Circle Lake Report

Rice County, MINNESOTA

Summary of the Lake Management Study

Field Work:

Circle Lake Management Program Formulated

Watershed and Fish Projects Should Improve Conditions

Circle Lake is a 837 acre lake in the Rice County, Minnesota.

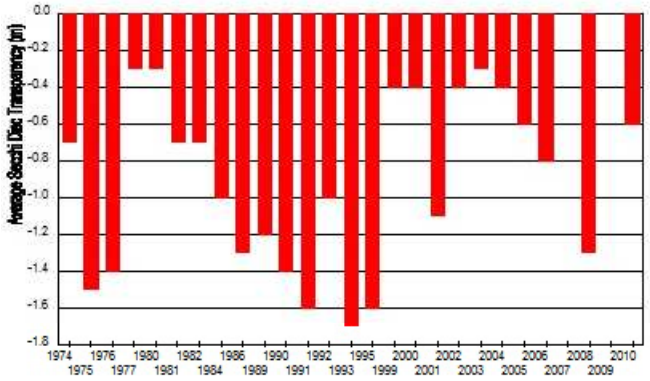
The Circle Lake Association authorized a lake and watershed evaluation of Circle Lake in 2010. The objectives of the evaluation were to characterize the water chemistry, the aquatic plants, and the fish community in Circle Lake as well as evaluate watershed conditions and then prepare lake management ideas.

Circle Lake, Rice County, Minnesota

Water Quality: Circle Lake (Figure 5) was sampled at one location in May, June, July, and August. Results are shown below. Circle Lake has high phosphorus concentrations and poor mid summer clarity. Historical water quality data are shown to the right.

Water quality results for summer sampling in 2010.

	Secchi Disc (ft)	Total Phosphorus (ppb)	Ortho Phosphorus (ppb)	Chlorophyll a (ppb)
June 30, 2010	0.46	525		53
July 25, 2010	0.15	469		315
Sept 27, 2010	0.91	188	149	19
Oct 31, 2010	1.22	159	27	--
Summer Average	0.61	303		129



Summer average water clarity measurements based on Secchi disc measurements for Circle Lake.

Circle Lake Statistics

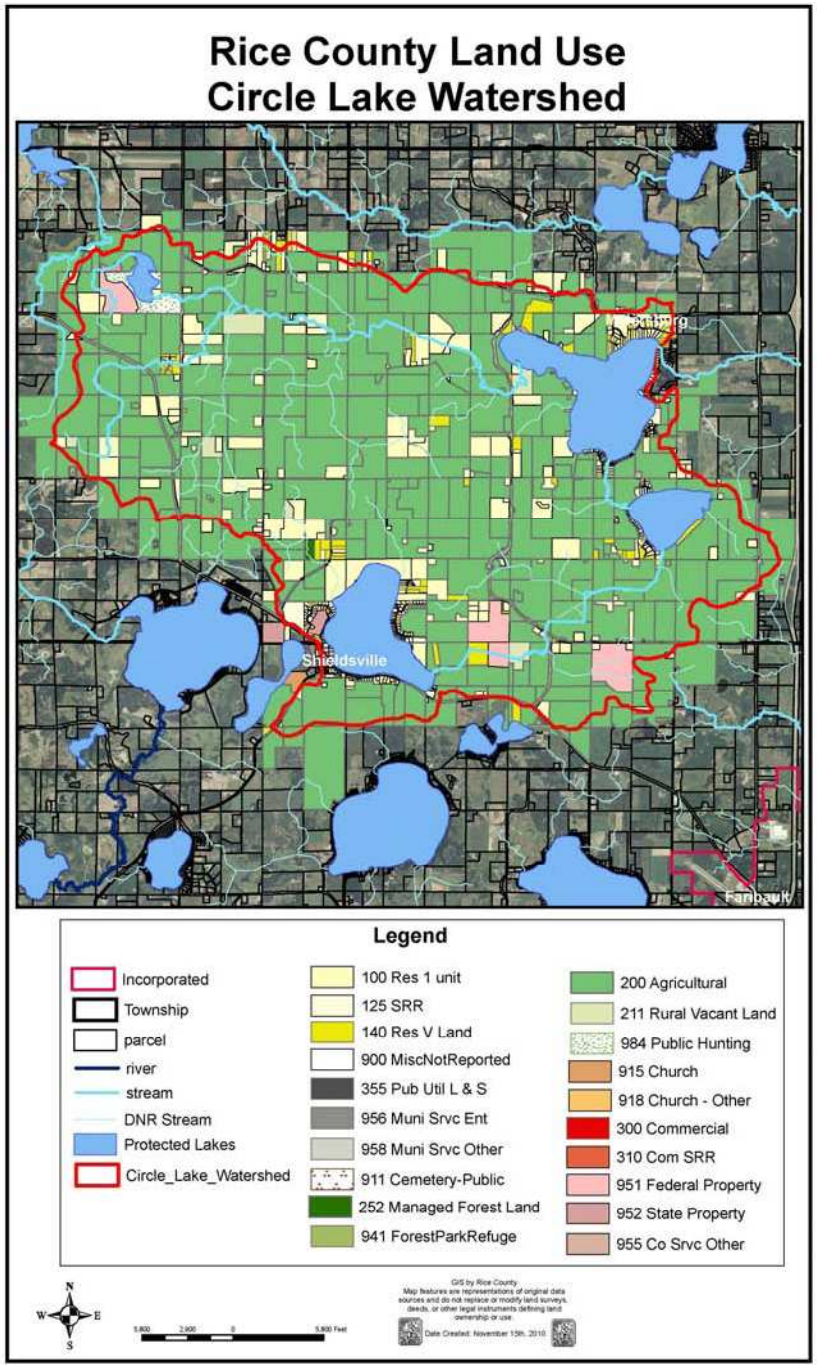
Lake size (acre):. 837
Maximum depth (feet):. 14
Mean depth (feet):. 6
Watershed area (acre):. 23,025
(not including the lake)
Watershed : Lake surface ratio. . 28:1
Clarity in 2010 (feet):. 0.61
Lake phosphorus in 2010 (ppb) . . . 303
Chlorophyll in 2010 (ppb). 129

This special newsletter was prepared by Blue Water Science, St. Paul, Minnesota and is part of a lake management program conducted on Circle Lake. The program was funded by the Circle Lake Association.

Summary of Lake and Watershed Conditions

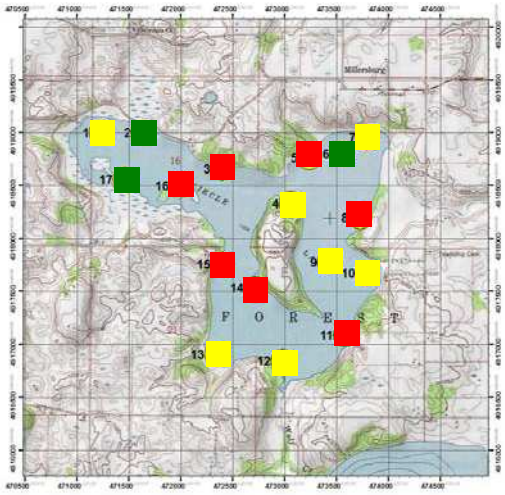
Watershed: A lake's watershed represents the land area that drains to the lake. The land area that drains to Circle Lakes is shown below. When there is a watershed to lake area ratio of less than 10:1 there is a good potential to have good water quality. Circle Lake watershed to lake area ratio is 28:1. That signifies a fairly large watershed and the watershed influence on water quality will be significant. The dominant land use is agricultural.

Stream sampling was also conducted in 2010. County Ditch 32 had higher phosphorus concentrations than Wolf Creek.



The watershed area draining to Circle Lake is outlined with a red line. (Source: Rice County, Minnesota).

Lake Sediment Phosphorus Release Potential: Besides the watershed contribution, another source of nutrients to a lake can be from lake sediments. Lake sediment analysis shows a number of areas with moderate to high potential for phosphorus release from sediments. An application of alum or iron are options for a lake sediment phosphorus control project. Circle Lake may be a candidate for either an alum or a sediment iron application which would lower the phosphorus release rate and improve water quality.



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.

What Is a Watershed?

A watershed is the land area around the lake that captures rainfall and where all the drainage and runoff goes into the lake. It is also called a drainage basin. If the watershed has pollution sources, then the pollution will be carried into the lake with runoff. It is important to reduce the source of pollution in the watershed because this in turn will reduce the amount of pollution that gets into the lake.

Lake Assessment

Circle Lake Status: Circle Lake is an 837 acre in size lake located in an ecoregion called the North Central Hardwood Forest Ecoregion. The Minnesota Pollution Control Agency (MPCA) has set up nutrient criteria for lakes that are located in that ecoregion (column 2). Circle Lake is classified as a shallow lake, so the impaired lake criteria of interest are in column 2.

Impaired Lake Status: Circle Lake fits the criteria for an impaired lake (comparing column 2 to column 3).

Ecoregion Values: Circle Lake is not within ecoregion criteria for clarity, algae, and phosphorus. In fact, Circle Lake has higher phosphorus levels than other lakes in the Central Hardwood Ecoregion.

Circle Lake is located in the North Central Hardwood Forest Ecoregion. Lakes in this ecoergion have water clarity between 5 - 8 feet.

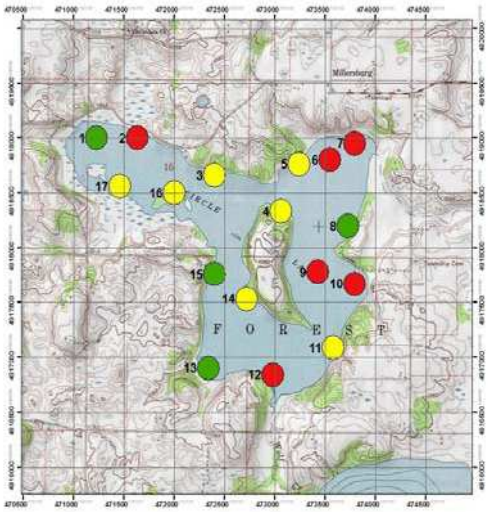
Lake criteria and existing water quality conditions for Circle Lake.

	1. Shallow Lake (MPCA impaired criteria for Western Corn Belt Plains)	2. Shallow Lake (MPCA impaired criteria for North Hardwood Forest Ecoregion)	3. 2010 Existing Values
Secchi Disc (ft & m) (water clarity)	<2.3 ft (<0.7 m)	<3.3 ft (1.0 m)	1.4 ft (0.4m)
Total Phosphorus (fertilizer nutrient)	>90 ppb	>60 ppb	303 ppb
Chlorophyll a (measure of algae)	>30 ppb	>20 ppb	129 ppb

Eurasian Watermilfoil Could Grow to Nuisance Conditions in Circle Lake

Lake sediment sampling results from 2010 have been used to predict lake bottom areas that have the potential to support three types of EWM growth. Eurasian watermilfoil was first observed in Circle Lake in 2010. Based on the key sediment parameters of NH_4 and organic matter (McComas, unpublished), a map was prepared that predicts what type of milfoil growth could be expected in the future.

The sediment nitrogen conditions in Circle Lake range from low to high with sediments over 10 ppm of nitrogen as candidates for heavy milfoil growth. However, several sediment sites have a high percentage of organic matter. It has been found that EWM does not grow well in sediments with over 20% organic matter. Under current sediment conditions, several areas in Circle Lake have the potential to exhibit heavy milfoil growth, whereas other areas would produce light to moderate growth. Poor water clarity could inhibit future milfoil growth and restrict it to shallow water areas.



Sediment sample locations are shown with a circle. The circle color indicates the type of Eurasian watermilfoil growth predicted to occur at that site. Key: green = light; yellow = moderate; red = heavy.

Recommended Lake Management Projects

In order to improve lake conditions and remove Circle Lake from the impaired waters list, a number of watershed and lake projects have been proposed and are shown below.

Summary of projects, costs, and potential funding source or contractor.

List of Projects	Costs	Potential Contributor, Contractor, or Funding Source
1. Watershed Projects		
1-1. Erosion control above mouth of Wolf Creek	$8,000 (does not include dredging costs)	SWCD, Cannon River Watershed Partnership (CRWP)
1-2. Wetland restoration along Ditch 32	$10,000 + depending on easements on land costs	USFWS, LOHC (land purchase), DU
1-3. Cattle management	$5,000 - $10,000	SWCD, Rice County
1-4. Shoreland protection and enhancement (landscaping projects)	$0 - $3,000 per year for 5 years	SWCD, CRWP
2. Fish Management		
2-1. Carp management	5 years @ $30,000/yr = $150,000	Commercial fishermen
2-2. Winter aeration	$1,000 per year (electrical plus maintenance)	Circle Lake Association
3. Aquatic Plant Projects		
3-1. Curlyleaf pondweed control ($300 - $400/ac)	$15,000 - $20,000 per year	MnDNR and Circle Lake Assoc.
3-2. Eurasian watermilfoil control ($400 - $500/ac)	$5,000 - $15,000 per year	MnDNR and Circle Lake Assoc.
4. Lake Sediment Manipulations		
4-1. Alum or iron addition for nutrient control	Alum addition: $660,000 (600 ac @ $1,100/ac) Iron addition: $540,000 (600 ac @ $900/ac)	MPCA
5. Ongoing Education Program	$0	CRWP and Circle Lake Assoc.
6. Lake Monitoring Program	$0 - $800	Circle Lake Association

Example of a carp harvesting operation.