Wadley Lake

Eastern Marathon County Lake Study

Final Study Results 2013

University of Wisconsin-Stevens Point
and
Marathon County Staff and Citizens

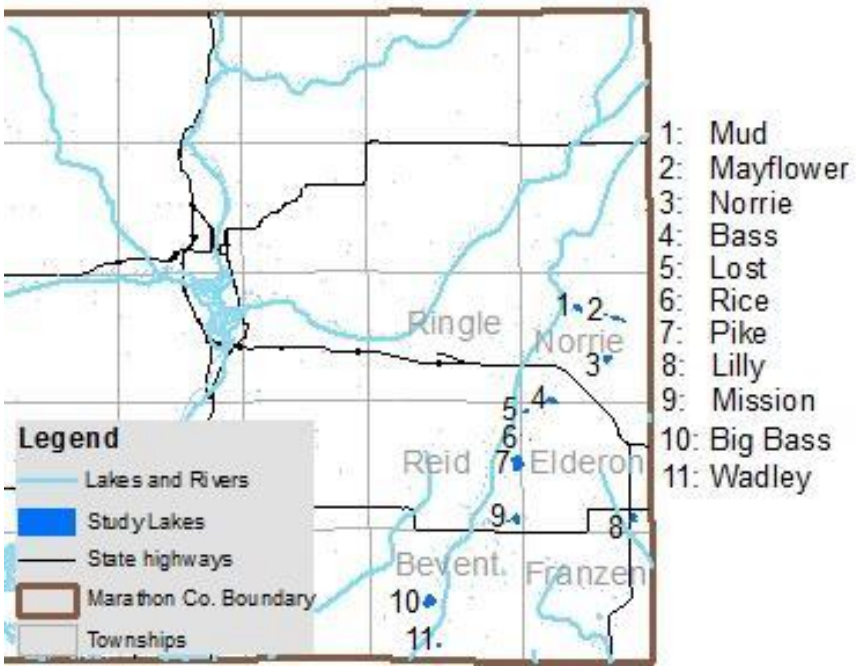
Healthy lakes add value to our communities. They provide a place to relax and recreate, and can stimulate tourism. Like any infrastructure, lakes require attention and good management practices to remain healthy in developed watersheds.

The purpose of this study is to learn about the current conditions of the fishery, habitat and aquatic ecosystems in order to help people make informed decisions to preserve what's good and correct any problems that exist.

To protect

the lake we must protect the "watershed," the land that drains or sheds its water into the lake.

Wadley Lake – Location



Wadley Lake

Township of Bevent

County Road Y

Surface Area: 47.2 acres

Maximum Depth: 24.6 feet

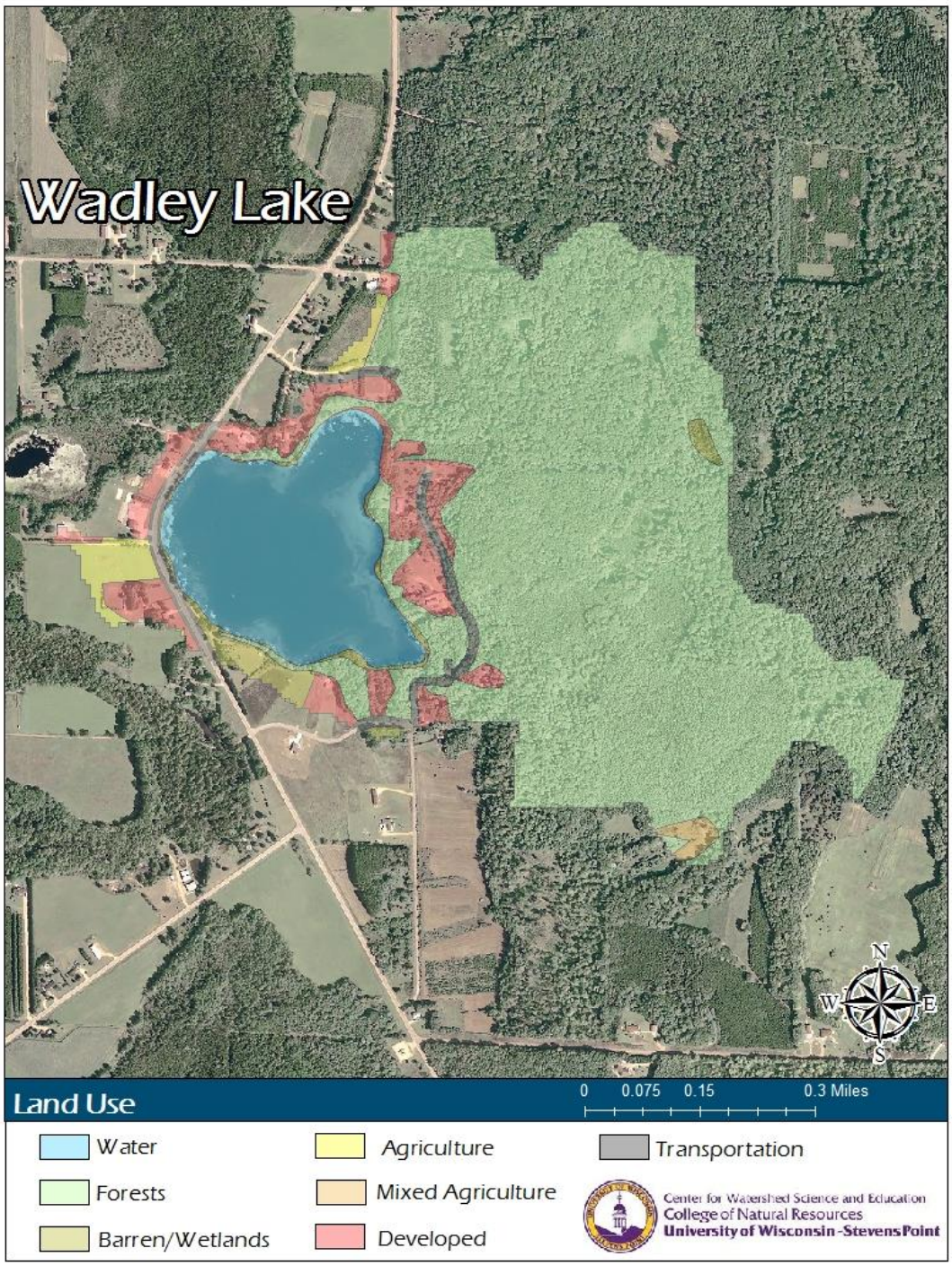
Water Flow

- Wadley Lake is a seepage lake with water entering the lake from groundwater.
- Surface water runoff and direct precipitation also contribute water, but to lesser extents.
- Water exits Wadley Lake through groundwater.

Wadley Lake, Marathon Co.

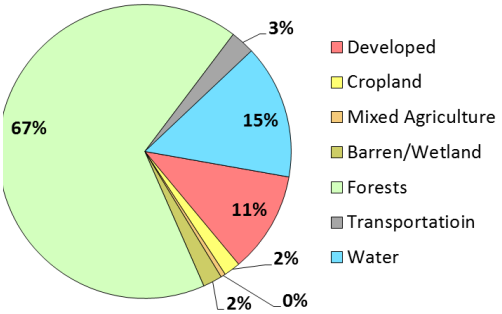
Wadley Lake – Surface Watershed

Surface Watershed: The area where water runs off the surface of the land and drains toward the lake.



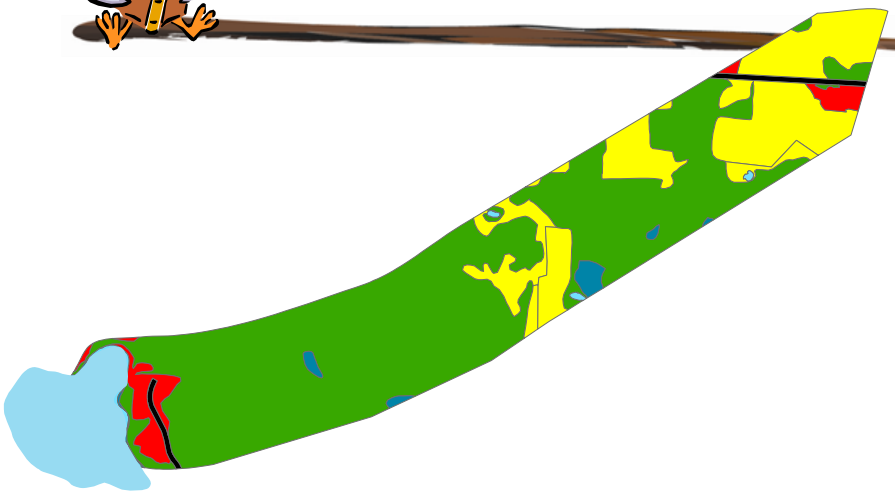
- **Land uses** and land management practices occurring in the watershed affect the water quality in the lake.
- Land uses and land management also play major roles in how water moves across the landscape and how much water soaks into the ground (for long-term storage) or quickly runs off the land.
- The surface watershed of Wadley Lake is 375 acres.
- The primary land use in the watershed is forests.
- In general, the land closest to the lake has the greatest immediate impact on water quality. The lake has a mix of residential development, wetlands, forests and agriculture around its perimeter.

Land Use in the Wadley Lake Watershed



Wadley Lake – Groundwater Watershed

Groundwater Watershed: The area where water soaks into the ground and travels below ground to the lake.



Land Use	Acres
Agriculture	84
Developed	14
Forested	241
Roads	5
Water	19
Wetland	5

- **Groundwater** slowly contributes water to our lakes throughout the 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 the winter and between rains.
- The quality of groundwater reflects what is happening on the land surface. Precipitation falling on forested land produces clean groundwater, whereas precipitation falling on lands that have chemical use can leach contaminants to groundwater. Groundwater contamination in central Wisconsin may include nitrogen, pesticides, herbicides and other soluble chemicals originating from septic systems, crops, barnyards, road maintenance, etc. Once in the groundwater, these chemicals slowly move towards a lake or river.
- The groundwater watershed for Wadley Lake is 368 acres.
- The primary land uses in the Wadley Lake groundwater watershed are forests and agriculture.
- In general, the land adjacent to the lake where groundwater enters the lake has the greatest immediate impact on water quality. Residential development and forests are adjacent to Wadley Lake where most of the groundwater enters.

Looking at Groundwater Up Close:

Groundwater enters Wadley Lake primarily from the east, but was also observed entering sporadically around the lake.

Groundwater exits on the west and the east sides of the lake.

Wadley Lake – Shoreland Vegetation

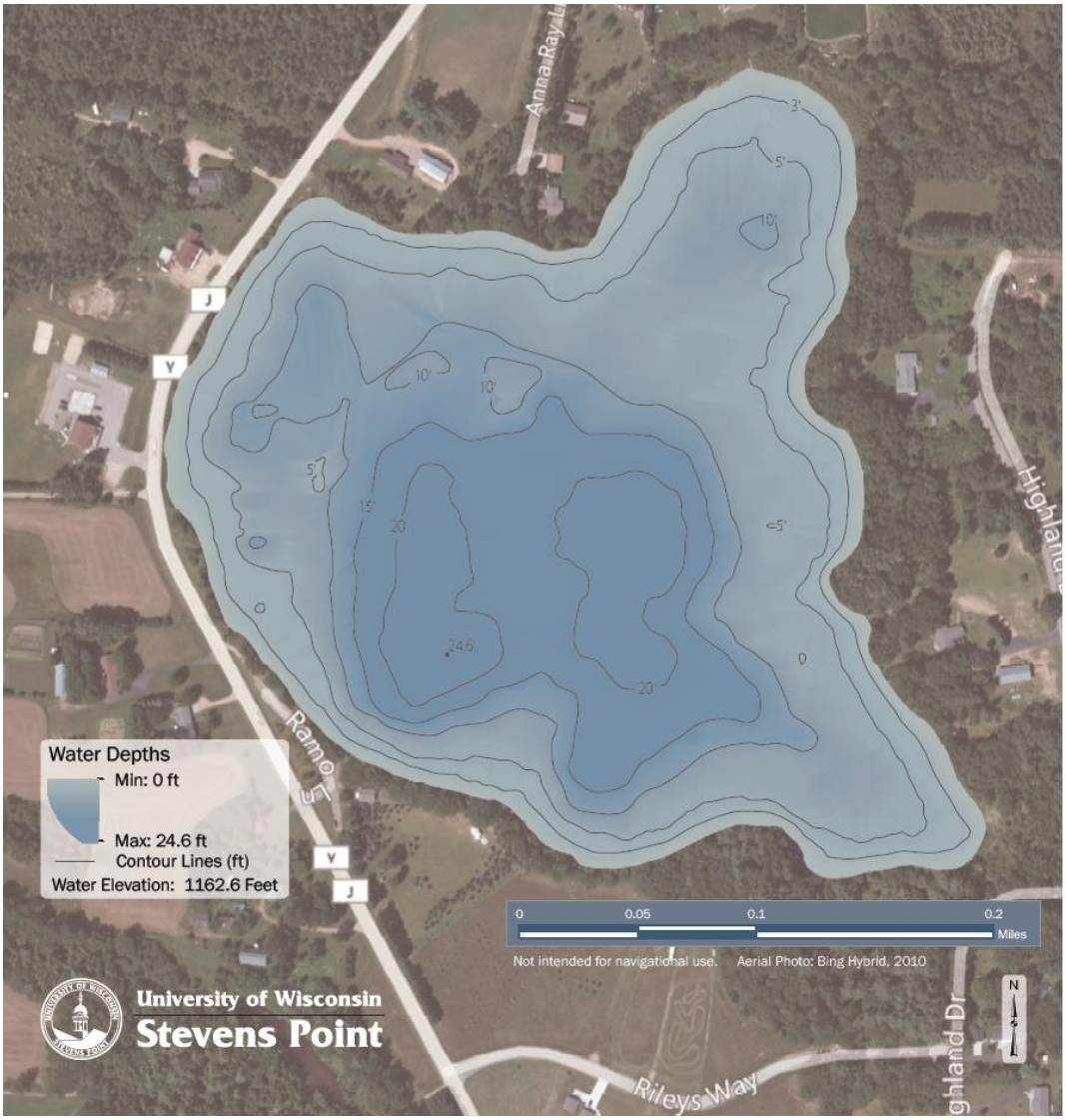
Shoreland vegetation is critical to a healthy lake's ecosystem. It provides habitat for aquatic and terrestrial animals including birds, frogs, turtles, and many small and large mammals. It also helps to improve the quality of the runoff that is flowing across the landscape towards the lake. Healthy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

The map below shows how far the 0.5 to 3 foot tall vegetation exists landward from the edge of Wadley Lake. A greater vegetative buffer provides more habitat and better water quality.

Wadley Lake – Lake Map

Wadley Lake's shape and depth play major roles in determining:

- Where aquatic plants can and cannot grow
- Species of fish and where they live
- How fast water in the lake warms up and cools down
- The water quality of the lake
- Abundance of habitat for species living in the water and on the land



WADLEY LAKE
BATHYMETRIC MAP

Map funded by the Wisconsin Department of Natural Resources Lake Planning Grant Program, Marathon County, Marathon County citizens, and lake and fishing groups.

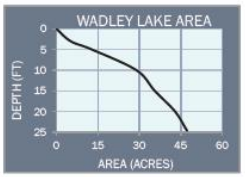
MARATHON COUNTY, WISCONSIN

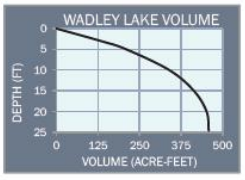
GPS and Sonar Survey
June, 2012

University of Wisconsin-Stevens Point Center for Watershed Science and Education, College of Natural Resources and the GIS Center, College of Letters and Science.

Cartography by Christine Koeller

LAKE AREA	47.2	Acres
Under 3 Feet	5.2	Acres (10.9%)
Over 20 Feet	4.3	Acres (9.1%)
VOLUME	459	Acre-feet
SHORELINE	1.2	Miles
MAX DEPTH	24.6	Feet





Wadley Lake – Fishery

Many factors determine which fish species thrive in a lake. Physical factors include the lake's type, depth, surface area, geology and lake bed materials. Water quality in the lake also plays a role: water clouded with sediment or algae reduces the success of visual feeders, while low levels of dissolved oxygen will limit the fish population to those that can tolerate periods with low oxygen.

Total and length of species in Wadley Lake during 2012 fyke net and seining surveys

Species	Min Length (in)	Max Length (in)	Average Length (in)	Total Catch
Bluegill*	0.9	8.3	3.1	294
Bluntnose Minnow*	1.3	2.6	1.9	170
Iowa Darter*	1.2	2.2	1.7	84
Largemouth Bass*	1.4	13.3	3.4	37
Yellow Bullhead	1.9	14.0	10.8	24
Black Crappie	7.7	12.5	10.2	9
Yellow Perch*	5.1	5.1	5.1	5
Northern Pike	12.8	20.9	16.8	2
Walleye	22.0	22.3	22.2	2
White Sucker	10.7	19.6	15.2	2
*A subsample of the total catch was measured.				

Total catch and length of species in Wadley Lake during the 2012 boom shocking survey

Species	Min Length (in)	Max Length (in)	Average Length (in)	Total Catch
Bluegill	1.0	7.7	2.9	89
Bluntnose Minnow	1.0	7.1	2.4	59
Largemouth Bass	2.3	14.8	6.5	35
Yellow Perch	3.0	5.7	3.8	7
Black Crappie	5.9	8.5	7.3	5
Green Sunfish	3.4	7.3	5.7	4
Iowa Darter	1.8	1.8	1.8	1
Northern Pike	16.3	16.3	16.3	1

- Wadley Lake supports a warm water fish community.
- In 2012, eleven fish species were sampled and identified out of the sixteen total species that have been recorded in surveys dating back to 1967 obtained from the Wisconsin DNR.
- The 2012 survey included three newly-documented species: bluntnose minnow, Iowa darter and yellow bullhead.
- Green sunfish, relatively uncommon to this area, was also present in the lake.
- The presence of young bass and sunfish sampling indicates successful reproduction of these species.
- Three rusty crayfish were captured during the sampling period.

Wadley Lake – Fishery

Species occurrence in Wadley Lake in 2012 survey and historical Wisconsin DNR records

Species	1967	1976	2012
Black Crappie	x	x	x
Bluegill	x	x	x
Bluntnose Minnow			x
Brown Bullhead		x	
Bullheads	x		
Emerald Shiner	x		
Green Sunfish		x	x
Iowa Darter			x
Johnny Darter	x		
Largemouth Bass	x	x	x
Mudminnow	x		
Northern Pike	x	x	x
Pumpkinseed	x	x	
Walleye		x	x
White Sucker		x	x
Yellow Bullhead			x
Yellow Perch	x	x	x

- Fish stocking records for Wadley Lake date back to 1938, according to Wisconsin DNR files. Largemouth bass and walleye were stocked prior to 1966. Most recently, adult northern pike has been the focus of stocking.
- A 1948 Wisconsin DNR report stated that a high proportion of catchable fish were present, with more than 50 percent exceeding eight inches. Black crappies were specifically noted as being of desirable size.
- In 1967, the average bluegill size was 6.1 inches, greater than the 2012 survey results.
- In 1967, an application was approved and land acquired to provide a boat launch and public parking.
- Fish cribs were added in 2007 to provide spawning habitat and cover for young fish.
- In 2012, the lake was chemically treated for control of nuisance aquatic plants.

Wadley Lake – Fishery

Habitat in and near the lake plays a large role in the composition of a fish community. Habitat is a combination of aquatic plants, woody structure, and lake substrate. Near the shore is found some of the most important fishery habitat.

Coarse woody habitat (CWH) is an important component of a healthy and balanced fishery, playing a key role in the life histories of many fish species. Downed trees, logs and branches along with aquatic plants offer refuge from predators, sheltered substrates for spawning, nurseries for young, and feeding grounds to forage for insects and algae. CWH is very important to other animals that live in or visit a lake, including turtles, frogs, birds and mammals.

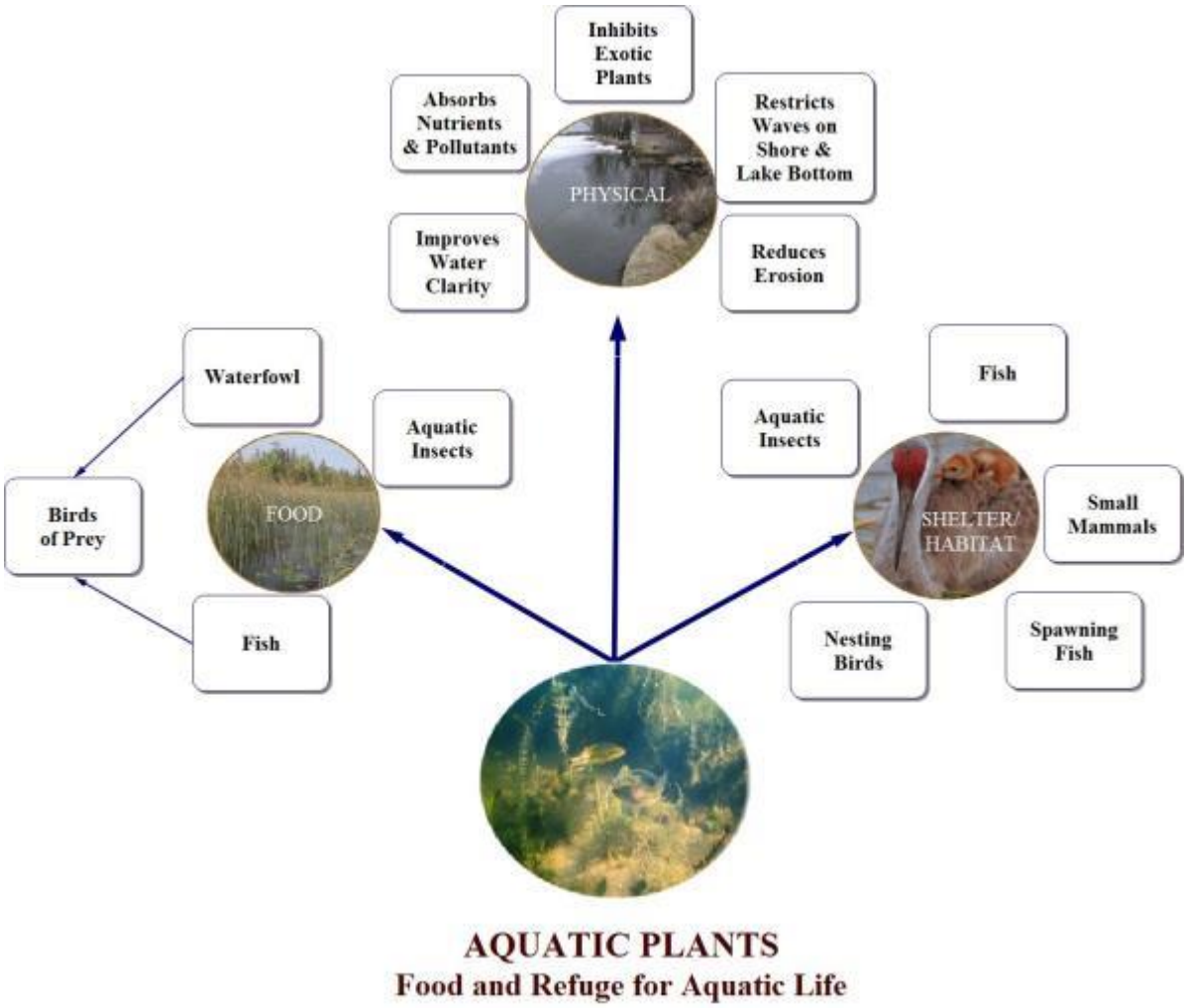
Coarse woody habitat (CWH) is available in Wadley Lake. This structure is utilized by young prey fish and other aquatic organisms for spawning, foraging and protective cover.

The addition of CWH cover would benefit the fish community.

- The bottom substrate in Wadley Lake primarily consists of marl (87.1%), although the eastern and southern shorelines also contain areas where hard substrates occur.
- Gravel areas are used by many fish for spawning habitat, including sunfish (bluegill, pumpkinseed and black bass), where males will construct nests and guard their young.
- Northern pike spawn in shallow or flooded areas with emergent and floating-leaf vegetation.
- Black crappie use bulrush habitat on gravel or sand substrates where they construct nests and guard young. Sparse areas of softstem bulrush are present in Wadley Lake.
- Yellow perch and walleye spawn in near-shore cobble in oxygen-rich environments.
- Sand can be important habitat for non-game minnow reproduction.

Wadley Lake – Aquatic Plants

Aquatic plants are the forest landscape within a lake. They provide food for creatures including fish, ducks and turtles, and habitat for fish, invertebrates and other aquatic animals. They create oxygen 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.



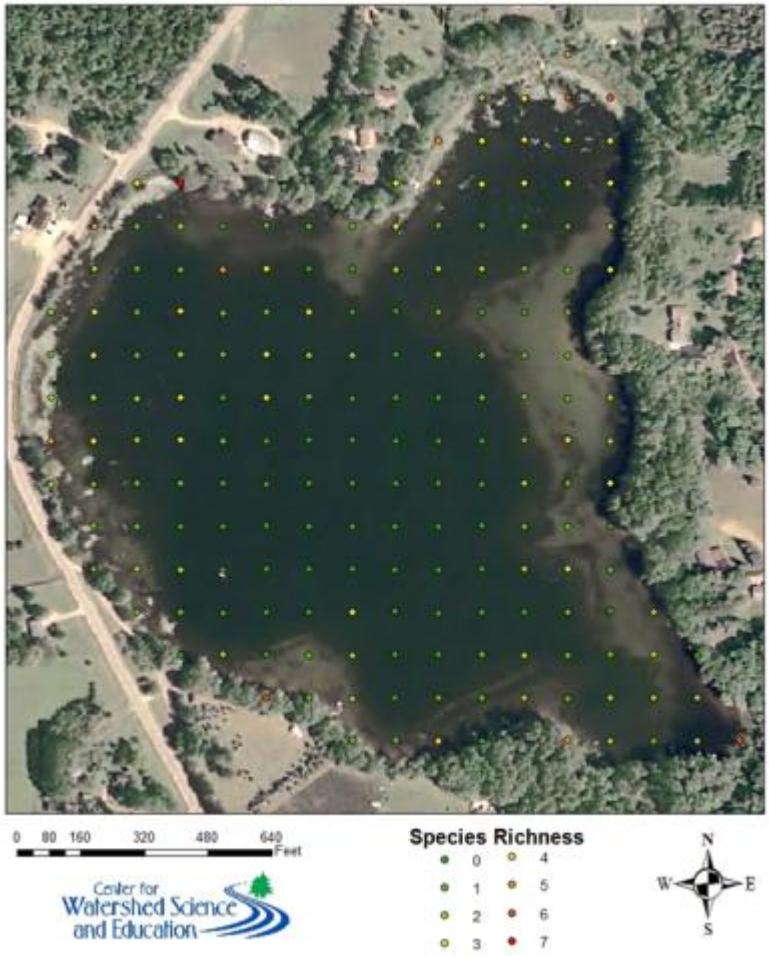
- The aquatic plant community in Wadley Lake is characterized by an average diversity when compared to other lakes in the Marathon County study, despite being impacted by disturbance.
- An aquatic plant survey conducted in 2012 documented eighteen species, with greatest species richness in the northeast and northwest bays of the lake.
- Eurasian water milfoil (EWM) occurred at 10% (eight) of the vegetated sites within the lake and was considered dense at one of the sites. EWM is an invasive species which should continue to be monitored in Wadley Lake to ensure that populations are not increasing or changing.

Wadley Lake – Aquatic Plants

- During the 2012 aquatic plant survey of Wadley Lake, 87 percent of the sites sampled had vegetation.
- The average depth of the sampled sites was 7 feet, with a maximum rooting depth of 20 feet. This rooting depth indicates excellent water clarity despite algae growth and suspended sediments in the lake.
- The species that occurred with most frequency was muskgrass, followed by slender naiad and Illinois pondweed. All are commonly found species of native aquatic plants .

Species Richness is a count of the number of plant species found at a survey point. A greater number of species in a lake helps to make the aquatic plant community more resilient to year-to-year changes and aquatic invasive species. More plant species means more diverse habitat and available food sources.

Wadley Lake 2012 Aquatic Plant Survey:
Species Richness



Illinois pondweed provides forage and cover for aquatic animals. The tuber is also an important source of food for waterfowl.

Muskgrass is a form of algae which resembles higher plants. It often grows in low, dense mats and is identified by its musky odor and rough texture. The water is often clear where muskgrass grows densely because of its ability to filter nutrients from water.

Wadley Lake – Aquatic Invasive Species

Aquatic Invasive Species are non-native plants or animals that may cause significant harm to a lake's ecosystem. Typically, they are introduced to a lake by hitching a ride on clothing, boats, trailers and other water recreation equipment. Aquatic invasive species can be introduced to a lake accidentally or intentionally. Once in a lake, they may be impossible to completely remove and can be difficult and costly to control. Prevention and early detection are the best ways to keep aquatic invasive species from establishing in a lake.

Lakes With Aquatic Invasive Species in Marathon and Northern Portage County, 2012

Lakes With Aquatic Invasive Species in Marathon and Northern Portage County, 2012

Lake Name	Banded Mystery Snail	Chinese Mystery Snail	Rusty Crayfish	Curly-Leaf Pondweed	Eurasian Water Milfoil	Purple Loosestrife
Marathon County (Shaded lakes are part of Eastern Marathon Co. Lake Study)						
Big Bass Lake	✓					
Big Rib River			✓		✓	
Eau Claire Flowage		✓			✓	
Flume Creek			✓			
Johnson Creek			✓			
Lake Wausau				✓		
Little Rib River			✓			
Little Trappe River			✓			
Lost Lake		✓				
Mayflower Lake		✓		✓		
Mission Lake	✓				✓	✓
Pike Lake	✓			✓		
Rice Lake	✓	✓		✓		
South Branch Embarrass River			✓			
Spring Brook			✓			
Trappe River			✓			
Wadley Lake	✓	✓		✓	✓	
Wausau Dam Lake					✓	
Wisconsin River			✓		✓	
Northern Portage County						
Tree Lake	✓	✓		✓		
Plover River			✓			
Lake DuBay		✓	✓	✓	✓	

Learn to identify invasive species & look for them in your lake!

Wadley Lake – Water Quality

Lakes go through a natural aging process that results in increased aquatic plant growth, fish, and wildlife over time. Within a lake's watershed, human activity on the land, in a wetland, or in the lake can dramatically accelerate this process. Depending on land management practices, changes in a lake that may have normally taken centuries to occur may take place in decades or even years. The amounts of nutrients, algal growth, and water clarity measurements help to define the age of a lake. Based on these measures, lakes can be classified for comparison to one another.

Oligotrophic Lakes

Common uses:

- ✓ Swimming
- ✓ Skiing
- ✓ Boating

Vegetation of oligotrophic lakes:

- ✓ Very little vegetation

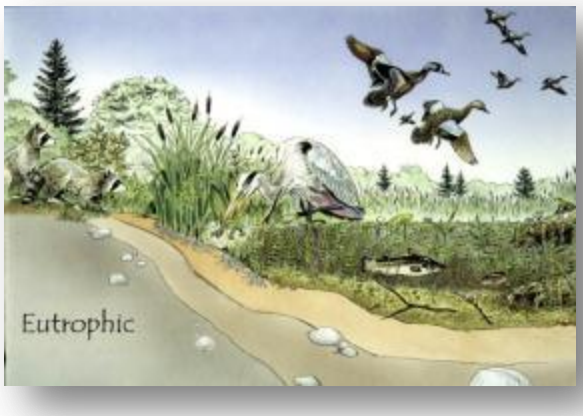
Mesotrophic Lakes

Common uses:

- ✓ Boating
- ✓ Fishing

Vegetation of mesotrophic lakes:

- ✓ Increased vegetation
- ✓ Occasional algal blooms



Eutrophic Lakes

Common uses:

- ✓ Fishing
- ✓ Wildlife watching

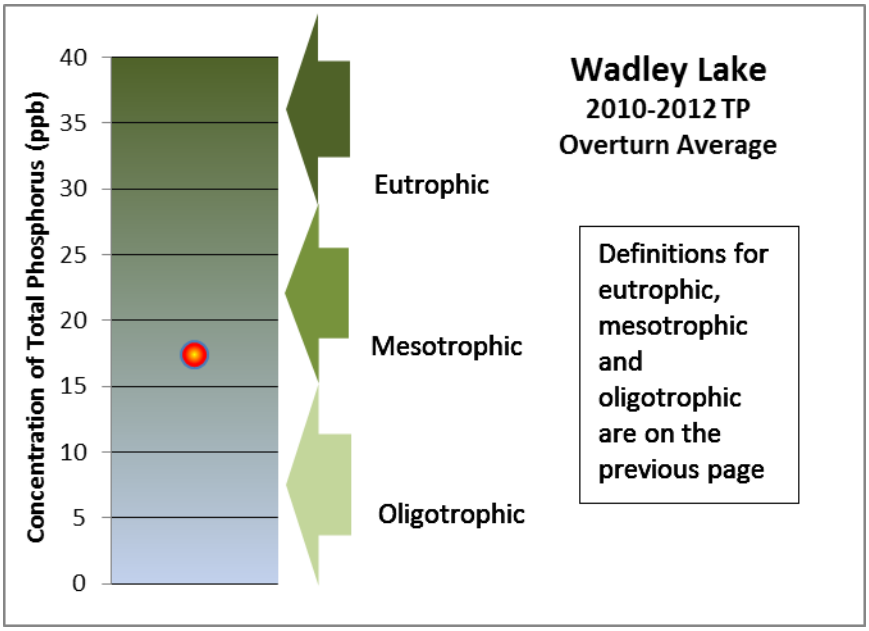
Vegetation of eutrophic lakes:

- ✓ Lots of aquatic plants
- ✓ Frequent algal blooms

Winter fish kills can occur in shallow lakes due to low oxygen levels.

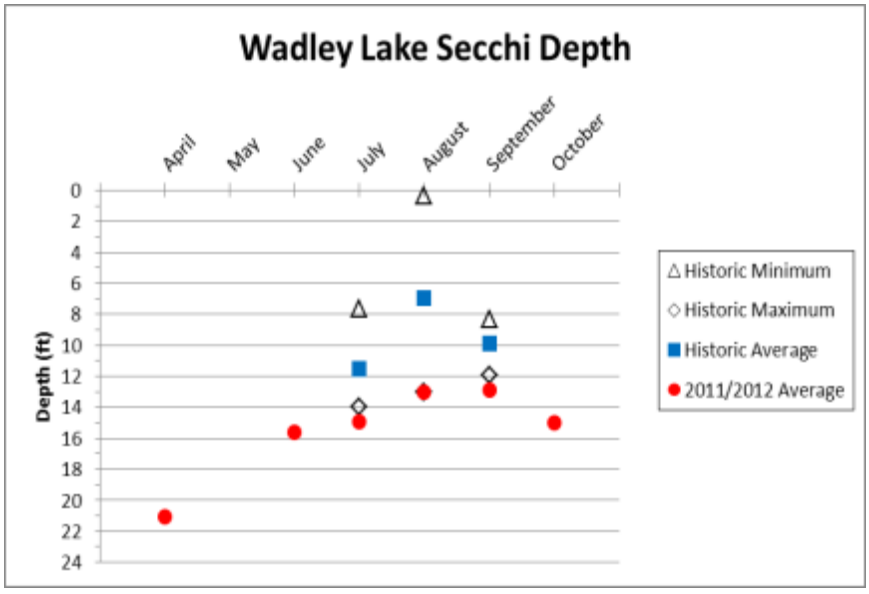
Wadley Lake – Water Quality

Phosphorus is a major nutrient that can lead to excessive algae and rooted aquatic plant growth in lakes. In fact, one pound of phosphorus entering a lake can result 300 to 500 pounds of algal growth. All Marathon County lakes have either sufficient or excessive nutrients for aquatic plant growth, so these lakes will benefit from limiting the addition of more nutrients. Sources of phosphorus include septic systems, animal waste, storm water runoff, soil erosion, and fertilizers for lawns, gardens and agriculture.



- Total phosphorus levels measured when Wadley Lake was well-mixed (overturn) are displayed in the graph to the left.
- Overturn sampling during the 2010-2012 monitoring period indicate that Wadley Lake is a mesotrophic lake with an average total phosphorus level slightly below the mid-range.

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.



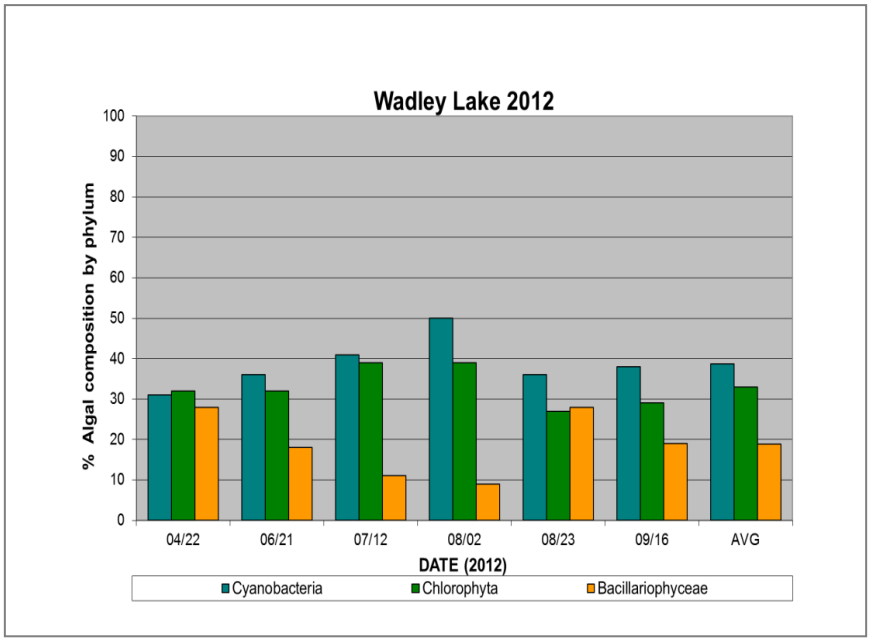
- The graph to the left shows water clarity data collected during the growing seasons in 2011 and 2012. It is typical for water clarity to vary throughout the year.
- The 2011/2012 average Secchi depth readings were somewhat deeper than historic averages, suggesting a possible recent improvement in water clarity.

Wadley Lake – Algae

Algae are microscopic, photosynthetic organisms that are important food items in all aquatic ecosystems. Different algal groups increase or decrease during the year and they can be used to analyze a lake's water quality because there are more varieties of algae than fish or aquatic plants. Conclusions can be drawn about water temperature, nutrient availability, and overall water quality of a lake using algal populations.

In Marathon County lakes, there are three dominant groups of algae: blue-green algae (Cyanobacteria), green algae (Chlorophyta), and diatoms (Bacillariophyceae).

- The Wadley Lake algal community displayed similar patterns in 2011 and 2012. These patterns are indicative of a fairly healthy lake transitioning from oligotrophic to mildly mesotrophic status.
- The green algae and blue-green algae were co-dominant groups for almost every sample of both years. The diatoms rarely co-dominated.
- The dominant green algal species are small single-celled and colonial organisms that are edible and easily digested. These algae can support a significant food web of herbivores and planktivorous fishes.
- Most diatom species present are associated with oligotrophic and mesotrophic waters, but several taxa are associated with eutrophic waters. This observation, linked with the co-dominance of the blue-green algae, supports the conclusion that Wadley Lake is an early mesotrophic lake with a diverse algal community.



PERCENT ALGAL COMPOSITION FOR WADLEY LAKE 2012

Blue-green algae have the widest tolerance range for temperatures and nutrient concentrations. Once well-established in a lake, blue-green algae are difficult to control and remove. A few varieties of blue-greens can produce toxins that are potentially harmful to livestock, pets and humans.

Wadley Lake – Sediment Core Analysis

Lake sediment can help to tell the history of a lake and changes that may have affected the lake related to water quality, the abundance of aquatic plants, and sedimentation or land use changes in the watershed. These changes are assessed by evaluating the content of the upper layer of the sediment versus lower layers. This information can help to guide management decisions for a lake.

- Analysis of Wadley Lake's sediment core suggests increased disturbance in the lake basin since the time of land clearing.
- Ragweed grains and the ragweed index are low deeper in the core, but rise substantially between 11 and 12.5 inches, reflecting a shift from logging to agriculture around the turn of the century.
- A shift in the diatom community and sedimentary changes reflect an increase in phosphorus and possibly filamentous algae in the top of the sediment core.
- There is greater input of silica-based materials to the deep part of the lake, indicating disturbance and more suspended sediment in the last century.
- A decrease in marl formation reflects a potential loss or change in the aquatic plant community or changes in groundwater flow into the lake over the same time period.

This sediment core was collected from Wadley Lake. The darker layers indicate organic-rich sediments often due to increased growth of aquatic plants and/or soil erosion. Additional analysis of these layers can help to confirm the source(s).

Diatom species found in lake sediments in Marathon County.

Diatoms are a type of algae commonly found in sediment. They are well-preserved in sediments due to silica-based cell walls which resist degradation.

Different species of diatoms are sensitive to water quality; thus, changes in the diatom community from the bottom to the top of the sediment core can reveal how water quality in the lake has changed over time.

Wadley Lake – What can you do?

Lake Users:

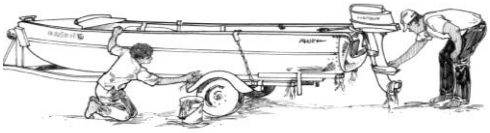
- ✓ Run boat engines efficiently
- ✓ Observe no/low wake zones
- ✓ Refuel away from water
- ✓ Dispose of trash properly
- ✓ Remove all aquatic plants from boats and trailers
- ✓ Respect wildlife and other lake users

Land Owners:

- ✓ Control soil erosion
- ✓ Keep livestock out of lakes and streams
- ✓ Control manure runoff
- ✓ Carefully manage nutrients and pesticides
- ✓ Leave natural shoreland vegetation in place or restore if it has been removed
- ✓ Learn to identify and look for invasive species

Home Owners:

- ✓ Leave natural shoreland vegetation in place or restore if it has been removed
- ✓ Leave woody habitat for young fish, turtles and frogs
- ✓ Eliminate the use of fertilizer or use no phosphorus fertilizer
- ✓ Eliminate or minimize use of pesticides
- ✓ Control soil erosion
- ✓ Control runoff from rooftops and hard surfaces
- ✓ Clean up after pets
- ✓ Learn to identify and look for invasive species



Stop the Spread of Aquatic Invasive Species!

Wetlands and Shorelands:

- LEARN how to identify invasive plants and animals, and who to contact if found.
- DO NOT PURCHASE prohibited and restricted species! Whenever possible purchase native plants.
- NEVER transplant water garden plants or aquarium plants into lakes, streams, wetlands, or storm water ponds. Properly dispose of unwanted plants and animals!
- REMOVE invasive exotic plants from your landscape and replace them with native plants or non-invasive exotic plants. Scout annually for new invasive plants.
- AVOID using garden plants from other regions whose invasive potential is poorly understood.

Lakes and Rivers:

- LEARN what Wisconsin invasive plants and animals look like and who to contact if seen in a lake or river.
- INSPECT your boat, trailer and equipment when traveling to different water bodies and REMOVE any attached aquatic plants or animals (before launching, after loading, and before transporting on a public highway).
- DRAIN all water from boats, motors, and all equipment after use at a lake.
- NEVER release live fish, bait or pets into a wetland or water body.
- BUY minnows from a Wisconsin bait dealer. Only use leftover minnows at that same water body.

Wadley Lake – Primary Researchers

Algae

Dr. Bob Bell (UW-Stevens Point)

Aquatic Plants

Jen McNelly (UW-Stevens Point)

Cultural Survey

Dr. Kristin Floress (UW-Stevens Point)

Fisheries and Lake Maps

Dr. Ron Crunkilton (UW-Stevens Point) and Dr. Justin Sipiorski (UW-Stevens Point)

Christine Koeller (UW-Stevens Point)

Sediment Core

Dr. Samantha Kaplan (UW-Stevens Point) and Paul Garrison (Wisconsin DNR)

Shoreland Assessments and Build Out

Dan McFarlane (UW-Stevens Point)

Water Quality and Watersheds

Nancy Turyk (UW-Stevens Point)

Zooplankton

Dr. Chris Hartleb (UW-Stevens Point)

UW-Stevens Point Graduate and Undergraduate Students

Project support provided by:

- *Wisconsin DNR Lake Protection grants*
- *UW-Stevens Point and UW-Stevens Point Faculty*
- *Marathon County*
- *Marathon County Citizens*

For more information about the study:

UW- Stevens Point: Nancy Turyk, 715-346-4155 Email: mclakes@uwsp.edu

Marathon County: Shawn Esser, 715-261-6010

http://www.co.marathon.wi.us/Departments/ConservationPlanningZoning/ConservationDivision/LakePrograms.aspx

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