Town of Winchester

Aquatic Plant Point Intercept Report: Hiawatha Lake

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inspire - discover - connect

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INTRODUCTION

The following report provides the results and analysis of the aquatic vegetation found in Hiawatha Lake through point-intercept surveys conducted by the North Lakeland Discovery Center (NLDC) in Manitowish Waters. These surveys were funded by the Town of Winchester, in partnership with the Town of Winchester Lakes Committee. The point-intercept survey was conducted in July of 2023 during peak aquatic vegetation growth. The purpose of the aquatic plant point-intercept survey is to provide data regarding the species present, abundance, and species richness on each lake.

Aquatic plants are vital to the well-being of a lake ecosystem. They provide functions and services to ecosystems such as breeding habitat, water purification, and soil stabilization. Additionally, they provide food and shelter for a variety of animals including moose, deer, waterfowl, fish, turtles, zooplankton, and macroinvertebrates. Despite their many contributions, some people still view plants as a nuisance. Although there are aquatic invasive species which can cause damage, most aquatic plants are essential for maintaining a healthy ecosystem (Skawinski 2022).

Aquatic invasive species are organisms which have spread beyond their natural range. The presence of aquatic invasive species in Northern Wisconsin, such as curly-leaf pondweed (*Potamogeton crispus*) and Eurasian watermilfoil (*Myriophyllum spicatum*), has had a negative impact on the quality of many water bodies. These species outcompete native plant species for space and energy, resulting in an overall decrease in plant biodiversity. Point-intercept surveys are an effective way to detect aquatic invasive species and to provide data regarding the species presence, abundancy and richness on each lake. At Hiawatha, 11 different species of aquatic plants and algae were found (Table 1). The following report provides information on the point-intercept methods, vegetation found, and summary of the results found.

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METHODS

The point-intercept method used on Hiawatha was developed by the Wisconsin Department of Natural Resources (WDNR) named as the "Recommended Baseline Monitoring of Aquatic Plants in Wisconsin: Sampling Design, Field and Laboratory Procedures, Data Entry and Analysis, and Applications" document. The point-intercept survey was conducted using a geo-referenced sampling grid, developed by the WDNR, input into GPS devices. Using a canoe or small boat and a GPS, each point was sampled. At each site, the plant community is surveyed with a pole rake sampler to determine species presence and rake fullness rating. The rake is dropped until it touches the lake bottom, spun around 3 times then is pulled up and given a rake fullness rating. This rating is an estimate of the total coverage of plants on the rake from 1-3. One is a few total plants, two is moderate total plants, and three is abundant total plants. When no plants were on the rake, the rake fullness rating was recorded as zero. Each aquatic plant species on the rake was identified and given a rake fullness rating based on its prevalence on the rake. The overall rake fullness and individual plant rake fullness were both recorded on the data sheet.

Aquatic plant species that were not pulled up on the rake but were visible within six feet of the point were recorded as visual sightings (V) on the data sheet. Boat observations (BO) were species observed that were not raked or visually recorded within six feet of a point. The depth at each point was determined by a depth finder or by foot markings on the rake or rope and recorded on the data sheet. The sediment type (mucky, sandy, or rocky) of the lake bottom was determined by the feel of the rake or when sediment was pulled up and was recorded. The three rakes used were a 7-foot pole rake, an extendable 8-foot pole rake, and a 25-foot rope rake. The pole rakes were used at depths of about 12 feet or less and the rope rake was used at depths that

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were unable to be reached by the pole rake. During this survey, a depth finder was equipped to the boat to speed up the process in determining the depths of sites that were greater than maximum depth of plants.

Sites that were inaccessible due to various reasons were recorded in categories labeled unnavigable, terrestrial, shallow, rocks, dock, swim area, temporary obstacle, or no information. Visual observations of species within the six feet range were recorded (Hauxwell et al., 2010). Samples that were unidentifiable in the field were bagged and identified later using a microscope. Species that were found to be state endangered, threatened, or of special concern were collected and pressed to create an herbarium collection. Species of special concern are those that are becoming less common throughout its range and may soon become a threatened species. Threatened species are protected by law and are at risk of becoming endangered.

The WDNR provides an Excel spreadsheet called "The Aquatic Plant Survey Data Workbook" with formulas to generate statistics about the species found. All data collected from the survey on the field sheet is entered into the entry sheet on the Excel spreadsheet. Any boat surveys are input into the boat survey tab on the Excel sheet. Once all data is entered, the statistics are automatically generated. The statistics worksheet is broken down into individual species statistics and summary statistics. Individual species statistics include the frequency of occurrence of plants, relative frequency, number of sites with vegetation, average rake fullness, and number of visual sightings. The summary statistics include the total number of sites visited, total number of sites with vegetation, sites shallower than the maximum depth of plants, frequency of occurrence, Simpson's Diversity Index, maximum depth of plants, sites sampled using pole or rope rake, average number of species per site, and species richness, including

visuals. A maximum depth of plant colonization graph is automatically generated from the maximum depth data (Hauxwell et al., 2010).

The Simpson's Diversity Index is an estimator of community diversity. It is based on the relative frequency of plants on the lake, and it is not impacted by the visual plant data. Simpson's Diversity Index is based on a scale of 0-1. The closer to 1, the more diverse the plant community (Hauxwell et al., 2010).

Finally, the worksheet calculates the Floristic Quality Index (FQI). The FQI metric is used to evaluate sampled plant communities' closeness to an undisturbed plant community. In Wisconsin, there is a demand by the WDNR, local governments, and lakeshore riparian for considering the quality of lake plant communities. It becomes important in a variety of planning, zoning, sensitive area designation, and aquatic plant management decisions. Floristic quality provides a standardized analysis technique, which aids in the development of regional and temporal trends of plant community "health". The floristic quality (*I*) = the average coefficient of conservatism (*C*) multiplied by the square root of the number of species in the lake (√N). All native species are included in the number of species. Conservatism (*C*) is the likelihood of a plant occurring in a landscape that is not relatively impacted by settlement. The collection of values ranges from 0-10, 10 being the species that are most sensitive to disturbance. Plants are assigned a *C* value based on substrate preference, tolerance to turbidity, rooting strength, reproductive means, and water drawdown tolerance (Nichols 1999).

To understand the results, the *I*, *C,* and N are compared to state and regional values. Statewide, the median number of species per lake is 13, with ranges from 1-44 species. The *C* value had a median of six, with ranges from 2-9.5. Finally, the *I* value had a median value of 22.2, with ranges from 3-44.6. *As C* values can vary region to region, the state is broken up into

eight different ecoregions. The three lakes surveyed are all in the Northern Lakes and Forests Ecoregion. The median number of species in this ecoregion is 13. The median *C* value is 6.7 and the median *I* is 24.3 (Nichols 1999). Hiawatha's statistics will be compared to these values in the following sections of the report.

Results

- Hiawatha had 176 total points plotted and of those points, all were accessible.
- No points were considered non-navigable due to a high abundance of plants or points on shore.
- The maximum depth of plants on Hiawatha was 7 feet deep, and the overall maximum depth recorded was 59 feet.
- The total number of sites with vegetation was 4.
- The average rake fullness rating was 1.30. The distribution total rake fullness is shown on Map 1.
- The frequency of occurrence of plants at sites shallower than maximum depth of plants was 0.28.
- The average number of species per site shallower than maximum depth was 0.19.
- The average number of species per site for all vegetated sites was 1.50.
- The overall species richness was 4 species, pulled up on the rake during sampling.
- The species richness including visual sightings was 11 species.
- The Simpson Diversity Index for Hiawatha is .72. This value indicates slightly above average diversity for the waterbody.

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The three most relatively frequent plants on Hiawatha were floating leaf bur reed (*Sparganium fluctuans*), floating leaf pondweed (*Potamogeton natans*), and pipewort (Eriocaulon aquaticum). Floating leaf bur reed had a relative frequency of 33.3% and its distribution is shown on Map 2. Floating leaf pondweed had a relative frequency of 33.3% and its distribution is shown on Map 3. Pipewort had a relative frequency of 16.7% and its distribution is shown on Map 4.

Floating leaf bur reed (*Sparganium fluctuans*) is a plant with 2 growth forms. It has a submerged and aquatic form. The vegetative aquatic form has long thin leaves that reach the surface and grow horizontally. The plant has a flowering emergent form with stiffer leaves that come out of the water with fruit and flowers held on a stout branching stem originating from the leaf axil. The plant is monoicous having both male and female flowers on the same plant (Monecious). The male flowers and female flowers are held on separate short branches and when they mature, they form a seed head of small spikes. Each spike is a fruit that can have a curved beak. The seed head resembles burs and therefore is where the common name is derived. (Skawinski 2022)

Floating leaf pondweed (*Potamogeton natans*) is an alternate leaved aquatic plant that almost exclusively produces floating leaves. Floating leaves are lace elliptic with a cordate base and are held up to the surface on long petioles that connect at a 90-degree angle. Floating leaves have 17-37 veins. Submerged leaves, if present, are long, linear, and often float towards the surface, and disintegrate in late summer. Fruits and flowers occur on emerged pedicels. The fruits (achenes) are small and numerous, and egg shaped (Skawinski 2022). Similarly, there is a sister species, Oakes' pondweed (*P. oakesianus*), that looks almost identical. One characteristic that separates them is habitat, where floating leaf pondweed is very common across most lakes,

Oakes' prefers shallow waters of bog margins and soft water lakes. Another characteristic is leaf shape; Oakes' does not have a cordate leaf base and instead tapers from the widest part of the leaf down to the petiole. Oakes' pondweed is a species of special concern in Wisconsin.

Pipewort (*Eriocaulon aquaticum*) is an aquatic plant with sharp pointed basal leaves. This plant has distinct button-like white flowers that are held out of the water on long stems. The roots of pipewort have very distinct segmentations down the entire length. This plant is found in shallow waters of clear lakes with sandy sediments (Skawinski 2022).

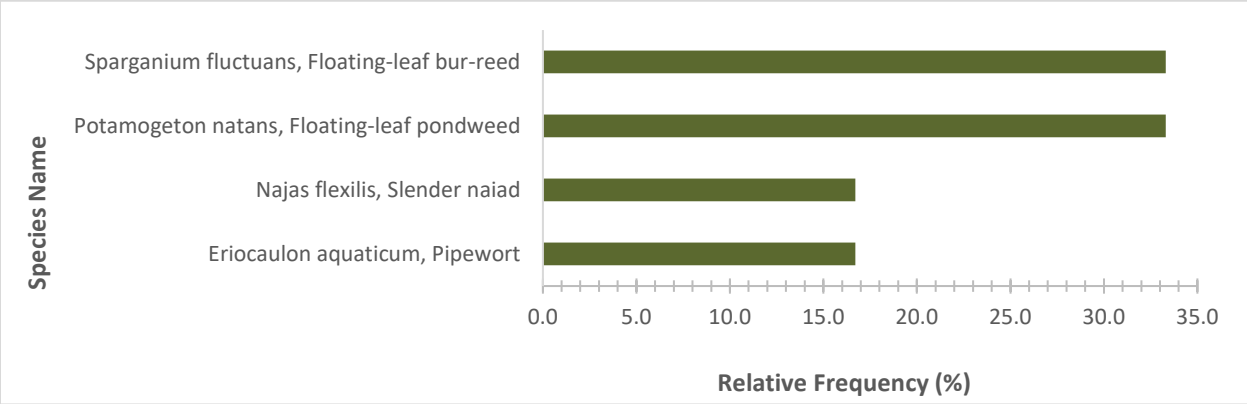

Figure 1: Hiawatha Lake 2023 relative frequency (%) of occurrence of aquatic plant species collected in rake during the 2023 point-intercept survey.

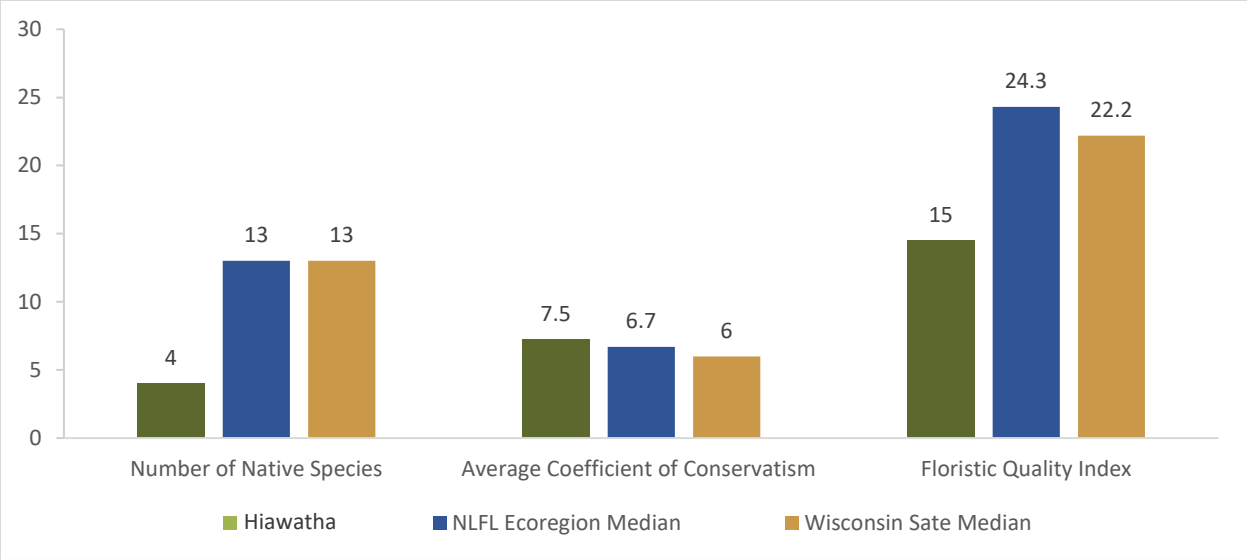

Figure 2: Floristic Quality Assessment of Hiawatha Lake using data from 2023 point intercept survey. Analysis follows Nichols (1999).

CONCLUSION

Analysis of the data collected from the plant point-intercept survey conducted on Hiawatha Lake indicates that it contains a relatively healthy plant community. A baseline that led to the conclusion is that no aquatic invasive species were detected, the presence of which would indicate declining lake health or disturbance. Hiawatha's floristic quality index value of 15 is lower than the state and regional means. Hiawatha Lake also has a conservatism value of 7.5 out of 10. These values indicate a low florist integrity and a higher sensitivity to changes in the proportion and distribution of vegetation. It is important to note that the FQI can be impacted by both the size and the heterogeneity of the lake (Bernthal 2003). Smaller lakes, such as Hiawatha, can be impacted by this in their calculations and misrepresented due to low *N* value, resulting in a low *I* value. Lastly, the Simpson Diversity index was another vital point of reference supporting the claim that Hiawatha is relatively healthy. Hiawatha Lake had a Simpson's Diversity Index of .72. The closer the diversity index is to 1, the more species diversity and even

distribution of aquatic plants. A Simpson's diversity index of .66 or greater concludes that Hiawatha's aquatic plants community is slightly above average species richness and evenness. Hiawatha Lake likely falls between the trophic indexes of oligotrophic and mesotrophic due to its size, depth, and bowl-like shape. This may indicate that nutrient availability is limited for large populations of aquatic plants and animals to uptake, which is evident in the results of the survey.

Table 1. Hiawatha Lake aquatic species list recorded in the 2023 survey.

Growth	Species	Common Name	Presence
Floating	*Eriocaulon aquaticum*	Pipewort	**X**
Submergent	*Isoetes sp.*	Quillwort	**V**
Submergent	*Najas flexilis*	Slender naiad	**X**
Floating	*Nuphar variegata*	Spatterdock	**V**
Submergent	*Nymphaea odorata*	White water lily	**V**
Submergent	*Pontederia cordata*	Pickerelweed	**V**
Submergent	*Potamogeton epihydrus*	Ribbon-leaf pondweed	**V**
Submergent	*Potamogeton gramineus*	Variable pondweed	**V**
Floating	*Potamogeton natans*	Floating-leaf pondweed	**X**
Submergent	*Potamogeton spirillus*	Spiral-fruited pondweed	**V**
Emergent	*Sparganium fluctuans*	Floating-leaf bur-reed	**X**
	Aquatic moss		

X = LOCATED ON RAKE DURING POINT INTERCEPT SURVEY
V = VISUAL; SEEN DURING SURVEY, BUT NEVER PICKED UP ON RAKE
BO = BOAT OBSERVATIONS; LOCALIZED OCCURANCES OF SPECIES OUTSIDE THE POINT-INTERCEPT GRID OR IN BETWEEN SAMPLING SITES.

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Hiawatha Lake - Map 1

Town of Winchester
Vilas County, Wisconsin

Total Rake Fullness Rating

LEGEND
Total Rake Fullness

- 3
- 2
- 1

0 0.05 0.1 0.2 mi
0 0.07 0.15 0.3 km

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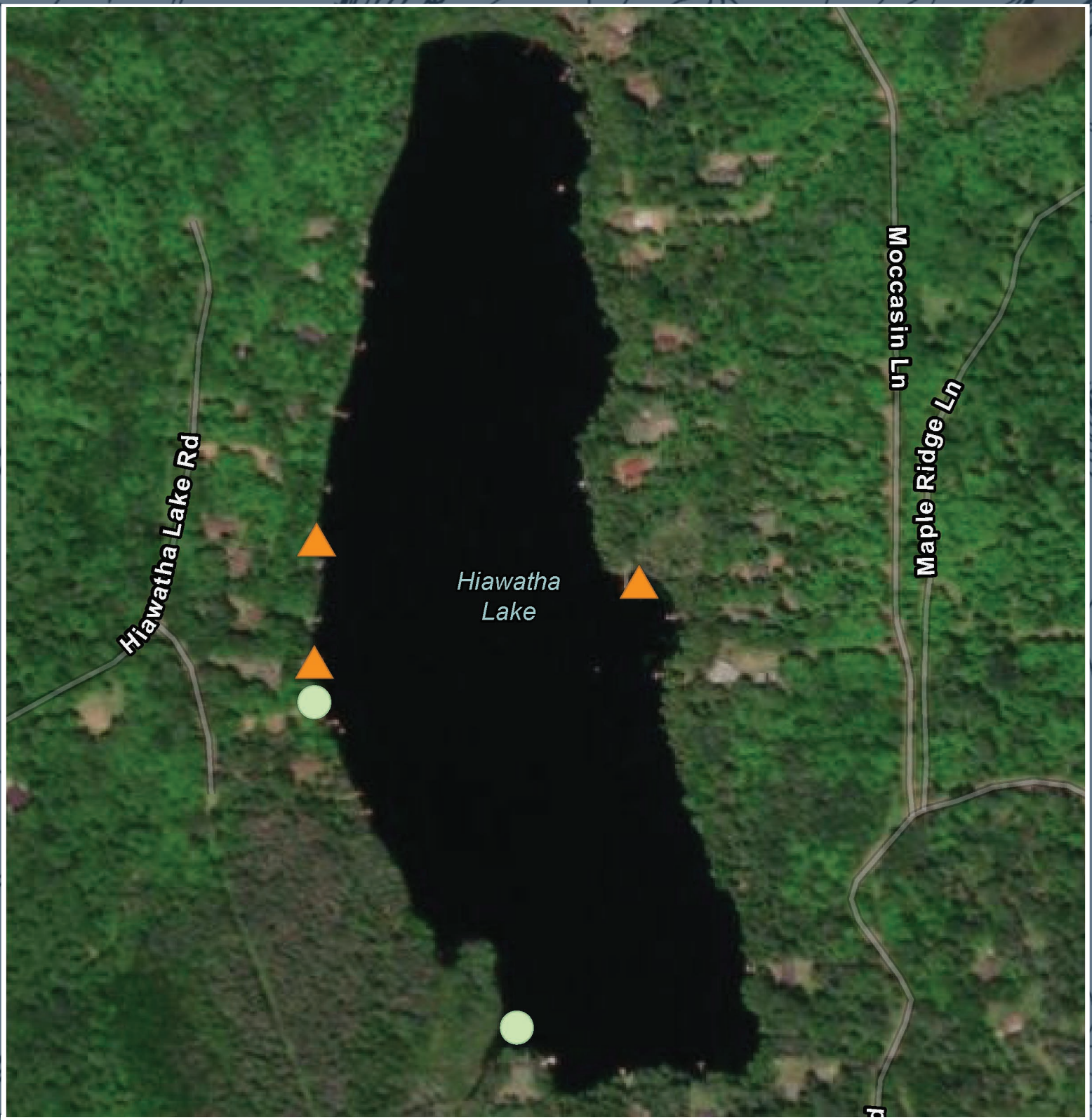

Hiawatha Lake - Map 2

Town of Winchester
Vilas County, Wisconsin

Distribution of Plant Species
Floating bur-reed
(Sparganium fluctuans)

LEGEND
Distribution of Plant Species

- Visual
- 3
- 2
- 1

N
W
E
S

0 0.05 0.1 0.2 mi
0 0.07 0.15 0.3 km

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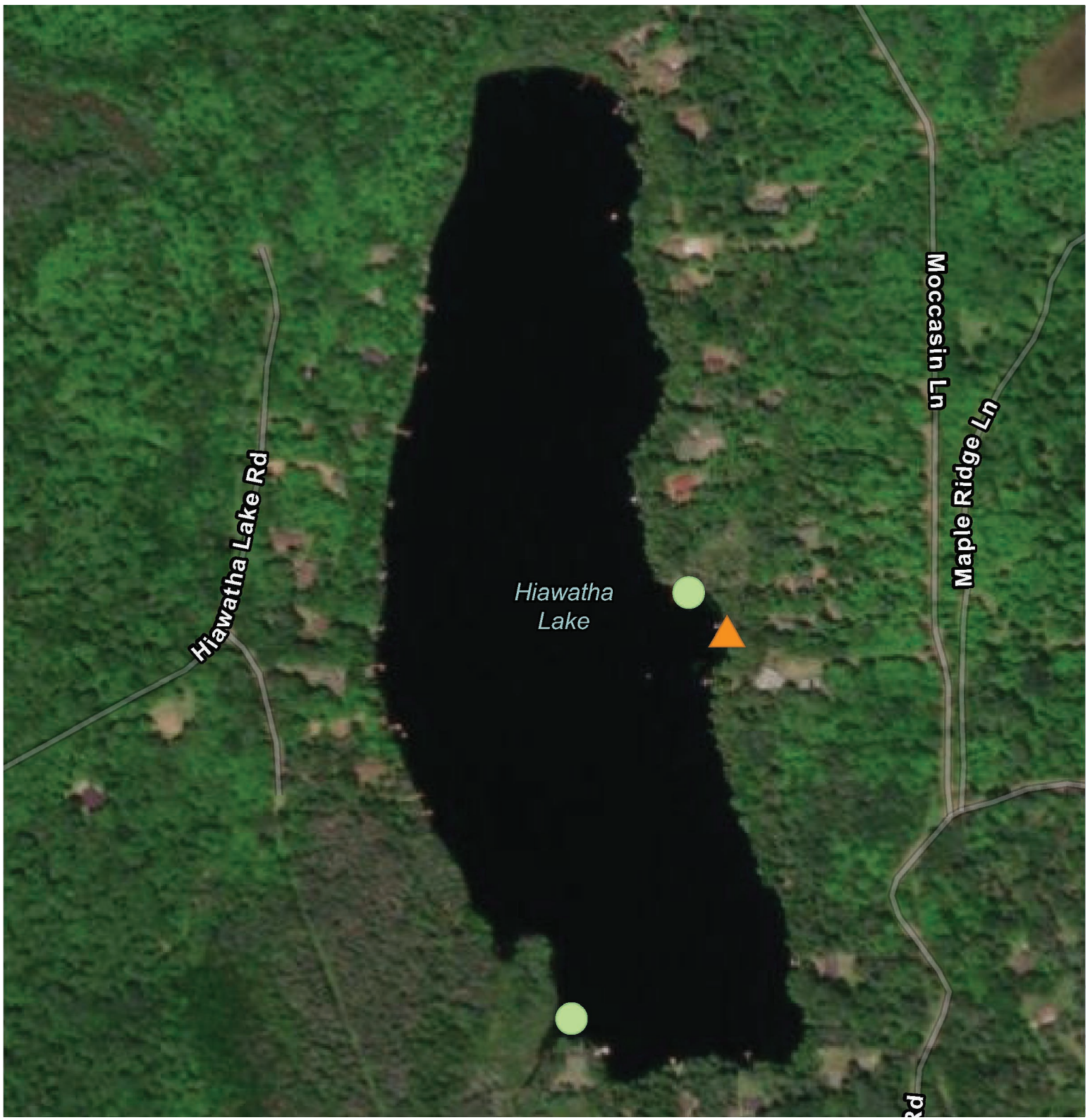

Hiawatha Lake - Map 3

Town of Winchester
Vilas County, Wisconsin

Distribution of Plant Species
Floating-leaf pondweed
(Potamogeton natans)

LEGEND
Distribution of Plant Species

- Visual
- 3
- 2
- 1

0 0.05 0.1 0.2 mi
0 0.07 0.15 0.3 km

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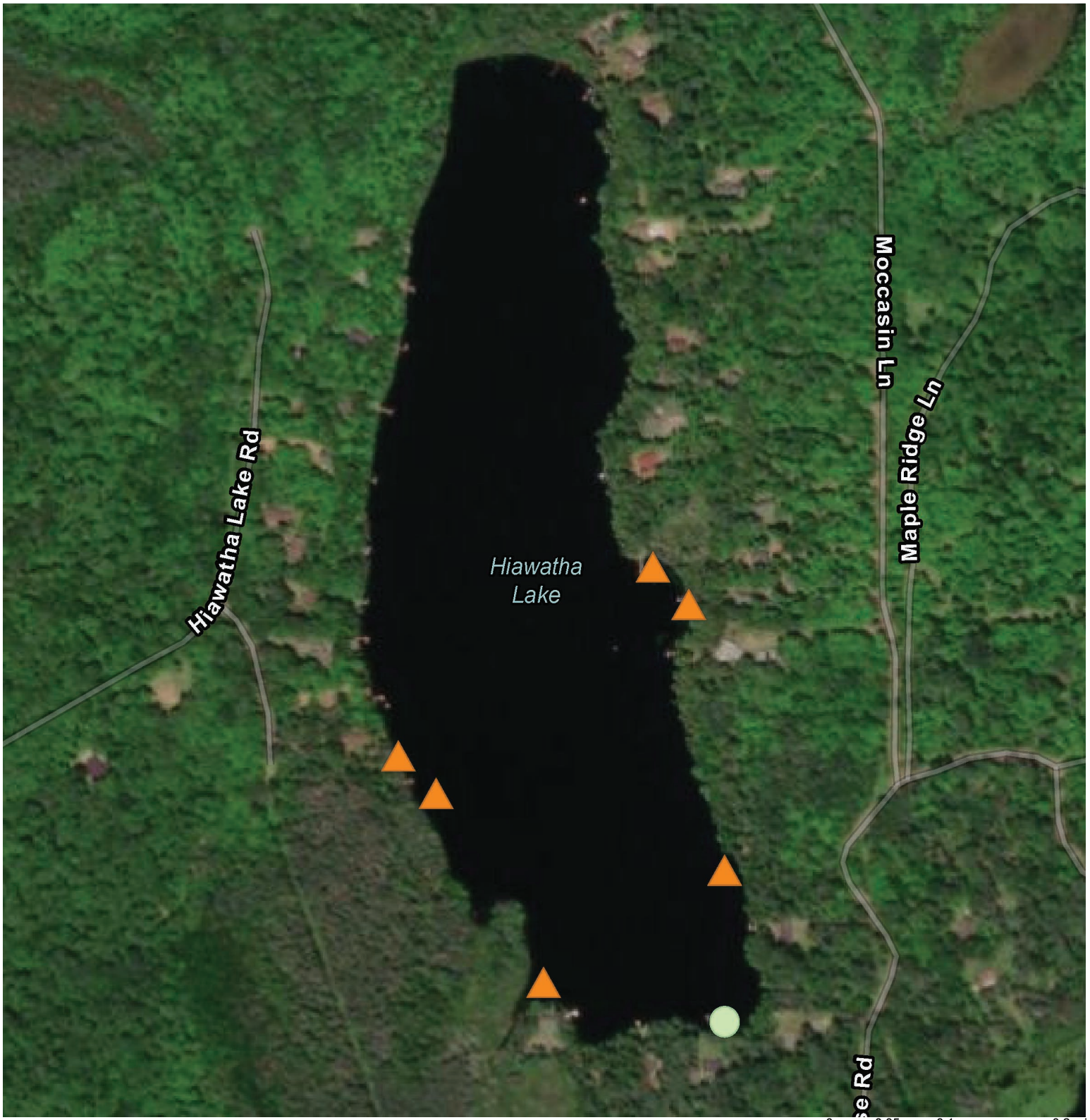

Hiawatha Lake - Map 4

Town of Winchester
Vilas County, Wisconsin

Distribution of Plant Species
Pipewort
(Eriocaulin aquaticum)

LEGEND
Distribution of Plant Species

- Visual
- 3
- 2
- 1

N
W
E
S

0 0.05 0.1 0.2 mi
0 0.07 0.15 0.3 km

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