

Aquatic Plant Point Intercept Report: Rock Lake

Prepared By: North Lakeland Discovery Center
Woods and Water Program
Lydia Dobberstein
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Contents

INTRODUCTION.....	3
METHODS.....	4
Field Sampling	4
Data Analysis	5
RESULTS.....	6
Table 1. Rock Lake’s aquatic plant species list recorded in 2025.	8
Figure 1. Rock Lake’s dominant sediment observed during 2025 survey.	9
Figure 2. Rock Lake’s maximum depth of plant of plant colonization in 2025.....	9
Figure 3. Floristic Quality Assessment and comparison of Rock Lake.	10
Species Abundance.....	11
Figure 4. Rock Lake’s relative frequency of occurrence of aquatic plant species collected during the 2025 point-intercept survey.....	13
CONCLUSION	14
REFERENCES.....	15
Map 1. Rock Lake’s total rake fullness	16
Map 2. Rock Lake’s species richness at each point	17
Map 3. Rock Lake’s distribution of fern pondweed.....	18
Map 4. Rock Lake’s distribution of coontail	19
Map 5. Rock Lake’s distribution of nitella	20
Map 6. Rock Lake’s distribution of common waterweed	21
Map 7. Rock Lake’s distribution of white water lily	22

INTRODUCTION

The following report presents the methods, results and analysis, and conclusion of the aquatic vegetation found in Rock Lake in Vilas County (WBIC 2311700) through a point-intercept survey conducted by the North Lakeland Discovery Center (NLDC) in Manitowish Waters. The survey was funded by the Wisconsin Department of Natural Resources (WDNR) Surface Water Grant¹ in partnership with Winchester Town Lakes Committee and the town of Winchester. The point-intercept survey was conducted in early to mid-July of 2025 during peak aquatic vegetation growth.

The purpose of an aquatic plant point-intercept survey is to collect standardized data on the distribution and relative abundance of aquatic plant species within a lake ecosystem. This survey generates quantitative and qualitative, geo-referenced data that can be analyzed to establish a baseline condition for the lake. This baseline allows future changes related to water clarity, non-native species introduction, water level fluctuations, or lake management activities to be assessed over time. By providing objective, science-based information, point-intercept survey data supports effective and efficient lake management by reducing uncertainty and minimizing conflict during the planning process. Additionally, these data contribute to broader statewide efforts by enabling lake-to-lake comparisons, identifying management trends and successful strategies, and advancing overall understanding of aquatic plant communities in Wisconsin lakes.

Aquatic plants are vital to the overall health and function of lake ecosystems. They provide essential ecological services, including breeding and nursery habitat of aquatic organisms, water purification, oxygen production, and sediment stabilization. Aquatic plants also serve as food and shelter for many animals, including moose, deer, waterfowl, fish, turtles, amphibians, zooplankton, and macroinvertebrates. Despite these contributions, aquatic plants are sometimes perceived as a nuisance by lake users. While certain aquatic invasive species can negatively impact lake ecosystems, most native aquatic plants play a critical role in maintaining ecological balance and supporting healthy, resilient lake systems (Skawinski 2022).

Aquatic invasive species are organisms that occur outside of their native range and are primarily introduced through human activities. In northern Wisconsin, species such as curly-leaf pondweed (*Potamogeton crispus*) and Eurasian watermilfoil (*Myriophyllum spicatum*) are present in many lakes. These species have the potential to spread and cause ecological or economic impacts, including recreational interference and reduced native plant diversity. However, scientific literature suggests that invasive species, specifically Eurasian watermilfoil, only in some cases reach nuisance levels while many other populations will often stagnate or decline on unmanaged lakes (Nichols 1999, Kujawa et al.

¹ WDNR Grant #AEPP85525

2017). Point-intercept surveys are a tool for early detection of aquatic invasive species and for comparing the distribution and relative abundance of native and non-native plant species within a lake.

METHODS

The point-intercept method used on Rock Lake 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 (Hauxwell 2010). 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.

Field Sampling

At each site, the plant community is surveyed with a pole or rope rake sampler to determine species presence and rake fullness rating. The rake is dropped until it touches the lake bottom, spun around three times, then 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 left blank. 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 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 foot range were recorded instead

(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.

Data Analysis

The WDNR provides an Excel workbook called “The Aquatic Plant Survey Data Workbook” with formulas to generate statistics about the findings. All data collected on the field sheet from the survey is entered into the entry sheet of the Excel workbook. Any boat surveys are inputted into the boat survey sheet on the workbook. Once all data is entered, the statistics are automatically generated. The statistics sheet 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).

Frequency of occurrence at sites shallower than the maximum depth of plant growth considers how often a species was collected in rake samples relative to the total number of sites within the littoral zone, defined as the area up to the maximum depth at which plants were found during the survey. This metric may also be referred to as the littoral frequency of occurrence. The relative frequency of abundance is based on this littoral frequency of occurrence in proportion to all plants recorded in the survey. Therefore, the relative frequencies of all species sum to 100%.

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. The 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, this sheet calculates the Floristic Quality Index (FQI), a metric used to evaluate how closely a sampled plant community resembles an undisturbed or minimally impacted community. In Wisconsin, the WDNR, local governments, and landowners increasingly rely on floristic quality to assess lake plant communities. FQI plays an important role in planning, zoning, sensitive area designation, and aquatic plant

management decisions. Floristic quality provides a standardized method for evaluating plant community conditions, allowing for comparisons across regions and overtime. The floristic quality (I) = the average coefficient of conservatism (C) multiplied by the square root of the number of species in the lake ($\sqrt{N}$). 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 human 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 2.0-9.5. Finally, the I value had a median value of 22.2, with ranges from 3.0-44.6. As C values can vary region to region, the state is broken into eight different ecoregions. This lake is within 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). Rock Lake's statistics will be compared to these values in the following sections of the report.

RESULTS

A total of 306 sites were visited on Rock Lake, with vegetation present at 107 of those sites. At these sites, the dominant substrate was muck (Figure 1). 31 different species of aquatic plants, moss and algae were found which may include nonnative species or species listed as special conservation concern according to WDNR Natural Heritage Inventory (Table 1). Plants were found at depths up to 13 feet, while the most frequent depth of colonization was 3 feet (Figure 2). The average rake fullness rating was 1.39, indicating below moderate plant density (Map 1). The frequency of occurrence of plants at sites shallower than maximum depth of plants was 42.29% of sites, with an average of 1.13 species per site that is shallower than maximum depth. The average number of all species was 2.66 per vegetated site (Map 2). In total, 30 plant species were collected using the rake method, and 31 species were documented when including visual sightings. The high Simpson Diversity Index of 0.93 reflects a well-balanced and diverse aquatic plant community in this lake. Lastly, the mean conservation coefficient (C) of this lake's aquatic plants is 6.89 with a Floristic Quality Assessment of 36.47 (Figure 3).

Rock Lake's previous aquatic plant point intercept survey was conducted by Onterra LLC in 2017, during which 27 species were documented. The mean conservation coefficient (C) was 6.85, with a Floristic Quality Assessment (FQI) of 34.91. Results may vary between years depending on environmental conditions and survey timing; however,

both the 2017 and 2025 data fall within the “specific needs, moderate tolerance” category for conservation coefficient and the “Very High Quality” category for FQI.

Table 1. Rock Lake's aquatic plant species list recorded in 2025.

Community Category	Scientific Name	Common Name	Status in Wisconsin	Observation Method 2025	Littoral Frequency of Occurrence %
Emergent	<i>Phalaris arundinacea</i>	Reed canary grass	Nonnative	Visual	
Emergent	<i>Pontederia cordata</i>	Pickernelweed	Native	Rake	5.14%
Emergent	<i>Typha</i>	Cattail	Native	Rake	0.79%
Emergent	<i>Zizania</i>	Wild rice	Native	Rake	1.58%
Emergent/Floating Leaf	<i>Sparganium</i>	Bur-reed	Native	Rake	3.16%
Emergent/Floating Leaf	<i>Sparganium angustifolium</i>	Narrow-leaved bur-reed	Native	Rake	0.40%
Emergent/Floating Leaf	<i>Sparganium fluctuans</i>	Floating-leaf bur-reed	Native	Rake	0.79%
Floating Leaf	<i>Brasenia schreberi</i>	Watershield	Native	Rake	0.79%
Floating Leaf	<i>Nuphar variegata</i>	Spatterdock	Native	Rake	1.19%
Floating Leaf	<i>Nymphaea odorata</i>	White water lily	Native	Rake	9.09%
Submergent	<i>Ceratophyllum demersum</i>	Coontail	Native	Rake	14.62%
Submergent	<i>Ceratophyllum echinatum</i>	Spiny hornwort	Native	Rake	2.37%
Submergent	<i>Chara</i>	Muskgrasses	Native	Rake	1.58%
Submergent	<i>Elodea canadensis</i>	Common waterweed	Native	Rake	9.09%
Submergent	<i>Elodea nuttallii</i>	Slender waterweed	Native	Rake	0.40%
Submergent	<i>Heteranthera dubia</i>	Water star-grass	Native	Rake	0.79%
Submergent	<i>Myriophyllum farwellii</i>	Farwell's water-milfoil	Native	Rake	0.40%
Submergent	<i>Myriophyllum sibiricum</i>	Northern water-milfoil	Native	Rake	6.72%
Submergent	<i>Najas gracillima</i>	Northern naiad	Native	Rake	0.79%
Submergent	<i>Nitella</i>	Nitella	Native	Rake	9.09%
Submergent	<i>Potamogeton amplifolius</i>	Large-leaf pondweed	Native	Rake	3.56%
Submergent	<i>Potamogeton friesii</i>	Fries' pondweed	Native	Rake	0.40%
Submergent	<i>tenuissimus</i> (formerly <i>P.</i>	Slender Pondweed	Native	Rake	6.32%
Submergent	<i>Potamogeton richardsonii</i>	Clasping-leaf pondweed	Native	Rake	7.11%
Submergent	<i>Potamogeton robbinsii</i>	Fern pondweed	Native	Rake	14.62%
Submergent	<i>Potamogeton spirillus</i>	Spiral-fruited pondweed	Native	Rake	0.40%
Submergent	<i>Potamogeton vaseyi</i>	Vasey's pondweed	Concern	Rake	1.58%
Submergent	<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	Native	Rake	2.77%
Submergent	<i>Utricularia minor</i>	Small bladderwort	Native	Rake	0.40%
Submergent	<i>Utricularia vulgaris</i>	Common bladderwort	Native	Rake	3.56%
Submergent	<i>Vallisneria americana</i>	Wild celery	Native	Rake	3.16%

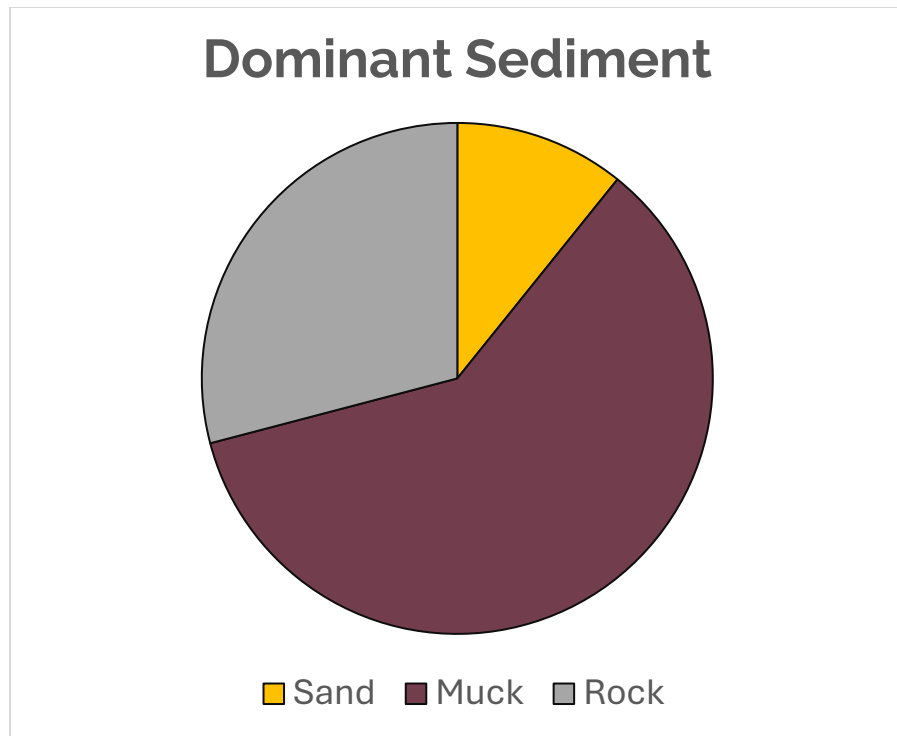


Figure 1. Rock Lake's dominant sediment observed during 2025 survey.

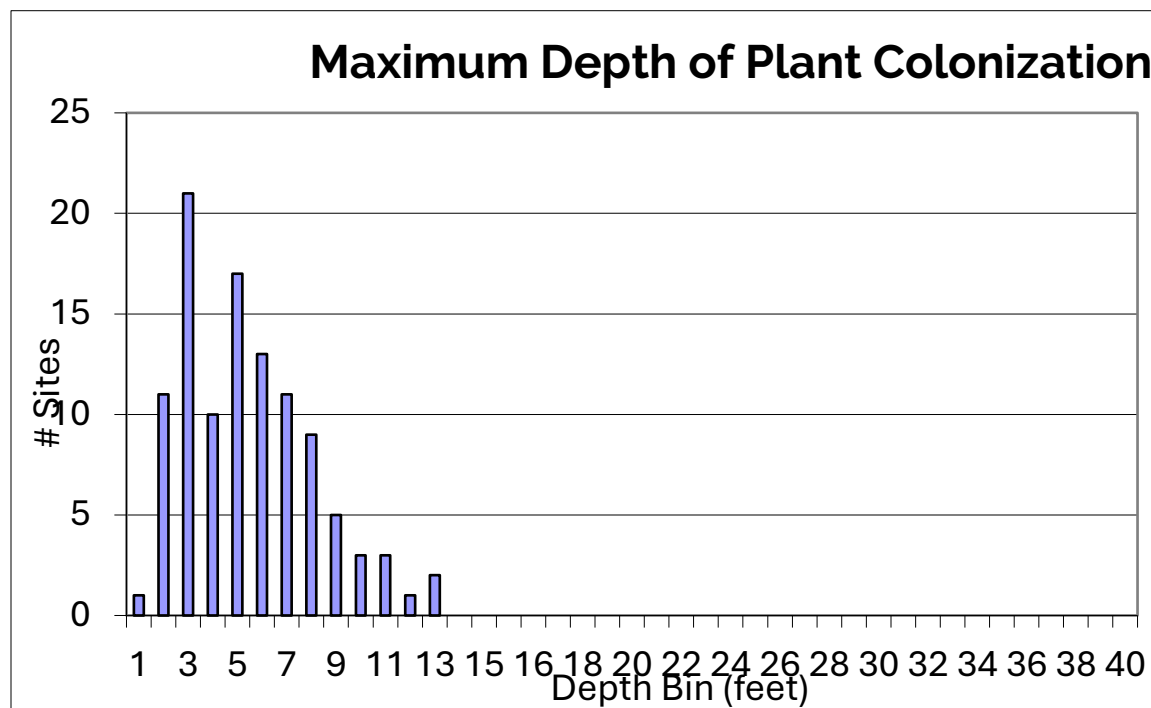


Figure 2. Rock Lake's maximum depth of plant of plant colonization in 2025.

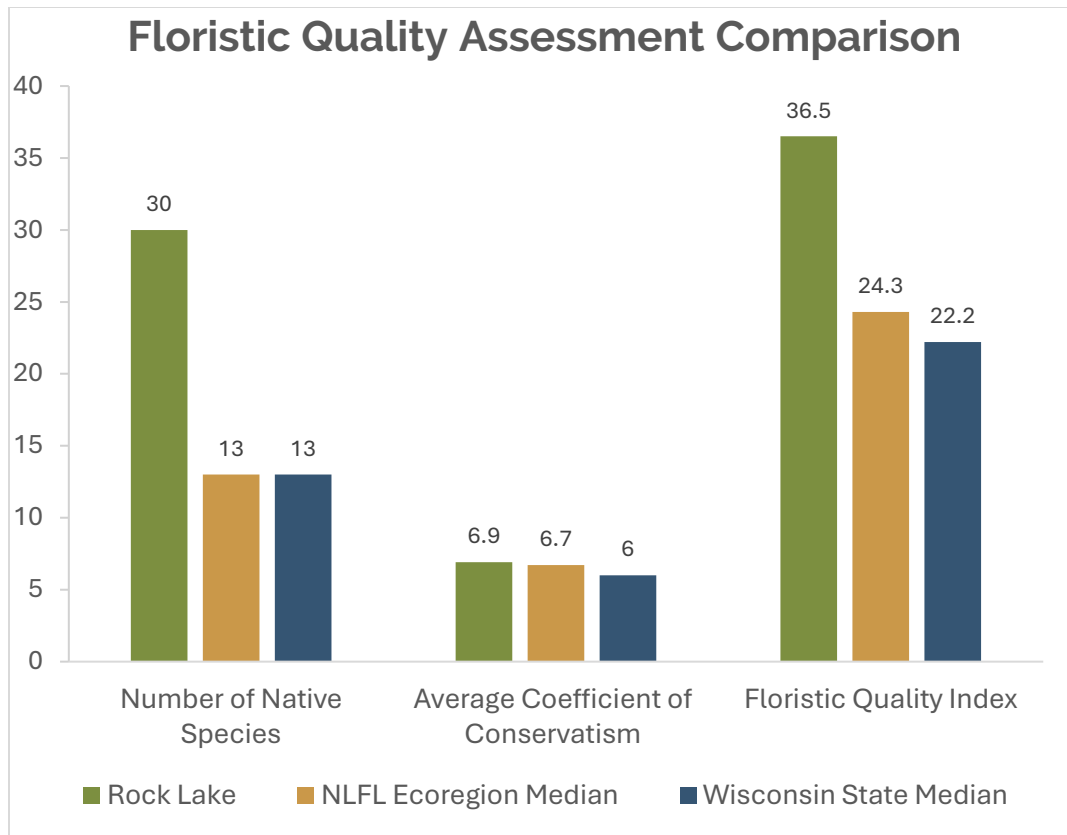


Figure 3. Floristic Quality Assessment and comparison of Rock Lake.

Species Abundance

The five most relatively abundant plants on Rock Lake are fern pondweed (*Potamogeton robbinsii*), coontail (*Ceratophyllum demersum*), nitella (*Nitella p.*), common waterweed (*Elodea canadensis*), and white waterlily (*Nymphaea odorata*) (Figure 4). Fern pondweed had a relative frequency of 13% and its distribution is shown on Map 3. Coontail had a relative frequency of 13% and its distribution is shown on Map 4. Nitella had a relative frequency of 8.1% and its distribution is shown on Map 5. Common waterweed also had a relative frequency of 8.1% and its distribution is shown on Map 6. White water lily also had a relative frequency of 8.1% and its distribution is shown on Map 7.

Fern pondweed (*Potamogeton robbinsii*) is a submerged aquatic plant found primarily in northern and eastern Wisconsin, growing in deeper waters with sandy or silty substrates. Its stiff, dark green-brown leaves are arranged closely in an alternating pattern along the stem, giving it a fern-like appearance. Unlike many pondweeds, it does not produce floating leaves. This species is sensitive to water quality degradation, thriving in unpolluted, low-nutrient environments. Fern pondweed provides habitat and food for a wide range of aquatic organisms, from invertebrates to waterfowl and fish, including northern pike (Borman et al. 1997; Skawinski 2022).

Ceratophyllum demersum commonly known as coontail, is a submergent aquatic plant that is widespread and common throughout Wisconsin's lakes, ponds and other slow moving waters. It is a rootless perennial that floats freely in the water column but is often loosely anchored in soft sediments by modified leaves. The plant has whorled leaves that are usually twice forked and toothed, giving it a bushy, raccoon-tail appearance, and the leaves are typically dark green. Small, inconspicuous flowers are produced in the leaf axils, but reproduction commonly occurs through fragmentation. This species is tolerant of a wide range of environmental conditions, including low light and high nutrient levels. Though it has the capacity to grow in nuisance level densities, it provides important habitat for fish and aquatic invertebrates (Borman et al. 1997; Skawinski 2022).

Various species of nitella, commonly referred to as just nitella or by the common name stoneworts, are submergent macroalgae that resemble higher aquatic plants. Nitella is a nonvascular plant and lacks specialized tissues for transporting water. This plant forms delicate, branched stems with whorled branchlets that are smooth and flexible, lacking both the gritty texture and skunky odor that distinguishes it from muskgrasses (*Chara* species). The structures are typically light to dark green and may form low, carpet-like beds along lake bottoms. Nitella species are most often found in deeper areas of clear, soft-water lakes with sandy or mucky substrates and low nutrient levels. Reproduction occurs through specialized structures called oogonia rather than flowers or seeds. Nitella plays an important ecological role by stabilizing sediments, improving water clarity, and providing habitat for aquatic invertebrates (Borman et al. 1997; Skawinski 2022).

Common waterweed (*Elodea canadensis*) is a submergent perennial species commonly found throughout Wisconsin and most of the United States, growing in waters from shallow ankle-deep areas to several meters deep. In Europe, it is considered an aggressive exotic species and is the target of extensive control efforts. This plant prefers soft, fine sediments rich in organic matter and is often found in mucky shallow or deeper clear waters. Its flat, lance-shaped leaves grow in whorls of three along the stem, are pointed, lack leaf stalks, and often become denser toward the tips of the stems. Tiny white or pink three-petaled flowers appear on long, thread-like stalks that reach the water's surface, though reproduction through fragmentation is more common. Common waterweed often forms dense underwater mats, providing habitat for aquatic invertebrates and helping to stabilize sediment (Borman et al. 1997; Skawinski 2022).

White water lily (*Nymphaea odorata*) is a common floating aquatic plant found throughout Wisconsin and much of the United States, typically rooted in soft, mucky sediments. Its large, green to purple leaves float on the water's surface and feature a narrow notch from the edge to near the center, with leaves reaching up to 30 cm in diameter. The red-colored stems can grow in waters up to 2.5 meters deep. During the summer, white flowers with yellow centers emerge individually on the surface. White water lilies reproduce both sexually through seeds and vegetatively via rhizomes. This species often forms dense mats that provide habitat for aquatic organisms, while seeds serve as forage for waterfowl, and rhizomes are consumed by muskrats, beavers, deer, and porcupines (Borman et al. 1997; Skawinski 2022).

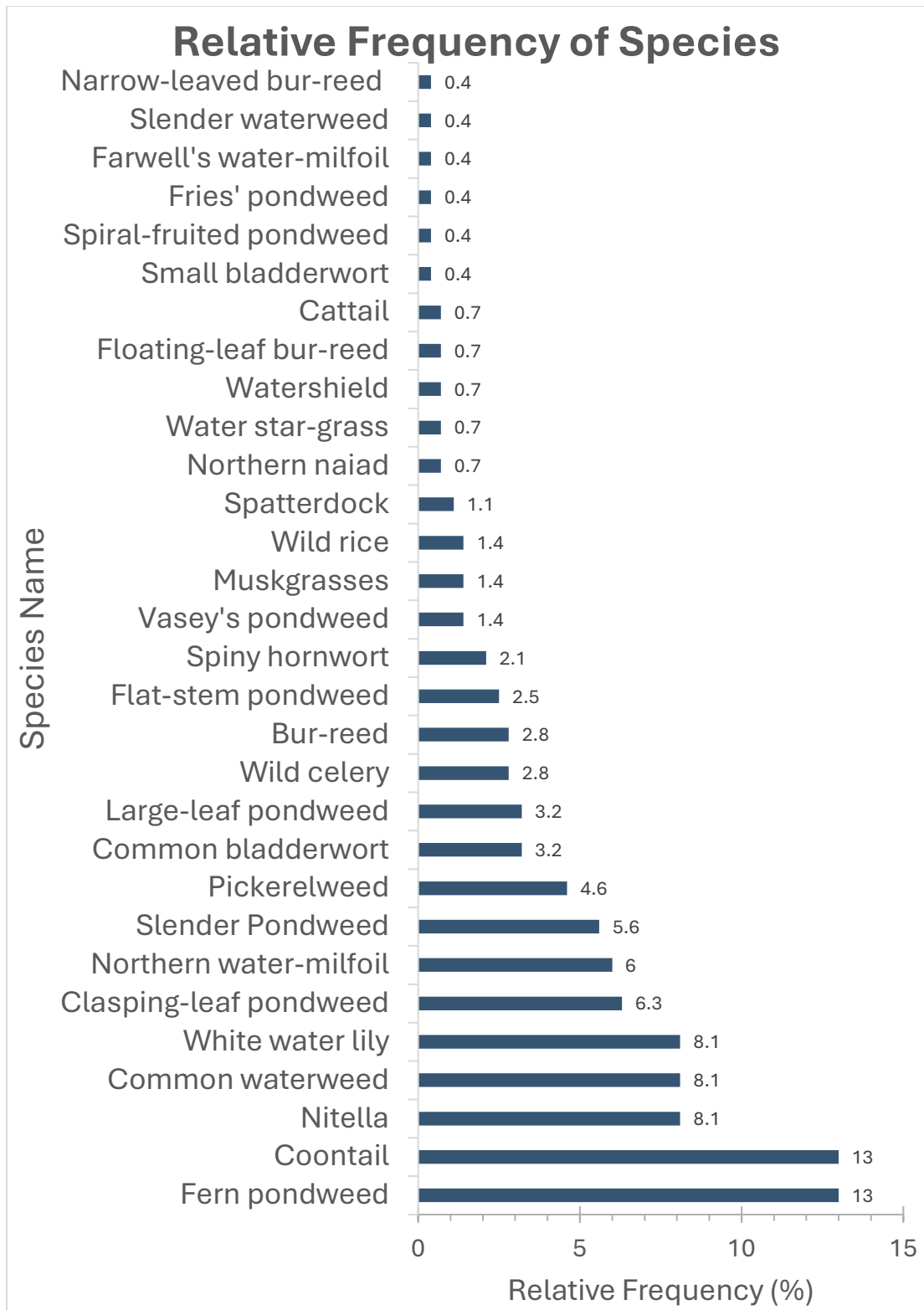


Figure 4. Rock Lake's relative frequency of occurrence of aquatic plant species collected during the 2025 point-intercept survey.

CONCLUSION

The aquatic vegetation surveys conducted on Rock Lake in the summer of 2025 provide a comprehensive understanding of the plant communities inhabiting this water body. Rock Lake exhibited strong species richness and diversity, with a total of 31 aquatic plant, moss, and algae species documented through rake sampling and visual observations. These figures surpass both the regional and statewide median values for species richness and diversity, reflecting the high ecological quality and relative health of the lake's aquatic plant community.

Analysis of the data collected from the point-intercept survey indicates that Rock Lake contains a healthy and well-balanced aquatic plant community. No aquatic invasive species were detected during the survey. Rock Lake's Floristic Quality Index (FQI) value of 36.47 is well above the statewide median of 22.2 and the Northern Lakes and Forests Ecoregion median of 24.3. Additionally, Rock Lake has a mean coefficient of conservatism (C) value of 6.89 out of 10, which exceeds both state and regional medians. These values indicate high floristic integrity and a plant community that is less sensitive to disturbance and changes in vegetation distribution. The high Simpson's Diversity Index of 0.93 further supports the conclusion that Rock Lake supports a diverse and resilient assemblage of aquatic vegetation. It is important to note that Floristic Quality Index values can be influenced by lake size and habitat heterogeneity (Bernthal 2003).

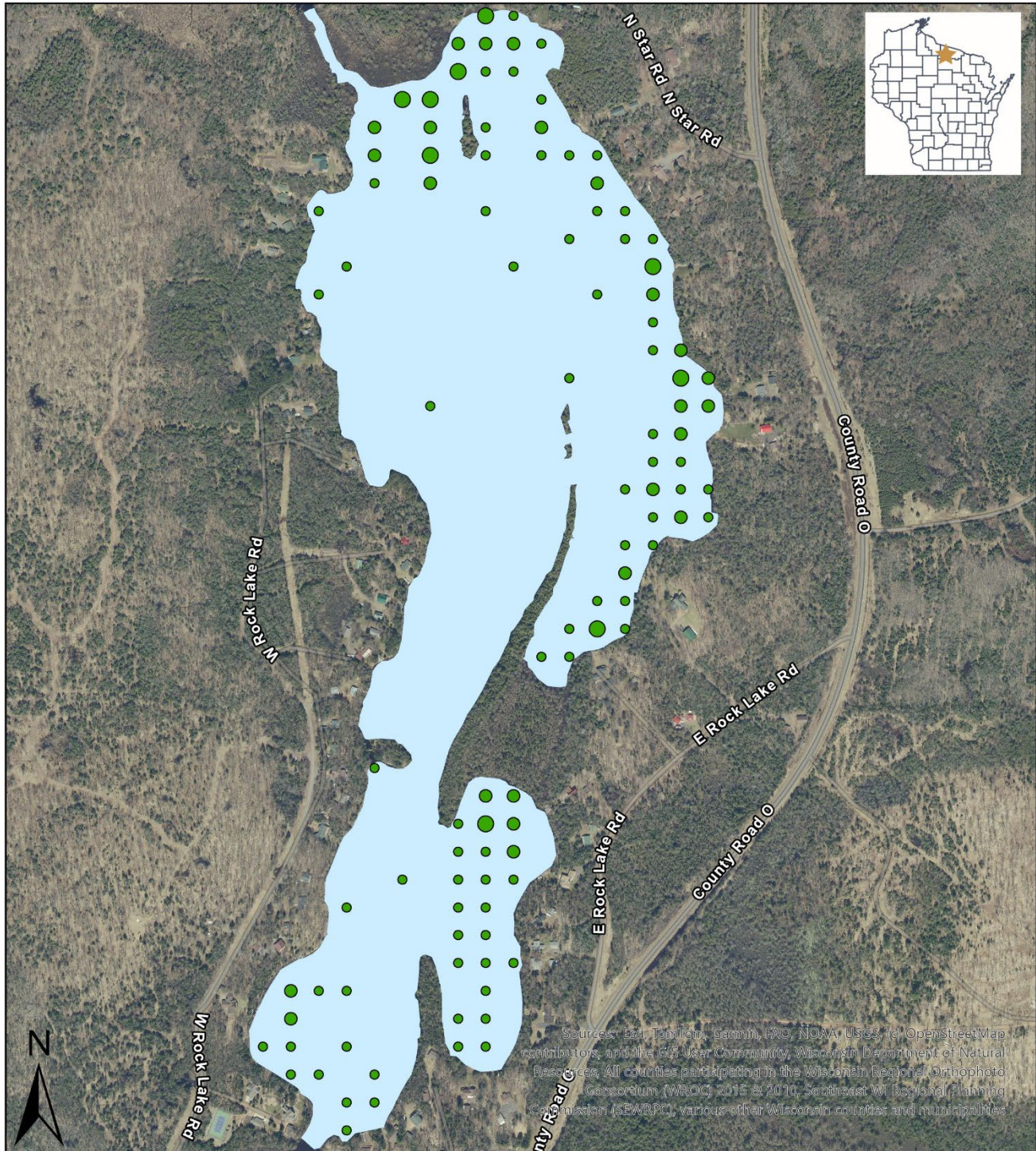
Ultimately, these surveys not only fulfill their role in documenting species presence and abundance but also support Rock Lake's broader goals of preserving water quality, biodiversity, and overall ecological integrity. Continued monitoring using standardized point-intercept methods will be essential for tracking long-term changes in the aquatic plant community, detecting invasive species early, and informing effective lake stewardship and management decisions moving forward.

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Map 1. Rock Lake's total rake fullness

Rock Lake Point Intercept Survey Rake Fullness



0 0.15 0.3 Miles

Town of Winchester
Vilas County, Wisconsin
2025

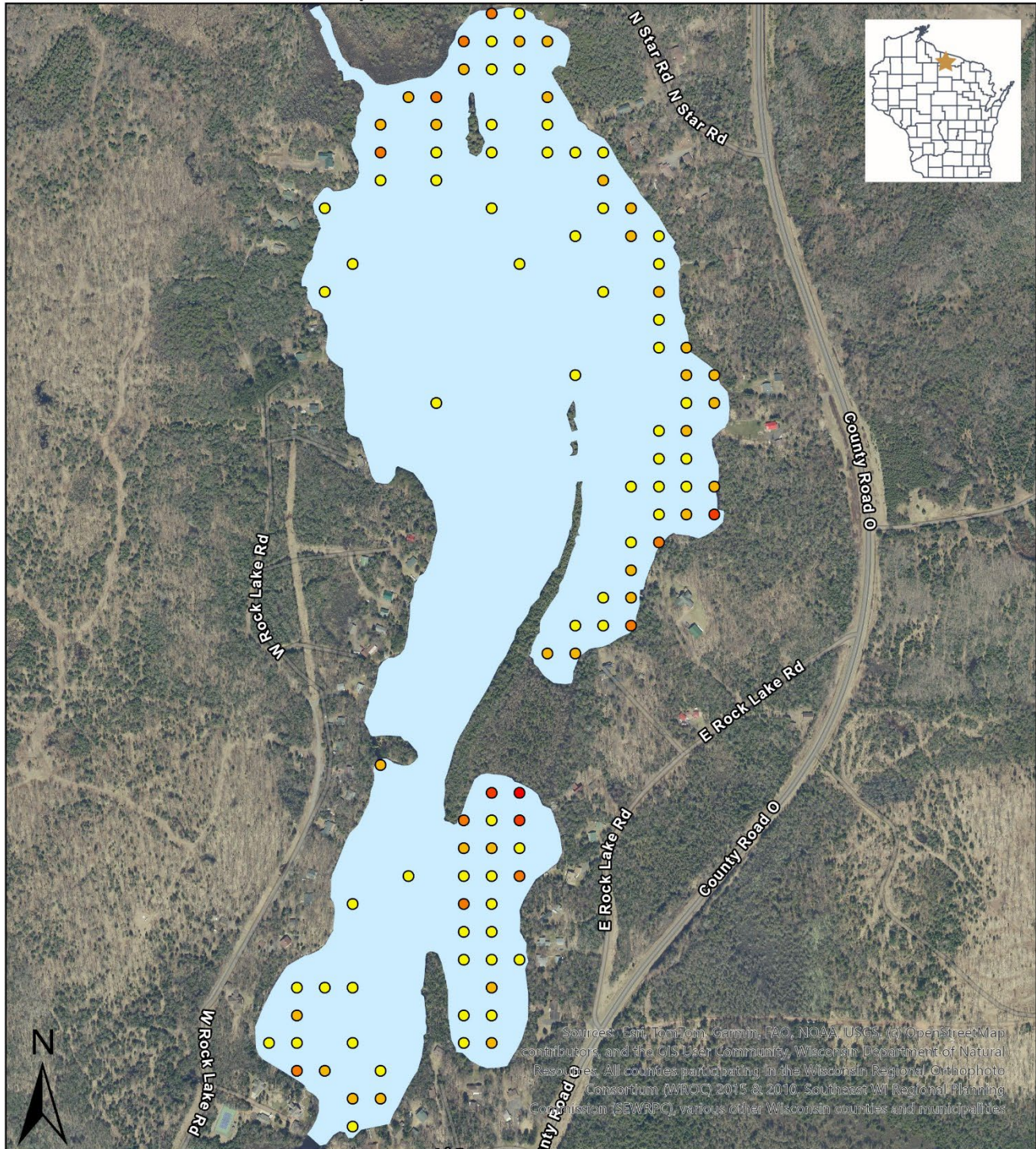


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Map 2. Rock Lake's species richness at each point

Rock Lake Point Intercept Survey Species Richness



0 0.15 0.3 Miles

Town of Winchester
Vilas County, Wisconsin
2025

Legend Species Richness

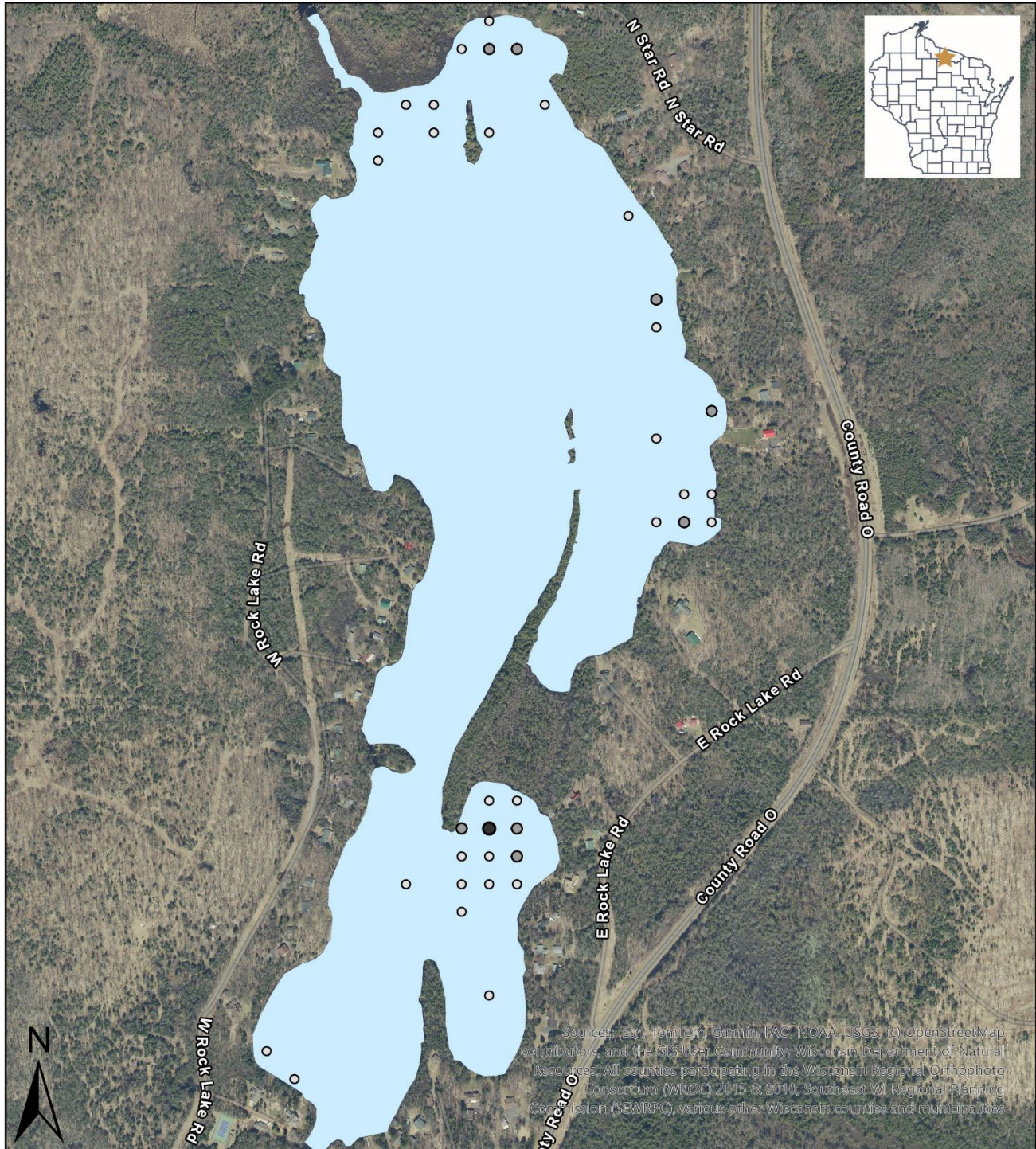
1-2 3-4 5-7 8-9 10-12

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Map 3. Rock Lake's distribution of fern pondweed

Rock Lake Point Intercept Survey Distribution of Fern Pondweed



0 0.15 0.3 Miles

Town of Winchester
Vilas County, Wisconsin
2025

Legend

Potamogeton robbinsii

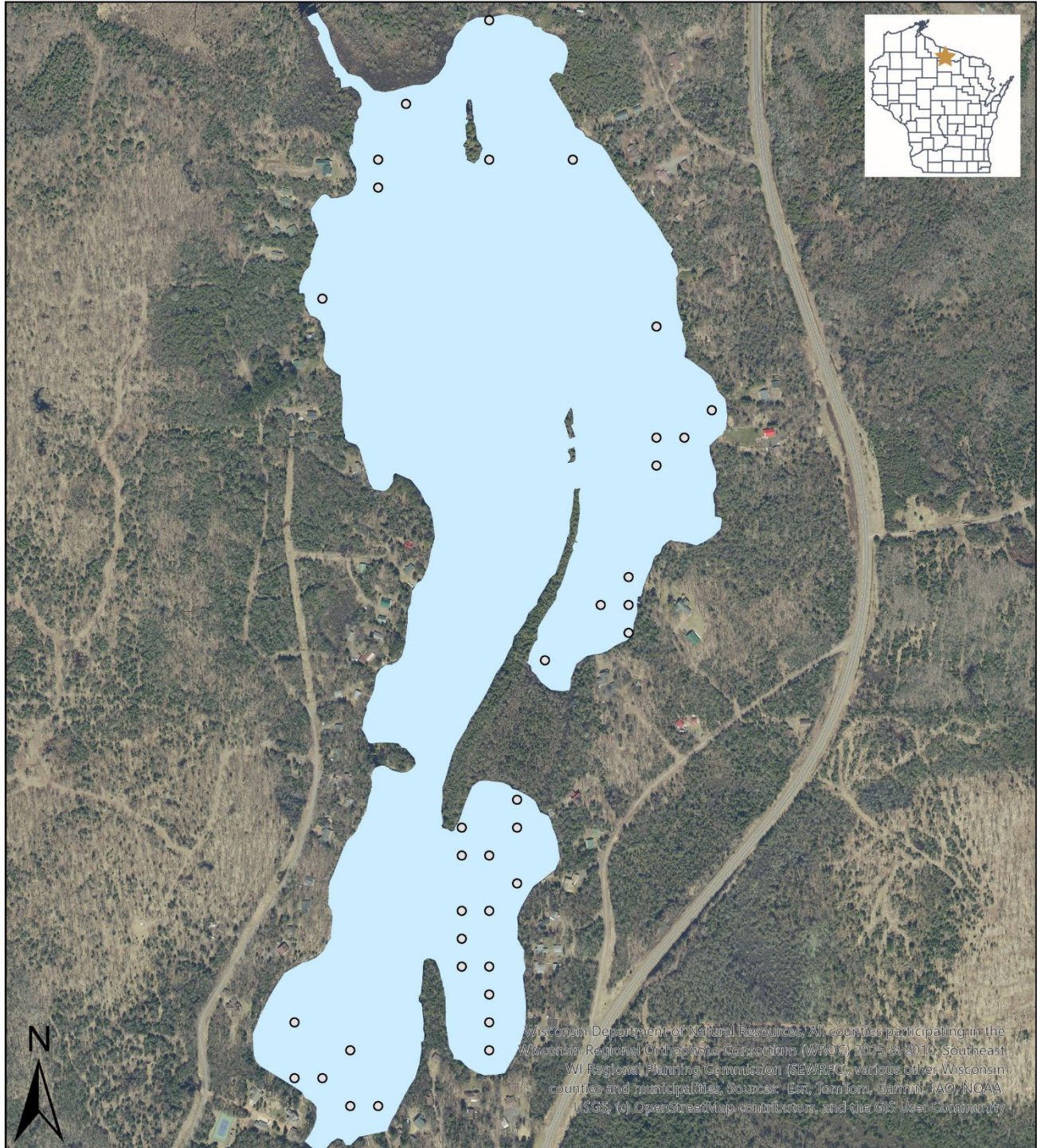
- 1 rake fullness
- ◐ 2 rake fullness
- 3 rake fullness



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Map 4. Rock Lake's distribution of coontail

Rock Lake Point Intercept Survey Distribution of Coontail



0 0.15 0.3 Miles

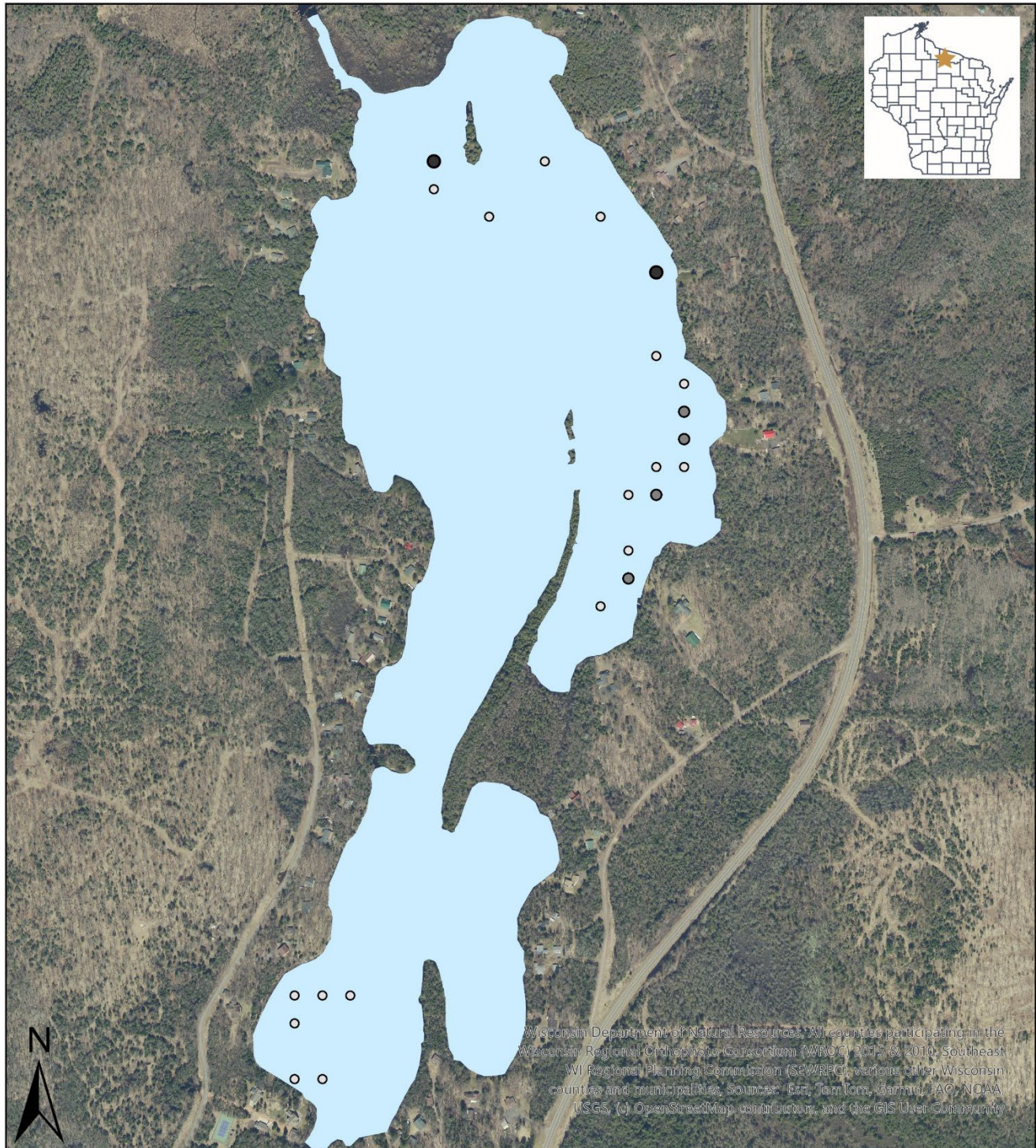
Town of Winchester
Vilas County, Wisconsin
2025

Legend
*Ceratophyllum
demersum*
○ 1 rake fullness

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Map 5. Rock Lake's distribution of nitella

Rock Lake Point Intercept Survey Distribution of Nitella



0 0.15 0.3 Miles

Town of Winchester
Vilas County, Wisconsin
2025

Legend

Nitella sp

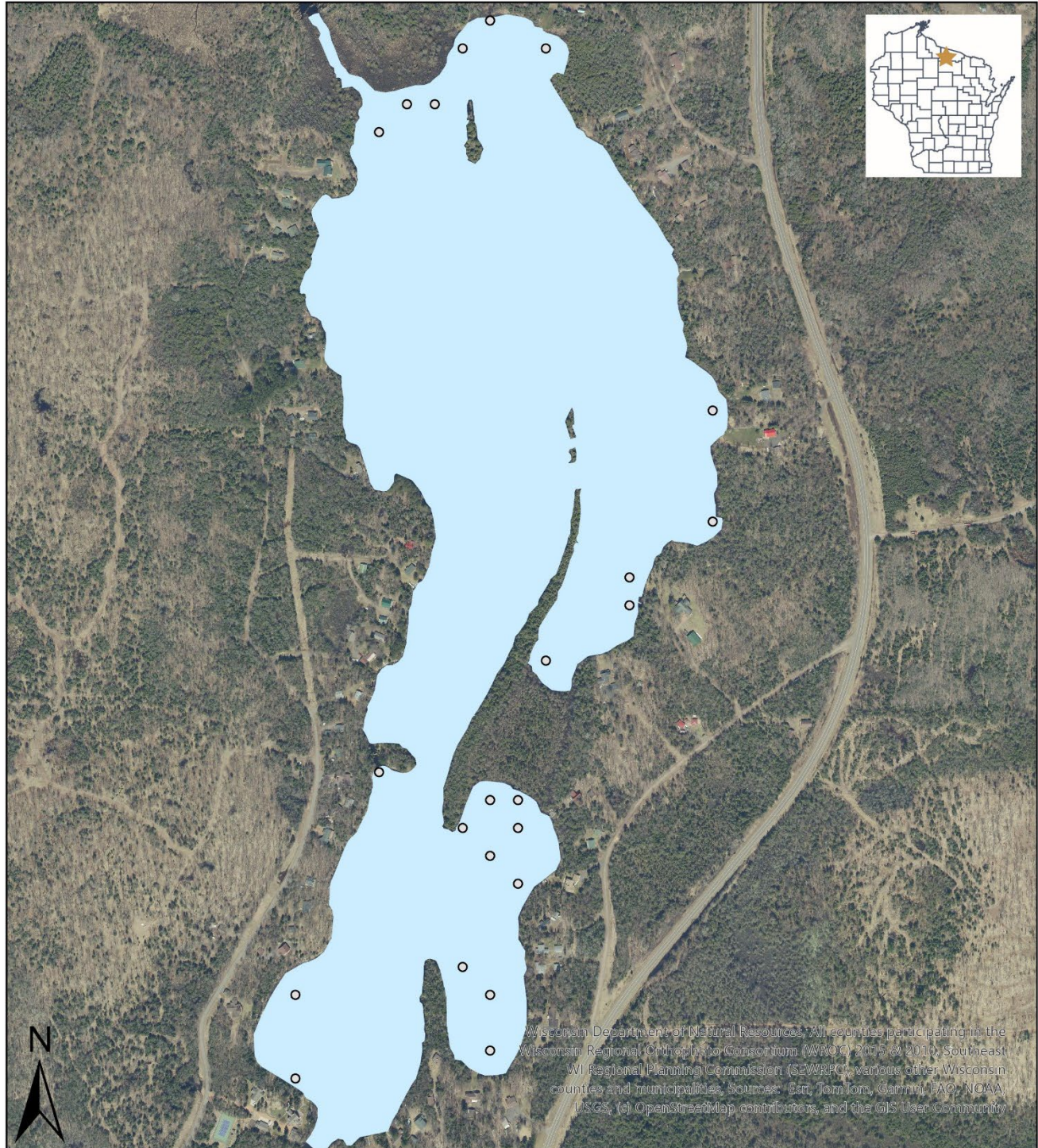
- 1 rake fullness
- 2 rake fullness
- 3 rake fullness



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Map 6. Rock Lake's distribution of common waterweed

Rock Lake Point Intercept Survey Distribution of Common Waterweed



0 0.15 0.3 Miles

Town of Winchester
Vilas County, Wisconsin
2025

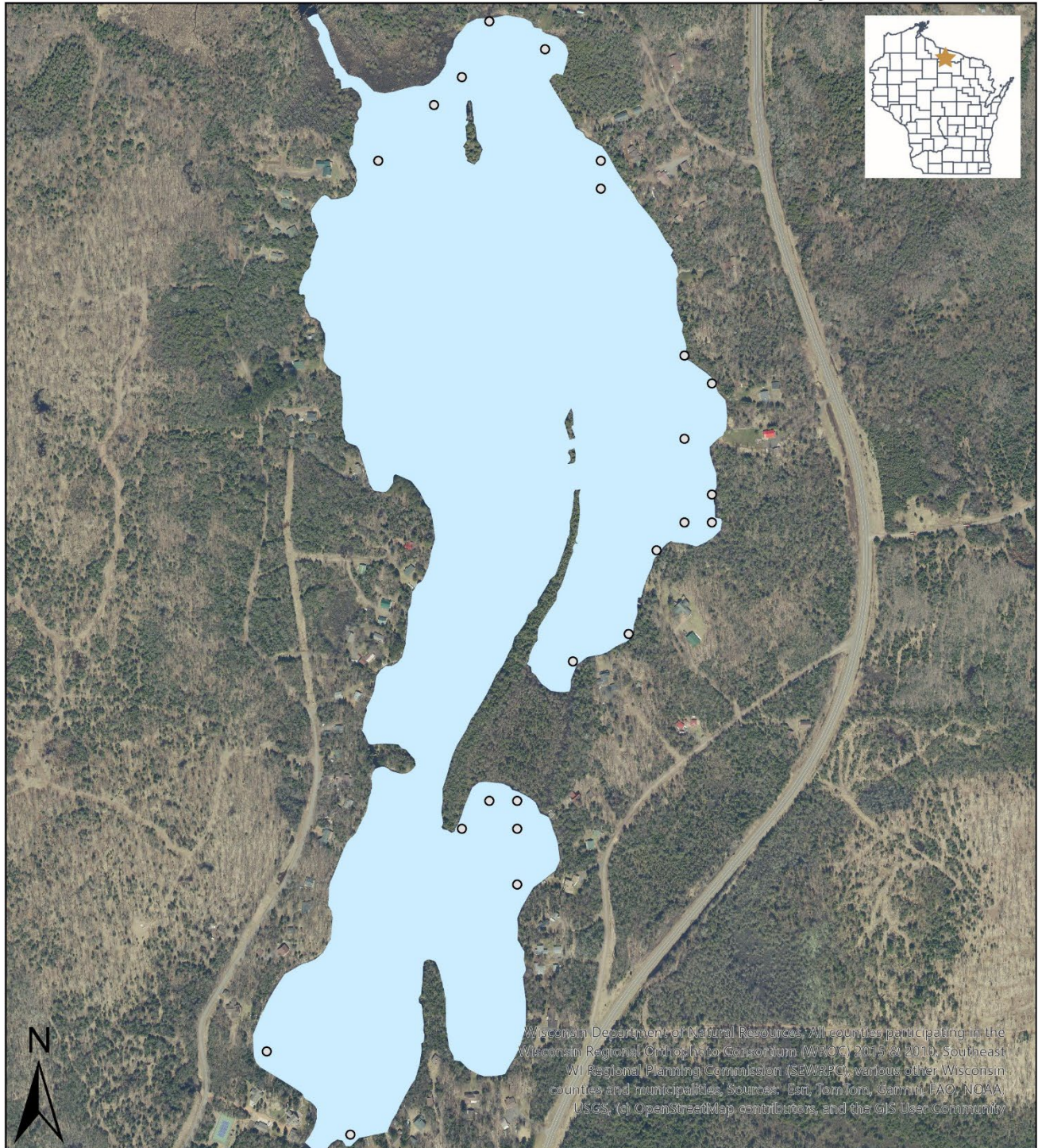
Legend
Elodea canadensis
◦ 1 rake fullness

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Map 7. Rock Lake's distribution of white water lily

Rock Lake Point Intercept Survey Distribution of White Water Lily



0 0.15 0.3 Miles

Town of Winchester
Vilas County, Wisconsin
2025

Legend
Nymphaea odorata
○ 1 rake fullness

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