

# Oconto County Lakes Project

## NELLIGAN LAKE STUDY SUMMARY REPORT

**2021**

*University of Wisconsin-Stevens Point and  
Oconto County Staff and Citizens*

### 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**

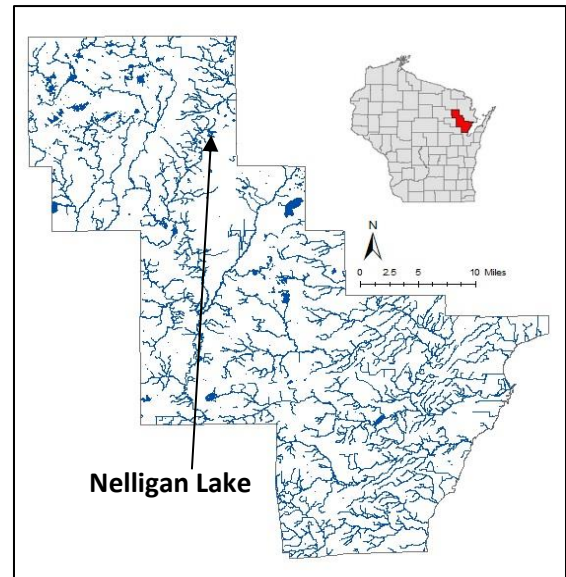
# Background

- Nelligan Lake is a 48-acre seepage lake in northern Oconto County with a maximum depth of 23 feet.
- Most water enters and leaves Nelligan Lake via groundwater. Surface water runoff and direct precipitation also contribute water.
- Visitors have access to the lake from one public boat landing located on the lake's northwest side.
- This report summarizes data collected during the 2019-2020 lake study.

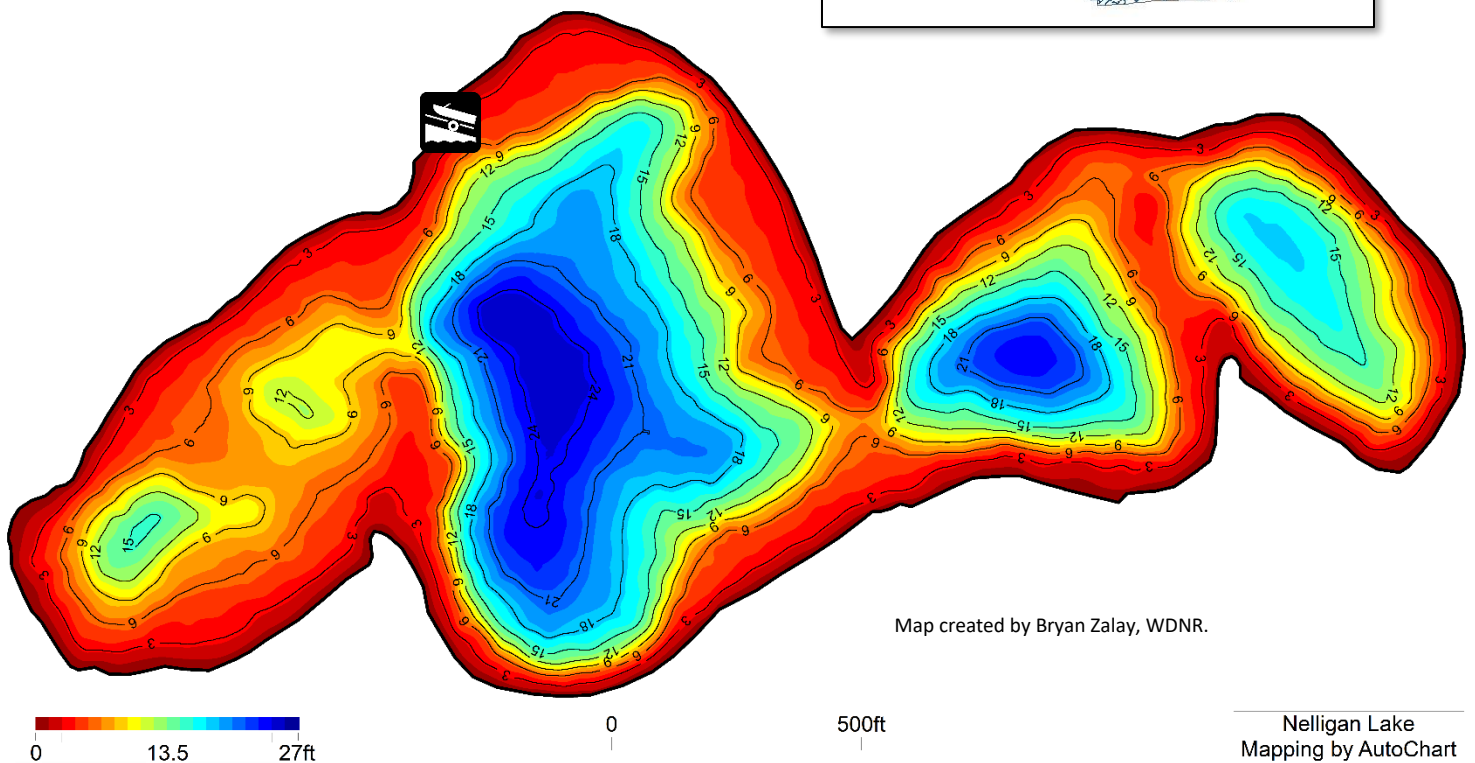
**Township of Riverview**

**Surface Area: 48 acres**

**Maximum Depth: 23 feet**



**Nelligan Lake**



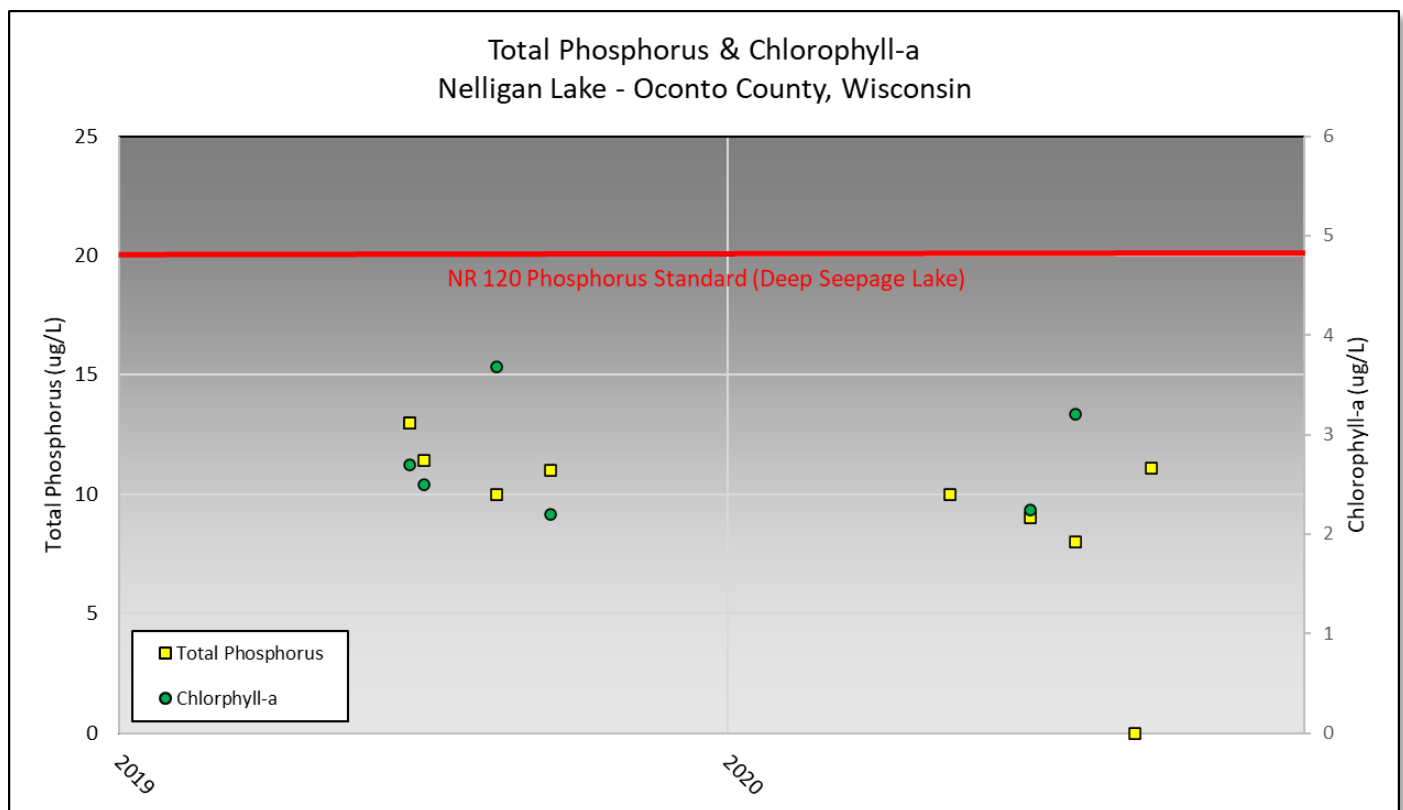
Map created by Bryan Zalay, WDNR.

Nelligan Lake  
Mapping by AutoChart

# Water Quality

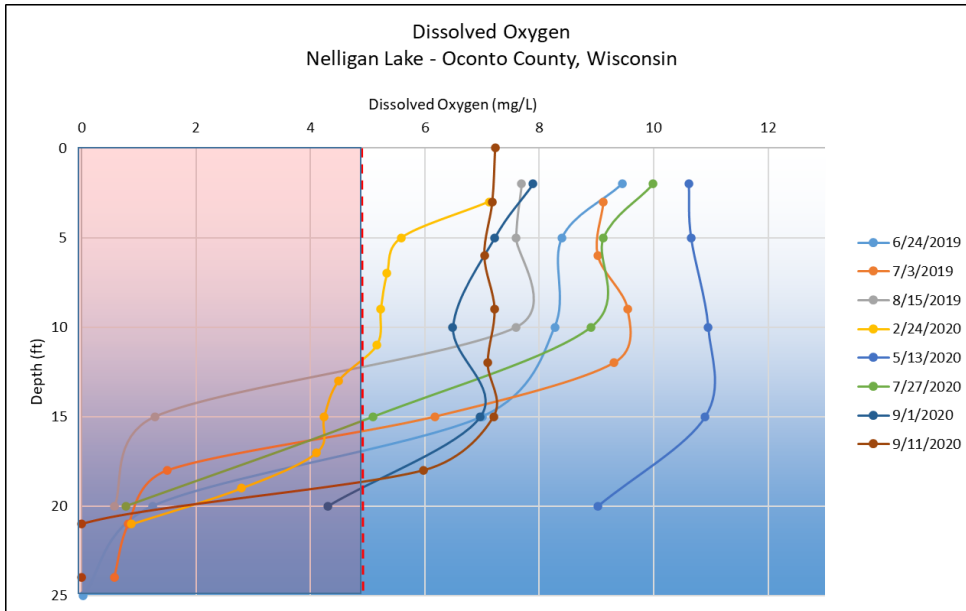
**Nutrients** such as phosphorus and nitrogen are what feed aquatic plants and algae in a lake. Excessive amounts of nutrients delivered to a lake will result in abundant plant and algae growth. Disturbance within a watershed combined with the landscape's inability to infiltrate and filter runoff is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

- Total Phosphorus was consistently below the Wisconsin state standard of 20 ug/L for deep seepage lakes during the two-year study. The long-term trend (based on summer samples) suggests a slightly decreasing average concentration.
- 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 and when nuisance algae blooms become more frequent.



# Water Quality

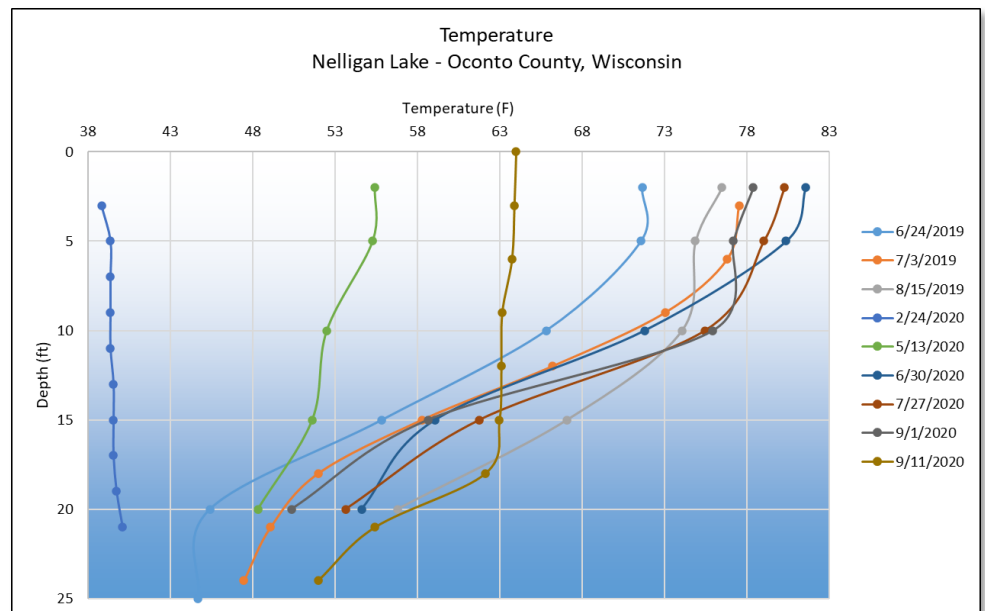
Sufficient **dissolved oxygen** in lake water is essential to the survival of aquatic organisms. The amount of dissolved oxygen present within a lake varies by season and depth. It is determined by the biological activity that consumes or produces oxygen, by water mixing through wind, changes in temperature, 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 Nelligan Lake throughout the year. The lowest concentrations were observed in late winter when only the top 11 feet has enough oxygen to support most fish species.
- Slight increases in dissolved oxygen at depth (~10 feet) are indicative of algae blooms.

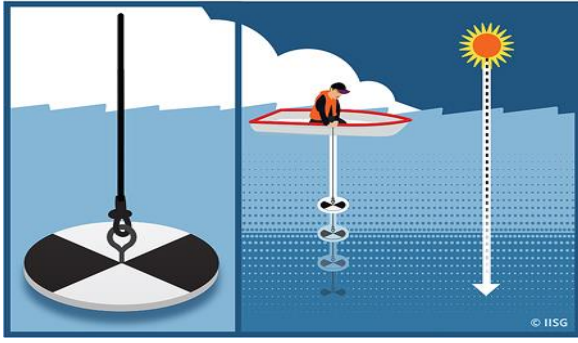
Lake water **temperature** has a significant impact on water chemistry, spatial distribution of fish, microbial growth and oxygen content.

- The temperature gradient in Nelligan Lake weak stratification between 5 and 15 feet during the growing season that separates warmer oxygen-rich water at the top from colder oxygen-poor water below.



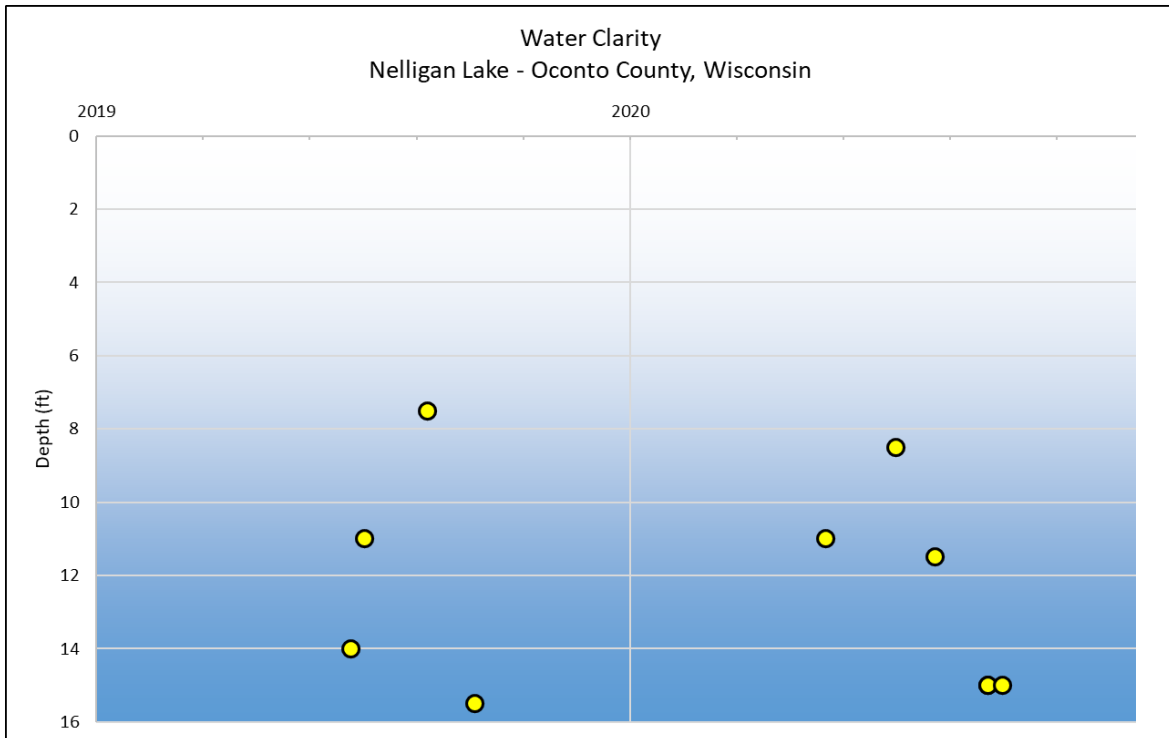
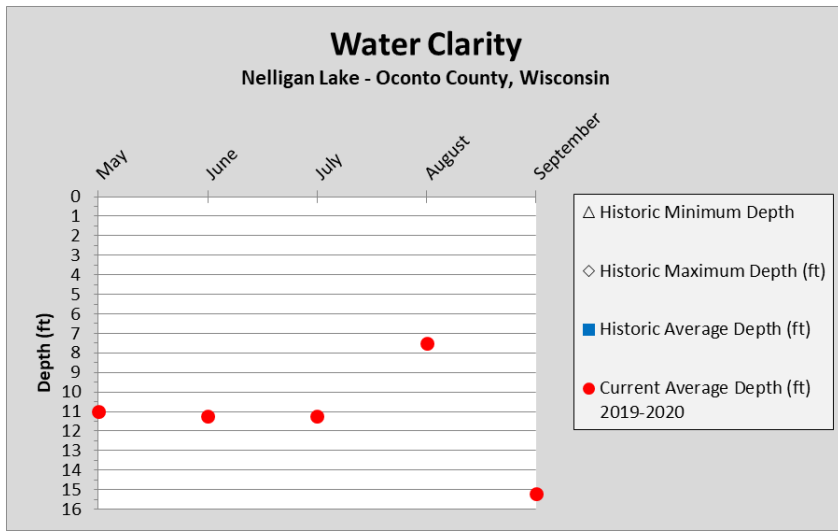


# Water Quality



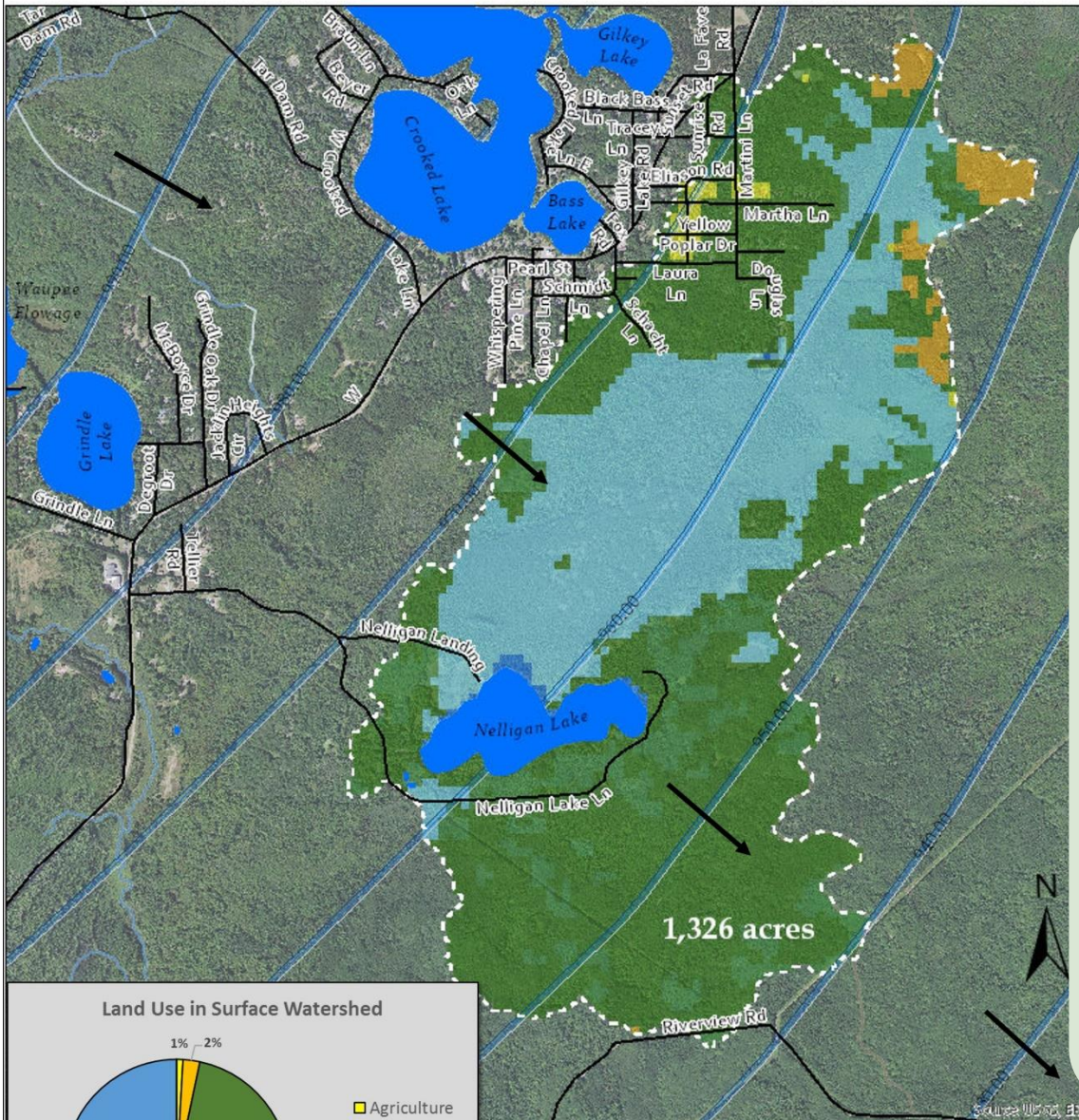
**Water clarity** is a measure of how deep light can penetrate (Secchi depth). Clarity is affected by water color, turbidity (suspended sediment), and algae. Water clarity helps determine where rooted aquatic plants can grow. It is typical for water clarity to vary throughout the year.

- No data is available for Nelligan Lake beyond the samples collected for this study. Additional monitoring is recommended.
- The graph below shows water clarity measurements taken between April and November.
- During 2019-20, on average, the poorest water clarity in Nelligan Lake was in August and the best



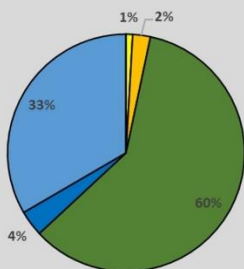
**Groundwater** provides water to lakes in Oconto County throughout the entire year. Hard surfaces on the landscape prevent water from soaking into the ground and becoming groundwater. This results in less water flowing to the lake during snowmelt and rain events. Water that does not infiltrate to groundwater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

## Nelligan 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.

Land Use in Surface Watershed



- Agriculture
- Grassland
- Forest
- Open Water
- Wetland

0 1,500 3,000 4,500 6,000 Feet

- Roads
- Surface Watershed Boundary
- Groundwater Contour
- Groundwater Flow Direction



# 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 Nelligan Lake were surveyed in July 2019. Most of Nelligan Lake's shoreland is healthy, but a few stretches are in need of restoration.

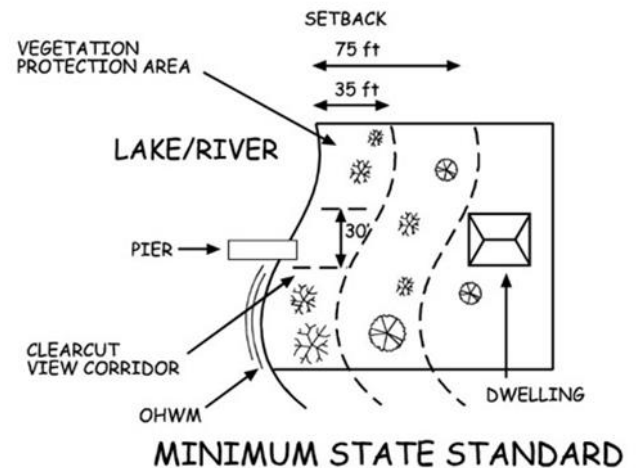
Total lakefront footage	No. Riparian lots	Measured shoreland disturbance (feet)	Measured shoreland disturbance (%)
8,042	12	620	8%



## 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:

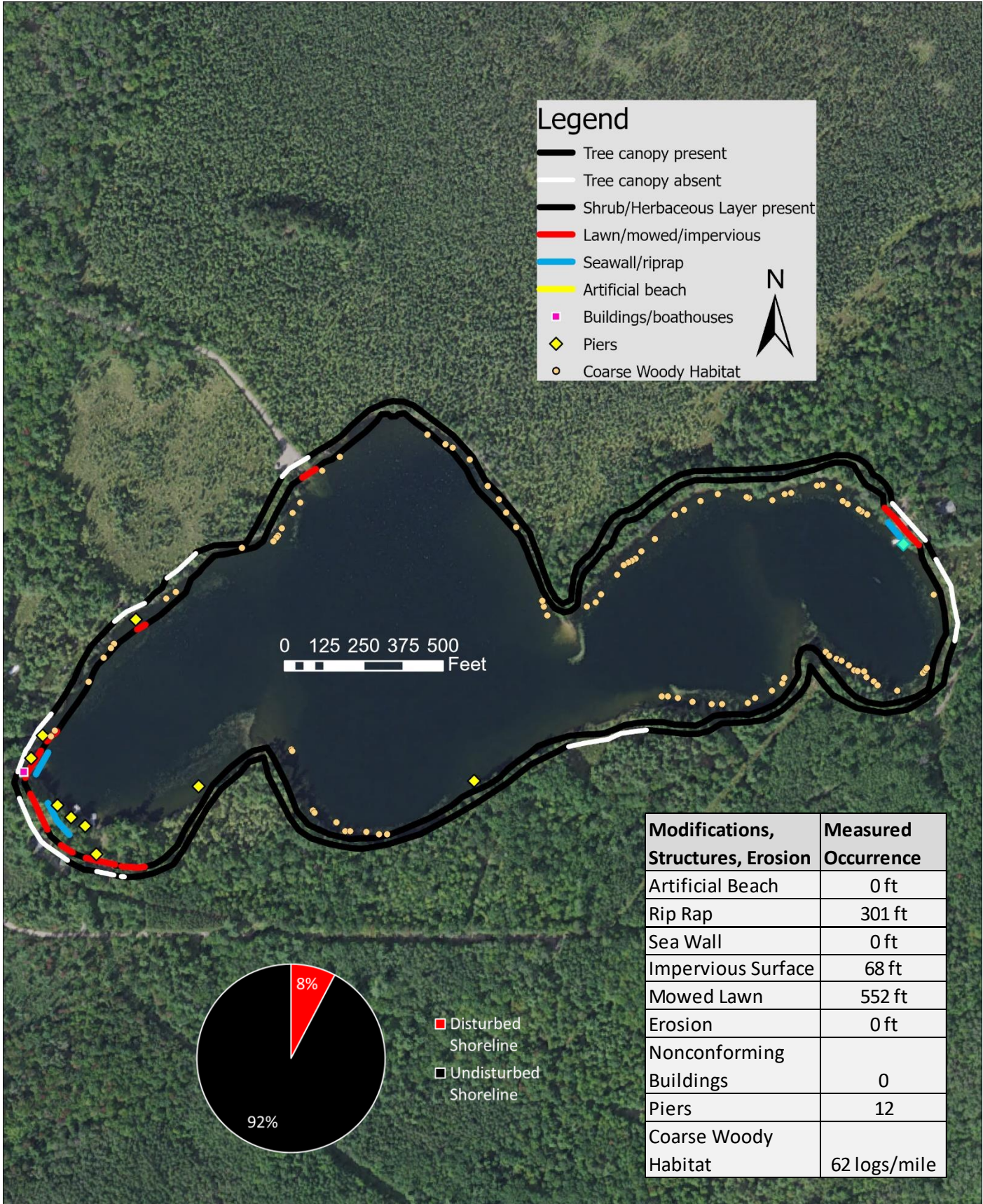
- Up to 30% of shoreline may be removed of shrubs and trees for a view corridor
- A mowed or constructed pedestrian path up to 5 feet wide to access lake



## What Can You Do To Help Nelligan 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.





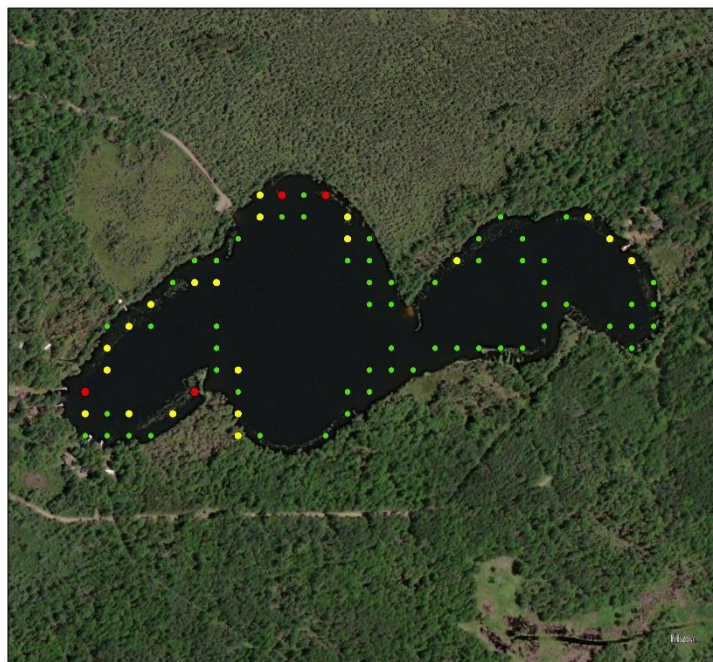


# Aquatic Plants


**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 Nelligan 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 10 species in the 2019 survey.
- During the 2019 aquatic plant survey of Nelligan Lake, 44% of visited sites had vegetative growth. The maximum depth of vegetation was 18 feet.
- The most frequently encountered plant species were Dwarf watermilfoil (76%), watershield (30%) and small purple bladderwort (23%). All three species are native to Wisconsin.
- No invasive species were observed.

Nelligan Lake Aquatic Plant Survey 2019:  
Rake Fullness



0 125 250 500 750 1,000 Feet

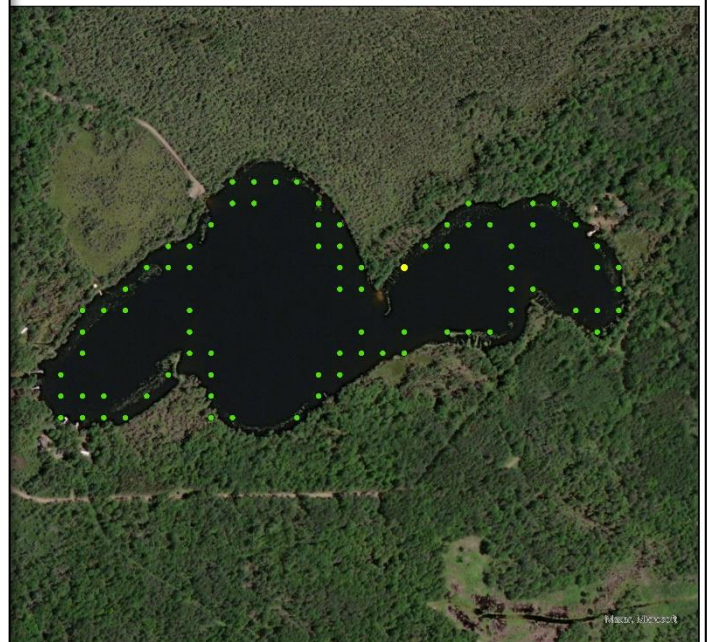
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**Rake Fullness**


- 1
- 2
- 3



Nelligan Lake Aquatic Plant Survey 2019:  
Total Number of Species



125 250 500 750 1,000 Feet

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**Total Number of Species**

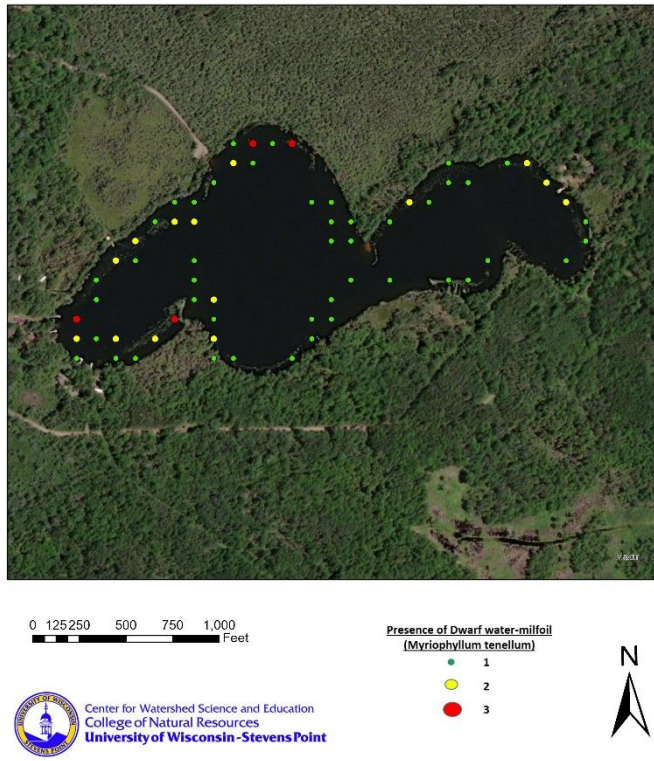
- 1-3
- 4-7
- 8+





# Aquatic Plants

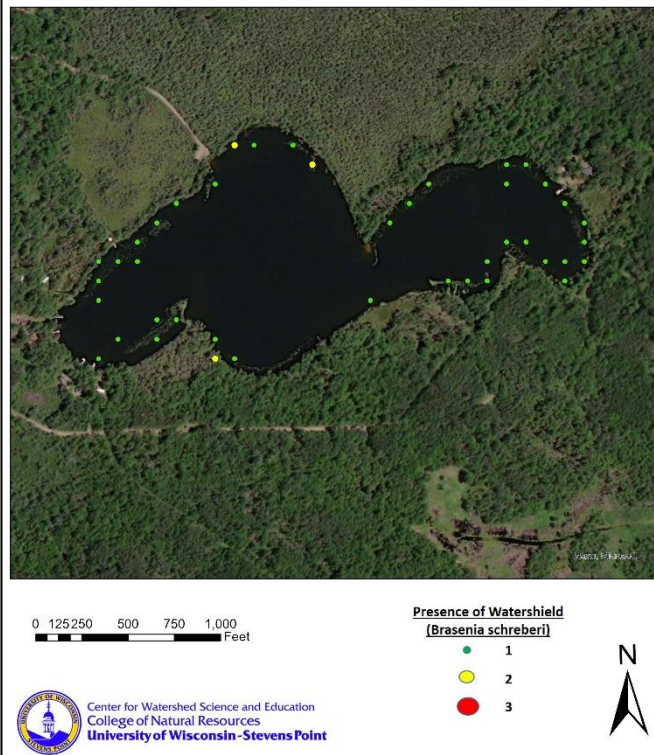
## Nelligan Lake Aquatic Plant Survey: 2019 Dwarf water-milfoil (*Myriophyllum tenellum*)



**Dwarf water-milfoil** is a very sensitive species with little tolerance for disturbance and, thus, is an indicator of a high-quality, natural environment. It grows in dense clusters of thin, unbranched stems from rhizomes in sandy soil. The fruit is eaten by waterfowl that often rises above the water surface in shallow areas.



## Nelligan Lake Aquatic Plant Survey: 2019 Watershield (*Brasenia schreberi*)



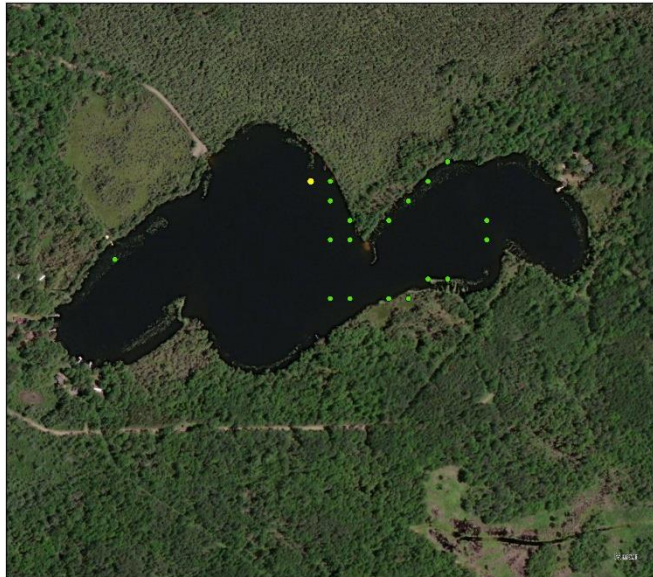
**Watershield** has floating leaves with their distinctive jelly-like slime on the undersides and stems. While providing shade and shelter for aquatic animals and food for waterfowl, the plants secrete a number of chemicals that kill or inhibit growth of bacteria, algae, and other plants. Native Americans reportedly ate its tuberous roots.





# Aquatic Plants

## Nelligan Lake Aquatic Plant Survey: 2019 Small purple bladderwort (*Utricularia resupinata*)



**Small purple bladderwort** is a sensitive species considered Threatened in Minnesota and of Special Concern in Wisconsin, so it should not be disturbed. A carnivorous plant, it has tiny bladders that capture small invertebrates to be broken down and digested.



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.

- No invasive species have been observed in Nelligan Lake.



**STOP AQUATIC  
HITCHHIKERS!™**

Prevent the transport of nuisance species.  
Clean all recreational equipment.

[www.ProtectYourWaters.net](http://www.ProtectYourWaters.net)

# Acknowledgments

*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 & Water 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

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