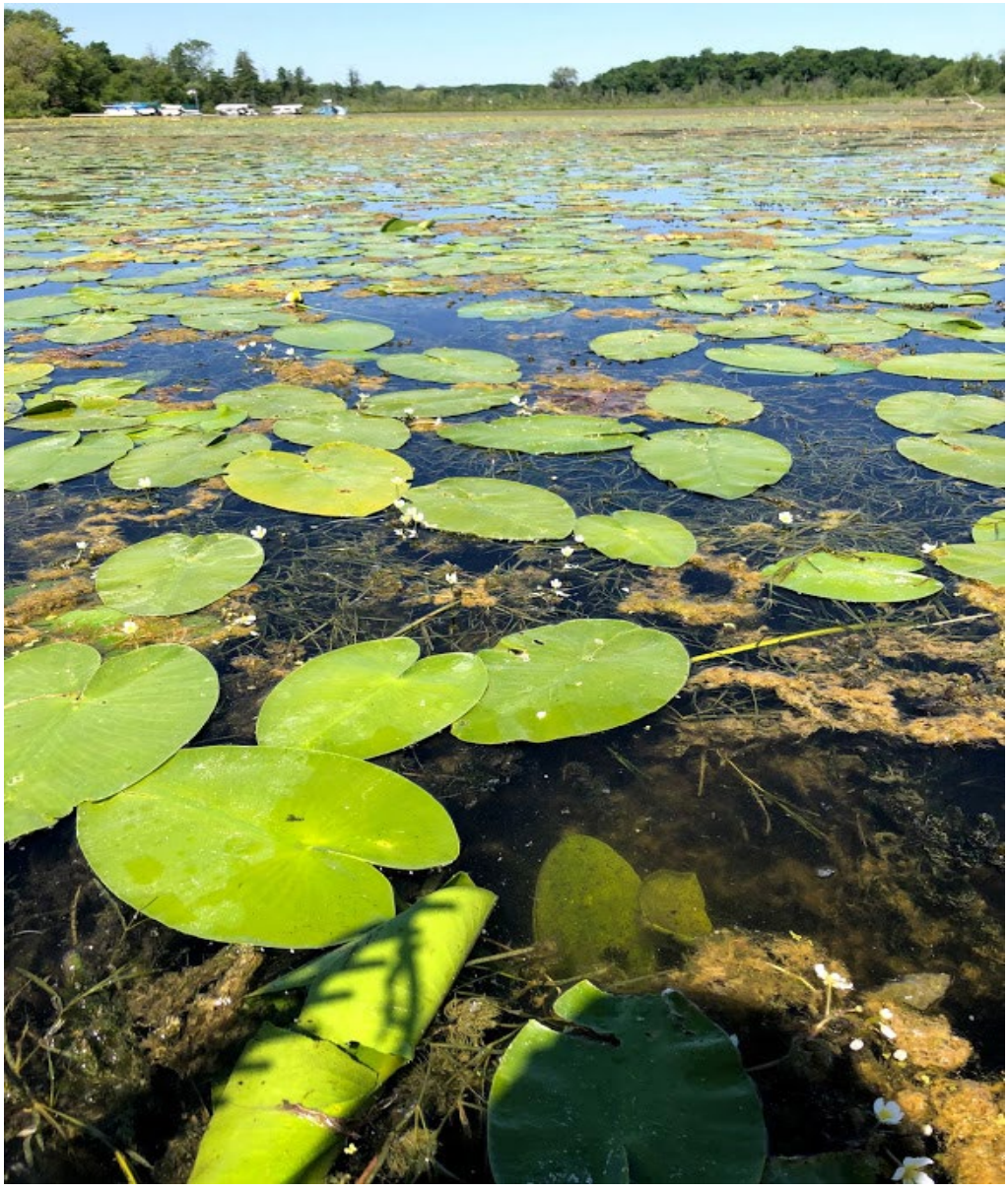
Lake Ripley Management District

# Aquatic Plant Assessment of Lake Ripley



**East side of Lake Ripley on June 12, 2020; photo taken by Lianna Spencer**

# Lake Ripley Point-Intercept Survey Report

**By: Lianna Spencer**

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## Summary

Historically, Lake Ripley has had a diverse and abundant native plant population. During the 1970's two invasive plants, Eurasian watermilfoil and curly-leaf pondweed, entered the lake threatening to cause challenges. Controlling and monitoring these invasive plants requires continued studies of their composition and abundance. That being said, the plants within Lake Ripley have been surveyed and monitored for 45 years. In anticipation of an update to the Lake Ripley Management District's (LRMD) comprehensive management plan, a full point-intercept survey was completed by LRMD, in June, 2020.

## Introduction

The composition of plants in Lake Ripley has been studied for over 45 years! A thriving and diverse native plant community is the foundation of a healthy and high-functioning lake ecosystem. Aquatic plants are vital for maintaining ideal water quality and habitat conditions. The relative abundance, distribution and types of rooted aquatic plants can be used as an indicator of lake quality. Ideally, healthy lakes will have at least moderate levels of native plant growth that are characterized by high species diversity.

An absence of vegetation and associated habitat can lead to declines in native fish and wildlife, while favoring more tolerant "rough fish" like carp. It can also lead to increased algal blooms and higher turbidity, resulting in a loss of water clarity that is likely to further suppress plant growth. A different set of problems occurs when exotic aquatic plants gain dominance and become overly abundant. This situation can create single-species monocultures of low habitat value, impede recreational use of the water, stunt fish growth, and contribute to dramatic fluctuations in dissolved oxygen levels that can stress aquatic life.

In 2006 the DNR revised their protocols for aquatic plant surveys and since then Lake Ripley has conducted their surveys according to these updated protocols. Full point-intercept surveys were conducted in 2006, 2011, 2015, and 2020.

## Methods

Two of three scientists that completed the full point-intercept survey in the summer of 2020 for the Lake Ripley Management District had previous experience conducting PI surveys on Lake Ripley. The surveyors employed the point-intercept sampling method in accordance with

protocols approved by the Wisconsin Department of Natural Resources (WDNR) and used on Lake Ripley in surveys conducted in 2006, 2011 and 2015. Based on parameters specific to Lake Ripley, the DNR has mapped a 725-point sampling grid over the entire lake. Of the 725 points, 378 were sampled during the 2020 survey. Using GPS, the field crew navigated to each of the predetermined grid points. Researchers locate the sample points using a hand-held GPS. This continuity of sampling and recording style is hoped to lead to an increased correlation between the studies

When researchers arrive at a sampling point by boat, a metal rake is lowered into the water to collect a plant sample and at the same time measure water depth. The rake is dragged along the ground six to twelve inches to collect a full, thorough sample of plants and at the same time to determine the sediment composition of the lake's bottom. The rake is then pulled up.

The density of plant cover on the rake is recorded and is in itself a useful point of data. Each species is then identified and assigned a density rating based on the amount of that plant found on the rake. Plants that are in close proximity (<1ft from sample point) to the sample point but not collected on the rake are recorded as "visual" sightings.

The data collected are later analyzed and used for statistical analysis. The analyses are used for determining trends within the lake's aquatic plant community and monitoring and managing any invasive species found.

The 2020 survey was completed the week of June 15-June 18, with sampling dates occurring consecutively. Lianna Spencer (Lake Researcher, LRMD), Patricia Cicero (Land and Water Conservation Director, Jefferson County), and Dwight Osmon (Field Technician, LRMD) performed the plant inventory. Lianna Spencer took the lead on preparing for and conducting the survey, specimen preparation and data analysis.

**Results**

The total number of plant species found using the point-intercept and visual survey methods was 25. Of these, 23 aquatic plant species were found through point-intercept sampling. The remaining two (bulrush, cattails) were recorded as visuals. Plants were found growing in water as deep as 16 feet. The six most dominant plant species from most to least documented were: coontail (*Ceratophyllum demersum*), fetid stonewort (*Chara contraria*), Fries' pondweed (*Potamogeton friesii*), globular stonewort (*Chara globularis*), water celery (*Vallisneria americana*) and Eurasian watermilfoil (*Myriophyllum spicatum*). Small pondweed (*Potamogeton pusillus*) and sago pondweed (*Stuckenia pectinata*) were close runner-ups, being found at only one and two fewer sites, respectively, than milfoil.

The total plant density within the lake is recorded using the average rake fullness value. In 2020 the average rake fullness value measured 2.10, compared to 2.36 in 2015. A likely explanation for the decrease is the seasonal timing of the two surveys, as many of these lake plants' growth peaks later in the season. The 2015 survey was conducted in August, when plants are more mature which would make their density fuller.

In total, four earlier-unrecorded native species were found and documented in the 2020 plant survey.

Needle spikerush, *Eleocharis acicularis,* was found in a shallow, quiet, sandy part of the lake on the north end. It has never before been recorded on Lake Ripley! This native species serves as food for a wide variety of waterfowl as well as muskrats. It also is spawning habitat and shelter for invertebrates within the lake.

White water crowfoot, *Ranunculus aquatilis*, had a specimen pressed for the lake in an earlier study, but had not been found on the rake in a survey before. This plant can be very valuable to the lake and the surrounding organisms. As white water crowfoot flowers give way to their fruits, the water crowfoot bed becomes a choice spot for dabbling ducks (Through the Looking Glass, Borman et al). The fruits and the foliage are consumed by a variety of waterfowl. Upland game birds, such as the ruffed grouse, have been known to consume this plant when it is growing in shallow areas. The stems and leaves of this plant provide valuable invertebrate habitat and it is considered a fair produced of food for trout (Through the Looking Glass, Borman et al).

Large duckweed, *Spirodela polyrhiza*, and common watermeal, *Wolffia columbiana*, had been visually recorded during a previous plant survey, but neither of them had been pulled up on the rake until 2020. The large duckweed was found in the southeastern part of Marina Bay floating among small duckweed, common watermeal, white water lily and spatterdock. Both the Needle spikerush and the Large duckweed were collected, pressed and sent to the Wisconsin State Herbarium for positive identification.

For the purposes of this survey, Eurasian Water Milfoil (EWM) and hybrid milfoil were accounted for as one species under the label of EWM. EWM, an invasive species whose rapid growth in the late 1980s spurred the creation of the Lake Ripley Management District, is still prevalent in the lake, though it appears to be hybridizing with the native northern milfoil.. This hybrid shares visual features of Eurasian watermilfoil and northern watermilfoil. For example, some of the hybrid stems have the whitish or tan hue of the native, but with 12-20 leaflets per leaf of EWM. Because the most accurate method to differentiate between watermilfoil species is with genetic analysis, unavailable to us in the field, the Eurasian watermilfoil and hybrid species were combined in the 2020 survey data. The frequency of occurrence for Eurasian watermilfoil was 17.96% in 2020, up from 3.3% in 2015, but greatly reduced from the 40.6% recorded in 2011. The bump from the 2015 survey might be due to seasonal timing differences between the surveys or due to the decision to label the hybrid with the EWM instead of as northern or alone.

Curly-leaf pondweed (CLP) is the other invasive plant species in Lake Ripley. In 2020, this plant had a frequency of occurrence of 8.29%, similar to its rate of 8.9% in 2011. 2015's survey was completed in August when most of the curly-leaf plants would have died back, so the low rate of 1.4% recorded in that study was not likely representative of the true population of this species in the lake at that time

**Discussion**

The 2020 survey was completed within the week of June 15-18, providing a snapshot of plant conditions for this span of the lake's season. Each plant has its own growth patterns, from sprouting to peak growth to dieback, which is why knowing when in the growing season a PI

survey is conducted is pivotal to interpreting results. The plant whose population of interest during the 2020 survey was curly-leaf pondweed; therefore the crew prioritized a June sampling in order to capture the height of the curly-leaf pondweed season in the lake. Since our 2015 survey was done in August, CLP had not been assessed to its fullest. This data confirms that our native plant populations are able to compete successfully and contain the CLP to its earlier-identified level of approximately 8 – 9% of the total lake plant population, even at its height of growth.

During the 2020 survey we were able to find two new species in the lake. The first new species was large duckweed, *Spirodela polyrhiza*, a small, free-floating plant that can provide great shade for fish and food for waterfowl. The large duckweed was found in Marina Bay within the white water lilies and spatterdock lilies. We also found needle spikerush, *Eleocharis acicularis*, on the north end in a shallow, sandy, quiet part of the lake. This plant is great habitat for fish to lay their eggs on.

Two other plants that had been seen visually but never found on the rake, were also recorded in the 2020 survey. Watermeal and white water crowfoot were both found on the rake in 2020, making them officially documented plant species in Lake Ripley. It is very exciting to find undocumented plants in our lake because that increases our species diversity. Increasing the species diversity within a lake means that the lake is healthy enough to support a wide variety of plants.

The total number of plant species documented in the lake for the last ten years are: 26 in 2020, 34 for 2015 and 28 for 2011. The number of plants has remained fairly consistent, only wavering by a few each year that were probably around but were not actively seen. Both the 2011 and 2020 survey were completed in June which could account for similar numbers due to the seasonality of the plants. Comparing the frequency of occurrence, 13 native plant species have increased, 6 have decreased, 1 with no significant change. Coontail, fetid stonewort, globular stonewort, and Fries' pondweed have all seen large increases this year.

The relative frequency of occurrence is the frequency of a species divided by the total frequency of all species (Table 1). The sum of the relative frequencies should equal 100 percent. This statistic presents an indication of how plants occur throughout the lake in relation to each other. The relative frequency of occurrence is also used to calculate importance values and the Simpson's diversity index (Table 1). Coontail makes up 42% of the plant community in June 2020, with an increase of 15% from 2015.

Coontail also has the highest importance value for Lake Ripley, with a score of 25.7. The importance value is the product of the relative frequency and the average density and is expressed as a percent for each species. This number provides an indication of the dominance of a species within a community based upon both frequency and density (Table 1).

The coefficient of conservatism is a number on a scale from 0 to 10 that represents an estimated probability that a plant species is likely to occur in a lake unaltered from what is believed to be pre-settlement conditions. A coefficient of 10 indicates the plant is almost certain to be found only in an un-degraded natural community, and a coefficient of 0 indicates the probability is almost 0. Introduced plants were not part of the pre-settlement flora, so no coefficient is

assigned to them. Higher coefficients of conservatism are indicative of native plants that are more intolerant of habitat modification or impaired water quality. The data for the eco-region that includes Lower Spring Lake is for 68 lakes: the Coefficient of Conservatism ranges from 6.87 to 2.12 with an average of 5.21. The 2020 mean coefficient of conservatism for Lake Ripley is 5.8, decreasing since 2015's mean coefficient of 5.95. This average takes into account plants that are documented on the rake and not observed during the boat survey.

The floristic quality index (FQI) is used to assess a lake's quality using the aquatic plants that live in it. FQIs range from 3.0 to 44.6 in Wisconsin. The higher the value, the more likely the plant is negatively influenced by human activities that affect water quality or habitat. Plants with low values are tolerant of human disturbances, and often exploit these impacts to the point where they may crowd out other species. Generally, higher FQI numbers mean a healthier plant community. In 2011 and 2015 the FQI for Lake Ripley was 23.77 and 25.92, respectively. In 2020, Lake Ripley's floristic quality index was 25.93, which continues to rank above the median (21.10) and average (20.00) values for the Southeast Wisconsin Till Plains ecoregion.[1]

The Simpson Diversity index increased to 0.90 in 2020, from 0.86 in 2015. This index is calculated as one minus the sum of each of the relative frequencies squared. The closer the SDI value is to one, the greater the diversity is between communities being compared. The index allows the plant community at one location to be compared to the plant community at another location. It also allows a single location's plant community to be compared over time. The index value (on a scale of 0-1) represents the probability that two individuals (randomly selected) will be different species. The greater the index value, the higher the diversity in a given location. Plant communities with high diversity are usually representative of healthier lakes, and also tend to be more resistant to invasion by exotic species.

Plant depth will fluctuate from year to year depending on changes in water clarity conditions. Plants may be found at depths of over 20 ft. in clear lakes, but only in a few feet of water in stained or turbid lakes. While some species can tolerate very low light conditions, others are only found near the surface. In general, the diversity of the plant community decreases with increased depth. During the 2020 survey, plants were not found in depths greater than 16 feet. However, the 2015 survey documented plants at 15 feet and 2011 documented plants at 21 feet (Table 3). Depths at which plants are growing also impact the number of sites sampled (Table 3). Other factors that restrict access to sampling points include pier placement, boaters, and other obstructions.

**Table 1: 2020 plant inventory findings**

[1] Median and average FQI for Wisconsin lakes sampled in the SWTP eco-region (updated: August 2011). Statistics provided by Michelle Nault, Wisconsin DNR.

| Species | Frequency of Occurrence (%) | Average Density** (1-3 scale) | Relative Frequency | Importance Value |
|---|---|---|---|---|
| *Ceratophyllum demersum* (coontail) | 42.3 | 1.64 | 15.7 | 25.7 |
| *Chara contraria* (fetid stonewort) | 39.8 | 1.59 | 14.8 | 23.5 |
| *Chara globularis* (globular stonewort) | 31.8 | 1.77 | 11.8 | 20.9 |
| *Eleocharis acicularis* (needle spikerush) | 0.3 | 1.00 | 0.1 | 0.1 |
| *Elodea canadensis* (waterweed) | 1.9 | 1.00 | 0.7 | 0.7 |
| *Heteranthera dubia* (water star grass) | 3.9 | 1.00 | 1.4 | 1.4 |
| *Lemna minor* (small duckweed) | 0.8 | 1.00 | 0.3 | 0.3 |
| *Myriophyllum sibiricum* (northern watermilfoil) | 1.1 | 1.00 | 0.4 | 0.4 |
| **Myriophyllum spicatum* (Eurasian watermilfoil) | 17.9 | 1.35 | 6.7 | 9.1 |
| *Najas marina* (spiny naiad) | 3.0 | 1.00 | 1.1 | 1.1 |
| *Nuphar variegata* (spatterdock) | 3.3 | 2.33 | 1.2 | 2.8 |
| *Nymphaea odorata* (white water lily) | 2.5 | 1.33 | 0.9 | 1.2 |
| **Potamogeton crispus* (curly-leaf pondweed) | 8.3 | 1.17 | 3.1 | 3.6 |
| *Potamogeton friesii* (Fries' pondweed) | 37.8 | 1.67 | 14.0 | 23.4 |
| *Potamogeton gramineus* (variable pondweed) | 6.6 | 1.13 | 2.4 | 2.7 |
| *Potamogeton illinoensis* (Illinois pondweed) | 0.8 | 1.33 | 0.3 | 0.4 |
| *Potamogeton pusillus* (small pondweed) | 16.3 | 1.36 | 6.1 | 8.3 |
| *Potamogeton strictifolius* (stiff pondweed) | 3.6 | 1.23 | 1.3 | 1.6 |
| *Ranunculus aquatilis* (white water crowfoot) | 2.8 | 1.00 | 1.0 | 1.0 |
| *Spirodela polyrhiza* (large duckweed) | 0.3 | 3.00 | 0.1 | 0.1 |
| *Stuckenia pectinata* (Sago pondweed) | 16.0 | 1.24 | 6.0 | 7.4 |
| *Utricularia vulgaris* (common bladderwort) | 7.5 | 1.15 | 2.8 | 3.2 |
| *Vallisneria americana* (water celery) | 19.9 | 1.08 | 7.4 | 8.0 |
| *Wolffia columbiana* (common watermeal) | 0.8 | 1.00 | 0.3 | 0.3 |
| Filamentous algae | 63.26 | 1.62 | NA | NA |
| Freshwater sponge | 0.28 | 1.00 | NA | NA |

* = Species not native to Wisconsin
** = Average Densities and corresponding Importance Values are based on a 1-3 rake-fullness scale.

## Table 2: Statistical summary for all plant species documented in the 2020 inventory

| **Aquatic Plant** | **Number of Sites Found** | **FREQ[a] [0-15'] (%)** | **FREQ[b] [Veg. Sites] (%)** | **RFREQ[c] (%)** | **ADEN[d] (1-3 scale)** | **IV[e]** | **C[f]** |
|---|---|---|---|---|---|---|---|
| Coontail *Ceratophyllum demersum* | 153 | 42.27 | 40.69 | 15.7 | 1.64 | 25.7 | 3 |
| Fetid Stonewort *Chara contraria* | 144 | 39.78 | 38.30 | 14.8 | 1.59 | 23.5 | NA |
| Fries' Pondweed *Potamogeton friesii* | 136 | 37.75 | 36.17 | 14.0 | 1.67 | 23.4 | 8 |
| Globular Stonewort *Chara globularis* | 115 | 31.77 | 30.59 | 11.8 | 1.77 | 20.9 | 3 |
| Water Celery *Vallisneria americana* | 72 | 19.89 | 19.15 | 7.4 | 1.08 | 8.0 | 6 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Eurasian watermilfoil<br>*Myriophyllum spicatum* | 65 | 17.96 | 17.29 | 6.7 | 1.35 | 9.1 | 0 |
| Small pondweed<br>*Potamogeton pusillus* | 59 | 16.30 | 15.69 | 6.1 | 1.36 | 8.3 | 7 |
| Sago pondweed<br>*Stuckenia pectinata* | 58 | 16.02 | 15.43 | 6.0 | 1.24 | 7.4 | 3 |
| *Curly-Leaf Pondweed<br>*Potamogeton crispus* | 30 | 8.29 | 7.98 | 3.1 | 1.17 | 3.6 | 0 |
| Common bladderwort<br>*Utricularia vulgaris* | 27 | 7.46 | 7.18 | 2.8 | 1.15 | 3.2 | 7 |
| Variable Pondweed<br>*Potamogeton gramineus* | 23 | 6.35 | 6.12 | 2.4 | 1.13 | 2.7 | 7 |
| Water Stargrass<br>*Heteranthera dubia* | 14 | 3.87 | 3.72 | 1.4 | 1.0 | 1.4 | 6 |
| Stiff Pondweed<br>*Potamogeton strictifolios* | 13 | 3.59 | 3.46 | 1.3 | 1.2 | 1.6 | 8 |
| Spatterdock<br>*Nuphar variegata* | 12 | 3.31 | 3.19 | 1.2 | 2.3 | 2.8 | 6 |
| Spiny naiad<br>*Najas marina* | 11 | 3.04 | 2.93 | 1.1 | 1.0 | 1.1 | 0 |
| White water crowfoot<br>*Ranunculus aquatilis* | 10 | 2.76 | 2.66 | 1.0 | 1.0 | 1.0 | 8 |
| White Water Lily<br>*Nymphaea odorata* | 9 | 2.49 | 2.39 | 0.9 | 1.3 | 1.2 | 6 |
| Common Waterweed<br>*Elodea canadensis* | 7 | 1.93 | 1.86 | 0.7 | 1.0 | 0.7 | 3 |
| Northern watermilfoil<br>*Myriophyllum sibiricum* | 4 | 1.10 | 1.06 | 0.4 | 1.0 | 0.4 | 6 |
| Common Watermeal<br>*Wolffia columbiana* | 3 | 0.83 | 0.80 | 0.3 | 1.0 | 0.3 | 0 |
| Illinois Pondweed<br>*Potamogeton illinoensis* | 3 | 0.83 | 0.80 | 0.3 | 1.3 | 0.4 | 6 |
| Small Duckweed<br>*Lemna minor* | 3 | 0.83 | 0.80 | 0.3 | 1.0 | 0.3 | 4 |
| Needle spikerush<br>*Eleocharis acicularis* | 1 | 0.28 | 0.27 | 0.1 | 1.0 | 0.1 | 5 |
| Large Duckweed<br>*Spirodela polyrhiza* | 1 | 0.28 | 0.27 | 0.1 | 1.0 | 0.1 | 5 |
| Cattails<br>*Typha sp.* | V | V | V | V | V | V | V |
| Softstem Bulrush<br>*Schoenoplectus tabernaemontani* | V | V | V | V | V | V | V |
| Filamentous algae | 229 | NA | NA | NA | NA | NA | NA |
| Freshwater sponge | 1 | NA | NA | NA | NA | NA | NA |

* = Species not native to Wisconsin

GS = species observed at lake's edge during general boat survey

V = species observed visually during point-intercept survey

[a]FREQ [0-17'] = Frequency of Occurrence within depth zone defining extent of plant growth. The number of occurrences of a species divided by the number of sampling points in the 0-17' depth range.

[b]FREQ [Veg. Sites] = Frequency of Occurrence within sites where plants were collected. The number of occurrences of a species divided by the number of sampling points with documented plant growth.

[c]RFREQ = Relative Frequency of Occurrence.

[d]ADEN = Average Density. The sum of the density ratings for a species (1-3 rake fullness scale) divided by the number of sampling points with vegetation.

[e]IV = Importance Value. The product of the relative frequency (RFREQ) and the average density, expressed as a percentage.

[f]C = Coefficient of Conservatism. Used to compute Floristic Quality Index. Values range from 0-10, with higher values indicative of plant species intolerant of habitat modification or water quality impairment caused by human disturbance.

### Table 3: Statistical descriptions based on all plants inventoried (2020)

| | |
|---|---|
| [a]Total Number of Points Sampled | 378 |
| [b]Number of Points Sampled within Depth Range of Potential Plant Growth (0-16') | 376 |
| [c]Number of Points with Vegetation | 362 |
| [d]Maximum Depth of Plant Growth | 16 |
| [e]Number of Species in Lake | 25 |
| [f]Frequency of Occurrence of Vegetation within Range of Plant Growth (0-16') | 96.28 |
| [g]Simpson Diversity Index | 0.90 |
| [h]Species Richness | 24 |
| [i]Species Richness + Visuals | 26 |
| [j]Floristic Quality Index (FQI) | 25.47 |
| [k]Mean Coefficient of Conservatism (C) | 5.84 |
| Average Number of Species Sampled Per Site (0-16') | 2.58 |
| Average Number of Species Sampled Per Site (Veg. Sites Only) | 2.69 |
| Average Number of Native Species Sampled Per Site (0-16') | 2.30 |
| Average Number of Native Species Sampled Per Site (Veg. Sites Only) | 2.41 |

[a]Does not include sample points in depths beyond 17 ft. where plant growth could not be documented

[b]Includes all sample points within the 0-17-ft. littoral zone that was shown to support plant growth

[c]Includes all sample points where vegetation was found after taking a rake sample

[d]Represents deepest point where vegetation was sampled. This depth will fluctuate from year to year depending on changes in water clarity conditions. Plants may be found at depths of over 20 ft. in clear lakes, but only in a few feet of water in stained or turbid lakes. While some species can tolerate very low light conditions, others are only found near the surface. In general, the diversity of the plant community decreases with increased depth.

[e]Includes plant species documented in the lake and along the zero-depth shoreline margin using both the point-intercept method and a general boat survey.

[f]Percentage of occurrence that vegetation would be sampled within the 0-17-ft. littoral zone

[g]Simpson Diversity Index: One minus the sum of each of the relative frequencies squared (SDI = 1 - $\sum(RFREQ^2)$). The closer the SDI value is to one, the greater the diversity is between communities being compared. The index allows the plant community at one location to be compared to the plant community at another location. It also allows a single location's plant community to be compared over time. The index value (on a scale of 0-1) represents the probability that two individuals (randomly selected) will be different species. The greater the index value, the higher the diversity in a given location. Plant communities with high diversity are usually representative of healthier lakes, and also tend to be more resistant to invasion by exotic species.

[h]Indicates the number of different plant species found in and directly adjacent to the lake (on the waterline). Species richness only counts those plants documented as part of the point-intercept data. It includes filamentous algae, freshwater sponge, and unidentified *Myriophyllum* and *Najas* species. This number does not include the species found during general boat surveys (GS).

[i]Indicates the number of different plant species found in and directly adjacent to the lake (on the waterline). This species richness count includes visuals found in the point-intercept survey. This number does not include the species found during general boat surveys (GS).

[j]Measures the impact of human development on a lake's aquatic plant community. Species in the index are assigned a Coefficient of Conservatism (C), which ranges from 3.0 to 44.6 in Wisconsin. The higher the value, the more likely the plant is negatively influenced by human activities that affect water quality or habitat. Plants with low values are tolerant of human disturbances, and often exploit these impacts to the point where they may crowd out other species. The FQI is calculated by averaging the conservatism value for each species found in the lake, and then multiplying that value by the square root of the number of species (FQI=meanC$\sqrt{N}$). Consequently, a higher index value indicates a healthier macrophyte community.

[k]Mean Coefficient of Conservatism (C) among species documented during point-intercept survey. Does not include species observed during the follow-up boat survey.

**Table 4: Statistics for the 2006, 2011, 2015 and 2020 plant surveys**

| | 2006 | 2011 | | 2015 | 2020 |
|---|---|---|---|---|---|
| Total Number of Points Sampled | 398 | 421 | | 369 | 378 |
| Number of Points Sampled Shallower than Maximum Depth of Plants | 369 | 407 | | 359 | 376 |
| Number of Points with Vegetation | 318 | 366 | | 330 | 362 |
| Maximum Depth of Plant Growth | 17 ft | 21 ft | | 15 ft | 16 ft |
| Total Number of Species in Lake (includes visuals and boat survey) | 31 | 28 | | 34 | 26 |
| [a]Species Documented on the Rake | 20 | 21 | | 24 | 24 |
| Frequency of Occurrence at sites shallower than maximum depth of plants | 86 | 90 | | 91 | 96 |
| Average Rake fullness for all vegetation | -- | 1.61 | | 2.36 | 2.10 |
| Simpson Diversity Index | 0.85 | 0.89 | | 0.86 | 0.90 |
| Floristic Quality Index (FQI) | 22.75 | 23.77 | | 25.92 | 25.47 |
| Mean Coefficient of Conservatism (C) | 5.69 | 5.76 | | 5.95 | 5.84 |

| | | | | | |
|---|---|---|---|---|---|
| Average Number of Species Sampled Per Site | 1.76 | 2.33 | | 2.19 | 2.58 |
| Average Number of Species Sampled at Sites with Vegetation | 2.05 | 2.60 | | 2.39 | 2.69 |
| Average Number of Native Species Sampled Per Site | 1.52 | 2.02 | | 1.79 | 2.30 |
| Average Number of Native Species Sampled at Sites with Vegetation | 2.00 | 2.34 | | 1.97 | 2.41 |

[a]Includes filamentous algae and freshwater sponge.

**Table 5: Percent frequency of occurrence of aquatic plant species (2006-2020)**

| Species | Year | | | |
|---|---|---|---|---|
| | 2006 | 2011 | 2015 | 2020 |
| Chara sp. | 53.1 | -- | -- | -- |
| Common bladderwort | -- | 2.7 | 1.7 | 7.5 |
| Common watermeal | -- | -- | -- | 0.8 |
| Common waterweed | 0.8 | 9.8 | 0.6 | 1.9 |
| Coontail | 12.2 | 25.3 | 27.3 | 42.3 |
| *Curly-leaf pondweed | 1.4 | 8.9 | 1.4 | 8.3 |
| *Eurasian watermilfoil | 6.8 | 3.7 | 3.3 | 17.9 |
| Fetid stonewort | -- | 49.6 | 43.2 | 39.8 |
| Flat-stem pondweed | -- | -- | 0.3 | -- |
| Floating-leaf pondweed | -- | -- | 0.6 | -- |
| Forked duckweed | 0.3 | -- | -- | -- |
| Fries' pondweed | 7.3 | 20.1 | 5.6 | 37.6 |
| Globular stonewort | -- | -- | 5.9 | 31.8 |
| Horned pondweed | -- | 0.2 | 0.3 | -- |
| Hybrid watermilfoil | 4.6 | 12.3 | 2.8 | -- |
| Illinois pondweed | -- | 7.4 | 0.8 | 0.8 |
| Leafy pondweed | 0.8 | -- | -- | -- |
| Naiad sp. | -- | -- | -- | -- |
| Needle spikerush | -- | -- | -- | 0.3 |
| Northern watermilfoil | 3.8 | 24.6 | 7.2 | 1.1 |
| Potamogeton sp. | -- | -- | 2.8 | -- |
| Sago pondweed | 16.8 | 32.7 | 48.5 | 16.0 |
| Slender naiad | 1.1 | 2.0 | 7.0 | -- |
| Small duckweed | 1.1 | 0.2 | V | 0.8 |
| Small pondweed | 0.3 | 0.5 | 0.8 | 16.3 |
| Spatterdock | 1.9 | 1.7 | 1.4 | 3.3 |
| Spiny naiad | 33.3 | 18.7 | 35.4 | 3.0 |
| Stiff pondweed | -- | -- | 0.3 | 3.6 |
| Variable pondweed | -- | 0.2 | 1.1 | 6.4 |
| Water bulrush | -- | -- | -- | -- |
| Water celery | 3.0 | 10.6 | 22.0 | 19.9 |
| Water star grass | 4.3 | 1.0 | 1.4 | 3.9 |
| White water crowfoot | -- | -- | -- | 2.8 |

| | | | | |
|---|---|---|---|---|
| White water lily | 1.6 | 1.2 | 0.8 | 2.5 |

* = Species nonnative to Wisconsin

**Table 6: Number of littoral-zone sample sites where each species was found (2006-2020)**

| Species | Year | | | |
|---|---|---|---|---|
| | 2006 | 2011 | 2015 | 2020 |
| Arum-leaved arrowhead | -- | -- | V | -- |
| Cattail | -- | -- | -- | V |
| Chara sp. | 196 | -- | -- | -- |
| Common bladderwort | -- | 11 | 6 | 27 |
| Common watermeal | -- | V | -- | 3 |
| Common waterweed | 3 | 40 | 2 | 7 |
| Coontail | 44 | 103 | 98 | 153 |
| *Curly-leaf pondweed | 5 | 36 | 5 | 30 |
| *Eurasian watermilfoil | 25 | 15 | 12 | 65 |
| Fetid stonewort** | -- | 202 | 155 | 144 |
| Flat-stem pondweed | -- | -- | 1 | -- |
| Floating-leaf pondweed | -- | V | 2 | -- |
| Forked duckweed | 1 | -- | -- | -- |
| Fries' pondweed | 27 | 82 | 20 | 136 |
| Globular stonewort** | -- | -- | 21 | 115 |
| Hardstem Bulrush | -- | -- | V | -- |
| Horned pondweed | -- | 1 | 1 | -- |
| Hybrid watermilfoil | -- | 50 | 10 | -- |
| Illinois pondweed | 18 | 30 | 3 | 3 |
| Large duckweed | -- | -- | -- | 1 |
| Leafy pondweed | 3 | -- | -- | -- |
| *Naiad* sp. | -- | -- | -- | -- |
| Needle spikerush | -- | -- | -- | 1 |
| Northern watermilfoil | 14 | 100 | 26 | 4 |
| *Potamogeton* sp.(Hybrid) | -- | -- | 10 | -- |
| Sago pondweed | 62 | 133 | 174 | 58 |
| Softstem bulrush | -- | -- | -- | V |
| Slender naiad | 4 | 8 | 25 | -- |
| Small duckweed | 4 | 1 | V | 3 |
| Small pondweed | 1 | 2 | 3 | 59 |
| Spatterdock | 7 | 7 | 5 | 12 |
| Spiny naiad | 123 | 76 | 127 | 11 |
| Stiff pondweed | -- | -- | 1 | 13 |
| Variable pondweed | -- | 1 | 4 | 23 |
| Water bulrush | -- | -- | -- | -- |
| Water celery | 11 | 43 | 79 | 72 |
| Water stargrass | 16 | 4 | 5 | 14 |
| White water crowfoot | -- | -- | -- | 10 |
| White water lily | 6 | 5 | 3 | 9 |

| | | | | |
|---|---|---|---|---|
| Total Number of Species Documented: | 19 | 23 | 28 | 24 |

* = Species nonnative to Wisconsin
** = 2015 inventory differentiated between *Chara* species

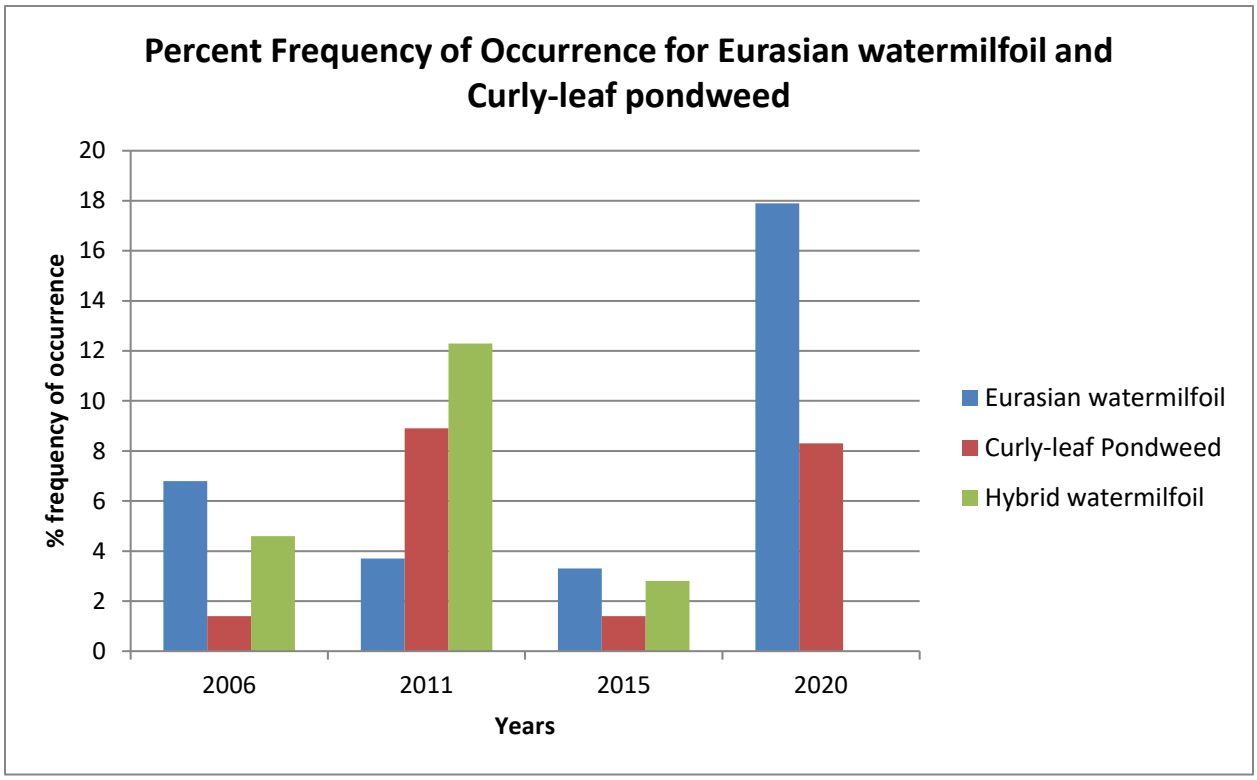
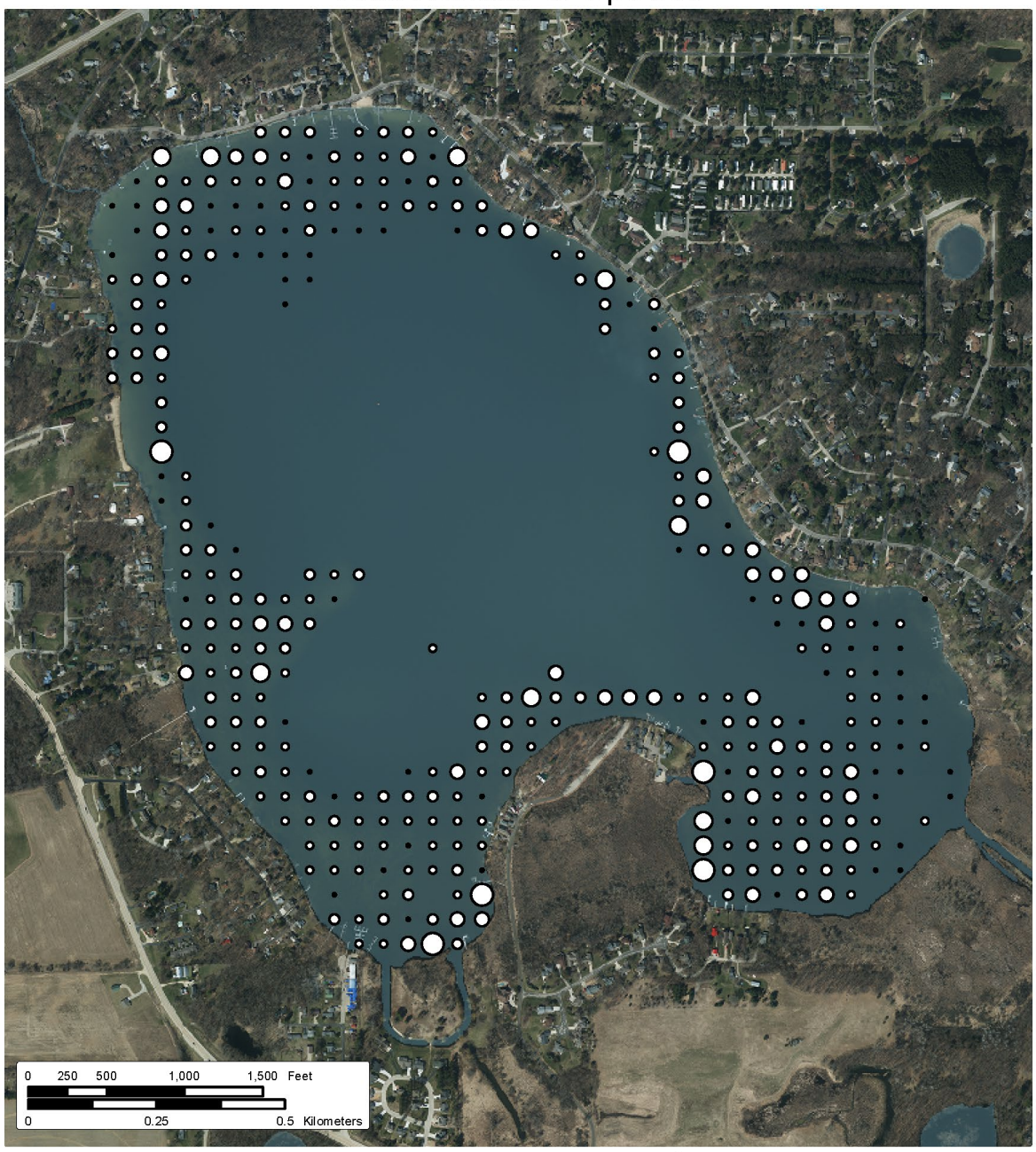



**Figure 1: Frequency of Occurrence for Non-Native Aquatic Plant Species Found Among Littoral-Zone Sample Sites (2006-2020)**

# Aquatic Plant Survey
# Lake Ripley - Jefferson County - June 2020
## Total Number of Species



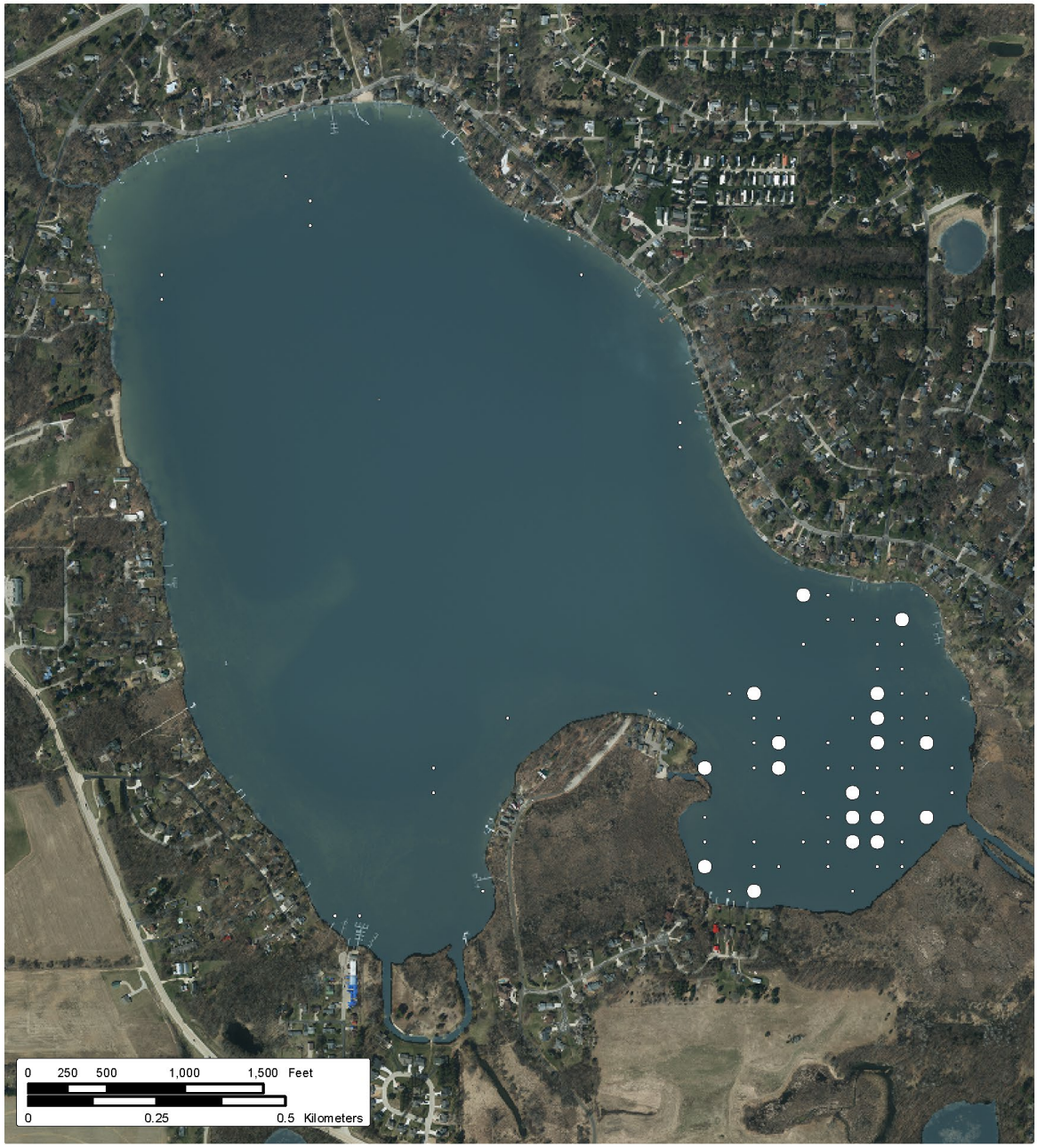

**Total # of Species at each Survey Site**

• 1 ○ 3 ○ 5
○ 2 ○ 4 ○ 6

Spring 2020
Aerial

Author:
Jefferson County Land
& Water Conservation Dept Date: 11/27/2020

# Aquatic Plant Survey
# Lake Ripley - Jefferson County - June 2020
## Total Number of Invasive Species



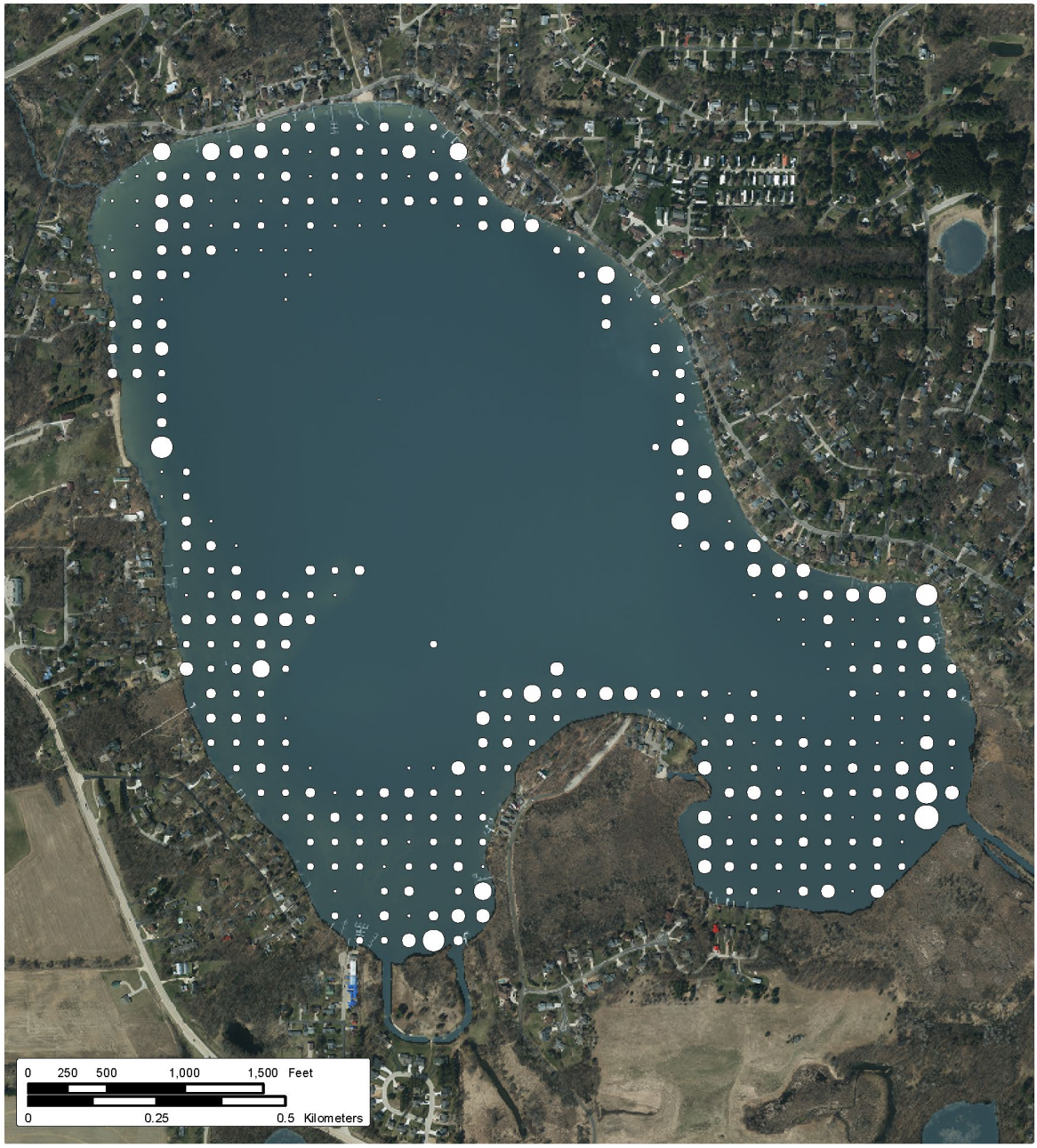

**Total # of Species at each Survey Site**

◦ 1 ○ 2

Spring 2020
Aerial

Author:
Jefferson County Land
& Water Conservation Dept Date: 11/27/2020

# Aquatic Plant Survey
# Lake Ripley - Jefferson County - June 2020
## Total Number of Native Species



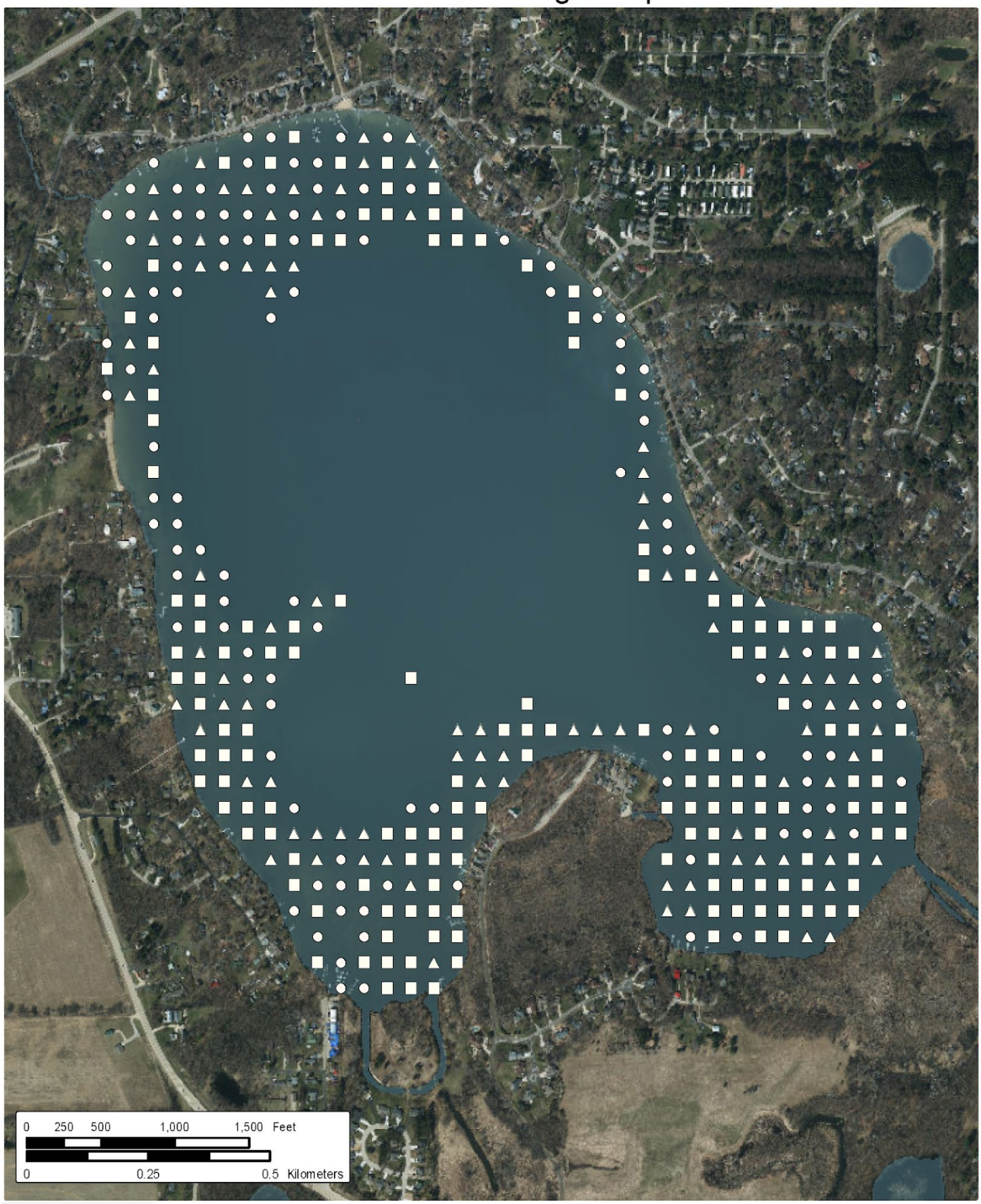

**Total # of Species at each Survey Site**

| | | | |
|---|---|---|---|
| 1 | 3 | 5 | 7 - 8 |
| 2 | 4 | 6 | |

Spring 2020
Aerial

Author:
Jefferson County Land
& Water Conservation Dept Date: 11/30/2020

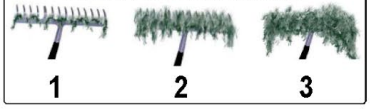
# Aquatic Plant Survey
# Lake Ripley - Jefferson County - June 2020
## Rake Fullness Rating all Species




**Rake Fullness Rating**

- ○ 1
- △ 2
- □ 3

Illustration of Rake Fullness Rating




Author:
Jefferson County Land & Water Conservation Dept

Spring 2020 Aerial

Date: 11/25/2020

Total Rake Fullness Rating

○ 1 □ 3

△ 2 ♦ Visual

# Lake Ripley - Jefferson County
June 2020

Illustration of
Rake Fullness Rating





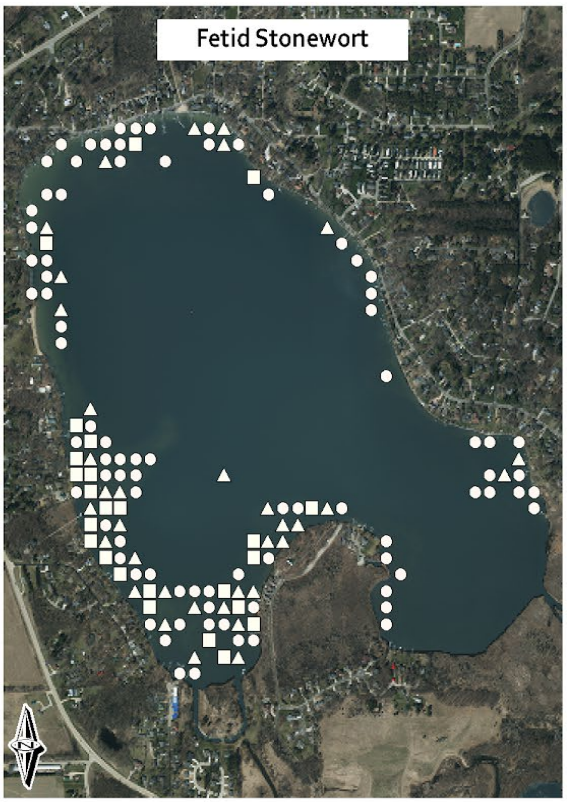
Total Rake Fullness Rating

○ 1 □ 3

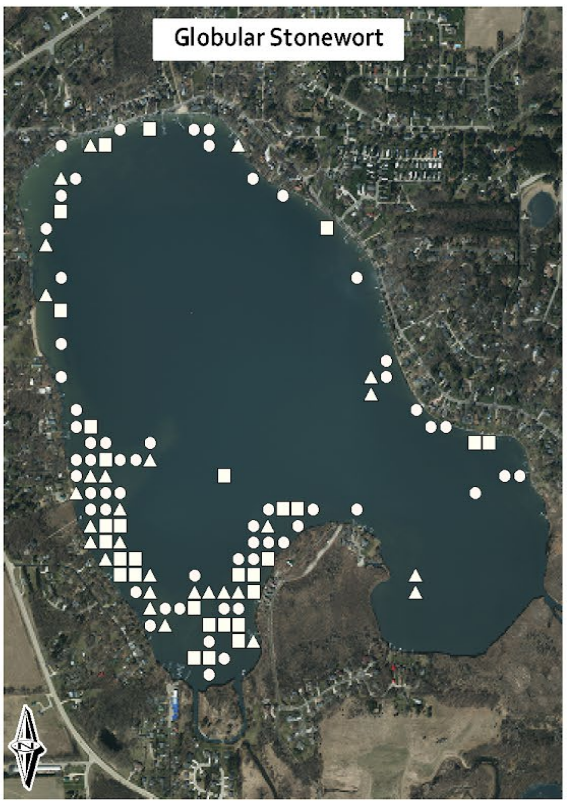
△ 2 ♦ Visual

# Lake Ripley - Jefferson County
June 2020

Illustration of
Rake Fullness Rating





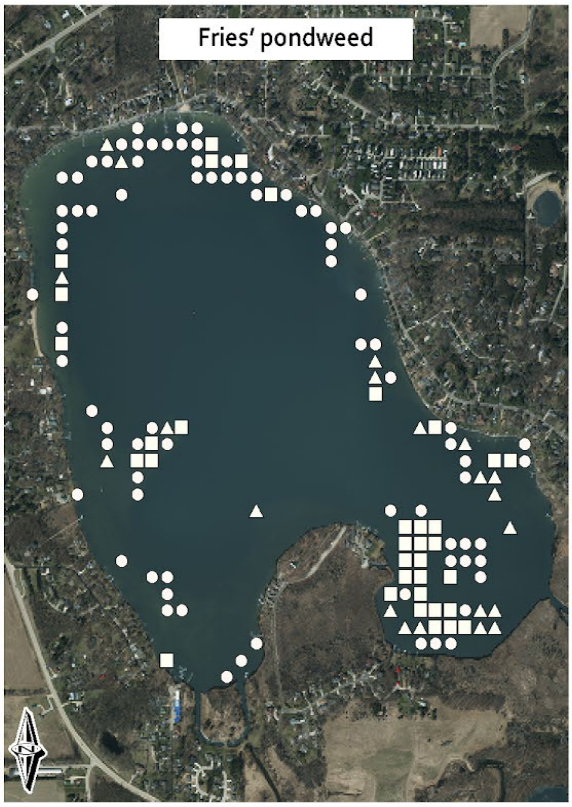

Total Rake Fullness Rating

○ 1 □ 3

△ 2 ♦ Visual

# Lake Ripley - Jefferson County
June 2020

Illustration of Rake Fullness Rating




Total Rake Fullness Rating

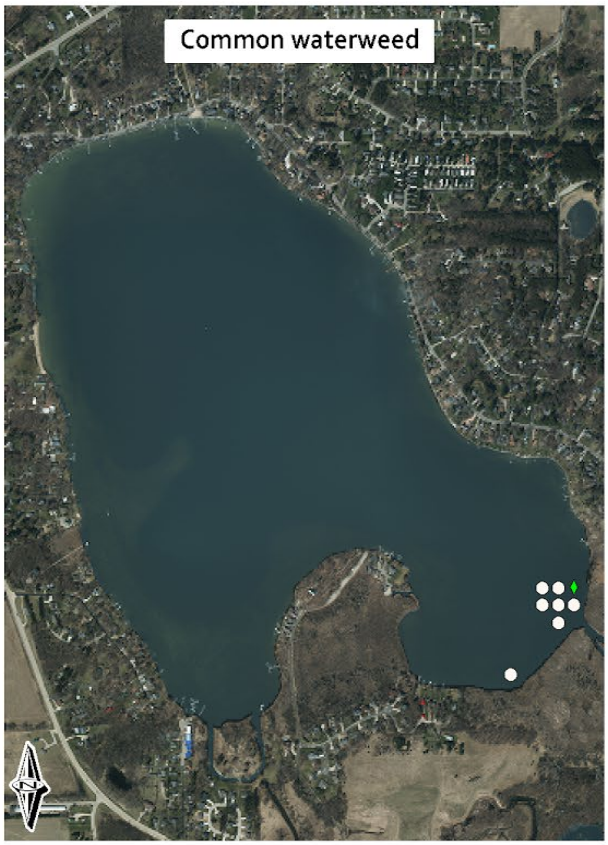
○ 1 □ 3

△ 2 ♦ Visual

# Lake Ripley - Jefferson County
June 2020

Illustration of
Rake Fullness Rating







Total Rake Fullness Rating

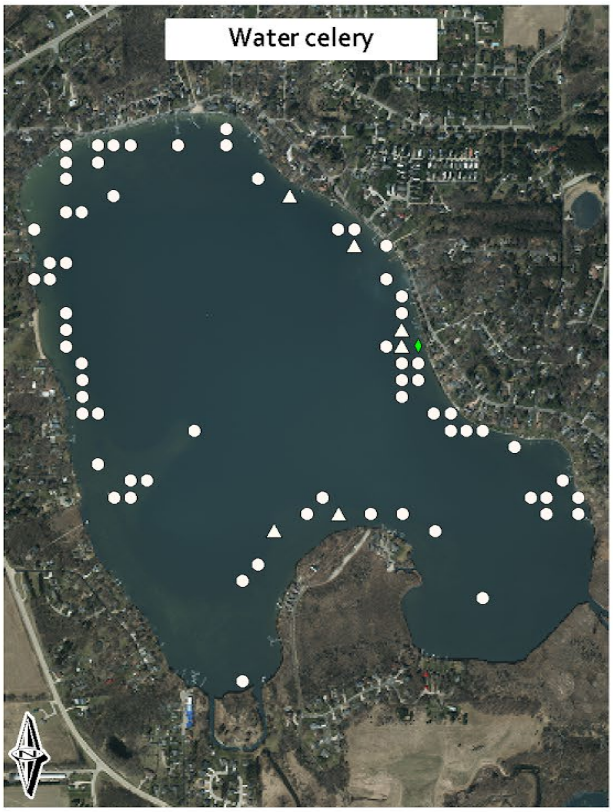
○ 1 □ 3

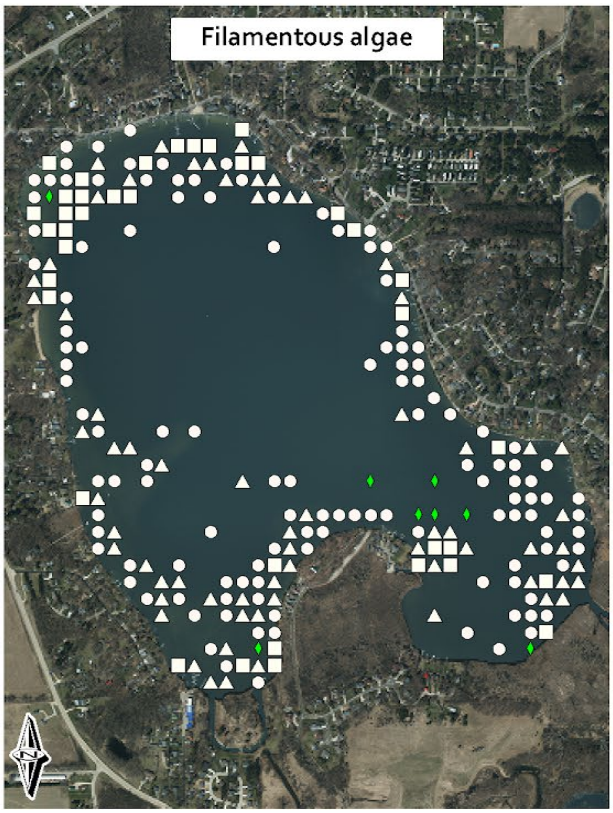
△ 2 ♦ Visual

# Lake Ripley - Jefferson County
June 2020

Illustration of
Rake Fullness Rating





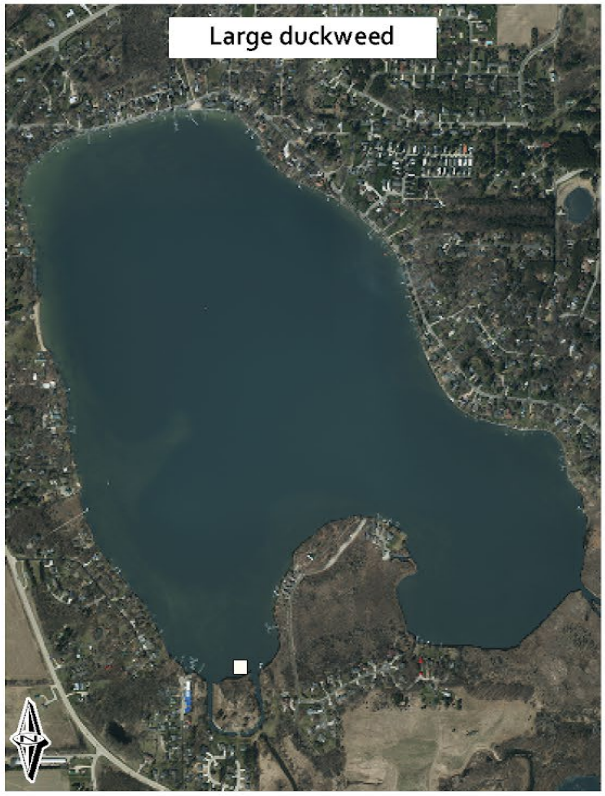

Total Rake Fullness Rating

○ 1 □ 3

△ 2 ♦ Visual

# Lake Ripley - Jefferson County
June 2020

Illustration of
Rake Fullness Rating




Total Rake Fullness Rating

○ 1 □ 3

△ 2 ♦ Visual

# Lake Ripley - Jefferson County
June 2020

Illustration of
Rake Fullness Rating