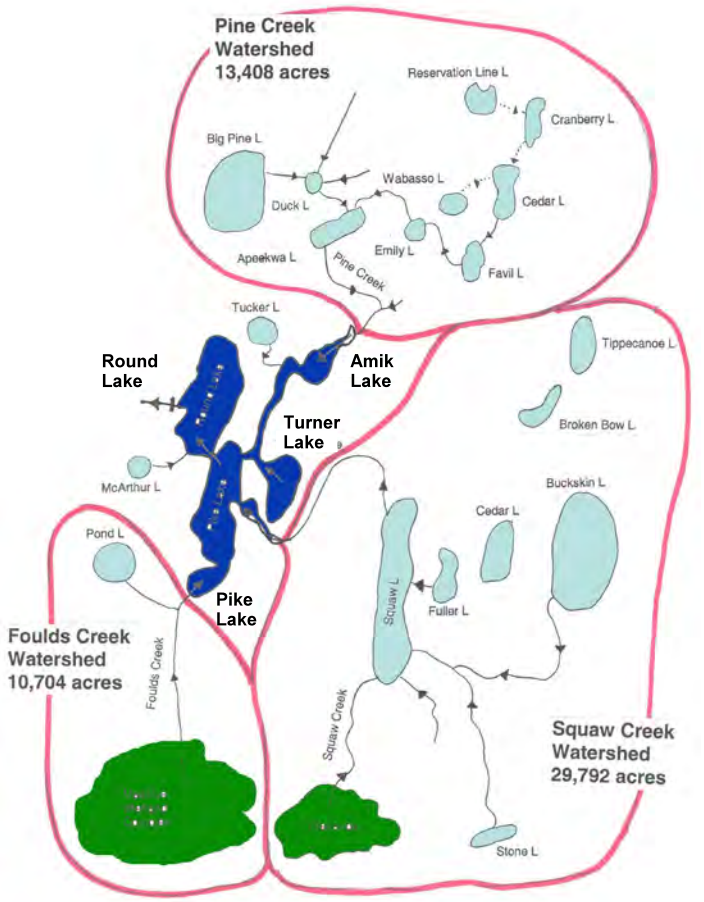
Pike Lake Chain of Lakes Report
PRICE AND VILAS COUNTIES, WISCONSIN
Summary of the Lake Management Study

Prepared by Blue Water Science, St. Paul, MN, May 2012

Wetlands Impact Lake Water Quality in Major Ways

The Pike Lake Chain of Lakes is water rich. The large drainage area (over 61,000 acres), generates a large quantity groundwater and surface water runoff. Pike Lake has the largest watershed and Turner Lake has the smallest. However, Turner Lake may receive water from Amik Lake and maybe even Pike Lake. If this is the case, the "potential" watershed of Turner Lake would be much larger. Wetlands in the watershed comprise the largest land use category. The springs that come out of the wetlands carry wetland breakdown products which produce a brownish-red stain to the water. This is a natural occurrence. The 'bog' stain will be extra heavy when there is a "wet" year (a lot of rain) following a "dry" year (below average rain). The wetlands are purged and the reddish color as well as phosphorus, have a high concentration that reaches the lakes. This occurred in 2010.



Approximate watersheds (red outline) and wetlands (green) and other lakes in the Pike Lake Chain of Lakes.

Lake and Watershed Statistics

Amik Lake

Lake size (acres)	224
Mean depth (feet)	5
Maximum depth (feet)	8
Full watershed area (not including lake)	15,023
Water clarity (feet)(Secchi disc)(2010)	4.6
Lake phosphorus (parts per billion)(2010)	36

Pike Lake

Lake size (acres)	806
Mean depth (feet)	11
Maximum depth (feet)	17
Full watershed area (not including lake)	58,596
Water clarity (feet)(Secchi disc)(2010)	3.3
Lake phosphorus (parts per billion)(2010)	44

Round Lake

Lake size (acres)	726
Mean depth (feet)	16
Maximum depth (feet)	24
Full watershed area (not including lake)	61,274
Water clarity (feet)(Secchi disc)(2010)	4.6
Lake phosphorus (parts per billion)(2010)	31

Turner Lake

Lake size (acres)	149
Mean depth (feet)	8
Maximum depth (feet)	12
Full watershed area (not including lake)	567
Water clarity (feet)(Secchi disc)(2010)	6.6
Lake phosphorus (parts per billion)(2010)	24

Stream Characteristics

Pine Creek

Watershed area (ac)	13,408
Average runoff (11 inches = 0.92 ft)	0.92
Amount of water (ac-ft)	12,290
Average flow rate over the year (cubic ft per second)	17

Foulds Creek

Watershed area (ac)	10,704
Average runoff (11 inches = 0.92 ft)	0.92
Amount of water (ac-ft)	9,848
Average flow rate over the year (cubic ft per second)	14

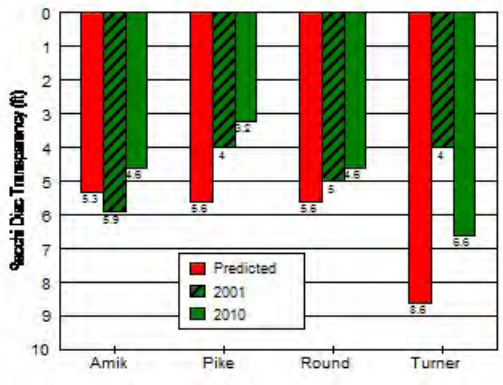
Squaw Creek

Watershed area (ac)	29,792
Average runoff (11 inches = 0.92 ft)	0.92
Amount of water (ac-ft)	27,408
Average flow rate over the year (cubic ft per second)	37

Water Quality Influenced by Watershed Inputs and Lake Processes

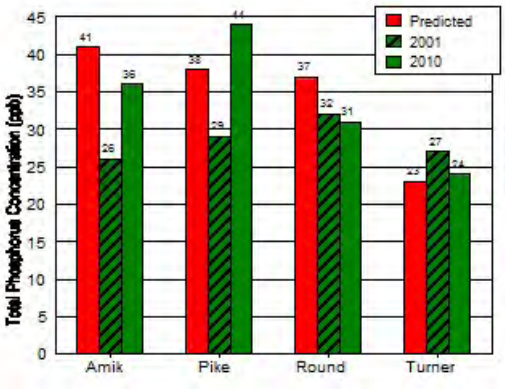
The water quality of the Pike Lake Chain of Lakes is fair and water is not as clear as in other area lakes, but the water flow and nutrient inputs are greater than other lakes due to the large watershed. However, not all of the Pike Lake Chain of Lakes are impacted the same way. Pike Lake may have the biggest response to stream inflows. Both the Foulds Creek and Squaw Creek watershed flows enter Pike Lake. On the other hand, Turner Lake has a smaller watershed but has soft lake sediments. Boat traffic and wind mixing may contribute to the lower-than-predicted lake clarity.

Clarity (Secchi Disc)



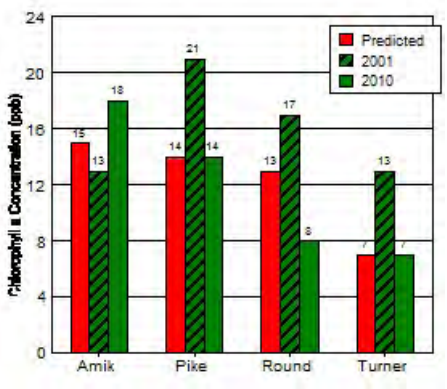
Clarity is not as good as predicted for the four lakes. This is due, in part, to the "bog" stain that colors the water and reduces transparency in Pike and Round.

Total Phosphorus



Total phosphorus is somewhat high, but close to what would be predicted, based on stream phosphorus concentrations.

Algae (Chlorophyll)



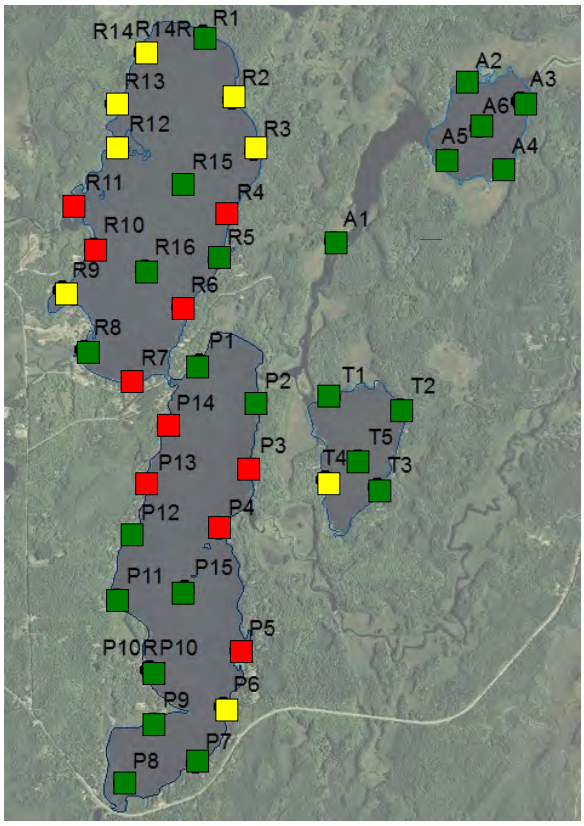
The algae concentration was close to predicted or slightly higher than expected in 2001.

Lakes Are Located In a Natural Setting

The land use in the watershed of the Pike Lake Chain of Lakes is dominated by natural areas of forests, wetlands, and lakes. Although water quality is not at US EPA Lake and Forest Ecoregion benchmarks for clarity (8-15 feet), total phosphorus (14-27 ppb), or chlorophyll (less than 10 ppb), the existing water quality of the Pike Lake Chain of Lakes reflect a naturally eutrophic condition. There is not much that can be done to lower the phosphorus concentration in the lakes. The lake phosphorus concentrations are close to what would be predicted based on stream phosphorus levels measured in 2001 and in 2010 (results are shown in the graphs above) and stream phosphorus levels are at natural background levels. In addition, in Pike and Round, there may be some phosphorus release from the lake sediments as well. Lake sediments were tested in 2010 and phosphorus release potential is shown to the right. Ongoing lake protection projects should be continued, such as maintaining shoreland buffers and maintaining onsite systems. Expensive lake restoration projects to reduce stream phosphorus concentrations would not be practical at this time.

Interesting Lake Facts

- Estimated 90% of the Pike Lake Chain of Lakes shoreline has a natural vegetative buffer.
- There is enough water flowing out of Round Lake to supply a City of 780,000 (at 65 gallons per person per day)



Lake sediment sample locations are shown with color squares. Colored squares represent phosphorus release potential at that site. Key: Green = low; Yellow = moderate; and Red = high.

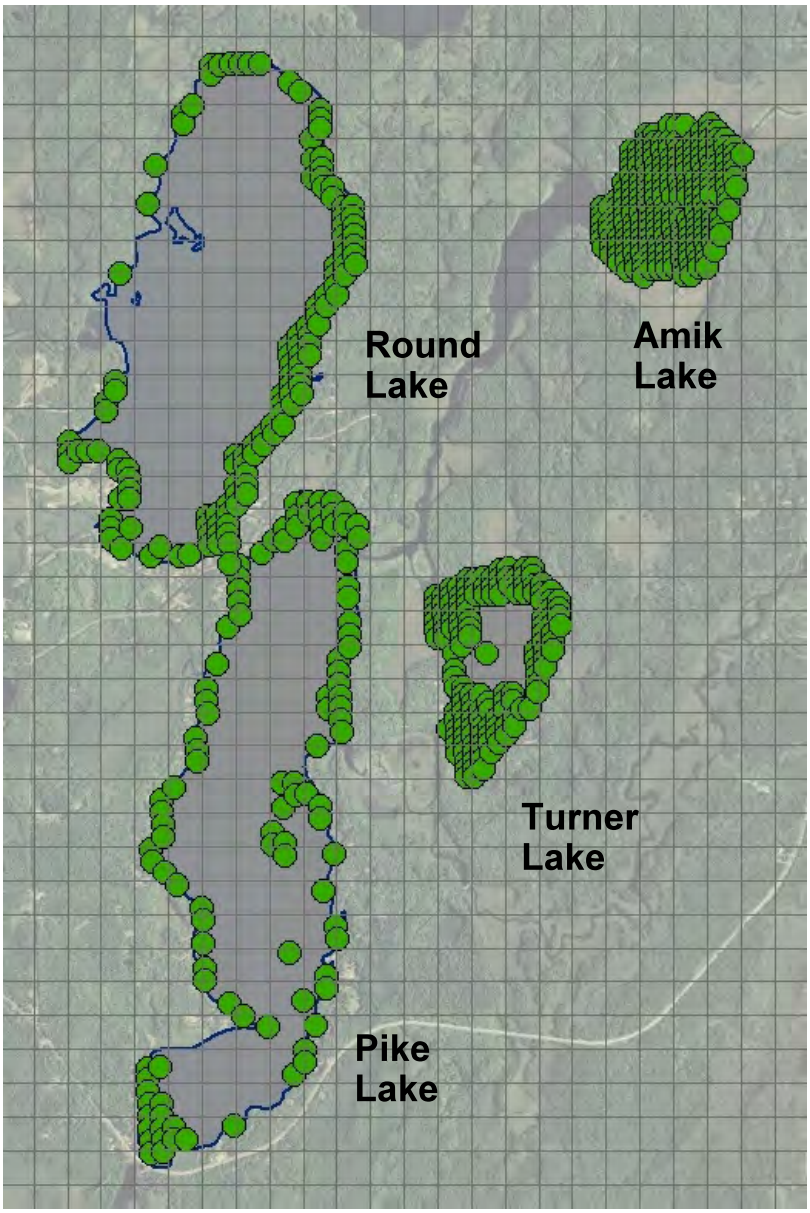
Updated Aquatic Plant Surveys Shows Fair Diversity in All Four Lakes

The number of aquatic plant species found in the four Pike Lake Chain of Lakes ranges from 15 (Round) to 19 (Pike). However the depth of water that plants grow to varies. Amik is a shallow lake and plants were found throughout the lake. Turner had pretty good plant distribution with growth out to 11 feet of water depth. Plant growth in Pike and Round Lakes did not go much deeper than 9 feet. Because Pike and Round drop off relatively quickly, aquatic plant growth is restricted to the nearshore areas at these two lakes.

Plant assemblages (groups of plant species) were similar for Pike and Round Lakes and water celery was the most common plant. Amik and Turner Lakes had different dominant plants which likely reflects different bottom conditions and shallower depths. The dominant plant in Amik was fern pondweed and the dominant plant in Turner was elodea.

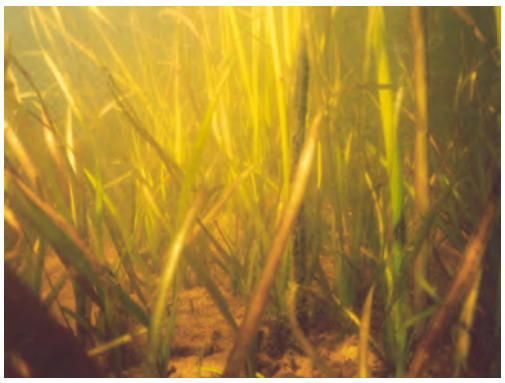
No submerged aquatic invasive plant species (curlyleaf pondweed or Eurasian watermilfoil) were observed in the four lakes.

Aquatic plants are essential for sustaining good water quality and maintaining a good fishery. No aquatic plant projects are needed at this time, but plant surveys every few years would help track potential declines with a call for improvement projects.

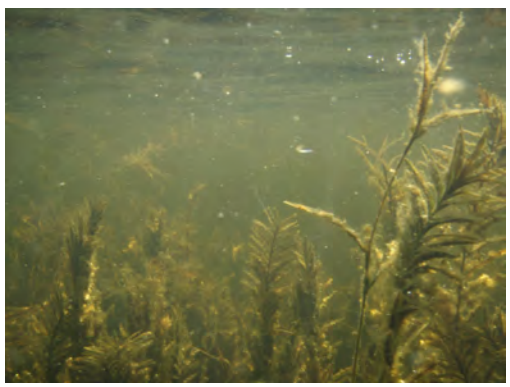


Native Plant Distribution (shown in green) in the Pike Lake Chain, 2010.

Three most common aquatic plants in the Pike Lake Chain are shown below.



Water Celery (dominant plant in Pike and Round)



Fern Pondweed (dominant in Amik)

Elodea (dominant in Turner)

Aquatic Invasive Species Potential for Significant Growth is Low

Based on lake characteristics that were evaluated for this report, it was found that a majority of the invasive species of concern will not grow very well in the Pike Chain of Lakes. For example, two submerged non-native aquatic plants, curlyleaf pondweed and Eurasian watermilfoil, have specific sediment chemistry requirements and sediment samples from all four Pike Lake Chain of Lakes indicate the chemistry may not be optimal. For curlyleaf, it was found most of the lake sediments had high iron which is correlated to light growth of curlyleaf. For Eurasian watermilfoil, a majority of the lake sediments had low to moderate nitrogen concentrations which is correlated with light growth of milfoil.

For another invasive species of concern, the zebra mussel, it was found the calcium concentration in the water column, which is critical for shell production, was moderate. Therefore, zebra mussel growth would not likely reach optimal conditions. However, it is still important to implement and maintain good AIS prevention programs on an ongoing basis.

Overview of eight aquatic invasive species that could impact The Pike Lake Chain are listed below. As of 2010, curlyleaf pondweed, Eurasian watermilfoil, and zebra mussels have not been observed in the Pike Lake Chain.

Species	Pike Lake Chain Status	Potential for Nuisance Colonization in the Pike Lake Chain	Management Action	
			Short Term	Long Term
Plants				
1. Curlyleaf pondweed	Not in the Pike Lake Chain of Lakes	low	annual surveys by consultant or residents	selective treatment for nuisance growth conditions
2. Eurasian watermilfoil	Not in the Pike Lake Chain of Lakes	low to moderate	annual surveys by consultant or residents	selective treatment for nuisance growth conditions
3. Purple loosestrife	In the area	moderate	annual surveys by residents	spot control and use of beetles for large area control
Invertebrate				
4. Zebra mussels	Absent, but in Price County	moderate	mussel monitoring devices for early detection	contingency funds for aggressive rapid response
5. Rusty crayfish	Present in Turner Lake	low to moderate	crayfish traps to monitor the population	use existing fish to control rusty crayfish
6. Chinese mystery snail	Present in Pike Lake	moderate	no action needed	no action needed
Species to Watch				
7. VHS	absent	moderate to high	information and education	
8. Hydrilla	absent	low to moderate	information and education	

Curlyleaf Pondweed, an invasive aquatic plant, is not found in the Pike Lakes Chain. It has a low to moderate growth potential.

Eurasian Watermilfoil, an invasive aquatic plant, is not found in the Pike Lakes. It has a low growth potential in the Pike Chain.

Zebra Mussel, an invasive aquatic mollusk, is not found in the Pike Lakes. It has a low to moderate growth potential in the Pike Lake Chain.