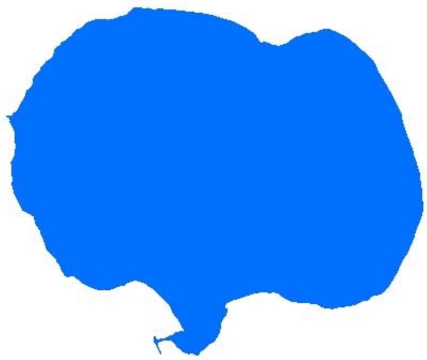
Park Lake

09-0029-00 Carlton County



Park Lake is located 3.4 miles Northwest of Mahtowa, MN in Carlton County. It is a round lake covering 381.28 acres (Table 1).

Park Lake has no inlets and one outlet, which classifies it as a groundwater drainage lake. Because it has an outlet, Park Lake isn't subject to the water level problems that other groundwater lakes experience.

Water quality data have been collected on Park Lake from 1985-2016 (Tables 2 & 3). These data show that the lake is mesotrophic (TSI = 43) with moderately clear water conditions most of the summer and excellent recreational opportunities.

Table 1. Park Lake location and key physical characteristics.

Location Data	
MN Lake ID:	**09-0029-00**
County:	**Carlton**
Ecoregion:	**Northern Lakes and Forests**
Major Watershed:	**Kettle River**
Latitude/Longitude:	**46.618554, -92.652941**
Invasive Species:	**None as of 2018**

Physical Characteristics	
Surface area (acres):	**381.28**
Littoral area (acres):	**375.8**
% Littoral area:	**98.6 %**
Max depth (ft), (m):	**16**
Inlets:	**0**
Outlets:	**1**
Public Accesses:	**1**

Table 2. Availability of primary data types for Park Lake.

Data Availability		
Transparency data		**Good**
Chemical data		**Good**
Inlet/Outlet data	--	**Not necessary**
Recommendations		**For recommendations refer to page 15.**

Lake Map

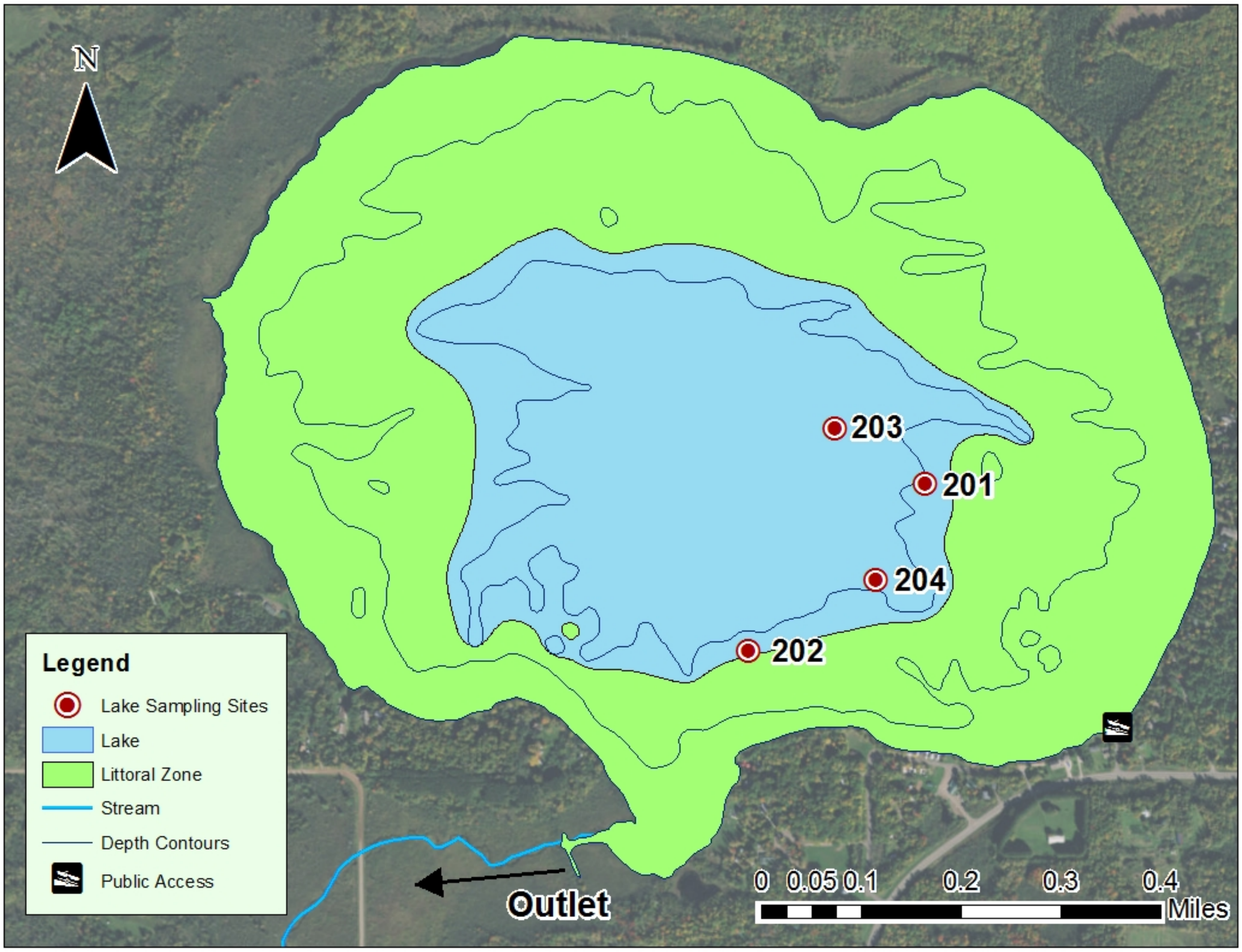


Figure 1. Map of Park Lake with 2010 aerial imagery and illustrations of lake depth contour lines, sample site locations, inlets and outlets, and public access points. The light green areas in the lake illustrate the littoral zone, where the sunlight can usually reach the lake bottom, allowing aquatic plants to grow.

Table 3. Monitoring programs and associated monitoring sites. Monitoring programs include the Citizen Lake Monitoring Program (CLMP), Clean Water Legacy Surface Water Monitoring (CWLSWM), Carlton Soil and Water Conservation District (SWCD), Minnesota Pollution Control Agency (MPCA).

Lake Site	Depth (ft)	Monitoring Programs
203	10	CLMP: 1985-2008; CWLSWM: 2016; SWCD: 2009-2010; MPCA: 1982
204	14	CLMP: 2011-2014
201	10	CLMP: 1974-1975
202	10	CLMP: 1984

Average Water Quality Statistics & Comparisons

The information below describes available chemical data for Park Lake through 2017 (Table 4). Data for total phosphorus, chlorophyll *a*, and Secchi depth are from the primary site 203.

Minnesota is divided into 7 ecoregions based on land use, vegetation, precipitation and geology. The Minnesota Pollution Control Agency (MPCA) has developed a way to determine the "average range" of water quality expected for lakes in each ecoregion[1] (Table 4). Park Lake is in the Northern Lakes and Forests Ecoregion (Figure 2).

The MPCA has developed Impaired Waters Standards for lakes in each ecoregion to determine if a lake is impaired for excess phosphorus/eutrophication (Table 4). Lakes that are over the impaired waters standards are placed on the state's Impaired Waters List[2].

Figure 2. Minnesota ecoregions.

Table 4. Water quality means compared to ecoregion ranges and impaired waters standard.

Parameter	Mean	Ecoregion Range[1]	Impaired Waters Standard[2]	Interpretation
Total phosphorus (ug/L)	16.1	14 – 27	> 30	Results are within the expected range for the Northern Lakes and Forests Ecoregion and the lake is not impaired for excess phosphorus.
[3]Chlorophyll *a* (ug/L)	3.8	4 – 10	> 9	
Chlorophyll *a* max (ug/L)	7.0	< 15		
Secchi depth (ft)	10.0	8 – 15	< 6.5	
Dissolved oxygen	*See page 8*			Dissolved oxygen depth profiles show that the lake mixes periodically in summer.
Total Kjeldahl Nitrogen (mg/L)	0.53	<0.4 – 0.75		Indicates insufficient nitrogen to support summer nitrogen-induced algae blooms.
Alkalinity (mg/L)	37	40 – 140		Indicates some sensitivity to acid rain and soft water.
Color (Pt-Co Units)	45	10 – 35		Indicates some tannins (brown stain).
pH	8.3	7.2 – 8.3		Within the expected range for the ecoregion. Lake water pH less than 6.5 can affect fish spawning and the solubility of metals in the water.
Chloride (mg/L)	2.9	0.6 – 1.2		Slightly above the expected range for the ecoregion, but still considered low level.
Total Suspended Solids (mg/L)	1.7	<1 – 2		Indicates low suspended solids and clear water.
Specific Conductance (umhos/cm)	89.7	50 – 250		Within the expected range for the ecoregion.
TN:TP Ratio	30:1	25:1 - 35:1		Within the expected range for the ecoregion, and shows the lake is phosphorus limited.

[1]The ecoregion range is the 25th-75th percentile of summer means from ecoregion reference lakes: https://www.pca.state.mn.us/quick-links/eda-guide-typical-minnesota-water-quality-conditions
[2]For further information regarding the Impaired Waters Assessment program, refer to http://www.pca.state.mn.us/water/tmdl/index.html
[3]Chlorophyll *a* measurements have been corrected for pheophytin
Units: 1 mg/L (ppm) = 1,000 ug/L (ppb)

Water Quality Characteristics - Historical Means and Ranges

Table 5. Water quality means and ranges for primary sites.

Parameters	Primary Site 203	Site 201	Site 202	Site 204
Total Phosphorus Mean (ug/L):	16.1	-	-	-
Total Phosphorus Min:	10.0			
Total Phosphorus Max:	24.0			
Number of Observations:	18			
Chlorophyll *a* Mean (ug/L):	3.8	-	-	-
Chlorophyll-a Min:	2.0			
Chlorophyll-a Max:	7.0			
Number of Observations:	18			
Secchi Depth Mean (ft):	10.0	8.2	7.0	11.3
Secchi Depth Min:	17.0	7.5	6.0	6.9
Secchi Depth Max:	5.5	9.5	8.0	15.4
Number of Observations:	284	15	4	37

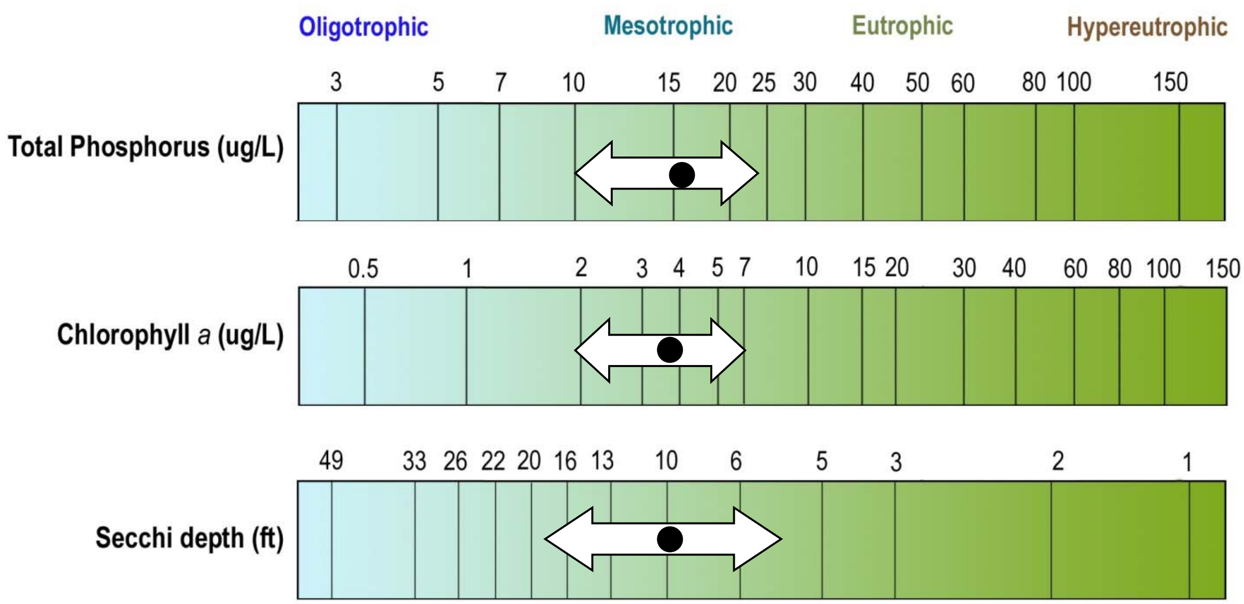


Figure 3. Park Lake total phosphorus, chlorophyll a and transparency historical ranges. The arrow represents the range and the black dot represents the historical mean (Primary Site 203). Figure adapted after Moore and Thornton, [Ed.]. 1988. Lake and Reservoir Restoration Guidance Manual. (Doc. No. EPA 440/5-88-002)

Transparency (Secchi Depth)

Transparency is how easily light can pass through a substance. In lakes it is how deep sunlight penetrates through the water. Plants and algae need sunlight to grow, so they are only able to grow in areas of lakes where the sun penetrates. Water transparency depends on the number of particles in the water. An increase in particulates results in a decrease in transparency. The transparency varies year to year due to changes in weather, precipitation, lake use, flooding, temperature, lake levels, etc.

The annual mean transparency in Park Lake ranges from 8.0 to 12.0 feet (Figure 4). The annual means hover fairly close to the long-term mean. For trend analysis, see page 10. Transparency monitoring should be continued annually at site 203 to track water quality changes.

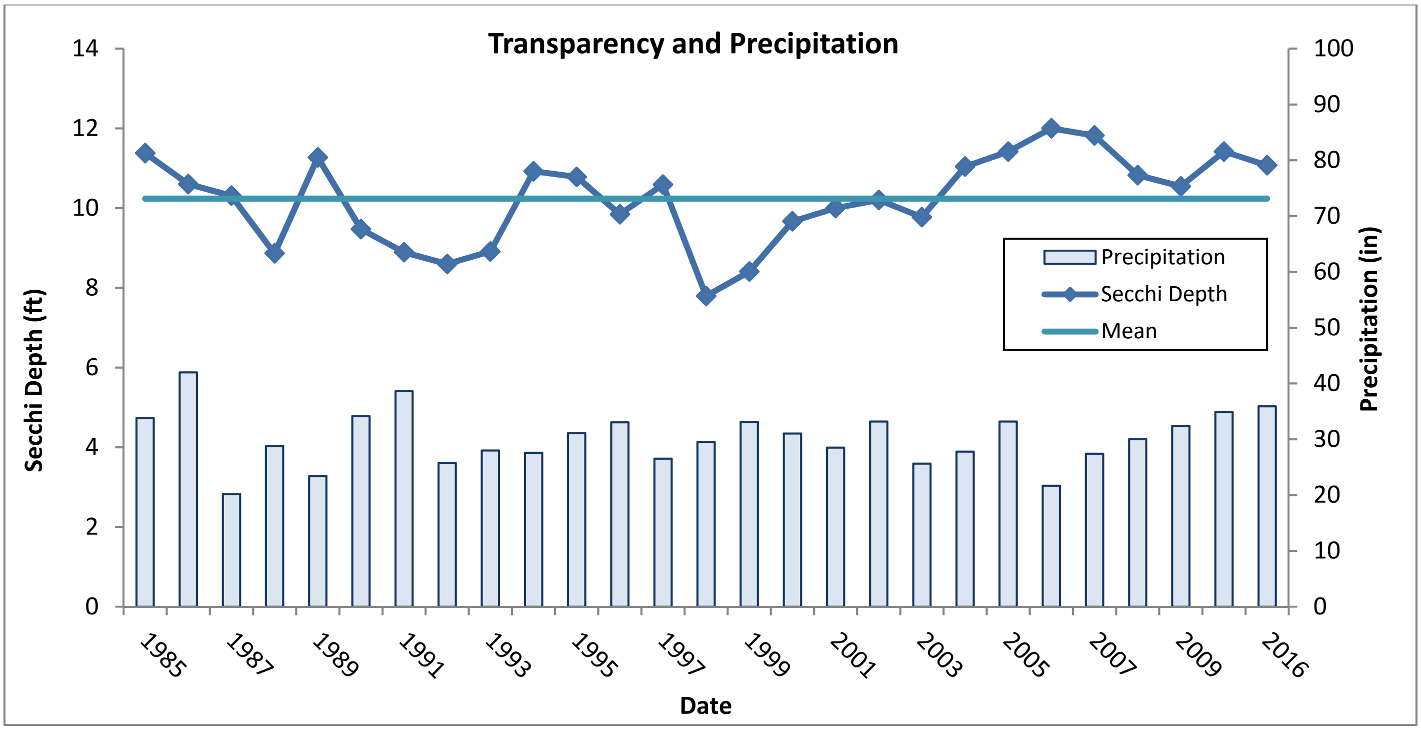


Figure 4. Annual mean transparency compared to long-term mean transparency

Park Lake transparency ranges from 5.5 to 17.0 ft at the primary site (203). Figure 5 shows the seasonal transparency dynamics. The maximum Secchi reading is usually obtained in early summer. Park Lake transparency is high in May. It then declines through June, July, and August. The transparency then rebounds in September and October after fall turnover. This transparency dynamic is typical of a Minnesota lake. The dynamics have to do with algae and zooplankton population dynamics, and lake turnover.

It is important for lake residents to understand the seasonal transparency dynamics in their lake so that they are not worried about why their transparency is lower in August than it is in June. It is typical for a lake to vary in transparency throughout the summer.

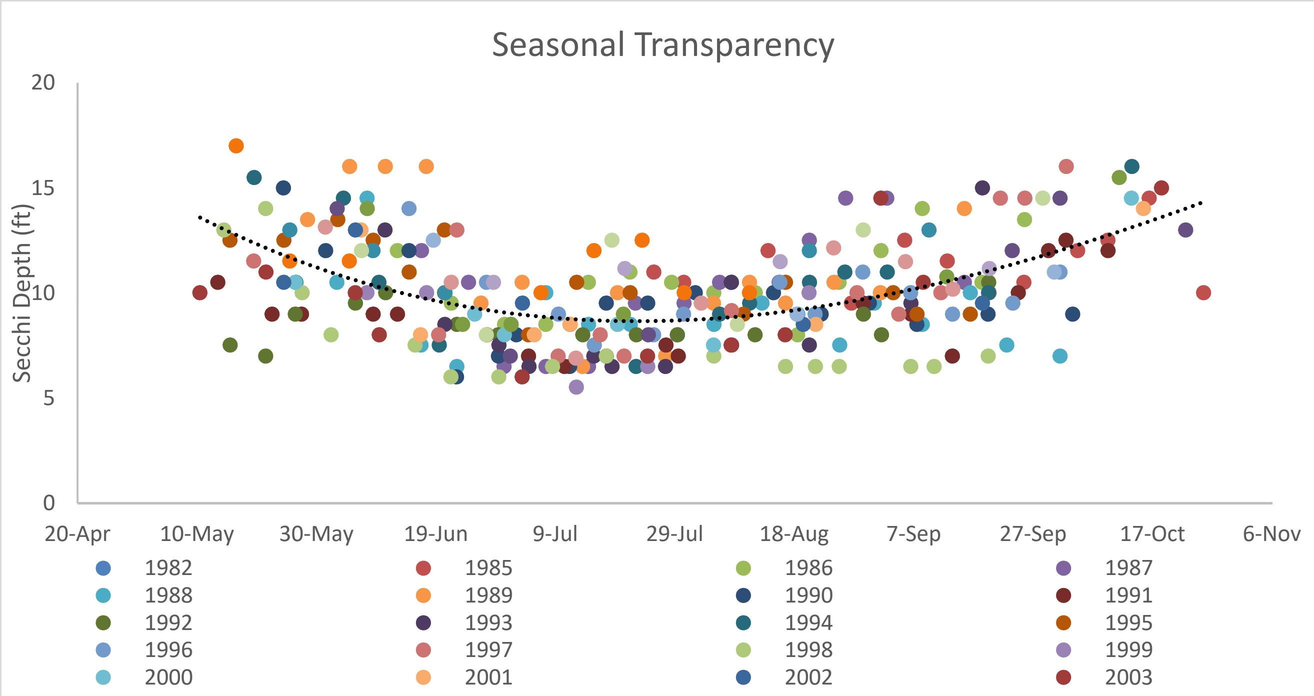


Figure 5. Seasonal transparency dynamics and year to year comparison (Primary Site 203). The black line represents the pattern in the data.

User Perceptions

When volunteers collect Secchi depth readings, they record their perceptions of the water based on the physical appearance and the recreational suitability. These perceptions can be compared to water quality parameters to see how the lake "user" would experience the lake at that time. Looking at transparency data, as the Secchi depth decreases the perception of the lake's physical appearance and recreational suitability decreases (Figures 6-7).

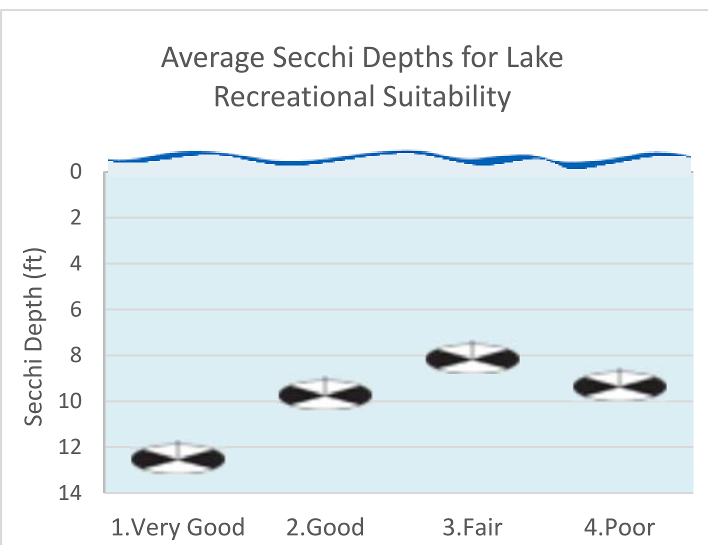


Figure 6. Average Secchi depth (ft) for each lake recreational suitability rating.

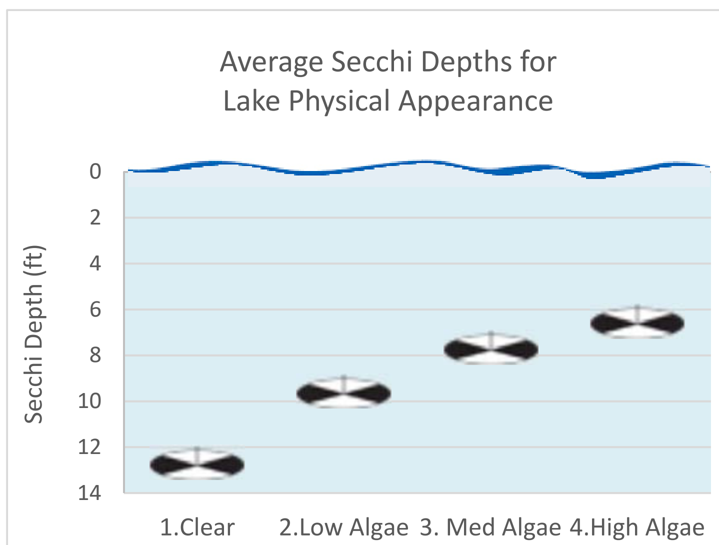


Figure 7. Average Secchi depth for each lake physical appearance rating.

Algae

Chlorophyll *a* is the pigment that makes plants and algae green. Chlorophyll *a* is tested in lakes to determine the algae concentration or how "green" the water is.

Chlorophyll *a* concentrations greater than 10 ug/L are perceived as a mild algae bloom, while concentrations greater than 20 ug/L are perceived as a nuisance.

Chlorophyll *a* has been consistently low in Park lake throughout the four years of monitoring. (Figure 8).

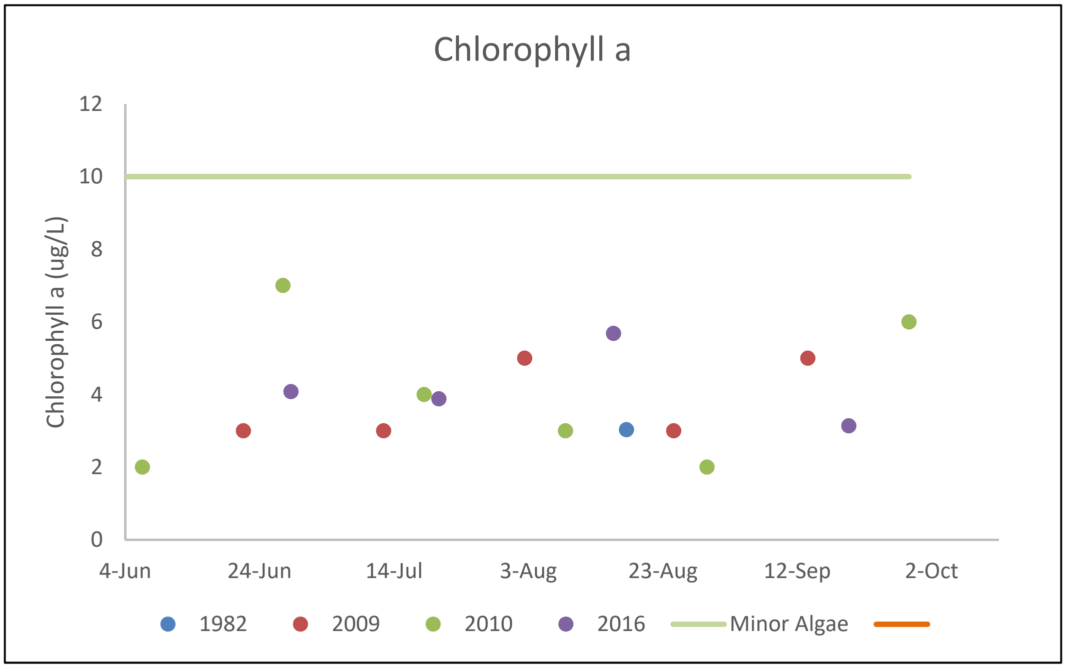


Figure 6. Chlorophyll a concentrations (ug/L) for Park Lake at site 203.

Chlorophyll *a* concentrations did not exceed 10 ug/L, indicating clear water for most of the summer. There was not much variation over the years monitored and chlorophyll *a* concentrations remained relatively steady over the summer.

Phosphorus

Park Lake is phosphorus limited, which means that algae and aquatic plant growth is dependent upon available phosphorus.

Total phosphorus was evaluated in Park Lake in 2009-2010, 2016. The data do not indicate much seasonal variability. All the data points fall into the mesotrophic range (Figure 9).

Phosphorus should continue to be monitored to track any future changes in water quality.

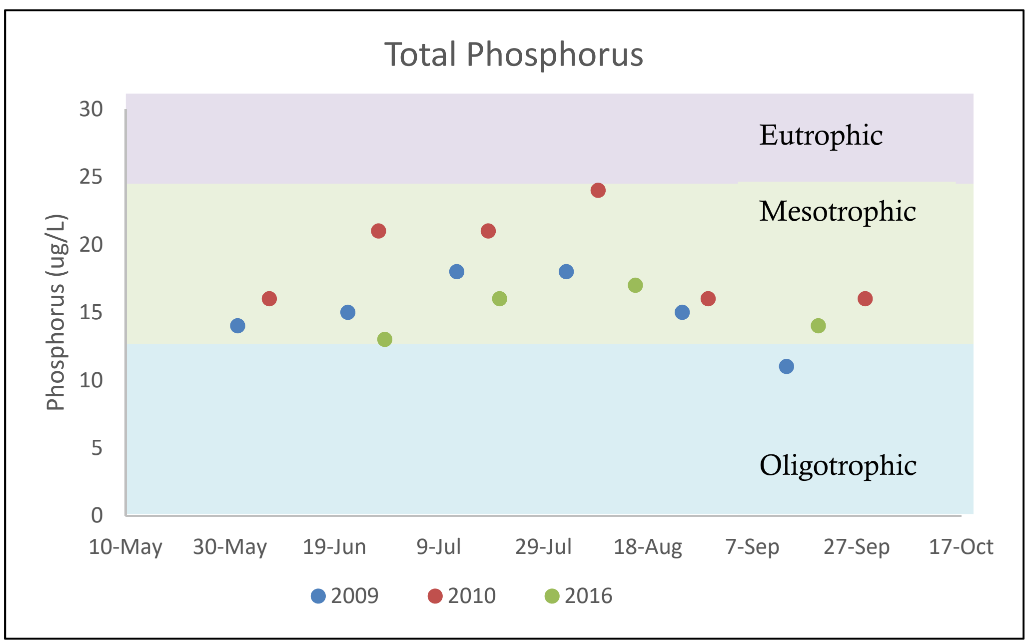


Figure 7. Historical total phosphorus concentrations (ug/L) for Park Lake site 203.

Oxygen

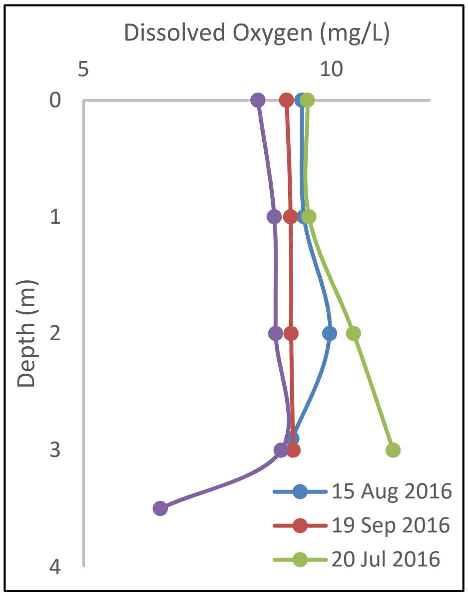


Figure 8. Representative dissolved oxygen profiles from 2016 in Park Lake.

Dissolved Oxygen (DO) is the amount of oxygen dissolved in lake water. Oxygen is necessary for all living organisms to survive except for some bacteria. Living organisms breathe in oxygen that is dissolved in the water. Dissolved oxygen levels of <5 mg/L are typically avoided by game fisheries.

Park Lake is a shallow lake, with a maximum depth of 16 feet. Dissolved oxygen profiles from data collected in 2016 at site 203 show the lake mixes throughout the summer (Figure 10). In a shallow lake, the water column never completely stratifies. Any windy day can mix up the water column causing phosphorus from the anoxic lake bottom to re-suspend into the water. This phenomenon is known as internal loading.

Trophic State Index (TSI)

TSI is a standard measure or means for calculating the trophic status or productivity of a lake. More specifically, it is the total weight of living algae (algae biomass) in a waterbody at a specific location and time. Three variables, chlorophyll a, Secchi depth, and total phosphorus, independently estimate algal biomass.

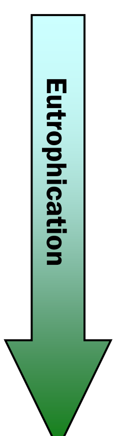
If all three TSI numbers are within a few points of each other, they are strongly related. If they are different, there are other dynamics influencing the lake's productivity, and TSI mean should not be reported for the lake. Park Lake falls into the mesotrophic range (Tables 6, 7).

Table 6. Trophic State Index for Park Lake.

Trophic State Index	
TSI Phosphorus	44
TSI Chlorophyll-a	44
TSI Secchi	42
TSI Mean	43
Trophic State:	Mesotrophic

Numbers represent the mean TSI for each parameter.

Table 7. Trophic state index attributes and their corresponding fisheries and recreation characteristics.



Park Lake

TSI	Attributes	Fisheries & Recreation
<30	**Oligotrophy:** Clear water, oxygen throughout the year at the bottom of the lake, deep cold water.	Trout fisheries dominate.
30-40	Bottom may become anoxic (no oxygen).	Trout fisheries in deep lakes only. Walleye, Cisco present.
40-50	**Mesotrophy:** Water moderately clear most of the summer. May be "greener" in late summer.	No oxygen at the bottom of the lake results in loss of trout. Walleye may predominate.
50-60	**Eutrophy:** Algae and aquatic plant problems possible. "Green" water most of the year.	Warm-water fisheries only. Bass may dominate.
60-70	Blue-green algae dominate, algal scums and aquatic plant problems.	Dense algae and aquatic plants. Low water clarity may discourage swimming and boating.
70-80	**Hypereutrophy:** Dense algae and aquatic plants.	Water is not suitable for recreation.
>80	Algal scums, few aquatic plants.	Rough fish (carp) dominate; summer fish kills possible.

Source: Carlson, R.E. 1997. A trophic state index for lakes. *Limnology and Oceanography*. 22:361-369.

Trend Analysis

For detecting trends, a minimum of 8-10 years of data with 4 or more readings per season are recommended. Minimum confidence accepted by the MPCA is 90%. This means that there is a 90% chance that the data are showing a true trend and a 10% chance that the trend is a random result of the data. Only short-term trends can be determined with just a few years of data, because there can be different wet years and dry years, water levels, weather, etc, that affect the water quality naturally.

Park Lake had enough data to perform a trend analysis on transparency (Table 8). The data was analyzed using the Mann Kendall Trend Analysis.

Table 8. Trend analysis for Park Lake.

Lake Site	Parameter	Date Range	Trend
203	Total Phosphorus	2009-2010, 2016	Insufficient Data
203	Chlorophyll *a*	2009-2010, 2016	Insufficient Data
203	Transparency	1985-2010	No Trend

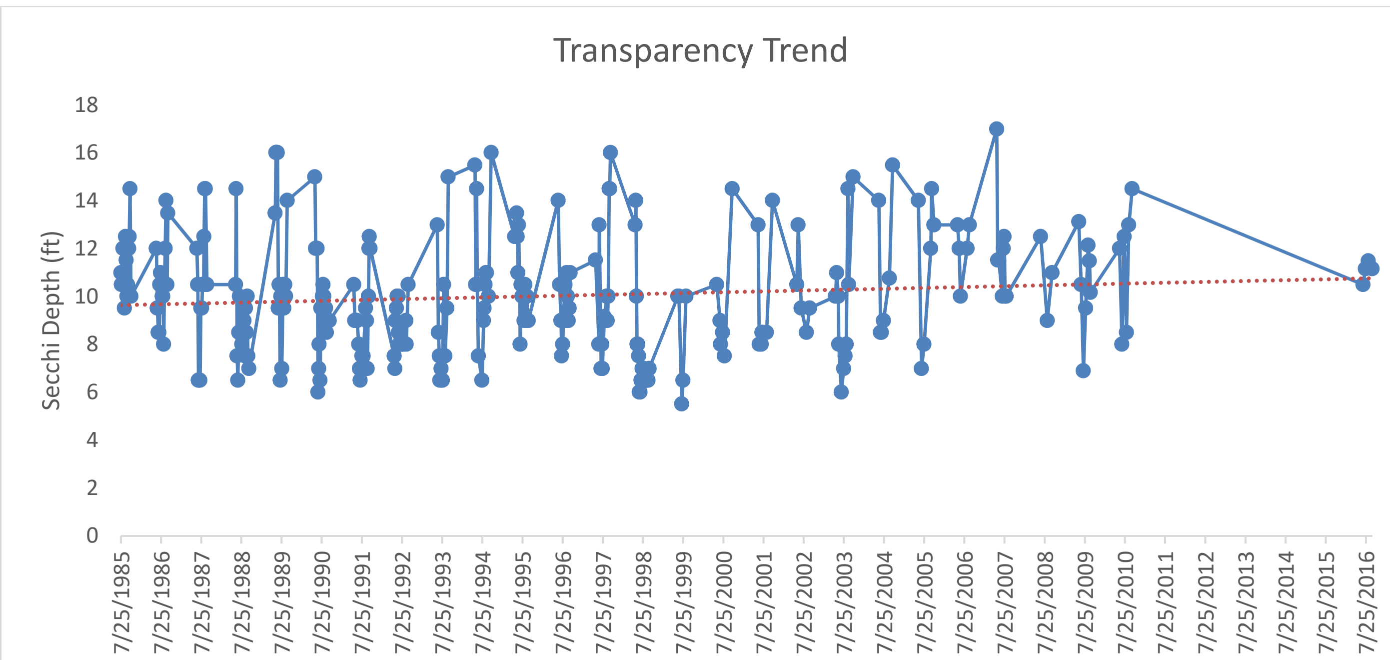


Figure 9. Transparency (feet) for site 203 from 1985-2010, 2016.

Park Lake shows insufficient evidence of a transparency trend through 2010 (Figure 11). There was a gap in monitoring from 2010 to 2016. Transparency monitoring should continue so that this trend can be tracked in future years.

Lakeshed

Understanding a lakeshed requires an understanding of basic hydrology. A watershed is defined as all land and water surface area that contribute excess water to a defined point. The MN DNR has delineated three basic scales of watersheds (from large to small): 1) basins, 2) major watersheds, and 3) minor watersheds.

The Kettle River Major Watershed is one of the watersheds that make up the St. Croix River Basin, which drains south to the Gulf of Mexico (Figure 14).

The MN DNR also has evaluated catchments for individual lakes with greater than 100 acres surface area. These lakesheds (catchments) are the "building blocks" for the larger scale watersheds. Park Lake falls within lakeshed 3501201 (Figure 12). Though very useful for displaying the land and water that contribute directly to a lake, lakesheds are not always true watersheds because they may not show the water flowing into a lake from upstream streams or rivers. While some lakes may have only one or two upstream lakesheds draining into them, others may be connected to a large number of lakesheds, reflecting a larger drainage area via stream or river networks.

In an effort to prioritize protection and restoration efforts of fishery lakes, the MN DNR has developed a ranking system by separating lakes into two categories based on their lakeshed, those needing protection and those needing restoration. Modeling by the DNR Fisheries Research Unit suggests that total phosphorus concentrations increase significantly over natural concentrations in lakes that have watershed with disturbance greater than 25%. Therefore, lakes with watersheds that have less than 25% disturbance need protection and lakes with more than 25% disturbance need restoration (Table 9). Watershed disturbance was defined as having urban, agricultural and mining land uses. Watershed protection is defined as publicly owned land, public water, wetlands, or conservation easement.

Table 9. Suggested approaches for watershed protection and restoration of DNR-managed fish lakes in Minnesota.

Watershed Disturbance (%)	Watershed Protected (%)	Management Type	Comments
< 25%	> 75%	Vigilance	Sufficiently protected -- Water quality supports healthy and diverse native fish communities. Keep public lands protected.
	< 75%	Protection	Excellent candidates for protection -- Water quality can be maintained in a range that supports healthy and diverse native fish communities. Disturbed lands should be limited to less than 25%.
25-60%	n/a	Full Restoration	Realistic chance for full restoration of water quality and improve quality of fish communities. Disturbed land percentage should be reduced and BMPs implemented.
> 60%	n/a	Partial Restoration	Restoration will be very expensive and probably will not achieve water quality conditions necessary to sustain healthy fish communities. Restoration opportunities must be critically evaluated to assure feasible positive outcomes.

The next step was to prioritize lakes within each of these management categories. DNR Fisheries identified high value fishery lakes, such as cisco refuge lakes. Ciscos (*Coregonus artedi)* can be an early indicator of eutrophication in a lake because they require cold hypolimnetic temperatures and high dissolved oxygen levels. These watersheds with low disturbance and high value fishery lakes are excellent candidates for priority protection measures, especially those that are related to forestry and minimizing the effects of landscape disturbance. Forest stewardship planning, harvest coordination to reduce hydrology impacts and forest conservation easements are some potential tools that can protect these high value resources for the long term.

Park Lake's lakeshed is classified with having 68% of the watershed protected and 3% of the watershed disturbed (Figure 13). Therefore, this lakeshed should have a protection focus. Goals for the lake should be to limit any increase in disturbed land use. Park Lake is a headwaters lakeshed, which means that no other lakesheds flow into it (Figure 12).

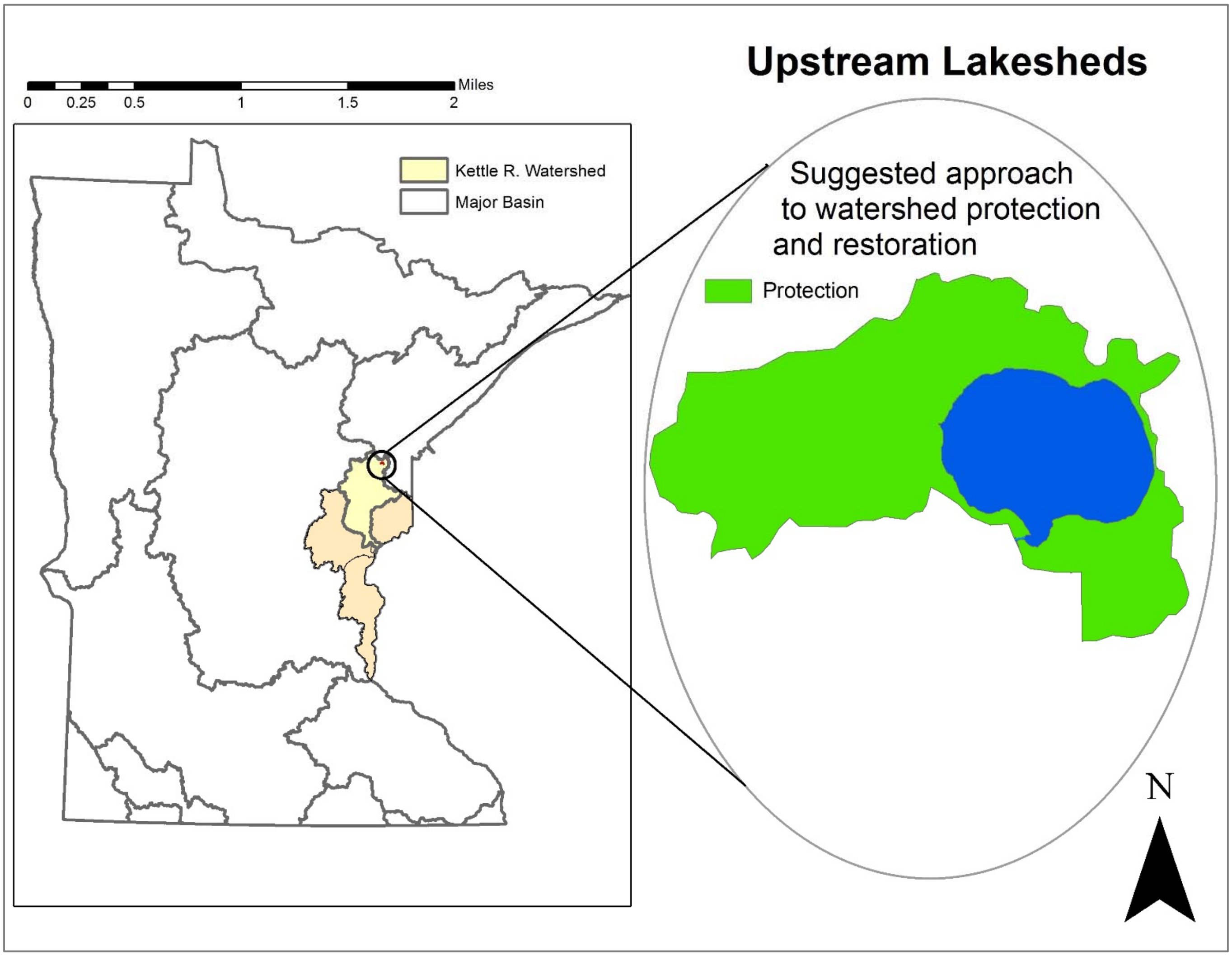
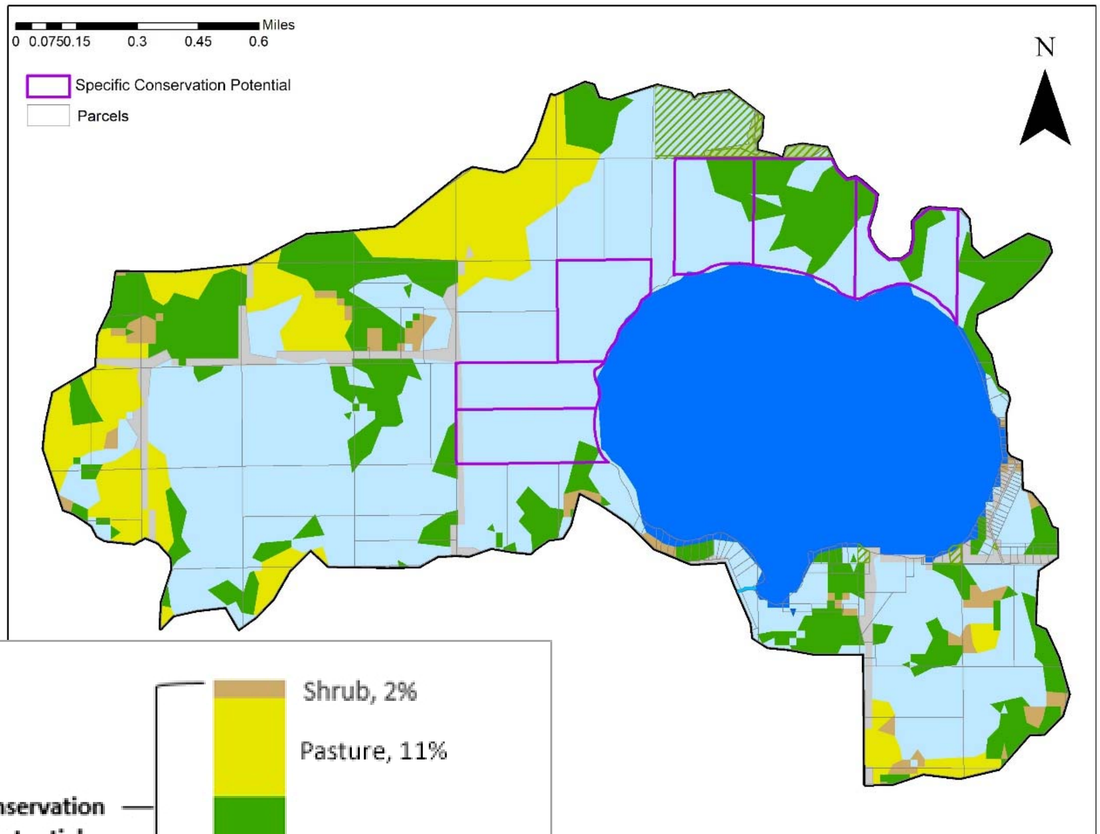


Figure 10. Kettle River major watershed and MN basins (left), and Park Lake lakeshed and upstream catchments with protection suggestions (right).

Land use and Ownership

Activities that occur on the land within the lakeshed can greatly impact a lake. Land use planning helps ensure the use of land resources in an organized fashion so that the needs of the present and future generations can be best addressed.

More than half (68%) of the Park Lake lakeshed is protected. This total includes water, wetlands, and publicly owned land. There are six parcels along the lakeshore which have conservation potential. They are privately-owned parcels with over 20 acres that are less than 50% developed or agriculture.



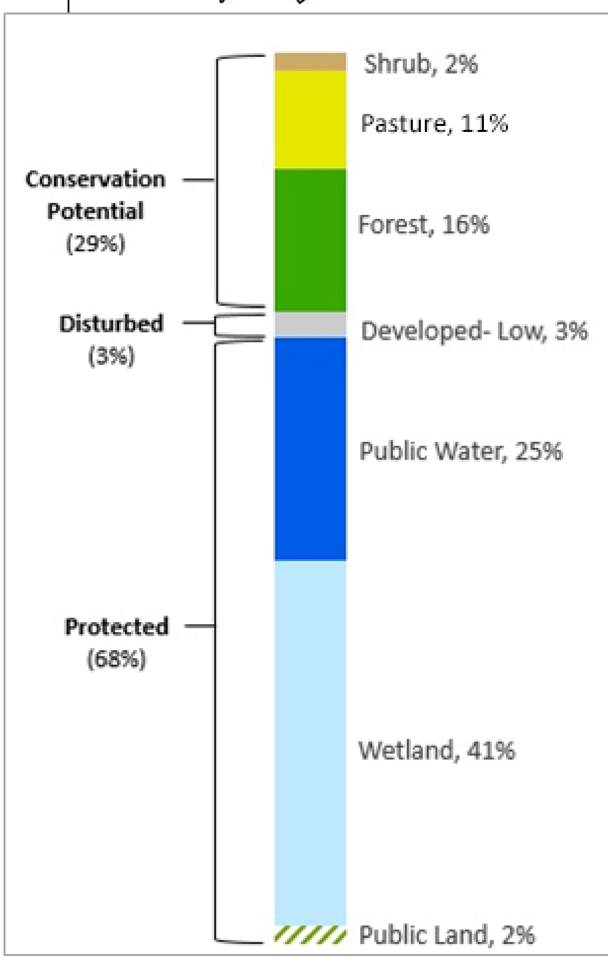


Figure 11. Land use and ownership in the Park Lake lakeshed.

The lakeshed vitals table identifies where to focus organizational and management efforts for each lake (Table 10). Criteria were developed using limnological concepts to determine the effect to lake water quality.

KEY

● Possibly detrimental to the lake
◉ Warrants attention
○ Beneficial to the lake

Table 10. Park Lake lakeshed vitals table.

Lakeshed Vitals		Rating
Lake Area	381.28 acres	descriptive
Littoral Zone Area	375.8 acres	descriptive
Lake Max Depth	16 ft.	descriptive
Lake Mean Depth	5 ft.	◉
Water Residence Time	N/A	Not Available
Miles of Stream	0.05	descriptive
Inlets	0	○
Outlets	1	○
Major Watershed	35- Kettle River	descriptive
Minor Watershed	35012	descriptive
Lakeshed	3501201	descriptive
Ecoregion	Northern Lakes and Forest	descriptive
Total Lakeshed to Lake Area Ratio (total lakeshed includes lake area)	4:1	◉
Standard Watershed to Lake Basin Ratio (standard watershed includes lake areas)	4:1	○
Wetland Coverage	41%	○
Aquatic Invasive Species	None	○
Public Drainage Ditches	None	○
Public Lake Accesses	1	◉
Miles of Shoreline	3.4	descriptive
Shoreline Development Index	1.2	○
Public Land to Private Land Ratio	0:1	◉
Development Classification	Recreational Development	◉
Miles of Road	3.2	descriptive
Municipalities in lakeshed	None	○
Forestry Practices	None	○
Feedlots	1	●
Sewage Management	Compliance inspections are required for subsurface sewage treatment systems at point-of-sale or permit application in shoreland areas.	◉
Lake Management Plan	None	◉
Lake Vegetation Survey/Plan	DNR 1997, 2016	○

Park Lake, Status of the Fishery (DNR, 9/10/2012)

Park Lake is a 376 acre lake located near Mahtowa, Minnesota with 100% littoral area and a maximum depth of 16 feet. Park Lake is accessible on the southeastern corner of the lake off county road 7. Park Lake is primarily managed for walleye and largemouth bass. More than 54,000 walleye fingerlings and 1,000 yearlings were stocked between 1990 and 2012. Park was last assessed in 2004. Park was assessed in 2012 to help evaluate the walleye fingerling stocking program as well as update information on other fish populations.

Walleye fingerlings are stocked into Park Lake at a rate of one pound per littoral acre (376 pounds) during even years. Walleye abundance of 0.8 per gillnet lift was down from 2004 (1.1) and below average compared to other Minnesota lakes of similar type. Walleye gillnet CPUE from six investigations since 1979 have ranged from 0.2 to 1.6 per lift. Not enough individuals were sampled to evaluate stock density or growth. All of the walleye sampled (7) were aged to years that walleye were stocked. Despite stocking numerous year-classes since 1990, the success of the biennial fingerling stocking program appears limited.

A total of 47 largemouth bass were sampled by electrofishing. The largemouth bass catch rate of 86.2 fish per hour of electrofishing was up from 2004 (19.6). Largemouth bass average length was 12.9 inches and growth was slow compared to other Duluth Area lakes. All year-classes from 2001 through 2010 were represented except 2008.

Northern pike abundance of 12.7 per gillnet lift was down from 2004 (13.2) and above average compared to other Minnesota lakes of similar type. Average size was 18.9 inches and growth was slow compared to other Duluth Area lakes. All year-classes from 2003 to 2011 were represented, except 2004.

Bluegill abundance of 9.2 per trapnet lift was down slightly from 2004 (9.4) and was average when compared to other Minnesota lakes of similar type. Average length of sampled bluegills was 6.8 inches and growth was slow compared to other Duluth Area lakes. All year-classes from 2003 to 2011 were represented, except 2008.

Black crappie abundance of 1.0 per lift was up slightly from 2004 (0.9) and was average compared to other Minnesota lakes of similar type. Average size was 6.5 inches but not enough individuals were captured to evaluate stock density or growth. All year-classes from 2003 to 2011 were represented, except 2006 and 2008.

Yellow perch abundance of 29.2 per gillnet lift was down from 2006 (120.2) and above average compared to other Minnesota lakes of similar type. Average length was 6.1 inches and growth was average compared other Duluth Area lakes. All year-classes from 2002 through 2008 were represented.

Other fish species sampled include black, brown and yellow bullhead, Iowa darter, Johnny darter, central mudminnow, bluntnose minnow, fathead minnow, rock bass, white sucker, hybrid sunfish and pumpkinseed sunfish.

Park Lake was included in an index of biotic integrity (IBI) assessment in 2012. In addition to standard gillnets and trapnets, beach seines and backpack electrofishing equipment were used to index species richness of the nearshore lake habitat.

See the link below for specific information on gillnet surveys, stocking information, and fish consumption guidelines. http://www.dnr.state.mn.us/lakefind/showreport.html?downum=09029000

Key Findings and Recommendations

Monitoring Recommendations
Transparency monitoring at sites 203 should be continued annually. It is important to continue transparency monitoring weekly or at least bimonthly every year to enable year-to-year comparisons and trend analyses. Phosphorus and chlorophyll a monitoring should continue at site 203, as the budget allows, to track future water quality trends.

Overall Conclusions
Park Lake is a mesotrophic lake (TSI = 44) with insufficient evidence of a long-term trend in water clarity. The total phosphorus, chlorophyll *a* and transparency ranges are within the ecoregion ranges (Table 4).

Park's lakeshed lies next to the Kettle Lake State Wildlife Management Area; 16 % of the lakeshed land area is forested and 41% of the lakeshed is wetlands, which is generally good for water quality. Sixty-eight percent (68%) of the lakeshed is lakeshed is protected, while only 3% of the lakeshed is disturbed (Figure 13).

Phosphorus Loading and Priority Impacts
Park Lake is at an advantage because the lakeshed is a headwaters catchment, which means no additional water flows into this lakeshed from upstream areas. This means that the land practices around the lake are the main impact to the lake's water quality.

Almost half (40%) of the lakeshed is wetlands, which is good for water storage and water quality. Wetlands function to hold extra water during high water levels and filter water before it flows downstream.

Table 11. Watershed characteristics.

Lakeshed to Lake Area Ratio (lakeshed includes lake area)	4:1
Watershed to Lake Area Ratio (watershed includes lake areas)	4:1
Number of Upstream Lakes	0
Headwaters Lake?	Yes
Inlets / Outlets	0 / 1
Water Residence Time	N/A

Development appears to be fairly light around Park Lake, with it mostly being concentrated on the eastern and southern shores. Figure 13 shows the presence of large parcels on the north and western shores that would be good candidates for conservation easements and/or aquatic management areas (AMAs). Conservation easements can be set up easily and with little cost with help from organizations such as the Board of Soil and Water Resources and the Minnesota Land Trust. AMAs can be set up through the local DNR fisheries office.

Park Lake is located a the top of the watershed, which means that the water storage of the wetlands and lack of heavy development benefits downstream water bodies.

Best Management Practices Recommendations

The management focus for Park Lake should be to protect the current water quality and the lakeshed. Efforts should be focused on managing and/or decreasing the impact caused by current and additional development, including second tier development, and impervious surface area. Project ideas include protecting land with conservation easements, enforcing county shoreline ordinances, shoreline restoration, rain gardens, and septic system maintenance.

Park Lake Goals

1. Protection Focus: minimize disturbed land uses and maintain protected lands
2. Manage phosphorus loading from **nearshore**, Table 12
3. Focused BMPs per land type: Table 12

Table 12. Best Management Practices Table specific to Park Lake (refer to Figure 13)

Category	Land use type	Conservation project ideas	Results	Who	Contact for help
Conservation Potential Land	private forests (16%, 246.6 acres)	Forest stewardship planning, 3rd party certification, SFIA, local woodland cooperatives.	Conserve and protect current forest cover	• Individual Property Owners	Carlton SWCD (218) 384-3891 https://carltonswcd.org
	pasture/hay (11%, 169.6 acres)	Conservation Reserve Program (CRP), maintain vegetative cover, plant trees, conservation easements, grassed waterways, ditch buffers, maintain/restore wetlands.	Reduce water runoff and soil erosion, better water storage.	• Individual Property Owners	Natural Resources Conservation Service 218-720-5209
Disturbed Land	developed, low intensity (3%, 46.2 acres)	Shoreline buffers, rain gardens	Reduce water runoff and shoreline erosion in lakes and streams.	• Individual Property Owners	Carlton SWCD (218) 384-3891 https://carltonswcd.org

The current lakeshore homeowners can lessen their negative impact on water quality by installing or maintaining the existing trees on their properties. Forested uplands contribute significantly less phosphorus (lbs/acre/year) than developed land cover (Table 12).

About 16% of the lakeshed is privately owned forested uplands (Table 12). Forested uplands can be managed with Forest Stewardship Planning, 3rd party certification, SFIA, and local woodland cooperatives. Contact the Soil and Watershed Conservation District for options for managing private forests.

Native aquatic plants stabilize the lake's sediments and tie up phosphorus in their tissues. When aquatic plants are uprooted from a shallow lake, the lake bottom is disturbed, and the phosphorus in the water column gets used by algae instead of plants. This contributes to "greener" water and more algae blooms. Protecting native aquatic plant beds will ensure a healthy lake and healthy fishery. If a swimming area is necessary in front of people's docks, clear only a small area of plants. Clearing a whole 100 foot frontage is not necessary and can contribute to additional algae blooms.

Table 13. Organizational contacts and reference sites

Organizational contacts and reference sites

DNR Fisheries Office	5351 North Shore Drive, Duluth, MN 55804 218-302-3264, duluth.fisheries@state.mn.us
Regional Minnesota Pollution Control Agency Office	525 Lake Avenue South, Suite 400, Duluth, MN 55802 218-723-4660 https://www.pca.state.mn.us/about-mpca/duluth-office
Carlton County Soil and Water Conservation District	808 3rd St, Carlton, MN 55718 (218) 384-3891, https://carltonswcd.org/
Carlton County	301 Walnut Ave, Carlton, MN 55718 http://carltoncountymn.govoffice3.com