Big Hills Lake

Final Study Results 2013

University of Wisconsin–Stevens Point
and
Waushara County Staff and Citizens
To protect the lake we must protect the “watershed,” the land that drains or sheds its water into the lake.
Big Hills Lake – Location

Southwest of Saxeville
East of County Road G
Township of Mount Morris

Surface Area: 125 acres
Maximum Depth: 22 feet

Water Flow

- Big Hills Lake is a seepage lake; most of its water enters via groundwater. Surface water runoff and direct precipitation also contribute water to lesser extents.
- Most water exits Big Hills Lake through groundwater outflow.

WAUSHARA COUNTY LAKES STUDY –

1 Pine (Springwater)    18 W. Branch Mill Pond
2 Twin                 19 Porters
3 Gilbert               20 Pearl
4 Long (Saxeville)     21 Johns
5 Long (Oasis)         22 Bughs
6 Huron                23 Irogami
7 Wilson               24 Alpine
8 Kusel                25 Silver (Wautoma)
9 Silver (Springwater) 26 Deer
10 Round               27 Little Hills
11 Big Hills           28 White Riv. Flowage
12 Napowan             29 Witters
13 Beans               30 Lucerne
14 Morris              31 Spring
15 Pine (Hancock)      32 Curtis
16 Fish                33 Pleasant
17 Marl
Land uses and land management practices occurring in a watershed affect the water quality in a 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 Big Hills Lake is 498 acres.
- The primary land use in the watershed is developed land.
- Wetlands, forest, and developed land surround Big Hills Lake. Generally, the land closest to the lake has the greatest immediate impact on water quality.
**Groundwater** provides water to lakes in Waushara 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 the winter and between rains. Groundwater pumping can also reduce the amount of water entering lakes.

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.

On the map below, arrows indicate the direction of groundwater flow to and from the lakes. Most of the groundwater enters Big Hills Lake from the northwest.
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 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.

Shorelands around Big Hills Lake were surveyed in 2011. Much of the shoreland vegetation is in poor condition and is in need of restoration.
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 in the water and utilize nutrients that would otherwise be used by algae. A healthy lake typically has a variety of aquatic plants creating diversity that can help to prevent the establishment of aquatic invasive species.

- The aquatic plant community in Big Hills Lake is characterized by an average diversity of plant species when compared to other lakes in the Waushara County Lakes Study, with a total of 16 species.
- During the 2013 aquatic plant survey of Big Hills Lake, 46 percent of the sites sampled had vegetative growth.
- The maximum depth at which aquatic plant growth was found was 20 feet.
- The lack of intensive high-speed boating helps to preserve the integrity of Big Hills Lake by reducing disturbance to the lakebed. Disturbed conditions often encourage the colonization of aquatic invasive species.
The two most frequently encountered plant species were muskgrass (*Chara* spp.) and variable-leaf pondweed.

Three species had a C-value of 8 or greater, indicating good health in the aquatic plant community.

Eurasian water milfoil (EWM) was documented at the far western side of the lake near the boat landing. EWM can create dense beds which can damage boat motors, make areas non-navigable, and prevent activities like swimming and fishing.

**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 food sources are available.

The floating and submerged leaves of **variable-leaf pondweed** differ in shape and size. This plant provides habitat for many insects, which are important food sources for fish and other wildlife. The seeds are consumed by waterfowl.

**Chara** 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 Chara grows densely because of its ability to filter nutrients from water.
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 remove. Prevention and early detection are the best ways to keep aquatic invasive species from establishing in a lake.

### Lakes with Aquatic Invasive Species in Waushara County, 2012

<table>
<thead>
<tr>
<th>Lake Name</th>
<th>Banded Mystery Snail</th>
<th>Chinese Mystery Snail</th>
<th>Rusty Crayfish</th>
<th>Curly Leaf Pondweed</th>
<th>Eurasian Water Milfoil</th>
<th>Hybrid Eurasian/Northern Water Milfoil</th>
<th>Zebra Mussel</th>
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Learn to identify invasive species & look for them in your lake!
Big Hills 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.
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 Waushara 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 the lake was well-mixed in the spring and fall are displayed in the graph to the left.

In samples collected during fall and spring 2010-2012, the average total phosphorus level indicated that Big Hills Lake was slightly higher compared with earlier samples and may be transitioning towards a mesotrophic category. 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 Waushara 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.

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 measurements taken between April and November. It is typical for water clarity to vary throughout the year.

During the summers of 2011 and 2012, on average the poorest water clarity in Big Hills Lake was 10.5 feet in August and the best was 18 feet in July. The 2011-12 average water clarity in June and July was better compared to historic measurements.
Big Hills Lake – What can you do to help?

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 shorland vegetation in place or restore if it has been removed
- Learn to identify and look for invasive species

Home Owners:
- Leave natural shorland 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 know 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.
Big Hills Lake – Primary Researchers

Aquatic Plants
Golden Sands Resource Conservation & Development Council, Inc.

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

Shoreland Assessments
Ed Hernandez and Waushara County Land Conservation Department Staff

Dan McFarlane (UW-Stevens Point)

Water Quality and Watersheds
Nancy Turyk, Dr. Paul McGinley, Danielle Rupp and Ryan Haney (UW-Stevens Point)

Ed Hernandez and Waushara County Land Conservation Department Staff

UW-Stevens Point Students

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