Note: Methodology, explanation of analysis and biological background on Wild Rice Lake studies are contained within the Manitowish Waters Chain of Lakes-wide Management Plan document.

8.7 Alder Lake

An Introduction to Alder Lake

Alder Lake, Vilas County, is a deep, lowland drainage lake with a maximum depth of 28 feet, a mean depth of 11.1 feet, and a surface area of approximately 265 acres. The Trout River enters the lake from the south, coming from downstream Wild Rice Lake. It then empties to the north, on its way to Manitowish Lake. Alder Lake is considered to be mesotrophic and its watershed encompasses approximately 50,694 acres. In 2014, 37 native aquatic plant species were found in the lake, of which fern pondweed (*Potamogeton robbinsii*) was the most common. Two non-native shoreland plants, giant reed and reed canary grass, were found during surveys.

Field Survey Notes

Much vegetation observed in the shallower, organic-sediment flats along the southeastern side of the lake. Sparser vegetation along the steeply sloped southern side of lake.

Vasey's pondweed located on a few point-intercept locations.

Shoreline erosion occurring along public access point on northwestern side of lake.

Photo 8.7. Alder Lake, Vilas County

Lake at a Glance* – Alder Lake

Morphology	
Acreage	265
Maximum Depth (ft)	26.0
Mean Depth (ft)	11.1
Volume (acre-feet)	2,935
Shoreline Complexity	1.7
Vegetation	
Curly-leaf Survey Date	July 2, 2014
Comprehensive Survey Date	July 29, 2014
Number of Native Species	37
Threatened/Special Concern Species	Vasey's pondweed
Exotic Plant Species	Giant reed, reed canary grass
Simpson's Diversity	0.92
Average Conservatism	6.6
Water Quality	
Wisconsin Lake Classification	Deep, Lowland Drainage
Trophic State	Mesotrophic
Limiting Nutrient	Phosphorus
Watershed to Lake Area Ratio	46:1

These parameters/surveys are discussed within the Chain-wide portion of the management plan.

8.7.1 Alder Lake Water Quality

Water quality data was collected from Alder Lake on six occasions in 2014/2015. Onterra staff sampled the lake for a variety of water quality parameters including total phosphorus, chlorophyll-*a*, Secchi disk clarity, temperature, and dissolved oxygen. Please note that the data in these graphs represent concentrations and depths taken during the growing season (April-October), summer months (June-August) or winter (February-March) as indicated with each dataset. Furthermore, unless otherwise noted the phosphorus and chlorophyll-*a* data represent only surface samples. In addition to sampling efforts completed in 2014/2015, any historical data was researched and are included within this report as available.

Some historical data exist for two water quality parameters of interest – total phosphorus and chlorophyll-*a* concentrations. In 2014, average summer phosphorus concentrations (20.5 µg/L) were less than the median value (23.0 µg/L) for other deep, lowland drainage lakes in the state (Figure 8.7.1-1). This value is also lower than the value for other lakes within the Northern Lakes and Forests ecoregion. A weighted value from all available data ranks as *Excellent* for a deep, lowland drainage lake.

Total phosphorus surface values from 2014-2015 are compared with bottom-lake samples collected during this same time frame in Figure 8.7.1-2. Concentrations from the epilimnion were found to be similar to those in the hypolimnion during these time periods, with slightly higher concentrations observed in the hypolimnion in August and February. As explained in the Chainwide Report (Water Quality Section Primer), sediments within a lake often release phosphorus under anoxic conditions. When mixing occurs in the lake, these nutrients may be transported to the upper water column for use by algae or aquatic plants. The data in Figure 8.7.1-2 indicate that a minimal amount of phosphorus release is occurring in Alder Lake.

Similar to what has been observed with the total phosphorus dataset, summer average chlorophyll-*a* concentrations (4.5 µg/L) were slightly lower than the median value (7.0 µg/L) for other lakes of this type (Figure 8.7.1-3), as well as lower than the median for all lakes in the ecoregion. Both of these parameters, total phosphorus and chlorophyll-*a*, rank within a TSI category of *Excellent*, indicating the lake has enough nutrients for production of aquatic plants, algae, and other organisms but not so much that a water quality issue is present. During 2014 visits to the lake, Onterra ecologists recorded field notes describing very good water conditions.

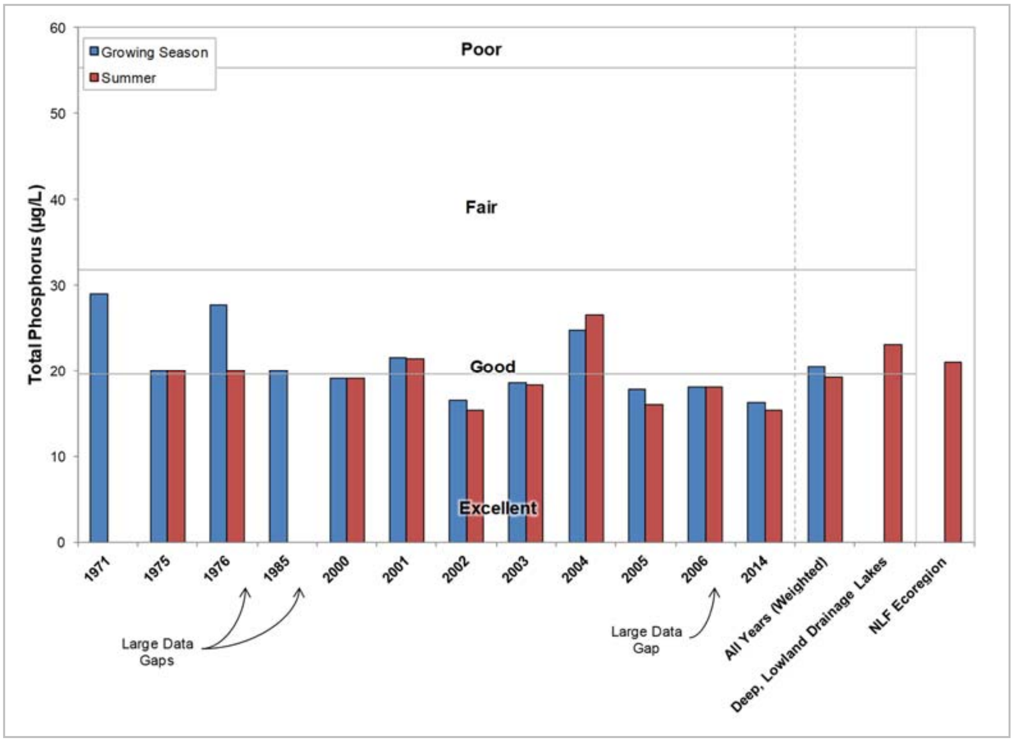


Figure 8.7.1-1. Alder Lake, state-wide deep, lowland drainage lakes, and regional total phosphorus concentrations. Mean values calculated with summer month surface sample data. Water Quality Index values adapted from WDNR PUB WT-913.

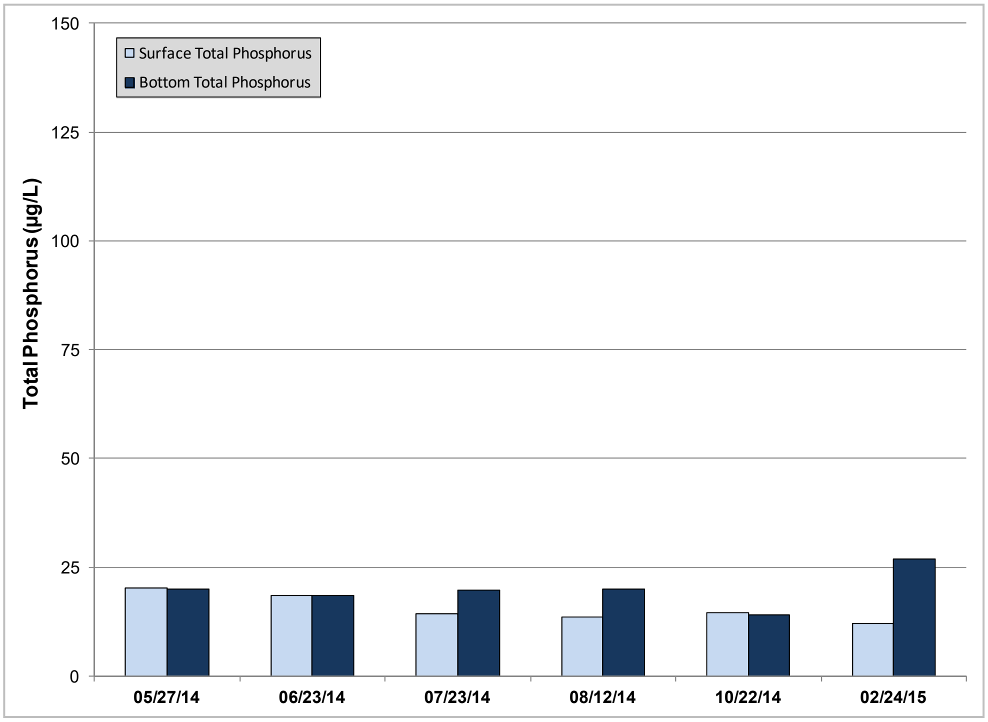


Figure 8.7.1-2. Alder Lake surface and bottom total phosphorus values, 2014-2015.

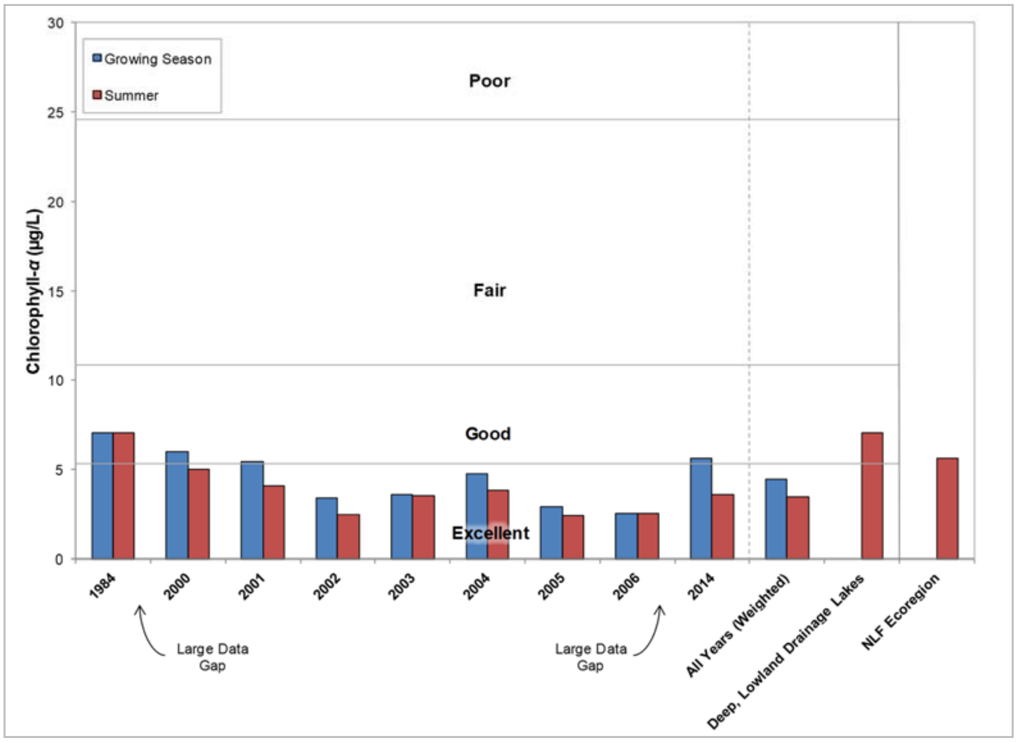


Figure 8.7.1-3. Alder Lake, state-wide deep, lowland drainage lakes, and regional chlorophyll-*a* concentrations. Mean values calculated with summer month surface sample data. Water Quality Index values adapted from WDNR PUB WT-913.

The clarity of Alder Lake's water can be described as *Good* to *Excellent* during the summer months in which data has been collected (Figure 8.7.1-4). A weighted average over this timeframe is greater than the median value for other deep, lowland drainage lakes in the state and is also larger than the regional median. Secchi disk clarity is influenced by many factors, including plankton production and suspended sediments, which themselves vary due to several environmental conditions such as precipitation, sunlight, and nutrient availability. In Alder Lake as well as the other lakes in the Manitowish Waters Chain of Lakes, a natural staining of the water plays a role in light penetration, and thus water clarity, as well. The waters of Alder Lake contain naturally occurring organic acids that are washed into the lake from nearby wetlands. The acids are not harmful to humans or aquatic species; they are by-products of decomposing terrestrial and wetland plant species. This natural staining may reduce light penetration into the water column, which reduces visibility and also reduces the growing depth of aquatic vegetation within the lake.

"True color" measures the dissolved organic materials in water. Water samples collected in May and July of 2014 were measured for this parameter, and were found to be 40 and 50 Platinum-cobalt units (Pt-co units, or PCU), respectively. Lillie and Mason (1983) categorized lakes with 0-40 PCU as having "low" color, 40-100 PCU as "medium" color, and >100 PCU as high color.

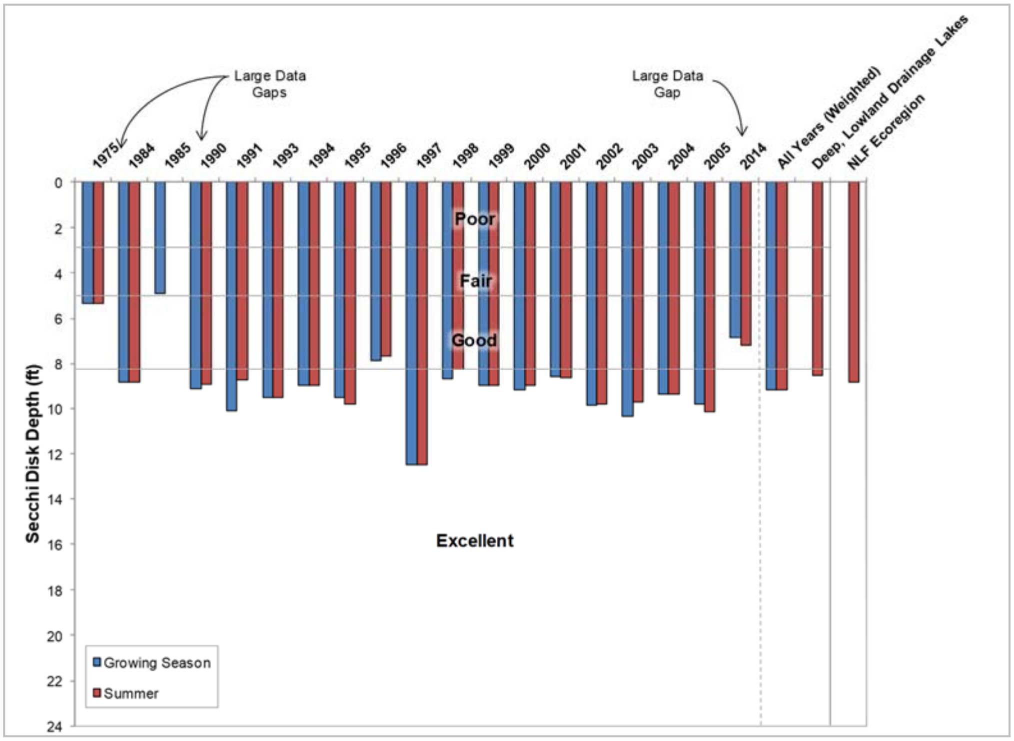


Figure 8.7.1-4. Alder Lake, state-wide deep, lowland drainage lakes, and regional Secchi disk clarity values. Mean values calculated with summer month surface sample data. Water Quality Index values adapted from WDNR PUB WT-913.

Alder Lake Trophic State

The TSI values calculated with Secchi disk, chlorophyll-*a*, and total phosphorus values range in values spanning from lower mesotrophic to eutrophic (Figure 8.7.1-5). In general, the best values to use in judging a lake's trophic state are the biological parameters; therefore, relying primarily on total phosphorus and chlorophyll-*a* TSI values, it can be concluded that Alder Lake is in a mesotrophic state.

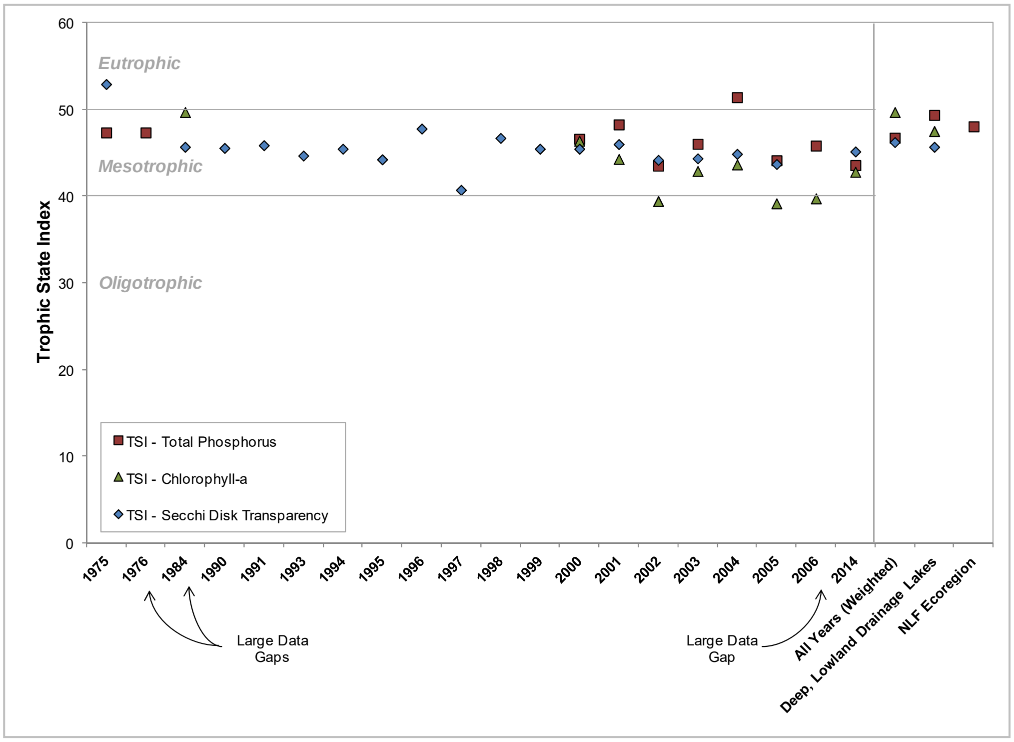


Figure 8.7.1-5. Alder Lake, state-wide deep, lowland drainage lakes, and regional Trophic State Index values. Values calculated with summer month surface sample data using WDNR PUB-WT-193.

Dissolved Oxygen and Temperature in Alder Lake

Dissolved oxygen and temperature profiles were created during each water quality sampling trip made to Alder Lake by Onterra staff. Graphs of those data are displayed in Figure 8.7.1-6 for all sampling events.

Alder Lake mixes thoroughly during the spring and fall, when changing air temperatures and gusty winds help to mix the water column. During the summer months, the lake was not observed to mix completely. The bottom of the lake was found to become void of oxygen (anoxic) several times during the year. This occurrence is not uncommon in Wisconsin lakes, as bacteria break down organic matter that has collected at the bottom of the lake and in doing so utilize any available oxygen. If the lake mixes completely, oxygen will be reintroduced to the lower levels of the water column.

The lake mixes completely again in the fall, re-oxygenating the water in the lower part of the water column. During the winter months, the coldest temperatures are found just under the overlying ice, while oxygen gradually diminishes once again towards the bottom of the lake. In February of 2015, oxygen levels remained sufficient throughout most of the water column to support most aquatic life in northern Wisconsin lakes.

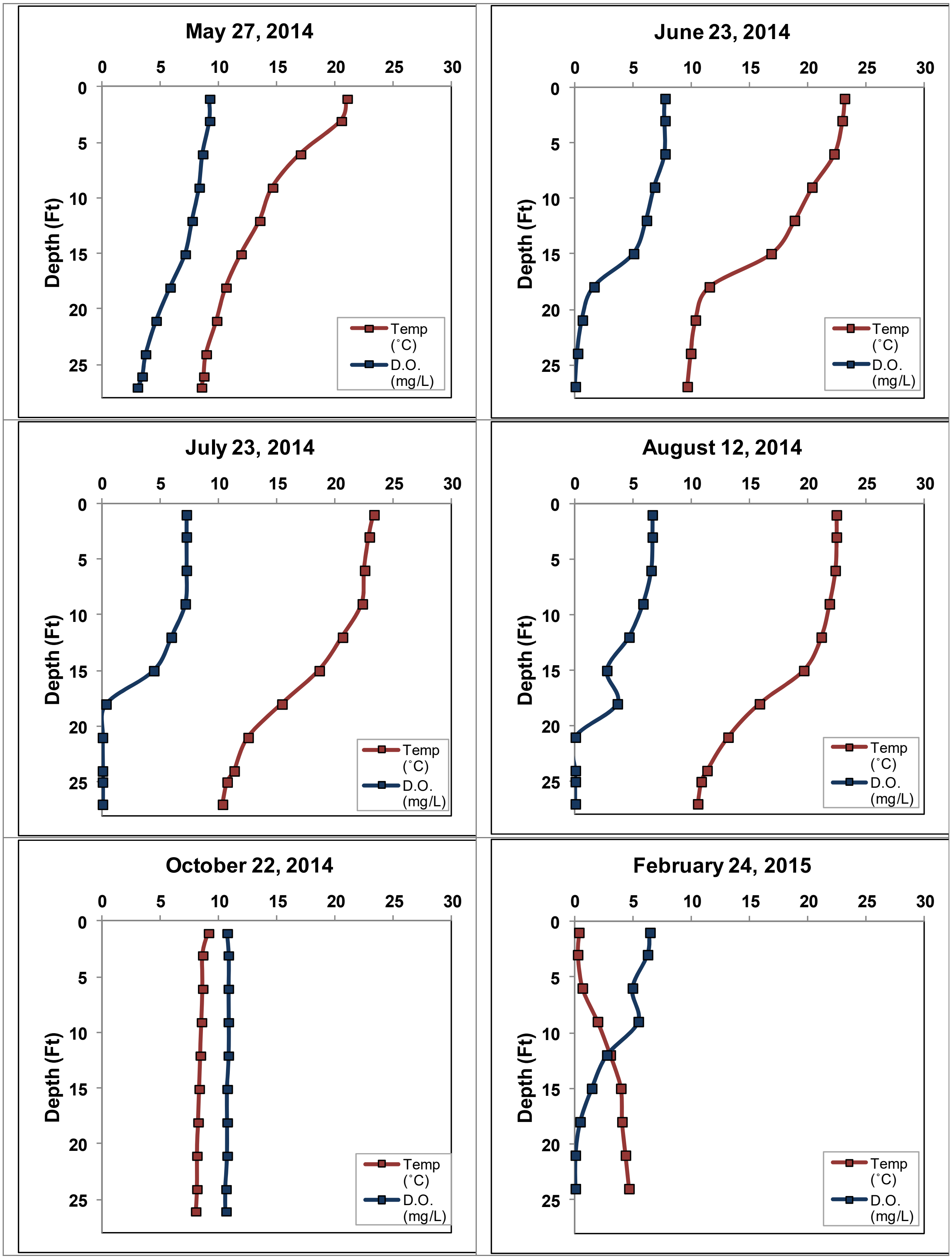


Figure 8.7.1-6. Alder Lake dissolved oxygen and temperature profiles.

Additional Water Quality Data Collected at Alder Lake

The water quality section is centered on lake eutrophication. However, parameters other than water clarity, nutrients, and chlorophyll-*a* were collected as part of the project. These other parameters were collected to increase the understanding of Alder Lake's water quality and are recommended as a part of the WDNR long-term lake trends monitoring protocol. These parameters include; pH, alkalinity, and calcium.

As the Chain-wide Water Quality Section explains, the pH scale ranges from 0 to 14 and indicates the concentration of hydrogen ions (H^+) within the lake's water and is thus an index of the lake's acidity. Alder Lake's surface water pH was measured at roughly 7.6 during May and July of 2014. These values are slightly above neutral and falls within the normal range for Wisconsin lakes. Fluctuations in pH with respect to seasonality is common; in-lake processes such as photosynthesis by plants act to reduce acidity by carbon dioxide removal while decomposition of organic matter adds carbon dioxide to water, thereby increasing acidity.

A lake's pH is primarily determined by the amount of alkalinity that is held within the water. Alkalinity is a lake's capacity to resist fluctuations in pH by neutralizing or buffering against inputs such as acid rain. Lakes with low alkalinity have higher amounts of the bicarbonate compound (HCO_3^-) while lakes with a higher alkalinity have more of the carbonate compound of alkalinity ($CO_3^=$). The carbonate form is better at buffering acidity, so lakes with higher alkalinity are less sensitive to acid rain than those with lower alkalinity. The alkalinity in Alder Lake was measured at 33.2 and 40.2 mg/L as $CaCO_3$ in May and July of 2014, respectively. This indicates that the lake has a substantial capacity to resist fluctuations in pH and has a low sensitivity to acid rain.

Samples of calcium were also collected from Alder Lake during 2013. Calcium is commonly examined because invasive and native mussels use the element for shell building and in reproduction. Invasive mussels typically require higher calcium concentrations than native mussels. The commonly accepted pH range for zebra mussels is 7.0 to 9.0, so Alder Lake's pH of 7.6 falls within this range. Lakes with calcium concentrations of less than 12 mg/L are considered to have very low susceptibility to zebra mussel establishment. The calcium concentration of Alder Lake was found to be 11.0 mg/L in July of 2014, which is below but near the optimal range for zebra mussels. Plankton tows were completed by Onterra staff during the summer of 2014 and these samples were processed by the WDNR for larval zebra mussels. No veligers (larval zebra mussels) were found within these samples.

8.7.2 Alder Lake Watershed Assessment

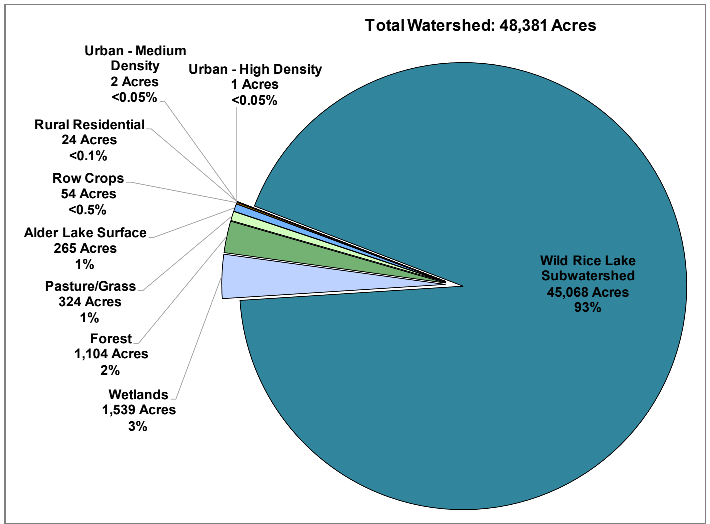


Figure 8.7.2-1. Alder Lake watershed proportion of land cover types. Based upon National Land Cover Database (NLCD – Fry et. al 2011).

Alder Lake's watershed is 48,381 acres in size. Compared to Alder Lake's size of 265 acres, this makes for an incredibly large watershed to lake area ratio of 182:1. Similar to most lakes that are downstream of other lakes, the large majority of the lake's watershed consists of the lake immediately upstream. For Alder Lake this means that 45,068 acres (98%) of Alder Lake's watershed is the Wild Rice Lake subwatershed. The direct watershed of Alder Lake is a very small part of the lake's total watershed (Figure 8.7.2-1). Wisconsin Lakes Modeling Suite (WiLMS) modeling indicates that Alder Lake's residence time is approximately 22 days, or that the water within the lake is completely replaced 17.5 times per year.

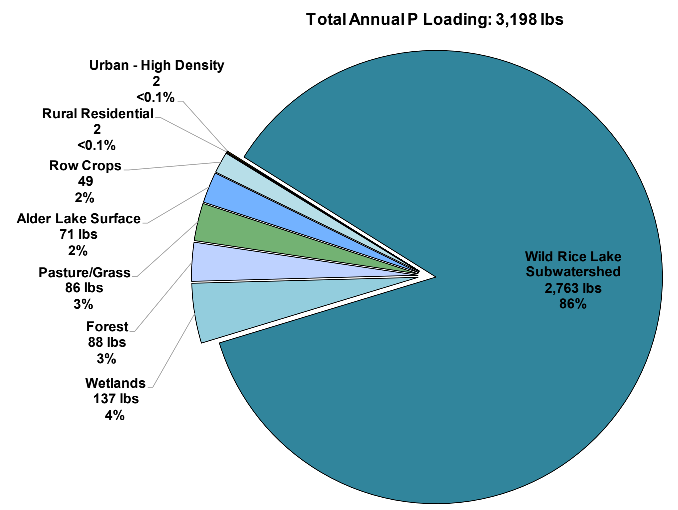


Figure 8.7.2-2. Alder Lake estimated potential annual phosphorus loading. Based upon Wisconsin Lake Modeling Suite (WiLMS) estimates.

Of the estimated 3,198 pounds of phosphorus being delivered to Alder Lake on an annual basis, approximately 2,763 pounds (86%) originates from Wild Rice Lake which is the lake immediately upstream of Alder Lake (Figure 8.7.2-2). Using the estimated annual potential phosphorus load, WiLMS predicted an in-lake growing season average total phosphorus concentration of 20 µg/L, which is the same as the measured growing season phosphorus concentration of 20 µg/L. This means the model works well for Alder Lake.

Because the large majority of the phosphorus that enters Alder Lake comes from the upstream Wild Rice Lake, efforts to reduce phosphorus levels in Alder Lake should concentrate on reducing phosphorus inputs to Wild Rice Lake.

8.7.3 Alder Lake Shoreland Condition

Shoreland Development

As mentioned previously in the Chain-wide Shoreland Condition Section, one of the most sensitive areas of the watershed is the immediate shoreland area. This area of land is the last source of protection for a lake against surface water runoff, and is also a critical area for wildlife habitat. In late summer of 2014, Alder Lake's immediate shoreline was assessed in terms of its development. Alder Lake has stretches of shoreland that fit all of the five shoreland assessment categories. In all, 1.5 miles of natural/undeveloped and developed-natural shoreline were observed during the survey (Figure 8.7.3-1). This constitutes about 54% of Alder Lake's shoreline. These shoreland types provide the most benefit to the lake and should be left in their natural state if at all possible. During the survey, 0.5 miles of urbanized and developed–unnatural shoreline (20%) was observed. If restoration of the Alder Lake shoreline is to occur, primary focus should be placed on these shoreland areas as they currently provide little benefit to, and actually may harm, the lake ecosystem. Alder Lake Map 1 displays the location of these shoreline lengths around the entire lake.

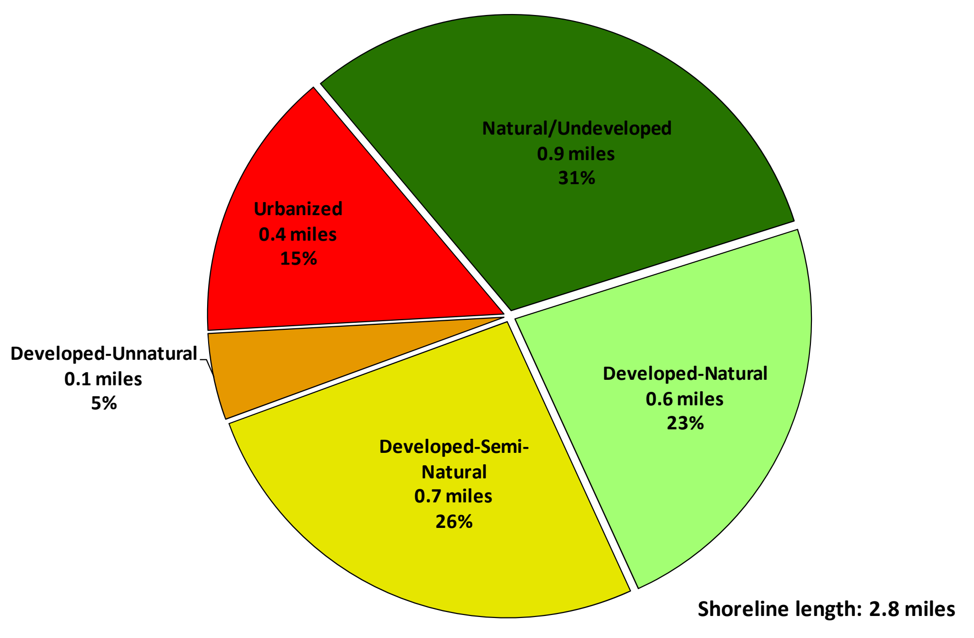


Figure 8.7.3-1. Alder Lake shoreland categories and total lengths. Based upon a late summer 2014 survey. Locations of these categorized shorelands can be found on Alder Lake Map 1.

Coarse Woody Habitat

As part of the shoreland condition assessment, Alder Lake was also surveyed to determine the extent of its coarse woody habitat. Coarse woody habitat was identified and classified in three size categories (2-8 inches in diameter, 8+ inches in diameter, or clusters of pieces) as well as four branching categories: no branches, minimal branches, moderate branches, and full canopy. As discussed earlier, research indicates that fish species prefer some branching as opposed to no branching on coarse woody habitat, and increasing complexity is positively correlated with higher fish species richness, diversity and abundance (Newbrey et al. 2005).

During this survey, 36 total pieces of coarse woody habitat were observed along 2.8 miles of shoreline (Alder Lake Map 2), which gives Alder Lake a coarse woody habitat to shoreline mile ratio of 13:1 (Figure 8.7.3-2). Only instances where emergent coarse woody habitat extended from shore into the water were recorded during the survey. Twenty-five pieces of 2-8 inches in diameter pieces of coarse woody habitat were found, eleven pieces of 8+ inches in diameter pieces of coarse woody habitat were found, and no instances of clusters of coarse woody habitat were found.

To put this into perspective, Wisconsin researchers have found that in completely undeveloped lakes, an average of 345 coarse woody habitat structures may be found per mile (Christensen et al. 1996). Please note the methodologies between the surveys done on Alder Lake and those cited in this literature comparison are much different, but still provide a valuable insight into what undisturbed shorelines may have in terms of coarse woody habitat.

Onterra has completed coarse woody habitat surveys on 98 lakes throughout Wisconsin since 2012, with the majority occurring in the NLF ecoregion on lakes with public access. The number of coarse woody habitat pieces per shoreline mile in Alder Lake falls below the 25th percentile of these 98 lakes (Figure 8.7.3-2).

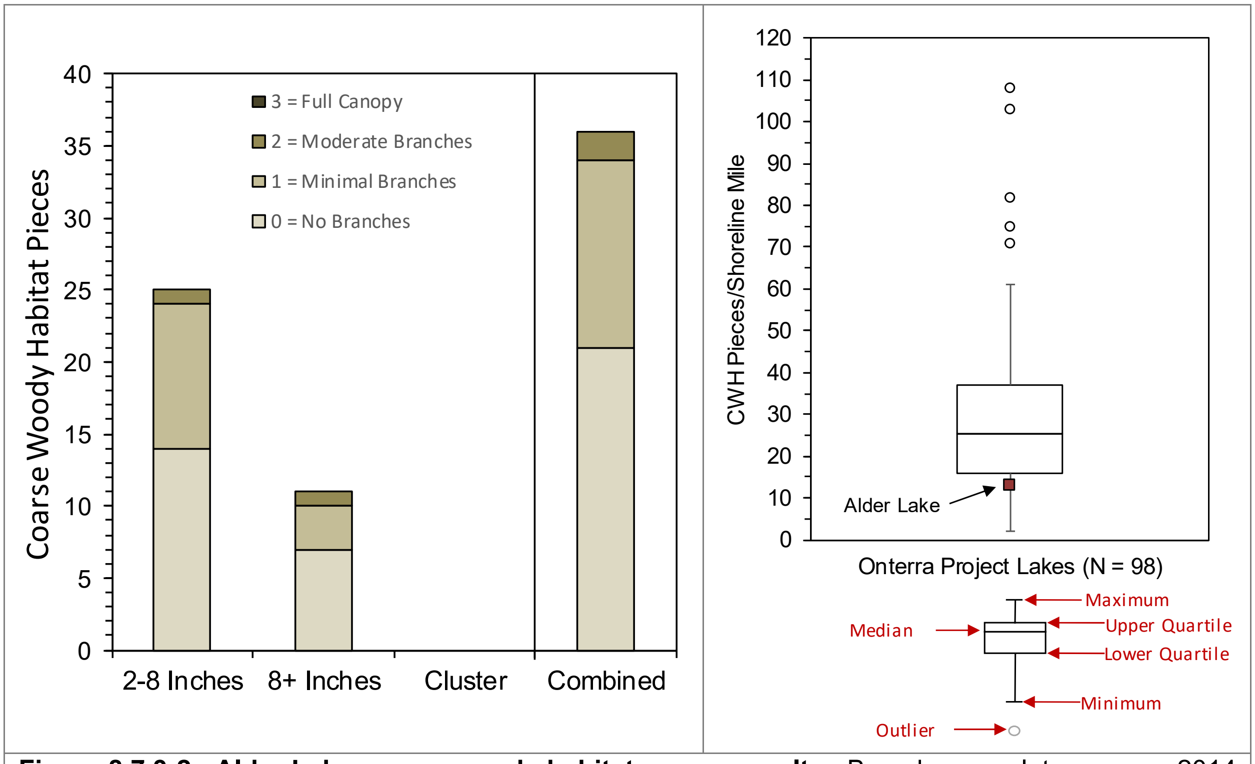


Figure 8.7.3-2. Alder Lake coarse woody habitat survey results. Based upon a late summer 2014 survey. Locations of the Alder Lake coarse woody habitat can be found on Alder Lake Map 2.

8.7.4 Alder Lake Aquatic Vegetation

An early season aquatic invasive species survey was conducted on Alder Lake on July 2, 2014. While the intent of this survey is to locate *any* potential non-native species within the lake, the primary focus is to locate occurrences of curly-leaf pondweed which should be at or near its peak growth at this time. During this meander-based survey of the littoral zone, Onterra ecologists did not locate any occurrences of curly-leaf pondweed or any other submersed non-native aquatic plant species.

The aquatic plant point-intercept survey was conducted on Alder Lake on July 29, 2014 by Onterra. The floating-leaf and emergent plant community mapping survey was completed on that same day to map these community types. During all surveys, 37 species of native aquatic plants were located in Alder Lake (Table 8.7.4-1). Twenty-six of these species were sampled directly during the point-intercept survey and are used in the analysis that follows, while 11 species were observed incidentally during visits to Alder Lake. Two non-native species, giant reed (*Phragmites australis*) and reed canary grass (*Phalaris arundinacea*) were observed along the Alder Lake shoreline.

Aquatic plants were found growing to a depth of 15 feet. As discussed later on within this section, many of the plants found in this survey indicate that the overall community is healthy, diverse and in one species case somewhat rare. Of the 149 point-intercept locations sampled within the littoral zone, roughly 74% contained aquatic vegetation. Alder Lake Map 3 indicates that most of the point-intercept locations that contained aquatic vegetation are located in shallow bays that are more likely to hold organic substrates. Approximately 61% of the point-intercept sampling locations where sediment data was collected at were sand, 31% consisted of a fine, organic substrate (muck) and 8% were determined to be rocky (Chain-wide Fisheries Section, Table 3.5-5).

Table 8.7.4-1. Aquatic plant species located in Alder Lake during 2014 plant surveys.

Growth Form	Scientific Name	Common Name	Coefficient of Conservatism (C)	2014 (Onterra)
Emergent	*Bolboschoenus fluviatilis*	River bulrush	5	I
	Carex lasiocarpa subsp. *americana*	American woolly-fruit sedge	9	I
	Equisetum fluviatile	Water horsetail	7	I
	Eleocharis palustris	Creeping spikerush	6	X
	Juncus effusus	Soft rush	4	I
	Phragmites australis	Giant reed	Exotic	I
	Phalaris arundinacea	Reed canary grass	Exotic	I
	Scirpus cyperinus	Wool grass	4	I
	Schoenoplectus tabernaemontani	Softstem bulrush	4	X
FL/E	*Sparganium fluctuans*	Floating-leaf bur-reed	10	I
Submergent	*Bidens beckii*	Water marigold	8	X
	Chara spp.	Muskgrasses	7	X
	Ceratophyllum demersum	Coontail	3	X
	Elatine minima	Waterwort	9	I
	Elodea nuttallii	Slender waterweed	7	X
	Elodea canadensis	Common waterweed	3	X
	Isoetes spp.	Quillwort species	N/A	X
	Myriophyllum sibiricum	Northern watermilfoil	7	X
	Nitella spp.	Stoneworts	7	X
	Najas flexilis	Slender naiad	6	X
	Potamogeton spirillus	Spiral-fruited pondweed	8	X
	Potamogeton pusillus	Small pondweed	7	X
	Potamogeton epihydrus	Ribbon-leaf pondweed	8	X
	Potamogeton foliosus	Leafy pondweed	6	X
	Potamogeton praelongus	White-stem pondweed	8	X
	Potamogeton vaseyi	Vasey's pondweed	10	X
	Potamogeton richardsonii	Clasping-leaf pondweed	5	X
	Potamogeton amplifolius	Large-leaf pondweed	7	X
	Potamogeton gramineus	Variable pondweed	7	X
	Potamogeton zosteriformis	Flat-stem pondweed	6	X
	Potamogeton robbinsii	Fern pondweed	8	X
	Utricularia intermedia	Flat-leaf bladderwort	9	I
	Utricularia minor	Small bladderwort	10	X
	Utricularia vulgaris	Common bladderwort	7	X
	Vallisneria americana	Wild celery	6	X
S/E	*Eleocharis acicularis*	Needle spikerush	5	X
	Sagittaria sp.	Arrowhead sp.	-	I

FL = Floating Leaf; FL/E = Floating Leaf and Emergent; S/E = Submergent and Emergent; FF = Free Floating
X = Located on rake during point-intercept survey; I = Incidental Species

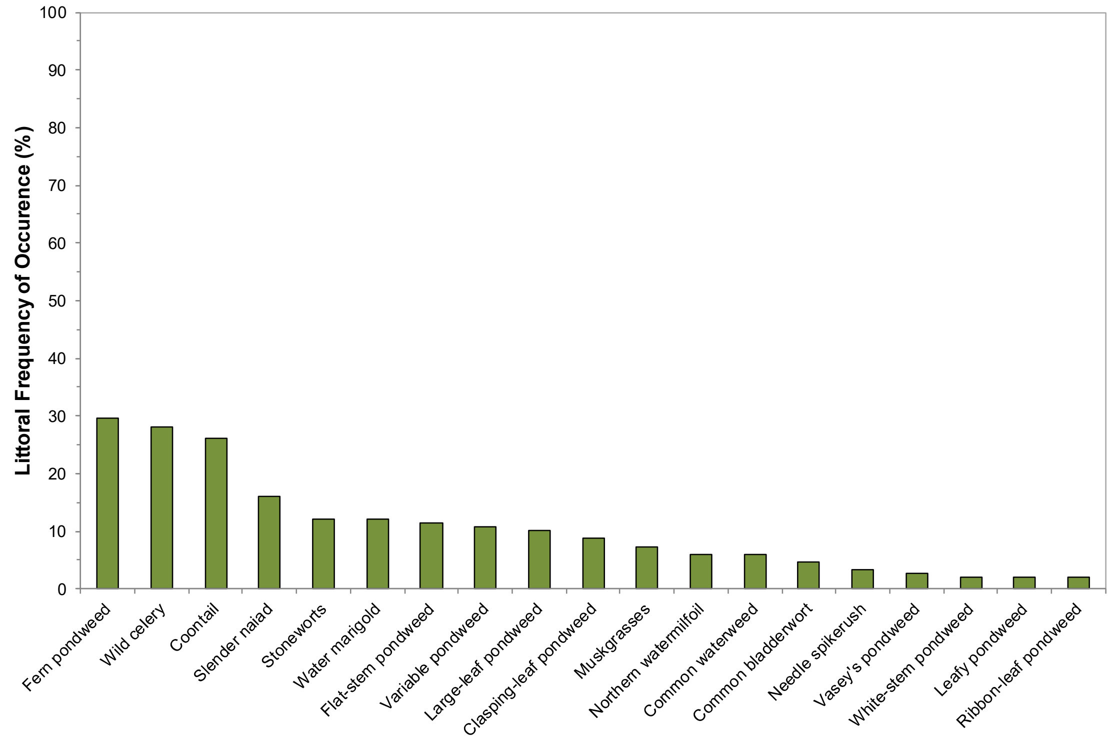


Figure 8.7.4-1. Alder Lake aquatic plant littoral frequency of occurrence analysis. Created using data from a 2014 point-intercept survey. Please note that only species with a frequency of occurrence greater than 2% are depicted.

Figure 8.7.4-1 (above) shows that fern pondweed, wild celery and coontail were the most frequently encountered plants within Alder Lake. Fern pondweed is a low-growing plant that was likely named after its palm-frond or fern-like appearance. This plant is known to provide habitat for smaller aquatic animals that are used as food by larger, predatory fishes. Wild celery is a long, limp, ribbon-leaved turbidity-tolerant species that is a premiere food source for ducks, marsh birds, shore birds and muskrats. Animals may eat the entire plant, including the tubers that reside within the sediment. Coontail is largely un-rooted (although do sometimes possess structures that function similar to roots or become partially buried in the sediment) and its location can be largely a product of water movement.

During aquatic plant inventories, 37 species of native aquatic plants (including incidentals) were found in Alder Lake. Because of this, one may assume that the system would also have a high diversity. As discussed earlier, how evenly the species are distributed throughout the system also influence the diversity. The diversity index for Alder Lake's plant community (0.92) lies above the Northern Lakes and Forest Lakes ecoregion value (0.86), indicating the lake holds exceptional diversity.

As explained earlier in the Manitowish Waters Chain of Lakes-wide document, the littoral frequency of occurrence analysis allows for an understanding of how often each of the plants is located during the point-intercept survey. Because each sampling location may contain numerous plant species, relative frequency of occurrence is one tool to evaluate how often each plant species is found in relation to all other species found (composition of population). For instance, while fern pondweed was found at 30% of the sampling locations, its relative frequency of occurrence is 14%.

Explained another way, if 100 plants were randomly sampled from Alder Lake, 14 of them would be fern pondweed. This distribution can be observed in Figure 8.7.4-2, where together 14 native (and one non-native) species account for 90% of the aquatic plant population within Alder Lake, while the other 12 species account for the remaining 10%. Eleven additional native species were found incidentally from the lake but not from of the point-intercept survey, and are indicated in Table 8.7.4-1 as incidentals.

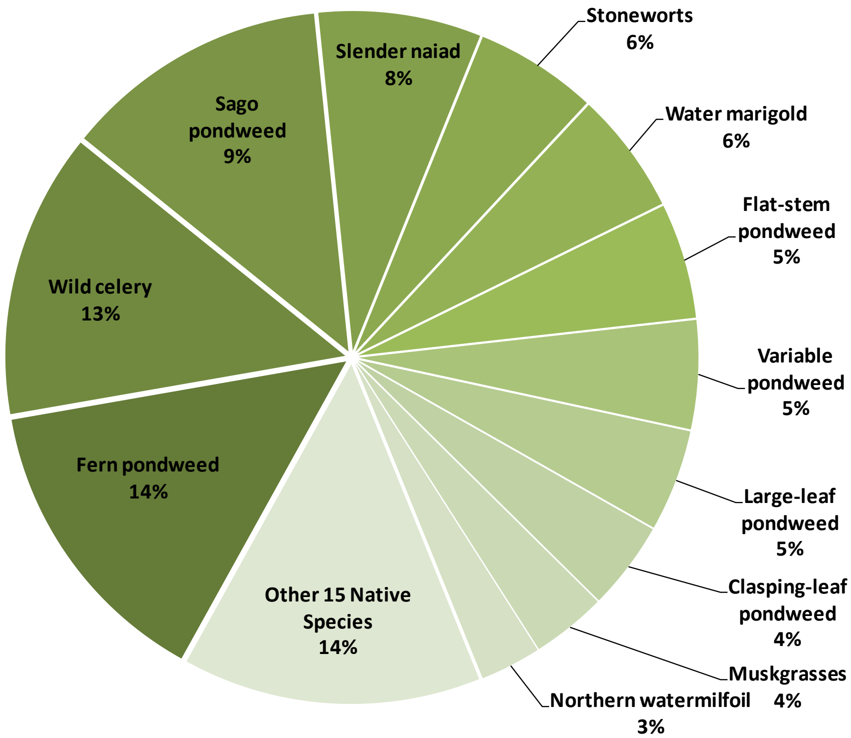


Figure 8.7.4-2. Alder Lake aquatic plant relative frequency of occurrence analysis. Created using data from 2014 point-intercept survey.

Alder Lake's average conservatism value (6.6) is higher than the state median (6.0) but slightly lower than the Northern Lakes and Forests ecoregion median (6.7). This indicates that the plant community of Alder Lake is indicative of a moderately disturbed system. Combining Alder Lake's species richness and average conservatism values to produce its Floristic Quality Index (FQI) results in a value of 33.9 which is above the median values of the ecoregion and state.

Alder Lake was found to have few emergent and floating-leaf aquatic plant communities. The 2014 community map indicates that approximately 0.7 acres of the lake contains these types of plant communities (Alder Lake Map 4, Table 8.7.4-2). Ten floating-leaf and emergent species were located on Alder Lake (Table 8.7.4-1), all of which provide valuable wildlife habitat.

Table 8.7.4-2. Alder Lake acres of emergent and floating-leaf plant communities from the 2014 community mapping survey.

Plant Community	Acres
Emergent	0.7
Floating-leaf	0.0
Mixed Floating-leaf and Emergent	0.0
Total	0.7

The community map represents a 'snapshot' of the emergent and floating-leaf plant communities, replications of this survey through time will provide a valuable understanding of the dynamics of these communities within Alder Lake. This is important, because these communities are often negatively affected by recreational use and shoreland development. Radomski and Goeman (2001) found a 66% reduction in vegetation coverage on developed shorelines when compared to undeveloped shorelines in Minnesota Lakes. Furthermore, they also found a significant reduction in abundance and size of northern pike (*Esox lucius*), bluegill (*Lepomis macrochirus*), and pumpkinseed (*Lepomis gibbosus*) associated with these developed shorelines.

One species located within an emergent community on Alder Lake is non-native, giant reed (*Phragmites australis*). This species was mixed within a cattail community on the lake's northern shoreline. Further downstream, a colony of giant reed was observed on the north shore of the Trout River (Map 4). There are 27 known genetic strains for giant reed worldwide – 11 of which appear to be native to the United States. The European strain is far more invasive than the native US strains. Vouchers of this plant were collected and sent to the UW-Stevens Point Herbarium for verification. Though difficult to differentiate based upon morphological features along, the samples are believed to be of the non-native, invasive strain.

Further information pertaining to this non-native species may be found in the Chain-wide Aquatic Plant section, non-native plants sub-section. Continued monitoring of this population and nearby shoreline reaches is important to learn impacts of this species on the native shoreline plant community.

Non-Native Aquatic Plants in Alder Lake

Reed canary grass

Reed canary grass (*Phalaris arundinacea*) is a large, coarse perennial grass that can reach six feet in height. Often difficult to distinguish from native grasses, this species forms dense, highly productive stands that vigorously outcompete native species. Unlike native grasses, few wildlife species utilize the grass as a food source, and the stems grow too densely to provide cover for small mammals and waterfowl. It grows best in moist soils such as wetlands, marshes, stream banks and lake shorelines. Reed canary grass was observed infrequently along the shore of Alder Lake. Reed canary grass is difficult to eradicate; at the time of this writing there is no commonly accepted control method. This plant is quite resilient to herbicide applications. Small, discrete patches have been covered by black plastic to reduce growth for an entire season. However, the species must be monitored because rhizomes may spread out beyond the plastic.

Giant Reed (aka Phragmites)

Giant reed (*Phragmites australis* subsp. *australis*) is a tall, perennial grass that was introduced to the United States from Europe. While a native strain (*P. australis* subsp. *americanus*) of this species exists in Wisconsin, the plants located along the shorelines and in shallow water in Alder are the non-native, invasive strain. Giant reed forms towering, dense colonies that overtake native vegetation and replace it with a monoculture that provides inadequate sources of food and habitat for wildlife.

Giant reed was found growing along the shore on the northeast and northwest sides of the lake (Alder Lake Map 4). Because this species has the capacity to displace the valuable wetland plants along the exposed shorelines, it is recommended that these plants be removed by cutting and bagging the seed heads and applying herbicide to the cut ends. This management strategy is most effective when completed in late summer or early fall when the plant is actively storing sugars and carbohydrates in its root system in preparation for over-wintering. A permit issued by the WDNR will likely be needed to place herbicide on plants that are located within the water.

8.7.5 Alder Lake Fisheries Data Integration

Fishery management is an important aspect in the comprehensive management of a lake ecosystem; therefore, a brief summary of available data is included here as a reference. The following section is not intended to be a comprehensive plan for the lake's fishery, as those aspects are currently being conducted by the fisheries biologists overseeing Alder Lake. The goal of this section is to provide an overview of some of the data that exists. Although current fish data were not collected as a part of this project, the following information was compiled based upon data available from the Wisconsin Department of Natural Resources (WDNR) the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) and personal communications with DNR Fisheries Biologist Hadley Boehm (WDNR 2018 & GLIFWC 2017).

Fish Stocking

To assist in meeting fisheries management goals, the WDNR may stock fry, fingerling or adult fish in a waterbody that were raised in nearby permitted hatcheries (Photograph 8.7.5-1). Stocking of a lake may be done to assist the population of a species due to a lack of natural reproduction in the system, or to otherwise enhance angling opportunities. Alder Lake has been stocked from 1999 to 1973 with muskellunge. Stocking efforts for Alder Lake are displayed in Table 8.7.5-1.

Photograph 8.7.5-1. Fingerling Muskellunge.

Table 8.7.5-1. Stocking data available for muskellunge in Alder Lake (1973-1999).

Lake	Year	Species	Age Class	# Fish Stocked	Avg Fish Length (in)
Alder Lake	1973	Muskellunge	Fingerling	500	9
Alder Lake	1976	Muskellunge	Fingerling	500	11
Alder Lake	1980	Muskellunge	Fingerling	500	9
Alder Lake	1983	Muskellunge	Fingerling	150	11
Alder Lake	1986	Muskellunge	Fingerling	300	12
Alder Lake	1988	Muskellunge	Fingerling	300	10.5
Alder Lake	1990	Muskellunge	Fingerling	300	9
Alder Lake	1991	Muskellunge	Fingerling	150	11.5
Alder Lake	1992	Muskellunge	Fingerling	150	11
Alder Lake	1993	Muskellunge	Fingerling	300	10
Alder Lake	1999	Muskellunge	Large Fingerling	150	12.1

Alder Lake Spear Harvest Records

Walleye open water spear harvest records are provided in Figure 8.7.5-1 from 1999 to 2017. As many as 130 walleye have been harvested from the lake in the past (2000), but the average harvest is roughly 42 fish in a given year. Spear harvesters on average have taken 56% of the declared quota. Additionally, on average 8% of walleye harvested have been female.

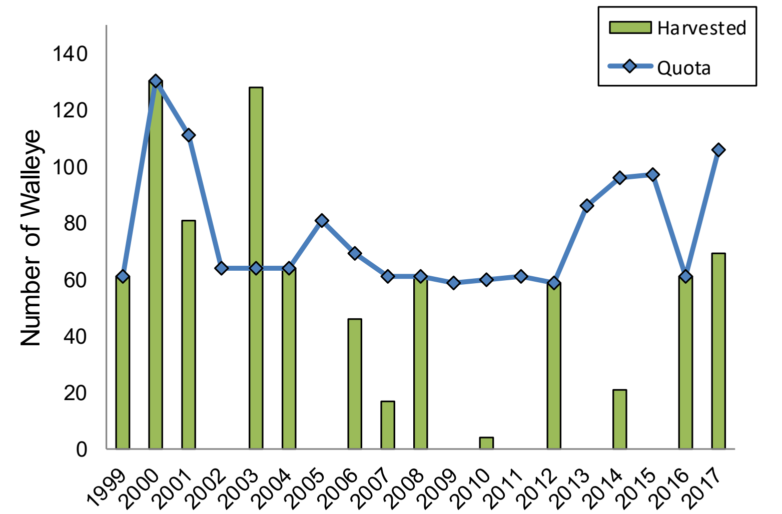
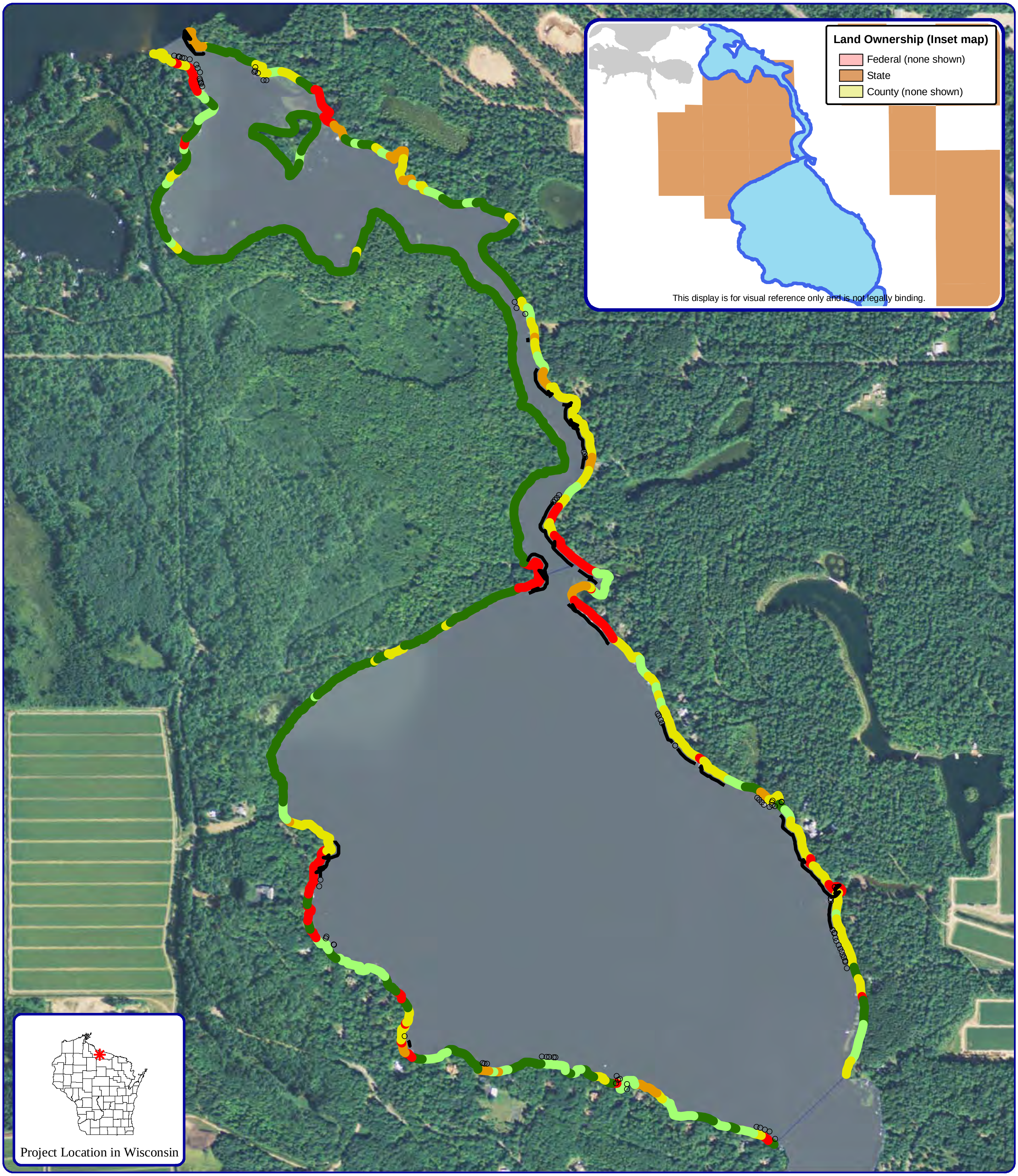


Figure 8.7.5-1. Alder Lake walleye spear harvest data. (GLIFWC 1999-2017).

Although Alder Lake has been declared as a spear harvest lake for muskellunge, it has not historically seen a harvest. It is possible that spearing efforts have been concentrated on other larger lakes in the region, which would potentially have a higher estimated safe harvest for muskellunge.



N
W E
S
950
Feet

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

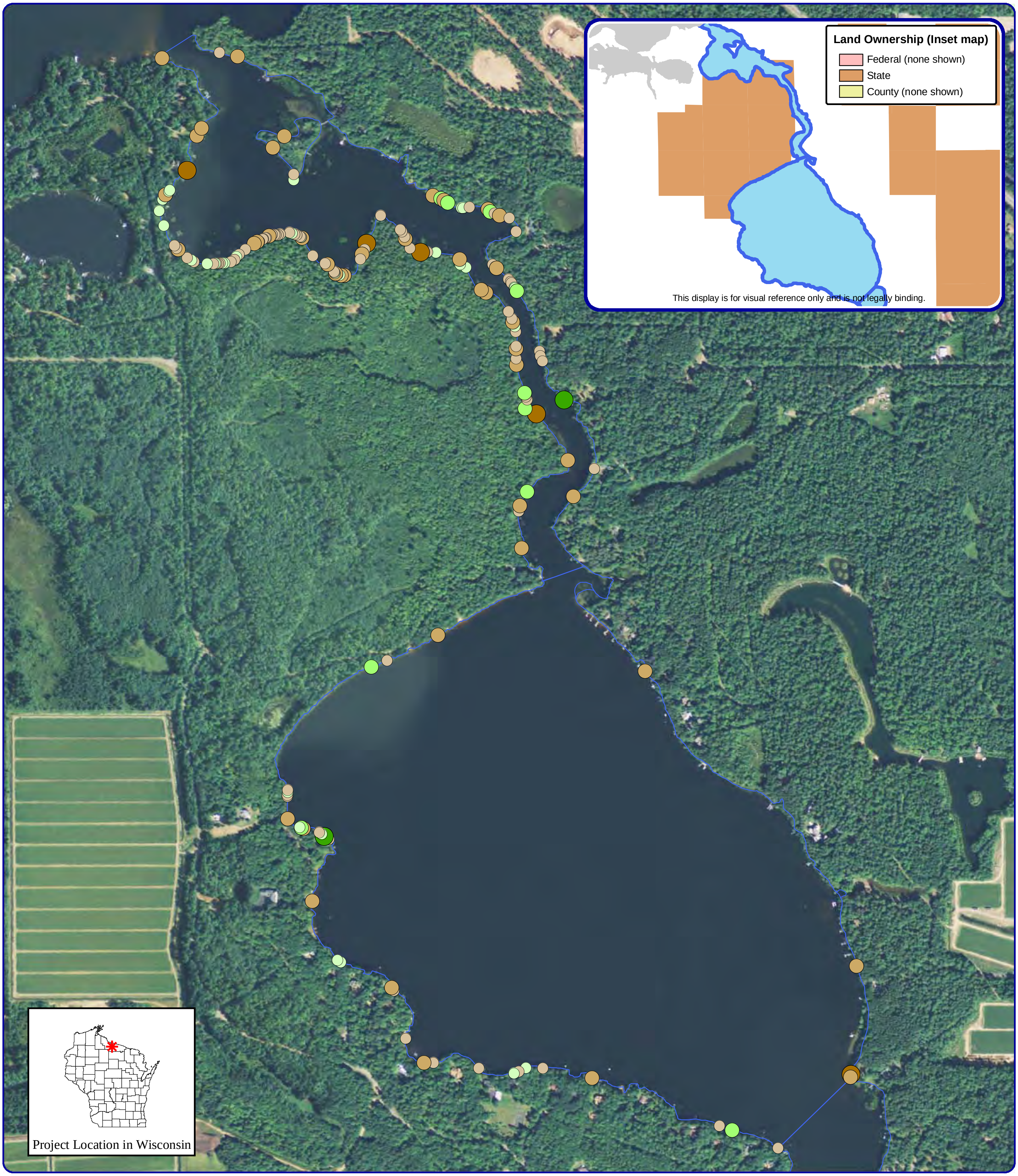
Sources:
Hydro: WDNR
CWH Survey: Onterra, 2014
Orthophotography: NAIP, 2013
Map date: October 20, 2014
Filename: *MapX_Alder_SCA_2014.mxd*

Legend

- Natural/Undeveloped
- Developed-Natural
- Developed-Semi-Natural
- Developed-Unnatural
- Urbanized

Seawall
- Masonary/Metal/Wood
- Rip-Rap

Alder Lake - Map 1
Manitowish Waters
Chain of Lakes
Vilas County, Wisconsin
Shoreland Condition



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Legend

2-8 Inch Pieces
- No Branches
- Minimal Branches
- Moderate Branches
- Full Canopy (none)

8+ Inch Pieces
- No Branches
- Minimal Branches
- Moderate Branches
- Full Canopy (none)

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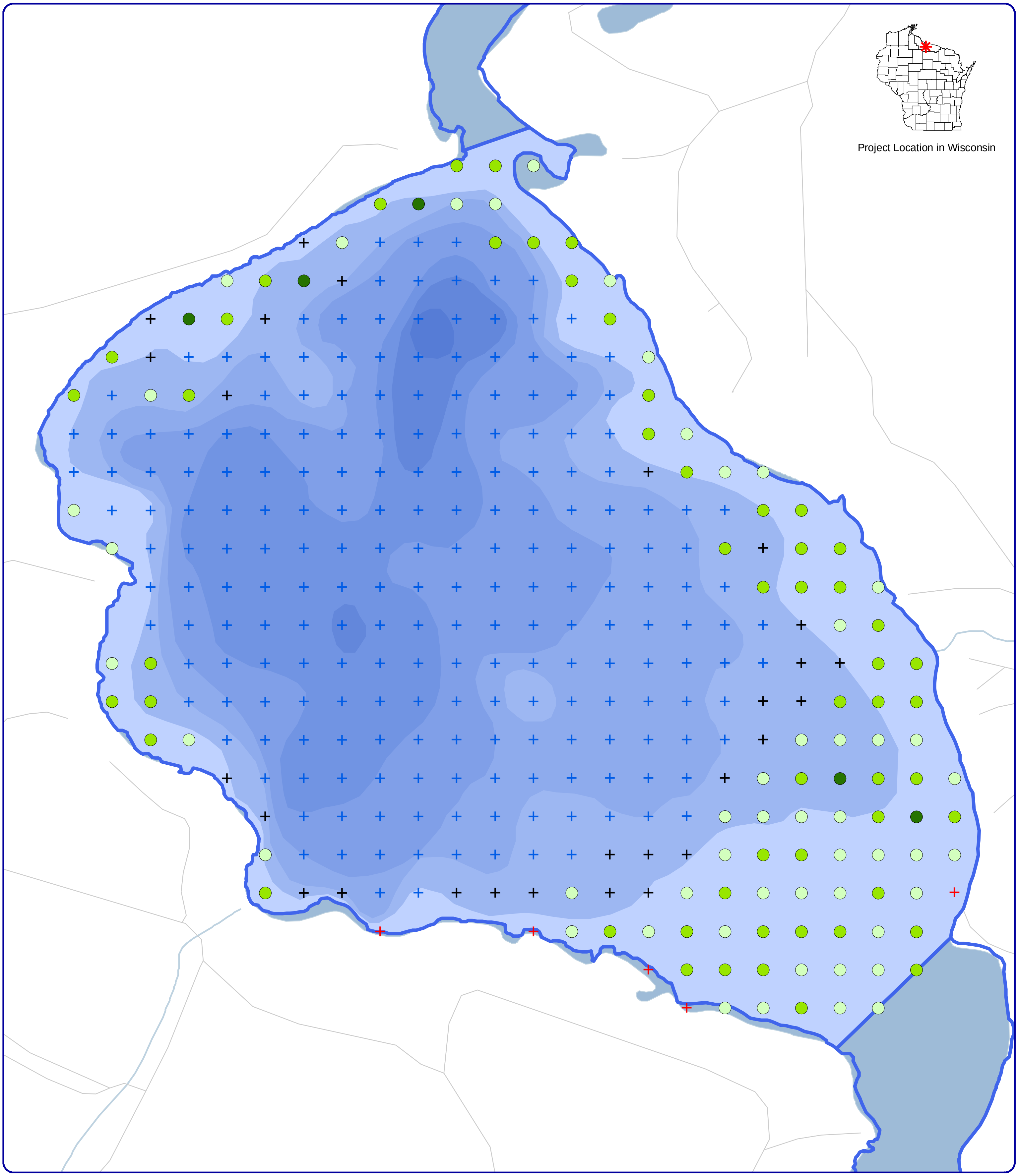
www.onterra-eco.com

Sources:
Hydro: WDNR
CWH Survey: Onterra, 2014
Orthophotography: NAIP, 2013
Map date: October 20, 2014
Filename: MapX_Alder_CWH_2014.mxd

Alder Lake - Map 2
Manitowish Waters
Chain of Lakes
Vilas County, Wisconsin
Coarse Woody Habitat



Legend

2014 Point-intercept Survey

- Total Rake Fullness = 1
- Total Rake Fullness = 2
- Total Rake Fullness = 3
- No Vegetation
- Non-navigable
- Deep

Alder Lake - Map 3

Manitowish Waters Chain of Lakes

Vilas County, Wisconsin

Aquatic Plant Distribution

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Lake Management Planning
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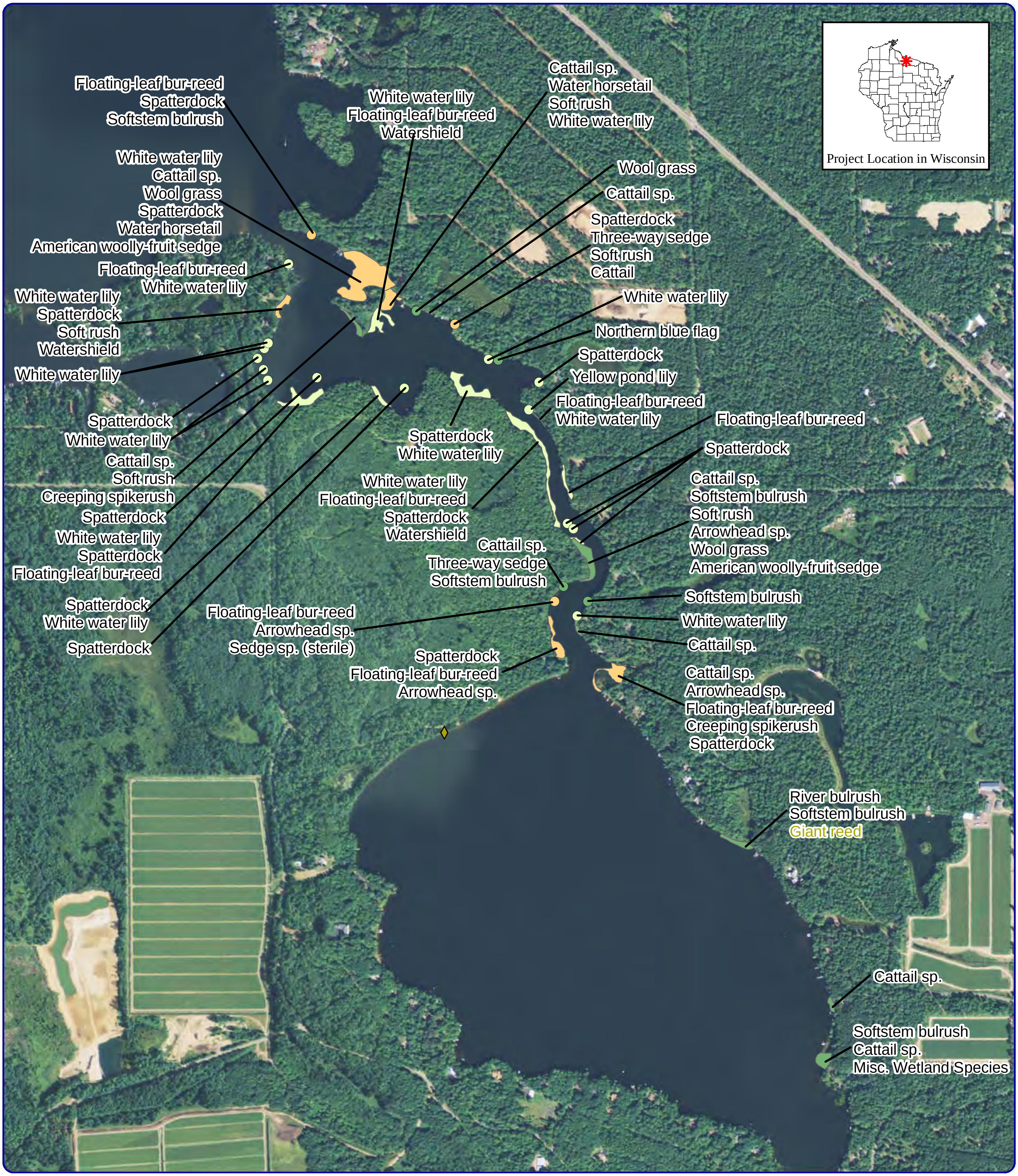
920.338.8860
www.onterra-eco.com

Sources:
Roads and Hydro: WDNR
Map Date: December 16, 2014
Filename: Alder_TRFPI_2014.mxd



N
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1,150
Feet

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Sources:
Hydro: WDNR
Aquatic Plants: Onterra, 2014
Orthophotography: NAIP, 2013
Map date: October 14, 2014
***Filename:** MapX_Alder_Comm_2014.mxd*

Legend

Small Plant Communities
- Emergent
- Floating-leaf
- Mixed Floating-leaf & Emergent
- Giant Reed

Large Plant Communities
- Emergent
- Floating-leaf
- Mixed Floating-leaf & Emergent
- Giant Reed

Alder Lake - Map 4
Manitowish Waters
Chain of Lakes
Vilas County, Wisconsin

Emergent & Floating-Leaf Aquatic Plant Communities