

## Wabasso Lake 2017 Lake Assessment Report

Prepared by  
Vilas County Land & Water Conservation

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Assessment Type	Metric	Metric Context	Wabasso Lake Results
Water Quality	Total Phosphorus	WISCALM Criteria: FAL <sup>1</sup> : 20 ug/L in seepage lakes REC <sup>2</sup> : 20 ug/L in seepage lakes	12.47 ug/L
	Chlorophyll a	WISCALM Criteria: FAL <sup>1</sup> : 27 ug/L REC <sup>2</sup> : >20 ug/L more than 5% of days	2.56 ug/L
Aquatic Plant Point-Intercept	Floristic Quality Index	24.3 median for Northern Lakes and Forest Lakes Ecoregion	27.74
	Average Value of Conservatism	6.7 median for Northern Lakes and Forest Lakes Ecoregion	8.36
	Docks/Mile	>16 docks/mile density correlated with less fish diversity	0 docks/mile

<sup>1</sup>Fish and aquatic life; <sup>2</sup>Recreation; <sup>3</sup>Frequency of Occurrence

Metrics & Contexts sourced from: WisCALM 2018; Hauxwell et al 2010; Nichols 1999; and Jacobson et. al. 2016.

Additional Data		
Water Quality	Secchi Depth	12.0 ft
Aquatic Plant Point-Intercept Survey	Max Depth of Plants	14.00 ft
	FOO <sup>3</sup> shallower than max depth	87.6%
	Simpson's Diversity Index	0.76
	Rare Plants	Potamogeton confervoides (Algal Leaved Pondweed); Potamogeton vaseyi (Vasey's Pondweed); Potamogeton oakesianus (Oakes Pondweed)
AIS Early Detection Survey	Verified & <b>New</b> AIS Found	None
Shoreland Habitat	% Natural Cover	97%
	% Impervious	3%
	Parcels With Runoff Concerns	1 parcel
	Coarse Woody Habitat	341 logs/mile

## Executive Summary

Wabasso Lake's Directed Lakes survey results indicate it is a high quality lake: Excellent water quality, an aquatic plant community of just less than average diversity but with "high quality" species, and no detected or documented Aquatic Invasive Species. Noteworthy aquatic plants include *Potamogeton confervoides* (Algal leaved pondweed), *Potamogeton vaseyi* (Vasey's Pondweed), and Oakes' Pondweed (*Potamogeton oakesianus*). A red algae *Sirodotia sp.*, a largely undocumented species in WI, was also found. The lake's coarse woody habitat is close to that of an average undeveloped lake (Christensen 1996). The lake consists of 3 parcels all managed by the US Forest Service. One erosion concern identified is the gully in the boat launch driveway that is allowing stormwater to be diverted into the lake. This lake is currently designated as non-motorized, and given the frequency of occurrence of large purple bladderwort (*Utricularia purpurea*) it is likely important to keep this designation to maintain the current plant community. Other recommendations include: addressing erosion in the boat launch, implement Clean Boats Clean Waters, monitor for aquatic invasives, maintain coarse woody habitat, protect the uniqueness off the aquatic plant community, update water quality data, and protect loon nesting areas.

## Introduction

Lakes are a vital natural resources to the economy and way of life in Vilas County. With over 75% of property taxes coming from lake front properties (based on 2016 tax roll), and tourism estimated to bring in an additional \$212.5 million annually (*Total Tourism Impacts*), it is in the county's best interest to keep these lakes attractive. Vilas County sits at a headwaters region, meaning that this area's lakes and rivers are dependent on precipitation and groundwater. This area does not glean significant water from upstream waterways, so local conservation practices often protect our waters directly as well as maintain the water quality as it heads downstream out of Vilas County. With these ideas in mind, the Vilas County Land & Water Conservation Department successfully applied for a grant to assess lake health through the DNR's Directed Lakes program.

There has been very little data collected and/or shared with the WI DNR from Wabasso Lake. The purposes of the study of Wabasso Lake are to: 1) fill data gaps by collecting data; and 2) identify any negative lake health issues for future focus. This data can also be used by the Vilas County Land & Water Conservation Department in the future with its planned watershed assessments.

Wabasso Lake is a 52 acre Deep Seepage Lake located in the Town of Lac du Flambeau. It is designated as a non-motorized lake. Wabasso Lake's maximum depth is 45 feet and is made up of 85% sand, 0% gravel, 5% rock, 10% muck (*Wabasso Lake*). The adjacent riparian land is managed by 1 landowner, the US Forest Service, and is primarily undeveloped apart from 1 rustic campground and boat launch. The ground cover is primarily forests and bogs. Surrounding soils are indicated as sandy soils (Sayner-Rubicon Complex, Rubicon Sand, Kinross Mucky Sand, and Karlin Loamy Fine Sand) and wetland soils (Loxley & Dawson Peats) with slopes ranging from 0%-15% (*Web Soil Survey*).

## Results and Discussion

Note – See Appendix 1 for Methods

### Water Quality

Wabasso Lake is a 52 acre and 42 ft deep seepage lake. Water quality assessments reference WisCALM Deep Seepage Lake criteria.

The total phosphorus criteria for fish & aquatic life and recreation is 20 ug/L. The total phosphorus sampled on Wabasso Lake at each sampling event was less than this amount, with an average total phosphorus of 12.47 ug/L.

The chlorophyll a criteria for fish and aquatic life is 27 ug/L. The chlorophyll a criteria for recreation is 5% of days where chlorophyll a is >20 ug/L. The chlorophyll a results at each sampling event were always less than these criteria, with an average of 2.56 ug/L. A second year of sampling is not required (Hein).

Water in Wabasso Lake was reported at “clear” and “blue” in color at all sampling events. Secchi depths averaged 12.0 ft, and is indicative of good water clarity and little algae growth. The lower pH (6.21) and alkalinity (3.66 mg/L) are anticipated because of the surrounding bogs – and indicates Wabasso is a softwater lake. Calcium concentrations are very low (0.594 mg/L) as is the conductivity (10.5 uS/cm), so the lake would not likely be suitable for zebra mussels (Cohen).

Temperature and dissolved oxygen monitoring showed the lake was stratified, with a thermocline existing at 9-18 ft., depending on the date sampled. “Warm water” fish need dissolved oxygen levels of at least 5 mg/L (Shaw et.al.). This threshold was reached in Wabasso Lake at 6–15 ft. depending on the date sampled, and dissolved oxygen levels of 0 mg/L were reached at 12-18 ft. At 0 mg/L dissolved oxygen, chemical processes differ in this anoxic environment and certain nutrients like phosphorus can be converted to bio-available forms and released lake-wide during turnover events, fueling algae and plant growth. See Appendix 2 for water quality raw data and temperature and dissolved oxygen profiles.

### Aquatic Plant Point-Intercept Survey

The Point-Intercept survey was done via canoe from July 5-July 12, 2017. Of the 217 point-intercept (PI) locations, 144 were visited – see Figure 8. Those that were not visited were skipped because either they were deeper than the maximum depth of plants, or the points were non-navigable/terrestrial.

There were a few note-worthy plant findings on Wabasso Lake. Algal leaved pondweed (*Potamogeton confervoides*) is a Threatened species in WI. Vasey’s pondweed (*Potamogeton vaseyi*) is a species of Special Concern in WI. Oakes pondweed (*Potamogeton oakesianus*) was also verified on Wabasso Lake and is a species of Special concern (*Wisconsin’s Rare Plants*).

Water lobelia (*Lobelia dortmanna*) was seen at four sites, but its structure makes it difficult to catch on a rake. It is likely that water lobelia was under-surveyed for calculations affecting the average value of conservatism and floristic quality.

Water willow (*Decodon verticillatus*) is a native plant but is a purple loosestrife look-alike and was abundant on the shorelines.

An odd-looking algae was collected on the rake at more than 2 PI points and was sent to the DNR in Madison for identification. From there, DNR staff Gina LaLiberte worked with experts in California to identify the specimen to the genus *Sirodotia*, and suspecting *Sirodotia suecica*, although species is not officially verified due to the lack of fruiting bodies. *Sirodotia* is a red algae that has been largely undocumented in WI.

Table 1. Wabasso Lake 2017 Aquatic Plant Point-Intercept Statistics. Values sourced from UW-Extension Lakes Aquatic Plant Survey Data Workbook formulas.

### Wabasso Lake 2017 Point-Intercept Summary

Total number of sites visited	<b>144</b>
Total number of sites with vegetation	<b>106</b>
Total number of sites shallower than maximum depth of plants	<b>121</b>
Frequency of occurrence at sites shallower than maximum depth of plants	<b>87.60</b>
Simpson Diversity Index	<b>0.76</b>
Maximum depth of plants (ft.)**	<b>14.00</b>
Number of sites sampled using rake on Rope (R)	<b>70</b>
Number of sites sampled using rake on Pole (P)	<b>59</b>
Average number of all species per site (shallower than max depth)	<b>1.76</b>
Average number of all species per site (veg. sites only)	<b>2.01</b>
Average number of native species per site (shallower than max depth)	<b>1.76</b>
Average number of native species per site (veg. sites only)	<b>2.01</b>
Species Richness	<b>12</b>
Species Richness (including visuals)	<b>18</b>
Floristic Quality Index	<b>27.74</b>
Average Value of Conservatism	<b>8.36</b>

The Species Richness for Wabasso Lake is 12. This figure includes only those species collected with the rake, and does not include visual sightings. Wabasso Lake has slightly less species on average than other lakes: average Species Richness for the Northern Lakes and Forests Ecoregion is 13 and the state of Wisconsin average is 13 (Nichols). See Appendix 5 for Species Richness Map.

The Average Value of Conservatism of 8.36 is significantly higher than Northern Lakes and Forest Lakes Ecoregion average of 6.7 and the state of Wisconsin average of 6.0 (Nichols). This shows that there are “high quality” plants typical of undisturbed systems in Wabasso Lake.

The Floristic Quality Index weighs both the species richness and the average value of Conservatism. The Floristic Quality for Wabasso Lake is 27.74. This value is higher than the Northern Lakes and Forest Lakes Ecoregion of 24.3 and the state of Wisconsin of 22.2 (Nichols).

The Simpson Diversity Index for Wabasso Lake is 0.76. This indicates less species and less even distribution of those species in Wabasso Lake than other lakes in the Ecoregion (where 0 = no diversity and 1 = infinite diversity).

Of the plant species found, large purple bladderwort (*Utricularia purpurea*) was by far the most prevalent, with a littoral frequency of occurrence of 76%. It grew deeper than most other plants in the lake (with the exception of aquatic moss) being found from depths ranging from 1 ft. - 14 ft.

Table 2. Wabasso Lake 2017 Aquatic Plant Point-Intercept Species Collected Via Rake, Coefficients of Conservatism, and Littoral Frequency of Occurrence

Species – Collected via Rake	Common Name	Coefficient of Conservatism	Littoral Frequency of Occurrence
<i>Utricularia purpurea</i>	Large purple bladderwort	9	76%
<i>Nymphaea odorata</i>	White water lily	6	26%
<i>Utricularia geminiscapa</i>	Twin-stemmed bladderwort	9	18%
<i>Brasenia schreberi</i>	Watershield	6	17%
<i>Eriocaulon aquaticum</i>	Pipewort	9	16%
<i>Potamogeton vaseyi</i>	Vasey's pondweed	10	9%
<i>Myriophyllum tenellum</i>	Dwarf water-milfoil	10	5%
<i>Myriophyllum farwellii</i>	Farwell's water-milfoil	8	2%
<i>Nitella</i>	Nitella	7	2%
<i>Pontederia cordata</i>	Pickeralweed	8	2%
<i>Potamogeton confervoides</i>	Algal-leaved pondweed	10	1%
<i>Carex sp.</i>	Carex sp.	n/a	1%

Six additional species were visually encountered within 6 ft. of a PI point, but not captured on a rake. These plants are not factored into Diversity calculations.

Table 3. Wabasso Lake 2017 Aquatic Plant Point-Intercept Additional Species Visually Encountered

Species – Visuals	Common Name
<i>Dulichium arundinaceum</i>	Three-way sedge
<i>Eleocharis palustris</i>	Creeping spikerush
<i>Lobelia dortmanna</i>	Water lobelia
<i>Nuphar variegata</i>	Spatterdock
<i>Potamogeton oakesianus</i>	Oakes pondweed
<i>Decodon verticillatus</i>	Water willow

For Wabasso Lake, the plants with more difficult ID were collected, photographed, and pressed. Pressed specimens are housed at the Freckmann Herbarium including: *Eleocharis palustris*, *Myriophyllum farwellii*, *Potamogeton confervoides*, *Potamogeton oakesianus*, *Potamogeton vaseyi*, *Utricularia geminiscapa*, and *Utricularia purpurea*. Plants not photographed or pressed were *Nymphaea odorata*, *Brasenia schreberi*, *Eriocaulon aquaticum*, *Myriophyllum tenellum*, *Nitella*, *Pontederia cordata*, *Carex sp.*, *Dulichium arundinaceum*, *Lobelia dortmanna*, *Nuphar variegata*, and *Decodon verticillatus*.

### AIS Early Detection Survey

On June 16, 2017, the AIS Early Detection Survey was completed. Although multiple species were searched for, **no AIS were found** during the survey and no AIS are documented as in SWIMS as being Verified or Observed. The water was clear enough to effectively look for AIS while snorkeling, so all target sites and boat launch area were snorkeled.

Veliger tows were sampled on July 19, 2017. Results were analyzed by DNR staff in Madison. No zebra mussel veligers were found in the Wabasso Lake sample (Kail).

Sediment samples were taken on June 16, 2017 and analyzed by DNR staff in Madison for spiny waterfleas. No evidence of spiny waterfleas was found in the samples (Kail).

### Coarse Woody Habitat

Coarse woody habitat was mapped on May 9, 2017 when the water was clear and easy to detect submerged logs. 450 logs were counted between the ordinary high water mark and the 2 ft depth contour along the 1.32 miles of shoreline, giving the density of 341 logs/mile of shoreline – see Appendix 6.

Note that not all logs were completely submerged due to the water being below the ordinary high water mark.

102 logs crossed the ordinary high water mark, providing a habitat “bridge” between the water and land. 8 logs were submerged with the full tree crown providing more structure to the Coarse Woody Habitat.

### Shoreline Assessment

The shoreline of Wabasso Lake consists of 3 parcels, all of which are managed by the US Forest Service. A boat launch and primitive campground are located on one of the parcels, but the others are undeveloped.

Lake-wide, 64% of the riparian area (35 ft. inland from shore) is covered by a shrub/herbaceous layer. However, 33% of the riparian area is covered by duff – this is naturally occurring and does not present runoff or erosion concerns. Together, this makes 97% of the lakeshore riparian area as undisturbed. Only 3% of the riparian area was categorized as Impervious due to the boat launch and campground areas. See Appendices 7-9 for Riparian Buffer Zone Cover Types.

Since Wisconsin now allows 100 ft. frontage lake parcels, and each parcel (or each 100 ft.) is allowed a 35 ft. viewing corridor through the Riparian Buffer Zone (Vilas County Shoreland Zoning Ordinance), 65% native vegetation remaining in the Riparian Buffer Zone is the lake-wide standard target. This rate does not reflect a biological or ecological best practice. Wabasso Lake clearly exceeds this statistic.

The only human structure noted in the Riparian and Littoral Zones was 1 fire pit. No docks were observed. Ten docks or less per kilometer (16 docks/mile) of shoreline has been shown to be a threshold of maintaining high quality fish diversity in Minnesota (Jacobsen et. al). See Appendix 10 for Human Structures in Riparian Buffer and Littoral Zones Chart.

Few runoff and erosion concerns were documented. The shoreline had 1 site where erosion was significant – a gully was present in the boat launch driveway. Others were 2 trails from campsites to the lake including 1 set of stairs, however erosion appeared to be minimal from those sources. See Appendix 11 for Number of Parcels with Erosion or Runoff Concerns.



Figure 1. Gully in boat launch driveway.

Within the Bank Zone, no modifications or bank erosion were observed.

Emergent and floating plants were seen at each parcel's adjacent littoral zone. No plant removal was observed. See Appendix 12 for Aquatic Plant Observations Per Parcel.

Photos of the riparian area and data from the shoreline assessment are housed with the Vilas County Land & Water Conservation Department and will be shared with the Department of Natural Resources.

## Observations

While working on Wabasso Lake, there were a few noteworthy observations not related to the Directed Lakes protocols. One Common Loon was seen on a nest on Wabasso Lake in June. However, it appeared that the loon had abandoned her nest by early July.

Orchids that appear to be *Pogonia sp.* were growing in bog areas near the boat launch (Sheehan). While they are not threatened or endangered, they are beautiful!

Each day while working on Wabasso Lake, water snakes (*Nerodia sipedon*) were seen regularly. One day staff encountered 3 different individuals.



Figure 2. *Pogonia* orchid on Wabasso Lake, 2017.

## Recommendations

Wabasso Lake does not have an associated lake organization, however the US Forest Service is the only landowner and riparian-based lake protection recommendations could be brought to their attention. The Lac du Flambeau Waters Alliance works with lakes in the Lac du Flambeau Township and may also be a source of assistance.

Wabasso Lake's water quality is good, and the surrounding land use is predominantly forested and undeveloped. In the interest of protecting Wabasso Lake's water quality and habitat, it is recommended to:

- Continue non-motorized designation
  - The density and commonness of large purple bladderwort would likely be a cause for grief from those attempting to motor through Wabasso Lake. In order to preserve the existing plant community ecology, a non-motorized designation is quite important.
- Address erosion in boat launch driveway
  - It appears that an erosion gully has formed in boat launch driveway and is directing stormwater to the lake. Phosphorus naturally occurring in the soil is contained within eroded material, and if entering the lake will likely add to the lake's plant productivity – eutrophication. Water diversions and/or infiltrations should be used to move stormwater to where it can infiltrate rather than run into the lake during storm events. Because this is a site managed by the US Forest Service, USFS agency staff would likely need to engineer and correct this issue.
- Implement a Clean Boats Clean Waters (CBCW) Campaign
  - It appears that Wabasso Lake had CBCW campaigns in the past. Continuing these campaigns during higher traffic times would help reduce the spread of AIS. This could be accomplished through volunteers, the Lac du Flambeau Waters Alliance, or the US Forest Service. Help with coordinating a campaign is available through the Vilas County Land & Water Conservation Department.
- Monitor for AIS
  - AIS monitoring should occur every few years. This could be accomplished through volunteers, the Lac du Flambeau Waters Alliance, or the US Forest Service. Help with coordinating an AIS Monitoring program is available through the Vilas County Land & Water Conservation Department.
- Maintain Coarse Woody Habitat
  - Wabasso Lake appears to be rich with bass and panfish. Encourage leaving down wood where it falls to maintain fish habitat. Again, keeping the motorless designation is important here – at low speeds (canoeing or trolling) these branches are not considered hazardous and boaters are less likely to want to remove them. From the scope of these assessments, adding Coarse Woody Habitat (i.e. tree drops) is not necessary.
- Protect the uniqueness of the aquatic plant community
  - The bulk of the plants in Wabasso Lake represent “high quality” habitat. This is a lake to treasure and protect through preventive conservation efforts.

- Update water quality information
  - Water chemistry data should be sampled and shared with DNR periodically to detect changes in water quality. When water chemistry data is sampled, use a WI certified lab to process the results so they are usable for WI DNR as well (ex. WI State Lab of Hygiene) and can be compared from year to year.
- Protect Loon nesting areas
  - If there is not signage at the boat launch asking boaters to stay 200 ft. from loons, consider posting some. These are available through Northland College's LoonWatch Program.

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## Appendices

- Appendix 1: Methods
- Appendix 2: Water Quality Raw Data and Temperature & Dissolved Oxygen Profiles
- Appendix 3: Aquatic Plant Point-Intercept Sampling Point Map
- Appendix 4: Aquatic Plant Point-Intercept Plant Photos
- Appendix 5: Species Richness by Sampling Point Map
- Appendix 6: Coarse Woody Habitat Map
- Appendix 7: Riparian Buffer Zone Cover Types Chart
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- Appendix 11: Number of Parcel with Erosion or Runoff Concerns
- Appendix 12: Aquatic Plant Observations

## Appendix 1: Methods

All surveys mentioned below were completed following the WI DNR's Directed Lakes protocols May 3, 2016 revision (Hein and Ferry, 2016). Any deviations from the protocols are mentioned within each section here. Decontamination of the boat and equipment via the DNR's bleach method occurred before a new body of water was entered (*Boat, Gear, and Equipment Decontamination and Disinfection Manual Code 9183.1*).

### Water Quality Sampling

Water quality sampling was done on three occasions and scheduled with the Lansat Satellite schedule Path 25. Temperature and dissolved oxygen profiles were measured at the deep hole using a YSI ProODO meter.

Lake water for chemistry analysis was collected with a 2 meter Integrating Sampler from the deep hole. Samples were analyzed by the WI State Lab of Hygiene in Madison, WI. "Blank" samples were also included for quality assurance. Sampling parameters varied by date:

- July: Temperature and dissolved oxygen profile; Secchi; total phosphorus; and chlorophyll a
- August: Temperature and dissolved oxygen profile; Secchi; total phosphorus; chlorophyll a; calcium; conductivity; alkalinity; and pH
- September: Temperature and dissolved oxygen profile; Secchi; total phosphorus; and chlorophyll a

Total phosphorus and chlorophyll a results were compared to the WisCALM criteria for deep seepage lakes.

### Aquatic Plant Point Intercept Survey

WI DNR staff created a grid-based map consisting of 217 point-intercept (PI) sampling points for Wabasso Lake and shared the resulting shapefile. Using the Minnesota DNR GPS Application software and a Garmin 76CX unit, the PI points were downloaded. As indicated in the Directed Lakes protocols, the standard WI Point-Intercept methods were used (Hauxwell et. al.). Land & Water staff navigated to each point that was shallower than the maximum depth for aquatic plants (determined during sampling) and identified each macrophyte collected on a double headed rake. A rake on a pole was used for sites shallower than 5 ft., while a rake on a rope was used for sites deeper than 5 feet. Species that were seen within 6 ft. from the boat that were not collected on the double headed rake were recorded as "visuals".

Plants were identified using several resources: *Aquatic Plants of the Upper Midwest 2<sup>nd</sup> Edition* (Skawinski), *Through the Looking Glass 2<sup>nd</sup> Edition* (Borman et. al.), *Manual of Vascular Plants of the Northeastern United States and Canada 2<sup>nd</sup> Edition* (Gleason and Cronquist), and "Identifying Pondweeds – A Brief Summary" (Knight).

Results were entered on the Aquatic Plant Survey Data Workbook (*Aquatic Plant Management in WI*). Statistics including Simpson's Diversity Index, Species Richness, Floristic Quality, and Average Value of Conservatism are sourced from this workbook's imbedded formulas.

Ideally, a representative aquatic plant for each species located would be collected, photographed, and pressed. Most plants found were treated as above, however a few were not – see the Results for more

details. All pressed plants were verified and are now housed with the UW-Stevens Point Freckmann Herbarium (Office phone 715-346-2637).

#### AIS Early Detection Surveys

Staff snorkeled and rake sampled at targeted sites around the lake in search of aquatic invasive species. Boat launches, inlets, outlets, high use areas, and changes in habitat are typically targeted areas, and Wabasso Lake's target sites included 5 areas near campsites or where habitat changes occurred in addition to the boat launch area. See Figure 1. A boat meander survey around the lake edge that included littoral rake sampling and riparian visual surveys was also done to increase aquatic and riparian invasive species detection.

AIS visually searched for included: hydrilla, water hyacinth, European frogbit, curly leaf pondweed, water lettuce, yellow floating heart, fanwort, Eurasian water-milfoil, Brazilian waterweed, parrot feather, didymo, water chestnut, purple loosestrife, yellow iris, flowering rush, Japanese knotweed, Phragmites, Japanese hops, faucet snails, zebra/quagga mussels, Chinese & banded mystery snails, Asian clams, rusty crayfish, swamp crayfish, New Zealand mudsnails, spiny waterfleas, and starry stonewort.

Veliger tows using a 50 cm opening plankton net were taken at 3 different locations to detect zebra mussels. Results were analyzed by WI DNR staff (Gina LaLiberte).

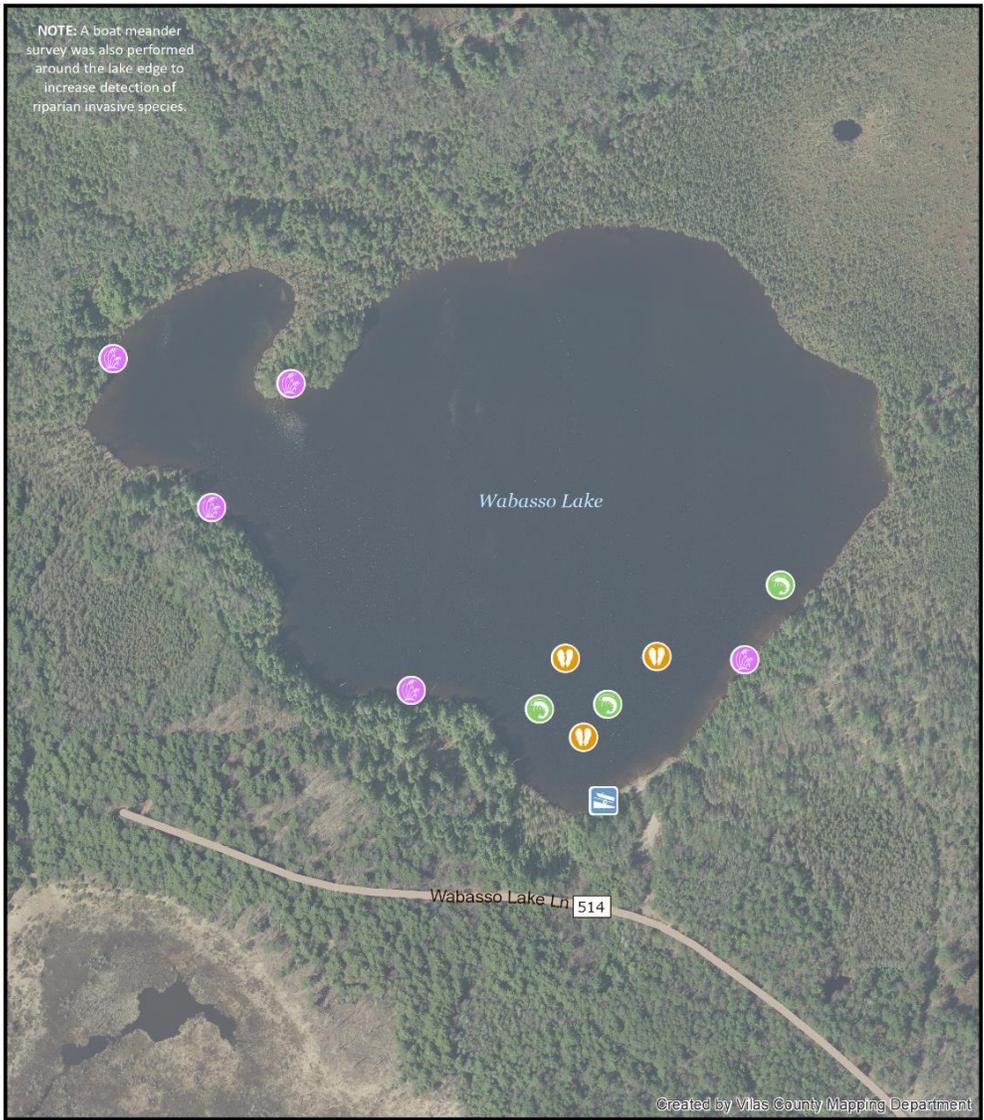
Sediment samples using an Ekman Dredge were taken to detect spiny waterfleas at 3 different locations on the lake. Results were analyzed by WI DNR staff (Gina LaLiberte).



# Aquatic Invasive Species Survey Sites (2017)

## Wabasso Lake, Lac du Flambeau

NOTE: A boat meander survey was also performed around the lake edge to increase detection of riparian invasive species.



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Created by Vilas County Land & Water Conservation  
Department and Vilas County Mapping Department  
Document: AIS Survey - Wabasso.mxd



Spiny Waterflea  
Sediment Sampling



Zebra Mussel Veliger  
Sampling



Target Site



Boat Launch

Figure 3. AIS Monitoring included the boat launch area, 5 target sites, 3 spiny waterflea sediment samples, and 3 veliger tows.

### Coarse Woody Habitat

Coarse woody habitat was surveyed according to the existing 2016 draft of the Lake Shoreland & Shallows Habitat Monitoring Field Protocol (Hein et. al.). Coarse woody habitat situated between the ordinary high water mark and the 2 ft. depth contour at least 4 inches in diameter and 5 ft. long was documented and mapped. A Garmin 76CX was used to mark each piece of wood. Certain features about the wood were manually noted: “Branchiness” (no branches; a few branches; full crown); does the wood cross the ordinary high water mark (touch shore; not touch shore); and is 5 ft. of the wood currently submerged (in water; not in water).

Data was downloaded using BaseCamp software, and a map was created in ArcMap.

### Shoreland Assessment

Coarse woody habitat was surveyed according to the existing 2016 draft of the Lake Shoreland & Shallows Habitat Monitoring Field Protocol (Hein et. al.). This survey collected information per land parcel. An ArcMap file was created that contained the parcel boundaries around Wabasso Lake with a centroid in each parcel pushed out 50 ft. into the lake. A 35 ft. boundary inland was drawn around the lake to designate the Riparian Zone. This data was downloaded onto a Trimble Nomad data logger. The centroid and parcels lines and gave a target and boundaries to work with while on the lake assessing the parcels.

The Shoreland Assessment protocols call for documenting the condition of the Riparian Buffer Zone 35 ft. inland from shore, the bank zone, and the littoral zone – see Figure 4.

Data collected on the Riparian Buffer Zone were percent of cover (canopy, shrubs, herbaceous, impervious surfaces, manicured lawn, agriculture, and other); human structures (buildings, boats on shore, fire pits, and other); runoff concerns (point source, channelized flow/gully, straight stair/trail/road to lake, lawn/soil sloping to lake, bare soil, sand/silt deposits, and other).

Data collected on the Bank Zone were horizontal lengths of the following: vertical sea wall; rip rap; other erosion control structures; artificial beach; bank erosion >1 ft. face; and bank erosion < 1ft. face.

Data collected on the Littoral Zone were the number human structures: piers, boat lifts, swim rafts/water trampolines, boathouses, and marinas. Presence/absence of aquatic emergent and floating plants were noted. Signs of aquatic plant removal were also noted.

Photos of the 35 ft. Riparian Buffer Zone were taken at approximately 50 ft. from shore.

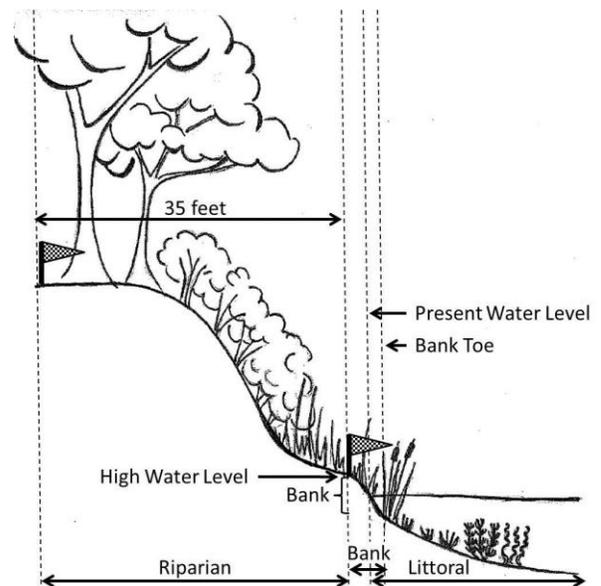


Figure 4. Shoreland areas assessed included the Riparian Buffer Zone, Bank Zone, and Littoral Zone. Graphic courtesy of WI DNR.

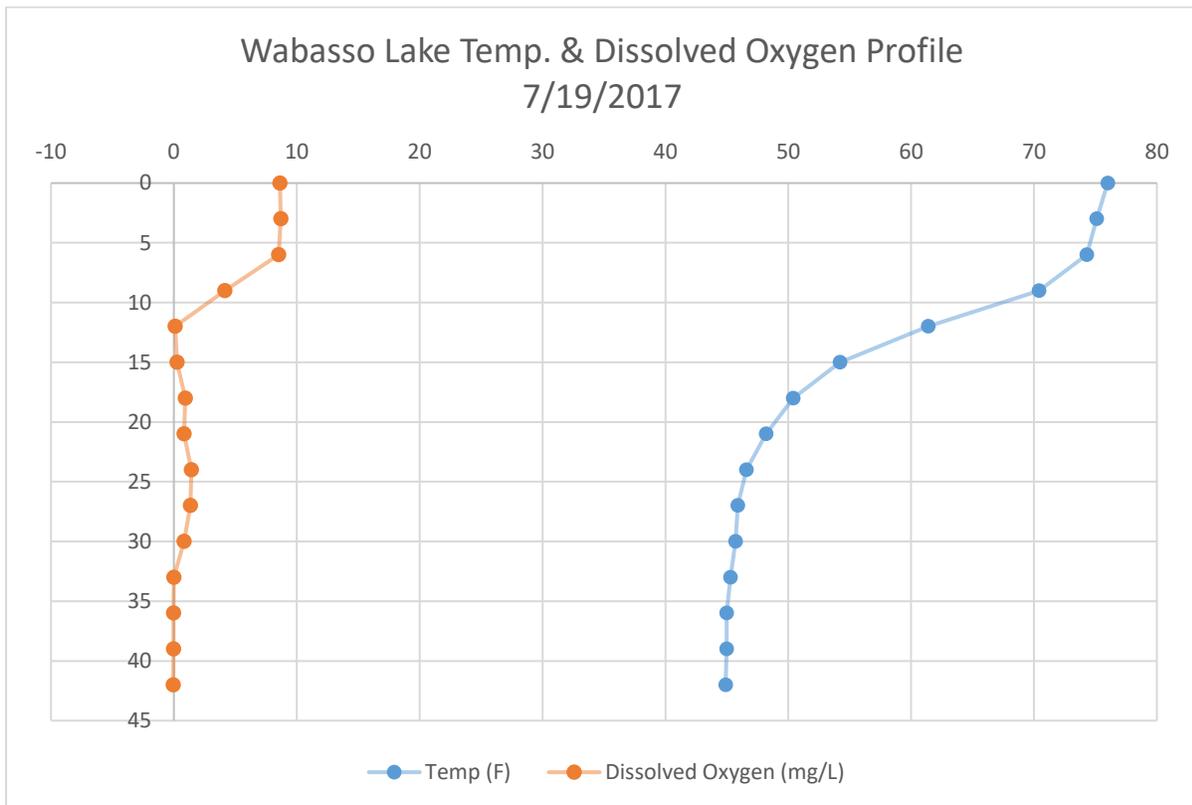
## Appendix 2: Water Quality Raw Data and Temperature and Dissolved Oxygen Profiles

Table 4. Results of 2017 Wabasso Lake water quality testing.

	July (7/19/17)	August (8/21/17)	September (9/13/17)	2017 Average
<b>Secchi (ft.)</b>	11.0 ft.	11.5 ft.	13.5 ft.	12.0 ft.
<b>Total Phosphorus</b>	11.3 ug/L*	17.7 ug/L	8.42 ug/L*	12.47 ug/L
<b>Chlorophyll a</b>	3.97 ug/L	2.45 ug/L	1.25 ug/L	2.56 ug/L
<b>Calcium</b>	Not sampled	0.594 mg/L	Not sampled	n/a
<b>Alkalinity</b>	Not sampled	3.66 mg/L	Not sampled	n/a
<b>pH</b>	Not sampled	6.21	Not sampled	n/a
<b>Conductivity</b>	Not sampled	10.5 uS/cm	Not sampled	n/a

\* Total Phosphorus reading was between level of detection and level of quantification

The July, August, and September temperature and dissolved oxygen profiles show the lake was stratified at 9-18 ft. depth, depending on date sampled – see Figure 2.



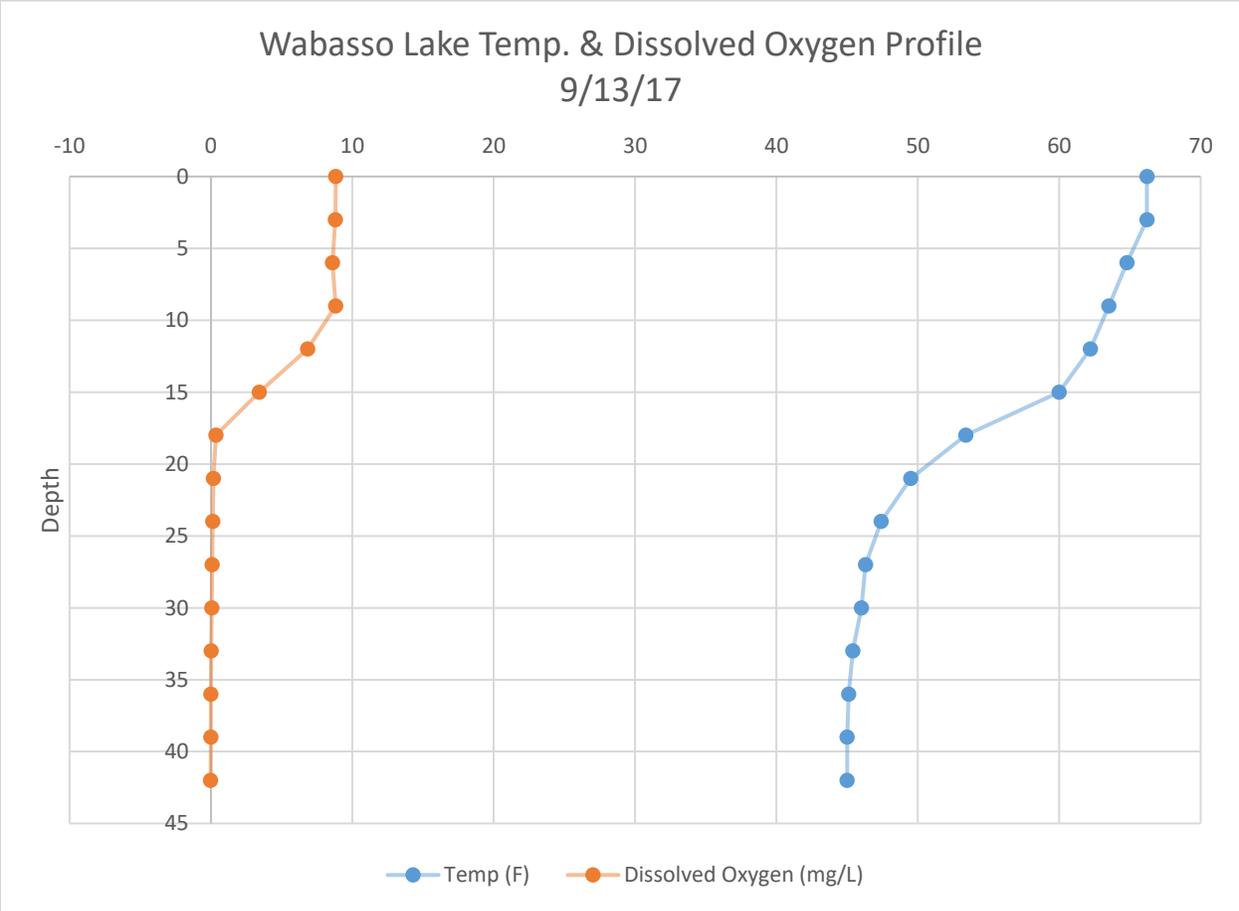
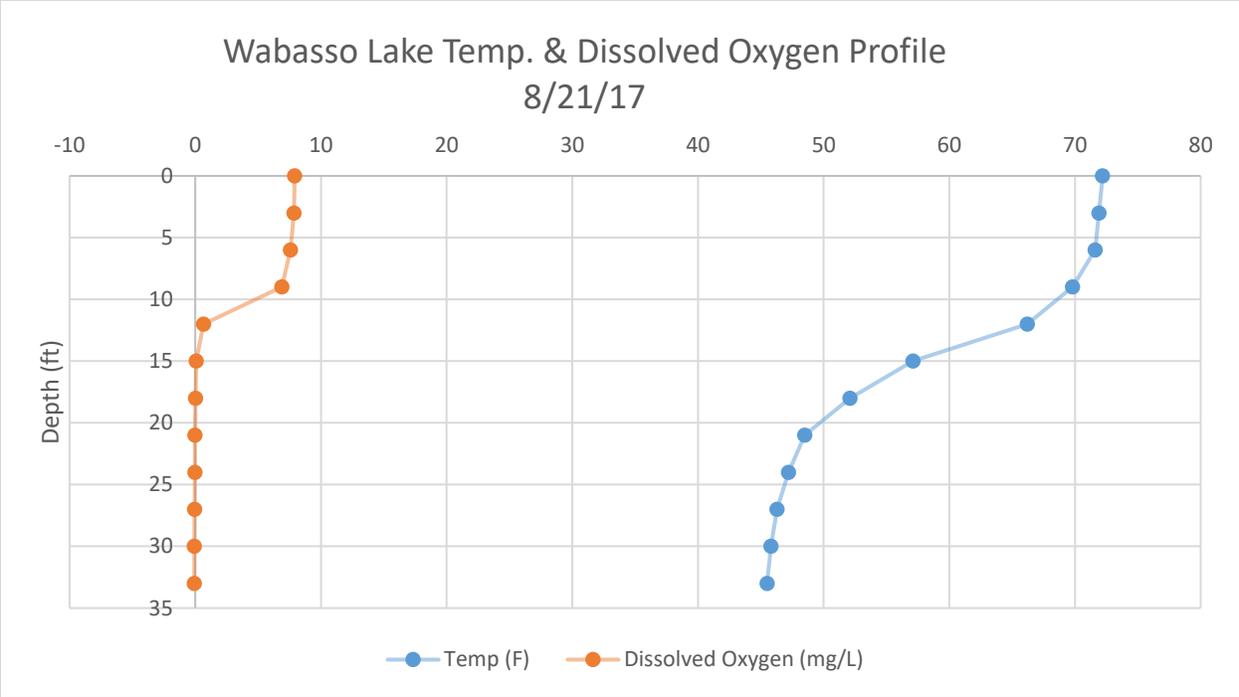


Figure 5. Temperature and dissolved oxygen profiles for Wabasso Lake in 2017.

### Appendix 3: Aquatic Plant Point-Intercept Sampling Point Map

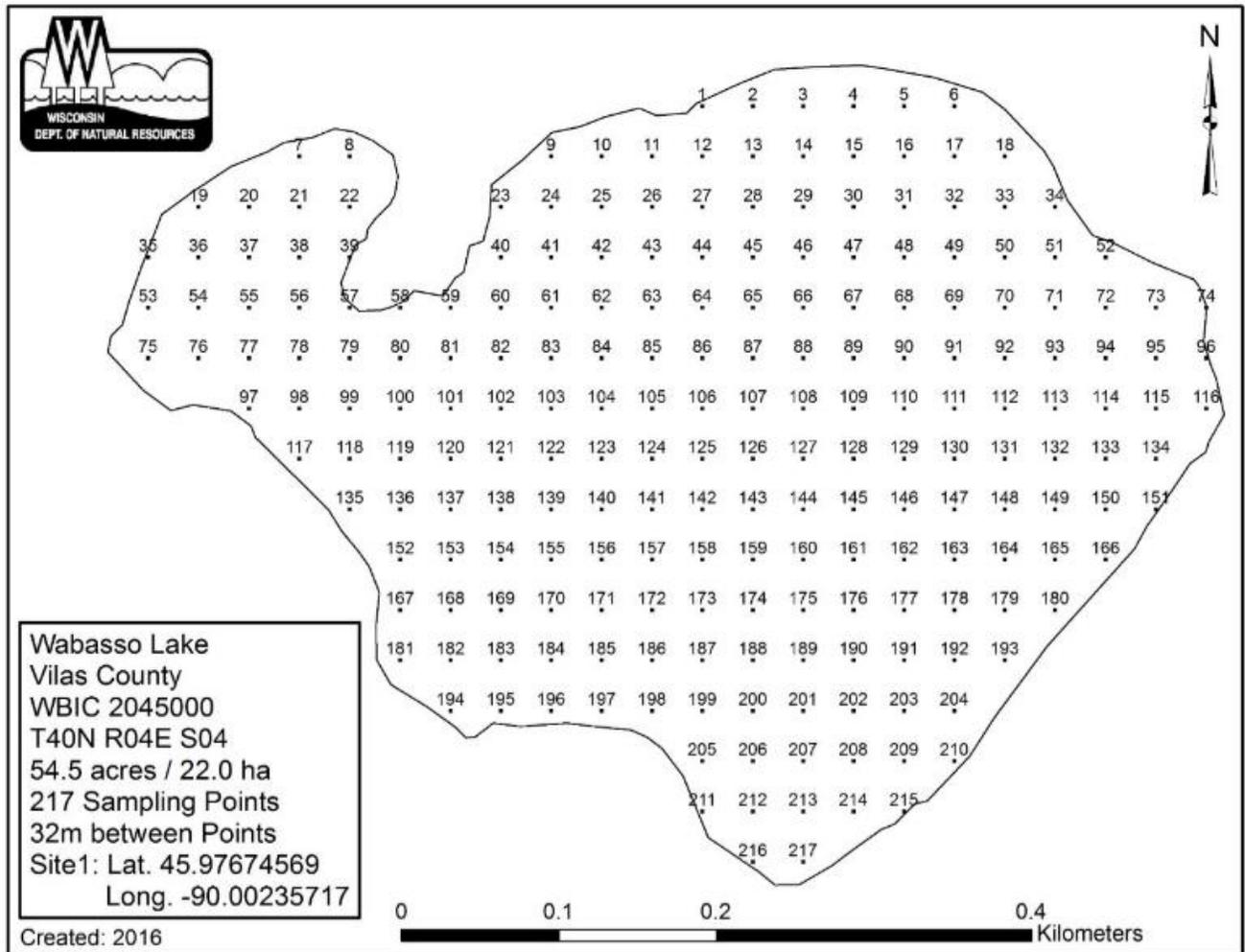


Figure 6. Wabasso Lake Point Intercept Map. Courtesy of WI DNR.

## Appendix 4: Aquatic Plant Point-Intercept Plant Photos



Figure 7. Algal leaved pondweed (*Potamogeton confervoides*) found in Wabasso Lake 2017 point-intercept survey.



Figure 8. Vasey's Pondweed (*Potamogeton vaseyi*) found in Wabasso Lake 2017 point-intercept survey.



Figure 9. Water lobelia (*Lobelia dortmanna*). Photo courtesy of WI State Herbarium, Robert W. Freckmann.



Figure 10. Oakes pondweed (*Potamogeton oakesianus*) found in Wabasso Lake 2017 point-intercept survey.



Figure 11. Water willow (*Decodon verticillatus*). Photo courtesy of WI State Herbarium. Steve Garske.



Figure 12. Large purple bladderwort (*Utricularia purpurea*) had a 76% frequency of occurrence in the 2017 point-intercept survey on Wabasso Lake.



Figure 13. Red algae (*Sirodotia* sp.) found during Wabasso Lake 2017 point-intercept survey.

## Appendix 5: Species Richness by Sampling Point Map

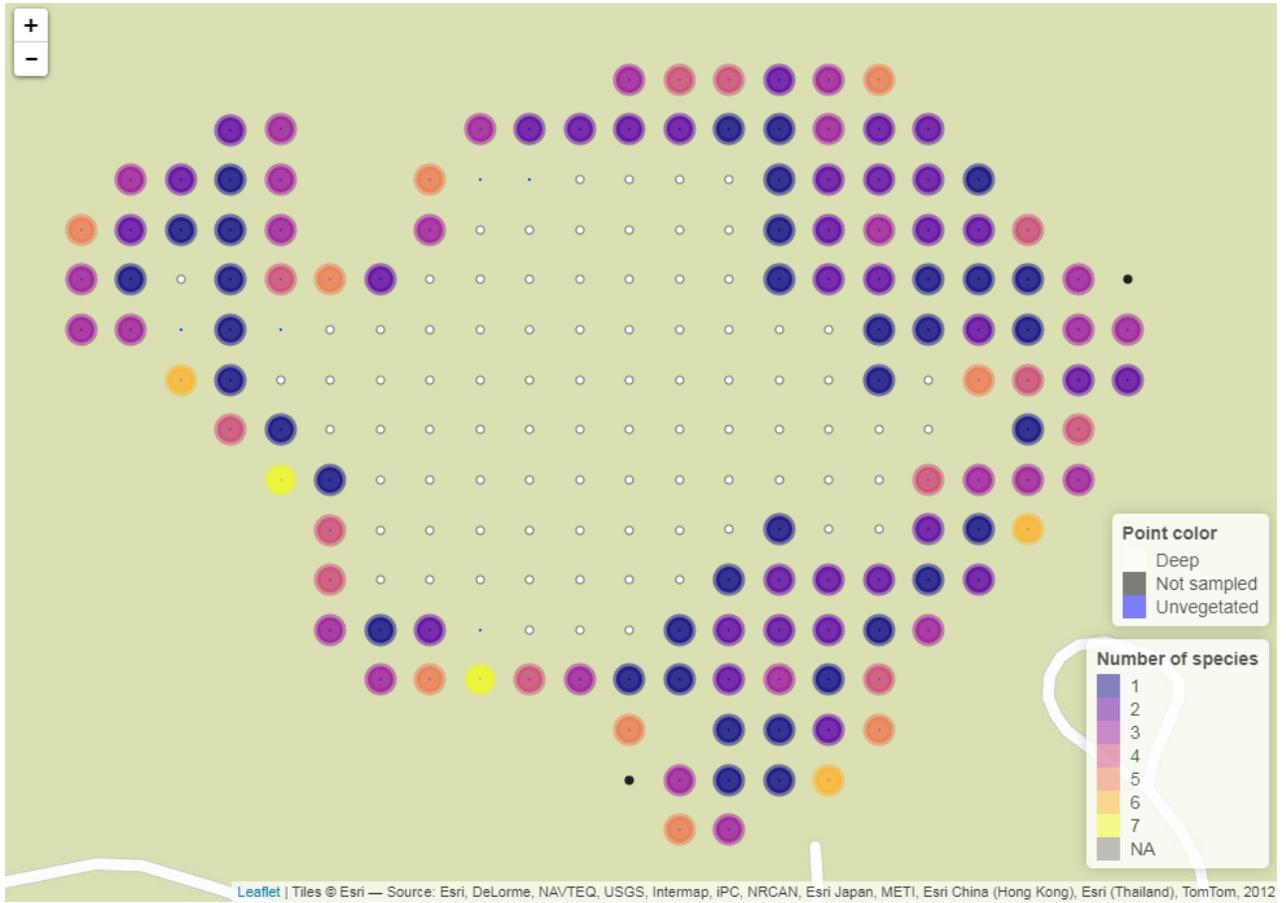


Figure 14. Wabasso Lake species richness by sampling point. Map courtesy of WI DNR.

## Appendix 6: Coarse Woody Habitat Map



### Coarse Woody Habitat (2017)

Wabasso Lake, Lac du Flambeau



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Created by Vilas County Land & Water Conservation  
Department and Vilas County Mapping Department  
Document: Wabasso CHW.mxd

#### Coarse Woody Habitat Location and Coverage

##### Crosses OHHM

- Full Tree Crown (6)
- A Few Branches (32)
- No Branches (64)

##### Does Not Cross OHHM

- Full Tree Crown (2)
- A Few Branches (76)
- No Branches (270)

Figure 15. Coarse Woody Habitat Characterization for Wabasso Lake, 2017. 341 logs/mile were documented.

Appendix 7: Riparian Buffer Zone Cover Types Chart

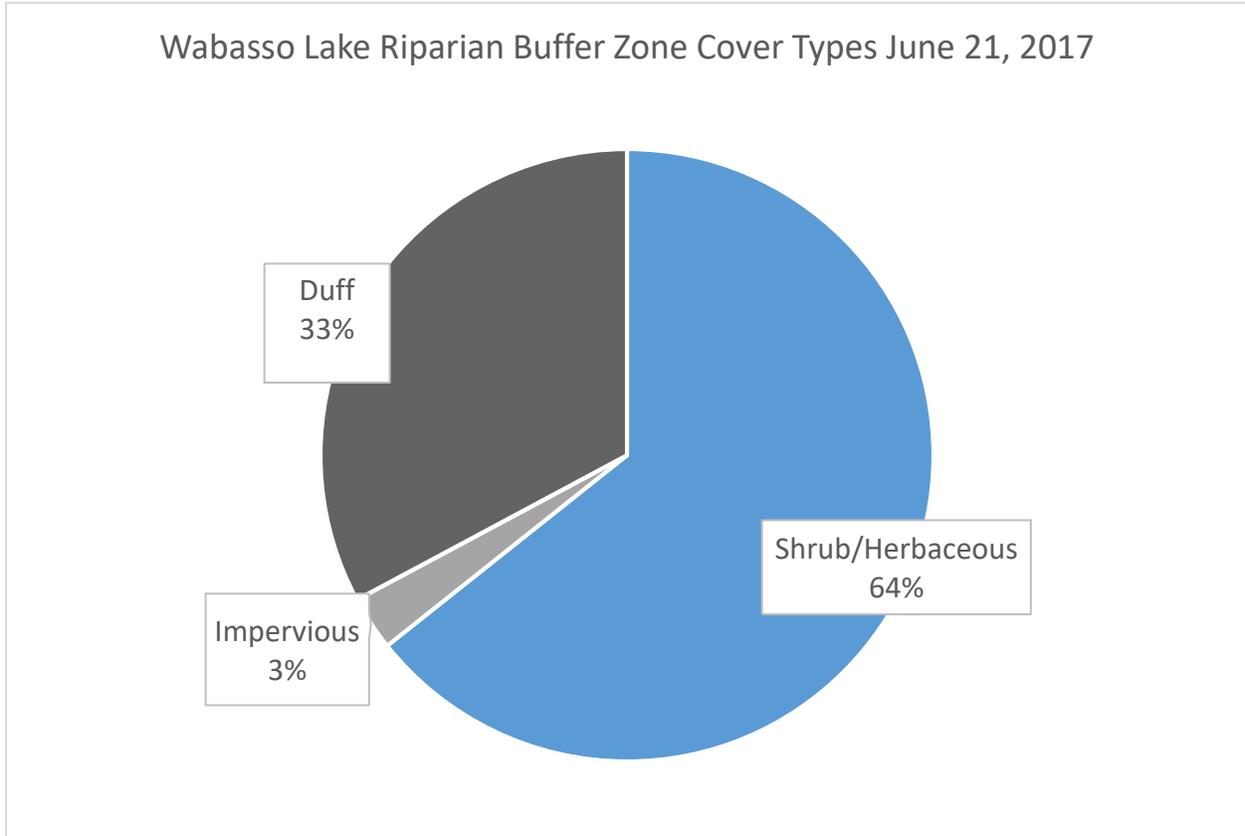


Figure 16. Ground cover type in Riparian Buffer Area (35 ft. inland from shore) on Wabasso Lake, 2017.

Appendix 8: Canopy Cover

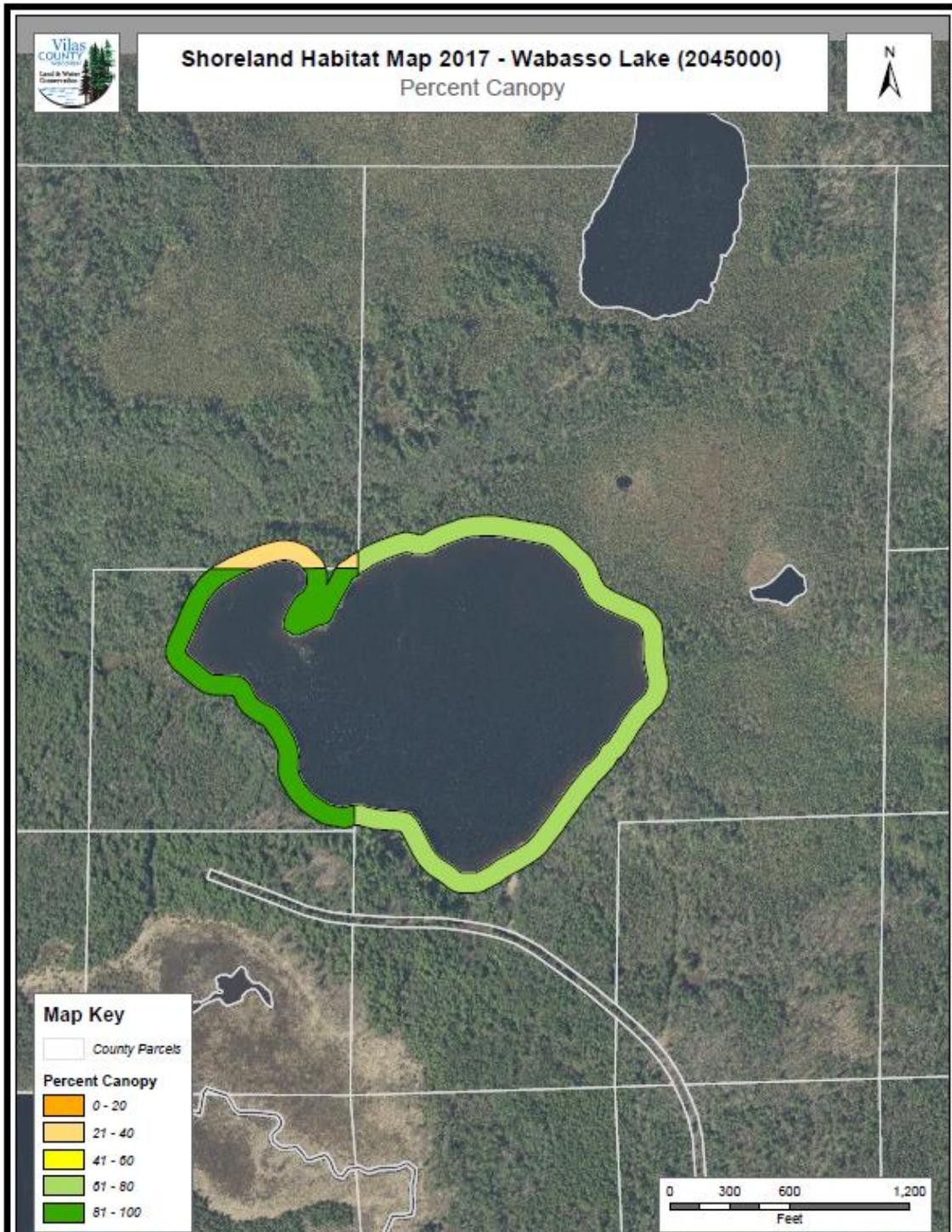


Figure 17. Canopy cover percent per parcel within 35 ft buffer area on Wabasso Lake 2017. Lower coverage amounts due to wetland habitats.

Appendix 9: Shrub/Herbaceous Cover

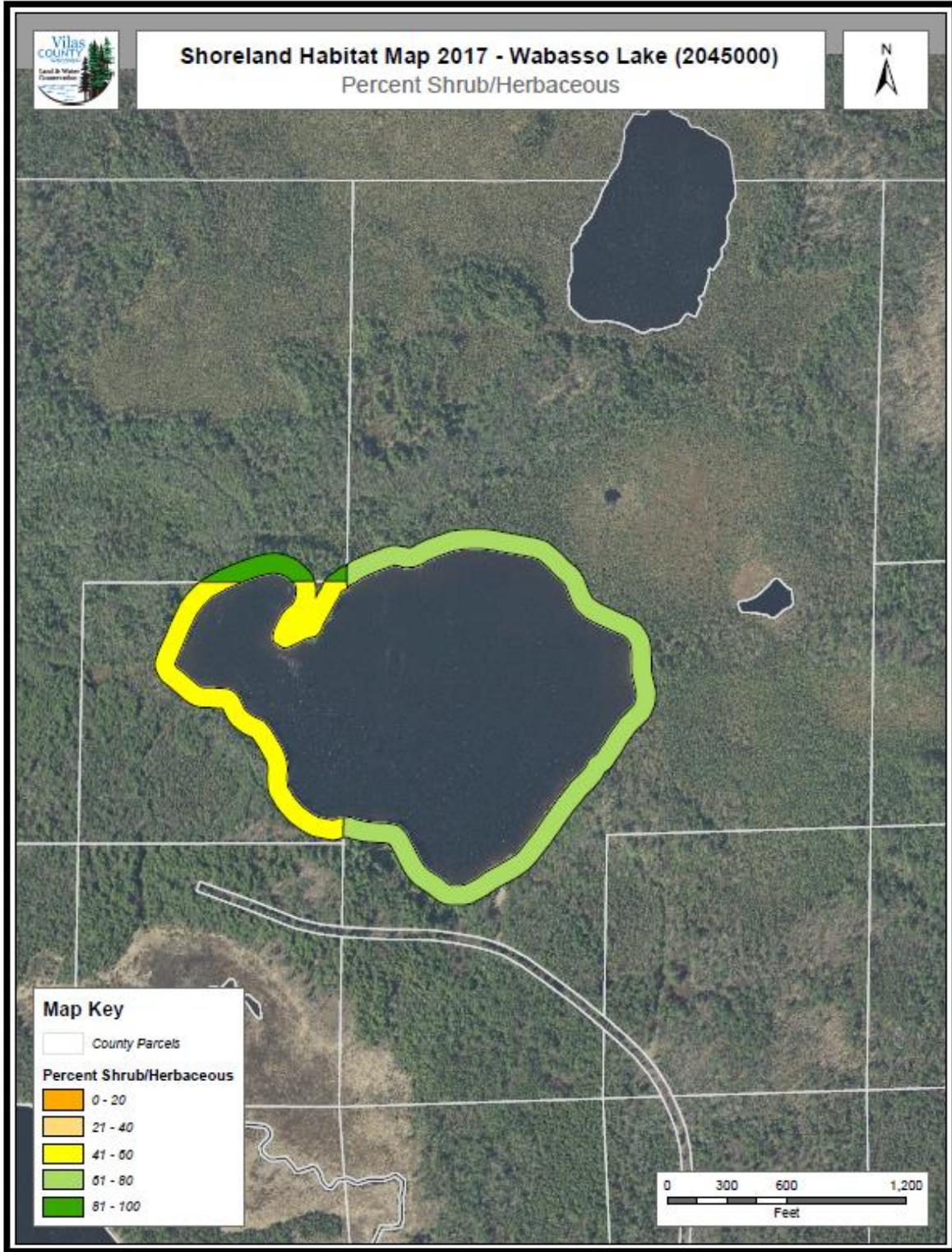


Figure 18. Percent shrub/herbaceous cover per parcel within 35 ft buffer area on Wabasso Lake 2017. Lower coverage amounts due to pine duff cover.

## Appendix 10: Human Structures in Riparian Buffer and Littoral Zones

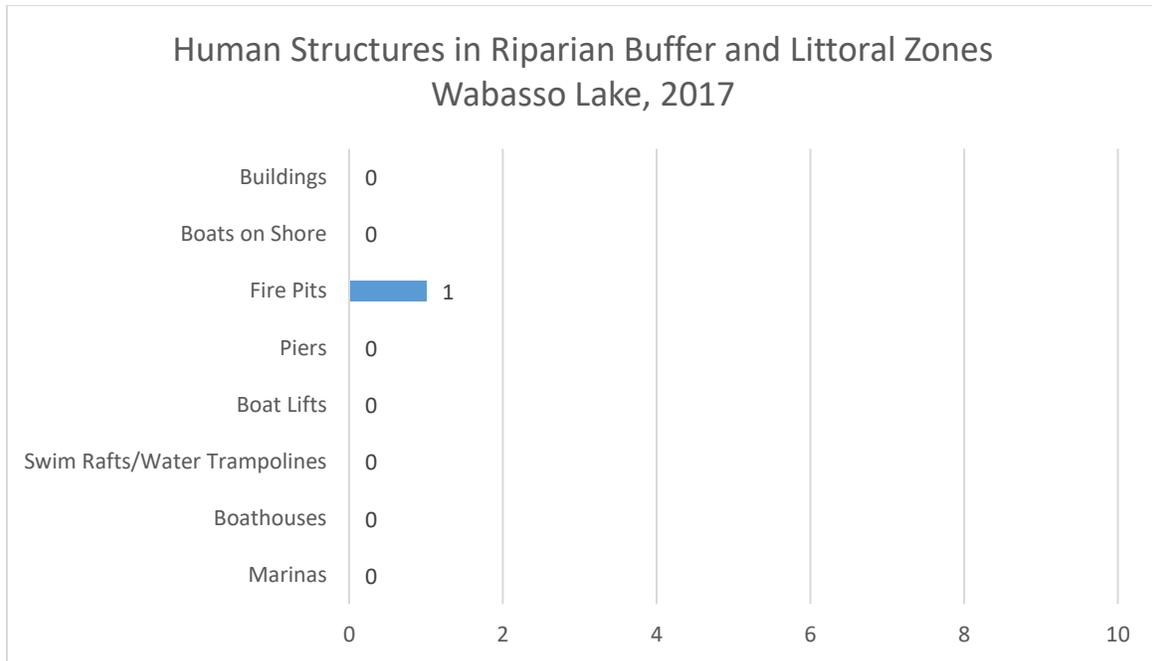


Figure 19. Human structures documented in the Riparian Buffer and Littoral Zones on Wabasso Lake 2017.

## Appendix 11: Number of Parcels with Erosion or Runoff Concerns

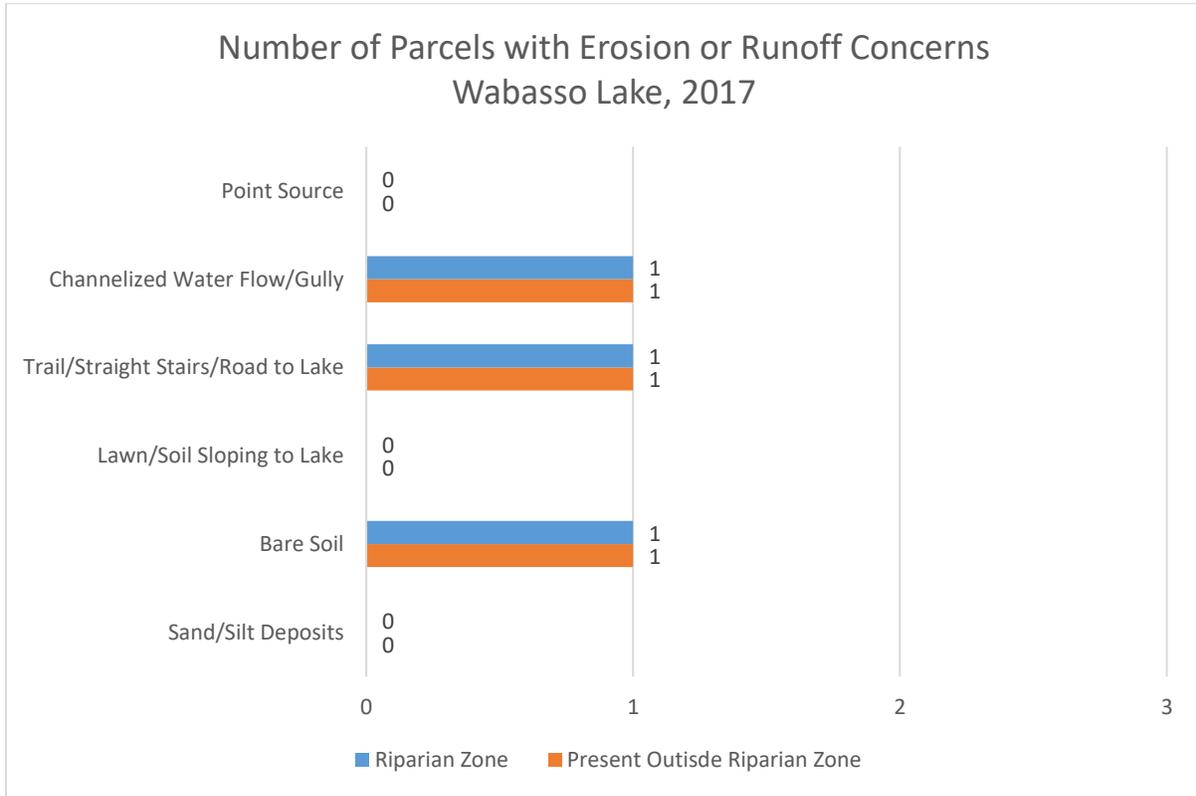


Figure 20. Number of parcels with runoff and erosion concerns in Riparian Zone and Outside Riparian Zone. Wabasso Lake 2017.

Appendix 12: Aquatic Plant Observations

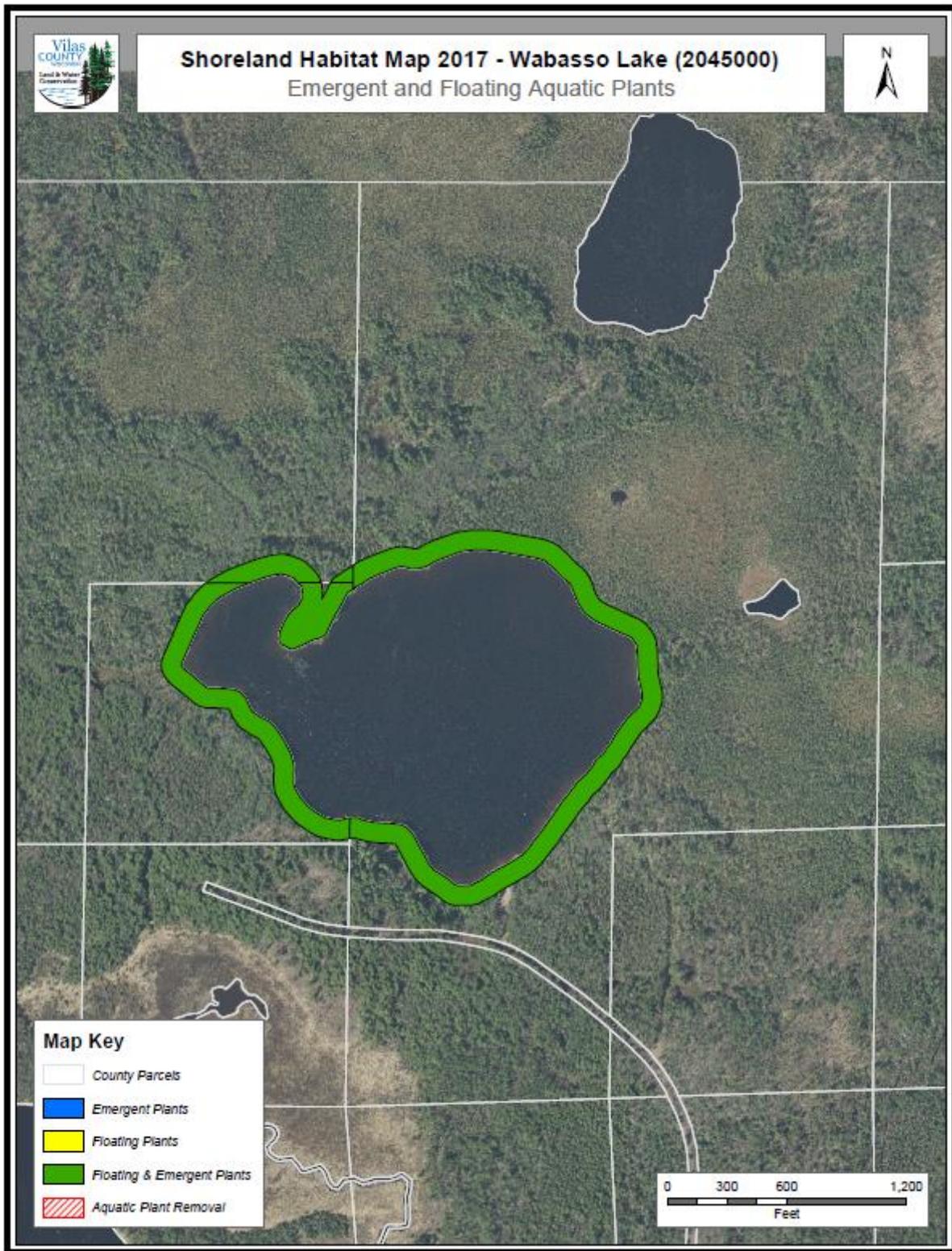


Figure 21. Emergent and floating aquatic plants were observed adjacent to all 3 parcels on Wabasso Lake, 2017. No aquatic plant removal was evident.