemic herbicide first released in 2018 and created with a focus on management of small-scale populations of EWM. ProcellaCOR requires limited contact time to be successful. Applications rates of 3-5 PDU/ac-ft, or more in deeper water, should be used. All rates should be verified with the product manufacturer prior to application.

Secondary recommendation: Aquastrike, active ingredients endothall and diquat.

Aquastrike has been successfully used throughout Wisconsin to control populations of EWM. Aquastrike combines a systemic active ingredient (endothall) with a fast-acting contact (diquat) to control target plants. Due to the lakes' morphology application rates should be near the maximum allowed at 1.625 gallons/ac-ft.

Secondary recommendation: Active ingredient diquat – multiple trade names. Diquat is a fast-acting contact herbicide that can provide control of EWM. However, many product labels limit application to a maximum rate of 2 gallons per surface acre, regardless of depth. In deeper water diquat alone is not enough to control EWM.

Secondary recommendation: Combination of 2,4-D and Aquathol (active ingredient endothall).

This combination has been used throughout Wisconsin to control EWM. The combination of two active ingredients provides multiple modes of action and added control in locations of limited contact time. Applications rates of each active ingredient vary based on site conditions but are generally from 1.5-3.0 PPM 2,4-D and 2.0-4.0 PPM endothall.

Plan Goals and Strategies

The Lac Courte Oreilles Lake aquatic plant committee came up with several goals for aquatic plant management for the lake and developed a strategy of actions to effectively and efficiently reach those Goals. The goals that COLA decided on include the following:

To help fund many of these goals and strategies, COLA is encouraged to apply for AIS control grants from the WDNR as needed. COLA should notify the WDNR of their intent to apply for a grant by September 1 with the grant applications being due by November 1.

Goal 1) Control existing populations of AIS.

Goal 2) Prevent the introduction and spread of aquatic invasive species.

Goal 3) Preserve the lakes' diverse native plant communities.

Goal 4) Lake residents and users are made aware of the importance of native aquatic plants, the means to protect them, and the threat of aquatic invasive species.

Goal 5) Restoration and preservation of native shoreline vegetation

Goal 6) Waterfront residents will protect lake water quality and plant communities by minimizing runoff of pollutants from their lake property.

Goal 1) Control existing populations of AIS.

Objective 1: Control existing CLP/EWM infestations following the recommended control strategy previously detailed.

- The EcoHarvester and Herbicide Treatments will be the primary means of control..

Objective 2: Identify locations of CLP/EWM plants and beds, and monitor the effectiveness of control methods

- AIS locations will be identified by two primary methods. One method will be using volunteer shoreline observers which will help locate AIS infestations. These will be tracked with the use of the ArcGIS Collector App that COLA has recently implemented. These volunteers will be especially vital to locating pioneer patches of AIS that are outside of the currently known areas.

- The other means of locating AIS beds will be done by implementing annual pre and post point intercept surveys as funding allows in areas where the EcoHarvester was used as a control method which are large enough to encompass at least 40 points in a sub-point intercept grid. This will also provide the information needed to determine the effectiveness of the EcoHarvester and any potential impacts it may have on the native plant community. It is also recommended that the surveys use a finer grid than the WDNR generated grid used for the whole lake. Doubling the number of points for the grid, such as was done in Musky and Stucky Bays, would allow for more detailed coverage in the areas the EcoHarvester was used.

- Conduct a turion bed density study following established protocol in chronic areas of CLP to determine if control methods are being effective at reducing the turion load in the sediment. An initial study will determine the current density of the existing turion seed bank as a reference point.

Objective 3: Lake residents can identify potential invasive species and know how to remove them along their shoreline if they want to hand-pull them.

- Instruct residents how to properly identify AIS, particularly CLP/EWM, and who to contact for final verification.
- Instruct residents how to properly remove AIS along their lakeshore if they desire to hand pull it. Landowners will be encouraged to record their activity with the date and hours spent removing AIS and share this information with COLA. Proper hand-pulling technique would involve:
    - pull complete CLP and EWM plant and root;
    - Either net or have a second person assisting to collect;
    - Remove all plant fragments away from the water (composting is fine).

Goal 2) Prevent the introduction and spread of aquatic invasive species.

Lac Courte Oreilles Lake is used heavily by anglers and other recreational users. This significantly increases the risk of invasive plant spread and the introduction of new invasive species. Managing AIS once it is found can be time-consuming and financially expensive, therefore preventing the introduction of new AIS such as zebra mussels and purple loosestrife is of paramount importance. In order to catch a new invasive species or bed of AIS while it is still small and therefore easier to manage, it is especially crucial that the Adopt-a-Shoreline volunteers become familiar with the various aquatic invasive species that are of concern to Lac Courte Oreilles .

Objective 1: Continue volunteer Monitoring for the presence of aquatic invasive species.

- The general procedure for volunteer monitoring is volunteers are assigned to monitor specific stretches of the shoreline and bays by the AIS observer Coordinator.
- The stretches of shoreline and bays will be monitored on at least a monthly basis starting shortly after ice-out (mid to late April) and continue through until the end of the summer. More frequent monitoring can take place if the volunteer has the time available. Monitoring should take place during the first week of each month and the volunteers will report their observations (AIS present or not present) to the AIS observer Coordinator. The Coordinator will send out monthly (May, June, July,) post-card or email reminder notices to the volunteer monitors. Volunteer hours will be recorded for purposes of in-king and matching grant requirements.
- COLA will provide training to monitors on the ArcGIS Collector App that will capture coordinates when the user locates locations of AIS. Sawyer County AIS Coordinator or COLA confirms any areas of suspected AIS.
- COLA using ArcGIS or APM consultant maps the confirmed locations of AIS as they are found. The size and estimated density of the AIS beds are recorded.
- Annual maps will be prepared by COLA or the APM consultant to gauge success in controlling the AIS infestations. Maps will include acreage and estimated density of the beds.

Objective 2: Continue watercraft inspections.

- It is important for the Courte Oreilles Lakes Association to continue its Clean Boats/Clean Waters Program. This program is provided through the University of Wisconsin Extension in cooperation with the Wisconsin DNR. The Association will continue the public landing inspections either through volunteer or hire. WDNR grants funds will be applied for each year to assist with the inspections.

- COLA will continue to investigate and determine the efficacy of implementing camera monitoring of the WDNR, Bass Lake Township and Sand Lake Township boat landing on Lac Courte Oreilles Lake.

Objective 3: Maintain AIS signage and info at all boat landings.

- Ensure that adequate and updated information is available at all the boat landings (private and public) educating users about AIS.
- Provide contact numbers, such as the WDNR and COLA, for people to call or email if suspect plants or animals are found.
- Post maps of current AIS bed locations at all boat landings and instruct users of the lake to try to avoid boating in these areas to help minimize the potential to spread it

Objective 4: Support Township and county wide AIS ordinances

- COLA will support township or county wide ordinances aimed at controlling and reducing the spread of AIS. Implementation of a Decontamination Station should be considered at the DNR landing

Goal 3) Preserve the lakes' diverse native plant communities.

The plant community in Lac Courte Oreilles Lake is very diverse. It is important to preserve the diversity and quantity of the native plants that are present. This diverse plant community provides key habitat for a diverse fish population, helps to prevent the spread of invasive plants and it also helps to provide protection from shoreline erosion. It is important to understand that these plants play a very important role in the ecosystem of Lac Courte Oreilles Lake.

Objective 1: Minimize removal of native plants from waterfront corridors.

- It will be stressed to homeowners that removing native vegetation opens new areas for colonization by invasive species. This is especially noteworthy for properties on the lake adjacent to where AIS have been found. Stress hand removal only of native plants (no herbicides) if needed to maintain access for swimming and navigation. Limit this hand clearing to a thirty-foot access corridor or less. Note that invasive species may be removed along the entire shoreline by hand.

- Provide residents with educational materials and present information regarding aquatic plant values and methods at annual meetings and in newsletters to limit impacts to native aquatic plants.

Objective 2: Control methods selectively target invasive species avoiding impacts to native plants.

- Mechanical removal of CLP is recommended to occur in early spring when CLP is typically the dominant plant growing that early in the season. Harvesting CLP early in the season once it is tall enough to be effectively collected by the EcoHarvester will minimize any major impacts to the native plants. If herbicide is used as a control method, it will be used early in the season before native plants are actively growing

- Mechanical removal of EWM is recommended to occur in late spring/early summer when it is typically taller than most native plants and therefore vulnerable to selective mechanical removal by the EcoHarvester without major impacts to the native plants. If patches of EWM are discovered later in the summer the optimum time to harvest it then is when it first starts to "top out" on the surface. The native plants typically reside well below the surface minimizing the impact to them.

Objective 3: Restore wild rice (*Zizania palustris*) beds in Musky Bay.

- Wild rice used to be abundant in Musky Bay but no longer exists in the bay, particularly along the eastern shoreline. Increases in the flocculent sediment and prolific growth of other aquatic plants were too much to overcome for the wild rice. With the recent reductions in phosphorus loadings occurring in the bay, habitat restoration and reseeding efforts should now be undertaken to restore the wild rice beds that once existed in the bay. The LCO Conservation Department is a resource to utilize to help with restoration efforts. Future aquatic plant point-intercept data conducting in Musky Bay will help to evaluate and track any restoration efforts.

Wild rice bed

Goal 4) Lake residents and users are made aware of the importance of native aquatic plants, the means to protect them, and the threat of aquatic invasive species.

It is very important that lake residents become educated about the identification of the various invasive plant species that are or could become established in the Lake. This will provide a greater awareness about these species and if one is discovered it is more likely that it would be found before it has spread to a large area and thus be easier to manage.

Objective 1: The Courte Oreilles Lakes Association will implement an aggressive education effort.

- Implement the education plan detailed below.*(recommend COLA set this section up how they desire)*

Target audience

- Lake shore property owners and their visitors
- Boat landing visitors

Messages

- Explain the plan activities to increase support for APM plan implementation (volunteer and monetary resources). This will include explaining treatment strategies and importance of timing.
- It is likely not possible to eradicate an AIS once it is established in the lake. The plan is geared to minimize the growth and spread of existing infestations of AIS. All efforts will be employed to try and eradicate it, however.
- Describe the importance of native plants to the lakes.
- Describe how lake residents and users can best preserve native plants – no wake near shore, effects of activity and parking boats on shallow reefs/sandbars, only limited clearing/raking for dock access and swimming, preventing introduction of invasive species, etc.
- Plant identification information
- How to protect natives while controlling invasive species
- Provide maps of AIS locations and areas of native plants of special concern to residents to avoid boating through these areas
- DNR permits are required for any aquatic herbicide application – including herbicides available on-line and shown in magazine advertisements. Fines may result if herbicides are applied without the appropriate permit.
- It is ok to hand pull invasive species along your entire shoreline. You must be confident in your identification of invasive plant species. And,

you must be very careful to remove any plant fragments from the water.

- It is ok to compost aquatic invasive plants well away from the water and use the compost in your garden.
- Identify who to contact for suspected aquatic invasive species locations.
- Property owners can hand pull or rake aquatic plants (or hire someone else to do this) in an area up to 30 feet wide along the shoreline that they own. This activity should be minimized to prevent the introduction and spread of invasive (weedy) aquatic plants in the cleared areas.

Methods

- Website
- Newsletter (Short Ears/Long Tales)
- Facebook page
- Annual meetings
- Special mailings (including packets of info to new property owners)
- Workshops and training
- UWEX/DNR informational materials and staff resources will be used whenever possible.
- Sawyer County AIS Coordinator can provide training on plant identification.

Goal 5) Restoration and preservation of native shoreline vegetation

Shoreline vegetation is very important to the ecosystem of Lac Courte Oreilles Lake. It provides key habitat for amphibians, reptiles, insects, birds and aquatic mammals. Furthermore, it buffers the lake from non-point source pollution and reduces erosion into the lake. Currently, the LCO Lake shoreline is “built-out” meaning very few vacant lots remain for development. As that development occurred, the native vegetation that was present around the lake shore in many cases has been replaced by lawns and/or non-native, ornamental plants. Often the tree and shrub layers are reduced or eliminated resulting in heavier runoff containing more sediment and nutrients which can fuel unwanted algae and plant growth. It is vital that individual parcels that do have intact shoreline buffers be preserved and parcels that do not have adequate vegetative buffers be restored. Due to the importance of having shoreline buffers and vegetation in place to enhance and preserve the water quality of LCO Lake, shoreline property owners of parcels that are not meeting shoreline buffer BMP's will be highly encouraged to undertake shoreline buffer restoration projects.

Objective 1: The Courte Oreilles Lakes Association will implement an aggressive, effective education effort about the importance of native shoreline vegetation

- Organize and provide education about the importance of native shoreline vegetation and encourage restoration.

Objective 2: Designate several successful buffer zone restoration projects so lake residents can better understand what a buffer restoration looks like and track its progression.

- Encourage shoreline restoration projects and facilitate shoreline restoration projects through incentives and/or cost share programs with Sawyer County or other grants. The WDNR has a Healthy Lakes and Rivers grant program that shoreline property owners are encouraged to take advantage of. More information on this grant program can be found on the WDNR website.[14]

- COLA will encourage property owners to report substandard buffer parcels and/or suspected violations of the County Shoreland Zoning Ordinance relating to setbacks, impervious surface requirements, lack of building permit(s) to COLA for referral to Sawyer County for action to require buffer restoration.

Objective 3: Conduct a second shoreline assessment to map and document the current status of the shoreline of Lac Courte Oreilles Lake.

- The draft guidance document prepared by the WDNR "Lake Shoreland and Shallow Habitat Monitoring Field Protocol"[15] will be followed for the assessment. Use of this document will provide a standard methodology for surveying, assessing, and mapping the habitat along the shore of Lac Courte Oreilles Lake.

Goal 6) Protect lake water quality and plant communities by minimizing runoff of pollutants from waterfront property and within the watershed.

The Courte Oreilles Lakes Association is encouraged to work with property owners, the Lac Courte Oreilles Tribe, the Sawyer County Zoning and Conservation Department, the Department

[14] Surface Water Grant Program fact sheet: Management (wi.gov)
[15] https://leapsllc.com/wp-content/uploads/Gilmore/Appendix-D-Shoreland-Habitat-Monitoring-Field-Protocol.pdf

of Natural Resources, and other partners to further assess pollutant loading concerns and options for management.

Watershed protection measures should concentrate on areas where phosphorus loading potential is the highest and runoff to the lake is most direct. Residential and agricultural areas along the lakeshore provide the highest potential for phosphorus loading to the lake.

COLA will encourage residents to protect water quality by installing infiltration practices such as rain gardens and rain barrels. These practices capture water from roofs and paved areas allowing water to soak into the ground rather than flowing to the lake.

Buffers of natural vegetation along the shoreline also help to slow runoff water and allow infiltration and should be encouraged. The first shoreline buffer survey done on Lac Courte Oreilles Lake showed a 60/40 split in adequate buffering….60%-adequate 40% nonexistent or inadequate.

The use of any fertilizers should also be discouraged. Phosphorus free fertilizer still contains nitrogen which will accelerate plant growth in the lake if there is any runoff. This could encourage the spread and increase the density of adjacent CLP/EWM stands. Property owners should be encouraged to follow the practices mentioned below through education and incentive programs.

Objective 1: Establish an effective education program to help reduce runoff from waterfront property.

- Implement the education plan detailed below.

  <u>**Target audience**</u>

  - Shoreline parcel property owners

  <u>**Messages**</u>

  - Waterfront development impacts lake water quality and aquatic plant growth
  - Provide information on lawn care practices that can help a lake and why they help the lake
  - Provide information regarding waterfront practices to protect the lakes
  - Natural wetlands provide critical pollutant filters

- Use zero phosphorus fertilizer, or better yet, don't use any fertilizer (nitrogen affects growth of plants in the water)
- Encourage property owners to establish rain gardens to collect and filter runoff from impervious surfaces on their property
- How buffer installations can help the lake and how to install them

Methods

- COLA Website
- Demonstration sites
- Newsletter (Short Ears/Long Tales)
- Annual meetings
- Special mailings (including packets of info to new property owners)
- Workshops and training
- On-on-one technical assistance visits
- Use UWEX/DNR informational materials and staff resources whenever possible

Objective 2: Implement erosion control Best Management Practices (BMP's) for high risk parcels of farmland in the Couderay watershed.

- In 2016 COLA commissioned the University of Wisconsin - Stevens Point to conduct an erosion study of the Upper Couderay River Watershed[16]. The erosion study was designed to assist Sawyer County in the identification of "priority farms" in the county that may benefit from implementation of erosion control best management practices that would conserve valuable topsoil and prevent soil sediment and phosphorus from entering area lakes. The erosion study contains the modeling and mapping necessary to help both farmers and lake associations in the Upper Couderay River Watershed—all of which eventually flows into LCO—identify and better manage farm parcels most vulnerable to erosion. COLA will work with Sawyer County/NRCS/WDNR/DATCP to help ensure those high-risk agricultural parcels implement BMP's to reduce erosion and runoff.

Objective 3: Ensure septic systems along the lakeshore are operating according to code and not impacting water quality

- The last shoreline septic system survey was completed by Sawyer County in 2013. At that time there were found to be 5.5% of the septic systems to be failing and ordered to

[16] https://www.uwsp.edu/cols-ap/GIS/Documents/COLA/Final%20Report%20-%20UCRW%20Environmental%20Information%20GIS%20Database%20Development%208-29-17.pdf

subsequently be fixed. It would be recommended to have a septic system survey around the lakeshore be completed approximately every ten years. Within the next five years a septic system survey will be completed. This would likely need to proceed with the cooperation and assistance from Sawyer County.

Implementation

To coordinate effective implementation of the aquatic plant management plan, the COLA board defined specific tasks to be handled by volunteer coordinators. The elements to be handled by each coordinator position are listed in the following discussion:

COLA AIS Coordinator Descriptions

Overall AIS Program Coordinator

- Coordination the elements/personnel of COLA AIS Program (see below)
- Maintain an up to date Aquatic Plant Management Plan (APMP) for the LCO lakes – *note that a new point-intercept plant survey is required every five years in order to be eligible for WDNR AIS control grant funding*
- Prepare yearly maps of AIS locations. Coordinate annual AIS planning with DNR and other stakeholders in the prior fall and winter. Perform public notification and securing of necessary treatment/mechanical harvesting permits
- Prepare WDNR permit applications and submit on behalf of COLA
- Act as primary spokesperson regarding the COLA AIS Program w/COLA membership, WDNR, local government, LCO Tribal government, and other lake associations
- Identify need and apply for monetary grants to support COLA AIS program
- Ensure proper management of COLA AIS grants and contracts
- Prepare pre and post treatment/season effectiveness reports.

Eco-Harvester (EH) Coordinator

- Act as primary contact with Weeder’s Digest (manufacturer) regarding purchase, operator training, maintenance training, warranty, any future mfg. maintenance/repairs
- Act as primary contact with the LCO Conservation Department regarding the requirements of the COLA/Tribe EH Use Agreement dated May 7, 2020 including storage, weekly and annual maintenance, necessary repairs, and establishment of annual usage schedules between COLA and LCOCD
- Assist in preparation of annual WDNR mechanical harvesting permit application(s) and ensure that any COLA use of the EH is authorized by appropriate permit coverage.
- Recruit and train volunteer operators, helpers, and drivers and coordinate their harvesting efforts thru out the AIS growing/harvesting season
- Ensure proper reuse/disposal of all harvested AIS biomass

- Maintain up to date EH and associated trailer(s) insurance coverage, maintenance logs, licenses, and registrations
- Etc.

AIS Observer Coordinator

- Recruit AIS Observers and provide AIS identification training
- Organize the AIS Observers to ensure that all sections of the littoral zone (<20 feet of water) around the LCO lakes are assigned to a trained AIS Observers
- Coordinate with the AIS ArcGIS Specialist to provide "ArcGIS Collector" training and together ensure that the AIS Observers are providing observational data in accordance with established protocol
- Stay abreast of AIS threat information and identification guidance provide by WDNR
- Assist in preparation of annual treatment/harvest maps and permit applications
- Etc.

AIS ArcGIS Coordinator

- Manage and provide maintenance, calibration, and updating of the ArcGIS Collector App (the "system") to track and communicate AIS locational information gathered on the LCO lakes
- Oversee and ensure ESRI-ArcGIS licensing and renewal requirements are up to date
- In conjunction with the AIS Observer Coordinator provide system use training to AIS Observers
  using the Collector tutorial and in person training sessions as necessary
- Coordinate the annual preparation of treatment/harvest maps for public notification, public comment, and permitting purposes
- Assist in the annul preparation of WDNR treatment/harvest permit applications
- Provide maps and other AIS locational information for the COLA website and membership communication
- Etc.

Clean Boats/Clean Waters Coordinator

- Apply for WDNR CBCW grant each year by December 10.
- Hire boat inspector to monitor boat ramp(s) (March)
- Provide inspector with your contact information
- Keep inspector supplied with CBCW forms
- Pick up forms at the end of each month and provide Chris Bedwell with hours worked.
- Enter the monthly form data in the WDNR SWIMS database
- Occasionally, drop by the ramp to make sure there are no issues with the inspector.
- On occasion, substitute for the inspector if a time conflict arises.

Recommended Timeline for control measures

Whether mechanical or chemical control is used to control AIS, a permit from the WDNR is required. These permits must be applied for online using the WDNR website[17].

The following timeline should be used for implementing control measures if a permit is needed:

Note that a mechanical permit may be viable for several years before needing renewal.

- Communicate in the Fall/Winter with all stakeholders on next years plans. Apply for the appropriate permit (mechanical/chemical) early in the year. Recommend applying January/February. This will allow for enough time to adjust permit parameters/requirements with the WDNR.
- Areas and acreages to be specified for control in the permit will be identified based off the previous seasons post treatment surveys and shoreline volunteer monitoring.
- Before control measures are implemented, a pre-treatment survey will be conducted to get an accurate assessment of the growth and areas of the AIS planned to be controlled. The closer this assessment occurs to the treatment the better.
- Control of the AIS will take place in accordance with the recommended control strategy discussed earlier in this document.
- Post treatment surveys will be conducted in the control areas. This will be important to assess the effectiveness of the treatment and to assess any potential impacts to the native plant community.
  - Timing of the post treatment survey is critical for areas with CLP. If mechanical harvest was used, the post treatment survey can occur shortly after harvesting is completed. If chemical control was used a sufficient time period needs to elapse to allow the chemical control to take effect. The post treatment survey should occur within a 30-45 day time period after applying the herbicide. This should be enough time to assess the effectiveness of the chemical control and should be prior to the CLP dying off naturally also.
  - It is also recommended that an additional post treatment survey be conducted in areas where CLP was noted. A second growth of CLP has been known to occur once the lake cools in the fall. Monitoring these areas will determine if this has occurred and subsequent control methods can be used to target this late season CLP growth to mitigate turion seed bank production.
- After the post-treatment surveys, the results should be assessed to determine effectiveness of treatment and to prepare maps for future treatment efforts.

[17] https://dnr.wi.gov/lakes/plants/forms/

Five Year Timeline of Activities

Goals, Objectives, Action Items	Responsible Parties	2021	2022	2023	2024	2025	Grant Eligible
Goal1: Control Existing Populations of AIS							
Objective 1: Control Existing CLP/EWM infestations following the recommended control strategy							
Ecoharvester will be primary means of control- refer to section recommended *timeline for control measures*	COLA AIS coordinator, EH Manager, Observer Coordinator, ArcGIS Specialist, LCO, WDNR	**X**	**X**	**X**	**X**	**X**	**Eligible for grant match**
Objective 2: Identify locations of CLP/EWM plants and beds, and monitor the effectiveness of control methods							
Volunteer shoreline observers will help locate AIS infestations. These will be tracked with the use of the ArcGIS Collector App and associated maps that COLA is implementing.	Observer Coordinator, ArcGIS Specialist	**X**	**X**	**X**	**X**	**X**	**Eligible for grant match**
The other means of locating AIS beds will be done by implementing annual pre and post annual meander surveys in areas where the Ecoharvester was used as the control method the previous season. Meander surveys will record the presence/absence of AIS using the ArcGIS Collector App and generate the associated map that will be used for permitting and reporting the information needed to determine the effectiveness of the Ecoharvester in controlling invasive species.	Observer Coordinator, ArcGIS Specialist	**X**	**X**	**X**	**X**	**X**	**X**

Goals, Objectives, Action Items	Responsible Parties	2021	2022	2023	2024	2025	Grant Eligible
Conduct a turion bed density study following established protocol in chronic areas of CLP to determine if control methods are being effective at reducing the turion load in the sediment. An initial study will determine the current density of the existing turion seed bank as a reference point.	COLA AIS coordinator, APM Consultant		X			X	X
Objective 3: Lake residents can identify potential invasive species and know how to remove them along their shoreline if they want to hand-pull them.							
Instruct residents how to properly identify AIS, particularly CLP/EWM, and who to contact for final verification.	Observer Coordinator	X	X	X	X	X	**Eligible for grant match**
Instruct residents how to properly remove AIS along their lakeshore if they desire to hand pull it.	Observer Coordinator	X	X	X	X	X	**Eligible for grant match**
Goal 2) Prevent the introduction and spread of aquatic invasive species							
Objective 1: Continue volunteer Monitoring for the presence of aquatic invasive species							
The general procedure for volunteer monitoring is volunteers are assigned to monitor specific stretches of the shoreline and bays by the AIS Observer Coordinator.	Observer Coordinator, ArcGIS Specialist	X	X	X	X	X	**Eligible for grant match**

Goals, Objectives, Action Items	Responsible Parties	2021	2022	2023	2024	2025	Grant Eligible
The stretches of shoreline and bays will be monitored on at least a monthly basis starting shortly after ice-out (mid to late April) and continue through until the end of the summer. More frequent monitoring can take place if the volunteer has the time available. Monitoring should take place during the first week of each month and the volunteers will report their observations (AIS present or not present) to the AIS Observer Coordinator. The Coordinator will send out monthly (May, June, July and August) post-card or email reminder notices to the volunteer monitors.	Observer Coordinator, ArcGIS Specialist	X	X	X	X	X	**Eligible for grant match**
COLA will provide training to monitors on the ArcGIS Collector App that will capture coordinates when the user locates locations of AIS. The COLA AIS Coordinator, Sawyer County AIS Coordinator or LCO Conservation Department confirms any areas of suspected AIS.	Observer Coordinator, ArcGIS Specialist	X	X	X	X	X	**Eligible for grant match**
Using Collector gathered data points the COLA ArcGIS Specialist will map confirmed locations of AIS as they are found or pre and post surveys are conducted. The size and density of the AIS beds will be recorded.	ArcGIS Specialist	X	X	X	X	X	X
Annual maps will be prepared to gauge success in controlling the AIS infestations. Maps will include acreage and density of the beds.	ArcGIS Specialist	X	X	X	X	X	X
Objective 2: Continue watercraft inspections							
It is important for the Courte Oreilles Lakes Association to continue its Clean Boats/Clean Waters Program. This program is provided through the University of Wisconsin Extension in cooperation with the Wisconsin DNR. The Association will continue the public landing inspections either through volunteer or hire	CB/CW Coordinator	X	X	X	X	X	X

Goals, Objectives, Action Items	Responsible Parties	2021	2022	2023	2024	2025	Grant Eligible
COLA will continue to investigate and determine the efficacy of implementing camera monitoring of the WDNR and Sand Lake Township boat landings on Lac Courte Oreilles Lake.	CB/CW Coordinator	X					
Objective 3: Maintain AIS signage and info at all boat landings							
Ensure that adequate and updated information is available at all the boat landings (private and public) educating users about AIS	AIS Coordinator	X	X	X	X	X	**Eligible for grant match**
Provide contact numbers, such as the WDNR, for people to call if suspect plants or animals are found.	AIS Coordinator	X	X	X	X	X	
Post maps of current AIS bed locations at all boat landings and instruct users of the lake to try to avoid boating in these areas to help minimize the potential to spread it	ArcGIS Specialist	X	X	X	X	X	
Goal 3) Preserve the lakes' diverse native plant communities							
Objective 1: Minimize removal of native plants from waterfront corridors							
It will be stressed to homeowners that removing native vegetation opens new areas for colonization by invasive species. This is especially noteworthy for properties on the lake adjacent to where AIS have been found. Stress hand removal only of native plants (no herbicides) if needed to maintain access for swimming and navigation. Limit this hand clearing to a thirty-foot access corridor or less. Note that invasive species may be removed along the entire shoreline by hand	AIS Coordinator	X	X	X	X	X	

Goals, Objectives, Action Items	Responsible Parties	2021	2022	2023	2024	2025	Grant Eligible
Provide residents with educational materials and present information regarding aquatic plant values and methods at annual meetings and in newsletters to limit impacts to native aquatic plants	AIS Coordinator	X	X	X	X	X	
Objective 2: Control methods selectively target invasive species avoiding impacts to native plants							
Mechanical removal of CLP is recommended to occur in early spring when CLP is typically the dominant plant growing that early in the season. Harvesting CLP early in the season once it is tall enough to be effectively collected by the Ecoharvester will minimize any major impacts to the native plants. If herbicide is used as a control method, it will be used early in the season before native plants are actively growing	EH Manager, LCO Conservation, APM Applicator	X	X	X	X	X	
Mechanical removal of EWM is recommended to occur in late spring/early summer when it is typically taller than most native plants and therefore vulnerable to selective mechanical removal by the Ecoharvester without major impacts to the native plants. If patches of EWM are discovered later in the summer the optimum time to harvest it then is when it first starts to "top out" on the surface. The native plants typically reside well below the surface minimizing the impact to them	EH Manager, LCO Conservation	X	X	X	X	X	
Objective 3: Restore wild rice (Zizania palustris) beds in Musky Bay							
With the recent reductions in phosphorus loadings occurring in the bay, habitat restoration and reseeding efforts should now be undertaken to restore the wild rice beds that once existed in the bay. The LCO Conservation Department is a resource to utilize to help with restoration efforts	AIS Coordinator, LCO Conservation	X	X	X	X	X	X

Goals, Objectives, Action Items	Responsible Parties	2021	2022	2023	2024	2025	Grant Eligible
Goal 4) Lake residents and users are made aware of the importance of native aquatic plants, the means to protect them, and the threat of aquatic invasive species							
Objective 1: The Courte Oreilles Lakes Association will implement an aggressive education effort							
Implement the education plan as previously detailed	COLA Board, AIS Coordinator	X	X	X	X	X	
Goal 5) Restoration and preservation of native shoreline vegetation							
Objective 1: The Courte Oreilles Lakes Association will implement an aggressive, effective education effort about the importance of native shoreline vegetation							
Organize and provide education about the importance of native shoreline vegetation and encourage restoration	COLA Board, AIS Coordinator	X	X	X	X	X	X
Objective 2: Designate several successful buffer zone restoration projects so lake residents can better understand what a buffer restoration looks like and track its progression							
Encourage shoreline restoration projects and facilitate shoreline restoration projects through COLA provided monetary incentives and/or cost share programs with Sawyer County or other grants	AIS Coordinator, Sawyer County	X	X	X	X	X	X
COLA will encourage property owners to report substandard buffer parcels and/or suspected violations of the County Shoreland Zoning Ordinance relating to setbacks, impervious surface requirements, lack of building permit(s) to COLA for referral to Sawyer County for action to require buffer restoration.	COLA Board, Sawyer County	X	X	X	X	X	
Objective 3: Conduct a shoreline assessment to map and document the current status of the shoreline of Lac Courte Oreilles Lake							

Goals, Objectives, Action Items	Responsible Parties	2021	2022	2023	2024	2025	Grant Eligible
The draft guidance document prepared by the WDNR "Lake Shoreland and Shallow Habitat Monitoring Field Protocol" will be followed. Use of this document will provide a standard methodology for surveying, assessing, and mapping the habitat along the shore of Lac Courte Oreilles Lake	AIS Coordinator		X				X
Goal 6) Protect lake water quality and plant communities by minimizing runoff of pollutants from waterfront property and within the watershed							
Objective 1: Establish an effective education program to help reduce runoff from waterfront property							
Implement the education plan as previously detailed	COLA Board, AIS Coordinator	X	X	X	X	X	
Objective 2: Implement erosion control Best Management Practices (BMP's) for high risk parcels of farmland in the Couderay watershed							
In 2016 COLA commissioned the University of Wisconsin - Stevens Point to conduct an erosion study of the Upper Couderay River Watershed . The erosion study was designed to assist Sawyer County in the identification of "priority farms" in the county that may benefit from implementation of erosion control best management practices that would conserve valuable topsoil and prevent soil sediment and phosphorus from entering area lakes. The erosion study contains the modeling and mapping necessary to help both farmers and lake associations in the Upper Couderay River Watershed—all of which eventually flows into LCO—identify and better manage farm parcels most vulnerable to erosion. COLA should work with Sawyer County to help ensure those high-risk agricultural parcels implement BMP's to reduce erosion and runoff	COLA Board, AIS Coordinator, Sawyer County	X	X				Potential DNR funding to help with runoff manage-ment
Objective 3: Ensure septic systems along the lakeshore are operating according to code and not impacting water quality							

Goals, Objectives, Action Items	Responsible Parties	2021	2022	2023	2024	2025	Grant Eligible
The goal is to complete a septic system survey of the shoreline properties on LCO approximately every ten years. Within the next five years a septic system survey should be completed. This would likely need to proceed with the cooperation and assistance from Sawyer County	COLA Board, AIS Coordinator, Sawyer County					**X**	**X**

Monitoring and Assessment

Aquatic Plants

Aquatic plant surveys are the primary means to track achievement towards the goals stated in this plan. Every five years whole lake point-intercept plant surveys will be done to update the knowledge of the aquatic plant ecosystem and to further determine if management strategies were effective. Additionally, this will lead to a further understanding of how aquatic plant communities change over time. The plant surveys will be conducted in accordance with the guidelines established by the WI DNR.

A new point-intercept survey is required every 5 years in order to be eligible for AIS control grant funding

To better track the effectiveness of the treatment where the EcoHarvester was used, annual meander surveys pertaining to presence/absence of AIS will be completed by COLA using inhouse expertise in the bays where the EcoHarvester was used. If COLA decides to conduct point intercept survey methods, it is recommended that the surveys use a finer grid than the WDNR generated grid used for the whole lake. Doubling the number of points for the grid, as was done previously in 2010 for Musky and Stucky Bays, would allow for more detailed coverage in these areas. In areas without enough grid points, an estimate of areal acreage will be recorded.

Education

To evaluate the effectiveness of the education and prevention actions identified in this plan a survey of boaters and property owners is recommended to be completed periodically. The Clean Boats, Clean Waters Volunteer Boat Landing Monitoring Program includes a questionnaire for boaters using the landing that the volunteer asks and records. This would be one simple way to evaluate the effectiveness of education and prevention actions taken. Also, additional surveys can be utilized to gauge target areas for future education.

Water Quality

The Lac Courte Oreilles Conservation Department annually monitors the lake during the summer months for total phosphorus, Chl-a and records Secchi disk values. Profiling with a multi-parameter water quality meter also is conducted. If for some reason the LCO Conservation Department was not able to continue their monitoring of the lake, COLA should be prepared to continue volunteer monitoring of water quality through the WI DNR self-help monitoring program to help with water quality trend evaluations.

Contingency Plan for Newly-found Populations of an AIS

A contingency fund should be set aside to deal specifically with a new AIS infestation. COLA should expect to pay all the cost for control up-front since the AIS rapid response grant operates on a reimbursement basis. If a new non-native, invasive species introduction should occur, the following plan should be followed once a potential identification has occurred.

1. For positive identification of the invasive species contact a designated local plant identification expert, (i.e. Sawyer County AIS coordinator, LCO Conservation Department) and the WI DNR.

2. Notify WI DNR aquatic plant management specialists of positive identification. Collect plant for a voucher specimen.

3. Carry out response plan using one or more of the following methods:

    a) Hand pulling
    b) Deploy the Ecoharvester if growth conditions warrant
    c) Herbicide use (permits required)
    d) Mapping spatial coverage and density

4. If warranted, apply for an invasive species rapid response grant from the WI Department of Natural Resources. It is recommended to check the WI DNR website to be sure that the latest version is being used.

5. Notify residents of positive invasive species identification and location.

6. Carefully monitor infested area and nearby areas for effectiveness of control methods.

7. Repeat controls as needed.

References

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Neuswanger, David J. August 2019. July 2019 Report on Mechanical Plant harvest Under DNR Permit #NO-2019-58-4405M. 3pp.

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Appendices