

# Oconto County Lakes Project

## BOULDER LAKE STUDY

### SUMMARY REPORT

2023

#### Oconto County Lakes Project Reports:

**State of the  
Oconto County  
Lakes**

Lake Study  
Summary  
Reports

**Operational Strategy and  
Plan for Surface Water  
Management and  
Protection**

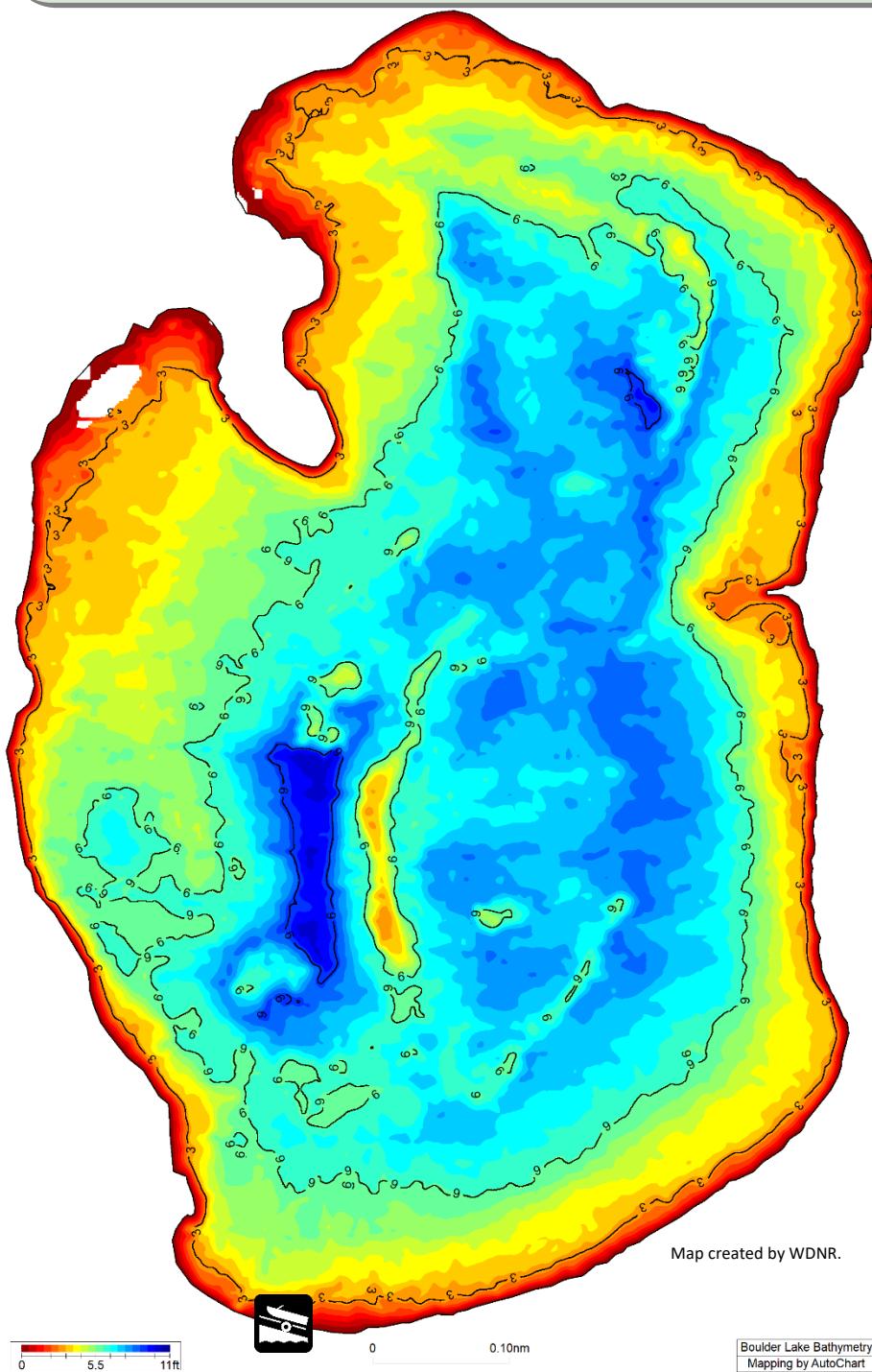
Lake  
Management  
Plans



Center for Watershed Science and Education  
College of Natural Resources  
University of Wisconsin-Stevens Point

# Background

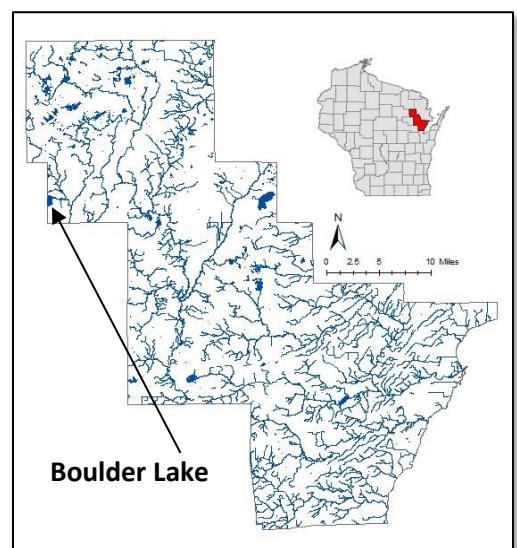
- Boulder Lake is a 370-acre spring lake in western Oconto County with a maximum depth of 11 feet.
- Most water enters Boulder Lake via groundwater and leaves via a small tributary stream on the east side leading to the South Branch Oconto River. Surface water runoff and direct precipitation also contribute water.
- Visitors have access to the lake from one public boat launch located on the lake's south side.
- This report summarizes data collected during the 2021-2022 lake study.



**Township of Doty**

**Surface Area: 370 acres**

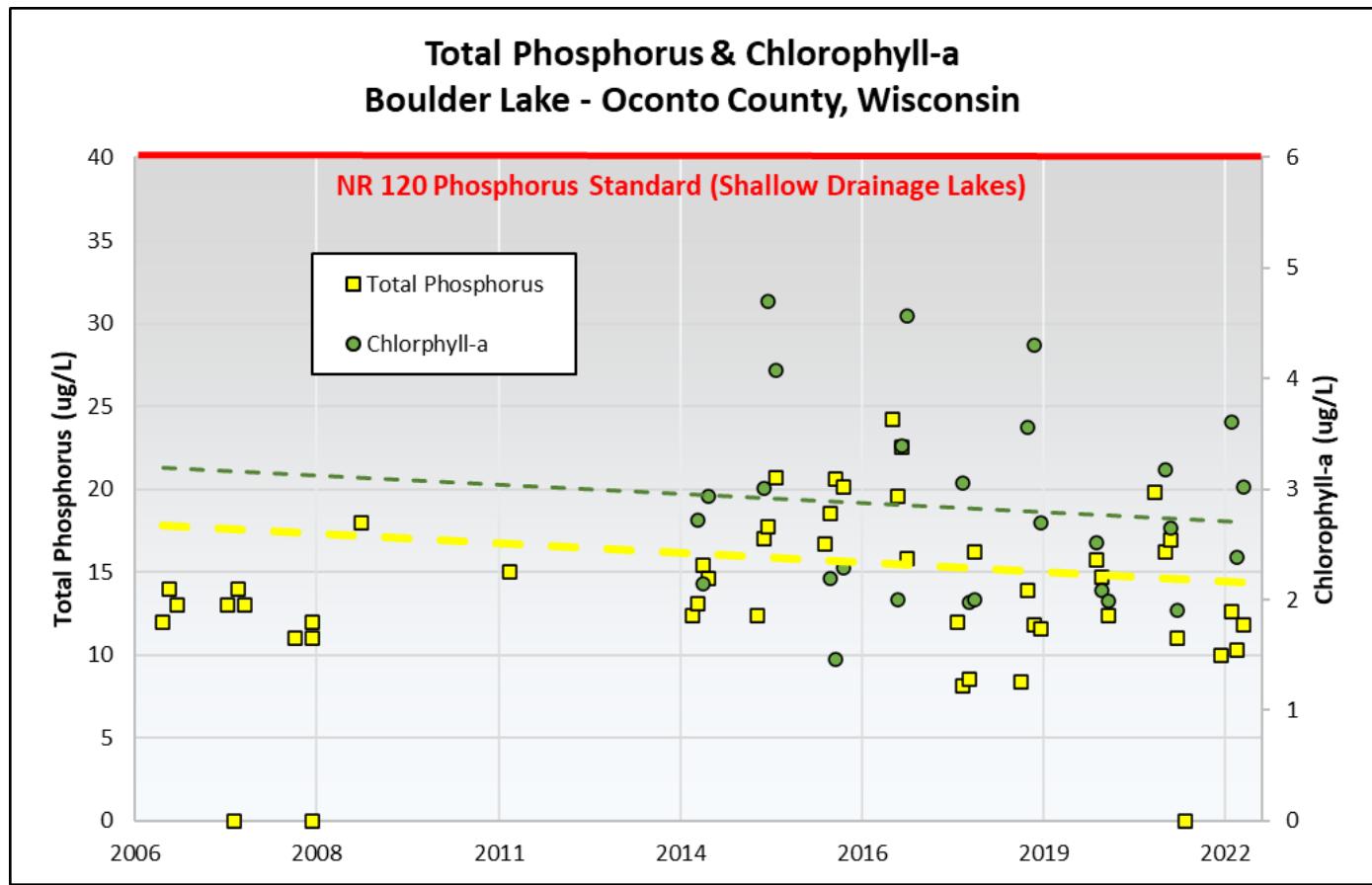
**Maximum Depth: 11 feet**



# Water Quality

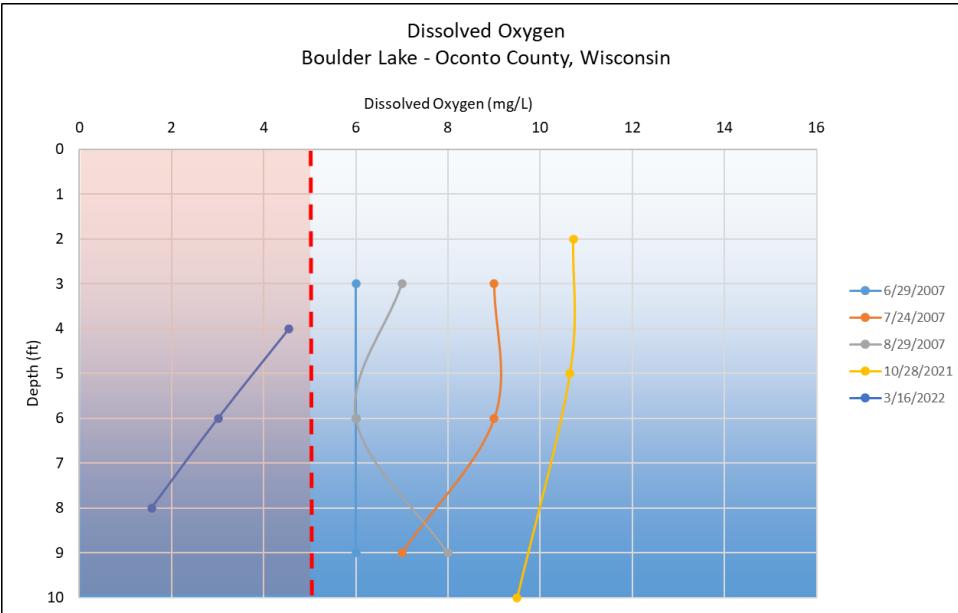
**Nutrients** such as phosphorus and nitrogen are what feed aquatic plants and algae in a lake. Excessive amounts of nutrients delivered to a lake will result in abundant plant and algae growth. Disturbance within a watershed combined with the landscape's inability to infiltrate and filter runoff is what primarily delivers nutrients to a lake.

- Total Phosphorus was consistently below the Wisconsin state standard of 40 ug/L for shallow drainage lakes during the two-year study. The long-term trend suggests slowly decreasing average concentrations.
- Inorganic nitrogen remained below the threshold of 0.3 mg/L when algal blooms increase.
- Chlorophyll-a, an indirect measure of algae, remained below the threshold of 6 ug/L throughout the study.



# Water Quality

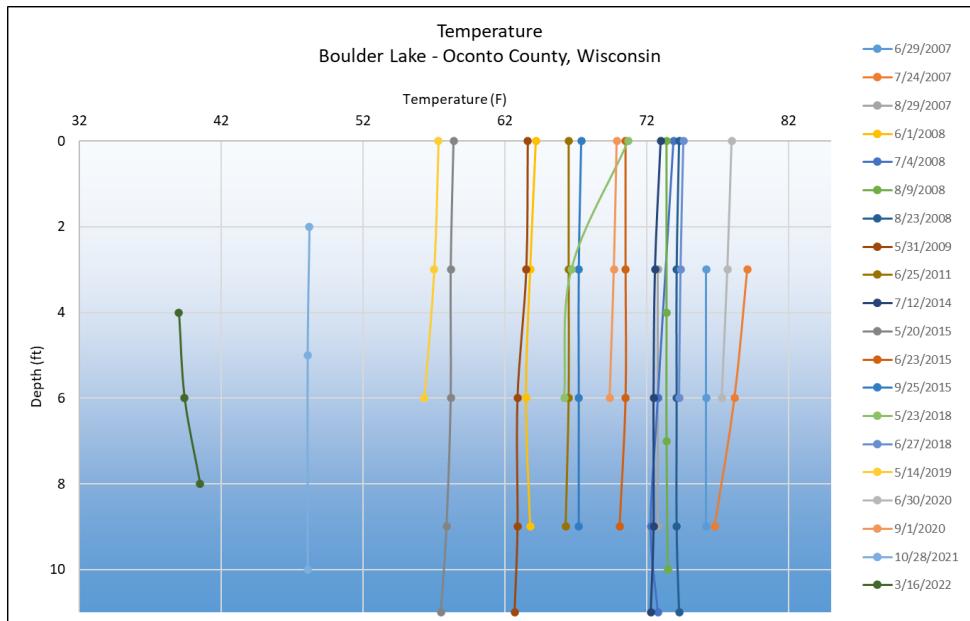
Sufficient **dissolved oxygen** in lake water is essential to the survival of aquatic organisms. The amount of dissolved oxygen present within a lake varies by season and depth. It is determined by the biological activity that consumes or produces oxygen, by water mixing through wind, changes in temperature, and inputs of surface and groundwater. Generally, at least 5 mg/L oxygen is required for fish.



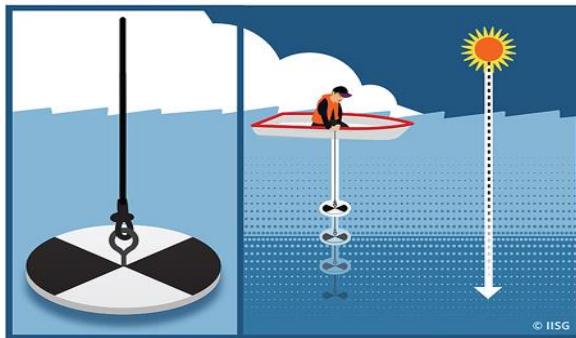
➤ Sufficient oxygen is available in the water column of Boulder Lake through most of the year but may become anoxic in late winter. Generally, the top 4 feet maintains enough oxygen to support most fish species.

Lake water **temperature** has a significant impact on water chemistry, spatial distribution of fish, microbial growth and oxygen content.

- Temperature profiles in Boulder Lake are typical of a shallow, mixed lake with similar water temperatures from surface to bottom at each sampling event.

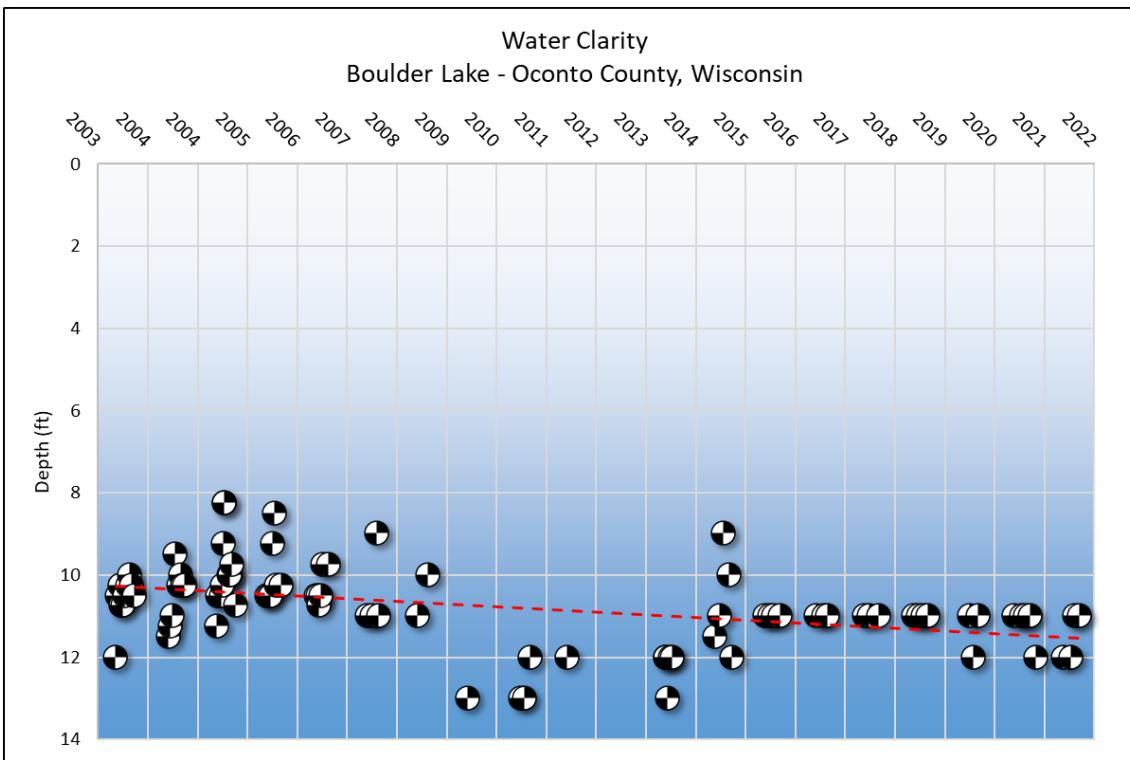
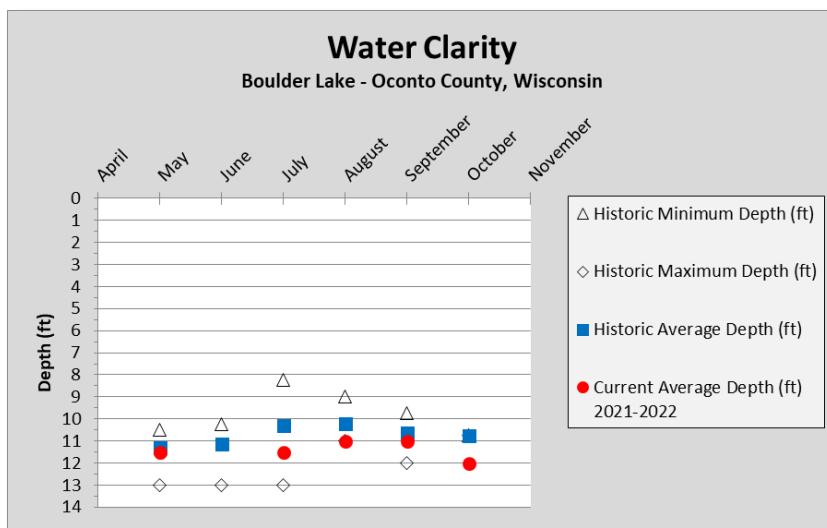


# Water Quality



**Water clarity** is a measure of how deep light can penetrate (Secchi depth). Clarity is affected by water color, turbidity (suspended sediment), and algae. Water clarity helps determine where rooted aquatic plants can grow. It is typical for water clarity to vary throughout the year.

- The graphs below show water clarity measurements taken between May and November.
- During 2021-22, the poorest average water clarity was in August and best was in October. Comparison to previous data suggests a trend of slightly increasing water clarity.



# Water Quality

**Other chemistry** data was collected from lake water samples, such as basic cations, pollutants and acid rain input, and physical parameters. Results of such analyses can provide insights into a variety of other potential impacts to the lake. While concentrations of these compounds in lake water is usually low, higher concentrations can be indicators of other potential issues.

- Concentrations of potassium (1.47 mg/L), chloride (0 mg/L) and sodium (1.76 mg/L) were all low. This suggests minimal impact from septic systems, road salt, animal waste and fertilizers.
- DACT, a screening tool to determine if your lake is being impacted by pesticides, was not detected.
- Water in Boulder Lake is hard (138 mg/L CaCO<sub>3</sub>), having an elevated level of dissolved minerals. These minerals tend to bind with phosphorus making it unavailable to algae blooms.

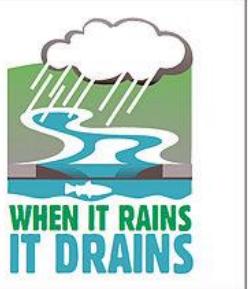
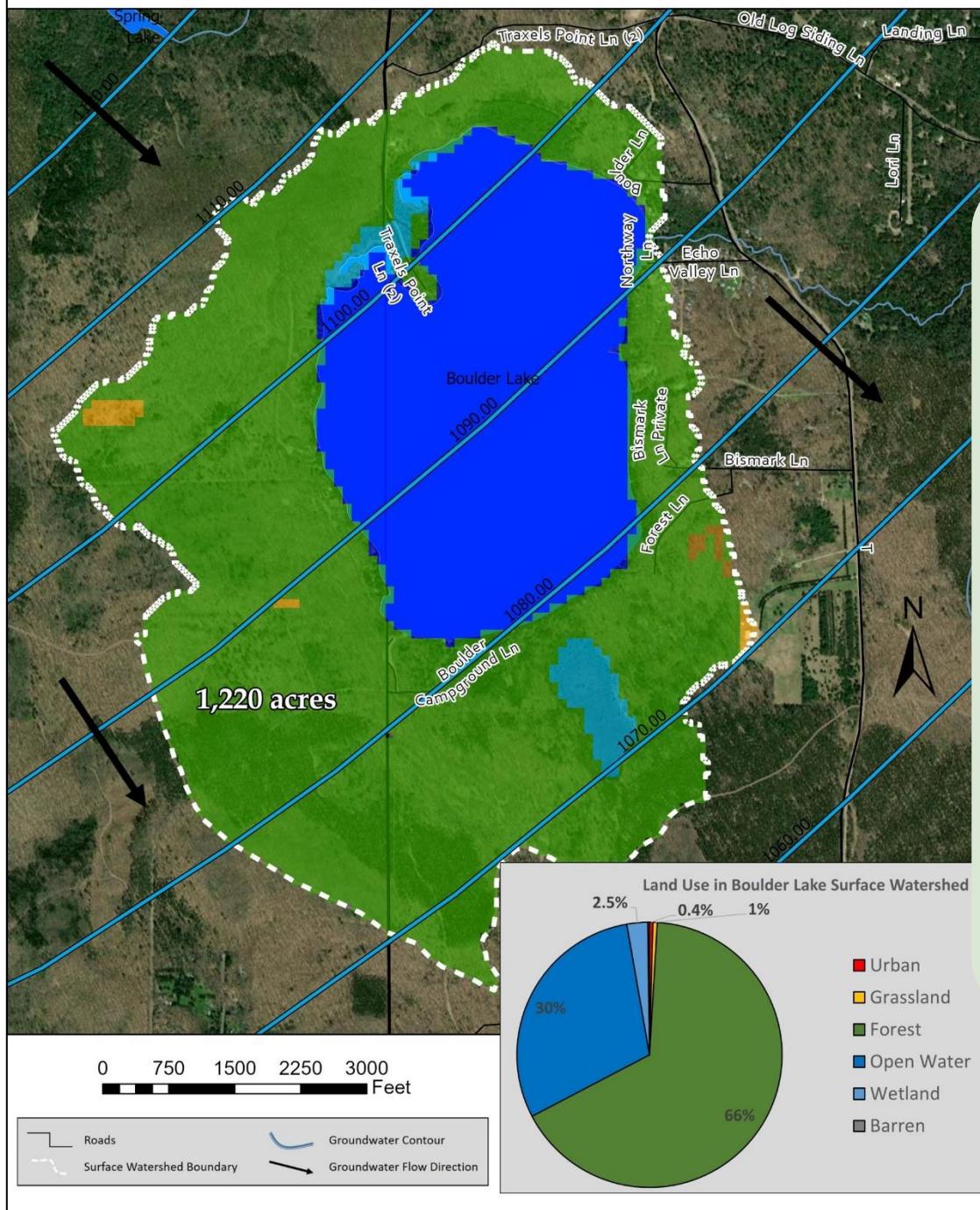


*For more information on how to interpret  
your lake's water quality data, please refer to  
the "State of the Oconto County Lakes  
Report" that is on file with Oconto County.*

# Watershed

**Groundwater** provides water to lakes in Oconto County throughout the entire year. Hard surfaces on the landscape prevent water from soaking into the ground and becoming groundwater. This results in less water flowing to the lake during snowmelt and rain events. Water that does not infiltrate to groundwater becomes **surface runoff** flowing across the surface of the landscape where it can move sediment and contaminants to the lake from within its watershed.

## Boulder Lake Surface Watershed & Groundwater Flow



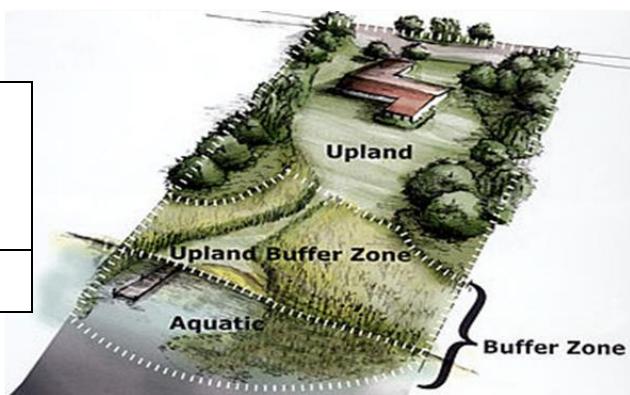
The quality of lake water reflects what is happening on the land surface. Precipitation falling on forests produces clean groundwater, whereas precipitation falling on land that has chemical use can produce runoff and groundwater that contains these chemicals. Groundwater contamination may include nitrogen, pesticides, herbicides and other soluble chemicals originating from septic systems, crops, barnyards, and road de-icing. Once in the groundwater, these chemicals move slowly towards a lake or river.

# Shorelands

**Shoreland vegetation** is critical to a healthy lake's ecosystem. It provides habitat for many aquatic and terrestrial animals including birds, frogs, turtles, and many small and large mammals. It also helps to improve the quality and quantity of the runoff that flows across the landscape towards the lake. Healthy shoreland vegetation includes a mix of tall, native grasses/flowers, shrubs and trees.

- Shorelands around Boulder Lake were surveyed in August 2021. Many shoreland areas are healthy, but some stretches are in need of restoration.

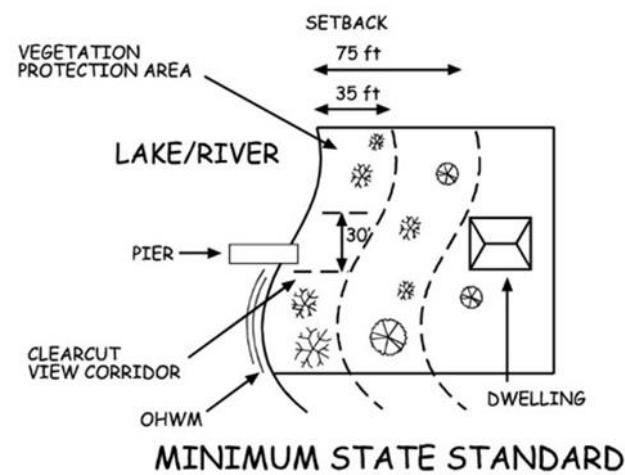
Total lakefront footage (feet)	No. Riparian lots	Measured shoreland disturbance (feet)	Measured shoreland disturbance (%)
18,291	73	4,961	27%



## State Shoreland Zoning Ordinance NR 115 Wisc. Adm. Code for Unincorporated Municipalities

No vegetation within 35 feet of the lake's edge shall be removed except for:

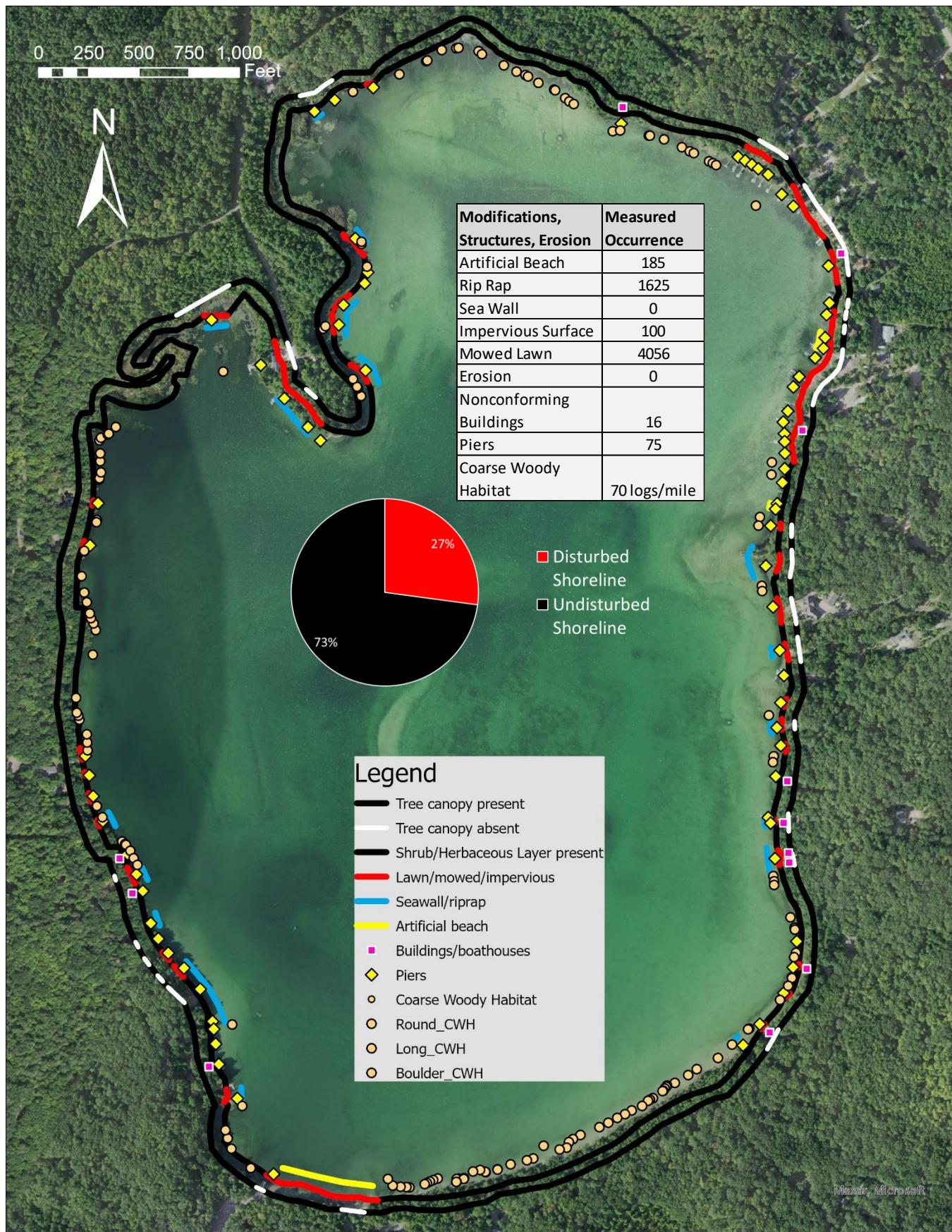
- Up to 30% of shoreline may be removed of shrubs and trees for a view corridor
- A mowed or constructed pedestrian path up to 5 feet wide to access lake



## What Can You Do To Help Boulder Lake?

- ✓ Leave natural shoreland vegetation in place or restore if it has been removed.
- ✓ Learn to identify and look for invasive plants and animals and know who to contact if found.
- ✓ Do not purchase prohibited and restricted species. Purchase native plants when possible.
- ✓ Never transplant water garden or aquarium plants into lakes, streams or wetlands. Properly dispose of them.
- ✓ Remove invasive exotic plants from your landscape and replace them with native plants or non-invasive exotics. Scout regularly for new invasive plants.
- ✓ Avoid using garden plants from other regions whose invasive potential is poorly understood.

# Shorelands

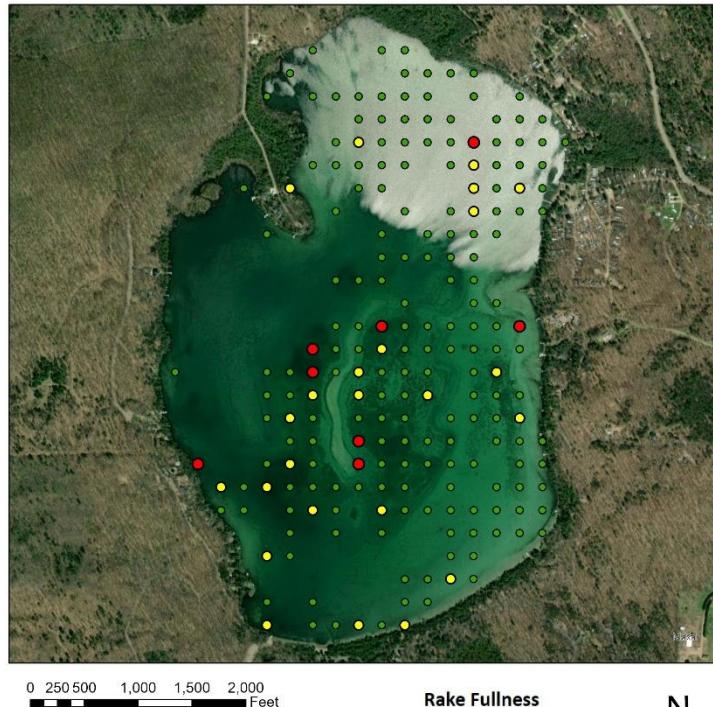


# Aquatic Plants

**Aquatic plants** are the forest landscape within a lake. They provide food and habitat for terrestrial and aquatic creatures such as fish, ducks, turtles, invertebrates and other animals. They increase oxygen levels in the water and utilize nutrients that would otherwise be used by algae. A healthy lake typically has a variety of aquatic plant species creating diversity that can help to prevent the establishment of aquatic invasive species.

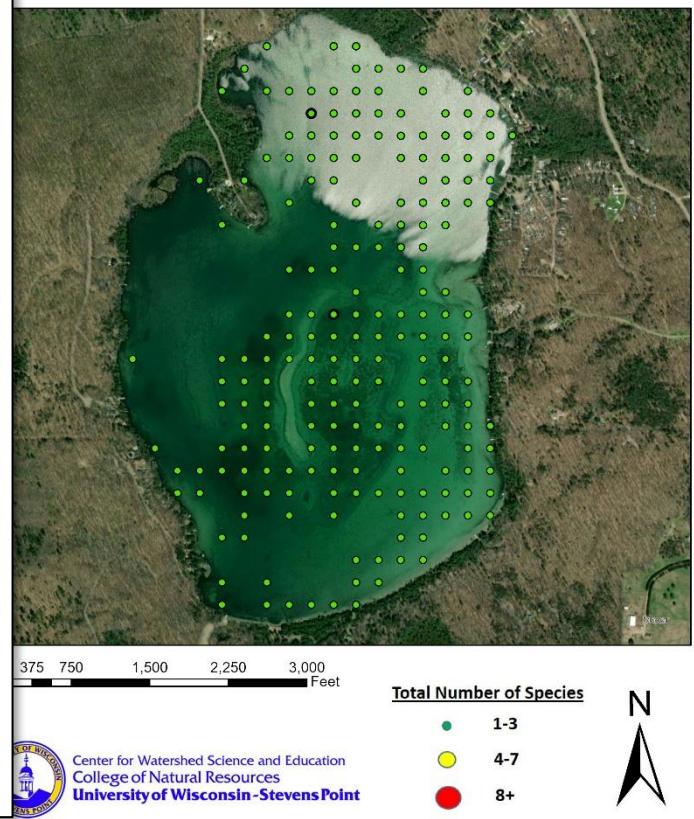
- The aquatic plant community in Boulder Lake is characterized by below average diversity of plant species when compared to other lakes in the Oconto County Lakes Project, with a total of 14 species in the 2021 survey.
- During the 2021 aquatic plant survey of Boulder Lake, 58% of visited sites had vegetative growth. The maximum depth of vegetation was 11 feet and the Floristic Quality Assessment (FQI) was 21.2.
- The most frequently encountered plant species were chara (91%), Illinois pondweed (20%), and variable pondweed (16%).
- Eurasian water-milfoil, an invasive species in Wisconsin, was observed at one location.

Boulder Lake Aquatic Plant Survey 2021:  
Rake Fullness



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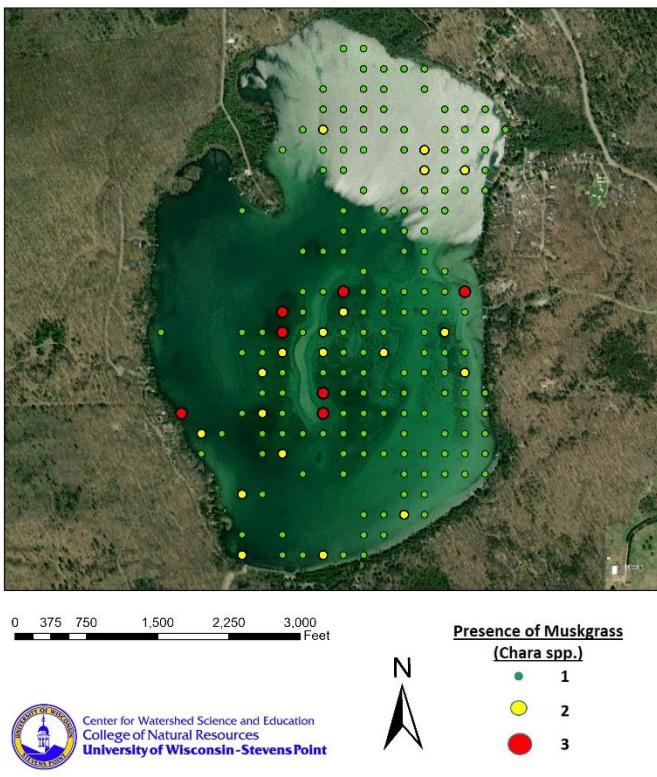
Boulder Lake Aquatic Plant Survey 2021:  
Total Number of Species



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# Aquatic Plants

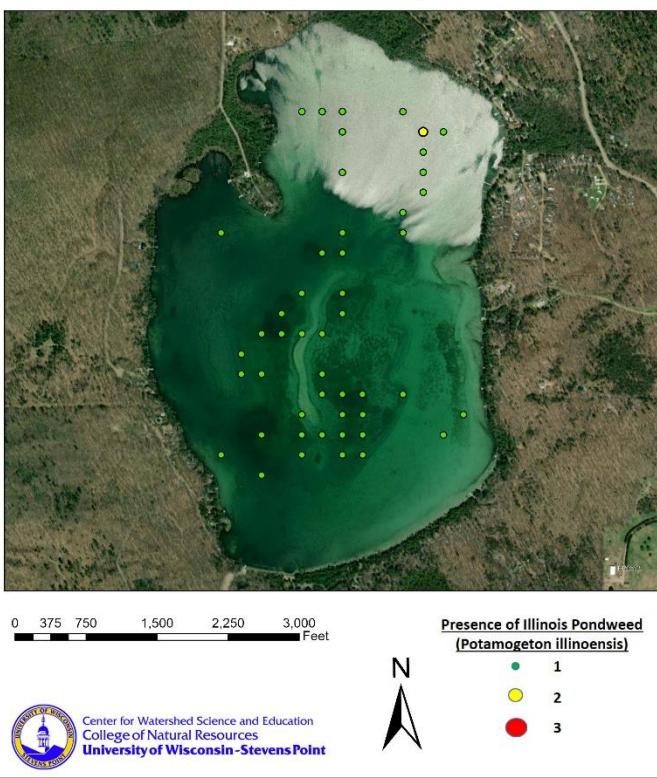
## Boulder Lake Aquatic Plant Survey 2021: Muskgrass (Chara spp.)



**Chara** is a type of macro algae that grows attached to muddy lake bottoms and has a musky odor. Muskgrass, as it is known, filters the lake water and is helpful in preventing the establishment of invasive species.



## Boulder Lake Aquatic Plant Survey 2021: Illinois pondweed (Potamogeton illinoensis)

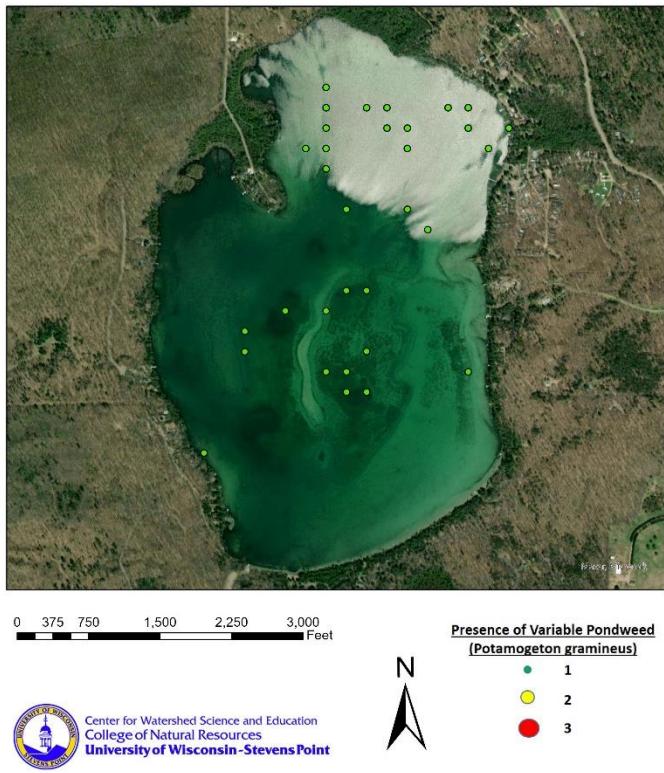


**Illinois pondweed** is important forage and cover for aquatic animals and an important food source for waterfowl.



# Aquatic Plants

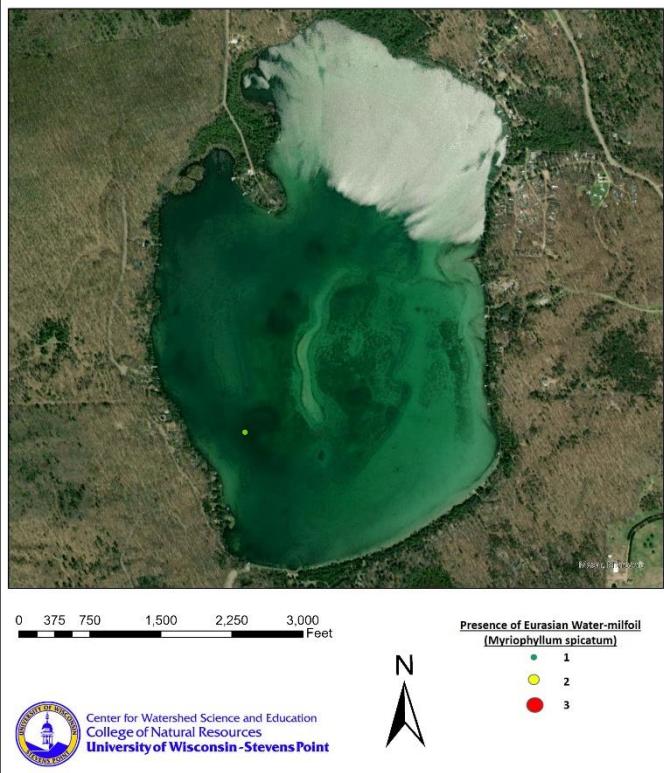
## Boulder Lake Aquatic Plant Survey 2021: Variable pondweed (*Potamogeton gramineus*)



**Variable pondweed** has both floating and submersed leaves which provide food and habitat for fish.



## Boulder Lake Aquatic Plant Survey 2021: Eurasian Water-milfoil (*Myriophyllum spicatum*)



**Eurasian watermilfoil** is one of the most common invasive aquatic plants in Wisconsin. It can form dense mats that choke out native plants and inhibit navigation. New plants can grow from stem fragments that root on contact with the substrate.



# Acknowledgments

Aquatic **invasive species** are non-native aquatic plants and animals that are most often unintentionally introduced into lakes by lake users. In some lakes, aquatic invasive plant species can exist as a part of the plant community, while in other lakes populations explode, creating dense beds that can damage boat motors, make areas non-navigable, inhibit activities like swimming and fishing, and disrupt the lakes' ecosystems.

- Eurasian water-milfoil, first documented in Boulder Lake in 2012, was observed at one location in the 2021 aquatic plant survey.
- Banded mystery snail was first documented in 2012.

This report was prepared as an appendix to the *Oconto County State of the Lakes Report*, which is on file with the Oconto County Land Conservation Department. Written and prepared by the Center for Watershed Science and Education at the University of Wisconsin-Stevens Point.

## Primary Authors

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## Acknowledgments

We are grateful to our project partners for supporting this project by providing insight, enthusiasm, and funding:

Oconto County Lakes and Waterways Association

Oconto County Land Conservation Department – Ken Dolata

Oconto County Staff and Citizens

UW Extension-Oconto County – Dale Mohr

Wisconsin Department of Natural Resources – Brenda Nordin & Brian Zalay

Wisconsin Department of Natural Resources Lake Protection Grant Program

UW-Stevens Point Water and Environmental Analysis Lab



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